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ROUND TABLE

Welcome from the General Chair

Carnegie Mellon Tepper SCHOOL OF BUSINESS

Michael A. Trick
Professor of Operations Research
Tepper School of Business
Carnegie Mellon University
Pittsburgh, PA 15213-3890

On behalf of the entire Pittsburgh INFORMS Organizing Committee, I would like to welcome you to Pittsburgh and to the 2006 INFORMS Annual Meeting. We have a full four days planned for you, and we hope you find the meeting interesting, informative, and fun.

Pittsburgh goes by many nicknames: the Steel City, the City of Champions, the 'Burgh, and, perhaps most fittingly, the Renaissance City. It is this last nickname that gave us the theme for the conference: OR Renaissance. With faster computing, more accessible data, and greatly improved techniques, our field is undergoing a renaissance in its relevance in solving problems of practical interest. With applications in medicine, logistics, public policy, revenue management, transportation, scheduling, natural resources, and many, many other fields, this is a great time to be in the fields of operations research and the management sciences, and our theme is a celebration of this. This conference is also an assessment of where we are, and where we are going as a field. What are the big challenges for the future, and are we prepared to undertake them?

One highlight of this conference is our stellar group of plenary speakers, including former Treasury Secretary and CEO of Alcoa Paul O'Neill, who will speak on the challenges we face in improving productivity in such areas as medicine and secondary education. We continue the INFORMS traditions of tutorials and interactive sessions, and are proud that the more than 3,000 scheduled presentations are an all-time high for INFORMS conferences. We thank all the track organizers for all their hard work in putting this program together.

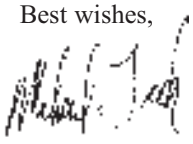
No conference would be complete without the social networking opportunities our receptions and other activities provide, and our slate of nightly receptions gives you the opportunity to see our city and its offerings. We would like to particularly highlight our General Reception Monday evening at the world-class Carnegie Museums of Art and Natural History and our new Tuesday night reception at our amazing baseball stadium, PNC Park.

This conference has been fortunate to have the generous support of a range of sponsors. SmartOps and the Office of Naval Research are our leadership sponsors, and we have received further support from CombineNet, the RAND Corporation, ILOG, IBM's Center for Business Optimization, IBM Research, PPG, AIMSS, SAS, Dash and our university sponsors: Carnegie Mellon, Carnegie Mellon's Tepper School of Business and Heinz School, the University of Pittsburgh's Katz School of Business and Department of Industrial Engineering, and Duquesne University's A.J. Palumbo School of Business Administration. When you see representatives of these groups at the conference, be sure to thank them for their support!

Finally, while we have a busy schedule over the next few days, we hope you get out and enjoy Pittsburgh. It is a wonderful city with lots to do, including riding the Incline to a view from the bluffs over the city, visiting the Heinz History Museum and the Andy Warhol museum, both just blocks from the Convention Center, and enjoying our array of restaurants in the area.

We wish you a successful conference, and thank you for joining us!

Best wishes,



Michael Trick, *General Chair, INFORMS Pittsburgh 2006*

Program at A Glance

SATURDAY, NOVEMBER 4

8:00am-5:00pm	AI & Data Mining Workshop	W – Cambria & Somerset East
8:00am-5:30pm	OR in Biology & Medicine Workshop	CC – Room 305
8:00am-5:00pm	CIST Conference	W – Fayette & Somerset West
8:30am-5:00pm	Vendor Workshops	CC – Level 3
3:00pm-7:00pm	Registration	CC – Ballroom Foyer
5:00pm-6:00pm	INFORMS Membership Meeting	W – Allegheny I

SUNDAY, NOVEMBER 5

7:00am-5:00pm	Registration	CC – Ballroom Foyer
8:00am-4:30pm	CIST Conference	W – Fayette & Somerset West
8:00am-9:30am	Technical Sessions (SA)	Convention Center
9:30am-10:00am	Coffee Break	CC – Ballroom Foyer & West Atrium
10:00am-11:30am	Technical Sessions (SB)	Convention Center
11:40am-12:30pm	Plenary Presentation	CC – Ballroom B
12:00pm-5:00pm	Exhibits, Job Fair, Email Center	CC – Ballroom A
12:30pm-1:30pm	Lunch Break (on your own)	
1:30pm-3:00pm	Technical Sessions (SC)	Convention Center
3:10pm-4:00pm	Plenary Presentation	CC – Ballroom B
4:00pm-4:30pm	Coffee Break	CC – Ballroom A
4:30pm-6:00pm	Technical Sessions (SD)	Convention Center
6:15pm-7:15pm	Subdivision Business Meetings	See p. 11
7:30pm-9:00pm	Welcome Reception	CC – Ballroom A

MONDAY, NOVEMBER 6

7:00am-5:00pm	Registration	CC – Ballroom Foyer
8:00am-9:30am	Technical Sessions (MA)	Convention Center
9:00am-5:00pm	Exhibits, Job Placement, Email Center	CC – Ballroom A
9:30am-10:00am	Coffee Break	CC – Ballroom A
10:00am-11:30am	Technical Sessions (MB)	Convention Center
11:40am-12:30pm	Plenary Presentation	CC – Ballroom B
12:30pm-1:30pm	Interactive Session	CC – Ballroom Foyer
12:30pm-1:30pm	Lunch Break (on your own)	
1:30pm-3:00pm	Technical Sessions (MC)	Convention Center
3:10pm-4:00pm	Plenary Presentation	CC – Ballroom B
4:00pm-4:30pm	Coffee Break	CC – Ballroom A
4:30pm-6:00pm	Technical Sessions (MD)	Convention Center
6:15pm-7:15pm	Subdivision Business Meetings	See p. 11
7:30pm-9:30pm	General Reception	Carnegie Museums
8:30pm-9:45pm	Awards Ceremony & Dessert Reception	Carnegie Museums

TUESDAY, NOVEMBER 7

7:00am-5:00pm	Registration	CC – Ballroom Foyer
8:00am-9:30am	Technical Sessions (TA)	Convention Center
9:00am-5:00pm	Exhibits, Job Placement, Email Center	CC – Ballroom A
9:30am-10:00am	Coffee Break	CC – Ballroom A
10:00am-11:30am	Technical Sessions (TB)	Convention Center
11:40am-12:30pm	Plenary Presentation	CC – Ballroom B
12:30pm-1:30pm	Interactive Session	CC – Ballroom Foyer
12:30pm-1:30pm	Lunch Break (on your own)	
1:30pm-3:00pm	Technical Sessions (TC)	Convention Center
3:10pm-4:00pm	Keynote Presentations	CC – Ballroom B & 305
4:00pm-4:30pm	Coffee Break	CC – Ballroom A
4:30pm-6:00pm	Technical Sessions (TD)	Convention Center
6:15pm-7:15pm	Subdivision Business Meetings	See p. 11
7:30pm-9:30pm	NEW! Tuesday Reception	PNC Park

BADGES REQUIRED FOR TECHNICAL SESSIONS

INFORMS Annual Meeting 2006 badges must be worn to all sessions and events. Badges will be checked at the entrance to technical session areas, as well as the Exhibit Hall. Attendees without badges will be directed to the INFORMS registration desk to register and pick up their badges. *All attendees, including speakers and session chairs, must register and pay the registration fee.* Lost badges can be replaced at the registration desk.

NOTE:

All technical sessions are held at the Convention Center. Some special events and subdivision meetings will be held at the Westin. Check the Master Track Schedule on pages 44-47 for specific room locations.

KEY

CC-Convention Center

W-Westin

QUICK REFERENCE including the Master Track Schedule

Don't miss this handy reference. It's a separate flyer that came with your program. The Master Track Schedule is also printed on pages 44-47.

WEDNESDAY, NOVEMBER 8

7:30am-5:00pm	Registration	CC – Ballroom Foyer
8:00am-9:30am	Technical Sessions (WA)	Convention Center
9:00am-3:30pm	Exhibits, Job Placement, Email Center	CC – Ballroom A
9:30am-10:00am	Coffee Break	CC – Ballroom A
10:00am-11:30am	Technical Sessions (WB)	Convention Center
11:40am-12:30pm	Plenary Presentation	CC – Ballroom B
12:30pm-1:30pm	Lunch Break (on your own)	
1:30pm-3:00pm	Technical Sessions (WC)	Convention Center
3:00pm-3:30pm	Coffee Break	CC – Ballroom A
3:30pm-5:00pm	Technical Sessions (WD)	Convention Center

"TSP ART" ON VIEW

Sunday Welcome Reception
Special Raffle!
Ballroom Foyer, Monday-Wednesday

The Pittsburgh Organizing Committee is proud to present six unique artworks that use operations research to provide new and fascinating interpretations of some iconic works of the art world. INFORMS member Robert Bosch, of Oberlin College, has created six pieces for the conference using the technique of "TSP Art." Bob first chooses a target image, selects a series of points from the image, and then connects them in a single traveling salesman tour. The result of this marriage of O.R. and fine art is always interesting, and frequently stunning.

The six works commissioned for the conference hearken to our Renaissance theme: the famous hands from Michelangelo's The Creation of Adam, and a detail from Leonardo's Mona Lisa. Pittsburgh's favorite son of the modern art movement, Andy Warhol, is represented with one of his most striking self-portraits as well as two playful Soup Cans. And, finally, another piece pays homage to one of our own--a portrait of George Dantzig. We hope you enjoy these works as much as we have.

One of the works will be raffled off during the Sunday Welcome Reception. Don't miss this opportunity to take home a fascinating work of art!



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Edited by **Peter Bell**

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0969-6016, BI-MONTHLY. VOL 13 / 2006

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Win $10,000! - Best MIP Model showcasing selected OPL-CPLEX Development System features

Win $10,000! - Best ODM-based Decision Support Application

Contest details and application procedures available on the ILOG Optimization Information Center web site December 1st, 2006. Applications will close August 31st, 2007 and winners will be announced at the Fall 2007 INFORMS Meeting.

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Schedule of Special Events

KEY
CC-Convention Center
W-Westin

For subdivision business meetings, see page 11.

WHERE TO GO FOR LUNCH?

Convention Center
Lunch buffet – sandwiches, salads, snacks and drinks served right in the Center, Level 3 Terrace. Sunday through Wednesday, 11:30am to 1:30pm.

At the Westin
Pizzeria Uno
Original Fish Market

At the Omni
Tap Room
Terrace Room
Palm Court
Starbucks

Sonoma Grill
At the Marriott Courtyard

Tonic Bar & Grill
971 Liberty Ave.
Closed Sunday

Trilogy
620 Liberty Ave.
Lunch Monday-Friday

Sree's Indian Cuisine
701 Smithfield St.
Lunch Monday-Friday

Downtown Fast Food
Subway, 703 Liberty Ave.

Brueggers Bagels, 411 7th Ave.

Jimmy Johns Gourmet Sandwiches, 506 Liberty Ave.

Au Bon Pain, USX Towers, Grant & 6th Ave.

Quiznos, 411 7th Ave

FRIDAY, NOVEMBER 3	LOCATION	TIME
Colloquia Registration & Dinner	W - Westmoreland	4:30pm-9:00pm
SATURDAY, NOVEMBER 4		
Combined Colloquia		
Breakfast	W – Allegheny I	7:30am-8:30am
Future Academician Colloquium	W – Allegheny II	8:15am-4:30pm
Future Practitioner Colloquium	W – Crawford West	8:30am-4:30pm
Teaching Effectiveness Colloquium	W – Crawford East	8:30am-4:30pm
Plenary	W – Allegheny II	4:45pm-5:45pm
Dinner	Offsite	7:00pm-9:00pm
INFORMS Executive Committee	W – Armstrong	8:00am-11:30am
AI & Data Mining Workshop	W – Cambria & Somerset East	8:00am-5:00pm
OR in Biology & Medicine Workshop	CC – 305	8:00am-5:30pm
CIST Conference	W – Fayette & Somerset West	8:00am-5:00pm
Organization Science Competition	W – Butler East	8:30am-5:00pm
Vendor Workshops-Morning		
Aptech Systems/GAUSS	CC – 306	8:30am-12:30pm
Dash Optimization	CC – 316	8:30am-12:30pm
GAMS Development Corp.	CC – 309	8:30am-12:30pm
SAS	CC – 317	8:30am-12:30pm
SCA Technologies	CC – 307	8:30am-12:30pm
Statgraphics Centurion XV	CC – 308	8:30am-12:30pm
ISR Editors	W – Butler West	8:30am-12:00pm
Meetings Committee	W – Suite 2322	8:30am-12:00pm
INFORMS Board	W – Westmoreland West & Central	12:00pm-5:00pm
Vendor Workshops-Afternoon		
Frontline Systems/Solvers	CC – 309	1:00pm-5:00pm
ILOG, Inc.	CC – 316	1:00pm-5:00pm
Imagine That/EXTEND	CC – 317	1:00pm-5:00pm
JMP/Statistics	CC – 307	1:00pm-5:00pm
Maximal Software, Inc.	CC – 315	1:00pm-5:00pm
Paragon/AIMMS	CC – 308	1:00pm-5:00pm
Responsive Learning Technologies	CC – 306	1:30pm-5:00pm
Meeting Registration	CC – Ballroom Foyer	3:00pm-7:00pm
INFORMS Membership Meeting/Reception	W – Allegheny I	5:00pm-6:00pm
Roundtable Reception	W – Allegheny III	5:00pm-6:00pm
Roundtable Meeting & Dinner	W – Allegheny III	6:00pm-10:00pm

PITTSBURGH INFORMATION DESK

and Restaurant Reservations
Convention Center – Ballroom Foyer
Sunday – Tuesday, 8:00am-5:00pm
Stop by the booth for tourist information on what to see and do in Pittsburgh, as well as brochures and menus for more than 140 restaurants. The staff will assist you in locating the perfect restaurant and making reservations.

Schedule of Special Events

KEY
CC-Convention Center
W-Westin

For subdivision business meetings, see page 11.

SUNDAY, NOVEMBER 5

New Member/First-Time Attendee Breakfast	W – Allegheny I & II	7:00am-8:00am
Meeting Registration	CC – Ballroom Foyer	7:00am-5:00pm
JPS Breakfast	W – Cambria	7:30am-9:00am
Guest Breakfast	W – Harvest Bar	7:30am-9:00am
INFORMS Board	W – Westmoreland West & Central	7:30am-3:00pm
CIST Conference	W – Fayette & Somerset West	8:00am-4:30pm
INFORMS Roundtable	W – Allegheny III	8:00am-4:30pm
Meetings Committee	W – Suite 2322	11:00am-1:00pm
Junior Faculty Interest Group Lunch	W – Allegheny I	11:30am-1:00pm
Colloquia Committee	W – Crawford East	11:30am-1:00pm
Plenary-Presidential Address: Mark S. Daskin	CC – Ballroom B	11:40am-12:30pm
O.R. Editors Lunch/Meeting	W – Westmoreland East	12:00pm-2:00pm
Exhibits/Job Fair/Email	CC – Ballroom A	12:00pm-5:00pm
M.S. Editors Lunch/Meeting	W – Washington	12:30pm-2:30pm
Omega Rho Lunch/Meeting	W – Crawford West	12:45pm-2:45pm
Plenary-McCord Morse: Marshall Fisher	CC – Ballroom B	3:10pm-4:00 pm
Roundtable & INFORMS Board	W – Westmoreland Central	4:30pm-6:00pm
IOL Reception	W – Butler	6:00pm-7:00pm
MSOM Reception	W – Allegheny I	6:15pm-7:15pm
President's Reception-Roundtable	W – Westmoreland West & Central	6:15pm-7:15pm
Welcome Reception	CC – Ballroom A	7:30pm-9:00pm
Minority Issues Forum Reception	W – Westmoreland East	8:00pm-9:00pm
Student Reception	W – Allegheny II	8:00pm-10:00pm
Women in OR/MS Forum Reception	Offsite-Trilogy Restaurant 620 Liberty Ave.	8:00pm-10:00pm

MONDAY, NOVEMBER 6

Board/Editors/Committee Chair Breakfast	W – Westmoreland East	7:00am-8:00am
Meeting Registration	CC – Ballroom Foyer	7:00am-5:00pm
ACORD Breakfast/Meeting	W – Cambria East	7:30am-9:00am
Guest Breakfast	W – Harvest Bar	8:00am-9:00am
Chapters/Fora Committee	W – Butler East	9:00am-10:00am
Section/Societies Committee	W – Butler West	9:00am-10:00am
Exhibits/Job Placement/Email	CC – Ballroom A	9:00am-5:00pm
Subdivisions Council	W – Westmoreland West	10:00am-12:00pm
Plenary: Patrick T. Harker	CC – Ballroom B	11:40am-12:30pm
COIN-OR Members & Users	CC – 307	12:15pm-1:15pm
Publications/Editors in Chief	W – Westmoreland East	12:30pm-3:30pm
Fellows Lunch	W – Allegheny II	12:45pm-2:30pm
Plenary: Paul H. O'Neill	CC – Ballroom B	3:10pm-4:00pm
CPMS Isolated Practitioners Workshop	CC - 325	6:15pm-7:15pm
General Reception	Carnegie Museums	7:30pm-9:30pm
Awards Ceremony & Dessert Reception	Carnegie Museum-Music Hall	8:30pm-9:45pm

See busing information on p. 15

THANK YOU

Coffee Break Sponsors

dash optimization

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COFFEE BREAKS

All breaks will be held in the Convention Center

Sunday, Nov. 5
9:30am-10:00am
Ballroom Foyer & West Atrium

4:00pm – 4:30pm
Ballroom A

Monday, Nov. 6
9:30am – 10:00am
Ballroom A
Sponsored by Dash Optimization

4:00pm – 4:30pm
Ballroom A

Tuesday, Nov. 7
9:30am – 10:00am
Ballroom A
Sponsored by SAS

4:00pm – 4:30pm
Ballroom A

Wednesday, Nov. 8
9:30am – 10:00am
Ballroom A

3:00pm – 3:30pm
Ballroom A

TUESDAY, NOVEMBER 7

Chapters/Fora Officers Breakfast	W – Fayette	7:00am-8:00am
Decision Analysis Editors	W – Somerset East	7:00am-8:00am
Practitioner & Practice Activities Committee	W – Crawford West	7:00am-8:00am
MSOM Editors	W – Washington	7:00am-8:00am
Meeting Registration	CC – Ballroom Foyer	7:00am-5:00pm
Transportation Science Editors	W – Cambria East	7:30am-8:30am
Student Chapter Officers	W – Fayette	8:00am-8:45am
Guest Breakfast	W – Harvest Bar	8:00am-9:00am
Pittsburgh Area Math Teachers Program	W – Westmoreland East	8:00am-4:00pm
Meetings Committee/Future Organizing Committees	W – Suite 2322	9:00am-5:00pm
Exhibits/Job Placement/Email	CC – Ballroom A	9:00am-5:00pm
Franz Edelman Selection Committee	W – Westmoreland West	11:00am-2:30pm
Plenary: Margaret L. Brandeau	CC – Ballroom B	11:40am-12:30pm
Sections/Societies Officers Lunch	W – Westmoreland Central	12:00pm-1:30pm
Academic/Practitioner Interface Lunch	W – Allegheny II	12:30pm-1:30pm
Women in OR/MS Business Meeting/Lunch	W – Allegheny I	12:30pm-1:30pm
Keynote: Edelman 2006 Reprise	CC – Ballroom B	3:10pm-4:00pm
Keynote: Better Press Coverage	CC – 305	3:10pm-4:00pm
Future Organizing Committee Reception	W – Butler	5:00pm-6:00pm
Tuesday Reception	PNC Park	7:30pm-9:30pm

See busing information on p. 15

WEDNESDAY, NOVEMBER 8

Meeting Registration	CC – Ballroom Foyer	7:30am-5:00pm
Exhibits/Job Placement/E-mail	CC – Ballroom A	9:00am-3:30pm
Plenary: William R. Pulleyblank	CC – Ballroom B	11:40am-12:30pm

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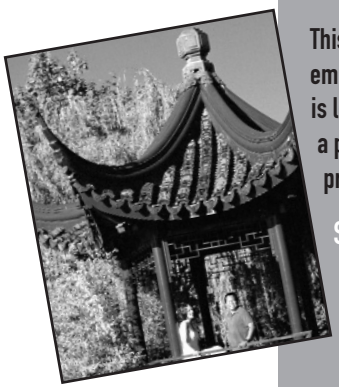
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You are invited to submit a proposal to present at the 2007 INFORMS Conference on O.R. Practice. Selected speakers can register for the meeting at a discounted fee of $490, a 40–50% discount off regular fees.

This prestigious conference has earned a reputation for high-quality presentations that emphasize real-world business topics and applied academic work. The Selection Committee is looking for case studies, best practice examples, applications reports and tutorials with a practice orientation to round out the 2007 program. We welcome submissions from both practitioners and academics.

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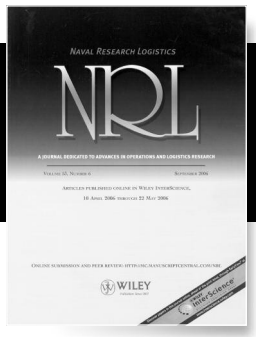
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Naval Research Logistics (***NRL***), founded in 1954, has had a distinguished history with the publication of seminal work that made an impact both on the theory and practice of operations research, statistics and finance. For many years, ***NRL***'s original focus on naval applications has been greatly extended to a wide range of military and civilian problems.

NRL publishes papers that make significant contribution to either methodology or practice or both. Methodological areas covered by the journal span the entire spectrum from probability and statistics, through optimization, simulation and stochastic processes, all the way to gametheory and decision science. Application areas also vary and include manufacturing, supply chain management, military, environmental issues and telecommunications to name a few. Papers dealing with either operational or tactical issues in addition to papers motivated by strategic issues are welcomed.

NRL is interested in research that cuts across functional areas such as Operations, Marketing and Finance, or research that brings together practices such as manufacturing, transportation, logistics, pricing and procurement.

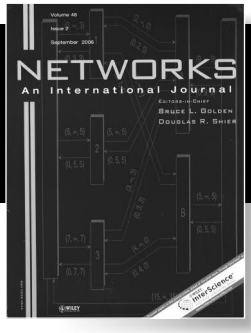
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Recent articles:

- Optimal pricing and inventory control policy in periodic-review systems with fixed ordering cost and lost sales (Vol. 53, No. 2)
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QUICK REFERENCE including the Master Track Schedule

Don't miss this handy reference. It's a separate flyer that came with your program. The Master Track Schedule is also printed on pages 44-47.

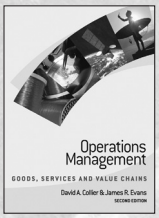
SUNDAY, NOVEMBER 5	LOCATION	TIME
Information Systems	W - Fayette	5:30pm-6:30pm
Aviation Applications	CC - 333	6:15pm-7:15pm
Artificial Intelligence & Data Mining	CC - 326	6:15pm-7:15pm
Decision Analysis Society Council	CC – 321	6:15pm-7:30pm
Energy, Natural Resources & the Environment	CC - 319	6:15pm-7:15pm
Forum on Education (INFORM-ED)	CC - 313	6:15pm-7:15pm
Location Analysis	CC - 401	6:15pm-7:15pm
Military Applications Society Council	W – Crawford West	6:15pm-7:15pm
Minority Issues Forum	W – Somerset West	6:15pm-7:15pm
Optimization	CC – 301	6:15pm-7:15pm
Railroad Applications	CC – 338	6:15pm-7:15pm
Revenue Management & Pricing	CC – 413	6:15pm-7:15pm
Simulation	CC – 317	6:15pm-7:30pm
Spreadsheet Productivity Research	CC – 309	6:15pm-7:15pm
Telecommunications	CC – 411	6:15pm-7:15pm
Transportation Science & Logistics Board	W – Crawford East	6:15pm-7:15pm
Quality, Statistics & Reliability	CC – 327	6:30pm-7:30pm
Revenue Management & Pricing Board	CC – 413	7:15pm-8:15pm

MONDAY, NOVEMBER 6		
Social Sciences	W – Crawford West	4:00pm-5:00pm
Decision Analysis Society	CC – 321	6:00pm-7:15pm
Technology Management	CC – 308	6:00pm-8:00pm
Applied Probability	CC – 402	6:15pm-7:15pm
Computing Society	CC – 306	6:15pm-7:15pm
Financial Services	CC – 332	6:15pm-7:15pm
Health Applications	CC – 330	6:15pm-7:15pm
Manufacturing & Service Operations Mgt	CC – 409	6:15pm-7:15pm
Military Applications Society	CC – 322	6:15pm-7:15pm
Public Programs & Processes	CC – 404	6:15pm-7:15pm
Service Science, Engineering & Practice Section: Organizational Meeting	CC – 313	6:15pm-7:15pm
SpORts in OR	CC – 311	6:15pm-7:15pm
Transportation Science & Logistics	CC – 334	6:15pm-7:15pm

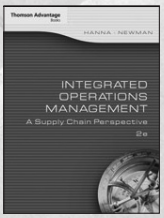
TUESDAY, NOVEMBER 7		
CPMS Council	W – Somerset West	8:00am-12:00pm
Women in OR/MS Forum	W – Allegheny I	12:30pm-1:30pm

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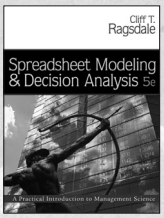
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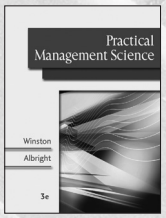
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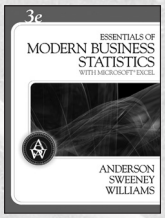
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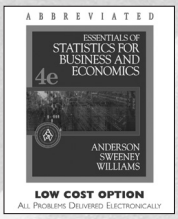
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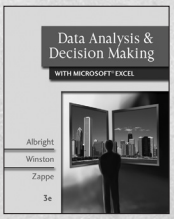
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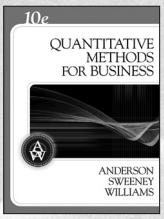
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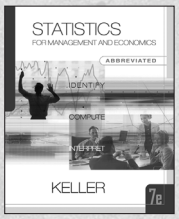
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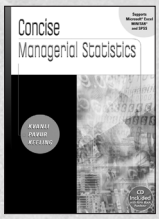
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SPEAKER GUIDELINES

Audio/Visual Equipment

Every room will be equipped with an LCD (data) projector and an overhead. Please follow these guidelines to ensure a successful presentation using the LCD projector:

- Bring your laptop PC to your session. We supply the projector, but we DO NOT supply the computer.
- Bring your AC power adaptor with you. There will be convenient AC power in every session room.
- Arrive at your session at least 30 minutes before it begins. All presenters in a session should set up and test the connection to the projector before the session begins.
- Do NOT attempt to run your presentation off the laptop battery, no matter how trustworthy.
- Produce and bring overhead transparencies as a backup.

Speaker Ready Room

There will be a special Speaker Ready Room available in the Convention Center, West Atrium (Level 3) during the meeting. You can stop by and practice connecting your laptop to the projector. We will also have quick instructions at each session room and technical assistance available for any problems.

Guidelines for Speakers

The room and location of your session are listed in the Technical Sessions section and in the Master Track Schedule. Please be on time for your session and check in with the session chair. Presentations should be limited to key issues with a brief summary. Time your presentation to fit within your designated time span and leave an opportunity for questions and audience participation. Bring copies of your paper to distribute or provide a handout with information relating to your oral presentation. INFORMS does not produce proceedings with complete papers. To obtain complete copies of any papers abstracted in the program, please contact the authors directly at the addresses supplied with each abstract.

Guidelines for Session Chairs

The role of the Chair is to coordinate the smooth running of the session. The Chair:

- Begins and ends each session on time. Each session lasts 90 minutes, with the time per presentation determined by the number of papers in the session. Equal time should be given to each paper.
- Introduces each presentation (just the title of the paper and the name of the presenting author).
- Ensures that presentations are made in the order shown in the program. This allows for "session jumping." If a speaker cancels or does not attend, the original time schedule should be adhered to rather than sliding every talk forward.
- Completes the session attendance forms (forms will be in the room).

Exhibit Hall

Name badges must be worn for admittance to the Exhibit Hall, located in the Convention Center, Spirit of Pittsburgh Ballroom, during the following hours:

Sunday, Nov. 5	12:00pm-5:00pm & 7:30pm-9:00pm*
Monday, Nov. 6	9:00am-5:00pm
Tuesday, Nov. 7	9:00am-5:00pm
Wednesday, Nov. 8	9:00am-3:30pm

*The Exhibit Hall will reopen Sunday evening for a gala Welcome Reception. All registrants are invited to the reception for the chance to meet colleagues and renew acquaintances.

Registration

The registration fee includes admittance to all technical sessions, the Exhibit Hall, the Welcome Reception on Sunday evening, the General Reception on Monday evening and the Tuesday evening reception. Meals–other than the three evening receptions–are not included.

Business Centers

- The UPS Store is located close to the Convention Center. Exit the east or west lobby doors, walk towards Penn Ave. and go left: the UPS Store is the second store front on the left side. Hours of operation: Saturday-Sunday, 9:00am-1:00pm; Monday-Wednesday, 8:00am-6:00pm.
- The Westin has a self-serve Business Center (level 2) open 24 hours.

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There are several options for Internet access available in the Email Center. If you bring your laptop, you can use a wired connection or the wireless access available. If you do not have a laptop, a limited number of computers are also available. Name badges must be worn for admittance. The Email Center will be open during the following hours:

Sunday, Nov. 5	12:00pm-5:00pm
Monday, Nov. 6	9:00am-5:00pm
Tuesday, Nov. 7	9:00am-5:00pm
Wednesday, Nov. 8	9:00am-3:30pm

BADGES REQUIRED FOR TECHNICAL SESSIONS

INFORMS Annual Meeting 2006 badges must be worn to all sessions and events. Badges will be checked at the entrance to technical session areas, as well as the Exhibit Hall. Attendees without badges will be directed to the INFORMS registration desk to register and pick up their badges. *All attendees, including speakers and session chairs, must register and pay the registration fee.* Lost badges can be replaced at the registration desk.

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Shuttle Bus Information

Shuttle between hotels and convention center

INFORMS will operate continuous shuttles between the Convention Center and our blocked downtown hotels on all days of the conference. In addition, a shuttle between the Center and the Radisson GreenTree will be in operation on Saturday and Sunday. Pickup location at Center: street level on Tenth Street, at the East Lobby.

INFORMS downtown hotels

Omni, Doubletree, Marriott City Center, Hilton
Pickup location: outside main lobby of each hotel.

Hours: Saturday – 7:30am to 7:00pm
Sunday – 7:00am to 9:30pm
Monday – 7:00am to 7:30pm
Tuesday – 7:00am to 6:30pm
Wednesday – 7:00am to 5:30pm

Frequency: Every 15 minutes

Radisson GreenTree Hotel

Saturday and Sunday ONLY, with scheduled departures. Trip is 20-30 minutes.

Radisson to Center: departing 7:30am, 8:30am, 9:30am, 12:30pm, 3:30pm.

Center to Radisson: departing 8:00am, 9:00am, 12noon, 3:00pm, 6:00pm, (9:00pm Sunday only).

Monday General Reception & Award Ceremony at Carnegie Museums

All buses to Carnegie Museums ***depart from the Convention Center.*** The INFORMS hotel shuttles (between the hotels and Center) will continue to operate until 7:30pm, so you can take a hotel shuttle to the Center and transfer there to a museum bus.

Departure

- From Convention Center, street level on Tenth St.
- Departure beginning at 7:00pm, *with last bus departing at 8:00pm.*
- Trip to museums is 20-30 minutes.

Return

- Return beginning at 8:30pm, *with last bus leaving museums at 10:00pm.*
- Drop-off locations: (1) Convention Center (for Westin & Marriott Courtyard); (2) Omni; (3) Doubletree; (4) Marriott City Center; (5) Hilton. If you are staying at a hotel not in the INFORMS block, go to the hotel closest to your destination and walk or take a cab from there.

Tuesday Reception at PNC Park

Departure

- From Convention Center, Omni, Doubletree, Marriott City Center, Hilton.
- Departure beginning at 6:45pm, *with last bus departing at 7:45pm.*

Return

- Return beginning at 8:00pm, *with last bus leaving the Park at 9:45pm.*
- Drop-off locations: (1) Convention Center (for Westin & Marriott Courtyard); (2) Omni; (3) Doubletree; (4) Marriott City Center; (5) Hilton. If you are staying at a hotel not in the INFORMS block, go to the hotel closest to your destination and walk or take a cab from there.

Coat/Luggage Check Room

Convention Center, Ballroom Foyer

Saturday	6:30am to 7:30pm
Sunday	6:30am to 10:00pm
Monday	6:30am to 8:00pm
Tuesday	6:30am to 7:30pm
Wednesday	6:30am to 5:30pm

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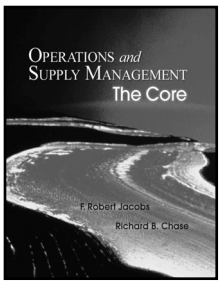
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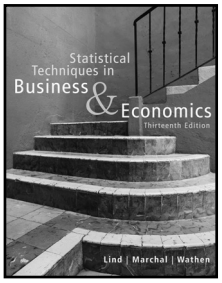
McGraw-Hill/Irwin 2008 titles:



Operations and Supply Management: The Core

F. Robert Jacobs,
Indiana University–Bloomington
Richard Chase,
University of Southern California
ISBN 007329473X

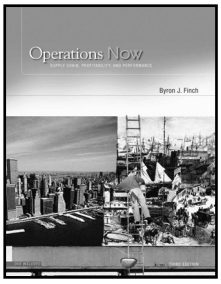
Jacobs and Chase continue to lead the field of Operations Management with cutting edge up-to-date content, technology, and motivation. Now, in this First edition, Jacobs and Chase focus on the core concepts of operations and supply management.



Statistical Techniques in Business and Economics, 13E

Douglas A. Lind, *Coastal Carolina University*
William G. Marchal, *University of Toledo*
Samuel A. Wathen,
Coastal Carolina University
ISBN 0073272965

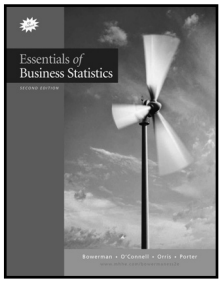
Lind/13e is a perennial market best seller due to its comprehensive coverage of statistical concepts and methods delivered in a student friendly, step-by-step format.



Operations Now: Supply Chain Profitability and Performance, 3e

Byron Finch, *Miami University–Oxford, OH*
ISBN 0073297054

Operations Now introduces the operations function from a vantage point that encompasses both the entire organization and the broader supply network.



Essentials of Business Statistics, 2/e

Bruce Bowerman, *Miami University of Ohio*
Richard O'Connell, *Miami University of Ohio*
J. Burdette Orris, *Butler University*
Dawn Porter, *Georgetown University*
ISBN 0073319880

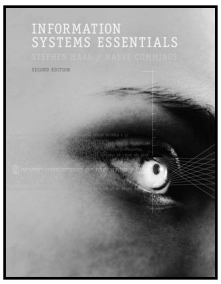
The new edition of *Essentials of Business Statistics* delivers clear and understandable explanations of core business statistics concepts, making it ideal for a one term course in business statistics.



Business Driven Technology, 2e

Stephen Haag, *University of Denver*
Paige Baltzan, *University of Denver*
Amy Phillips, *University of Denver*
ISBN 0073323063

BDT takes a business-first approach, starting each chapter by explaining the value of a business initiative and then detailing the technology that enables the initiative.



Information Systems Essentials, 2e

Stephen Haag, *University of Denver*
Maeve Cummings, *Pittsburgh State University*
ISBN 007332308X

The new 2nd edition of *Information Systems* by Haag/Cummings has many new and updated features that will make your Information Systems course more manageable for both your students and yourself.



Management Information Systems, 8e

James A. O'Brien,
Northern Arizona University
George M. Marakas, *University of Kansas*
ISBN 0073323098

The benchmark text for this syllabus is organized by technology (a week on databases, a week on networks, a week on systems development, etc.) while being taught from a managerial perspective.

Homework Manager and Homework Manager Plus:

Homework Manager is an on-line tool for self-study or instructor-assigned homework that provides students with drill and practice in a web-based environment on key problems and concepts covered in the textbook. All of the even numbered problems in the text are included in both 'static' and algorithmic version. *Homework Manager Plus* also includes the entire electronic text.

Please stop by the McGraw-Hill/Irwin booth for more information on these titles.

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GUEST PROGRAM

The program for registered guests includes a continental breakfast on Sunday, Monday and Tuesday mornings; the Welcome Reception on Sunday evening; the General Reception on Monday evening; and the Tuesday Reception. Registered guests will receive a colored name badge that must be worn for admittance to these events. Guests are not eligible to attend the technical sessions. Guest registration is $65; go to the Registration Desk to register your guest.

Guest Breakfasts
Sunday, Nov. 5 7:30am – 9:00am
Monday, Nov. 6 8:00am – 9:00am
Tuesday, Nov. 7 8:00am – 9:00am
The Westin, Harvest Bar, Level 2.
Identify yourself as an INFORMS guest and present your ticket when you arrive at the restaurant. Tickets are included in the registration packet.

GUEST TOURS

You may still be able to register for the following guest tours. Go to the INFORMS registration desk for information on availability. ***Meet in the Westin Hotel lobby for guest tour departures - buses will leave at the beginning time listed for each tour, and will return to the Westin Hotel at the ending time listed.***

Fallingwater Tour
Sunday, November 5
8:30am-5:30pm $74 (lunch included)
The tour takes you through the magnificent mountain scenery of the Laurel Highlands to Frank Lloyd Wright's Fallingwater. Dramatic cantilevered terraces soar over a cascading waterfall. This breathtaking house is described as the clearest expression of Wright's ideal...that man can live in harmony with nature. Lunch will be held at The Stone House Restaurant & Inn, one of the original wayside inns along the National Road. Lunch will be a choice of steak or chicken caesar salad. After lunch, continue to the Christian W. Klay Winery for a tour and tasting.

Pittsburgh City Tour
Monday, November 6
9:30am-3:30pm $57 (lunch included)
The tour begins atop Mt. Washington with a spectacular view of Pittsburgh. Descend the mountain in the Duquesne Incline. Next stop is the Senator John Heinz Pittsburgh Regional History Center in the Strip District, a treasure house of historical materials. Lunch takes place at the Pennsylvania Brewing Company, a national historic landmark. German fare at its best is served, including knackwurst, kraut and goulash, apple strudel and Penn Pilsner. The last stop is the Strip District, the center of the wholesale produce market in Pittsburgh. Everyone will receive a book on all the places to eat and shop in The Strip.

Pittsburgh's Treasures Tour
Tuesday, November 7
9:30am-4:30pm $76 (lunch included)
A knowledgeable tour guide will meet you and bring Pittsburgh's story to life. The first stop is Clayton, a Victorian time capsule displaying affluent family life. The tour continues to the Nationality Rooms in the Cathedral of Learning of the University of Pittsburgh. Each room exemplifies the old-world culture of a particular nation. Lunch will take place at Oakland's Duranti's Restaurant. The final stop is Phipps Conservatory, over two acres of lush plantings and foliage encased in a great glass house. Paths meander through a Japanese Garden, tropical settings, an Orchid Room, and many other botanical delights.

PLANT TOURS

A limited number of openings may still be available for the following plant tours. Go to the INFORMS registration desk for information on availability. Buses for plant tours will leave at the beginning time listed for each tour, and will return to the Convention Center at the ending time listed. ***Buses depart from the Convention Center, Tenth Street (outside East Lobby). Note that the Lawrence Convention Center tours are walking tours; meet at Main Entrance, East Lobby, 10th St.***

PPG Springdale & Creighton Plants
Monday, November 6
8:00am-12:30pm $30
PPG Springdale produces industrial coatings, and recently become PPG's first pure-Kanban plant, running according to lean manufacturing concepts. This tour will be an introduction to an alternative view of plant scheduling and operations. PPG Creighton is PPG's original glass manufacturing plant, producing quality glass in the shapes demanded by today's automobile designs. This tour will be an overview of the manufacturing process for laminated glass (primarily windshields and backlights). Buses depart from the Convention Center, Tenth Street (outside East Lobby).
Requirements:
– Closed leather shoes with hard soles required (no open toe, high heels, tennis shoes).
– Legs and arms must be covered; at Springdale, lab coats for protection will be provided.
– Electronic devices (including cell phones) are not permitted into production areas.
– Cameras (including cell phone and PDA cameras) are not permitted on site.
– Lighters, matches, food and drink are not permitted into production areas.
NOTE: Handicap access will be limited in some manufacturing spaces due to tight clearances and safety requirements.

David L. Lawrence Convention Center Walking Tours
Meet in the Convention Center, Main Entrance, East Lobby, 10th St.
Monday, November 6
12:30pm-1:30pm $10
4:00pm-5:00pm $10

Tuesday, November 7
12:30pm-1:30pm $10

One of the most noted green buildings in Pittsburgh is the David L. Lawrence Convention Center. The convention center is the first certified green convention center in the U.S. In conjunction with the main Green Building Alliance Tour described below, the Green Building Alliance will conduct three separate, one-hour walking tours of the convention center itself. Wear comfortable walking shoes.

Green Building Alliance Tour (Bus & Walking)
Tuesday, November 7
7:45am-12:00pm $30
Green buildings are designed to minimize the environmental and energy impact of their materials, construction, operation and eventual deconstruction. Through the work of Pittsburgh's Green Building Alliance, the city has become a center for green building design. This tour includes stops at four showcase green buildings. Docents familiar with the operations will be on-hand, and other green building initiatives will be pointed out during the drive between each stop. Wear comfortable walking shoes - travel between some buildings will be by walking (5 city blocks or less). Buses depart from the Convention Center, Tenth Street (outside East Lobby).

Special Receptions

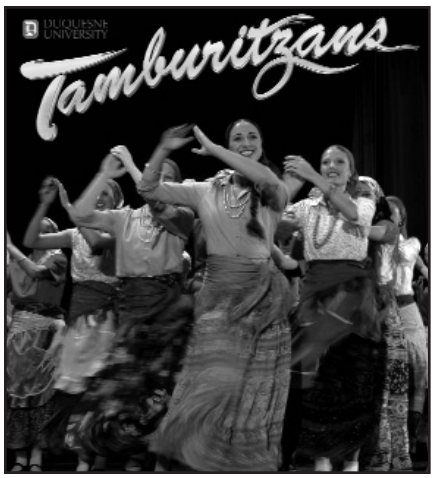
WELCOME RECEPTION

Sponsored by: Carnegie Mellon, Carnegie Mellon Tepper School, Carnegie Mellon Heinz School, University of Pittsburgh Katz School, University of Pittsburgh Department of Industrial Engineering, Duquesne University Palumbo School of Business Administration.

Sunday, November 5
7:30pm-9:00pm
8:15pm-8:45pm-Performance by the Tamburtizans
Convention Center Spirit of Pittsburgh Ballroom

Wear badge for admission. INFORMS and the Pittsburgh Organizing Committee welcome you to the 2006 Annual Meeting with an evening of fellowship and fun. The Duquesne University Tamburitzans, America's longest-running multicultural song and dance company, will showcase the traditional music and dance of Eastern Europe and neighboring folk cultures. Brilliant costumes, colorful tunes and spectacular dancing will be brought to you by this talented company of young people, all full-time students at Duquesne. The Welcome Reception is the perfect venue to meet with colleagues, visit the exhibits and enjoy some great food. You'll receive a ticket for one complimentary beer or wine when you enter the Ballroom. Soft drinks and water are complimentary, with a cash bar available for other beverages.

Your meeting registration fee covers admission to this reception. If your guest would like to accompany you, a guest registration must be purchased (guests will receive a special badge). The $65 guest fee includes the General Reception on Monday, Tuesday reception at PNC Park, and continental breakfasts (at the Westin Hotel) Sunday-Tuesday.



The Duquesne University Tamburitzans, America's longest-running multicultural song and dance company.

GENERAL RECEPTION INFORMS AWARDS CEREMONY at The Carnegie Museums

Monday, November 6
General Reception, 7:30pm-9:30pm
Awards Ceremony & Dessert Reception,
8:30pm-9:45pm

Wear badge for admission. See important bus information below.

The General Reception and the INFORMS Awards Ceremony will both be held at The Carnegie Museums. You are cordially invited to attend one or both of these events. The General Reception runs from 7:30 to 9:30pm. The Awards Ceremony is scheduled from 8:30 to 9:15pm, followed by a dessert reception from 9:15 to 9:45pm.

General Reception

Sponsored by RAND, PPG and CombineNet.

7:30pm-9:30pm
It's two fabulous museums in one – the Carnegie Museum of Natural History and the Carnegie Museum of Art – and the entire expansive building of exhibits is open to INFORMS attendees for this exclusive engagement. You'll see everything from dinosaurs to Amazon fish, Mayan culture, Post-Impressionist paintings and mid-nineteenth century American art. The Hall of Architecture contains the largest collection of plaster casts of architectural masterpieces in the U.S., and the marble Hall of Sculpture replicates the interior of the Parthenon.

We'll be serving great food and drink throughout the evening, along with some wonderful entertainment. Watch – and listen – for performances by students from Carnegie Mellon School of Music, who will provide musical vignettes scattered throughout the halls and exhibits.

You'll receive a ticket for one complimentary beer or wine when you enter the Museum. Soft drinks and water are complimentary, with a cash bar available for other beverages.

INFORMS Awards Ceremony and Dessert Reception

Sponsored by IBM Center for Business Optimization.

Ceremony 8:30pm-9:15pm, Music Hall
Dessert Reception 9:15pm-9:45pm, Music Hall Foyer

The INFORMS Board of Directors invites you to honor and celebrate the achievements of our colleagues at the annual Awards Ceremony, held this year at a new time and fabulous new location, the grand Music Hall of the Carnegie Museums. The society's most prestigious awards will be bestowed during the ceremony, including the von Neumann Theory Prize, the Lanchester Prize, INFORMS Prize for Teaching of Practice, Philip McCord Morse Lectureship Award, INFORMS Prize, George Kimball Medal, Expository Writing Prize, INFORMS President's Award, and the Bonder Scholarships for Health Care and Military Applications. In addition, the winners of two student paper awards will be announced – the Nicholson Student Paper Competition and the Dantzig Dissertation Awards. Following the ceremony, we invite you to congratulate the awardees during a special dessert reception.

Wear badge for admission. Your meeting registration fee covers admission to the General Reception and Awards Ceremony. If your guest would like to accompany you, a guest registration must be purchased (guests will receive a special badge). The $65 guest fee includes the Welcome Reception on Sunday, Tuesday reception at PNC Park, and continental breakfasts (at the Westin Hotel) Sunday-Tuesday.

BUS INFORMATION

Departure
Buses will leave the Convention Center (street level, 10th Street, see page 42 for location) beginning at 7:00pm, with the ***last bus departing for the museums at 8:00pm.*** The drive to the Museums is approximately 20-30 minutes. The INFORMS hotel shuttles will continue operating between the hotels and the Convention Center until 7:30pm. If you are at one of the hotels, you can take the hotel shuttle to the Convention Center and transfer to the Museum bus there.

Return
For the return trip, buses will begin departing from the Museums at 8:30pm, with the ***last bus leaving the Museums at 10:00pm.*** The return buses will drop people at the following locations: (1) Convention Center (for Westin and Marriott Courtyard); (2) Omni; (3) Doubletree; (4) Marriott City Center; (5) Hilton. If you are staying at a hotel not in the INFORMS block,
you should go to the hotel closest to your destination and walk or take a cab from there.

TUESDAY RECEPTION AT PNC PARK

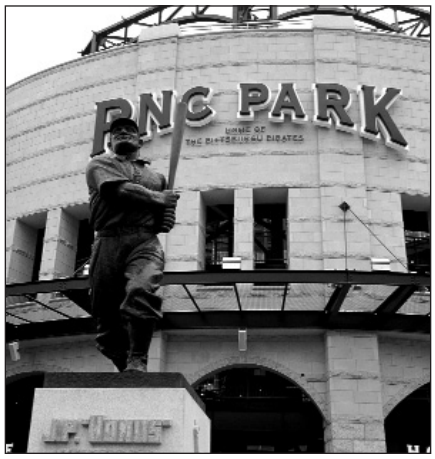
Sponsored by SmartOps.

7:30pm-9:30pm
Wear badge for admission. See important bus information below.

We're going to take you out to the ballpark for tonight's fun and casual reception. Dubbed "The Best Ballpark in America" by ESPN, PNC Park is a great spot for a party! You'll have a bird's-eye view of the ball field, a great venue to relax with friends, and the opportunity to sample from our menu of casual supper food. You'll receive 2 tickets for complimentary beer or wine when you arrive. Soft drinks and water are complimentary, with a cash bar available for other beverages.

Then listen (and maybe even dance!) to the high-energy sounds of John McDonald and The Mango Men. The premier party band in Pittsburgh, the group features Caribbean-flavored music drenched in reggae, salsa, Cajun and island rhythms, with a repertoire of Jimmy Buffett and Bob Marley tunes, plus everything from the Beatles to Sting/Police and UB40. The band has appeared in concert with Red Hot Chile Peppers, Michael McDonald, Smokey Robinson, and the Beach Boys. Don't miss this fabulous evening.

Wear badge for admission. Your meeting registration fee covers admission to the Tuesday Reception. If your guest would like to accompany you, a guest registration must be purchased (guests will receive a special badge). The $65 guest fee includes the Sunday Welcome Reception, General Reception on Monday, and continental breakfasts (at the Westin Hotel) Sunday-Tuesday.



BUS INFORMATION

Tuesday Reception

Departure
Buses will depart on a continuous basis ***between 6:45pm and 7:45pm*** from the following locations: (1) Convention Center, street level (for Westin and Marriott Courtyard); (2) Omni; (3) Doubletree; (4) Marriott City Center; (5) Hilton. Note that for this party buses will be leaving directly from the INFORMS hotels, as well as from the Convention Center.

Return
Buses will begin departing from PNC at 8:00pm, with the ***last bus leaving the Park at 9:45pm.*** The return buses will drop people at the following locations: (1) Convention Center (for Westin and Marriott Courtyard); (2) Omni; (3) Doubletree; (4) Marriott City Center; (5) Hilton. If you are staying at a hotel not in the INFORMS block, you should go to the hotel closest to your destination and walk or take a cab from there.



Carnegie Museum

THANK YOU

Welcome Reception Sponsors

Carnegie Mellon

Carnegie Mellon Tepper School of Business

Carnegie Mellon Policy • Management • Information Technology Heinz School

school of engineering industrial engineering
University of Pittsburgh

Joseph M. Katz Graduate School of Business
University of Pittsburgh

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General Reception Sponsors

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Tuesday PNC Park Reception Sponsor

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Networking & Social Events

SATURDAY, NOVEMBER 4

INFORMS Membership Meeting & Reception
5:00pm-6:00pm
Westin – Allegheny I, Level 3
The INFORMS Board of Directors encourages all members to bring their ideas, opinions and suggestions to this annual membership meeting. Current business and future directions for INFORMS are on the agenda. Wine and cheese will be served.

SUNDAY, NOVEMBER 5

Breakfast for New Members & First-Time Attendees
7:00am-8:00am (Ticket Required)
Westin – Allegheny I & II, Level 3
The INFORMS Membership and Meetings Committees will host this breakfast to welcome and orient people who are new to INFORMS and the meeting. Representatives from a number of INFORMS subdivisions will be on hand to provide information about their member services. Continental breakfast will be served. New members and first-time attendees will receive a ticket for the breakfast with their registration materials.

Junior Faculty Interest Group Luncheon
11:30am-1:00pm
Westin – Allegheny I, Level 3
$15 – *A limited number of tickets will be available on-site. Go to the INFORMS registration desk for information on availability.*
All junior faculty are invited to participate. This event gives junior faculty in engineering and business schools the opportunity to discuss career development and exchange ideas. A buffet lunch will be served. Luncheon and JFIG paper competition are sponsored by *Northwestern University, Department of Industrial Engineering and Management Sciences; University of Maryland, Robert H. Smith School of Business; University of Texas at Dallas, School of Management; and Princeton University, Department of Operations Research and Financial Engineering.*

INFORMS Online Reception
6:00pm-7:00pm
Westin – Butler, Level 2
Meet INFORMS Online staff and volunteers. Celebrate with the retiring editor in chief. Tour INFORMS Online. Give us your feedback. Find out how you can help out. Or just enjoy the society and refreshments.

Minority Issues Forum Reception
8:00pm-9:00pm
Westin – Westmoreland East, Level 2
Come meet old friends and make new ones while talking about minority issues and other intellectual issues and opportunities. Also, enjoy poster presentations from minority doctoral students from different departments from across the United States. *Sponsored by Texas A&M University, Industrial Engineering Department; Northwestern University, Department of Industrial Engineering and Management Sciences; Cornell University, Department of Operations Research and Industrial Engineering; and University of Chicago, Graduate School of Business.*

Women in OR/MS Forum Reception
8:00pm-10:00pm
Trilogy Restaurant - 620 Liberty Ave.
All those interested in encouraging women in the OR/MS profession are invited to join us for a reception at the Trilogy restaurant, located between the Convention Center and the Hilton at 620 Liberty Avenue. Light hors d'oeuvres, beer and wine will be served. *Sponsored by University of Pittsburgh, Department of Industrial Engineering; Pittsburgh Organizing Committee; University of Florida, College of Engineering and Department of Industrial & Systems Engineering; and ILOG, Inc.*

Student Reception
8:00pm-10:00pm
Westin – Allegheny II, Level 3
All students registered for the meeting are encouraged to attend this special reception for an opportunity to socialize and network with other students in your own field as well as those with different specialties and interests.
Sponsored by IBM Research.

IBM Research

MONDAY, NOVEMBER 6

COIN-OR Members & Users Meeting & Bag Lunch
12:15pm-1:15pm
Convention Center – Room 307
Anyone interested in open-source software tools, open standards, and data and model repositories for OR is encouraged to attend the members and users meeting of the Computational Infrastructure for OR (COIN-OR). Bring your own lunch and your ideas. The agenda for the meeting is posted on http://www.coin-or.org/events/informs06.html

CPMS Isolated Practitioner Workshop & Reception
6:15pm-7:15pm
Convention Center – Room 325
CPMS, The Practice Section of INFORMS, sponsors this workshop on topics of interest to isolated practitioners, the "Lone Rangers" of OR/MS. The 23rd workshop in this series will address timely issues that affect the isolated practitioner community. All are welcome to participate in the workshop, discussion and reception. Wine and cheese will be served.

TUESDAY, NOVEMBER 7

Women in OR/MS Forum Business Meeting & Luncheon
12:30pm-1:30pm
Westin – Allegheny I, Level 3
All those interested in issues related to women professionals in OR/MS are invited to join us for lively conversation at our business meeting. The second annual Award for the Advancement of Women in OR/MS will be presented. *Sponsored by SAS Institute; Texas A&M University, Industrial and Systems Engineering Department; ILOG, Inc.; Arizona State University, Department of Industrial Engineering; Pennsylvania State University, Smeal College of Business; and Washington University at St. Louis, John M. Olin School of Business.*

Academic/Practitioner Interface Luncheon
12:30pm-1:30pm
Westin – Allegheny II, Level 3
$20 – *Ticket required - sign up at the INFORMS registration desk.*
Don't miss this opportunity to network with colleagues, both in the practice and academic arenas. Members of the INFORMS Roundtable will facilitate roundtable discussions focusing on academic-practitioner collaboration during this sit-down luncheon. The event is organized and sponsored by the INFORMS Roundtable, an INFORMS subdivision whose purpose is to promote OR/MS excellence in practice.
Sponsored by the INFORMS Roundtable.

ROUND TABLE

ARTIFICIAL INTELLIGENCE & DATA MINING WORKSHOP

8:00am-5:00pm $50
Westin – Cambria & Somerset East, Level 2

The workshop will highlight the frontiers of new knowledge and applications of AI and DM in OR, including presentations in advances in supervised and unsupervised learning; bioinformatics and imaging; business and finance management; classification and pattern detection; decision-making and optimization; intelligent systems; manufacturing systems; and support vector machines

OR IN BIOLOGY & MEDICINE WORKSHOP

8:00am-5:30pm $80
Convention Center, Room 305
Partially funded by The National Science Foundation

In recent years the frontiers of biological and medical research have become increasingly dependent on sophisticated modeling, analysis and computational techniques. Operations research and mathematics are rapidly emerging as vital tools for investigating complex biological systems. The interaction between the fields of O.R. and biomedicine has been fruitful and synergistic. The interdisciplinary nature of the work poses many challenges, including the research itself, funding, education and establishing an academic career. The purpose of this workshop is to bring together researchers in biology, medicine, O.R., mathematics and other disciplines, for the purposes of examining the challenges of this cross-disciplinary research.

VENDOR WORKSHOPS

Aptech Systems, Inc.
GAUSS Matrix Programming Language
8:30am-12:30pm
Convention Center – Room 306

Rather than allowing other programmers to decide the best method for solving your operations research problems, consider writing your own! In this workshop we introduce the fully featured GAUSS matrix programming language and discuss how it can solve common operations research problems.

Dash Optimization, Inc.
Fast Track Optimization Modeling Using Xpress-MP
8:30am-12:30pm
Convention Center – Room 316

This workshop will provide participants with an insight into new modeling and optimization techniques, and first-hand accounts of leading business practitioners on how they are currently using optimization to solve practical problems. Modeling experts from Dash Optimization will focus on novel ways of modeling existing business problems using linear, mixed integer, quadratic, non-linear, stochastic and constraint programming techniques.

GAMS Development Corporation
Application Prototyping with GAMS
8:30am-12:30pm
Convention Center – Room 309

The workshop is designed to show you how to use the GAMS modeling and rapid prototyping tools in an efficient and productive way. The largest part of the workshop consists of hands-on exercises building GAMS models and applications. Sample optimization-based decision support applications will be built from scratch. We will show how easy and flexible GAMS interacts with other applications, including MS Office applications. Examples of how to build sophisticated algorithms will be given. You will also get an introduction on how to analyze and debug large problems using the various tools available within the GAMS system.

SAS
Optimization Modeling and Deployment with SAS
8:30am-12:30pm
Convention Center – Room 317

OPTMODEL from SAS provides powerful, accessible optimization modeling, integrated with the SAS programming language and with SAS data handling, analytical (statistics, forecasting, data mining, etc.), and reporting capabilities. We'll explore the flexibility and versatility of OPTMODEL including: rich, succinct algebraic modeling syntax; unified solver access for linear and nonlinear optimization; and the ability to program customized algorithms with OPTMODEL code. We will also preview the mixed-integer programming features that will debut in the next version of OPTMODEL. Finally, we'll demonstrate how to deploy SAS optimization models for general use and how to create business-oriented interfaces for SAS optimization models.

SCA Technologies LLC
Predicting the Outcome - Before You Make the Decision!
8:30am-12:30pm
Convention Center – Room 307

This informative workshop will show, through operations modeling software, how a company can have a unified framework that brings together the financial, operational and decision-making aspects of their business that are traditionally distributed across various functional units. See how 'What-If' scenarios can help optimize business decisions.

StatPoint, Inc.
Statistical Analysis Using STATGRAPHICS
8:30am-12:30pm
Convention Center – Room 308

Presenters Neil Polhemus and Seth Wyatt will demonstrate the use of STATGRAPHICS Centurion and STATGRAPHICS Mobile for statistical data analysis. Topics covered will include data visualization, statistical model building, classification and regression, time series forecasting, sequential sampling and process optimization. Data synchronization between desktop computers and handheld computing devices will also be discussed.

AIMMS by Paragon Decision Technology
Optimization Modeling in AIMMS 3.7: A Stochastic Approach
1:00pm-5:00pm
Convention Center – Room 308

Be one of the first to experience AIMMS 3.7 - the new release of AIMMS (Oct 2006)! We will show many of the new features, including integrated GIS support, Parallel Solver sessions, Multi-Developer support and Stochastic Programming support. Experience the different aspects of building a complete optimization-based decision support application in AIMMS, including the easy-to-use Model Explorer and Page Manager, basic tools that allow you to build an optimization model and interactive GUI. Get a global overview of the new AIMMS 3.7 features. Finally, we present AIMMS 3.7 Stochastic Programming support: we will show the ability to solve a mathematical model with uncertainty to optimality without changing the actual structure of the deterministic model (creating a robust solution).

Saturday Workshops

Frontline Systems, Inc.
Optimization in Excel with Premium Solver Platform V7.0
1:00pm-5:00pm
Convention Center – Room 309

Is Excel only for small optimization models, as some vendors claim? Don't miss the final burial of this myth, as we demonstrate our brand-new Premium Solver Platform V7.0 with full support for Excel 2007, worksheets with 16 thousand columns and one million rows, multiple solutions for integer programming and global optimization problems, and the ability to solve simulation optimization problems, using our Risk Solver Engine, with breakthrough performance. Take home a free trial CD.

ILOG, Inc.
ILOG ODM: The Next Revolution in Optimization
1:00pm-5:00pm
Convention Center – Room 316

ILOG Optimization Decision Manager (ODM) is a revolutionary new tool that makes it easier for business users to understand the value of optimization. Learn how ODM 2.0 applications can easily be created directly from OPL models. See how the power of CPLEX can be leveraged to create powerful optimization applications.

Imagine That, Inc.
EXTEND
Convention Center – Room 317
1:00pm-5:00pm

Bring your laptop and get a free copy of Extend LT. During this session you will create your own model, discovering the many features that make Extend easy to use, powerful and scalable. Spend an afternoon with us and see why Extend is the tool of choice for simulation practitioners and educators.

JMP
Exploratory Data Mining and Discovery with JMP
1:00pm-5:00pm
Convention Center – Room 307

JMP is a state-of-the-art statistical package from SAS Institute. Designed for the busy professional who wants to quickly and easily analyze their data and needs sophisticated analyses–from classical statistical methods to six sigma and exploratory data mining–that only SAS can provide. Intuitive, interactive and graphical, JMP lets you focus on the insight your data can provide. The workshop will cover the basics and more advanced features specific to the needs of the attendees.

Maximal Software, Inc.
Optimization Modeling with MPL: Integrating Optimization in Real-World Business Applications
1:00pm-5:00pm
Convention Center – Room 315

The workshop focuses on optimization modeling and how to embed optimization models into applications. It is designed to teach the participants how to develop their own optimization models, link them to data sources and solve the models using state-of-the-art, industrial-strength solvers. The speakers will take you through all the steps of an optimization project using optimization software tools from Maximal Software, ILOG and ARKI Consulting. Participants will leave with an excellent overview of optimization modeling and a good working knowledge of how to successfully build optimization applications.

Responsive Learning Technologies, Inc.
Online Games for Operations Management and Supply Chain Courses
1:30pm-3:00pm - The Supply Chain Game
3:30pm-5:00pm - Managing Operations at Littlefield Technologies
Convention Center – Room 306

Each 90-minute session will describe a competitive, web-based assignment designed with leading scholars to excite and engage students at the undergraduate and graduate levels. Each session will begin with an overview, followed by participants playing the online game and then concluding with a debriefing.

Whether you work in industry, government or consulting, you'll find the best applications resources at the INFORMS Annual Meeting.

Focus on Practice
Sunday–Wednesday

Real-world applications are the focus of 37 practice-oriented sessions. Track 25 features seven sessions on "OR Practice," including presentations on portfolio optimization, semi-conductor manufacturing, telecommunications and applications at Hewlett-Packard. Two sessions in Track 25 reprise presentations by Edelman Competition finalists, with talks by the U.S. Department of Homeland Security, Travelocity, Animal Health Institute, Omya Hustadmarmor and the Athens Olympic Committee. The Daniel H. Wagner Prize Competition (Track 24) offers another four sessions of applications case studies, presented by companies such as Jeppesen, Optiant, Hitachi, Innovative Scheduling and Delta Airlines. You can find practice-oriented talks in many other sessions, including tracks on multi-criteria decision making, supply chain and operations engineering, MSOM (Manufacturing & Service Operations Management), enterprise-wide optimization in the process industry, TSL (Transportation Science and Logistics), military applications and even OR in sports!

Practice-oriented sessions are highlighted in gray on the Master Track Schedule.

Daniel H. Wager Prize Competition
Sponsored by CPMS, The Practice Section of INFORMS
Monday–Tuesday
Track 24
Convention Center – Room 324
Contestants from Jeppesen, Optiant, Stanford, Innovative Scheduling, Delta and other organizations present their best projects in this competition that emphasizes the quality and coherence of implemented O.R. work.

2006 Franz Edelman Award Reprise
Sponsored by CPMS, The Practice Section of INFORMS
Tuesday, November 7
3:10pm-4:00pm
Convention Center – Ballroom B
Warner Robins Air Logistics Center, the 2006 First Place Winner, will reprise their winning presentation during this keynote session. The team will describe how they used O.R. to arrive at a radically different approach to repair and overhaul activity on the C-5 transport aircraft.

CPMS Isolated Practitioner Workshop & Reception
Monday, November 6
6:15pm–7:15pm
Convention Center – Room 325
CPMS, The Practice Section of INFORMS, sponsors this workshop on topics of interest to isolated practitioners, the "Lone Rangers" of OR/MS. The 23rd workshop in this series will address timely issues that affect the isolated practitioner community. All are welcome to participate in the workshop, discussion and reception. Wine and cheese will be served.

Tutorials
Track 45, Sunday-Wednesday, Convention Center- 406
Track 46, Monday, Convention Center- 407
These 90-minute sessions offer an in-depth look at current methodologies. INFORMS will publish nine of the tutorials in a book available for purchase at the INFORMS booth in the exhibit hall (booth 310/312). Topics include agent-based modeling and simulation, disruptions in supply chain networks, approximate dynamic programming and other key topics.

Software Demonstrations
Sunday–Tuesday
Track 10
Convention Center – Room 310
See new product releases, case studies and software presented by leading vendors and solution providers.

Academic/Practitioner Interface Luncheon
Tuesday, November 7
12:30pm-1:30pm
Westin – Allegheny II, Level 3
$20 – *Ticket required, sign up at the INFORMS registration desk.*
Don't miss this opportunity to network with colleagues, both in the practice and academic arenas. Members of the INFORMS Roundtable will facilitate roundtable discussions focusing on academic-practitioner collaboration during this sit-down luncheon. The event is organized and sponsored by the INFORMS Roundtable, an INFORMS subdivision whose purpose is to promote OR/MS excellence in practice.
Sponsored by the INFORMS Roundtable

ROUND TABLE

Search the Technical Sessions
Be sure to check out all 55 technical session tracks, particularly those sponsored by INFORMS subdivisions, which offer many applications-oriented papers and sessions. You'll find presentations on aviation and health applications, data mining, e-business, financial services, energy, manufacturing, revenue management, transportation and many others.

Special Programs

O.R. Renaissance: Special Theme Sessions
The technical program features sessions related to the Annual Meeting theme, *O.R. Renaissance*. Improvements in computing, data availability, modeling and solution methods have created a renaissance in operations research. Our theme-related sessions present innovative and exciting work, with broad interest, that illustrate the ongoing O.R. renaissance.

O.R. Renaissance sessions are highlighted in purple on the Master Track Schedule.

2006 Combined Colloquia
Friday-Saturday
Westin – Allegheny I & II,
Crawford East & West - Level 3
The 2006 Combined Colloquia will feature the 8th Teaching Effectiveness Colloquium and the Future Academician and Future Practitioner Colloquia. Participants in the various colloquia will join together for a welcome dinner on Friday evening, as well as breaks and meals on Saturday.
Participation in the colloquia is by nomination only.
Sponsored by Omega Rho, McGraw-Hill/Irwin and Wiley.

Organization Science Dissertation Proposal Competition
Saturday
8:30am-5:00pm
Westin – Butler East, Level 2
Now in its 15th year, this competition is one of the most prestigious available to doctoral students studying organizations. Finalists present their dissertation proposals in a workshop on Saturday, and receive detailed feedback from a panel of respected organizational scholars who act as judges for the competition. The all-day workshop also provides an opportunity for attendees to interact with a small group of future colleagues.

CIST 2005 – 11th Conference on Information Systems and Technology
Saturday-Sunday
Westin – Fayette & Somerset West – Level 2
The theme of the 2006 conference is *IS Foundations: Opportunities and Risks*. The goal of this conference is to engage academic and industry researchers in a dialogue that examines a broad range of topics consistent with the main thrust of this theme.
Sponsored by Microsoft Research Group, University of Pittsburgh-Katz Graduate School of Business and Carnegie Mellon University-The Heinz School.

NEW Time and Location!
INFORMS Awards Ceremony and Dessert Reception
Held In conjunction with the General Reception
Monday, Nov. 6, The Carnegie Museums
Awards Ceremony– 8:30pm-9:15pm, Music Hall
Dessert Reception–9:15pm-9:45pm, Music Hall Foyer

The INFORMS Board of Directors invites you to honor and celebrate the achievements of our colleagues at the annual Awards Ceremony, held this year at a new time and fabulous new location, the grand Music Hall of the Carnegie Museums. The society's most prestigious awards will be bestowed during the ceremony, including the von Neumann Theory Prize, Lanchester Prize, INFORMS Prize for Teaching of Practice, INFORMS Prize, George Kimball Medal, Expository Writing Prize, INFORMS President's Award, the new INFORMS Impact Prize, and the Bonder Scholarships for Health Care and Military Applications. In addition, the winners of two student paper awards will be announced – the Nicholson Student Paper Competition and the Dantzig Dissertation Awards. Following the ceremony, we invite you to congratulate the awardees during a special dessert reception. For complete information on admission and busing to the Carnegie Museums, see page18.
Sponsored by IBM Center for Business Optimization.

IBM Center for Business Optimization

Pittsburgh Area Math Teachers Program
Tuesday
8:00am-4:00pm
Westin – Westmoreland East, Level 2
This program, geared to middle/high school/community college math and science teachers, will consist of introductory O.R. and computer application presentations followed by hands-on participation. Participants are also welcome to attend technical sessions, and will receive copies of all program materials.

JOB PLACEMENT SERVICES

Job Fair
Sunday, November 5
12:00pm-5:00pm
Convention Center – Ballroom A
The Job Fair provides an opportunity for job seekers to meet participating employers in an informal atmosphere and to discuss employment opportunities within those organizations. Employers meet and collect resumes from many job seekers in a short period of time early in the conference, giving them the chance to set up interviews during the conference.

INFORMS Job Placement Service
Monday-Tuesday, 9:00am-5:00pm
Wednesday, 9:00am-3:30pm
Convention Center – Ballroom A
This service provides employers and applicants a convenient venue for on-site interviews to explore opportunities in academia, industry and government. In addition, the job placement service offers:
- Online access to job listings and applicant files,
- Expanded information about jobs and applicants,
- Weekly updates of the database,
- Improved database search capabilities,
- Online data entry for applicants and employers,
- Extended availability of the database.

www.informs.org/JPS/

Job Placement Panel Discussions
Track 44
Convention Center – Room 405

THE INDUSTRY JOB SEARCH
Monday, November 6
4:30pm-6:00pm
The panel will discuss the industry interview process and the do's and don'ts associated with the job search. Participants include current and former industrial recruiters.

THE ACADEMIC JOB SEARCH
Tuesday, November 7
8:00am-9:30am
This panel will discuss the academic interview process and the do's and don'ts associated with the job search. Participants include current and former search chairs.

INFORMS MEETINGS

2007

April 29-May 1
INFORMS Practice Conference:
Applying Science to the Art of Business
Sheraton Vancouver Wall Centre
Vancouver, BC, Canada
Chair: Jack Levis
www.informs.org/Conf/Practice07

July 8-11
INFORMS International Puerto Rico 2007
Westin Rio Mar Beach Resort & Spa
Rio Grande, Puerto Rico
Chair: Karla Hoffman
www.informs.org/Conf/PuertoRico2007

November 4-7
INFORMS Annual Meeting 2007 Seattle
Washington State Convention and Trade Center & Sheraton Seattle
Seattle, Washington
www.informs.org/Conf/Seattle07

2008

April 13-15
INFORMS Practice Conference:
Applying Science to the Art of Business
Baltimore Marriott Waterfront
Baltimore, Maryland
Chair: Karl G. Kempf

October 12-15
INFORMS Annual Meeting 2008 Washington
Marriott Wardman Park Hotel & Omni Shoreham Hotel
Washington, DC
Chair: Hani S. Mahmassani
masmah@mail.umd.edu

2009

INFORMS Practice Conference:
Applying Science to the Art of Business
Spring 2009: Dates and location to be announced.

June 14-17
CORS/INFORMS International Toronto 2009
Westin Harbour Castle
Toronto, Ontario, Canada
Chair: Liping Fang
lfang@ryerson.ca

October 11-14
INFORMS Annual Meeting 2009 San Diego
San Diego Convention Center and Hilton San Diego
Chair: Soheila Jorjani
sjorjani@csusm.edu

2010

November 7-10
INFORMS Annual Meeting 2010 Austin
Austin Convention Center and Hilton Austin
Chair: Jonathan Bard, University of Texas at Austin
jbard@mail.utexas.edu

INFORMS SUBDIVISION MEETINGS

2006

December 3-6
Winter Simulation Conference 2006
Monterey Conference Center & Portola Plaza Hotel
Monterey, California
Chair: David Nicol
www.wintersim.org

2007

January 3–5
10th INFORMS Computing Society Conference
Colonnade Hotel
Coral Gables, Florida
Co-Chairs: Edward Baker, Anito Joseph, Anuj Mehrotra, Michael Trick
http://www.bus.miami.edu/ics2007/

June 28-30
INFORMS Marketing Science Conference
Singapore Management University
Singapore
Co-Chairs: Sundar Bharadwaj, Jin Han, David Montgomery, Tan Chin Tiong
http://www.business.smu.edu.sg/mks2007/

July 9-11
INFORMS Applied Probability Society Conference
EURANDOM & University of Eindhoven
Co-Chairs: Onno Boxma, Michel Mandjes
http://appliedprob.society.informs.org/INFORMS2007/Index.html

December 9-12
Winter Simulation Conference 2007
J.W. Marriott
Washington, DC
Chair: Jeffrey Tew

Plenary & Keynote Presentations

PRESIDENTIAL ADDRESS

Sunday, November 5
11:40am-12:30pm
Convention Center – Ballroom B

Everyday Lessons from Operations Research

Mark S. Daskin
President, INFORMS
Professor, Department of Industrial Engineering and Management Sciences
Northwestern University

Operations research has much to teach us about everyday living. In this talk, Mark S. Daskin will highlight a number of the key life lessons that operations research models, algorithms and theories can teach us. Examples will be drawn from such areas as optimization, stochastic modeling, probability, statistics and decision theory.



Mark S. Daskin is a Professor in the Department of Industrial Engineering and Management Sciences at Northwestern University. Prior to 1995, he was in the Civil Engineering Department. Before joining the Northwestern faculty in 1980, he was a faculty member at the University of Texas at Austin. Daskin received his PhD from the Civil Engineering Department at MIT in 1978. He also holds a BSCE degree from that department and a Certificate of Post-Graduate Study in Engineering from the University of Cambridge, England.

Daskin's research focuses on the application and development of O.R. techniques for the analysis of transportation, supply chain and manufacturing problems. He is the author of roughly 50 refereed publications as well as a text entitled, *Network and Discrete Location: Models, Algorithms, and Applications* (John Wiley, 1995). He is the recipient of the Fred C. Crane Award for Distinguished Service from the Institute of Industrial Engineers (2005), the Fellow Award from INFORMS (2004), and the Institute of Industrial Engineers Technical Innovation Award (2001). Daskin was recently elected a fellow of IIE and is a past editor-in-chief of *IIE Transactions and Transportation Science*. He is currently the president of INFORMS.

PHILIP McCORD MORSE LECTURE

Sunday, November 5
3:10pm-4:00pm
Convention Center – Ballroom B

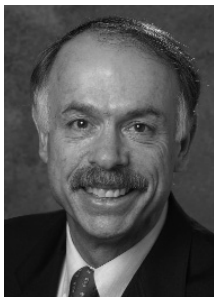
Rocket Science Retailing

Marshall Fisher
UPS Professor of Operations and Information Management
The Wharton School
University of Pennsylvania

Retailing is a huge industry. In the U.S., retail business represents about forty percent of the economy and is the largest employer. Retail supply chain management is still more art than science, but this is changing rapidly as retailers begin to apply analytic models to the huge volume of data they are collecting on consumer purchases and preferences. This industry-wide movement resembles the transformation of Wall Street that occurred in the 1970s when physicists and other "rocket scientists" applied their analytic skills to investment decisions.

To better understand this phenomenon, over the last decade Ananth Raman of Harvard Business School and Marshall Fisher have been leading a group of academics working with about 50 leading retailers to assess their progress towards rocket science retailing and to accelerate that progress through selected research projects. This presentation will review the current state of industry practice in retail supply chain management and summarize research in four areas:

- Assortment planning, which involves determining the set of products a retailer will carry at each store at each point in time to optimize a profit function. A new algorithm for using sales history to determine an assortment by store and describe its application at various retailers will be presented.
- Store execution, where Fisher is working with several colleagues and five retailers to analyze large data sets at the store-week level on sales, customer satisfaction and store execution to determine what most influences customer satisfaction and sales.
- A product life cycle approach to inventory management at the store-SKU level that has been successfully applied at a number of retailers.
- Approaches of several successful retailers such as World and Zara in creating a responsive supply chain.



Marshall Fisher is the UPS Professor of Operations and Information Management at the Wharton School of the University of Pennsylvania and co-director of the Fishman-Davidson Center for Service and Operations Management. His research has focused on supply chain management, with a varying emphasis that has included private truck fleet scheduling, supply chain management for hard-to-predict fashion products and a scientific approach to retail buying.

In 1981, Fisher co-founded Distribution Analysis, Research and Technology, Inc., a company that provided private truck fleet optimization software based on his research to major clients, and served as Chairman until its merger with Manugistics Inc. in 1990. He is also a co-founder and Chairman of 4R Systems, Inc., a company that provides supply chain planning software to retailers of short lifecycle products.

Numerous awards, including the 1977 Lanchester prize for the best paper in operations research, and the 1983 Edelman Prize from The Institute of Management Sciences for the best application of management science, have recognized Marshall Fisher's research. He is a member of the National Academy of Engineering and a Fellow of INFORMS, the Production and Operations Management Society, and the Manufacturing and Service Operations Management Society. In 2005, Fisher's paper, "The Lagrangian Relaxation Method for Solving Integer Programming Problems," published in *Management Science* in 1981 was voted by the membership of INFORMS as one of the ten most influential papers published in *Management Science* during its 50-year history

OMEGA RHO DISTINGUISHED LECTURE

Monday, November 6
11:40am-12:30pm
Convention Center – Ballroom B

The Science and Art of Service Management: From Customer to Co-Producer

Patrick T. Harker
Dean, The Wharton School
University of Pennsylvania

A dramatic transition of the customer's role in many service industries (e.g., retailing, banking, health care, software development and even education) is underway. Instead of being a passive recipient of a service production and delivery process, the customer is playing a much more active and even leading role in the process. Innovations in technology and service design have increasingly enabled firms to incorporate self-service technology to augment or substitute for "traditional" employee-provided service channels. Although it is clear that self-service can reduce cost, less is known about how customers utilize self-service channels in a multi-channel service delivery system and the resulting impact on firm performance. An important aspect of service operations is that customers are co-producers of the service. Thus, the performance of the delivery system and customers' use of service channels can be affected by customers' own efficiency or productivity in service co-production (customer efficiency).

This talk explores the concept of customer efficiency management, the ability of an organization to effectively manage a customer's efforts in a co-producing a service. Examples of this concept will be provided along with empirical evidence from the financial services industry. The implications of this concept to managers of service organizations will also be explored (including how it applies to my own business, higher education!).



Patrick T. Harker is the Dean of The Wharton School and the Reliance Professor of Management and Private Enterprise. He also created Wharton West, the school's San Francisco-based campus, as well as creating an alliance with INSEAD. Harker is also a Senior Fellow at the Wharton Financial Institutions Center and holds a secondary appointment as a Professor of Electrical and Systems Engineering at Penn. He currently serves as a Trustee of the Goldman Sachs Trust and the Goldman Sachs Variable Insurance Trust, is a member of the Advisory Board of Juniper Bank and Chair of the Scientific Advisory Board for Traffic.com, Inc.

Harker received his BSE and MSE in civil engineering in 1981, and an MA in economics and a PhD in civil and urban engineering (transportation planning and economics) from the University of Pennsylvania in 1983. The National Science Foundation named him a Presidential Young Investigator in 1986. In June 1991, President Bush named him a White House Fellow, one of 16 chosen in the country. Harker is the youngest faculty member to be awarded an endowed professorship in the history of the Wharton School. He served as Editor-in-Chief of *Operations Research* from 1996-1999.

OMEGA RHO

Omega Rho, the official Honor Society of INFORMS, was founded in 1976 to recognize superior scholarship and encourage leadership in operations research, management science and related disciplines. The society has 37 active collegiate chapters and more than 5,000 student and faculty members. It is a member of the Association of College Honor Societies. In addition to sponsoring Omega Rho Distinguished Lectures at INFORMS annual and international meetings, Omega Rho provides financial support to the annual INFORMS Doctoral Colloquium and to its local chapters.

Honorary Membership in Omega Rho is bestowed upon individuals who provide leadership and extraordinary support for the encouragement of operations research and management science through their professional activities. Prior to delivering the Omega Rho Distinguished Lecture, Patrick T. Harker will be inducted as the 40th Honorary Member of Omega Rho.

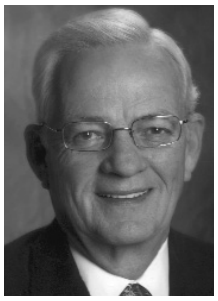
PLENARY

Monday, November 6
3:10pm-4:00pm
Convention Center – Ballroom B

Systems Analysis and Social Action – The Basis of Hope for a Better Future

Paul H. O'Neill
Former Secretary of the U.S. Treasury
Chairman and CEO, Alcoa

Productivity is rising at a rapid pace in the U.S. economy. The combination of systems analysis and the implementation of ideas that produce continuous learning and continuous improvement is a major contributing factor. At the same time, important sectors of our society such as medical care and primary and secondary education have been left behind. Much systems analysis of these sectors has been done but actual implementation of proven beneficial change has been painfully slow. The challenge for operations research and management science professionals is to turn their talents to understanding why change has been so slow to come in these critical sectors and to devise ways to accelerate progress.



Paul H. O'Neill was the 72nd Secretary of the U.S. Treasury, serving from 2001-2002. He was chairman and CEO of Alcoa from 1987 to 1999, and retired as chairman at the end of 2000. Prior to joining Alcoa, O'Neill was president of International Paper Company from 1985 to 1987, where he was vice president from 1977 to 1985. He worked as a computer systems analyst with the U.S. Veterans Administration from 1961 to 1966 and served on the staff of the U.S. Office of Management and Budget from 1967 to 1977. He was deputy director of OMB from 1974 to 1977.

O'Neill received a bachelor's degree in economics from Fresno State College in California, and a master's degree in public administration from Indiana University. He is the recipient of the National Institute of Public Affairs Career Education Award (1965), the William A. Jump Meritorious Award (1971) and the National Committee for Quality Assurance-2003 Heath Quality Award. He holds honorary degrees from Georgetown University, Carnegie Mellon University, University of Pittsburgh and Duquesne University. O'Neill serves on the boards of prominent corporations and organizations, including Celanese Corporation, Eastman Kodak, the Heinz School, RAND and the National Quality Forum.

PLENARY

Tuesday, November 7
11:40am-12:30pm
Convention Center – Ballroom B

Using Mathematical and Systems Models to Inform Policy Decisions: A Personal Perspective

Margaret L. Brandeau
Professor, Department of Management Science and Engineering
Stanford University

How can physicians make good decisions about patient care when no relevant evidence from clinical trials is available? What is the most effective way to use limited resources to slow the spread of HIV? To what extent should local communities stockpile antibiotics for response to a potential bioterror attack? This talk will describe examples from past and ongoing research projects of O.R.-based analysis of policy questions. We describe some of the most important ways in which public policy questions differ from planning problems faced in the private sector. We provide perspective on key elements of a successful policy analysis, ways in which such analysis can influence policy, and modeling and policy challenges for the future.



Margaret L. Brandeau is Professor of Management Science and Engineering at Stanford University. She holds a BS in mathematics and an MS in operations research from the Massachusetts Institute of Technology, and a PhD in engineering-economic systems from Stanford. She is an operations researcher and policy analyst with extensive background in the development of applied mathematical and economic models, and a distinguished investigator in HIV. Among other awards, Brandeau has received a Presidential Young Investigator Award from the National Science Foundation, the Pierskalla Prize from INFORMS for research excellence in health care management science, and the departmental Outstanding Teaching Award. She also holds a patent on a method for operation assignment in printed circuit board assembly.

Brandeau has published numerous articles in areas of applied O.R. and policy analysis, has co-edited the books *Modeling the AIDS Epidemic: Planning, Policy*, and *Prediction and Operations Research in Health: A Handbook of Methods and Applications*, and has served as Principal Investigator on a broad range of funded research projects. She has served on the boards of several journals, including *Operations Research, Management Science* and *Health Care Management Science.* Her HIV research focuses on using mathematical and economic models to assess the value of different HIV and drug abuse interventions, both in the U.S. and abroad. Her recent research has focused on preparedness planning for potential bioterror attacks, including modeling and analysis of the bioterrorism response supply chain.

Reprise Presentation

EDELMAN COMPETITION 2006 AWARD WINNER

Tuesday, November 7
3:10pm-4:00pm
Convention Center – Ballroom B

Streamlining Aircraft Repair and Overhaul at Warner Robins Air Logistics Center

William D. Best, Warner Robins Air Logistics Center

Mandyam M. Srinivasan, University of Tennessee, College of Business Administration

Sridhar Chandrasekaran, Realization Technologies, Inc.

The Warner Robins Air Logistics Center (WR-ALC) used operations research in 2005 to arrive at a radically different approach to manage the repair and overhaul activity on its C-5 transport aircraft. WR-ALC used an O.R. technique called Critical Chain to reduce the number of C-5 aircraft undergoing repair and overhaul in the depot from twelve to seven in just eight months. The time required to repair and overhaul the C-5 aircraft was reduced by 33 percent. The five additional aircraft now in operation have generated immediate additional revenue of at least $49.8 million per year. The replacement value for these aircraft is estimated at $2.37 billion. The additional workload the center is accommodating will bring in additional revenue of $119 million through 2008, with this number projected to increase to $248 million by 2009.

The Franz Edelman Award for Achievement in Operations Research and the Management Sciences calls out, recognizes and rewards outstanding, high-impact applications of OR/MS. Each year, six to seven finalists compete in the "Super Bowl" of O.R. in practice. The 2006 finalists include the Sabre Research Group and Travelocity; Transportation Security Administration and The Boeing Company; Omya Hustadmarmor; and Animal Health Institute and Cox Associates. In this keynote, the first place Warner Robins Air Logistics Center team will reprise their winning presentation.

KEYNOTE

Tuesday, November 7
3:10pm-4:00pm
Convention Center - Room 305

Your 15 Minutes of Fame: Want Better Press Coverage? Here's How…

Moderator:
Carol McGarry, Executive Vice President, Schwartz Communications, Inc.; Consultant to the INFORMS Public Information Committee

Panelists:
Brenda Dietrich, Director, Mathematical Sciences, IBM Research; President-Elect INFORMS

Irvin J. Lustig, Manager, Technical Services, Optimization and Visualization, ILOG, Inc.; Member, Public Information Committee

Vijay Mehrotra, Professor, San Francisco State University; Former CEO, Onward Inc.; Member, Public Information Committee

Stefanos Zenios, Professor, Stanford University

You may not be a Hollywood star, but your latest project can garner its share of the limelight. All it takes is a little PR savvy. This panel will give you the basic recipe for success as you juggle your wish to get media coverage for your work, your employer and the umbrella O.R. profession. We'll discuss how to identify the most promising projects to publicize, talk with the media so that they quote you, and at the same time help promote the profession. Carol McGarry will moderate the panel of experts who have already won their 15 minutes of fame and can share their experiences.

PLENARY

Wednesday, November 8
11:40am-12:30pm
Convention Center – Ballroom B

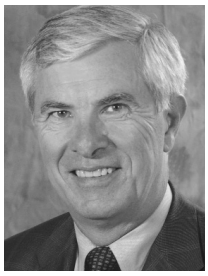
Optimization Everywhere? Five Critical Issues

William R. Pulleyblank
Vice President, Center for Business Optimization
IBM Global Business Services

Business and industry are steadily, but slowly, transforming the way that they perform their operations and planning. The types of tools that were at one time limited to very large enterprises are now being used by smaller businesses and even individuals. There is an increasing desire to combine data from a variety of sources with analytic methods to enable more rapid and better decision-making. This is driven in part by the economic pressures created by the need to both compete globally and to exploit global resources. This is enabled by the maturing of methods and tools and takes advantage of continuing advances in the underlying technologies. However, for this transformation to continue and accelerate, we must overcome five major obstacles:

- How do we deal with massive amounts of noisy data, both repository and streaming?
- Can we develop adequate methods for handling risk and uncertainty?
- How should we deal with issues of distributed data and computation?
- What does it require for operational systems to match the sophistication of long-term planning systems?
- How do we adapt these capabilities to the emerging networked business world?

Pulleyblank will discuss these issues as well as some approaches that are yielding success in dealing with them.



William R. Pulleyblank is the Vice President of the Center for Business Optimization within IBM Business Consulting Services. This group is leading the development and deployment of high powered optimization and analytic capabilities to improve the business performance of IBM's clients and customers. Prior to this, he was the Director of Exploratory Server Systems and Director of the Deep Computing Institute within IBM Research. These teams provided broad-based support to IBM's server activities as well as leading research in high performance computing. This included the Blue Gene project, which led to the creation of the Blue Gene/L supercomputer, since November 2004 certified as the most powerful supercomputer in the world. Pulleyblank was Director of Mathematical Sciences in IBM Research (1995-2000) and was the research relationship executive responsible for the financial services sector in IBM, the utility and energy services industry, and for the business intelligence group.

Pulleyblank has served on a number of boards and advisory panels, including the Advisory Committee of the Division of Mathematics & Physical Sciences of the National Science Foundation, the Board on Mathematical Sciences of the National Research Council, the iCORE Board of Directors and the Scientific Advisory Panel of The Fields Institute for Research in Mathematical Sciences. He also serves on the editorial boards of a number of journals. His personal research interests are in operations research, combinatorial optimization and applications of optimization. In addition to writing scientific papers and books, he has consulted for several companies including: Mobil Oil on helicopter routing; Marks and Spencer on depot management; Statistics Canada on survey validation; and CP Rail on train scheduling.

SUNDAY, NOVEMBER 5

■ SA45
8:00am-9:30am
Convention Center – Room 406
Location, Transport and Land-Use: Modeling Spatial-Temporal Information
Yupo Chan, University of Arkansas at Little Rock

This tutorial identifies principles that govern siting, community development and product/service delivery. Included are procedures to perform: site location, land-use planning, location-routing, competitive allocation of products and services, and spatial forecasting. We develop solution techniques for a number of applications, including emergency-response, supply-chain management, environmental planning, intelligent transportation systems and supply-chain management.

■ SA46
8:00am-9:30am
Convention Center – Room 407
Pricing and Revenue Management
Andrew Boyd, PROS Revenue Management

Pricing and revenue management has become one of the fastest growing specialties within O.R. Businesses are investigating what mathematical modeling can bring to the world of sales and distribution. In this tutorial, we introduce some basic pricing and revenue management models and their interactions. We also examine the commercial market for pricing and revenue management software and services and identify future research opportunities.

■ SB45
10:00am-11:30am
Convention Center – Room 406
A Practical Approach to Pricing Optimization
Maarten Oosten and Darius Walczak, PROS Revenue Management

Pricing optimization generalizes traditional revenue management in that demand need not be independent across products. We define pricing optimization for multiple products facing stochastic demand over a finite time horizon. We address static controls (e.g., LP) as well as dynamic controls. We demonstrate equivalencies between general pricing formulations and traditional revenue management models, and highlight economic and managerial insights. Finally, we address some practical issues, and highlight challenges and open research problems.

■ SB46
10:00am-11:30am
Convention Center - Room 407
Math Programming Approaches to Approximate Dynamic Programming
Dan Adelman, University of Chicago

Approximate Dynamic Programming (ADP) is a new class of methods for breaking Bellman's curse of dimensionality. We summarize math programming approaches to ADP, focusing on applications in inventory control, revenue management and queueing. We derive a parsimonious, exactly solvable math program whose optimal dual prices are used to construct a value function approximation. Dual information provides economic insights, including a "price-directed" control policy.

■ SC45
1:30pm-3:00pm
Convention Center - Room 406
Enhance Your Own Research Productivity Using Spreadsheets (From Sin to Salvation)*
Janet Wagner and Jeffrey Keisler, University of Massachusetts-Boston

Spreadsheets are preferred by many OR/MS modelers. However, user surveys indicate that most do not use basic good practices and most large spreadsheets are seriously flawed. Fortunately, solutions to many of these problems are widely available and easy to learn. The authors, who have first-hand experience with both "sin" and "salvation" in the spreadsheet kingdom, present "top ten" Excel methods and four major applications reflecting personal and professional experiences. Bring your laptops!

■ SC46
1:30pm-3:00pm
Convention Center - Room 407
Model Uncertainty, Robust Optimization and Learning*
Andew Lim, George Shanthikumar and Z.-J. Max Shen, University of California at Berkeley

We discuss different models of model uncertainty with variable, parameter and measure uncertainty sets, and present different approaches to robust optimization with and without benchmarking. Two alternative learning approaches, Objective Bayesian Learning and Operational Learning will be discussed. Applications considered for illustration are the classical inventory control problem, the inventory control problem with censored demand data and the portfolio selection problem.

TutORials 2006
TutORials 2006, the latest installment in the new INFORMS Tutorials in Operations Research Series, includes nine noteworthy tutorials being presented in Pittsburgh (*). This volume is available in hard copy book form and on CD. You can place your order at the INFORMS booth in the exhibit hall (310/312). If you ordered *TutORials 2006* when you registered for the meeting, you received a voucher for your purchase in your registration envelope. Bring the voucher to the INFORMS booth to pick up your order.

■ SD45
4:30pm-6:00pm
Convention Center - Room 406
Electricity Deregulation: What is Wrong and How We Got There
Lester Lave and Seth Blumsack, Carnegie Mellon University

Regulated monopolies for electricity supply worked well from 1910 until 1975, when a host of problems led to deregulation. But deregulation has produced higher prices, unreliability and transmission congestion. Recently the emphasis on deregulation has eased and some states have returned to their original regulatory regimes. We explore reasons for current problems in electricity markets and evaluate solutions. We conclude that either regime may satisfy market demands, though neither will produce a free competitive market.

■ SD46
4:30pm-6:00pm
Convention Center - Room 407
Opt Art
Robert Bosch, Oberlin College

Optimization is concerned with finding the best way to complete a task. Many applications of optimization, such as scheduling, matching and routing, are well known. In this tutorial, we will showcase novel applications of optimization to the area of fine art: portraits constructed out of complete sets of dominoes (via integer programming), mosaics comprised of abstract geometric tiles (via integer programming and various heuristics), and continuous line drawings (via the "solution'' of large-scale instances of the traveling salesman problem).

MONDAY, NOVEMBER 6

■ MA45
8:00am-9:30am
Convention Center - Room 406
Semidefinite and Second Order Cone Programming and their Application to Shape Constrained Regression and Density Estimation*
Farid Alizadeh, Rutgers, State Univ. of New Jersey

Many statistical analyses require the approximation of a functional relationship between explanatory and response variables, subject to certain "shape constraints." This implies a connection between shape-constrained regression and semidefinite programming. In this tutorial, we introduce semidefinite programming and second order cone programming, review specific statistical problems amenable to solution via semidefinite programming, and discuss extensions and limitations to this method.

■ MB45
10:00am-11:30am
Convention Center – Room 406
Robust and Data-Driven Optimization: Modern Decision-Making Under Uncertainty*
Dimitris Bertsimas, MIT, and
Aurelie Thiele, Lehigh University

We present a mathematical approach to decision-making under uncertainty incorporating limited information on the sources of randomness and decision-makers' risk attitudes. We review recent developments in robust and data-driven optimization, where random variables represent uncertain parameters in a convex uncertainty set and the decision-maker protects the system against their worst-case values. We also address construction of sets using historical data and connections with coherent risk measures.

■ MC45
1:30pm-3:00pm
Convention Center - Room 406
Tutorial on Agent-Based Modeling and Simulation
Charles M. Macal and Michael North, Argonne National Laboratory

Agent-based modeling and simulation (ABMS) is a new approach to modeling systems comprised of autonomous, interacting agents. Complex adaptive systems, emergent behavior and self-organization are a few of the notions from ABMS. Applications are growing rapidly in fields ranging from modeling the stock market to predicting the spread of epidemics. This tutorial covers the foundations of ABMS, development toolkits and methods, practical aspects and the relationship of ABMS to conventional O.R.

■ MD45
4:30pm-6:00pm
Convention Center – Room 406
Decision Making Under Conflicting Criteria
Ravi Ravindran, Pennsylvania State University, and
Jyrki Wallenius, Helsinki School of Economics

Multiple Criteria Mathematical Programming (MCMP) involves simultaneous optimization of several objective functions, usually conflicting, subject to a system of constraints. We will define MCMP terminology, provide introductory examples, discuss basic concepts and present general formulations. Then, methods for the solution of MCMP problems will be reviewed. Goal programming, Compromise Programming and Interactive Methods will be discussed as examples of broad categories of MCMP approaches.

TUESDAY, NOVEMBER 7

■ TA45
8:00am-9:30am
Convention Center – Room 406
Linear Equations, Inequalities, Linear Programs (LP), and a New Efficient Algorithm*
Katta G. Murty, University of Michigan

Linear programming (LP) is the 20th century extension of the classical subject linear algebra to solve systems of linear inequalities. In this talk we briefly review the history of the development of algorithms for linear equations, inequalities and LPs. Then we review existing algorithms used for LPs, all of which depend on matrix inversion operations. We then discuss a new descent method that has the potential for solving LPs without matrix inversions.

■ TB45
10:00am-11:30am
Convention Center - Room 406
Aviation Security System Design and Optimization Using Operations Research Modeling and Analysis
Sheldon Jacobson, University of Illinois, and
John Kobza, Texas Tech University

This tutorial provides an overview and survey of applying operations modeling and analysis methodologies to address both aviation security tactical and strategic problems. A variety of models are presented that address specific and general aviation security issues. Several of these models have been presented to and used by the Transportation Security Administration (TSA) in developing and refining aviation security system operations. Future directions for aviation security are also discussed.

■ TC45
1:30pm-3:00pm
Convention Center - Room 406
Game Theory in Supply Chain Analysis*
Gerard Cachon, University of Pennsylvania, and
Serguei Netessine, The Wharton School

Game theory has become an essential tool in the analysis of supply chains with multiple agents, often with conflicting objectives. We discuss both non-cooperative and cooperative game theory in static and dynamic settings and outline game-theoretic concepts that have potential for future applications. We demonstrate the existence and uniqueness of equilibrium in non-cooperative games. A newsvendor game is employed throughout as an illustrative example.

■ TD45
4:30pm-6:00pm
Convention Center – Room 406
Planning for Disruptions in Supply Chain Networks*
Lawrence Snyder, Lehigh University,
Richard Church, University of California-Santa Barbara, Mark Daskin, Northwestern University, and Paola Scaparra, University of Kent

We present a broad range of models for designing supply chains that are resilient to disruptions. We categorize these models by the status of the existing network (a network may be designed from scratch, or an existing network may be modified to prevent disruptions at some facilities), then by the underlying optimization model (facility location or network design), and finally by the risk measure (expected cost or worst-case cost). We conclude with suggested directions for future research.

WEDNESDAY, NOVEMBER 8

■ WA45
8:00am-9:30am
Convention Center – Room 406
Approximate Dynamic Programming for High-dimensional Applications*
Warren B. Powell, Princeton University, and
Huseyin Topaloglu, Cornell University

We show how dynamic programming and math programming can be merged to solve very high-dimensional applications under the umbrella of approximate dynamic programming. Using a form of Bellman's equation constructed around the post-decision state variable, we obtain simple, scalable algorithms that have been applied to large scale, industrial applications. The techniques are illustrated using applications from transportation, supply chain management, financial portfolios and blood management.

■ WB45
10:00am-11:30am
Convention Center – Room 406
Multi-Echelon Production/ Inventory Systems: Optimal Policies,Heuristics, and Algorithms*
Geert-Jan Van Houtum, Eindhoven University of Technology

The development of the theory of multi-echelon production/inventory systems started almost 50 years ago. Planning concepts based on this theory are increasingly incorporated into the practice of supply chain management. In this tutorial, we focus on optimal policies and key insights for serial, assembly and distribution systems. In particular, we demonstrate why generalized forms of base stock policies are optimal for many systems. We also present applications of multi-echelon theory.

■ WC45
1:30pm-3:00pm
Convention Center - Room 406
Complementarity-Based Modeling of Electric Power Markets: Transmission Constraints and Market Power
Ming-Che Hu, Johns Hopkins University

I discuss the modeling of power market games using this powerful and flexible approach. Such models can represent large systems, including thousands of generators and transmission lines, while accounting for peculiarities of particular market designs. I review models of perfect competition and Cournot competition, and their use in evaluations of market designs, merger proposals, and transmission reinforcements. Multilevel games, represented as MPECs and EPECs, are also discussed.

■ WD45
3:30-5:00
Convention Center – Room 406
Peer-to-Peer Technologies: A Research-Oriented Introduction
Ramayya Krishnan, Michael Smith and Rahul Telang, Carnegie Mellon University

P2P technologies–Napster, Kazaa, and Bit Torrent in file sharing and grid computing in shared services computing–offer network infrastructure that is widely used for large scale, high bandwidth information exchange or for high-end computation. In this tutorial, we will discuss interesting research issues–redictive modeling and incentive engineering–that arise in the context of these peer-to-peer networks.

Stanford Ad
I have it!!

Convention Center – Room 310

SUNDAY, NOVEMBER 5

■ SB10
10:00am–10:45am
Dash Optimization
Nitin Verma, nitin.verma@dashoptimization.com

Building Optimization Applications Using Mosel and XAD
This tutorial focuses on building optimization models using simple and advanced features available in Mosel, our modeling and programming language, and integrating them seamlessly with Xpress-Application Developer for visualization, analysis and deployment purposes.

10:45am–11:30am
GAMS Development Corporation
Steven Dirkse, sdirkse@gams.com

Rapid Application Prototyping with GAMS
GAMS Development will demonstrate how an application can be built using GAMS. We'll use both fundamental modeling practices, our state-of-the-art solvers and the latest in data access and application integration tools to quickly produce a working application: a Sudoku calculator sure to impress friends and family!

■ SC10
1:30pm–2:15pm
StatPoint, Inc.
Neil Polhemus, neil@statgraphics.com
Seth Wyatt

Synchronized Data Analysis Using STATGRAPHICS Centurion and STATGRAPHICS Mobile
StatPoint will demonstrate the interaction between STATGRAPHICS Centurion, its award-winning desktop statistical analysis package, and STATGRAPHICS Mobile, the first serious statistical software package for Pockets PCs and other handheld devices. The presentation will include a discussion of data synchronization and an illustration of distributed forecasting using ARIMA models.

2:15pm–3:00pm
Salford Systems
Mikhail Golovnya, golomi@salford-systems.com

RandomForests and TreeNet/MART
Salford Systems will demo both RandomForests and TreeNet/MART, Leo Breiman's and Jerome Friedman's newest advances to data mining. Both RandomForests and TreeNet enable the modeler to construct predictive models of extraordinary accuracy. Models are built up gradually through a large collection of small trees, each of which improves on its predecessors through an error-correcting strategy.

■ SD10
4:30pm–5:15pm
JMP
Curt Hinrichs, curt.hinrichs@jmp.com

The Joy of Data Analysis with JMP
JMP is a state-of-the-art statistical package from SAS Institute. Designed for the busy professional who wants to quickly and easily analyze their data and needs sophisticated analyses–from classical statistical methods to modern design and exploratory data mining–that only SAS can provide. Intuitive, interactive and graphical, JMP lets you focus on the insight your data can provide. This demo will cover some of the powerful features and intuitive navigation of JMP.

5:15pm-6:00pm
Minitab, Inc.
Nicole DeFazio, ndefazio@minitab.com
Eduardo Santiago, esantiago@minitab.com

Response Surface Optimization Using Minitab
Attendees will learn how to use Minitab Statistical Software to perform Response Surface Optimization. Tips and tricks, customizing Minitab for teaching and business as well as additional advanced capabilities will be demonstrated. Minitab Statistical Software is the ideal package for Six Sigma and other quality improvement projects and is used in over 4,000 colleges and universities worldwide for the past 30 years.

MONDAY, NOVEMBER 6

■ MA10
8:00am–8:45am
statistics.com
Peter Bruce, pbruce@statistics.com

Teaching Data Mining Using Excel with XLMiner
With XLMiner, you can take advantage of Excel's familiar environment and short learning curve to teach data mining. For classification and precision XLMiner offers neural nets, k-nearest-neighbor, logistic and linear regression, Naive Bayes, decision trees and discriminant analysis. Plus association rules, clustering, and utilities for sampling and partitioning data.

8:45am–9:30am
Palisade Corporation
Shawn Harahush, sharahush@palisade.com

From Software to Solutions in Statistics and Risk Analysis
Palisade, famous for its Monte Carlo simulation software @RISK, offers a suite of powerful and sophisticated analytical data software tools that are useful both independently and in conjunction with one another. These tools fall into 4 main categories: Risk and decision analysis, data analysis, optimization and developer kits.

■ MB10
10:00am-10:45am
Imagine That, Inc.
Dave Krahl, davek@imaginethatinc.com

ExtendSim
See the future of the Extend simulation application. Introducing ExtendSim 7… with its revolutionary new simulation technology and 3D animation. Core ExtendSim features including hierarchical model building, user interface creation and interactive modeling will also be showcased.

10:45am-11:30am
Decisioneering, Inc.
Tracy Manchego, tmanchego@crystalball.com

Crystal Ball Software
Crystal Ball® is a suite of Microsoft® Excel-based applications for Monte Carlo simulation, forecasting, optimization and real options analysis. Crystal Ball transforms your spreadsheets into dynamic models that solve almost any problem involving uncertainty, variability and risk. We provide software, training and consulting services to understand, communicate and manage risk.

■ MC10
1:30pm–2:15pm
LINDO Systems, Inc.
Mark Wiley, mwiley@lindo.com

Efficient Tools for Optimization Modeling
LINDO Systems will demonstrate the latest enhancements to LINDO API, LINGO and What'sBest – their popular linear, integer, quadratic, general nonlinear and global optimization tools. Find out how easy it is to quickly build complex optimization models; effortlessly access data in Excel and databases; and seamlessly embed optimization into your own applications.

2:15pm–3:00pm
Maximal Software, Inc.
Bjarni Kristjansson, bjarni@maximalsoftware.com

Introducing New Release of MPL Modeling System for Optimization with New and Enhanced Features
We will demonstrate the newest release of MPL, one of the fastest and most scalable modeling languages on the market today. The innovative OptiMax 2000 Component Library, which allows MPL models to be easily embedded into end-user applications, has been augmented to include several new objects and methods. The speed and scalability of the model generation has been greatly enhanced, and with the new 64-bit Itanium version capable of solving much larger models than ever before. Several new solvers have been added and existing solvers updated. Data access has been improved with new native drivers and now offers full XML/SOAP support for Internet connectivity.

■ MD10
4:30pm–5:15pm
Ziena Optimization, Inc.
Richard Waltz, waltz@ziena.com

Overview of the KNITRO Optimization Solver
This software demonstration will provide an overview of how to effectively use KNITRO in a variety of environments and applications. The presentation will demonstrate usage of KNITRO as both an embeddable callable library and through various modeling languages. The demonstration will highlight some of the newer and most relevant features.

5:15pm–6:00pm
Lumina Decision Systems, Inc.
Max Henrion, henrion@lumina.com

Analytica: What It Does That Spreadsheets Can't
A rare chance to see Analytica demonstrated by its originator: users prefer Analytica to spreadsheets because of its transparency, flexibility for multiple dimensions, efficient Monte Carlo, scalability and its powerful new Optimizer. Analytica models are typically 10 to 100 times more compact than equivalent spreadsheets, and correspondingly easier to build, understand and audit.

TUESDAY, NOVEMBER 7

■ TA10
8:00am–8:45am
Syncopation Software
Chris Dalton, cdalton@syncopation.com

DPL 7.0 Preview: Portfolio Analysis and More!
Get a preview of the powerful new features in DPL 7.0! See how you can glean more insights with the Initial Decision Alternatives Tornado and Option Value Diagram. Save time in the pre-presentation crunch with the new endpoint replay capability. Go beyond project-level analysis by analyzing a portfolio of opportunities.

8:45am–9:30am
Frontline Systems, Inc.
Daniel H. Fylstra, dfylstra@frontsys.com

Simulation Optimization, Excel 2007 and the Premium Solver Platform
See the just-released Premium Solver Platform V7.0, with new support for Excel 2007 and million-row worksheets, large-scale multi-worksheet models, multiple solutions for integer programming and global optimization problems, a new object-oriented API, and a special focus on new simulation optimization capabilities, 10 to 100 times faster than existing tools.

■ TB10
10:00am–10:45am
SAS Institute, Inc.
Ed Hughes, ed.hughes@sas.com
Trevor Kearney, trevor.Kearney@sas.com

SAS Optimization: What's New, What's Next
We'll demonstrate the current and upcoming features that make SAS the smart choice for optimization. Highlights include: OPTMODEL's unified linear and nonlinear optimization modeling language; integration with SAS data handling and analytics; and model deployment with spreadsheet and Enterprise Guide interfaces. Additionally, we'll preview the upgraded mixed-integer optimization capabilities in our next release.

10:45am–11:30am
SCA Technologies
Narendra Bhat, narendra.bhat@sca-tech.com

Predictive Cost Modeling for the Intelligent Enterprise
Managers need solutions to facilitate rapid scenario-based evaluations needed to enhance their cost structure and productivity. Should these solutions include Make-Buy, Restructuring, Product Reassignments, Outsourcing, Process Improvements, etc., a modeling tool can be the answer to saving time and money before a decision! View how modeling works!

■ TC10
1:30pm–2:15pm
ILOG, Inc.
Gregory Glockner, gglockner@ilog.com

Introducing ILOG's Optimization Decision Management System (ODMS)
Combining the power of ILOG CPLEX with a complete system for optimization modeling, application development, and business user participation. Learn about ILOG's new Optimization Decision Manager (ODM), enabling the development of interactive CPLEX-based planning and scheduling applications with business participation in the model and application refinement process. Integrated with ILOG's OPL-CPLEX Development System, it allows modelers to effortlessly prototype, refine and deploy applications that provide extensive support for what-if analysis, scenario comparison, controlled relaxation of constraints and goal programming.

SOFTWARE DEMONSTRATIONS
Continued on next page.

2:15pm–3:00pm
AIMMS by Paragon Decision Technology
Peter Nieuwesteeg, p.nieuwesteeg@aimms.com
Gertjan de Lange, gertjan.de.kange@aimms.com

AIMMS 3.7: Extended Algorithmic and Graphical Capabilities
Check out the latest AIMMS version 3.7. We will walk you through the basics of AIMMS and demonstrate some of the new features: integrated GIS support to enhance visualization and interpretation of data; new Syntax Editor to make it easier to modify AIMMS source code and to perform visual code inspection; Stochastic Programming support to create a robust solution under uncertainty without changing the actual structure of a model; Parallel Solver Session support to increase performance by allowing math programs to be solved in parallel. We will show important extensions to Multi-Development support, and our successful Pivot Table. For details on AIMMS 3.7 and a free trial: www.aimms.com/aimms/aimms37.html.

■ TD10
4:30pm–5:15pm
Responsive Learning Technologies, Inc.
Sam Wood, wood@responsive.net

Online Games for Operations Courses
See a demonstration of online games that are used in operations management courses and supply chain management courses in more than 100 undergraduate and MBA-level programs to teach topics like capacity management, lead time management, inventory control, and supply chain design and logistics.

5:15pm–6:00pm
AMPL Optimization LLC
Robert Fourer, 4er@ampl.com
David M. Gay, dmg@ampl.com

New Solver Support in the AMPL Modeling Language
Using a variety of examples, this presentation will survey the AMPL modeling language's support for new linear and integer optimization features in CPLEX 10 and nonlinear optimization features in KNITRO 5. Of particular interest are CPLEX's direct handling of certain logical implications and KNITRO's recognition of complementarity conditions as constraints.

MONDAY AND TUESDAY

12:30pm-1:30pm
Convention Center – Ballroom Foyer

Researchers, practitioners and students share their work in OR/MS in these sessions presented as poster displays, laptop demonstrations or other creative formats. Authors will be on hand to present their work.

Two new awards will recognize the best Interactive Presentations with a first-place award of $1,000 and second-place award of $500. A panel of judges will review each presentation and announce the award-winners on Tuesday at 1:15pm. Judges are Brenda Dietrich, IBM, President-Elect INFORMS; Jeffrey Camm, University of Cincinnati, Editor-*INTERFACES;* Don Wagner, ONR, Program Manager; Miguel Lejeune, Carnegie Mellon, Interactive Sessions Chair.

MONDAY, NOVEMBER 6

Computer Implementation of EMS Deployment Models
Rashid Al-Jalahema, University of Arizona; Jeff Goldberg

A Multi-Agent Complex Systems Modeling Framework for Improving Supply Chain Resilience
Partha Datta, Cranfield University; Peter Allen, Martin Christopher

Bayesian Sequential Change Diagnosis: Detection and Identification of a Change in a Random Sequence
Christian Goulding, Princeton University; Savas Dayanik, H. Vincent Poor

Production Planning with Start-Time Dependent Variable Costs
James Luedtke, Georgia Institute of Technology; George Nemhauser

Process to Expedite Admission Decisions
Luciano Fleischfresser, OSSM – ATC

Optimal Job Releasing for a Benchmark Reentrant Line
Jose Ramirez-Hernandez, University of Cincinnati; Emmanuel Fernandez

Optimal Planning Quantities for Product Transition
Hongmin Li, MIT

Design and Analysis of Large-Scale Networks
Hari Prasad Thadakamalla, Pennsylvania State University; Reka Albert, Soundar R.T. Kumara

Screening with Externalities
Thomas Weber, Stanford University

Vessel Traffic Modeling and Risk Analysis for the Istanbul Strait
Ozgecan Uluscu, Rutgers, The State University of New Jersey; Tayfur Altiok

An Investigation of the Performance Effects of Internal Capabilities and Supplier Linkage
Xiaosong Peng, University of Minnesota; Roger Schroeder, Rachna Shah

An Integrated Procedure for Supply Chain Network Designs with Scale Economies
Michael Bucci, North Carolina State University; Michael Kay, Donald Warsing

The Impact of Process Flexibility on First-Mover Advantages
Bin Shao, University of Illinois-Urbana Champaign; Dilip Chhajed

Observation, Theory and Simulation of Integrated Concurrent Engineering
John Chachere, Stanford University

A Visual Tour of Music
Arpi Mardirossian, University of Southern California; Elaine Chew

When Can Manipulations be Avoided in Two-Sided Matching Markets? Maximal Domain Results
Fuhito Kojima, Harvard University

An O.R. Approach to Business Calculus
Audrey Borchardt, Villanova University; Bruce Pollack-Johnson

RAMP for the Linear Ordering Problem
Dorabela Gamboa, Polytechnic of Porto; Fred Glover, Cesar Rego

System Contents and Delay in Discrete-time Queues: Performance Assessment of Communication System
Peixia Gao, Ghent University; Herwig Bruneel, Koenraad Laevens, Sabine Wittevrongel

Interactive Sessions

Impact of Using Designated Secure Rest Facilities on Single Lane Truck Dispatching Productivity
Steven Morris, Georgia Institute of Technology; Alan Erera

Closed Form Harmonic Prior Bayes Estimators for the Multivariate Normal Mean
Juntian Xu, The Wharton School; Lawrence Brown

Revenue Management in Mobile Communication Networks
Joakim Kalvenes, SMU; Neil Keon

TUESDAY, NOVEMBER 7

Supply Chain Contracting: Motivating Competing Suppliers
Hongmin Li, MIT

Freight Movement Model Development for the State of Oklahoma
Karthik Ayodhiramanujan, Oklahoma State University; Ricki Ingalls, Manjunath Kamath, Simin Pulat, Guoquiang Shen

Predicting Engineering and Operations Failure Risks Using a Quantitative Project Model
John Chachere, Stanford University

Developing Reusable Final Examination Timetables
Christine R. Kraft, Clemson University; James P. Jarvis

The ESP Driving Interface for Music Expression Synthesis: Mapping Strategies for Tempo Smoothness
Jie Liu, University of Southern California; Elaine Chew, Alexandre François

Heuristic Methods to Solve Hospital Evacuation Planning Problems
Esengul Tayfur, Clemson University; Kevin Taaffe

Incorporating Profitability and Risk for the Risk Averse Selective Newsvendor
Kiran Chahar, Clemson University; Kevin Taaffe

How to Effectively Implement Six Sigma: Inputs from Social Exchange Theory and Knowledge Management
Anant Deshpande, University of Texas Pan American

Benchmarking's Methodology in a Set of Organizations
Guillermina Salut, Universidad Nacional de Rosario; Marta Liliana Cerrano, José Garrera, Daniela Nora Gomez, Luis Diego Piacenza

Maintenance Scheduling with Multi-Skilled Workforce Constraints: Model, Algorithms and Applications
Hongman Gao, University of Mississippi

A Quantitative Investigation of Japanese Government Subsidy Policy for Private Universities
Anwar Sanusi, National Graduate Institute of Policy Studies

Line of Sight on Terrain Data
Aysegul Peker, North Carolina State University; Shu-Cherng Fang, John Lavery

Optimizing Importance Sampling Parameter for Portfolios of Credit Risky Assets
Huiju Zhang, University of Maryland; Michael Fu

A Dynamic Tool for Aviation Market Analysis
Brendan Hogan, MITRE/CAASD

An Empirical Analysis of the Determinants of Product Lock-in in Enterprise Software
Ian Larkin, University of California

An Approach to Solve Mixed Integer Linear Programming Formulations with Big-M Constraints
Archana Khurana, Guru Govind Singh Indraprastha University; Iftekhar Karimi, Arul Sundaramoorthy

An Ant-Based Algorithm for the VRP with Simultaneous Delivery and Pick-Up
Bülent Çatay, Sabanci University

Collaborative, Multi-Attribute Analysis of Facility Design Decisions
John Chachere, Stanford University

Global Optimization in Model-Based Clustering
Jeffrey Heath, University of Maryland; Michael Fu, Wolfgang Jank

Methodological Frameworks for Multi-Agent Supply Chain Modeling
Ramakrishna Govindu, Wayne State University; Ratna Babu Chinnam

Model-based Decision Support in Open-Ended Problem Domains
Andrew Crapo, GE Global Research

The Use of Simulation in Boat Facility Siting
Edward Baker, University of Miami; Maria Villanueva

INTERACTIVE SESSION AWARD PRESENTATION

Tuesday, 1:15pm
Ballroom Foyer







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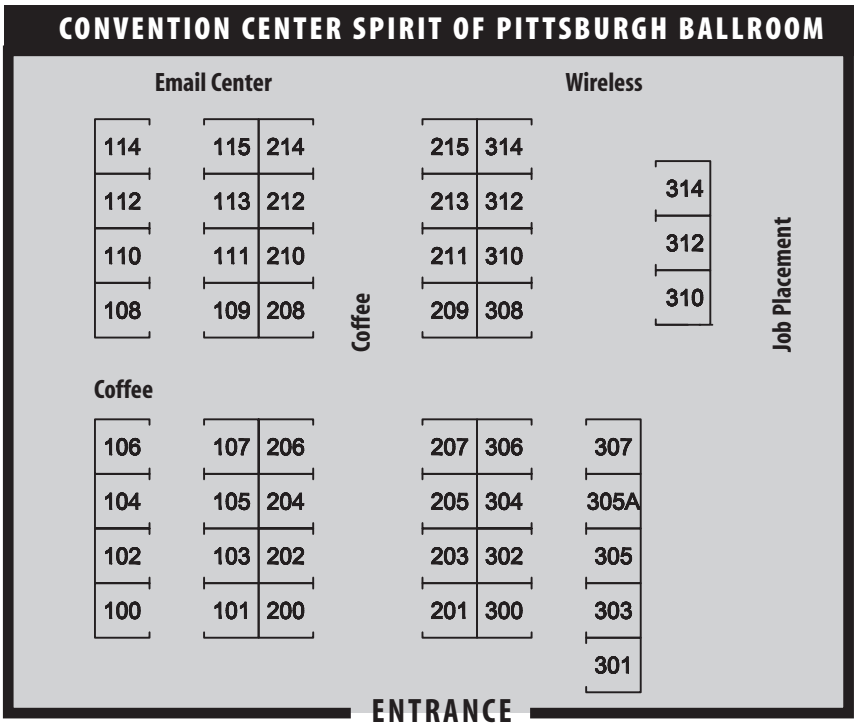
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Exhibits Open:

Sunday, Nov. 5	12:00pm-5:00pm
	7:30pm-9:00pm
Monday, Nov. 6	9:00am-5:00pm
Tuesday, Nov. 7	9:00am-5:00pm
Wednesday, Nov. 8	9:00am-3:30pm



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AMPL Optimization LLC **#111**
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www.ampl.com
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offers linear, mixed integer, quadratic, non-linear and stochastic programming capabilities. These components will be showcased along with Dash's modeling and programming language Mosel, Xpress-IVE development environment, and Xpress-Application Developer, Dash's new API for GUI development using Mosel.

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JMP **#302**
SAS Campus Dr.
Cary, NC 27513
www.jmp.com
JMP is comprehensive, interactive statistical desktop software from SAS that provides a dynamic, interactive way to interact with and analyze data. Busy professionals can easily spot data patterns with one glance at a chart or graph, perform sequential analysis from that point, and compare the results all in one window.

Ketron Optimization **#113**
2001 Jefferson Davis Hwy., #1211
Arlington, VA 22202-3619
www.ketronmn.com
Ketron Optimization specializes in design, development and application of mathematical programming optimization and modeling software, and off-the-shelf decision support applications. The software is used as an optimization toolkit by analysts in every sector of the economy. Ketron also provides support for users of the software: support ranges from hotline assistance through complete application-system development.

LINDO Systems, Inc. **#300**
1415 North Dayton St.
Chicago, IL 60622
www.lindo.com
LINDO Systems will be featuring our optimization modeling software for solving large-scale linear, integer, nonlinear and global problems. We will be demonstrating LINDO API - our powerful solver engine, LINGO - our integrated modeling language and solvers, and What'sBest! - our large scale Excel solver. Stop by for a free trial CD.

Lumina Decision Systems, Inc. **#110**
26010 Highland Way
Los Gatos, CA 95033
www.lumina.com
Analytica–beyond the spreadsheet: Analytica is a graphic tool for creating and communicating quantitative models. Serious modelers prefer Analytica to spreadsheets because of its transparency, flexibility for multiple dimensions, efficient Monte Carlo, scalability and its powerful new Optimizer. Analytica models are typically 10 to 100 times more compact than equivalent spreadsheets, and correspondingly easier to build, understand and audit.

Maximal Software, Inc. **#202**
2111 Wilson Blvd., Ste. 700
Arlington, VA 22201
www.maximalsoftware.com
Maximal Software is the developer of MPL Modeling System, an advanced modeling language for formulating optimization models. We will demonstrate how MPL provides one of the fastest and most scalable modeling languages on the market and how the OptiMax 2000 Component Library add-on can be used to build customized end-user applications to solve real-world optimization problems.

McGraw-Hill/Irwin **#207**
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www.mhhe.com
McGraw-Hill is the leading provider of textbooks and technology applications in higher education, offering high quality and carefully developed content to support all courses. McGraw-Hill publishes market-leading projects in management science, operations management, operations research, supply chain management, project management, service operations, quality management, simulation and statistics.

Minitab, Inc. **#106**
1829 Pine Hall Rd.
State College, PA 16801-3008
www.minitab.com
Minitab® is the leading statistical software package used in education. Instructors at more than 4,000 colleges, universities and high schools around the world use Minitab because it contains all the statistical methods students need and is powerful, reliable and easy to use. For a free demo, go to www.Minitab.com.

National Science Foundation **#312**
2100 Reston Pkwy., Ste. 350
Reston, VA 20191
www.nsf.gov
The National Science Foundation (NSF) is an independent federal agency to promote the progress of science; advance the national health, prosperity and welfare; and to secure national defense. NSF is the major source of federal backing in many fields such as mathematics, computer science and the social sciences. NSF fulfills its mission by issuing limited-term grants--about 10,000 new awards per year, with an average duration of three years--to fund specific research proposals that have been judged the most promising by a rigorous and objective merit-review system. Most of these awards go to individuals or small groups of investigators. Others provide funding for research centers, instruments and facilities that allow scientists, engineers and students to work at the outermost frontiers of knowledge. NSF's goal is to support the people, ideas and tools that together make discovery possible.

Palgrave Macmillan **#101**
Houndmills, Basingstoke
Hampshire RG21 6XS
United Kingdom
www.palgrave-journals.com
Palgrave Macmillan is a leading publisher of journals in operations research, including International Abstracts in OR (in connection with IFORS) and the journals of the OR society: Journal of the Operational Research Society, European Journal of Information Systems, Knowledge Management Research & Practice and, new for 2006, Journal of Simulation.

Palisade Corp. **#108**
798 Cascadilla St.
Ithaca, NY 14850
www.palisade.com
Palisade Corporation is a leading global provider of risk management, decision analysis, optimization and statistical analysis software. @RISK, Palisade's flagship product, is a Monte Carlo simulation add-in for Microsoft Excel providing advanced uncertainty and risk modeling. Palisade's DecisionTools Suite, NeuralTools and StatTools significantly broaden and enhance decision processes dependent on data analysis.

Responsive Learning Technologies **#305**
10181 Parlett Place
Cupertino, CA 95014
www.responsive.net
Excite and engage your students with our award-winning, competitive web-based games. The games are used in operations management courses and supply chain management courses in more than 100 undergraduate and MBA-level programs to teach topics like capacity management, lead time management, inventory control, and supply chain design and logistics.

Salford Systems **#213**
4740 Murphy Canyon Rd., Ste. 200
San Diego, CA 92108
www.salford-systems.com
Salford Systems will demo both RandomForests and TreeNet/MART, Leo Breiman's and Jerome Friedman's newest advances to data mining. Both RandomForests and TreeNet enable the modeler to construct predictive models of extraordinary accuracy. Models are built up gradually through a large collection of small trees, each of which improves on its predecessors through an error-correcting strategy.

SAS **#204**
SAS Campus Dr.
Cary, NC 27513
www.sas.com
O.R. professionals understand that operations research doesn't stand alone; success in O.R. is built on broad-based analytic strength. That's why SAS integrates operations research with a robust suite of data access and handling, analytic, and information delivery capabilities. Come see what's new and what's next in SAS optimization, simulation, scheduling and more.

SCA Technologies LLC **#102**
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Pittsburgh, PA 15213
www.sca-tech.com
SCA Technologies LLC is a leading software solutions and services provider in the area of predictive operations cost modeling and optimization. Our software enables global organizations with manufacturing and supply chains to identify opportunities that significantly improve their cost structure and efficiency to their decision-making processes.

SIAM **#211**
Society for Industrial and Applied Mathematics
3600 Market St. – 6th Fl.
Philadelphia, PA 19104
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Visit the SIAM booth to check out our new publications. Browse recently published optimization and math programming books, get sample journal issues, and receive information on publishing with SIAM. Membership information and applications will be available for those individuals interested in becoming a SIAM member. Don't forget to pick up a copy of SIAM News for the road.

SIMUL8 Corporation **#305A**
225 Franklin St. – 26th Fl.
Boston, MA 02110
www.simul8.com
Here at SIMUL8 Corporation we are well known for our $1,495 fast and friendly simulation software. But did you know we also develop powerful embedded simulation solutions and systems, focused for particular business issues? We will be showing SIMUL8 software and some of these solutions during the exhibition.

South-Western/Thomson **#301, 303**
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statistics.com **#215**
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www.statistics.com
Statistics.com is the leading provider of online professional development in statistics, featuring over 50 online courses. Distinguished experts answer your questions; there are no set times when you must be online. Statistics.com also sells XLMiner, the only comprehensive data mining add-in for Excel, and Resampling Stats for Excel.

StatPoint, Inc. **#112**
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www.statgraphics.com
StatPoint, Inc., developers of STATGRAPHICS statistical computing products, introduces STATGRAPHICS Mobile for handheld computers (Pocket PC, Pocket PC Phone Edition, or compatible device running Windows Mobile 5) and STATGRAPHICS Centurion XV Multilingual Edition, allowing users to operate the program in one language while creating output in another.

Syncopation Software Limited **#203**
1623 Main St.
Concord, MA 01742
www.syncopationsoftware.com
Syncopation Software is a leading provider of business analytic tools for decision analysis, risk analysis, Monte Carlo simulation, fault tree analysis and real option valuation. Syncopation's forthcoming DPL Release 7.0 broadens its offering by bringing class-leading decision support analytics to portfolio prioritization in a packaged, turnkey solution.

Taylor & Francis Group LLC **#103, 105**
CRC Press
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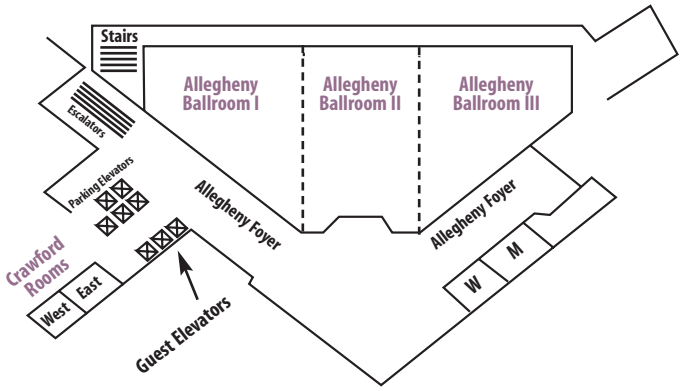
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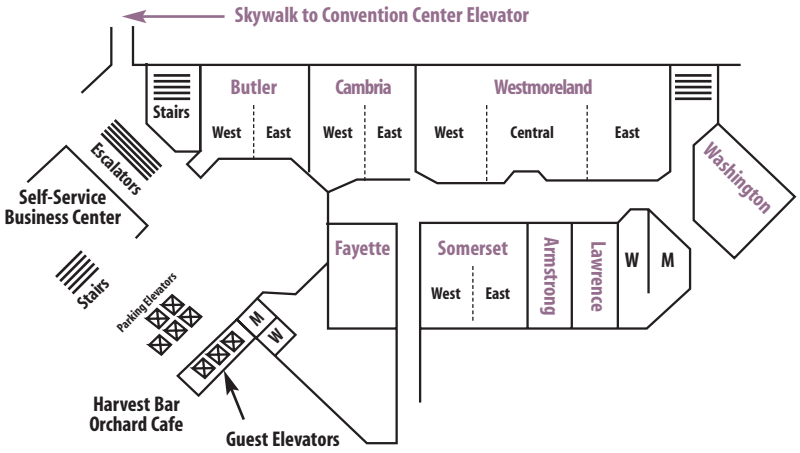
Ziena Optimization, Inc. **#100**
1801 Maple Ave.
Oak Park, IL 60201
www.ziena.com
Ziena Optimization sells KNITRO, the premier solver for nonlinear optimization problems. KNITRO computes local minima for smooth functions, and handles nonlinear constraints (convex and nonconvex), bound constraints, MPECs, systems of equations, nonlinear least squares, LPs and QPs. KNITRO offers three different algorithms (interior point direct, interior point CG and active set), and a basic multi-start capability for global searching. KNITRO includes programmatic interfaces for C/C++, Fortran and Java, and is available as a solver for most modeling languages.

Westin Hotel

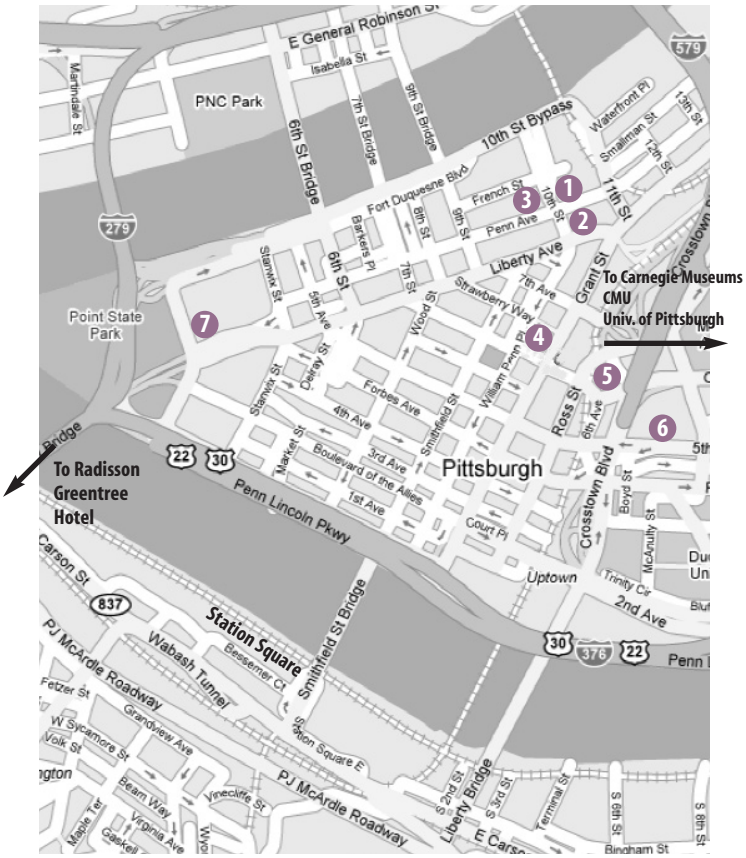
LEVEL 3



LEVEL 2



Downtown Hotels

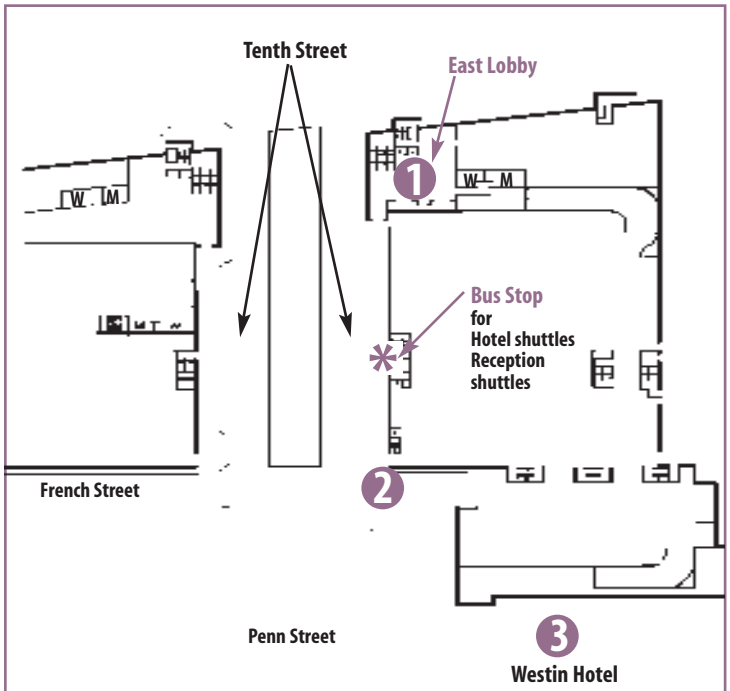


1. Convention Center
2. Westin Hotel
3. Marriott Courtyard
4. Omni William Penn
5. Doubletree Hotel
6. Marriott City Center
7. Hilton Pittsburgh

Hotel shuttle bus information, page 15.

Access to Convention Center

STREET LEVEL



1 East Lobby
Escalator/Elevator to Levels 2 & 3

2 Elevator to Level 3

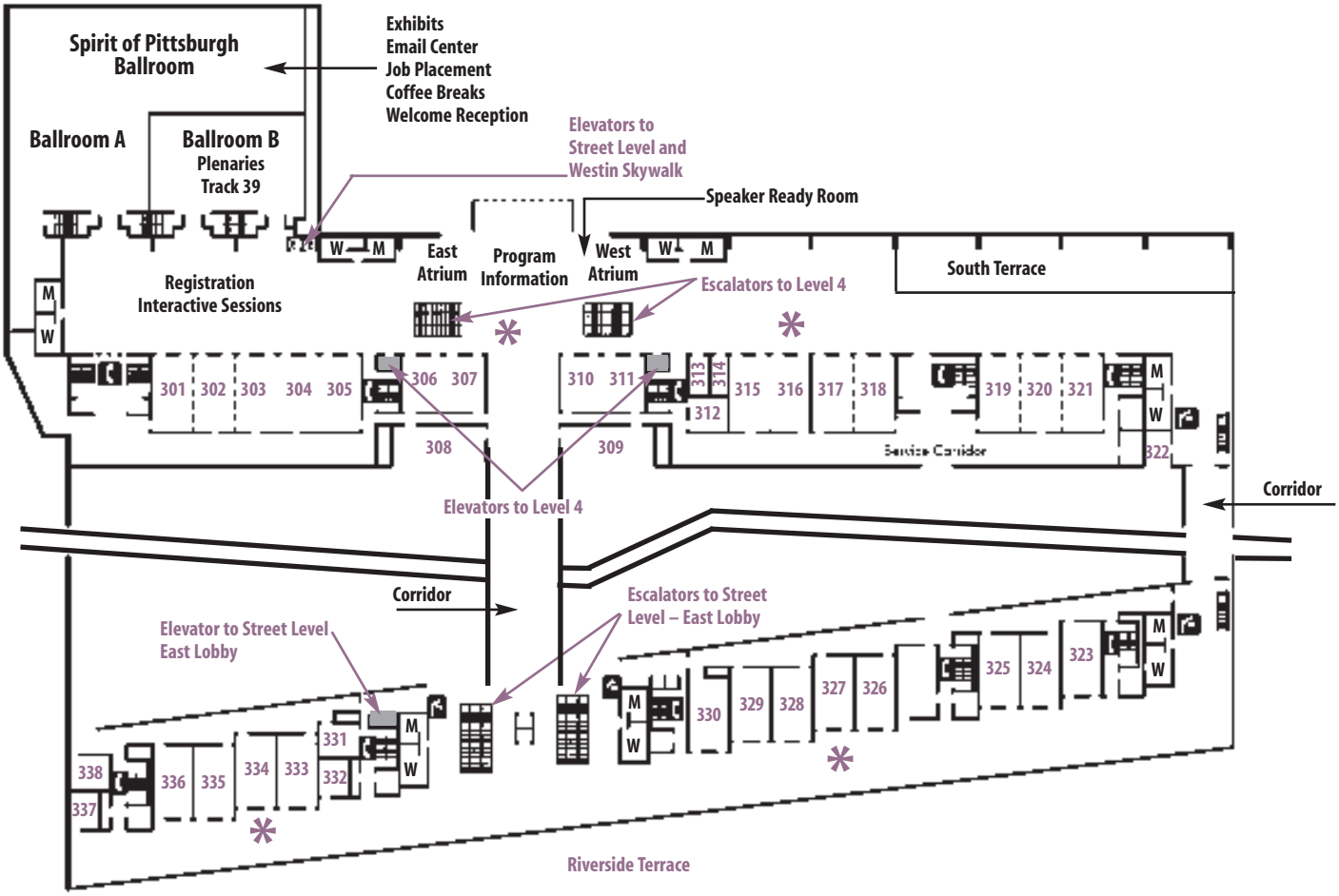
3 Skywalk from Westin
Take Walkway to Elevator
Elevator to Level 3

To access Level 4, go to Level 3 and follow signs

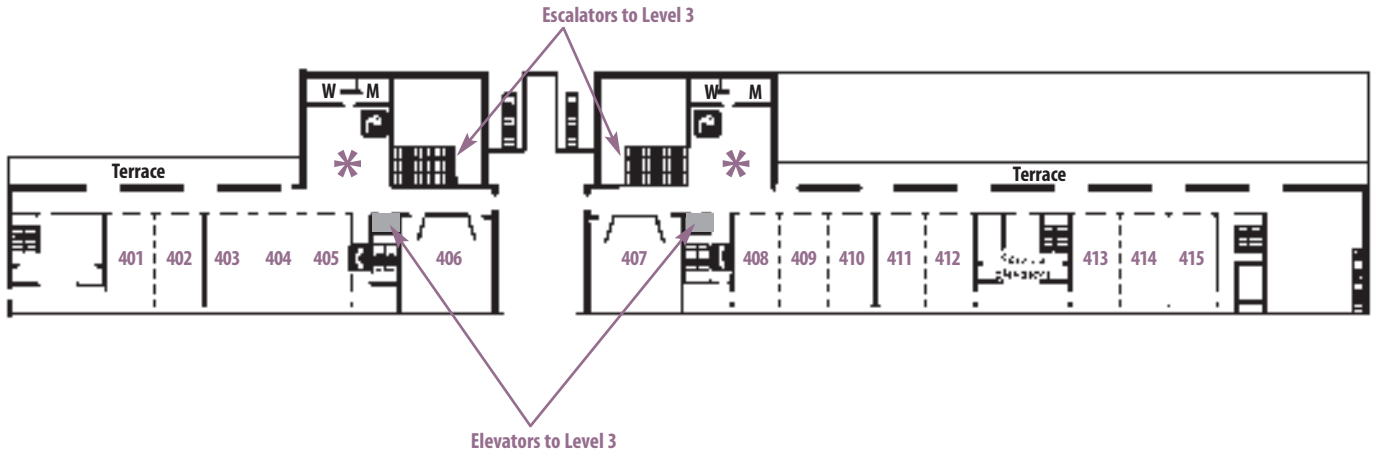
Convention Center

✻ Session Monitor Desk

LEVEL 3



LEVEL 4



Master Track Schedule – Sunday

Practice Sessions – Highlighted in Blue
Theme Sessions – Highlighted in Dark Gray

Convention Center Track	Room	SA 8:00-9:30	SB 10:00-11:30	Plenary 11:40–12:30	SC 1:30-3:00	Plenary 3:10-4:00	SD 4:30-6:00
1	Room 301	Optimization/Network & Combinatorial			Network/Combinatorial Opt.		Network/Combinatorial Opt.
2	Room 302	Open-Source Software	Open-Source Software		Open-Source Software		Open-Source Software
3	Room 303	Optimization/Linear Prog. & Complementarity			Linear Prog./Complementarity		Linear Prog./Complementarity
4	Room 304	Supply Chain & Operations Engineering			MSOM		Emerging Markets
5	Room 305	Optimization/Stochastic Programming		Presidential Address	Stochastic Programming	Philip McCord	Stochastic Programming
6	Room 306	Constraint Programming	Constraint Programming	Mark S. Daskin	Constraint Programming	Morse Lecture	Constraint Programming
7	Room 307	New Books	New Books	Everyday Lessons	New Books	Marshall Fisher	Computational Optimization
8	Room 308	Technology Management	Technology Management	from Operations	Technology Management	Rocket Science	Technology Management
9	Room 309	New Product Development	New Product Development	Research	New Product Development	Retailing	New Product Development
10	Room 310	No Session	Software Demonstrations	Ballroom B	Software Demonstrations	Ballroom B	Software Demonstrations
11	Room 311	OR in SpORts	OR in SpORts		OR in SpORts		OR in SpORts
12	Room 312	Dantzig Dissertation Award Finalists			Nicholson Student Paper Comp.		Nicholson Student Paper Comp.
13	Room 313	Education/INFORM-ED			Education		Education
14	Room 314	Statistics/Quality Control	Statistics/Quality Control		Statistics/Quality Control		Statistics/Quality Control
15	Room 315	Auctions & e-Commerce	Auctions & e-Commerce		Auctions & e-Commerce		Auctions & e-Commerce
16	Room 316	Dynamic Pricing/Forecasting	Dynamic Pricing/Forecasting		Dynamic Pricing/Forecasting		Dynamic Pricing/Forecasting
17	Room 317	Revenue Management	Revenue Management		Revenue Management		Production & Scheduling
18	Room 318	ENRE	ENRE		Geometric Programming		Geometric Programming
19	Room 319	ENRE	ENRE		ENRE		ENRE
20	Room 320	Decision Analysis Society			Decision Analysis		Decision Analysis
21	Room 321	Decision Analysis Society			Decision Analysis		Decision Analysis
22	Room 322	Military Applications	Military Applications		Military Applications		Military Applications
23	Room 323	Business Applications	New Frontiers		New Frontiers		Global Services Sourcing
24	Room 324	Organization Science	Organization Science		Organization Science		Organization Science
25	Room 325	OR Entrepreneurship	OR Entrepreneurship		OR Entrepreneurship		OR Practice
26	Room 326	Data Mining	Computing/Data Mining		Computing/Data Mining		Data Mining
27	Room 327	QSR-Quality, Statistics & Reliability			QSR		QSR
28	Room 328	QSR-Quality, Statistics & Reliability			QSR		QSR
29	Room 329	Healthcare	Healthcare		Healthcare		Healthcare
30	Room 330	Health Applications	Health Applications		Health Applications		Health Applications
31	Room 331	Financial Engineering & Risk Management			Computing/Heuristic Search		Financial Eng. & Risk Mgt.
32	Room 332	Financial Services	Financial Services		Financial Services		Financial Services
33	Room 333	Aviation Applications	Aviation Applications		Aviation Applications		Aviation Applications
34	Room 334	TSL-Transportation Science & Logistics			TSL		TSL
35	Room 335	TSL-Transportation Science & Logistics			TSL		TSL
36	Room 336	TSL-Transportation Science & Logistics			TSL		TSL
37	Room 337	Information Systems	Information Systems		Information Systems		Information Systems
38	Room 338	Railroad Applications	Railroad Applications		Railroad Applications		Railroad Applications
39	Ballroom B	Where Do We Want to Go?	Where Do We Want to Go?		Where Do We Want to Go?		Where Do We Want to Go?
40	Room 401	Location Analysis	Location Analysis		Location Analysis		Location Analysis
41	Room 402	Applied Probability	Applied Probability		Applied Probability		Applied Probability
42	Room 403	Scheduling	Scheduling		Scheduling		Scheduling
43	Room 404	Analytic Hierarchy Process	Analytic Hierarchy Process		Analytic Hierarchy Process		Analytic Hierarchy Process
44	Room 405	Applied Probability	Applied Probability		Junior Faculty Interest Group		Junior Faculty Interest Group
45	Room 406	Tutorials	Tutorials		Tutorials		Tutorials
46	Room 407	Tutorials	Tutorials		Tutorials		Tutorials
47	Room 408	SC & Operations Engineering	SC & Operations Engineering		SC & Operations Engineering		SC & Operations Engineering
48	Room 409	MSOM-Manufacturing & Service Operations Mgt.			MSOM		MSOM
49	Room 410	History of OR & MS	History of OR & MS		History of OR & MS		History of OR & MS
50	Room 411	Optimization	Telecommunications		Telecommunications		Telecommunications
51	Room 412	Data Envelopment Analysis	Data Envelopment Analysis		Data Mining/Machine Learning		Data Mining/Machine Learning
52	Room 413	Revenue Mgt. & Pricing	Revenue Mgt. & Pricing		Revenue Mgt. & Pricing		Revenue Mgt. & Pricing
53	Room 414	Revenue Mgt. & Pricing	Revenue Mgt. & Pricing		Revenue Mgt. & Pricing		Revenue Mgt. & Pricing
54	Room 415	Operations & Marketing-Emerging Markets			Emerging Markets		Emerging Markets
55	Room 416	Supply Chain	Supply Chain		Supply Chain		Computer Science

Master Track Schedule – Monday

Practice Sessions – Highlighted in Gray
Theme Sessions – Highlighted in Purple

Convention Center Track	Room	MA 8:00-9:30	MB 10:00-11:30	Plenary Interactive Session	MC 1:30-3:00	Plenary 3:10-4:00	MD 4:30-6:00
1	Room 301	Optimization/Network & Combinatorial			Network/Combinatorial Opt.		Network/Combinatorial Opt.
2	Room 302	Open-Source Software	Open-Source Software		Open-Source Software		Open-Source Software
3	Room 303	Linear Prog./Complementarity	Optimization/Nonlinear Prog.		Optimization/Nonlinear Prog.		Optimization/Nonlinear Prog.
4	Room 304	Optimization/Integer Programming			Optimization/Integer Prog.		Optimization/Integer Prog.
5	Room 305	Optimization/Stochastic Programming		11:40am-12:30pm	Stochastic Programming	Paul H. O'Neill	Applied Probability
6	Room 306	Computing	Project Management	Omega Rho	Finance-Risk Management	Systems Analysis	Quality Management
7	Room 307	Computing	Computing	Distinguished Lecture	Computational Optimization	and Social Action	Computational Optimization
8	Room 308	Technology Management	Technology Management	Patrick T. Harker	Technology Management	Ballroom B	Technology Management
9	Room 309	New Product Development	New Product Development	Science and Art of	Simulation		New Product Development
10	Room 310	Software Demonstrations	Software Demonstrations	Service Management	Software Demonstrations		Software Demonstrations
11	Room 311	Minority Issues	Minority Issues	Ballroom B	Energy		Minority Issues
12	Room 312	Women in OR/MS	Women in OR/MS		Women in OR/MS		Women in OR/MS
13	Room 313	Education/INFORM-ED	Education/INFORM-ED		Education		Education/INFORM-ED
14	Room 314	Auctions and e-Commerce	Auctions and e-Commerce		e-Business		e-Business
15	Room 315	Auctions & e-Commerce	Auctions & e-Commerce		Auctions & e-Commerce		Auctions & e-Commerce
16	Room 316	Dynamic Pricing/Forecasting	Dynamic Pricing/Forecasting		Dynamic Pricing/Forecasting		Dynamic Pricing/Forecasting
17	Room 317	Simulation	Simulation		Simulation		Dynamic Pricing/Forecasting.
18	Room 318	Counter Terrorism & OR	Counter Terrorism & OR		Counter Terrorism & OR		Counter Terrorism & OR
19	Room 319	Energy, Natural Resources & the Environment			ENRE		ENRE
20	Room 320	Decision Analysis Society	Decision Analysis Society		Decision Analysis		Decision Analysis
21	Room 321	Decision Analysis Society			Decision Analysis		Education/INFORM-ED
22	Room 322	Military Applications	Military Applications		Military Applications		Military Applications
23	Room 323	Global Services Sourcing	Global Services Sourcing		Global Services Sourcing		Global Services Sourcing
24	Room 324	Product Development	Daniel H. Wagner Prize		Daniel H. Wagner Prize		Daniel H. Wagner Prize
25	Room 325	Integer Programming	OR Practice	12:30pm-1:30pm	OR Practice		OR Practice
26	Room 326	DM & Automated Learning	Data Mining	Interactive Session	DM & Automated Learning		Computing/Data Mining
27	Room 327	QSR-Quality, Statistics & Reliability		Ballroom Foyer	QSR		QSR
28	Room 328	QSR-Quality, Statistics & Reliability			QSR		QSR
29	Room 329	Healthcare	Healthcare		Healthcare		Healthcare
30	Room 330	Health Applications	Health Applications		Health Applications		Health Applications
31	Room 331	Financial Engineering & Risk Management			Financial Eng. & Risk Mgt.		Financial Eng. & Risk Mgt.
32	Room 332	Financial Services	Project Management		Project Management		Project Management
33	Room 333	Aviation Applications	Aviation Applications		Aviation Applications		Aviation Applications
34	Room 334	TSL-Transportation Science & Logistics			TSL		TSL
35	Room 335	TSL-Transportation Science & Logistics			TSL		TSL
36	Room 336	TSL-Transportation Science & Logistics			TSL		TSL
37	Room 337	Information Systems	Information Systems		Information Systems		Information Systems
38	Room 338	Railroad Applications	Railroad Applications		Railroad Applications		Railroad Applications
39	Ballroom B	Ethics in OR	Great Unsolved Problems in OR		Great Unsolved Problems in OR		Great Unsolved Problems in OR
40	Room 401	Location Analysis	Location Analysis		Location Analysis		Location Analysis
41	Room 402	Applied Probability	Applied Probability		Applied Probability		Applied Probability
42	Room 403	Scheduling	Scheduling		Scheduling		Scheduling
43	Room 404	Analytic Hierarchy Process	Analytic Hierarchy Process		Public Programs & Processes		Public Programs & Processes
44	Room 405	Junior Faculty Interest Group	Junior Faculty Interest Group		Junior Faculty Interest Group		Job Placement
45	Room 406	Tutorials	Tutorials		Tutorials		Tutorials
46	Room 407	Marketing OR Skills	SC & Operations Engineering		SC & Operations Engineering		SC & Operations Engineering
47	Room 408	SC & Operations Engineering	SC & Operations Engineering		SC & Operations Engineering		SC & Operations Engineering
48	Room 409	MSOM	MSOM		MSOM		MSOM
49	Room 410	Closed-Loop SC	Closed-Loop SC		Closed-Loop SC		Closed-Loop SC
50	Room 411	Telecommunications	Telecommunications		MSOM		MSOM
		MSOM	MSOM		Planning & Response to Disasters		Planning & Response to Disasters
52	Room 413	Revenue Mgt. & Pricing	Revenue Mgt. & Pricing		Revenue Mgt. & Pricing		Revenue Mgt. & Pricing
53	Room 414	Inventory Management	Inventory Management		Inventory Management		Inventory Management
54	Room 415	Operations & Marketing-Emerging Markets			Emerging Markets		Emerging Markets
55	Room 416	Data Envelopment Analysis	Data Envelopment Analysis		Data Envelopment Analysis		Technology Management

Master Track Schedule – Tuesday

Practice Sessions – Highlighted in Gray
Theme Sessions – Highlighted in Purple

Convention Center Track	Room	TA 8:00-9:30	TB 10:00-11:30	Plenary Interactive Session	TC 1:30-3:00	Keynotes 3:10-4:00	TD 4:30-6:00
1	Room 301	Optimization/Network & Combinatorial			Network/Combinatorial Opt.		Network/Combinatorial Opt.
2	Room 302	Open-Source Software	Open-Source Software		Open-Source Software		Open-Source Software
3	Room 303	Optimization/Global Optimization			Global Optimization		Global Optimization
4	Room 304	Optimization/Integer Programming			Optimization/Integer Prog.		Optimization/Integer Prog.
5	Room 305	Bus. Process Risk Mgt.	SC Models & Design	11:40am-12:30pm	Flexibility/Competition in SC	Keynote	Operations Mgt. in SC
6	Room 306	Computing/Heuristic Search		Plenary	Computing/Heuristic Search	Edelman Reprise	Computing/Heuristic Search
7	Room 307	Computational Optimization	Computational Optimization	Margaret L. Brandeau	Computing	Streamlining Aircraft	Computational Optimization
8	Room 308	Technology Management	Technology Management	Using Mathematical	Technology Management	Repair and Overhaul	Technology Management
9	Room 309	New Product Development	New Product Development	and Systems Models	New Product Development	at Warner Robins	Product Development
10	Room 310	Software Demonstrations	Software Demonstrations	to Inform Policy	Software Demonstrations	Air Logistics Center	Software Demonstrations
11	Room 311	Healthcare Systems	Healthcare Systems	Decisions	Healthcare Systems	Ballroom B	Healthcare Systems
12	Room 312	Spreadsheet Productivity Research		Ballroom B	Spreadsheet Productivity		Spreadsheet Productivity
13	Room 313	Education/INFORM-ED			Education		Education
14	Room 314	e-Business	e-Business		e-Business		e-Business
15	Room 315	Auctions & e-Commerce	Auctions & e-Commerce		Auctions & e-Commerce		Auctions & e-Commerce
16	Room 316	Dynamic Pricing/Forecasting	Dynamic Pricing/Forecasting		Dynamic Pricing/Forecasting	Keynote	Dynamic Pricing/Forecasting
17	Room 317	Simulation	Dynamic Pricing/Forecasting.		Simulation	Your 15 Minutes	Simulation
18	Room 318	Counter Terrorism & OR	Counter Terrorism & OR		Counter Terrorism & OR	of Fame:	Counter Terrorism & OR
19	Room 319	ENRE	ENRE		ENRE	Want Better Press	ENRE
20	Room 320	Decision Analysis Society			Decision Analysis	Coverage?	Decision Analysis
21	Room 321	Decision Analysis Society	Decision Analysis Society		Decision Analysis	Here's How…	Decision Analysis
22	Room 322	Military Applications	Military Applications		Military Applications	Room 407	Military Applications
23	Room 323	Global Services Sourcing	Global Services Sourcing		Global Services Sourcing		Global Services Sourcing
24	Room 324	Daniel H. Wagner Prize	Industry Applications		Game Theory		Supply Chain Competition
25	Room 325	OR Practice	OR Practice	12:30pm-1:30pm	OR Practice		Management of Technology
26	Room 326	DM & Automated Learning	Data Mining	Interactive Session	DM & Automated Learning		Data Mining
27	Room 327	QSR-Quality, Statistics & Reliability		Ballroom Foyer	QSR		QSR
28	Room 328	QSR-Quality, Statistics & Reliability			QSR		QSR
29	Room 329	Healthcare	Healthcare		Healthcare		Healthcare
30	Room 330	Health Applications	Health Applications		Health Applications		Health Applications
31	Room 331	Financial Engineering & Risk Management			Financial Eng. & Risk Mgt.		Financial Engineering
32	Room 332	Project Management	Project Management		Supply Chain Optimization		Supply Chain Optimization
33	Room 333	Aviation Applications	Aviation Applications		Aviation Applications		Aviation Applications
34	Room 334	TSL-Transportation Science & Logistics			TSL		TSL
35	Room 335	TSL-Transportation Science & Logistics			TSL		TSL
36	Room 336	TSL-Transportation Science & Logistics			TSL		TSL
37	Room 337	Information Systems	Information Systems		Information Systems		Information Systems
38	Room 338	Transportation	Transportation		Transportation		Transportation
39	Ballroom B	Logistics	Great Unsolved Problems in OR		Great Unsolved Problems in OR		Logistics
40	Room 401	Location Analysis	Location & Networks		Facilities Planning & Design		Facility Location
41	Room 402	Applied Probability	Applied Probability		Applied Probability		Applied Probability
42	Room 403	Scheduling	Scheduling		Scheduling		Scheduling
43	Room 404	Multicriteria Decision Making	Multicriteria Decision Making		Multicriteria Decision Making		Multicriteria Decision Making
44	Room 405	Job Placement	Junior Faculty Interest Group		Junior Faculty Interest Group		Analytic Hierarchy Process
45	Room 406	Tutorials	Tutorials		Tutorials		Tutorials
46	Room 407	SC & Operations Engineering	SC & Operations Engineering		SC & Operations Engineering		SC & Operations Engineering
47	Room 408	SC & Operations Engineering	SC & Operations Engineering		SC & Operations Engineering		SC & Operations Engineering
48	Room 409	MSOM-Manufacturing & Service Operations Mgt.			MSOM		MSOM
49	Room 410	Closed-Loop Supply Chain & Reverse Logistics			Closed-Loop SC		Closed-Loop SC
50	Room 411	MSOM	MSOM		MSOM		MSOM
51	Room 412	Planning & Response to Disasters	Planning & Response to Disasters		Planning & Response to Disasters		Planning & Response to Disasters
52	Room 413	Revenue Mgt. & Pricing	Revenue Mgt. & Pricing		Revenue Mgt. & Pricing		Revenue Mgt. & Pricing
53	Room 414	Inventory Management	Inventory Management		Supply Chain Management		Supply Chain Management
54	Room 415	Operations & Marketing-Emerging Markets			Emerging Markets		Emerging Markets
55	Room 416	Artificial Intelligence	Artificial Intelligence		Artificial Intelligence		Production & Scheduling

Master Track Schedule – Wednesday

Practice Sessions – Highlighted in Gray
Theme Sessions – Highlighted in Purple

Convention Center Track	Room	WA 8:00-9:30	WB 10:00-11:30	Plenary 11:40-12:30	WC 1:30-3:00	WD 3:30-5:00
1	Room 301	Optimization/Network & Combinatorial			Network/Combinatorial Opt.	Integer Programming
2	Room 302	Open-Source Software	No Session		Game Theory	Economics
3	Room 303	Optimization/Global Optimization			Discrete Optimization	Discrete Optimization
4	Room 304	Scheduling Applications	No Session		No Session	No Session
5	Room 305	Coordination/Outsourcing-SC	Machine Sched. Problems	William R. Pulleyblank	No Session	No Session
6	Room 306	Computing/Heuristic Search	Computing/Heuristic Search	Optimization	Computing/Heuristic Search	Computing/Heuristic Search
7	Room 307	Computational Optimization	Computational Optimization	Everywhere?	Computational Optimization	Computational Optimization
8	Room 308	Technology Management	Technology Management	Five Critical Issues	Technology Management	Technology Management
9	Room 309	Business Applications	Sustainable Development	Ballroom B	Flexible Mfg. Systems	Manufacturing
10	Room 310	No Session	No Session		No Session	No Session
11	Room 311	Healthcare Systems	Healthcare Systems		Healthcare Systems	Novel Applications
12	Room 312	Enterprise-Wide Optimization In Process Industry			Optimization/Process Industry	Optimization/Process Industry
13	Room 313	Education/INFORM-ED			Education/INFORM-ED	Education/INFORM-ED
14	Room 314	e-Business/Commerce	Auctions/Competitive Bidding		Cost/Performance Analysis	Metaheuristics
15	Room 315	Auctions & e-Commerce	Auctions & e-Commerce		Auctions & e-Commerce	Auctions & e-Commerce
16	Room 316	Dynamic Pricing/Forecasting	Dynamic Pricing/Forecasting		Dynamic Pricing/Forecasting	Dynamic Pricing/Forecasting
17	Room 317	Shipping, Maritime SC Logistics	Simulation		Simulation	Simulation
18	Room 318	Modeling Systems	Marketing		Risk Analysis	Reliability
19	Room 319	Energy, Natural Resources & the Environment			ENRE	No Session
20	Room 320	Decision Analysis	Decision Analysis		Decision Analysis	Decision Support Systems
21	Room 321	Decision Analysis	e-Business/Commerce		Decision Analysis	Decision Analysis
22	Room 322	Military Applications	Military Applications		Military Applications	Military Applications
23	Room 323	Global Services Sourcing	Global Services Sourcing		Semiconductor Mfg.	Service Industry
24	Room 324	Supply Chain Competition	Supply Chain Competition		Supply Chain Competition	Supply Chain Competition
25	Room 325	Management of Technology	Innovation/Entrepreneurship		Industry Applications	Industry Applications
26	Room 326	Data Mining	Data Mining		Data Mining	Data Mining
27	Room 327	QSR-Quality, Statistics & Reliability			QSR	QSR
28	Room 328	QSR-Quality, Statistics & Reliability			QSR	QSR
29	Room 329	Healthcare Engineering	Constraint Programming		Continuous Optimization	Dynamic Programming/Control
30	Room 330	Marketing	Stochastic Processes/Opt.		Stochastic Processes/Opt.	Stochastic Processes/Opt.
31	Room 331	Finance-Risk Management	Finance-Risk Management		Finance-Risk Management	Simulation-Optimization
32	Room 332	Supply Chain Optimization	Supply Chain Risk Mgt.		Supply Chain Risk Mgt.	Computer-Assisted Analysis
33	Room 333	Aviation Applications	Aviation Applications		Aviation Applications	Aviation Applications
34	Room 334	TSL-Transportation Science & Logistics			TSL	TSL
35	Room 335	TSL-Transportation Science & Logistics			TSL	TSL
36	Room 336	Military Applications	Military Applications		Military Applications	Military Applications
37	Room 337	Supply Chain Management	Supply Chain Management		Supply Chain Management	Supply Chain Management
38	Room 338	TSL-Transportation Science & Logistics			Operations Management	Operations Management
39	Ballroom B	Education & Discrete Opt.	Forecasting		Linear Programming	Integer Programming
40	Room 401	Facility Location	ENRE		ENRE	ENRE
41	Room 402	Applied Probability	Applied Probability		Applied Probability	No Session
42	Room 403	Scheduling	Scheduling		Scheduling	Scheduling
43	Room 404	Multicriteria Decision Making	Multicriteria Decision Making		Multicriteria Decision Making	Multicriteria Decision Making
44	Room 405	Combinatorics	Networks & Graphs		Networks & Graphs	Simulation
45	Room 406	Tutorials	Tutorials		Tutorial	Tutorials
46	Room 407	SC & Operations Engineering	SC & Operations Engineering		No Session	No Session
47	Room 408	SC & Operations Engineering	SC & Operations Engineering		Supply Chain Risk Mgt.	Supply Chain Management
48	Room 409	MSOM-Manufacturing & Service Operations Mgt.			MSOM	No Session
49	Room 410	Closed-Loop Supply Chain	No Session		No Session	Reverse Supply Chains
50	Room 411	Optimization Techniques	Optimization Techniques		Supply Chain Practice	Reverse Supply Chains
51	Room 412	Aviation Applications	Aviation Applications		Aviation Applications	No Session
52	Room 413	Revenue Mgt. & Pricing	Revenue Mgt. & Pricing		Revenue Mgt. & Pricing	Revenue Mgt. & Pricing
53	Room 414	Supply Chain Management	Supply Chain Management		Supply Chain Management	Supply Chain Management
54	Room 415	No Session	Emerging Markets		Strategy/Strategic Planning	Telecommunications
55	Room 416	Production & Scheduling	Production & Scheduling		Information Systems	Information Systems

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How to Navigate the Technical Sessions

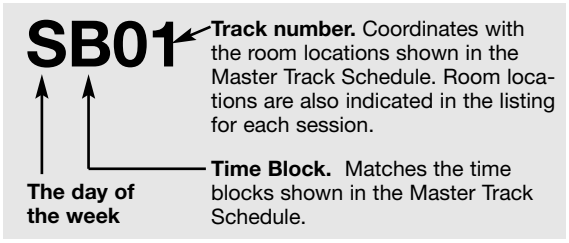
There are four primary resources to help you understand and navigate the Technical Sessions:

- This Technical Session listing, which provides the most detailed information. The listing is presented chronologically by day/time, showing each session and the papers/abstracts/authors within each session.
- The Session Chair, Author, and Session indices provide cross-reference assistance (pages 345-374).
- The map and floor plans on pages 42 and 43 show you where technical session tracks are located.
- The "Master Track Schedule" is on page 44 and the inside back cover. This is an overview of the tracks (general topic areas) and when/where they are scheduled.

Quickest Way to Find Your Own Session

Use the Author Index (pages 348-366) — the session code for your presentation(s) will be shown along with the room location (abbreviated). You can also refer to the full session listing for the room location of your session(s).

The Session Codes



Time Blocks

A — 8:00am - 9:30am
B — 10:00am - 11:30am
C — 1:30pm - 3:00pm
D — 3:30pm - 5:00pm

On Wednesday, D block is 3:30-5:30pm. Plenaries, keynotes and lunch breaks are interspersed among the technical session time blocks.

Room Locations/Tracks

All tracks and technical sessions are held in the Convention Center. Room numbers are shown on the Master Track Schedule and in the technical session listing. All 300 rooms and Ballroom B are on Level 3 of the Center; all 400 rooms are on Level 4.

Quick Reference

Don't miss the "Quick Reference," a separate flier you received in your registration packet. It includes the Master Track Schedule and floor plans, providing a quick, portable summary of the meeting

Sunday, 8:00am - 9:30am

■ SA01

Room 301

Geometric Optimization

Sponsor: Optimization/ Network and Combinatorial Optimization
Sponsored Session

Chair: Kasturi Varadarajan, University of Iowa, 101E MacLean Hall, Iowa City, IA, United States, kvaradar@cs.uiowa.edu

1 - Robust Shape Fitting via Peeling and Grating Coresets
Pankaj Agarwal, Duke University, Department of Computer Science, Levine Science Research Center D315, Durham, NC, 27708, United States, pankaj@cs.duke.edu

Let P be a set of n points in d-dimensional Euclidean space. A (k,eps)-kernel is a subset of P that, for every direction, epsilon-approximates the directional width of P, when k "outliers" can be ignored in that direction. We prove that small (k,eps)-kernels exist and describe efficient algorithms for computing them. Such kernels are instrumental in solving shape-fitting problems with k outliers. This is joint work with Sariel Har-Peled and Hai Yu.

2 - Randomized Algorithms for Geometric Set Cover
Ken Clarkson, Distinguished Member of Technical Staff, Bell Laboratories, Lucent Technologies, 600 Mountain Avenue, Room 2C-526, Murray Hill, NJ, 07974, United States, clarkson@research.bell-labs.com

While in general the set cover problem is hard to approximate, in the geometric setting it is possible, for a large class of problems, to obtain constant-factor approximations. I will describe an approach to do this, by applying random sampling to solve one particular easy version of the problem, that of finding "epsilon-nets", and then to leverage that solution to greater generality. Applications include covering a region with disks and guarding simple terrains. Joint with K. Varadarajan.

3 - Efficient Subspace Approximation Algorithms
Kasturi Varadarajan, University of Iowa, 101E MacLean Hall, Iowa City, IA, United States, kvaradar@cs.uiowa.edu, N D Shyamalkumar

We consider the problem of finding the optimal k-dimensional subspace that fits a set P of n points in d-dimensional Euclidean space. The quality of the fit of a subspace is measured by the sum of the distances of the n points to the subspace. We present approximation algorithms for this problem with running time linear in n and d and exponential in k and the approximation parameter. We also consider other related notions of fit.

4 - Thick Paths and Minimum-Cost Flows in Geometric Domains
Valentin Polishchuk, PhD Candidate, Stony Brook University, Stony Brook, NY, 11794, United States, valentin.polishchuk@stonybrook.edu, Joseph Mitchell

Planning non-crossing routes amidst polygonal obstacles for multiple moving objects has been a central problem in robotics, air traffic management, VLSI routing, and other fields. We provide efficient algorithms for finding a set of shortest thick paths between pairs of terminals on the boundary of a polygonal domain. We apply our thick paths techniques to obtain the first algorithmic results for the minimum-cost continuous flow problem in geometric domains.

■ SA02

Room 302

Joint Session Open-Source/ICS: Applications of the Nonlinear Optimization Software IPOPT I

Cluster: Open-Source Software: Open Source, Open Standards, Open Data, INFORMS Computing Society
Invited Session

Chair: Andreas Waechter, Research Staff Member, IBM TJ Watson Research Center, 1101 Kitchawan Road, Yorktown Heights, NY, 10598, United States, andreasw@watson.ibm.com

1 - Large-Scale Nonlinear Parameter Estimation with IPOPT
Victor M. Zavala, Carnegie Mellon University, 5000 Forbes Avenue, Pittsburgh, PA, 15213, United States, vzavala@andrew.cmu.edu, Lorenz Biegler

Previously intractable DAE-constrained estimation problems for complex process models have been considered. Although the related NLPs are highly nonlinear with possibly non-unique solutions, IPOPT has shown to be efficient in their solution. NLPs with up to 69,000 constraints and 530 degrees of freedom have been solved in a few minutes.

2 - Spacecraft Trajectory Optimization
Juan Arrieta, Carnegie Mellon University, 5000 Forbes Avenue, Pittsburgh, PA, 15213, United States, jarrieta@andrew.cmu.edu, Lorenz Biegler

The optimal thrusting sequence that will transfer a spacecraft between two points in the Solar System can be obtained from the solution to a large, nonconvex optimal control problem. The NLP resulting from direct transcription is solved with IPOPT. We present realistic examples: an orbit transfer and an Earth-Moon trajectory.

3 - IPOPT in a Software Package for Dynamic Optimization
Yi-Dong Lang, Carnegie Mellon University, 5000 Forbes Avenue, Pittsburgh, PA, 15213, United States, lang@andrew.cmu.edu, Andreas Waechter, Lorenz Biegler

A software package, DynoPC, uses IPOPT as the NLP solver to solve discretized dynamic optimization problems simultaneously. It invokes ADOL-C to evaluate constraints, Jacobians and Hessians required by IPOPT, based on user-supplied models. The package has been updated according to new developments of IPOPT, and tested on challenging examples.

■ SA03

Room 303

Interior Point Methods for Linear Programming

Sponsor: Optimization/ Linear Programming and Complementarity
Sponsored Session

Chair: Hande Benson, Assistant Professor, Drexel University, Department of Decision Sciences, 3141 Chestnut Street, Philadelphia, PA, 19104, United States, benson@drexel.edu

1 - Solving Linear Optimization Problems with MOSEK
Bo Jensen, MOSEK ApS, C/O Symbion Science Park, Fruebjergvej 3, Copenhagen, 2100, Denmark, bo.jensen@mosek.com

The software package MOSEK is capable of solving large-scale sparse linear optimization problems using either an interior-point, a primal simplex or a dual simplex algorithm. The aim of this talk is to present the optimizers and the recent advances in their implementation. Moreover, we will present numerical results demonstrating the optimizers performance.

2 - Complexity Results for Path Following Algorithms for Linear Programming
Renato Monteiro, Professor, ISyE, Georgia Institute of Technology, Atlanta, GA, United States, monteiro@isye.gatech.edu, Takashi Tsuchiya, Guanghui Lan

In this talk, we discuss complexities of path following algorithms for linear programming which take into account the geometry of the central path. We survey old iteration-complexity results for the the Vavasis-Ye and the MTY predictor-corrector algorithms. We also present complexity results for a new predictor-corrector trust region algorithm. We end the talk by surveying results about the geometric structure of the central path in terms of its curvature.

3 - A Constraint Reduced IPM for Convex Quadratic Programming, with Application to SVM Training
Jin Hyuk Jung, PhD Student, University of Maryland, Department of Computer Science, College Park, MD, 20742, United States, jjung@cs.umd.edu, Andre Tits, Dianne O'Leary

We propose a constraint reduction scheme for a convex QP with m inequality constraints and n variables,mdddn. We solve the normal equations with a reduced matrix, H + A'_Q diag(z/s)_Q A_Q, for a well chosen index set Q (adaptively shrunk) thus reducing the computational cost per iteration by a factor close to |Q|/m. We prove global, and local quadratic, convergence. We apply our scheme to support vector machine (SVM) training (primal QP formulation), with highly promising results.

4 - Exact Primal-Dual Regularization of Linear Programs
Dominique Orban, Ecole Polytechnique de Montreal, CP 6079 Succ. Centre-Ville, Montreal, QC, H3C-3A7, Canada, Dominique.Orban@polymtl.ca, Michael Friedlander

In the framework of linear programming, we propose a theoretical justification for regularizing the linear systems used to compute search directions when the latter are (nearly) rank deficient. We present a primal-dual infeasible algorithm for LPs with explicit primal and dual regularization. The regularization is termed exact to stress that, although the LP is regularized, we are still able to recover a solution of the original LP, independently of the values of the regularization parameters.

■ SA04

Room 304

Managing Supply Chain Uncertainties

Cluster: Supply Chain and Operations Engineering
Invited Session

Chair: Yusen Xia, Assistant Professor, Georgia State University, Atlanta, GA, 30303, United States, mgtyxx@langate.gsu.edu

1 - Supply Chain Revenue Management
Yusen Xia, Assistant Professor, Georgia State University, Atlanta, GA, 30303, United States, mgtyxx@langate.gsu.edu, Qiying Hu

In this talk, we study revenue management for a one-supplier and one-retailer supply chain where consumers can buy either from the supplier or from the retailer. Both centralized and decentralized settings are investigated.

2 - A Procurement Model with Supply Uncertainty
Haresh Gurnani, University of Miami, 417B Jenkins Building, Coral Gables, FL, 33124, United States, haresh@miami.edu, Tridip Ray, Saibal Ray

With the rapid expansion of global B2B commerce, newer suppliers with cheaper but possibly unreliable technologies enter the market place to win orders from firms by beating the price of their perfectly reliable (but expensive) competitors. The dilemma facing purchasing firms is the allocation of the tender across suppliers of varying supply reliability. The cases of perfect, imperfect, and incomplete information will be discussed.

3 - Performance Aspects of Collaborative Planning Forecasting and Replenishment (CPFR) Technologies
Craig Hill, Assistant Professor, Georgia State University, Dept. of Managerial Sciences, 35 Broad Street, 10th Floor, Atlanta, GA, 30302, United States, chill4@gsu.edu, Yusen Xia, Peter Zhang

The CPFR initiative is a relatively new management paradigm that supports supply chain members making joint decisions on their mutual supply chain issues. These issues and decisions include such things as inventory management and product design. This research uses empirical data to focus on the performance ramifications to companies that use this program.

4 - Make or Buy: Impact of Information on Optimal Production/Outsourcing Policies with Limited Capacity
Liwen Chen, PhD Student, The University of Texas at Austin, 1 University Station B6500, IROM Department, Austin, TX, 78712, United States, liwen.chen@mail.utexas.edu, Genaro Gutierrez

We study a production/outsourcing problem with limited capacity and outsourcing option using a formal Bayesian framework. We show find the optimal production/outsourcing policy. We provide monotonicity results of the critical points w.r.t. the production capacity and the information acquiring time. We find that the knowledge that we are going to get demand information later will change our operational decisions. We also explore mismatch cost, outsourcing option value.

■ SA05

Room 305

Computational Developments in Stochastic Integer Programming

Sponsor: Optimization/ Stochastic Programming
Sponsored Session

Chair: Miguel Lejeune, Assistant Professor, Carnegie Mellon University, 5000 Forbes Avenue, Tepper School of Business, Pittsburgh, PA, 15213, United States, mlejeune@andrew.cmu.edu

1 - Building Solutions for 2-Stage and Multi-Stage Stochastic Linear Programs Using Xpress-MP
Nitin Verma, Dash Optimization, 560 Sylvan Avenue, Englewood Cliffs, NJ, United States, nitin.verma@dashoptimization.com

In this talk we demonstrate how one could use the modeling, programming, optimization, and visualization tools available in Xpress-MP to build solutions for stochastic problems. Specifically, we will show how to easily build comprehensive solutions — for both analyses and deployment purposes — in a relatively short frame of time using Xpress- SP together with Xpress-IVE, and XAD.

2 - An Exact Solution Approach for Stochastic Integer Portfolio Optimization Problems
Miguel Lejeune, Assistant Professor, Carnegie Mellon University, 5000 Forbes Avenue, Tepper School of Business, Pittsburgh, PA, 15213, United States, mlejeune@andrew.cmu.edu, Pierre Bonami

We develop an exact solution method for portfolio optimization problems in which uncertainty in the estimate of the expected return and real-life market restriction modeled with integer constraints are simultaneously considered. We use a non-linear branch-and-bound algorithm and implement a new branching priority rule. Computational results on problems containing up to 200 assets are reported and benchmarked with others methods and solvers.

3 - Sharp Bound For Probabilities in a Distribution with Given Shape Information

Ersoy Subasi, RUTCOR, Rutgers University, 640 Bartholomew Road, Piscataway, NJ, 08854, United States, esub@rutcor.rutgers.edu, Mine Subasi, András Prékopa

The binomial moment problem with finite, preassigned supports and given shapes of the distribution is formulated and used to obtain sharp lower and upper bounds for probabilities that exactly r out of n events occurs as well as probabilities that at least r out of n events occurs. The bounds are based on the knowledge of some of the binomial moments of the number of events which occur. Numerical examples and applications in reliability and finance are presented.

4 - MIPing the Probability Set Covering Problem

Vineet Goyal, PhD Student, Tepper School of Business, Carnegie Mellon University, 5000 Forbes Avenue, Pittsburgh, PA, 15213, United States, vgoyal@andrew.cmu.edu, Anureet Saxena, Miguel Lejeune

We consider a probabilistic set covering problem where the right hand side is a random binary vector and the covering constraint must be satisfied with some probability. The problem can be formulated as a disjunctive program over the set of p-efficient points, and is solved with a branch and bound algorithm. In this paper, we give a novel MIP formulation of the probability constraint using only few additional variables. This approach overcomes the exponential enumeration of p-efficient points.

5 - Maximization of a Strongly Unimodal Multivariate Discrete Distribution

Mine Subasi, RUTCOR, Rutgers University, 640 Bartholomew Rd, Piscataway, NJ, 08854, United States, msub@rutcor.rutgers.edu, Ersoy Subasi, András Prékopa

A dual type linear programming algorithm is presented to find the maximum of a strongly unimodal multivariate discrete distribution. Numerical examples are presented.

■ SA06

Room 306

Applications of Constraint Programming

Sponsor: INFORMS Computing Society/Constraint Programming
Sponsored Session

Chair: Andrew Davenport, IBM, IBM T.J.Watson Research Center, 1101 Kitchawan Road, PO Box 218, Yorktown Heights, NY, 10598, United States, davenport@us.ibm.com

1 - Distributed Management of Schedules Using Simple Temporal Constraint Networks

Stephen Smith, Research Professor, Carnegie Mellon University, 5000 Forbes Avenue, The Robotics Institute, Pittsburgh, PA, 15213, United States, sfs@cs.cmu.edu, Anthony Gallagher, Terry Zimmerman, Laura Barbulescu, Zachary Rubinstein

We consider the problem of maintaining the schedules of a team of agents operating jointly in an uncertain execution environment. The objective is to maximize the quality of executed actions, and an action taken by a given agent may depend on those taken by others. Since no single agent has a complete view of the problem, agents must coordinate to identify scheduling decisions that maximize global quality. We describe a solution approach rooted in the use of Simple Temporal Network models.

2 - Systematic Local Search for Constraint Optimization

Bill Havens, Simon Fraser University, School of Computing Science, Burnaby, BC, V5A1S6, Canada, havens@cs.sfu.ca

We define a new search framework for solving constraint satisfaction problems (CSPs) and constraint optimization problems (COPs). The frameworks suggests a multiplicity of new hybrid search methods which combine aspects of stochastic local search, systematic constructive (bactrack) search algorithms and nogood learning techniques. Recently we have shown significant progress in using this hybrid method for hard random CSPs, job shop and open shop scheduling problems.

3 - A Survey of Existing and Unexplored Military Applications of Constraint Programming

Jean-Paul Watson, Sandia National Laboratories, PO Box 5800, MS 1110, Albuquerque, NM, 87185-1110, United States, jwatson@sandia.gov

Industrial logistics problems, e.g., transportation and scheduling, have been used to showcase the power and flexibility of constraint programming (CP) technology. However, the transference to military logistics problems - which are often richer than their industrial counterparts - is limited. We survey prior successful applications of CP in military logistics, and detail a number of unexplored problems for which CP may be particularly suitable.

4 - A Constraint-Programming Approach for Scheduling with Alternative Process Plans

Andrew Davenport, IBM, IBM T.J.Watson Research Center, 1101 Kitchawan Road, PO Box 218, Yorktown Heights, NY, 10598, United States, davenport@us.ibm.com

Manufacturing scheduling problems often involve jobs which can be scheduled using one of a number of different process routes through the manufacturing facility, as well as preferences on which process routes are selected. We present techniques and results for scheduling with alternative process routes using constraint programming approaches.

■ SA07

Room 307

New Books in Business Statistics

Cluster: New Books
Invited Session

Chair: Brett Saraniti, Hawaii Pacific University, 1060 Bishop Street, #402, Honolulu, HI, United States, b-saraniti@kellogg.northwestern.edu

1 - Presenting Business Statistics with "Concise Managerial Statistics"

Kellie Keeling, Assistant Professor, Virginia Tech, Business Information Technology(0235), Pamplin 1007, Blacksburg, VA, 24061-0235, United States, kkeeling@vt.edu

Concise Managerial Statistics is an introduction to Business Statistics text integrating the use of computers with statistics, by describing the concepts and applications while giving users the opportunity to carry out computer-generated solutions using SPSS, Excel, and MINITAB. The text includes Excel Add-ins that expand Excel's power in graphing and regression analysis. The cases, chapter examples, and exercises focus on the interpretation of statistical graphs and statistical conclusions.

2 - Writing a Basic Statistics Textbook

Samuel Wathen, Iterim Dean, Operations, Coastal Carolina University, Wall College of Business, Conway, SC, 29528, United States, wathen@coastal.edu

A basic statistics textbook is directed at two audiences: students and instructors. Writing for these audiences presents the challenge of presenting the material with many real world examples, illustrations, and scenarios so that students can connect with the topic of statistics. Instructors appreciate the readability of a text and the inclusion of a generally accepted set of topics. Instructors also desire many different forms of course support.

3 - Managerial Statistics: A Case-Based Approach

Brett Saraniti, Hawaii Pacific University, 1060 Bishop Street, #402, Honolulu, HI, United States, b-saraniti@kellogg.northwestern.edu

The business statistics course at the Kellogg School of Management has been using a case-based approach for the past decade. The course packet has evolved into a new textbook by Thomson-Southwestern titled "Managerial Statistics: A Case-Based Approach." Traditional topics are motivated by real world cases using a hands-on approach that utilizes a simple Excel macro.

■ SA08

Room 308

Technology Strategy: Entry, Adoption, and Acquisition

Sponsor: Technology Management
Sponsored Session

Chair: Sebastian Fixson, Adjunct Assistant Research Scientist, Industrial and Operations Engineering, University of Michigan, Ann Arbor, MI, United States, fixson@umich.edu

1 - Evolution of a Technological System and Organizational Dynamics: A Subsystem Level Analysis

Jaegul Lee, Postdoctoral Fellow, Carnegie Mellon University, Pittsburgh, PA, 15213, United States, jaegull@andrew.cmu.edu

This research examines the link between technological evolutions of the automobile emission control system at the subsystem level and the entry as well as exit patterns of firms' innovation activities. Findings of this research suggests that firms' entry and exit during the subsequent cycles of technological change is influenced significantly by the establishment of the subsequent technological regime and ecological processes of involved firm population.

2 - Knowledge Relatedness and Industry Life Cycle: Evidence from the Early Automotive Airbag Industry
Sebastian Fixson, Adjunct Assistant Research Scientist, Industrial and Operations Engineering, University of Michigan, Ann Arbor, MI, United States, fixson@umich.edu, Wonhee Lee

Linking the concepts of knowledge relatedness and industry life cycle we explore in this paper the dynamic nature of knowledge relatedness by comparing industry pre-takeoff and post-takeoff stages of the automotive airbag industry. We find that while prior to industry take-off firms' inward focus produces more valuable innovations, post industry take-off firms need to explore more across their firm boundaries to produce valuable innovations.

3 - Technology Adoption and Performance Among Medical Service Providers
J. Lamar Pierce, Carnegie Mellon University, Tepper School of Business, Pittsburgh, PA, 15213, United States, jlp1@andrew.cmu.edu, Aaron Chatterji

When and how to acquire new medical equipment is an important strategic decision for health care firms. Especially for new firms, significant tradeoffs exist between financial stability and quality of services. This study uses data on medical equipment to investigate the impact of technology adoption and financing on firm performance.

4 - Dynamic Competitive Advantage Through Innovation: M&A, Cooperation, Contracting & Tech. Performance
Giovanni Valentini, Bocconi University, ISEA, Milan, Italy, giovanni.valentini@unibocconi.it

Recent evidence suggests that the innovation process is increasingly involving partners beyond a firm's boundaries, including research companies, business partners, and universities. This work explores issues on the drivers and the consequences of an open innovation strategy.

■ SA09

Room 309

R&D Decisions in Entrepreneurial Settings

Cluster: New Product Development

Invited Session

Chair: Nitin Joglekar, Associate Professor, Boston University, 525 Commonwealth Avenue, Boston, MA, 02215, United States, joglekar@bu.edu

1 - Strategic Isomorphism, Legitimacy, and IPO Markets
David Deeds, Associate Professor, The School of Management, University of Texas at Dallas, PO Box 830688, SM 43, Richardson, TX, 75083-0688, United States, david.deeds@utdallas.edu, Theodore A. Khoury

Do investors reward conformity? In emerging industries, do they act as agents of isomorphism? We address these questions by examining the impact of a firm's strategic conformity on the flow of resources into the firm using a sample of 150 biotech firms that issued an IPO between 1982 to 2001. Using IPO performance as a measure of constituent-based legitimacy, we find that firms who conform to specific strategies are rewarded but we also find areas in which firms are penalized for conformance.

2 - Diagnosing Unforeseeable Uncertainty in Startups
Christoph Loch, Professor of Technology Management, INSEAD, Boulevard de Constance, Fontainebleau, France, christoph.loch@insead.edu

Novel startups often face unforeseeable uncertainty, or influence factors that cannot be identified beforehand. However, management systems (e.g., whether to proceed with parallel trials or by probing and learning) must be set at the outset. This contradiction can be resolved by asking for gaps and inconsistencies in one's knowledge: the PRESENCE of unforeseeable uncertainty can be diagnosed. The extent of uncertainty and complexity allow guidance in choosing the management systems.

3 - Balancing R&D and Marketing Tension in Startup Firms
Moren Levesque, Associate Professor, University of Waterloo, Waterloo, ON, Canada, levesque@waterloo.ca, Nitin Joglekar

When should the owner of a startup firm acquire working capital and how should she distribute this capital between R&D - that improves product quality - and marketing expenses - that builds the sales up? The industry focus is software, where both R&D and marketing are significant fractions of overall expenses. We develop a model to study optimal resource acquisition and allocation across successive stages of startup growth.

4 - Effects of Learning and Cooperation on New Firm Marketing
John Angelis, Case Western Reserve University, 10900 Euclid Avenue, Cleveland, OH, United States, john.angelis@case.edu

New firms face liabilities of newness. These liabilities exist both in a firm's marketing ability and in customer retention and acceptance. We investigate how a firm's optimal marketing expenditures should change due to learning over time and the firm's endogenous cooperation level with other firms.

■ SA11

Room 311

Real-Life Sports Applications

Sponsor: OR in Sports

Sponsored Session

Chair: Michael Trick, General Chair, INFORMS Anuual Meeting, Carnegie Mellon University, Tepper School of Business, 5000 Forbes Avenue, Pittsburgh, PA, 15217, United States, trick@cmu.edu

1 - Moneyball and the Mavs.
Wayne Winston, Professor, Indiana University, 3453 Maritime Court, Bloomington, IN, 47401, United States, winston@indiana.edu

We will describe our player and lineup evaluation system that has been used for Dallas Mavericks for 6 seasons. Over that time period the Mavs won more regular season games than any other NBA team. We will pay particular attention to how the coaching staff uses our data.

2 - ChartMine: Using Decision Theory and Data Mining to Improve On-Field Baseball Decision Making
Eric Bickel, Assistant Professor, Texas A&M University, 236B Zachry Engineering Center, 3131 TAMU, College Station, TX, 77843-3131, United States, ebickel@tamu.edu

Over 300 high schools and universities have used ChartMine®, including over 30% of NCAA D1, to improve pitching/hitting strategies. ESPN has used ChartMine to provide information to viewers during the College World Series. ChartMine is a software system that combines efficient data collection with a powerful database analysis tool, grounded on decision analytic theory. I will describe ChartMine and discuss some lessons learned from trying to make money by applying OR to sports decisions.

3 - Umpire Crew Scheduling at the U.S. Open
Adam Farmer, Logistics Engineer, The Home Depot, 2455 Paces Ferry Road, Atlanta, GA, 30339, United States, afarmer80@gmail.com, Jeffrey Smith

Scheduling umpires at the U.S. Open can require a significant amount of time due to several factors. The authors developed a system to automate the scheduling process and successfully implemented the system at the 2004 and 2005 U.S. Opens. In 2006, the system was enhanced to allow for the assignment of crew chiefs and incorporate ongoing assignment history throughout the course of the tournament. Results of the updated system's implementation at the 2006 U.S. Open will be discussed.

4 - Scheduling Major League Baseball Umpires
Tallys Yunes, University of Miami, Department of Management Science, Coral Gables, FL, 33124-8237, United States, tallys@miami.edu, Michael Trick, Heather Barringer, Jonathan Levine

In this talk we address the problem of constructing schedules for MLB umpire crews. We will discuss a few heuristic approaches for this problem and present computational results on real data. Our work created the 2006 MLB umpire schedule.

■ SA12

Room 312

2006 Dantzig Dissertation Award Finalists

Cluster: Dantzig Dissertation Prize

Invited Session

Chair: Robert Shumsky, Associate Professor, Tuck School, Dartmouth College, 100 Tuck Hall, Hanover, NH, 03755, United States, Robert.A.Shumsky@Dartmouth.EDU

1 - Availability Management for Configure-to-Order Supply Chain Systems
Ching-Hua Chen-Ritzo, Research Staff Member, IBM T.J. Watson Research Center, Mathematical Sciences, 1101 Kitchawan Road, Yorktown Heights, NY, 10598, chenritzo@us.ibm.com

We address the problem of aligning demand and supply in configure-to-order systems. Using stochastic programming methods, this study demonstrates the value of accounting for the uncertainty associated with how orders are configured, as well as the value of component supply flexibility in the presence

of order configuration uncertainty. We position our models within an increasingly popular business process called Sales and Operations Planning. Computational analyses were performed using data obtained from IBM System and Technology group.

2 - Maximizing the Efficiency of the U.S. Liver Allocation System through Region Design

Nan Kong, Assistant Professor, Industrial and Management Systems Engineering, University of South Florida, ENC 2505, Tampa, FL, 33620, United States, kong@eng.usf.edu

Allocating organs for transplantation has been a contentious issue in the U.S. for decades. One of the remaining central questions is how to facilitate regional distribution of organ procurement organizations. We formulate this problem as a large-scale set-partitioning problem to find the most efficient set of regions. We also design a branch-and-price algorithm for the problem, in which we apply a decomposition-based heuristic and several valid inequalities to algorithm effectiveness.

3 - Inventory Control in a Build-to-Order Environment

Melda Ormeci, School of Industrial & Systems Engineering, Georgia Institute of Technology, Atlanta, GA, 30332-0205, ormecime@isye.gatech.edu

We look at the challenges and solution strategies of employing build-to-order in the context of global supply. We introduce a new shipping policy, ''Ship-to-Average", which prescribes sending a fixed quantity, based on the long term average forecast, with each shipment and making adjustments only if the inventory strays outside a prescribed range. We provide theoretical support for the observed performance of this type of policy by addressing a Brownian control problem whose objective is to find the right balance between holding costs and the costs for adjusting shipment sizes.

■ SA13

Room 313

Teaching Case Competition I

Sponsor: Education (INFORM-ED)

Sponsored Session

Chair: Tasha R. Inniss, Assistant Professor of Mathematics, Spelman College, 350 Spelman Lane, SW, Box 320, Atlanta, GA, 30126, United States, tinniss@spelman.edu

1 - Presentations of Finalists #1 and #2 for the Seventh Annual INFORMS Case Competition

Tasha R. Inniss, Assistant Professor of Mathematics, Spelman College, 350 Spelman Lane, SW, Box 320, Atlanta, GA, 30126, United States, tinniss@spelman.edu

The FOUR finalists for the 2006 INFORMS Case Competition will deliver final presentations of their teaching cases to a panel of pre-selected judges and the audience. All are welcome to attend and observe these presentations as well as ask questions of the finalists. At the end of the four presentations, the judges will select the winner of the Case Competition. The winners and runners-up will be announced and presented with plaques as well as cash awards at the INFORM-ED Annual Business Meeting.

■ SA14

Room 314

Optimization in Quality Control

Contributed Session

Chair: Injun Jeong, Senior Researcher, Strategic Management Research Team / ETRI, 161 Gajeong-Dong, Yuseong-Gu, Daejeon, 305-700, South Korea, ijjeong@etri.re.kr

1 - A Robust Design Optimization Model Considering Multiple Responses of Different Types

Jamison Kovach, Assistant Professor, University of Houston, 312 Technology Building, University of Houston, Houston, TX, 77204, United States, jvkovach@uh.edu, Byung Rae Cho

Several robust design optimization models have been proposed in the literature, yet few have specifically addressed problems involving the simultaneous consideration of multiple quality characteristics of different types. Here, we propose a new robust design optimization strategy which is a more flexible and structured approach for solving multiresponse problems effectively.

2 - A Computationally Efficient Robust M-Estimator

Jonathan Stephenson, SAS Institute, 100 SAS Campus Drive, Cary, NC, 27513, United States, jonathan.stephenson@sas.com

A bounded-influence estimator is considered and its asymptotic properties are discussed. The influence function is depicted and the breakdown point is explored. Algorithmic choices are outlined with application to linear and nonlinear parameter estimation. Extensions to solving linear and nonlinear systems.

3 - Bayesian Approaches to Model Robust and Model Discrimination Designs

Vincent Agboto, Research Scientist, Battelle, 505 King Avenue, Columbus, OH, 43228, United States, agbotov@battelle.org, Christopher Nachtsheim

A criticism frequently associated with the use of many optimality criteria in industrial experiments is the specific reliance on a statistical model. One may respond by claiming that the true model is an approximation of an unknown element of a known set of models. We introduce a Bayesian design method that accounts for parameter estimation and prior probability on the set of models of interest. We also introduce some Bayesian model discrimination approaches. Useful examples will be given.

4 - Impacts of Inspection Policies on Quality Coordination in a Supply Chain

Hong Wan, Assistant Professor, School of Industrial Engineering, Purdue University, 315 N. Grant Street, West Lafayette, IN, 47907, United States, hwan@purdue.edu, Xiaowei Xu

This paper studies how inspection policies affect product quality in a supply chain. A manufacturer purchases components from a supplier. If the manufacturer coordinates with the supplier on component quality, she should use the All-or-None inspection policy; Otherwise, she should inspect at least a proportion of her order, but still fails to achieve the first-best component quality level. Supply chain efficiencies can be restores with a warranty-sharing contract.

5 - A Posterior Preference Articulation Method to Dual Response Surface Optimization

Injun Jeong, Senior Researcher, Strategic Management Research Team / ETRI, 161 Gajeong-Dong, Yuseong-Gu, Daejeon, 305-700, South Korea, ijjeong@etri.re.kr, Sungsoo Han, Kwangjae Kim

In dual response surface optimization, the mean and the standard deviation responses are often in conflict. To obtain a satisfactory compromise in such a case, a decision maker (DM)'s preference information on the tradeoffs among the responses should be incorporated into the problem. This paper proposes a posterior preference articulation method, which generates a comprehensive set of efficient solutions and then enables the DM to choose the best one from the set systematically.

■ SA15

Room 315

Laboratory Auctions Experiments

Cluster: Auctions and e-Commerce

Invited Session

Chair: Elena Katok, Associate Professor, Penn State University, 465 Business Building, University Park, PA, 16802, United States, ekatok@psu.edu

1 - Reverse Auctions with Social Identity

Sherry Li, Assistant Professor, University of Texas - Dallas, 2610 N. Floyd Road, School of Economics, Richardson, TX, 75083, United States, sherry.xin.li@utdallas.edu, Ernan Haruvy, Kutsal Dogan

In reverse auctions where the buyer has latitude to select the winner, social preferences may influence winner selection as well as the price offer. In a laboratory study, we induce social identity with preferences over paintings. Subjects in the role of sellers repeatedly make price offers and buyers can select any offer. Our investigation aims to outline the impact of the induced social identities on price offers and matches.

2 - Bidder Behavior in Multiple-Good Sealed Bid Auctions where the Number of Bidders is Unknown

Svetlana Pevnitskaya, Assistant Professor of Economics, Florida State University, 288 Bellamy Building, Department of Economics, Tallahassee, FL, 32306-2180, United States, spevnitskaya@mailer.fsu.edu, Kurt Schnier, Mark Isaac

This paper analyzes the individual bidding data from a series of sealed-bid auctions with uncertainty over how many participants bidders will be bidding against. For risk-neutral individuals, there is a theory of bidding in this environment. In this paper we 1) Examine the performance of this theory using our individual bidding data, and 2) Extend the analysis to include the implications of risk preferences and potentially risk-averse bidders.

3 - A Direct Test of Risk Aversion in First Price Sealed Bid Auctions

Elena Katok, Associate Professor, Penn State University, 465 Business Building, University Park, PA, 16802, United States, ekatok@psu.edu, Richard Engelbrecht-Wiggans

We present theory and experiments designed to provide a direct test of risk aversion as the explanation of "overbidding" relative to the risk-neutral Nash equilibrium in sealed-bid first price (SBFP) auctions. We conclude that risk aversion fails the test - it cannot, by itself, explain overbidding in SBFP auctions.

■ SA16

Room 316

Dynamic Pricing and Inventory Control

Cluster: Dynamic Pricing and Forecasting

Invited Session

Chair: Panos Kouvelis, Professor, Washington University in St. Louis, Olin School of Business, One Brookings Drive, Campus Box 1133, St. Louis, MO, 63130-4899, United States, kouvelis@wustl.edu

Co-Chair: Lingxiu Dong, Olin School of Business, Washington University in St. Louis, One Brookings Drive, Campus Box 1133, Saint Louis, MO, 63130, United States, dong@wustl.edu

1 - Flexible Capacity, Consumer Choice, and Competition Under Uncertainty

Weiping Chen, Ph.D. Candidate, Department of Industrial and Systems Engineering, Virginia Tech, Blacksburg, VA, 24061-0118, United States, wpchen@vt.edu, Ebru Bish

We study the firm's optimal capacity investment portfolio under a consumer choice model and responsive pricing. The firm produces two substitutable products and can invest in product-dedicated resources as well as a more expensive, flexible resource. We consider both monopoly and duopoly markets and characterize the structure of the optimal investment decision in both cases. We also investigate the benefits of flexible capacity under various situations and derive managerial insights.

2 - Dynamic Allocation to Multiple-Class Demand with Continuous Review

Joseph Milner, Professor, milner@rotman.utoronto.ca, Panos Kouvelis, Ding Qing

We consider how a firm should dynamically allocate inventory to different customer classes that are differentiated by price and willingness to wait for delayed delivery as well as reorder in a continuous review environment. We establish the optimal policy and introduce efficient and robust heuristics.

3 - Dynamic Pricing of Seasonal Products in the Presence of Forward-Looking Consumers

Yossi Aviv, Associate Professor of Operations Management, Olin School of Business, Washington University, Campus Box 1133, 1 Brookings Drive, St. Louis, MO, 63141, United States, aviv@wustl.edu, Amit Pazgal

We study the dynamic pricing of seasonal goods in the presence of strategic customers. Under limited inventory, consumers need to consider not only future prices, but the likelihood of stockouts, which depends on other customers' behavior. We analyze the structure of optimal purchasing strategies, and the way in which strategic consumer behavior impacts pricing policies and expected revenue performance for the seller.

4 - Dynamic Pricing and Inventory Control of Substitutable Products

Zhongjun Tian, Olin School of Business, Washington University in St. Louis, Campus Box 1133, St. Louis, MO, 63130, United States, tian@wustl.edu, Lingxiu Dong, Panos Kouvelis

We study the joint dynamic pricing and inventory control of multiple substitutable and perishable products for a retailer. The multinomial logit (MNL) model is adopted to capture consumer choice preferences. We derive the optimal dynamic pricing policy for the entire selling season, and identify key factors that affect the pricing guidelines. We study the effect of various pricing schemes on the initial inventory/assortment decisions and the interaction between the pricing and initial decisions.

■ SA17

Room 317

Multiechelon Revenue Management Models

Contributed Session

Chair: Carrie Crystal, PhD Student, Georgia Tech, College of Management, 800 W. Peachtree Street, Atlanta, GA, 30332, United States, carrie.crystal@mgt.gatech.edu

1 - Multiple Period Pricing Models

Tao Huang, PROS Revenue Management, 3100 Main St. Suite 900, Houston, TX, 77002, United States, thuang@prosrm.com, Eylem Tekin

We consider pricing models in a multi-period setting. First, we look into the dynamic pricing problems when the initial service capacity is fixed and present closed-form solutions for single-product dynamic pricing problems. Second, we consider problems where both the price and the initial capacity are decision variables under stochastic demand. We formulate multi-stage stochastic programming models and derive structural properties of the optimal value functions.

2 - Pricing and Ordering Policies When Demand is a Stochastic Function of Prices in Multiple Periods

Mehmet Gumus, Department of Industrial Engineering & Operations Research, University of California, Berkeley, CA, 94720, United States, mehmet@ieor.berkeley.edu, Phil Kaminsky, Hyun-Soo Ahn

We consider a joint pricing and ordering problem where stochastic demand realized at each period is influenced by the current price as well as prices at previous periods. We formulate finite-horizon stochastic dynamic programs for a firm maximizing its profit. We characterize the structure of optimal policies for make-to-order and make-to-stock models and conduct preliminary computational study.

3 - Structuring Long-Term Supply Contracts in the Presence of Spot Market

Zhan Pang, PhD Student, The Chinese University of Hong Kong, The Department of SEEM of CUHK, R615, M. W. Mong Engineering Building, Hong Kong, China, zpang@se.cuhk.edu.hk, Youyi Feng

We consider structuring the long-term supply contract of single product between a make-to-stock manufacturing system and its institutional customer(s), both of which are able to trade the product in a spot market. We structure a contract that not only provides strategic value of mitigating variability of sale and cash inflow, but also increases net revenue. An optimal supply curve is used to reach a Nash equilibrium through a series of bilateral bargaining game so as to strike a win-win deal.

4 - Price Optimally and Leverage the Marketing Effort When Entering a Direct Market

Gangshu Cai, Assistant Professor, Texas A&M International University, 311 Lake Carnegie, Laredo, TX, 78041, United States, gangshu@gmail.com, Sungjune Park, Moutaz Khouja

This work designs an aggregated discrete choice model enhanced with a marketing effort to identify the market share of the supplier and the retailer when they compete for the same market. We first analyze the multi-channel model with complete market information and provide optimal solutions to the scenarios before/after a Stackelberg game. We also study a multi-channel newsboy problem when considering with/without allowing the unsatisfied customers to switch from the retailer to the supplier.

5 - Revenue Management Performance Drivers

Carrie Crystal, PhD Student, Georgia Tech, College of Management, 800 W. Peachtree Street, Atlanta, GA, 30332, United States, carrie.crystal@mgt.gatech.edu, Mark Ferguson, Jeff Stratman

We present a theory-based model describing how key factors interact to impact revenue management performance and empirically test this theory. This study contributes to the literature by presenting a large scale comparison of practices and performance and indicating improvement areas for greatest impact.

■ SA18

Room 318

Investment Incentives and Risk Management in Electricity Markets

Sponsor: Energy, Natural Resources & The Environment

Sponsored Session

Chair: Shmuel Oren, Professor, University of California, Berkeley, IEOR Department, 4119 Etcheverry Hall, Berkeley, CA, 94720, United States, oren@ieor.berkeley.edu

1 - A Forward Capacity Market Model for Electricity

Hung Po Chao, Director of Market Monitoring, Independent Systems Operator, New England, One Sullivan Road, Holyoke, MA, 01040, United States, hchao@iso-ne.com

We study a multi-period forward capacity market for electricity that includes a primary capacity auction and multiple secondary reconfiguration auctions. The capacity is traded as an option with an energy strike price, which effectively sets an offer cap, as the marginal revenue for the capacity from energy market is capped at that level. Characterization of dynamic equilibrium for energy and capacity markets is established in a network. Market power issue is investigated.

2 - Free Allowances and Investments in a CO2 Constrained Restructured Electricity Market

Yves Smeers, Professor, Universite Catholique de Louvain CORE/UCL, 34 voie du Roman Pays, Louvain La Neuve, Be, B-1348, Belgium, smeers@core.ucl.ac.be, Andreas Ehrenmann

We consider a stylised investment model of generation in a restructured electricity system with a CO2 cap and trade. We discuss the incentive to ivnestments arising from granting free allowances on the base of output or fuel consumption.

3 - Incentives of Generation Firms for Long-Term Investment in the U.S. Electricity Transmission System

Enzo Sauma, Assistant Professor, Pontificia Universidad Catolica de Chile, Av. Vicuna Mackenna #4860, Raul Deves Hall, Piso 3, Macul, Santiago, Chile, esauma@ing.puc.cl, Shmuel Oren

We study the incentives that generation firms have in the U.S. electricity markets for supporting long-term social-welfare-improving transmission investments. We also examine how such incentives are affected by the ownership structure of financial transmission rights (FTRs). We show that generation firms may have disincentives for making socially beneficial transmission investments in the U.S. system. However, we also show how this situation could be reversed by correctly allocating FTRs.

4 - A Hybrid Bertrand-Cournot Model of Electricity Markets with Multiple Subnetworks

Jian Yao, University of California, Department of IEOR, 4141 Etcheverry Hall, Berkeley, CA, 94720, United States, jyao@ieor.berkeley.edu, Shmuel Oren, Benjamin Hobbs

We propose a hybrid Bertrand-Cournot model of electricity markets where inter-subnetwork connections are frequently congested but intra-subnetwork connections are not. In this model, generators behave Cournot regarding inter-subnetwork transmission quantities, but Bertrand regarding intra-subnetwork transmission prices. Numerical examples suggest that this model leads to equilibrium prices higher than those from a homogeneous Bertrand model, but lower than those from a homogenous Cournot model.

■ SA19

Room 319

Forestry Applications I

Sponsor: Energy, Natural Resources & The Environment

Sponsored Session

Chair: Susan King, U.S. Bureau of Labor Statistics, 2 Massachusetts Ave., NE, Room 3650, Washington, DC, United States, King.Susan@bls.gov

1 - Robust Optimization Applied to the Supply Chain of the Chilean Forest Industry

Pamela Alvarez, Facultad de Ingenierìa, Departamento de Ciencias de la Ingenierìa, Universidad Andrés Bello, Chile, ppalvare@puc.cl, Jorge Vera

The following work applies the methodology of robust optimization to problems of the supply chain of the Chilean forest industry in different planning levels. This methodology treats the uncertainty in optimization problems, associating with the uncertain problem a new one called robust counterpart. Specifically, robust models for problems of sawmill planning and problems of forest harvests are analyzed with uncertain yield parameters.

2 - Optimizing the Supply Chain for a Pulp Industry Using Decomposition Schemes

Helene Gunnarsson, Linköping Institute of Technology, Division of Optimization, S-581 83, Linköping, Sweden, hegun@mai.liu.se, Mikael Ronnqvist, Dick Carlsson

We consider the problem of planning the production, transportation and distribution of products in the pulp industry. The problem includes both binary and continuous decisions for production mix, terminal usage and ship routes, flows etc. We propose a mathematical model for the entire supply chain and we present a number of decomposition schemes to get a solution in acceptable computational time.

3 - Agent-Based Simulation of a Lumber Supply Chain

Sophie D'Amours, FORAC Research Consortium, Université Laval, Pavillon Pouliot, Québec, Qc, G1K 7P4, Canada, Sophie.damours@forac.ulaval.ca, Luis Antonio Santa-Eulalia, Sébastien Lemieux, Jean-Marc Frayret, Alain Rousseau

We present an agent-based simulator to test supply chain configurations and planning approaches for the lumber industry. The architecture of the simulator and a proposed simulation framework are discussed. Impacts of different planning approaches are evaluated. The simulator builds on FIPA standards and integrates optimization modules. The application deals with sawmills, drying and finishing facilities, warehouses and customer buying behavior.

4 - Collaborative Planning in Forest Transportation

Mikael Ronnqvist, Norwegian School of Economics and Business Administration, Dept. of Finance and Management Science, NHH, Helleveien 30, NO-5045, Bergen, Norway, Mikael.Ronnqvist@nhh.no

We describe and analyze how companies can coordinate their transportation planning and make a fair cost allocation or distribution of the cost savings. We make use of several economic models, including the Shapley value. We test the approach on a case study involving eight companies

■ SA20

Room 320

Communicating with Decision Makers

Sponsor: Decision Analysis Society

Sponsored Session

Chair: James Felli, Sr. Research Advisor, Eli Lilly & Company, Lilly Corporate Center, Indianapolis, IN, United States, felli_james_c@lilly.com

1 - Seven Principles for Effective Communication with Decision Makers

Lawrence Phillips, Professor, London School of Economics & Political Science, Department of Operational Research, Houghton Street, London, NW3 1AH, United Kingdom, larry_phillips@msn.com

Applying seven principles will improve our communication with decision makers: (1) Understand the client's problem, (2) Work as process consultants, (3) Engage with groups of key players rather than individuals, (4) Ensure meeting room arrangements facilitate interaction, (5) Use metaphor not jargon, (6) Model on-the-spot and display results graphically, and (7) Focus on creating aligned commitment.

2 - Transparent Decision Analysis

Robert Bordley, Technical Fellow, General Motors Research, 525 Choice Court, Troy, MI, 48084, United States, robert.bordley@gm.com

In most cases, the results, analyses and assumptions of a decision analysis should all be transparent to the stakeholders impacted by the decision. Much progress has been made on making the results of the analysis transparent. This paper presents practical ways of making the analysis visual.

3 - Metaphor Mapping

James Felli, Sr. Research Advisor, Eli Lilly & Company, Lilly Corporate Center, Indianapolis, IN, United States, felli_james_c@lilly.com

One obstacle faced by decision makers is a limited ability to visualize data. We present a new direction in data visualization: the use of metaphorical images to represent data sets. We will discuss the use of metaphor maps and their ability to succinctly convey information to a human observer.

■ SA21

Room 321

Decisions and Games Involving Outcomes Over Space and Time

Sponsor: Decision Analysis Society

Sponsored Session

Chair: L. Robin Keller, Professor, University of California, Irvine, Merage School of Business, Irvine, CA, 92697-3125, United States, lrkeller@uci.edu

1 - Geographically-Oriented Preference Functions

Craig Kirkwood, Professor, Arizona State University, W. P. Carey School of Business, PO Box 874706, Tempe, AZ, 85287-4706, United States, Craig.Kirkwood@asu.edu, L. Robin Keller

Some decisions involve alternatives with impacts that vary geographically. This paper applies multiattribute value and utility theory to develop functional forms for preference functions to address such decisions in a way that is both prescriptively sound and practical.

2 - Towards a General Preference Model Over Time Itself

Jeffery L. Guyse, Associate Professor, California State Polytechnic University, Pomona, College of Business Administration, 3801 West Temple Avenue, Pomona, CA, 91768, United States, JLGuyse@csupomona.edu

Trading monetary outcomes off over time has received significant attention by researchers. Likewise the psychological literature on perceived time is well developed. In this study we investigate the value function of time itself, independent of direct monetary considerations. The model can shed insights on how time is valued in a waiting or leisure setting, with special attention given to expectation and the shape of the value function.

3 - Prostate Cancer Decision Analyst: Choosing the Best Treatment
Jay Simon, Doctoral Student, University of California, Irvine, Operations & Decision Technologies, Irvine, CA, 92697-3125, United States, jsimon05@merage.uci.edu

A man diagnosed with prostate cancer faces a difficult decision. Treatments have varying cure rates and a wide range of side effects. We develop a multiple-objective decision model under uncertainty, which will be shaped by the preferences and personal characteristics of the individual. This quantitative process will incorporate both user input and medical data, and will allow an individual prostate cancer patient to meaningfully compare treatments.

4 - Reputation, Trust, and Rebates: How Online Auction Markets can Improve their Feedback Mechanisms
Lingfang Li, University of California, Irvine, 6336 Adobe Circle, Irvine, CA, 92617, United States, lingfanl@uci.edu

In current online auction markets only half of the buyers leave feedback after transactions, and nearly all of it is positive. This paper proposes a mechanism whereby sellers can provide rebates to buyers contingent on buyers' providing reports. In both a pure adverse selection model, and a model with adverse selection and moral hazard, there exists a pooling equilibrium where both good and bad sellers choose the rebate option, even though their true types are revealed through feedback.

■ SA22

Room 322

Missions and Means Framework: Mathematical Perspectives

Sponsor: Military Applications

Sponsored Session

Chair: Paul Tanenbaum, Director, Army Research Laboratory, Survivability/Lethality Analysis Directorate, ATTN: AMSRD-ARL-SL, Aberdeen Proving Ground, MD, 21005, United States, paul.tanenbaum@us.army.mil

1 - A Mathematical Missions and Means Framework: Order-Theoretic Aspects
Jonathan Farley, Science Fellow, Center for International Security and Cooperation, Stanford University, 616 Serra Street, Stanford, CA, 94305, United States, lattice@stanford.edu

Order-theoretic aspects of the military missions and means framework are discussed.

2 - Reflexive Control in Groups
Vladimir Lefebvre, Researcher, Institute for Mathematical Behavioral Sciences, University of California, Irvine, 5100 Social Sciences Plaza, Irvine, CA, 92697, United States, valefebv@uci.edu

A theoretical model of group behavior is introduced in this paper. We assume that each agent possesses a system of self-reflexion: a set of images of the self which can have sets of images of the self, etc. The model allows us to predict the agent's state based on his system of self-reflexion and reflexive control over him conducted by other agents.

3 - Missions and Means via Formal Concept Analysis
Stefan Schmidt, CEO, Phoenix Mathematics, Inc., 4045 Tellbrook Road, Las Cruces, NM, 88011, United States, stefan@phoenixmath.com

In a domain of actions and communications, we investigate how constraints on capabilities influence the ability to achieve certain tasks. Our mathematical method of choice is Formal Concept Analysis: We interpret tasks as objects and capabilities as attributes; we then derive hidden dependencies between capabilities via the lattice of formal concepts. Finally, we extend our model using Reflexive Theory to demonstrate how wrongly perceived constraints may influence the decision making process.

4 - Closure Systems and State Spaces
Alex Pogel, mathematician, Physical Science Laboratory, New Mexico State University, Las Cruces, NM, 88003, United States, apogel@psl.nmsu.edu

In this talk we will discuss the use of a closure system (a mathematical structure corresponding to set systems closed under intersection) as data-driven state space formed from a two-dimensional description of a system. We will describe connections of closure systems to Formal Concept Analysis (Ganter, Wille, Wolff, et al), knowledge spaces (Falmagne, Doignon, et al), and MMF (Deitz, Sheehan, et al).

5 - Scenario Analysis: A Tool for Enhancing the Mission Means Framework
Philipp Djang, Army Research Laboratory, Survivability/Lethality Analysis Directorate, ATTN:: AMSRD-ARL-SL-EI, White Sands Missile Range, NM, 88002, United States, philipp.djang@us.army.mil

The goal of this project is to develop a hierarchical mathematical program for the Mission and Means Framework. Based on scenario analysis, we propose a optimization model whose purpose is to construct a force that is robust across several conflicts and theatres for a given time horizon and against multiple threats which may or may not undergo modernization/adaptation. The mathematical program will optimize force survivability.

■ SA23

Room 323

Business Applications II

Contributed Session

Chair: Jason Niggley, University of Southern California, Marshall School of Business, 400C Bridge Hall, Los Angeles, CA, 90089, United States, niggley@usc.edu

1 - A Study of Corporate Cultural Differences Between Russia and the United States
Arthur Rasher, Associate Professor of Management, Unniversity of Tulsa, 600 South College Avenue, Tulsa, OK, 74104, United States, arasher@utulsa.edu, Galina Sokolova

The study compares the results of two studies of employment experiences in Moscow, Russia in 2004 and the same corporation in Tulsa, Oklahoma, United States, in 2005-2006. The studies used a qualitative research method - an adaptation of the critical incident method developed by Flanagan (1954). A record of incidents (a number of specific observations of particular differences) within two offices of an international company were collected and analyzed.

2 - Applying Sequence Theory to Service Operations
Jason Niggley, University of Southern California, Marshall School of Business, 400C Bridge Hall, Los Angeles, CA, 90089, United States, niggley@usc.edu

Starting with a theory of memory, how are related events remembered depending on the sequence in which they occur? Based on these findings, an optimal design of service operations exists.

■ SA24

Room 324

Perspectives on the Journal

Sponsor: Organization Science

Sponsored Session

Chair: Linda Argote, Carnegie Mellon University, 5000 Forbes Avenue, Pittsburgh, PA, 15213, United States, argote@andrew.cmu.edu

1 - Perspectives on the Journal
Linda Argote, Carnegie Mellon University, 5000 Forbes Avenue, Pittsburgh, PA, 15213, United States, argote@andrew.cmu.edu

The session will focus on INFORMS journal, Organization Science's Current Status and Future Directions. The session will provide an overview of Organization Science, including its editorial team, the vision for the journal, objectives, and its operation. Statistics about review time and acceptance rates will be presented. Future directions including special issues will be described.

2 - Aiming for a Successful Experience
Richard Burton, Duke University, Fuqua School of Business, 1 Towerview Drive, Durham, NC, 27708, rmb2@mail.duke.edu

The session will discuss how to increase the likelihood of a successful experience when submitting a manuscript to Organization Science. Characteristics of manuscripts that editors and reviewers regard positively will be identified. Common shortcomings of manuscripts will be described. How to respond successfully to editor's and reviewers' comments will be discussed.

■ SA25

Room 325

Panel Discussion: OR Entrepreneurship #1

Cluster: OR Entrepreneurship

Invited Session

Chair: Bruce Golden, University of Maryland, R.H. Smith School of Business, College Park, MD, 20742, United States, bgolden@rhsmith.umd.edu

1 - Panel Discussion: OR Entrepreneurship
Moderator: Bruce Golden, University of Maryland, R.H. Smith School of Business, College Park, MD, 20742, United States, bgolden@rhsmith.umd.edu, Panelists: Jean-Marc Rousseau, Yossi Sheffi, Sridhar Tayur, Irv Lustig, Michael Hooban

Many members of INFORMS have worked in an entrepreneurial capacity. Some have started and/or grown companies on a full-time basis. Others (e.g., professors) have started companies on a part-time basis. The purpose of this

session is to tell some of the stories associated with these activities and to discuss common experiences, obstacles, and strategies.

■ SA26

Room 326

Data Mining Applications in HealthCare

Sponsor: Data Mining
Sponsored Session

Chair: Shital Shah, Assistant Professor, Rush University Medical Center, 1700 W. Van Buren Street, 126B, Chicago, IL, 60612, United States, Shital_C_Shah@rush.edu

1 - Facilitating Performance Improvement at Academic Medical Centers - There's Data Everywhere
Sam Hohmann, University HealthSystem Consortium, 2001 Spring Road, Suite 700, Oak Brook, IL, United States, hohmann@uhc.edu

The University HealthSystem Consortium is an association of academic medical centers that gathers clinical and operational data from its members. The data is used to facilitate members' performance improvement efforts. By integrating information, UHC has been able to combine various data sets to enhance AMCs' self understanding of their performance and propel them in their improvement of quality, safety, and productivity. Examples will be shared.

2 - Bayesian Networks for Employable Medical Expert Systems
Rich Neapolitan, Professor, Northeastern Illinois University, 5500 N. St. Louis, Chicago, IL, 60515, United States, profrichneo@yahoo.com

Medical expert systems date back to the 1970's when MYCIN was created. In the 1990's a number of Bayesian network-based medical expert systems were developed. However, virtually none of them are deployed. I review the Bayesian network and its use in medical expert systems. Then I discuss design considerations necessary if we want do create a system that can seamlessly be incorporated into medical practice. Finally, I present Promedas, which is a system designed according to these considerations.

3 - Relabeling Algorithm for Improving Prediction Quality
Shital Shah, Assistant Professor, Rush University Medical Center, 1700 W. Van Buren Street, 126B, Chicago, IL, 60612, United States, Shital_C_Shah@rush.edu, Andrew Kusiak

The relabeling algorithm (for retrieval of noisy instances with binary outcomes) iteratively retrieves, selects, and re-labels data instances to improve prediction quality. It emphasizes knowledge generalization and confidence rather than classification accuracy. The proposed approach was successfully tested on the standard benchmark Pima Indians Diabetes dataset as well as bladder cancer immunotherapy data.

■ SA27

Room 327

Maintenance for Dynamic Environments

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: Julie Simmons Ivy, Assistant Professor, University of Michigan, 701 Tappan Street, Ann Arbor, MI, 48109, United States, jsimmons@bus.umich.edu

1 - Integrated Decision Making on Reconfiguration and Condition-Based Maintenance (CBM)
Jing Zhou, Ph.D. Candidate, University of Michigan, 2350 Hayward Street, Ann Arbor, MI, 48105, United States, zhoujz@umich.edu, Julie Simmons Ivy, Dragan Djurdjanovic, Jun Ni

In a multi-unit load sharing system, the dynamic interactions between component deterioration, working load, and production yield necessitate an integrated decision making on reconfiguration and CBM. An integrated model for the joint optimization of the economic load allocation and the optimal maintenance level is developed and illustrated through a numerical example. The results demonstrate that the integrated decision policy outperforms the fragmented one in terms of reduced total cost.

2 - Dynamic Modeling of Maintenance Policies Using Stochastic Petri Nets with Aging Tokens
Vitali Volovoi, Senior Research Engineer, Georgia Institute of Technology, 270 Ferst Drive, Atlanta, GA, 30332-0150, United States, vitali.volovoi@ae.gatech.edu

The benefits of improving existing maintenance policies are vast, as are the associated challenges. Appropriate resource allocation is impossible without comprehensive system-level modeling of failure and repair. Dynamic interactions among factors affecting operations, degradation, and maintenance must be quantitatively accounted for. To this end, a framework based on Petri nets is introduced; it is capable of modelling imperfect inspection and maintenance, opportunistic repair, and logistics.

3 - Heuristics for Flexible Resource Allocation in a Serial Line with Reliability Considerations
Chen-hung Wu, Assistant Professor, National Tsing Hua University, Hsinchu, Taiwan, 101, Section 2 Kuang Fu Road, Hsinchu, TW, 30013, Taiwan, wuch@ie.nthu.edu.tw, Douglas Down, Mark Lewis

We consider the allocation of flexible resources in a serial line with server failures. In addition to dedicated servers at each station, the system is equipped with a fixed number of flexible servers that are available to be assigned to any station. We show in the two-station case that transition monotone optimal policies minimize average inventory holding costs. We discuss heuristics based on the two-server model that reduce average holding costs significantly.

4 - A Predictive Maintenance Policy Based on Two Explicative Variables
Estelle Deloux, Ph.D. Student, Ecole des Mines de Nantes/IRCCyN, Rue Alfred Kastler, Nantes, 44307, France, estelle.deloux@emn.fr, Christophe Berenguer, B. Castanier

We are interested in the modelling and the evaluation of a maintenance policy for a single-unit system with a single failure mode function of several measurable quantities. The failure mode can be partially explained by two variables stochastically increasing with time. The probability of failure is assumed to increase with these variables. Different maintenance policies will be discussed in regard with their performance when the associated decision parameters minimize a given cost criterion.

■ SA28

Room 328

Multiscale Wavelets Analysis and Applications

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: Judy Jin, Associate Professor, Department of Industrial and Operations Engineering, University of Michigan, IOE 2855, Ann Arbor, MI, 48109, United States, jhjin@umich.edu

1 - Multiscale Methodology and Detectability
Xiaoming Huo, Assistant Professor, xiaoming@isye.gatech.edu

Multiscale methodology leads to powerful processing tools, such as wavelets. It has been proven to be effective in determining boundaries in some detectability problems, which is a fundamental problem in detection and ubiquitous in engineering. The existing results give the asymptotic rate of the boundaries. More precise distributional results can be derived, and they reveal more accurate properties of statistics that are used. Some recent results and applications will be discussed.

2 - Wavelet Features from Wireless Vibration Sensor Array for Container Integrity Monitoring
Satish Bukkapatnam, Associate Professor, School of Industrial Engineering & Management, Oklahoma State University, 322 EN, Stillwater, OK, 74078, United States, bsatish@okstate.edu

Of late, security and integrity of transportation container has assumed significant importance. Hurst exponents computed from wavelet analysis of vibration signals are found to capture the underlying burst patterns. The various integrity measures of a container, such as stability of the contents, terrain characteristics and transportation speed are estimated through the use of Hurst exponent and entropy features extracted through wavelet analysis of vibration signals.

3 - A Methodology for Classification and Detection of Helicopter Bearing Faults
David He, Associate Professor, University of Illinois at Chicago, davidhe@uic.edu

In this talk, the development of a general methodology using wavelet analysis integrated with data mining approaches for classification and detection of helicopter swashplate bearing faults will be reported. A successful application of the developed methodology to recent seeded fault tests for US Army CH-47D and MH-47E swashplate bearings will be discussed.

4 - Multiscale Feature Extraction for Embedded Operation Monitoring and Diagnosis
Judy Jin, Associate Professor, Department of Industrial and Operations Engineering, University of Michigan, IOE 2855, Ann Arbor, MI, 48109, United States, jhjin@umich.edu, Gabrielle Tremblay, Yu Zhou

For a complex system consisting of multiple embedded operations, it is challenging to monitor and diagnose individual operation conditions based on the system sensing signals. This research will present a systematic way how to use multiscale wavelets analysis to maximize the diagnosability of extracted features for individual operations in both time and frequency domains.

■ SA29

Room 329

Resource Allocation and Facility Location in Healthcare

Cluster: Joint Cluster Healthcare/ HAS: Healthcare Engineering
Invited Session

Chair: Julie Swann, Assistant Professor, Georgia Institute of Technology, Industrial and Systems Engineering, Atlanta, GA, 30332, United States, julie.swann@isye.gatech.edu

Co-Chair: Christina Scherrer, Assistant Professor, Southern Polytechnic State University, 1100 S. Marietta Parkway, Atlanta, GA, 30060, United States, cscherre@spsu.edu

1 - Emergency Response Planning

Eva Lee, Associate Professor, School of Industrial and Systems Engineering, Georgia Institute of Technology, Atlanta, GA, 30332, evakylee@isye.gatech.edu, Yang Zhang

We describe our work with state emergency response departments on facility location and planning for natural disasters, infectious disease outbreaks, and bioterrorism attacks. Optimization models and large-scale simulation will be described, and an actual field exercise related to an Anthrax drill will be reported.

2 - Network-Based Facility Location for Community Health Centers

Christina Scherrer, Assistant Professor, Southern Polytechnic State University, 1100 S. Marietta Parkway, Atlanta, GA, 30060, United States, cscherre@spsu.edu, Paul Griffin, Julie Swann

We determine the best location and medical service offerings for Community Health Centers (CHCs) using a network-based facility location approach. We expand upon an earlier model to consider weighted disease objectives and compare locations chosen by our model to existing locations based on several public health measures. We also use the model to analyze different healthcare access and coverage policy mechanisms for cost and effectiveness.

3 - The Davao City Health System: An Approach to Optimally Locating Community Health Facilities

Michael Johnson, Extern, Carnegie Mellon University, Center for Economic Development, 5000 Forbes Avenue, Pittsburgh, PA, 15213-3890, United States, johnson2@andrew.cmu.edu, Myra Esmeralda Silva

Davao City, Philippines operates a two-tiered health system in which a large network of community-based health centers feeds into a much smaller network of regional hospitals. There is evidence of substantial inequities and gaps in service coverage. We develop an alternative two-tier system, in which a lower tier of inexpensive health outpostsis links to a smaller number of health centers. We present computational results for this hierarchical facility location problem and policy implications.

4 - Supply Chain Coordination and Influenza Vaccination (Submitted for the 2006 Pierskalla Award)

Hamed Mamani, PhD Student, Massachusetts Institute of Technology, 77 Massachusetts Avenue, Building E40-130, Cambridge, MA, 02139, United States, hamed@mit.edu, David Simchi-Levi, Stephen Chick

Billions of dollars are being allocated for influenza pandemic preparedness. Vaccination is a primary weapon for fighting influenza outbreaks. Differences that distinguish the influenza vaccine supply chain from the typical supply chains include a nonlinear value of sales and vaccine production yield issues. We show that production risks, taken by the manufacturer, lead to an insufficient supply of vaccine and design a variant of the cost sharing contract that can coordinate the supply chain.

■ SA30

Room 330

Contemporary Operational and Strategic Issues in Hospitals

Sponsor: Health Applications Section
Sponsored Session

Chair: Yasar A. Ozcanm , Virginia Commonwealth University, PO Box 980203, 1008 E. Clay Street, Richmond, VA, 23298-0203, ozcan@vcu.edu

1 - Developing Fair and Feasible Schedules for Residents On-Call

Sarah Root, University of Michigan, 1205 Beal Avenue, Ann Arbor, MI, United States, seroot@umich.edu, Amy Cohn

Scheduling medical resident call shifts is challenging because of the many complex, competing feasibility rules to be satisfied. Furthermore, finding a feasible schedule is not enough, because it may be very imbalanced across residents. We present a scheduling approach that incorporates both feasibility and "fairness" and show real-world computational results.

2 - The Effect of Electronic Medical Records on Hospital Performance

Abby Swanson, Assistant Professor, Department of Health Administration & Policy, Medical University of South Carolina, 151 Rutledge Ave., Building B, PO Box 250961, Charleston, SC, 29425, swansonaj@vcu.edu, Yasar A. Ozcan

This study examines the prevalence and performance of Electronic Medical Records (EMRs) in acute care hospitals. Using logistic regression, organizational and environmental factors associated with hospital EMR use are identified. Data Envelopment Analysis and post hoc evaluations performed for comparison of hospitals with and without EMRs in efficiency and quality.

3 - Deciding What Time Patients Should be Ready on the Day of Surgery without Procedure-Specific Data

Ruth E. Wachtel, Associate Professor, Department of Anesthesia, University of Iowa, Iowa City, IA, 52242, ruth-wachtel@uiowa.edu, Franklin Dexter

No hospital has reported successfully implementing consensus guidelines for reduced NPO times. A patient can drink to 12 noon for surgery at 2 PM. Yet, 2 PM is the actual start time, not scheduled. For one preceding case, the start time of the next case follows a 3-parameter log normal distribution centered at the scheduled duration of the preceding case. Multiple previous cases are treated as one virtual case. Nurses access www.CaseDuration.com for distribution-free 0.05 prediction bounds.

4 - Hospital Pediatric Specialization: Implications for the Delivery of Patient Care

Mitch Harris, Ph.D. Candidate, NACHRI, 401 Wythe Street, Alexandria, VA, 22314, MHarris@nachri.org, Yasar A. Ozcan

Policy makers, payors and patients have shown increased interest in the concept of hospital specialization and its implications on effectiveness and quality of care. We present a model with levels of care complexity and hospital specialization that must be in fit for outcomes to be maximized.

■ SA31

Room 331

Financial Engineering

Cluster: Financial Engineering and Risk Management
Invited Session

Chair: Kay Giesecke, Assistant Professor, Management Science & Engineering, Stanford University, Stanford, CA, 94305, United States, giesecke@stanford.edu

1 - Connections Between Singular Control and Optimal Switching

Pascal Tomecek, PhD Student, School of OR&IE, 294 Rhodes Hall, Cornell University, Ithaca, NY, 14853, United States, pit3@cornell.edu, Xin Guo

We explore new connections between finite variation singular control and sequential optimal stopping problems. We apply our results, along with the standard probabilistic approach to singular control, to extend the theory of reversible investment. We give sufficient conditions on the existence of an optimal solution and on the regularity of the value function. Application areas include energy and credit risk management, and markets with friction.

2 - Portfolio Choice Under Model Uncertainty

Stefan Weber, Assistant Professor, School of OR&IE, Cornell University, 279 Rhodes Hall, Ithaca, NY, 14853, United States, sweber@orie.cornell.edu

We consider the problem of utility maximization under model uncertainty in the presence of both cost and risk constraints. Downside risk is measured by utility-based shortfall risk. We assume that investors take a worst case approach. By means of its dual problem, the optimization problem can explicitly be solved.

3 - Cross Market Calibration of Credit Spreads

Rajnish Kamat, Vice President, MSCI Barra, 2100 Milvia Street, Berkeley, CA, 94704, United States, Rajnish.Kamat@fea.com, Lisa Goldberg, Vijay Poduri

We use Credit Default Swap spread data along with equity market and balance sheet information to build a next generation structural model. The model uses an incomplete information framework and provides greater flexibility in calibration compared to the Merton model. Applications include rich-cheap analysis of credits, credit portfolio monitoring, pricing less liquid names, and deriving exposures to market variables for hedging.

■ SA32

Room 332

Best Financial Services Student Paper Competition

Sponsor: Financial Services

Sponsored Session

Chair: Suresh Nair, University of Connecticut, Storrs, CT, 06268, suresh.nair@business.uconn.edu

1 - Credit Spreads, Optimal Capital Structure, and Implied Volatility
Nan Chen, Assistant Professor, The Chinese University of Hong Kong, Room 709A, William M. W. Mong Engineering Building, Shatin, N. T., Hong Kong, nc2005@columbia.edu

We propose a two-sided jump model for credit risk by extending the Leland-Toft endogenous default model based on the geometric Brownian motion. The model shows that jump risk and endogenous default can have significant impacts on credit spreads, optimal capital structure, and implied volatility of equity options. Pricing formulae of credit default swaps and equity default swaps are also given.

2 - Discrete-Time Optimization of Consumption and Investment Decisions
Amit Bhandari, PhD Candidate, Industrial Engineering & Management Sciences, Northwestern University, 2145 N. Sheridan Road, Evanston, IL, 60208, United States, amitb@northwestern.edu

We extend Samuelson's (1969) discrete-time dynamic consumption and investment optimization problem to the case where the investor is intolerant of any decline in her standard of living. This is interpreted as a constraint that the consumption rate is non-decreasing over time. The investor first guarantees a consumption perpetuity at the current consumption rate and then allocates the remaining wealth under a state-dependent, adjusted coefficient of relative risk aversion.

3 - Pricing and Hedging of Volatility Derivatives
Ashish Jain, Columbia Business School, 3022 Broadway Uris Hall, New York, NY, 10027, United States, aj2109@columbia.edu

We propose a methodology to price and hedge volatility derivatives. We derive a no arbitrage relationship between variance swaps and other volatility derivatives. Using this argument, we derive a partial differential equation to price volatility swaps and variance options in the Heston stochastic volatility model and compute the volatility and variance strikes using numerical transform inversion techniques and simulation.

■ SA33

Room 333

Modeling the National Airspace System (NAS)

Sponsor: Aviation Applications

Sponsored Session

Chair: John Gulding, Senior Strategist, Federal Aviation Administration, 800 Independence Avenue SW, Washington, DC, 20591, United States, john.gulding@faa.gov

1 - Benefit Estimation in Presence of Demand Uncertainty
Dipasis Bhadra, Principal Economist, MITRE/CAASD, 7515 Colshire Avenue, McLean, VA, 22102, United States, dbhadra@mitre.org, Dave Knorr

Estimation of future benefits from federal programs designed to improve air transportation infrastructure using deterministic or point forecasts could be misleading in presence of uncertainty. Uncertainty rooted in airlines decisions, for example, make the forecasts at the airports very difficult, especially in the short run. We offer a framework where demand uncertainties can be incorporated in benefit estimation. We illustrate this framework by using an FAA investment program.

2 - A Characterization of Days of the Week in the National Airspace System
Brendan Hogan, Sr. Simulation Modeling Engineer, MITRE/CAASD & University of Virginia, 7515 Colshire Avenue, McLean, VA, 22102, United States, bhogan@mitre.org

The NAS consists of complex interactions between aircraft operators and the ATC system handling the flights. To gain insight into these patterns of activity with respect to day of the week, we use principal component analysis to demonstrate similarities between individual days. This information is helpful in selecting representative traffic days for the purpose of simulation or other analyses. In addition this technique can be extended to show trends over time and across user groups.

3 - Many Fields of Battle: How Cost Structures Affect Competition Across Multiple Markets
Li Zou, Ph. D. Candidate, University of Maryland, Robert H. Smith School of Business, College Park, MD, United States, lzou@rhsmith.umd.edu, Martin Dresner, Robert J. Windle

Traditional analysis of multipoint competition suggests that firms compete less intensely with one another when they have strategic contacts across multiple markets (the mutual forbearance effect). However, this argument does not account for the moderating role that production cost plays in these market relationships. This article examines the collusion-enhancing effects of multimarket contact and its effect on competition by using a model verified through data from the U.S. airline industry.

4 - Resource Allocation to a Portfolio of Modernization Technologies for the National Airspace System
Senay Solak, School of Industrial and Systems Engineering, Georgia Institute of Technology, 765 Ferst Drive, Atlanta, GA, 30332, United States, ssolak@isye.gatech.edu, Paul Collopy, Ellis Johnson, John-Paul Clarke

We develop common performance assessment measures and analyze correlation levels for a portfolio of National Airspace System modernization technologies. We then propose a portfolio optimization model to determine the optimal allocation of available resources to the technologies in consideration. In addition, the computational difficulty of the proposed model is analyzed, and appropriate solution methods are described.

■ SA34

Room 334

Games of Cooperation and Competition in Transportation

Sponsor: Transportation Science & Logistics

Sponsored Session

Chair: Richa Agarwal, PhD Candidate, School of Industrial and Systems Engineering, Georgia Institute of Technology, ragarwal@isye.gatech.edu

1 - Mechanism Design for Sustainable Alliances Among Sea Carriers
Richa Agarwal, PhD Candidate, School of Industrial and Systems Engineering, Georgia Institute of Technology, ragarwal@isye.gatech.edu, Özlem Ergun

In transportation industry, alliances among carriers are an important factor in staying competitive. Though working in close liaisons, carriers are governed by their own self-interests. We present membership mechanisms, by adopting a rationality based approach using notions from game theory and inverse optimization, to allocate resources and benefits among carriers for forming sustainable alliances.

2 - Network Games with Atomic Players
Jose Correa, Assistant Professor, Universidad Adolfo Ibáñez, Av. Presidente Errazuriz 3485, Las Condes, Santiago, Chile, correa@uai.cl, Roberto Cominetti, Nicolas Stier-Moses

We study network and congestion games with atomic players that can split their flow. As there can be players controlling a significant fraction of the flow, these games readily applies to competition among freight companies and telecommunication network service providers. We analyze the worst-case inefficiency of Nash equilibria and conclude although self-interested competitors will not in general achieve a fully efficient solution, the loss is not too severe.

3 - The Impact of Pricing and Buy-Back Menus on Supply Chain Performance
Pranava Goundan, Doctoral Candidate, Operations Research Center, MIT, 77 Massachusetts Avenue, Building E40-149, Cambridge, MA, 02139, United States, pranava@mit.edu, Ann Chan, David Simchi-Levi

We study the impact of a Buy-back Menu contract in a single-supplier, multi-retailer supply chain facing linear additive demand, that makes both pricing and inventory decisions. We compare two systems: competing and coordinating retailers, and show that using the proposed contract in both systems, the supplier may improve the performance of the supply chain to at least 75%, while still being guaranteed at least 50% of the optimal global supply chain profit.

■ SA35

Room 335

Theoretical and Practical Applications of Integrating Demand and Network Models

Sponsor: Transportation Science & Logistics

Sponsored Session

Chair: Laurie Garrow, Assistant Professor, School of Civil and Environmental Engineering, Georgia Institute of Technology, 790 Atlantic Drive, NW, Atlanta, GA, 30332, United States, laurie.garrow@ce.gatech.edu

1 - Theoretical and Practical Aspects of Modeling Network Equilibrium with Road Pricing

Peter Vovsha, Principal, PB Consult, 5 Penn Plaza, 19th Floor, New York, NY, 10001, United States, Vovsha@pbworld.com

The current paper is intended to systematically analyze possible operational approaches to a more consistent and theoretically sound modeling of road pricing. It starts with a formulation of a "seed" equilibrium model, discuss some basic aspects and pitfalls associated with practical implementation of this model, and then gradually adds features and discuss possible enhancements.

2 - Integrated Activity-Based Modeling and Dynamic Traffic Micro-Assignment Simulator

Travis Waller, University of Texas at Austin, 1 University Station C1761, Austin, TX, United States, S.Travis.Waller@engr.utexas.edu, Chandra Bhat

This talk will discuss research related to an integrated Activity-Based/DTA model (CEMDAP and VISTA). Given the disaggregate data on socio-demographics, activity-travel environment and prescribed policy actions for the base year, CEMDAP generates detailed activity-travel patterns for each individual in a population which serve as inputs for the integrated DTA model. Technical, computational, and practical issues involved in this demand-supply integration problem will be discussed.

3 - Dulles Metrorail - Congestion Mitigation Plan Microsimulation

John Duesing, Senior Associate, Cambridge Systematics, 405 Lexington Avenue, 26th Floor, New York, NY, 10174, United States, jduesing@camsys.com

Cambridge Systematics, as the developer of the Tyson's Corner Travel Demand Model for the County of Fairfax, developed a methodology for assessing the diversions and re-routing that will result from the construction of the Metrorail Orange line. We proposed integration of the Tyson's Corner demand model with a VISSIM traffic microsimulation model of the study area to adequately evaluate the traffic impacts in the corridor. This integration will allow for modal shifts, time period shifts, as well as route shifts that will occur due to construction impacts.

■ SA36

Room 336

Dynamic Problems in Rail and Road Transportation

Sponsor: Transportation Science & Logistics

Sponsored Session

Chair: Huseyin Topaloglu, Assistant Professor, Cornell University, 223 Rhodes Hall, Ithaca, NY, 14853, United States, huseyin@orie.cornell.edu

1 - Dynamic Empty Car Management in Railyards

Tolga Bektas, Postdoctoral Research Fellow, Universite de Montreal, Centre de Recherche sur les Transports, CP 6128, Succursale Centre-Ville, Montreal, Quebec, H3C 3J7, Canada, tolga@crt.umontreal.ca, Teodor Gabriel Crainic

This paper is concerned with accelerating the flow of empty cars in a major classification railyard in North America. Due to fluctations in inbound traffic, empty cars experience long delays at the yard. Such delays can be prevented by dynamic car reassignments. We describe a procedure using a sliding time window in order to reduce the time that empty cars spend in the yard and present the associated computational results.

2 - Dynamic Simulation Assignment Model for Intermodal Multi-Product Freight Transportation

Hani Mahmassani, University of Maryland, 3128 J. H. Kim Building, College Park, MD, 20742, United States, masmah@umd.edu, Kuilin Zhang, Jing Dong, Chung-Cheng Lu

A simulation-assignment model with joint mode and route choice is developed for multi-product freight shipments. Terminal operations are modeled as bulk queueing systems. Intermodal route choice is addressed by solving a multi-product intermodal shortest path problem. The model is applied to a trans-European corridor linking the Nordic countries to Southeastern Europe.

3 - Greedy Rules vs. Real-Time Complete Reoptimization Strategies for the Online Inventory Routing

Hani Mahmassani, University of Maryland, 3128 J. H. Kim Building, College Park, MD, 20742, United States, masmah@umd.edu, Ricardo Giesen, Patrick Jaillet

We study strategies for the online inventory routing problem (OIRP) under real-time information. We propose a greedy heuristic and a mixed-integer programming (MIP) formulation for the off-line version and introduce different rolling horizon strategies for the OIRP. We examine potential benefits of updating plans based on real-time information.

■ SA37

Room 337

Economics of Information Systems

Sponsor: Information Systems Society

Sponsored Session

Chair: Indranil Bardhan, Assistant Professor, The University of Texas at Dallas, School of Management, SM 41, 2601 N. Floyd Road, Richardson, TX, 75083-0688, United States, bardhan@utdallas.edu

1 - Testing a Theory of Network-Based Knowledge Spillovers in the Agglomeration of Technology Industries

Ajay Kumar, Doctoral Student, The University of Minnesota, Carlson School of Management, Minneapolis, 55455, United States, akumar2@csom.umn.edu, Robert Kauffman

We analyze the impacts of IT on the agglomeration of technology industries based on the multiple theoretical perspectives. We show that increasing use of IT diminishes the impetus of both market size linkages and congestion. It also leads to new IT industry agglomerations around thick labor markets. Agglomerated industries benefit from localized and network-based knowledge spillovers. The net impact of these effects leads to greater IT industry agglomeration.

2 - A Case-Based Model of Intellectual Property Reuse

Barrie R. Nault, Professor and Chair, University of Calgary, Haskayne School of Business, Calgary, AB, T2N 1N4, Canada, nault@ucalgary.ca, John D. Mitchell, Victoria L. Mitchell

Based on cases from the semiconductor industry, we build a model of intellectual property (e.g., software) reuse. We consider designer skills, a reuse repository, and the role of quality standards and incentives. Our results highlight a tradeoff between quality standards motivating reuse while reducing incentives for building new repository contributions.

3 - Information Technology and Firm Efficiency: A Non-Parametric Analysis

Indranil Bardhan, Assistant Professor, The University of Texas at Dallas, School of Management, SM 41, 2601 N. Floyd Road, Richardson, TX, 75083-0688, United States, bardhan@utdallas.edu, Shu Lin, Sunil Mithas

We apply data envelopment analyses to study the impact of information technology investments across a large sample of global firms from 1998 to 2004. Using panel data on IT spending, we explore the impact of IT on firm efficiency and study trends in firm efficiencies over time.

■ SA38

Room 338

RASIG Student Paper Session: Top 3

Sponsor: Railroad Applications

Sponsored Session

Chair: Pooja Dewan, BNSF Railway, Fort Worth, TX, United States, Pooja.Dewan@bnsf.com

1 - RASIG Student Paper Competition

RASIG (Rail Applications Special Interest Section), a subdivision of INFORMS (Institute for Operations Research and Management Science) sponsored a student research paper contest on Management Science in Railroad Applications. Authors of First Place, Second Place, and Honorable Mention papers will be asked to present at this session.

2 - First Place Winner: Spatial Scheduling and Resource Selection Problem: Modeling, Algorithm, and Application in the Production Gang Scheduling for Railway Maintenance Operations

Gang Li, PhD Student, The University of Texas at Austin, McCombs School of Business, 1 University Station B6000, Austin TX 78712, United States, gang.li@mail.utexas.edu

Given a set of geographically-dispersed jobs with time windows and inter-job coordination requirements, we address the problem of assigning and routing resources to jobs and sequencing the jobs to minimize the total cost for deploying and re-positioning resources. We formulate this combined routing-scheduling problem as a large-scale integer program, develop valid inequalities to strengthen the model, and report its successful application in the production gang schedul-

ing problem for a major railway company in North America. The model has been helping the company to save millions of dollars each year and significantly improve the quality of the company's maintenance operations.

3 - Second Place: Modeling Reordering and Local Rerouting Strategies to Solve Train Conflicts During Rail Operations

Andrea D'Ariano, Delft University of Technology, Faculty of Civil Engineering and Geosciences Transport and Planning Department, Stevinweg 1, 2628 CN Delft, Netherlands, a.dariano@tudelft.nl

A decision support system is presented to manage real-time timetable perturbations and blocked tracks. A mathematical model is adopted to solve train conflicts through reordering and local rerouting (dynamic use of platform tracks and alternative corridors). Rolling stock and passenger connections are also formulated. An iterative reordering and rerouting algorithm is developed to increase the punctuality. Experiments on a Dutch railway network show that the algorithm improves the solutions provided by practical dispatching rules.

4 - Honorable Mention: Solving Real Life Locomotive and Fuel Service Problems

Balachandran Vaidyanathan, University of Florida, 303 Weil Hall, Gainesville FL 32611, United States, vbala@ufl.edu

We study the problem of generating fuel and service feasible routing of locomotives starting from a base fleet assignment plan which satisfies several operational and contractual constraints. Fueling feasibility requires that every locomotive visits a service location at least once for every 1800 miles of travel. A locomotive fleet assignment plan which does not take the fueling and servicing requirements into consideration cannot be implemented and has limited value. Solving this problem is therefore of great value to US Railroads.

■ SA39

Ballroom B

Where Do We Want to Go in Practice?

Cluster: Where Do We Want to Go?

(In observance of Arthur Geoffrion's retirement)

Invited Session

Chair: Dwight Collins, dwight.collins@verizon.net

Co-Chair: Roundtable Strategic, Planning Committee, INFORMS, 7240 Parkway Drive, Suite 310, Hanover, MD, 21076-131, United States, RNuggehalli@ups.com

1 - Where Do We Want to Go in Practice?

Roundtable Strategic, Planning Committee, INFORMS, 7240 Parkway Drive, Suite 310, Hanover, MD, 21076-131, United States, RNuggehalli@ups.com

The evolving global economy, developments in technology, and changing managerial practices provide the OR/MS profession with new opportunities and challenges. OR/MS must change along with the world. In this session, the Roundtable examines pertinent developments, identifies and prioritizes candidate strategic goals for OR/MS professionals, and presents its plans and suggestions for making progress in those directions.

■ SA40

Room 401

Location Analysis: Models, Algorithms and Applications

Sponsor: Location Analysis

Sponsored Session

Chair: Jiamin Wang Assistant Professor, Long Island University, Roth Hall 202, 720 Northern Boulevard, Brookville, NY, 11548, United States, Jiamin.Wang@liu.edu

1 - Integrated Location, Routing and Scheduling Problems: Models and Algorithms

Zeliha Akca, PhD Candidate, Lehigh University, Industrial and Systems Engineering, Bethlehem, PA, 18015, United States, zea2@lehigh.edu, Rosemary Berger

We study the problem of determining the locations of capacitated facilities within a distribution network; deliveries are made along multiple stop routes and multiple routes may be assigned to the vehicles, which have capacity and time restrictions. We develop a set-partitioning-based formulation and identify valid inequalities. We develop a branch-and-price algorithm to solve instances of the problem and present computational results.

2 - Locating Cell Phone Towers in a Rural Environment

H. A. Eiselt, University of New Brunswick, Fredricton, NB, Canada, haeiselt@unb.ca, Vladimir Marianov

The presentation investigates the location of cell phone towers in a district in Nepal. In addition to provide widespread coverage, planners must also guard against losses due to insurgents. Our objective is a combination of average survival and worst-case survival of towers in case one of the towers is destroyed.

3 - Service Disciplines in Location Set Covering Problems with Stochastic Demands and Congestion

Seokjin Kim, Assistant Professor, Department of Business Administration, Millersville University, PO Box 1002, Millersville, PA, 17551-0302, United States, skim@millersville.edu, Oded Berman, Dmitry Krass

We consider the problem of minimizing the number of servers to be located on a network and achieving the service level at each node at least a required level. Markovian demands originate and infinite capacity queues are positioned at each node. Servers can be stationed at nodes and serve calls within a pre-specified service radius. We investigate the effect of dynamic and static disciplines, and further develop location models for emergency medical services with two call classes.

4 - The Probabilistic 1-Maximal Covering Problem on a Network with Discrete Demand Weights

Jiamin Wang, Assistant Professor, Long Island University, Roth Hall 202, 720 Northern Boulevard, Brookville, NY, 11548, United States, Jiamin.Wang@liu.edu, Oded Berman

We investigate locating a facility on a network with uncertain demand generated from the nodes. It is assumed that demand weights are independent discrete random variables. The objective is to maximize the probability that the total demand within a given distance of the facility reaches at least a pre-selected threshold level. It is shown that the problem is NP-hard and that an optimal solution exists in a finite set of dominant points. Solution procedures are developed to solve the problem.

■ SA41

Room 402

Queueing Methods and Applications

Sponsor: Applied Probability

Sponsored Session

Chair: Victor Araman, Assistant Professor, New York University, Henry Kaufman Management Center, 44 West 4th Street, New York, NY, 10012, United States, varaman@stern.nyu.edu

1 - SRPT Scheduling and Large Deviations

Bert Zwart, Associate Professor, H. Milton Stewart School of Industrial and Systems Engineering, Georgia Institute of Technology, 765 Ferst Drive, Atlanta, GA, 30332, United States, bertzwart@gatech.edu

In recent years, the SRPT discipline has become highly relevant as potential scheduling discipline in, for example, web servers. Motivated by this, we consider the GI/GI/1 queue, and investigate the probability that a large sojourn time occurs under the SRPT discipline. We show that SRPT outperforms FIFO for heavy-tailed service times and that the reverse is the case for light-tailed service times. The results provide qualitative insights into the way large sojourn times occur.

2 - Dynamic Control of a Make-to-Order, Parallel-Server System with Cancellations

Baris Ata, Assistant Professor, Kellogg School of Management, Northwestern University, 2001 Sheridan Road, Evanston, IL, 60208, United States, b-ata@kellogg.northwestern.edu, Melanie Rubino

Motivated by make-to-order production systems, we consider a dynamic control problem for a multiclass, parallel-server queueing system. The production system serves multiple classes of customers who require rigid due-date lead times and may cancel their order subject to a cancellation penalty. Under heavy traffic conditions, an approximately optimal non-greedy outsourcing and resource allocation policy is derived.

3 - Importance Sampling for Credit Risk Models

Achal Bassamboo, a-bassamboo@northwestern.edu, Sachin Jain

In recent times, credit markets have grown and research has been focused on modeling of default events for multi-firms. Most of these models rely on simulation for the pricing of derivatives. We consider one such class of models; specifically the intensity driven doubly stochastic processes and propose an asymptotically optimal change of measure for efficient simulation. We apply our result to specific models and support our theory with numerical simulations.

4 - Stein's Method for Some Stochastic Equations

Jose Blanchet, Assistant Professor, Harvard University, Statistics Department, 1 Oxford Street, Cambridge, MA, 02138, United States, blanchet@fas.harvard.edu

In 1972, Stein introduced a powerful method for approximating expectations via two ingredients: 1) An operator that characterizes the approximating distribution and 2) A coupling among random elements of interest. We will explain Stein's method and develop approximations for solutions of some important stochastic equations. Our examples include ARCH models (widely used in finance) and geometric sums, which arise in the study of the M/G/1 queue, the classical risk model and reliability models.

■ SA42

Room 403

Logistics Scheduling

Cluster: Scheduling

Invited Session

Chair: Chung-Yee Lee, Head & Chair Professor, Hong Kong University of Science & Technology, Clear Water Bay Road, Kowloon, Hong Kong, China, cylee@ust.hk

1 - A Nash Bargaining Solution for Partition of Jobs Between Two Manufacturers

Xiaoqiang Cai, Professor, Department of Systems Engineering and Engineering Management, The Chinese University of Hong Kong, Shatin, N.T., Hong Kong, xqcai@se.cuhk.edu.hk, Quanle Chen

Two manufacturers negotiate to partition a set of jobs that they have jointly obtained. Each manufacturer has his own processing capacity and setting, and thus has to look for the best schedule for his processing given any subset of jobs that he may get. We develop an algorithm, and show that it can derive the best solution to partition the jobs in a mutually acceptable and beneficial manner.

2 - Non-Cooperative Outsourcing Games

Tolga Aydinliyim, Case Western Reserve University, Weatherhead School of Management, 11119 Bellflower Road, Cleveland, OH, 44106, United States, tolga.aydinliyim@case.edu, George Vairaktarakis

We present a non-cooperative outsourcing model where each manufacturer processes part of his jobs on a dedicated in-house machine and sends his remaining jobs to a third-party. The third-party has a flexible machine which can process jobs from all manufacturers. Each manufacturer's strategy is determined as the set of jobs to be processed on the flexible machine. The Nash Equilibrium schedule and the centralized schedule do not necessarily coincide, so savings due to coordination are possible. We present structural properties, algorithms and coordination results.

3 - Single Machine Scheduling Under Potential Disruption

Chung-Yee Lee, Head & Chair Professor, Hong Kong University of Science & Technology, Clear Water Bay Road, Kowloon, Hong Kong, China, cylee@ust.hk, Gang Yu

In this paper, we study a new scheduling problem in which there is a possibility that a disruption will occur at a particular time and if it happens the machine (facility) will become unavailable for certain duration with a certain probability. We study two objective functions: the expected total weighted completion times and the expected maximum tardiness. (This research is supported in part by Hong Kong RGC grant HKUST 6145/03E.)

4 - Competitive Agent Scheduling and Its Applications

Michael Pinedo, New York University, IOMS Department, 44 West 4th Street, New York, NY, 10012, United States, mpinedo@stern.nyu.edu, Joseph Y. Leung

Two agents have to schedule two sets of jobs on a single resource. The two agents have different constraints and objectives. We consider the problem of minimizing the value of the objective function of agent A, while keeping the value of the objective of agent B less than or equal to a fixed value Q.

■ SA43

Room 404

What Would Not Have Been Possible Without the Work of Thomas L. Saaty

Cluster: Analytic Hierarchy Process

Invited Session

Chair: Iwan Azi, Professor, Johnson Graduate School of Management, Cornell University, 215 W. Sibley, Ithaca, NY, United States, ija1@cornell.edu

1 - On Validating the Analytic Hierarchy/Network Processes

Rozann Saaty, Creative Decisions Foundation, Pittsburgh, PA, United States, rozann@rwspublications.com

An essential fact regarding the truth of a theory is its validation in practice. One validates with: (1) A pairwise comparison matrix, (2) A hierarchy, (3) A network (both simple with market share and with benefits, opportunities, costs and risks. A compatibility index is used to compare the derived results with data.

2 - Advanced Decision Technologies

Daniel Saaty, President, Decision Lens, Inc., 282 N. Washington Street, Falls Church, VA, 22046, United States, dsaaty@decisionlens.com

Although AHP/ANP have been in existence for many years, there continues to be a lack of simple and elegant decision support software applications available to business users. Here we give a presentation on the latest in Decision Support software applications employing AHP/ANP and Linear Optimization to support government and commercial trade-off and resource allocation decisions. The software is shown in real business example for resource allocation in group decision making at DOD.

3 - When Should the Majority of Remaining US Combat Troops Withdraw from Iraq?

Tori Hinde, KGSB/University of Pittsburgh, Mervis Hall, Pittsburgh, PA, United States, tjhinde@katz.pitt.edu

The goal of this project was to determine the optimal US troop withdrawal strategy. The synthesized results of the entire ANP model which took into account the weighting factors of the strategic rating model indicate that the highest rated alternative for the short run is to withdraw major US combat troops in 2-5 years. The long run results, and those that should be used, indicate that the alternative with the best results for all participants is to redeploy the US troops within the region.

4 - A Complex Process of Forming a Regional Financial Arrangement (RFA)

Iwan Azis, Professor, Johnson Graduate School of Management, Cornell University, 215 W. Sibley, Ithaca, NY, United States, ija1@cornell.edu

In East Asia, the most decisive event that created interest for a closer regional cooperation was the 1997/98 financial crisis. Ineffective policy responses to a crisis, slow progress of WTO, growing risks of global imbalance, and strong interest among business sectors to access foreign markets and capital, are among the important reasons for such proliferations. The preferred form of cooperation developed using the ANP suggests that RFA w/o a common currency basket is most suitable.

■ SA44

Room 405

Applied Probability I

Contributed Session

Chair: Ivan Guardiola, Department of Industrial Engineering, Texas Tech University, Box 43061, Lubbock, TX, 79409, United States, ivan.guardiola@ttu.edu

1 - Stationary Work-Load of G/M/1 Queueing System with a Hysterestic Service Policy

Sunggon Kim, Department of Information and Statistics, Gyeongsang National University, Jinju, South Korea, sgkim@gsnu.ac.kr, Jongho Bae

We consider a queueing system with general inter-arrival times and exponentially distributed service times. The service policy has two stage. Server starts to serve the customer with normal service rate of 1. As soon as the amount of total work-load is larger than a threshold, the server increases the rate to a high rate of M, and keeps this rate until there are no customers. The stationary work-load is obtained by using level-crossing argument, martingale approach, and decomposition technique.

2 - The Use of Non-Stationary Palm Measures in Queueing Theory

Brian Fralix, PhD Student, ISyE, Georgia Institute of Technology, 324592 Georgia Tech Station, Atlanta, GA, 30332, United States, bfralix@isye.gatech.edu, Richard Serfozo, German Riano

We show that, under non-stationary Palm measures, some classical results from queueing theory are in a sense true outside of a stationary framework (in particular, Little's law and Papangelou's lemma (which gives us a time-dependent version of PASTA)). Moreover, we show that under certain conditions, these Palm probabilities of events converge in some sense to their stationary counterpart. In particular, when analyzing Markov processes, these probabilities often exhibit a nice form.

3 - On the Stability of Moment Closure Methods under Various Closure Schemes

Ivan Guardiola, Department of Industrial Engineering, Texas Tech University, Box 43061, Lubbock, TX, 79409, United States, ivan.guardiola@ttu.edu, Dr. Timothy I Matis

In this presentation, we highlight current research findings related to the stability of moment closure methods under various closure schemes. We propose a basic stability checking methods, as well as an interpretation of the stability of a closure scheme based on the kurtosis.

4 - Analysis of Unreliable Finite Buffer Multi-Server System with Vacations

Zhe George Zhang, Professor, Western Washington University, 516 High Street, Bellingham, WA, 98225, United States, george.zhang@wwu.edu, Jau-Chuan Ke

We consider a finite M/M/c queueing system in which all servers are unreliable and operate (d, c) vacation policy. The steady-state probability distribution of system size is calculated by means of the QR factorization with Cramer's rule. A computational algorithm is developed to determine the optimal vacation policy (d, c) to maximize the profit under a cost and revenue structure.

5 - Improved Inspections for Systems with Non-Self-Announcing Failures

Bahadir Aral, PhD Candidate, Texas A&M University, 241 Zachry 3131 TAMU, College Station, TX, 77843, United States, aralbaha@neo.tamu.edu, Georgia-Ann Klutke

In this study, we consider detection strategies for systems with non-self-announcing failures. System failures occur according to a non-homogeneous Poison Process with a known intensity function. We express the limiting average availability and the limiting inspection rate per unit time for periodic inspections and we also show how to construct an better inspection strategy, which will have a higher limiting availability, without changing the inspection rate.

■ SA45

Room 406

Tutorial: Location, Transport and Land-Use: Modeling Spatial-Temporal Information

Cluster: Tutorials

Invited Session

1 - Location, Transport and Land-Use: Modeling Spatial-Temporal Information

Yupo Chan, University of Arkansas at Little Rock, 2801 South University Avenue, Department of System Engineering, Little Rock, AR, 72204-1099, United States, yxchan@ualr.edu

This tutorial identifies principles that govern siting, community development, and product/service delivery. Included are procedures to perform: site location, land-use planning, location-routing, competitive allocation of products & services, and spatial forecasting. We develop solution techniques for a number of applications, including emergency-response, supply-chain management, environmental planning, intelligent transportation systems and supply-chain management.

■ SA46

Room 407

Tutorial: Pricing and Revenue Management

Cluster: Tutorials

Invited Session

1 - Pricing and Revenue Management

Andrew Boyd, Chief Scientist and Senior Vice President Science and Research PROS, 3100 Main Street, Suite 900, Houston, TX, 77002, United States, aboyd@prosrm.com

Pricing and revenue management has become one of the fastest growing specialties within OR. Businesses are investigating what mathematical modeling can bring to the world of sales and distribution.In this tutorial, we introduce some basic pricing and revenue management models and their interactions. We also examine the commercial market for pricing and revenue management software and services and identify future research opportunities.

■ SA47

Room 408

Inventory and Logistics Management

Cluster: Supply Chain and Operations Engineering

Invited Session

Chair: Brian Tomlin, Assistant Professor, University of North Carolina, McColl Building, CB3490, Chapel Hill, NC, 27599, United States, brian_tomlin@unc.edu

1 - On the Value of Pre-Season Orders when Supply is Uncertain

Yimin Wang, University of North Carolina, Chapel Hill, Kenan-Flagler Business School, McColl Building, CB 3490, Chapel Hill, NC, 27599, United States, yimin_wang@unc.edu, Brian Tomlin

We study the ordering decision of a firm that faces combined supply and demand risks. The supply risk refers to long and unreliable procurement leadtimes and the demand risk refers to the firm's uncertainty about its pre-season and in-season orders. We characterize the firm's optimal timing and quantity decision. We prove that a firm with pre-season orders might order earlier than one without. We also prove that a firm may strictly prefer a less reliable to a more reliable leadtime.

2 - Analysis of Serial Inventory Systems with Batch Ordering and Nested Replenishment Schedule

Kevin Shang, Fuqua School of Business, Duke University, Durham, NC, United States, khshang@duke.edu, Sean Zhou

We consider an N-stage serial inventory system where material is ordered in batches and according to a nested schedule. There are two types of fixed cost considered in this system: setup cost and order cost. The former is associated with each batch ordered; the latter is incurred for each replenishment cycle. We study two models that consider each of these fixed costs. For both models, we construct a lower bound to the optimal cost, an optimization algorithm, and an effective heuristic.

3 - Inventory Planning for Low-Demand Items for a Multi-Warehouse Online Retailer

Ping Josephine Xu, Operations Research Scientist, Amazon.com, 605 5th Avenue South, Seattle, WA, 98104, United States, pingx@amazon.com, Stephen Graves, Russell Allgor

E-tailers stock many low-demand SKUs in multiple warehouses to offer an extremely wide range of selections with very fast customer service at a minimum cost. The e-tailer manages and controls the inventory centrally: it utilizes its entire inventory, regardless of location, to serve demand. For a given stocking plan, we model the expected transportation and inventory costs to serve demand. We develop guidelines for stocking low-demand items across multiple warehouses.

4 - Analytical Insights into the Two-Stage Supply Chain Configuration Problem

Sean Willems, Assistant Professor of Operations Management, Boston University, School of Management, SMG 673, 595 Commonwealth Avenue, Boston, MA, 02215, United States, willems@bu.edu, N. Grace Hua

This research demonstrates how leadtime and cost impact total supply chain landed cost, inventory placement and the optimal supply chain configuration. We prove the relative importance of cost of good sold versus inventory cost drives whether or not a high cost low leadtime option is preferred; also, we show that there is benefit to synchronize the supply chain. Finally, we analytically prove the downstream stage is more likely to choose a high cost low leadtime option than the upstream stage.

■ SA48

Room 409

Retail Supply Chain Management

Sponsor: Manufacturing & Service Operations Management

Sponsored Session

Chair: Naren Agrawal, Associate Professor, Santa Clara University, OMIS Department, Santa Clara, CA, 95070, United States, nagrawal@scu.edu

Co-Chair: Stephen Smith, J. C. Penney Professor, Santa Clara University, OMIS Department, 500 El Camino Real, Santa Clara, CA, 95053-0382, United States, ssmith@scu.edu

1 - Inventory Management of a Fast-Fashion Retail Network

Jeremie Gallien, Associate Professor, Sloan School of Management, Massachusetts Institute of Technology, E53-389, 30 Wadsworth Street, Cambridge, MA, 02142, United States, jgallien@mit.edu, Felipe Caro

Fast-fashion retailers like Zara have met some success responding to volatile demand trends through frequent introductions of new garments produced in small series. An important associated operational problem is the allocation over time of a limited amount of inventory across all stores in their network. We present stochastic and deterministic models developed in collaboration with a large fast-fashion retailer to address this challenge, then discuss the implementation and impact of this work.

2 - Supplier Competition in Retail Supply Chains

Gurhan Kok, Duke University, One Towerview Drive, Durham, NC, United States, gurhan.kok@duke.edu

A retailer determines the stocking quantities of several competing products that are provided by different suppliers. Each supplier can offer better contract terms to the retailer in order to increase the stocking quantity of her product. We study the competition between the suppliers under different types of contracts and report its impact on contractual terms and the profits of each party involved.

3 - Optimal Retail Assortments for the Nested MNL and Other Consumer Choice Models

Stephen Smith, J. C. Penney Professor, Santa Clara University, OMIS Department, 500 El Camino Real, Santa Clara, CA, 95053-0382, United States, ssmith@scu.edu

This paper develops methods for determining optimal retail assortments, given that heterogeneous customers choose products based on the nested multinomial logit model. Optimal assortments for consumer choice models based on "satisficing" are also derived. A commercial database of consumer preferences is used to illustrate the optimization methods and to compare the corresponding assortments.

■ SA49

Room 410

History of OR/MS I

Cluster: History of OR and Management Science
Invited Session

Chair: Maurice Kirby, Lancaster University, Lancaster, United Kingdom, m.kirby@lancaster.ac.uk

1 - Leonid Khachiyan (1952-2005)
Endre Boros, Professor, RUTCOR, Rutgers University, 640 Bartholomew Road, Piscataway, NJ, 08854-8003, United States, boros@rutcor.rutgers.edu

Leo Khachiyan became famous for proving first the polynomiality of linear programming. He was in fact a genius mathematician and computer scientist who also made major contributions to several other areas, including game theory, combinatorial optimization and the theory of data mining. In this short talk we focus on his contributions in the last decade.

2 - Management and Probability Theory at the Bell System: 1900-1929: Traffic Operations and Quality Control
Paul J. Miranti, Professor, Rutgers Business School, 111 Washington Street, Newark, NJ, 07102, United States, miranti@business.rutgers.edu

This paper analyzes two antecedents to the emergence of the operations research and management science disciplines that evolved from the adaptation of probability theory to resolve problems in traffic management and manufacturing quality control at the Bell System prior to 1929.

3 - Operations Research and the Area Bombing of Nazi Germany
Maurice Kirby, Lancaster University, Lancaster, United Kingdom, m.kirby@lancaster.ac.uk

This paper revisits the author's original research on the role of Operations Research (OR) in informing the tactics and strategy of the Allied airforces in relation to the campaign of "area attack" launched against Germany in 1942. Contributions to the literature on the "morality" of area bombing and its contribution to Germany's defeat are ongoing, but the role of OR in justifying the bombing of civilian targets is rarely acknowledged. This paper reasserts the case for area bombing as a moral and entirely rational means of engaging with Nazi Germany in advance of the D-Day landings.

■ SA50

Room 411

INFORMS Optimization Society Award Session

Sponsor: Optimization
Sponsored Session

Chair: Tamás Terlaky, Professor, McMaster University, 1280 Main Street West, Hamilton, ON, L8S4K1, Canada, terlaky@mcmaster.ca

1 - The Farkas Prize of the INFORMS Optimization Society

The Farkas Prize of the INFORMS Optimization Society was established in 2006, and is administered by the Optimization Society (OS) of INFORMS. The Farkas Prize is awarded for the most significant contribution to the field of optimization by a researcher, or a team of researchers. It is awarded bi-annually at the INFORMS National Meeting.

2 - The Optimization Prize for Young Researchers

The Optimization Prize for Young Researchers, established in 1998 and administered by the Optimization Society of INFORMS. It is awarded in even numbered years to one (or more) young researchers for the most outstanding paper in optimization that is submitted to or published in a refereed professional journal. The prize serves as an esteemed recognition of promising colleagues who are at the beginning of their academic or industrial career.

3 - The Legacy of Gyula Farkas
András Prékopa, Professor, RUTCOR, Rutgers University, 640 Bartholomew Road, Piscataway, NJ, 08854, United States, prekopa@rutcor.rutgers.edu

Farkas' Theorem and Lemma is probably the most frequently cited result in the optimization literature, it is one of the first results taught in introductory LP and OR courses, both on undergraduate and graduate levels. He was a forerunner of optimization theory. He formulated the necessary condition of optimality, in an analytical mechanical framework, proved his Lemma and obtained other fundamental scientific results. His works represent the importance of applications as well. This talk highlights Gyula Farkas's life and work.

4 - The 2006 Winner of the Farkas Prize

The winner of the 2006 Farkas Prize will present a survey of his most influential results and give an insight of his recent research interest.

5 - The Winner of the 2006 Optimization Prize for Young Researchers

The winner of the 2006 Optimization Prize for Young Researchers presents the award winning paper.

■ SA51

Room 412

Data Envelopment Analysis I

Contributed Session

Chair: Olga Kaminer, PhD Student, York University, 4700 Keele Street, Toronto, ON, M3J 1P3, Canada, okaminer@schulich.yorku.ca

1 - An Industry-Level Analysis of the Potential and Realized Value of IT
Kim Huat Goh, University of Minnesota, 321 19th Avenue South, Minneapolis, MN, 55455, United States, kgoh@csom.umn.edu, Robert Kauffman

IT investments are evaluated by weighing their potential benefits and actual costs. Potential benefits, however, do not always translate to actual payoffs. We adopt the Malmquist productivity index to model the potential and realized value of IT and apply data envelopment analysis techniques to solve the model. We examine the gap between potential and realized value of IT in industries within the United States and assess the impact of competition on the potential and realized value of IT.

2 - Benchmarking the Competitiveness of Nations Through Neural Networks and Data Envelopment Analysis
Özgür Kabak, Istanbul Technical University, Isletme Fakultesi, Macka, Istanbul, Turkey, kabak@itu.edu.tr, Emel Aktas, Füsun Ülengin, Gündüz Ulusoy, Sule Önsel

Most composite indicators currently used to compare the competitiveness of nations either take predetermined fixed weight values or use subjective weights for different cluster of nations. In this study, the criteria that play the dominant role in each cluster are revealed based on the weights that've been specified by using artificial neural networks. A new composite index is proposed for the ranking of the nations. Data Envelopment Analysis is used to analyze the relative position of the nations.

3 - Performance Evaluation and Market Potential Forecasting Based on Statistical and DEA Methods
Wenjun Yin, IBM China Research Laboratory, Building 19 Zhongguancun Software Park, Beijing, BJ, China, yinwenj@cn.ibm.com, Jin Dong

Banking branches performance evaluation and market potential forecasting plays key roles in branch net-works optimization. However, current works focus only on internal business of the branches and ignore the geo-graphic and demographic information around the branches. With linkage to the geographic information system (GIS), statistical tools, data envelopment analysis (DEA) and their crossover are applied. Good result was achieved by a real case analysis of one of the biggest China banks.

4 - The Validity of Input Aggregation in DEA Models: A Nonparametric Statistical Test
Kankana Mukherjee, Assistant Professor, Worcester Polytechnic Institute, Department of Management, 100 Institute Road, Worcester, MA, 01609, United States, kmukher@wpi.edu, Subhash Ray

In many DEA applications multiple inputs or outputs are aggregated in value terms to reduce the number of constraints, thereby increasing the "degrees of freedom". While the theoretical implications of such aggregation have been studied, the statistical side still is in a rudimentary stage. We propose a nonparametric statistical test of the validity of price-weighted input aggregation using a smoothed bootstrap procedure. This is illustrated with an application to Indian manufacturing data.

5 - Effect of Competitive Environment on the Choice of Manufacturing Capabilities
Olga Kaminer, PhD Student, York University, 4700 Keele Street, Toronto, ON, M3J 1P3, Canada, okaminer@schulich.yorku.ca, Markus Biehl, Wade Cook, Murat Kristal, Aleda Roth

There is an ongoing debate in the strategy literature about whether or not tradeoffs need to be made in the development of competitive capabilities. In this study we investigate the trade-offs debate by using data from 150 manufacturers across North America. We theorize under which environmental conditions, such as environmental dynamism, the trade-off and cumulative models hold. We test our hypothesis using a DEA approach of manufacturing firms' capabilities and financial performance measures.

■ SA52

Room 413

Customer Behavior in Revenue Management

Sponsor: Revenue Management & Pricing

Sponsored Session

Chair: Xuanming Su, Assistant Professor, University of California, Haas School of Business, Berkeley, CA, 94720, United States, xuanming@haas.berkeley.edu

1 - Dynamic Pricing of Limited Inventories when Customers Negotiate

Chia-Wei Kuo, Department of Industrial and Operations Engineering, University of Michigan, Ann Arbor, MI, 48109, United States, cwkuo@umich.edu, Goker Aydin, Hyun-Soo Ahn

We consider a firm who adjusts the sticker price dynamically in the course of a selling season. Each customer observes the posted price and engages in a negotiation process to complete the purchase. We explore the interaction between dynamic pricing and negotiation and show how inventory and remaining selling period affect the seller's optimal pricing policy.

2 - The Effects of Information on a Queue with Balking and Phase-Type Service Times

Pengfei Guo, Ph.D. Candidate, Duke University, 1 Towerview Drive, Durham, NC, 27708, United States, pg18@duke.edu, Paul Zipkin

In this paper, we generalize the models in Guo and Zipkin (2003) to a system with phase-type service times. We model the system with no, partial (the system occupancy) and full (the exact waiting time) information about delay. We compute the busy probability and customers' average utility numerically. Our numerical results show that whether information is good or bad for the server or customers depends on the shape of customers' distribution.

3 - On the Threshold Purchasing Behavior of Customers Facing Dynamically Priced Perishable Products

Yong-Pin Zhou, University of Washington, Business School, Seattle, WA, United States, yongpin@u.washington.edu, Ming Fan, Minho Cho

Dynamic pricing is a standard practice that firms use for revenue management. As price fluctuates with the changes in inventory and time, a strategic customer may postpone a purchase in anticipation of lower prices in the future. We analyze a threshold purchasing policy for the strategic customer, and use numerical studies to study its impact on both the strategic customer's utility and the firm's revenue. We find that in most cases the policy can benefit both.

4 - Waiting Till the Last Minute: Strategic or Irrational?

Xuanming Su, Assistant Professor, University of California, Haas School of Business, Berkeley, CA, 94720, United States, xuanming@haas.berkeley.edu

Consumers often wait until the last minute before making a purchase. This indicates strategic behavior if they can secure a last-minute discount. Yet, consumers sometimes wait even when this implies higher prices and lower availability. We adopt a behavioral approach towards this phenomenon and study its implications on dynamic pricing strategies.

■ SA53

Room 414

Revenue Management and Beyond

Sponsor: Revenue Management & Pricing

Sponsored Session

Chair: Felipe Caro, Assistant Professor, UCLA Anderson School of Management, 110 Westwood Plaza, Suite B420, Los Angeles, CA, 90095, United States, fcaro@anderson.ucla.edu

Co-Chair: Rene Caldentey, Assistant Professor in Operations Management, Stern School of Business, New York University, 44 West Fourth Street, KMC 8-77, New York, NY, 10012, United States, rcaldent@stern.nyu.edu

1 - Integer Programming Models of Pricing Problems with Probabilisitic Choice

Romy Shioda, University of Waterloo, 200 University Avenue, Waterloo, ON, Canada, rshioda@math.uwaterloo.ca, Tuncel Levent

We present mixed-integer programming formulations of several product pricing models using probabilistic customer choice models. In these models, the probability that a customer segment would purchase a given product depends on their reservation prices and the product prices. We present some mathematical properties of these problems and computational experiments.

2 - Learning Customers' Preferences through Repetitive Sale Interactions

Paulo Rocha e Oliveira, Assistant Professor of Marketing, University of Miami, United States, paulomiamiedu@yahoo.com.br, Rene Caldentey, Gabriel Bitran

Knowing customers' preferences enhances a firm's ability to design and offer the right menu of products. Learning is not free, and companies must allocate valuable resources if they really want to know their customers better. In this paper, we investigate this trade-off between the value and cost of learning. We use an axiomatic approach to develop a learning model and investigate how pricing policies can be used to speed up the learning process while maximizing the firm's financial performance.

3 - Dynamic and Data-Driven Inventory Management Under Uncertainty

Aurelie Thiele, P.C. Rossin Assistant Professor, Lehigh University, 200 W. Packer Avenue, Bethlehem, PA, 18015, United States, aut204@lehigh.edu

We propose a framework based on dynamic and data-driven optimization to incorporate demand uncertainty. The approach is based on the monitoring of the actual demand and the decision-maker's ability to address sudden changes quickly, for instance by increasing the frequency of the observations and tracking additional quantities such as demand for other products or at other stores. We provide theoretical insights on the optimal solution and illustrate our findings on a numerical example.

4 - Centralized vs. Decentralized Competition for Price and Lead-time Sensitive Demand

Pelin Pekgun, PhD Candidate, Georgia Institute of Technology, 765 Ferst Drive, Atlanta, GA, 30332, United States, ppekgun@isye.gatech.edu, Pinar Keskinocak, Paul Griffin

We study two firms that compete on the basis of their price and leadtime decisions in a common market. We explore the impact of the decentralization of price and leadtime decisions, as quoted by the marketing and production departments, respectively, comparing three scenarios: (i) Both firms are centralized, (ii) Only one firm is centralized, (iii) Both firms are decentralized.

■ SA54

Room 415

Interfaces Between Marketing, Operations and Technology I

Cluster: Operations and Marketing for Emerging Markets

Invited Session

Chair: Jiong Sun, Doctoral Student, Tepper School of Business, Carnegie Mellon University, 5000 Forbes Avenue, Pittsburgh, PA, 15213, United States, jiong@cmu.edu

Co-Chair: Sunder Kekre, Professor of Operations Management and Manufacturing, Tepper School of Business, Carnegie Mellon University, 5000 Forbes Avenue, Pittsburgh, PA, 15213, United States, skekre@cmu.edu

1 - Product Line Design: Variety, Mass Customization and Economies of Scale

Dennis Z. Yu, Assistant Professor, Clarkson University, School of Business, PO Box 5790, Potsdam, NY, 13699-5790, United States, yuz@wustl.edu, Sergio Chayet, Panos Kouvelis

A manufacturer's product line design is studied when the production technology allows quality differentiation. Customers are heterogeneous in their valuation of product quality. The manufacturer faces a tradeoff between production capacity investment and holding cost of WIP due to the system congestion. The presence of economies of scale is characterized by the existence of the product variety limit. We derive the manufacturer's optimal strategies under both dedicated and flexible technologies.

2 - Fostering New Technology Adoption

Ozgen Karaer, PhD Candidate, Management Science and Engineering Department, Stanford University, Stanford, CA, United States, okaraer@stanford.edu, Feryal Erhun, Hau L. Lee

Faced with a new technology introduced in a market, a firm considers uncertainties regarding the future of this technology, network effects of adoption, and diseconomies of scales in costs while making the adoption decision. Recently, adoption of RFID technology is lower than expected due to this individual perspective of each firm. We study this low adoption problem and analyze the impact of methods to foster adoption such as quantity discounts, external funds, priority schemes, and mandates.

3 - Imitative Competition: Implications for Strategic Sourcing and Technology Transfer
Jiong Sun, Doctoral Student, Tepper School of Business, Carnegie Mellon University, 5000 Forbes Avenue, Pittsburgh, PA, 15213, United States, jiong@cmu.edu, Laurens Debo, Sunder Kekre, Jinhong Xie

Technology transfer offers global firms an opportunity to penetrate into emerging markets as well as source for their home markets. However, it also poses risks of potential technology imitation by local firms who may enter the emerging market and invade subsequently the global firms' home markets as well. We study how the competition affects a global firm's technology transfer and sourcing decisions, and a local competitor's imitation and exporting choices.

4 - Products with Network Externality: The Relevance of Unbundling and Mixed Bundling
R. Venkatesh, Associate Professor, University of Pittsburgh, Katz Graduate School of Business, 332 Mervis Hall, Pittsburgh, PA, 15260, United States, rvenkat@katz.pitt.edu, Vijay Mahajan, Ashutosh Prasad

Despite the hype surrounding Microsoft's decision to bundle Internet Explorer and Windows, we argue that unbundling and mixed bundling can be optimal for products with network externality. Specifically, we analyze a stylized model to propose normative guidelines on optimal bundling strategies for a profit maximizing seller. We show that when products have low to moderate network externality, unbundling is better when marginal costs are high. Mixed bundling is also superior to pure bundling except when the products have strong network externality.

■ SA55

Room 416

Supply Chain Logistics I

Contributed Session

Chair: Mehmet Sekip Altug, PhD Candidate, Columbia University, Graduate School of Business, Uris Hall 4J, New York, NY, 10027, United States, msa2104@columbia.edu

1 - Supply Chain Design on a Line with Lateral Transshipments
Yale Herer, Professor, Technion, Industrial Engineering and Management, Haifa, 32000, Israel, yale@technion.ac.il, Hussein Naseraldin

We investigate the problem of simultaneously determining the number of retail outlets, their location, the allocation of customers to retail outlets, inventory policy, transshipment policy, inventory quantities, and transshipment quantities in a periodic infinite horizon stochastic inventory problem where the objective is to minimize the average cost per period. We obtain the optimal solution and discuss its properties.

2 - Container Terminals as an Integral Part of Arab and Global Supply Chains: The Case of Lebanon
Nouri Beyrouti, Assistant Professor in Marketing & Management, Lebanese American University, Chouran 1102 2801, Beirut, 135053, Lebanon, nbeyruti@lau.edu.lb

With ever increasing containerization, the number of seaport container terminals and the competition among them has become quite remarkable. Operations are nowadays unthinkable without effective and efficient use of information technology as well as appropriate optimization (operations research) methods. The research will describe the main logistics process and operations in container terminals and provide an understanding of Lebanon competitive advantage.

3 - A Single-Warehouse Multi-Retailer Inventory System with Discounts Based on Order Frequency
Jose Ventura, Professor, Pennsylvania State University, 310 Leonhard Building, University Park, PA, 16802, United States, jav1@psu.edu, Brian Rieksts, Yale Herer

We study a single-warehouse multi-retailer inventory system in which a product is bought by the warehouse from an external supplier, who gives all-unit discounts on the purchasing cost based on the average order frequency. From the warehouse, the product is dispersed to satisfy the demand of all the retailers. A model with assumptions analogous to the EOQ environment is developed and an algorithm for a power-of-two policy that is 94% effective for a variable base planning period is derived.

4 - Misplaced Inventory and RFID: Information and Coordination
Almula Camdereli, UNC-Chapel Hill, 1800 Baity Hill Dr, Apt 215, Chapel Hill, NC, 27514, United States, almula_camdereli@unc.edu, Jay Swaminathan

Misplaced inventory is a major operational problem in many supply chains. Adoption of this technology has a fixed cost and variable cost of implementation, which can cause incentive issues in the supply chain. In this paper, we consider centralized, uncoordinated and coordinated supply chains under misplacement of inventory subject to uncertain demand. We characterize the incentives of the parties in these supply chains to invest in RFID.

5 - Full Collaboration: Analyzing Inventory Systems with Advance Supply and Advance Demand Information
Mehmet Sekip Altug, PhD Candidate, Columbia University, Graduate School of Business, Uris Hall 4J, New York, NY, 10027, United States, msa2104@columbia.edu, Alp Muharremoglu

In this paper, we combine both sides of information sharing and consider a manufacturer who gets both "advance supply" and "advance demand" information. The main questions we study are: i) How does the manufacturer use this information? ii) What is the value of such information sharing? We show that state-dependent base stock policies are optimal for the manufacturer. We derive closed-form approximations and analyze the value of collaboration."

Sunday, 10:00am - 11:30am

■ SB01

Room 301

Applications of the Arora-Rao-Vazirani Algorithm

Sponsor: Optimization/ Network and Combinatorial Optimization
Sponsored Session

Chair: Assaf Naor, Microsoft Research, One Microsoft Way, Redmond, WA, 98052-6399, United States, anaor@microsoft.com

1 - Geometric Embeddings and Sparsest Cut Variants
James R. Lee, Professor, Institute for Advanced Study, 1 Einstein Drive, Princeton, NJ, 08540, United States, jrl@ias.edu

In general, problems in the Sparsest Cut genre involve finding balanced separators in graphs: Our task is to break a given graph into two "large" pieces while minimizing the "interface" between them. Depending on the precise definition of these two objectives, different types of problems arise. We will discuss these variants and their applications, along with the known algorithmic results, and the relationship to semi-definite optimization and geometric embeddings.

2 - New Approximation Guarantee for Chromatic Number
Eden Chlamtac, Research Assistant, Princeton University, Computer Science Building, 35 Olden Street, Princeton, NJ, United States, chlamtac@CS.Princeton.EDU, Moses Charikar, Sanjeev Arora

We describe an algorithm which colors any 3-colorable graph using $O(n^{0.2074})$ colors, thus improving the algorithms of Karger, Motwani and Sudan, and Blum and Karger, which used $O(n^{3/14})$ colors. Using ideas inspired by the work of Arora, Rao and Vazirani, we demonstrate a better relation between vector chromatic number and true chromatic number. While this gives some improvement, we obtain our best result by adding "odd-cycle constraints" to the semidefinite program.

3 - Directed Metrics in Graph Optimization Problems
Yury Makarychev, Princeton University, 35 Olden Street, Princeton, NJ, 08540, United States, ymakaryc@cs.princeton.edu, Moses Charikar, Konstantin Makarychev, Amit Agarwal

The theory of metric embeddings has provided a powerful toolkit for undirected graph partitioning problems. The metrics of interest arise naturally as solutions of mathematical programming relaxations for graph partitioning problems. No analog of this embedding theory exists for directed (asymmetric) metrics, the natural distance functions that arise in considering directed problems. We discuss some successes and some obstacles in extending the embedding machinery to directed metrics.

4 - A New Integrality Gap for the Semidefinite Relaxation of Sparsest Cut
Assaf Naor, Microsoft Research, One Microsoft Way, Redmond, WA, 98052-6399, United States, anaor@microsoft.com

In this talk I will show that the Heisenberg group has an equivalent metric which is in squared L_2, yet it does not embed into L_1. It follows that the classical Heisenberg geometry on R^3 is a simple counter example to the Goemans-Linial conjecture on the integrality gap of the semidefinite relaxation of the Sparsest Cut Problem. Based on joint work with James R. Lee.

■ SB02

Room 302

Joint Session Open-Source/ICS: Applications of the Nonlinear Optimization Software IPOPT II

Cluster: Open-Source Software: Open Source, Open Standards, Open Data, INFORMS Computing Society
Invited Session

Chair: Andreas Waechter, Research Staff Member, IBM TJ Watson Research Center, 1101 Kitchawan Road, Yorktown Heights, NY, 10598, United States, andreasw@watson.ibm.com

1 - Large-Scale Nonlinear Programming for Optimal Design and Operation of Simulated Moving Bed Processes
Yoshiaki Kawajiri, Carnegie Mellon University, 5000 Forbes Avenue, Pittsburgh, PA, 15213, United States, kawajiri@cmu.edu, Lorenz Biegler

Simulated Moving Bed (SMB) chromatography is a widely used separation technique in chemical process industries, which is modeled by Partial Differential Algebra ic Equations (PDAEs). We present several optimization case studies of large-scale nonlinear programming of SMB with over 100,000 variables solved efficiently using IPOPT.

2 - Real-Time Optimization with ROMeo & IPOPT
Brian Baumrucker, Carnegie Mellon University, 5000 Forbes Avenue, Pittsburgh, PA, 15213, United States, bbaumruc@andrew.cmu.edu, Lorenz Biegler

The ROMeo (Rigorous On-line Modeling with Equation based Optimization) process modeling environment incorporates both reduced space SQP and IPOPT algorithms and is modified to deal with complementarity constraints. Numerical comparisons of the solvers will be presented and complementarity reformulations will be explored on a number of test problems.

3 - Circuit Tuning with IPOPT
Andreas Waechter, Research Staff Member, IBM TJ Watson Research Center, 1101 Kitchawan Road, Yorktown Heights, NY, 10598, United States, andreasw@watson.ibm.com

During the design of digital circuits, such as microprocessors, the optimal transistor widths have to determined, in order to achieve fast performance, given power and area constraints. We will describe the implementation of the IBM-internal EinsTuner circuit tuning tool, which uses circuit simulations and the IPOPT nonlinear optimizer.

■ SB03

Room 303

Applications of Linear Programming

Sponsor: Optimization/ Linear Programming and Complementarity
Sponsored Session

Chair: Javier Pena, Associate Professor of Operations Research, Carnegie Mellon University, 5000 Forbes Avenue, Pittsburgh, PA, 15213, United States, jfp@andrew.cmu.edu

1 - A Robust CVaR Portfolio Allocation Model Using Option Prices
Luis Zuluaga, Assistant Professor, University of New Brunswick, PO Box 4400, Fredericton, NB, E3B 5A3, Canada, lzuluaga@unb.ca, Juan Vera, Javier Pena

We present a novel linear programming portfolio allocation model in which worst-case Conditional Value-at-Risk (CVaR) is used as the risk measure. The worst-case CVaR is computed by considering underlying asset price probability distributions that replicate the observed prices of vanilla options.

2 - Static Arbitrage Bounds for Basket Options via Linear Programming
Juan Vera, Postdoctoral Fellow, Georgia State University, United States, jvera@andrew.cmu.edu, Luis Zuluaga, Javier Pena

We show that the problem of finding the best possible bounds on a basket option given the prices of other basket options can be cast as a linear program. We subsequently show that for special cases, e.g., when only calls on individual assets are given, the linear programming formulation can be simplified substantially and has a closed-form solution.

3 - A Gradient-Based Method for Computing Nash Equilibria of Two-Person Zero-Sum Sequential Games
Samid Hoda, Carnegie Mellon University, 5000 Forbes Avenue, Pittsburgh, PA, 15213, United States, shoda@andrew.cmu.edu, Javier Pena, Andrew Gilpin

We discuss an adaptation of Nesterov's smoothing technique to compute approximate equilibrium points of two-person, zero-sum sequential games. The algorithm is gradient-based with a rate of convergence O(1/k) where k is the iteration count, but with fairly low computational cost per iteration. The latter makes it particularly suitable to find approximate Nash equilibria of large games.

4 - Alternative Transportation Fuels: Modeling National-Scale Ethanol Production and Distribution
Scott Matthews, Associate Professor, Carnegie Mellon University, 5000 Forbes Avenue, Pittsburgh, 15213, United States, hsm@cmu.edu, Michael Griffin, William R. Morrow

Crude oil refining and gasoline distribution have been optimized over time. Ethanol is currently a niche market. Our LP model estimates the logistics costs associated with national ethanol production and distribution from biomass. We estimate higher downstream transportation costs than gasoline (15-48 cents compared to 3 cents per gallon) but remain a fraction of total cost at blends up to 16% ethanol. Total infrastructure constraints could make large-scale ethanol distribution infeasible.

■ SB04

Room 304

Strategic Interactions in Supply Chains

Cluster: Supply Chain and Operations Engineering
Invited Session

Chair: Haresh Gurnani, University of Miami, Department of Management, Coral Gables, FL, 33124, United States, hgurnani@exchange.sba.miami.edu

Co-Chair: Yunzeng Wang, University of Texas at Dallas, Richardson, TX, United States, Yunzeng.Wang@case.edu

1 - Partial Complementarity, Strategic Decision and Performance of Firms in Decentralized Supply Chains
Xiang Fang, Case Western Reserve University, Cleveland, OH, 44106, United States, xiang.fang@case.edu, Yunzeng Wang

Consider multiple manufacturers each producing a different product. The manufacturers rely on each other to fulfill a common demand stream from a type of customers who buy the multiple products as complementary sets. In addition, each manufacturer faces a separate customer type who buys only the manufacturer's own product. All streams of demands are uncertain. We explore the equilibrium behavior of manufacturers in choosing their individual production capacities or quantities.

2 - The Effect of Price Fluctuations on the Performance of Distribution Supply Chains
Srinagesh Gavirneni, Assistant Professor of Operations Management, Johnson Graduate School of Management, Cornell University, 310 Sage Hall, Ithaca, NY, 14853, United States, sg337@johnson.cornell.edu, Shu (Vickii) Zhou

We consider a decentralized distribution supply chain with one supplier and two retailers. The supplier provides one product to the retailers, and each retailer faces iid end-customer demands. We want to identify the effect of price fluctuations and information sharing on the supply chain performance in terms of the total supply chain costs. We also want to determine the optimal magnitudes of the price fluctuations and schedule the price fluctuations across retailers to maximize the benefit.

3 - Monotone Properties of Wholesale Price Contracts
Vera Tilson, Asssistant Professor, University of Rochester, Simon School of Business, Rochester, NY, United States, Vera.Tilson@case.edu

We focus on monotonicity properties of wholesale price — performing qualitative sensitivity analysis using order-theoretical framework. We establish sufficient conditions that guarantee monotone changes in contract parameters with changes in exogenous parameters. Many specific cases are encompassed by the assumptions including randomness in both yield and demand.

■ SB05

Room 305

Optimization Approaches in Financial Engineering I

Sponsor: Optimization/ Stochastic Programming
Sponsored Session

Chair: Stan Uryasev, Professor, University of Florida, Department of Industrial and Systems Engineering, Gainesville, FL, 32601, United States, uryasev@ufl.edu

1 - How Much Is a Model Upgrade Worth?
Sven Sandow, Director, Quantitative Analytics, Standard & Poor's, 55 Water Street, 46th Floor, New York, NY, 10041, United States, sven_sandow@standardandpoors.com, James Huang, Craig Friedman

We compute, from the point of view of an expected-utility-maximizing investor, the monetary values of probabilistic models that are used for financial decision-making. In the case of nearly homogeneous returns, the value of a model upgrade can be approximated by a function of the likelihood ratio.

2 - Methods of Reducing Optimization of Omega Function to Linear Programming
Sergey Sarykalin, PhD Student, University of Florida, 303 Weil Hall, PO Box 116595, Gainesville, FL, 32611, United States, saryk@ufl.edu, Stan Uryasev

We consider the problem of maximizing the Omega Function of a portfolio with a fixed benchmark. We propose two theorems reducing the original problem to the two relaxed problems without a restriction that the decision variables should sum up to 1. When the Omega function at optimality is greater than 1, both relaxed problem can be reduced to linear programming. We illustrate the proposed methodology with the case study on allocating recourses among managers in a hedge fund.

3 - Default Hazard Rate Modeling with Evolving and Non-Evolving Explanatory Variables

Craig Friedman, Standard & Poor's, 55 Water Street, New York, NY, 10041, United States, craig_friedman@standardandpoors.com

We discuss a statistical learning approach to default intensity (hazard rate) modeling. This approach allows us to incorporate explanatory variables whose evolution we want to model (such as common macroeconomic default drivers), as well as informative variables that we may not want to model (such as firm-specific financial ratios)

■ SB06

Room 306

Novel Randomization Approaches in Search

Sponsor: INFORMS Computing Society/Constraint Programming

Sponsored Session

Chair: Carla Gomes, Associate Professor, Cornell University, 4130 Upson Hall, Ithaca, NY, United States, gomes@cs.cornell.edu

1 - Disco-Novo-GoGo: Integrating Local Search and Complete Search with Restarts

Meinolf Sellmann, Assistant Professor, Brown University, 115 Waterman Street, PO Box 1910, Providence, RI, 02912, United States, sello@cs.brown.edu, Carlos Ansotegui, Warren Schudy

A hybrid algorithm is devised to boost the performance of complete search on under-constrained problems. We suggest to use random variable selection in combination with restarts, augmented by a coarse-grained local search algorithm that learns favorable value heuristics over the course of several restarts. Numerical results show that this method can speed-up complete search by orders of magnitude.

2 - The Max K-Armed Bandit Problem: Mediating the Use of Multiple Search Heuristics

Stephen Smith, Research Professor, Carnegie Mellon University, 5000 Forbes Avenue, The Robotics Institute, Pittsburgh, PA, 15213, United States, sfs@cs.cmu.edu

Randomization has been shown to be an effective means of boosting the performance of search heuristics in combinatorial domains, yet it is often the case that the utility of a given heuristic varies across problem instances. In this talk we consider the problem of allocating trials among a set of heuristics to best exploit their differential power, which we formalize as the Max k-armed bandit problem. We summarize recent theoretical results and show their application to scheduling problems.

3 - Supporting Parallel and Distributed Constraint-Based Local Search Algorithms.

Laurent Michel, Assistant Professor, Computer Science & Engineering Department, University of Connecticut, Storrs, CT, 06269, United States, ldm@engr.uconn.edu, Pascal Van Hentenryck

Optimization applications are challenging because of size, complexity or online requirements. At the same time, commodity multiprocessors offer significant opportunities but remain extremely challenging to program and use. It is therefore capital to lower the barrier to their adoption in the optimization domain. This talk offers an answer: programming language abstractions to minimize the distance between sequential and parallel and distributed algorithms.

4 - Streamlining Reasoning for Solution Finding and Counting

Carla Gomes, Associate Professor, Cornell University, 4130 Upson Hall, Ithaca, NY, United States, gomes@cs.cornell.edu, Ashish Sabharwal, Bart Selman, Meinolf Sellmann

We will introduce streamlining reasoning, a technique for effective solution finding and solution counting for hard combinatorial problems.

■ SB07

Room 307

New Books in Optimization

Cluster: New Books

Invited Session

Chair: Stephen Wright, Professor, University of Wisconsin-Madison, 1210 West Dayton Street, Madison, WI, 53706, United States, swright@cs.wisc.edu

1 - Interior Point Approach to Linear Optimization: Theory and Algorithms

Tamás Terlaky, Professor, McMaster University, 1280 Main Street West, Hamilton, ON, L8S4K1, Canada, terlaky@mcmaster.ca, Kees Roos, Jean-Philippe Vial

An interior point approach to both theoretical and algorithmic aspects of interior point methods for linear optimization. The first part presents duality theory and a simple polynomial IPM with full complexity and roundig analysis for solving linear optimization problems. Remainder discusses logarithmic barrier methods, target-following approaches, predictor-corrector approaches, sensitity analysis and implementation issues.

2 - Applied Optimization: Formulation and Algorithms for Engineering Systems

Ross Baldick, Professor, The University of Texas, 1 University Station, Austin, TX, 78712, United States, ross@baldick.com

The motivation for this book stems from my observations of the orientation of typical optimization texts used in optimization courses compared to the needs of students in our engineering program. Many optimization books and courses concentrate on the design of algorithms. In contrast, this book focuses on how to formulate simultaneous equations and optimization problems so that they can be solved by existing software.

3 - Numerical Optimization, Second Edition, J. Nocedal and S. Wright

Stephen Wright, Professor, University of Wisconsin-Madison, 1210 West Dayton Street, Madison, WI, 53706, United States, swright@cs.wisc.edu, Jorge Nocedal

Additions and improvements in the second edition of the book "Numerical Optimization" by J. Nocedal and S. Wright will be discussed. An outline of the contents and a sample of the approach used in the book will be presented.

4 - Nonlinear Optimization

Andrzej Ruszczynski, Professor, Department of Management Science and Information Systems, Rutgers University, 94 Rockefeller Road, Piscataway, NJ, 00854, United States, rusz@business.rutgers.edu

The book covers convex analysis, optimality conditions, duality, and methods for solving unconstrained and constrained problems. It addresses modern topics such as optimality conditions and numerical methods for problems involving nondifferentiable functions, semidefinite programming, metric regularity and stability theory of set-constrained systems, and sensitivity analysis of optimization problems. All results are proved and illustrated by numerous examples and figures.

■ SB08

Room 308

Behavioral Operations

Sponsor: Technology Management

Sponsored Session

Chair: Gary Pisano, Professor of Business Administration, Harvard Business School, Morgan Hall 417, Boston, MA, 02163, United States, gpisano@hbs.edu

Co-Chair: Francesca Gino, Lecturer and Post-Doctoral Fellow, Harvard Business School, Morgan Hall 412, Boston, MA, 02163, United States, fgino@hbs.edu

1 - Cross-Functional Coordination in Supply Chain (SC) Forecasting and Planning

Noel Watson, Assistant Professor, Harvard Business School, Soldiers Field Road, Medford, MA, 02155, United States, nwatson@hbs.edu

Quant. models of cross-functional coordination primarily exploit incentives which require complete system-wide knowledge by a planner. In practice, some efforts have instead focused on specific process mechanisms such as improving directly the collective information processing abilities of participating functions. We re-examine then coordination to see what is achievable without primarily changing incentives. Behavioral dynamic constructs such as perceptions are valuable in our models.

2 - A Behavioral Investigation of Service-Based Supplier Competitions

Karen Donohue, Associate Professor, Carlson School, University of Minnesota, 321 19th Avenue S., Minneapolis, MN, 55455, United States, KDonohue@csom.umn.edu, Saif Benjaafar, Elena Katok

We compare two types of supplier competitions that are proven, in theory, to be equally effective ways for a buyer to elicit high service quality from his supply base. We study the two mechanisms in the laboratory to determine whether these similarities hold true with human decision-makers. We also test the effect of the number of competitors and different service cost structures on service performance.

3 - Bridging Laboratory and Field Behavior: Bargaining and Auctions in Controlled Experiments on EBay

Gary Bolton, Smeal College of Business, Penn State University, 334 Business Building, University Park, PA, United States, gbolton@psu.edu, Axel Ockenfels

We conducted a controlled field experiment on eBay to investigate first, whether basic laboratory results on equitable bargaining and competitive bidding surface in a naturally occurring market environment among experienced traders, and second, whether trading strategies observed in the experiment can be linked to trading patterns observed outside the experiment.

4 - Research Proposal: The Cognitive Aspects of Scheduling

Yishai Boasson, Massachusetts Institute of Technology, 77 Massachusetts Avenue, Cambridge, MA, 02139, United States, yishai@MIT.EDU

We wish to understand how expert schedulers modify scheduling heuristics and choose between them. Field research methods will be used to collect data about expert scheduler behavior. Data will be compared and contrasted with lab data. Insights gained can be used in models for system design. This is different from previous works, as it is concerned with how schedulers make decisions, rather than with what those decisions are, or with benchmarking scheduler performance against normative theory.

5 - Experimental Operations Research

J. Neil Bearden, Assistant Professor, University of Arizona, Eller College of Management, Mcclelland Hall 417, Tucson, AZ, 85720, United States, jneilb@gmail.com

I survey laboratory studies of decision behavior in problems drawn from theoretical OR literature, focusing on job sequencing and revenue management. I argue that we should not be concerned with the "irrationality" of human decision making, but use OR models as standards to evaluate where decision making can be improved.

■ SB09

Room 309

Empirical and Experimental Research in New Product Development

Cluster: New Product Development

Invited Session

Chair: Kamalini Ramdas, Associate Professor, Darden School, 189 FOB, 100 Darden Boulevard, Charlottesville, VA, 22902, United States, Ramdask@Darden.virginia.edu

1 - The Lone Inventor: Kook or Hero?

Lee Fleming, Professor, Harvard Business School, 485 Morgan Hall, Boston, MA, 02163, United States, lfleming@hbs.edu

Why are lone inventors thought to be the sources of technological breakthroughs? The myth persists despite a variety of arguments that collaboration increases creativity. I argue and demonstrate that while the average rate and success of creative effort is lower for lone inventors, the successes are much more variable. If assessments of success depend on the maximum of a distribution, then a higher variance distribution could be a plausible basis for the "myth."

2 - Social Preferences and Performance in Buyer-Supplier Relationships

Christoph Loch, Professor of Technology Management, INSEAD, Boulevard de Constance, Fontainebleau, France, christoph.loch@insead.edu, Yaozhong Wu

Economically rational buyer-supplier partners need incentive contracts in order to efficiently coordinate. However, social preferences, or concerns for status, fairness and relationships, can allow parties to collaborate without formal contracts. We show in a model that social preferences can lead to successful coordination, and we show experimental evidence with human subjects that manipulating social concerns in subjects indeed reliably influences their behavior in a buyer-supplier setting.

3 - An Empirical Analysis of R&D Portfolios in the Pharmaceutical Industry

Christian Terwiesch, Associate Professor, University of Pennsylvania, 548 JMHH, Philadelphia, PA, 19104, United States, terwiesch@wharton.upenn.edu, Karl Ulrich, Karan Girotra

We present an empirical analysis of R&D performance in the pharmaceutical industry. Our focus is on the link between product portfolio and financial performance. We also explore various dimensions of R&D performance, including the R&D yield and the R&D efficiency.

■ SB10

Room 310

Software Demonstration

Cluster: Software Demonstration

Invited Session

1 - Dash Optimization - Building Optimization Applications Using Mosel and XAD

Nitin Verma, Dash Optimization, 560 Sylvan Avenue, Englewood Cliffs, NJ, United States, nitin.verma@dashoptimization.com

This tutorial focuses on building optimization models using simple and advanced features available in Mosel, our modeling and programming language, and integrating them seamlessly with Xpress-Application Developer for visualization, analysis, and deployment purposes. For updated information about Dash Optimization's activities meeting, please visit: www.dashoptimization.com/home/services/news/informs_nov2006.html.

2- Rapid Application Prototyping with GAMS

Steven Dirkse,GAMS Development, 1217 Potomac Street NW, Washington DC 20007, United States, sdirkse@gams.com

GAMS Development will demonstrate how an application can be built using GAMS. We'll use both fundamental modeling practices, our state of the art solvers, and the latest in data access and application integration tools to quickly produce a working application: a Sudoku calculator sure to impress friends and family!

■ SB11

Room 311

OR in SpORts I

Sponsor: OR in Sports

Sponsored Session

Chair: Eric Huggins, Assistant Professor of Management, Fort Lewis College, 1000 Rim Drive, Durango, CO, 81301, United States, huggins_e@fortlewis.edu

1 - Does the Pitcher or the Batter Control Home Plate in a Major League Baseball Game?

James Cochran, Louisiana Tech University, College of Administration & Business, PO Box 10318, Ruston, LA, 71055, United States, jcochran@cab.latech.edu

In baseball the question of who has more influence over the outcome of a plate appearance is critical - the answer may help teams assess value of players and decide at which positions to invest. We use regression analysis and data from the 04 MLB season - frequency of particular events (hits, homeruns, etc.) for individual pitcher/batter matchups and the frequency of the event for individual pitcher and hitters over the entire season - to assess relative influence of the pitcher and the batter.

2 - A Player Selection Heuristic for a Sports League Draft

Michael Fry, Assistant Professor, University of Cincinnati, 532 Lindner Hall, QAOM Department, Cincinnati, OH, 45221-0130, United States, mike.fry@uc.edu, Jeffrey Ohlmann, Andy Lundberg

We model the decision-making process of a sports franchise during a player selection draft. Our dynamic programming-based model considers both the needs of a particular team as well as the overall abilities of the players available to be drafted. Our model can be solved in real time during a draft using a spreadsheet-based decision support system. We provide an example of our strategy applied to a fantasy football draft and compare our proposed solution strategy to several competing heuristics.

3 - Optimal NFL Survivor

Eric Huggins, Assistant Professor of Management, Fort Lewis College, 1000 Rim Drive, Durango, CO, 81301, United States, huggins_e@fortlewis.edu

NFL Survivor is a game where players try to choose one winning team each week for the 17 week NFL season, without choosing the same team twice. Players that pick a losing team are eliminated until one winner (survivor) remains. We show that a greedy algorithm, picking the best team each week, is near (but not necessarily) optimal and discuss heuristic strategies. We also discuss results for a generalized version of the game.

■ SB12

Room 312

2006 Dantzig Dissertation Award Finalists

Cluster: Dantzig Dissertation Prize

Invited Session

Chair: Robert Shumsky, Associate Professor, Tuck School, Dartmouth College, 100 Tuck Hall, Hanover, NH, 03755, United States, Robert.A.Shumsky@Dartmouth.EDU

1 - Heterogeneous Congestion Control Protocols

A. Kevin Tang, Caltech, MC 256-80, Pasadena, CA, 91125, United States, aotang@caltech.edu

Homogeneity of price is an implicit yet fundamental assumption underlying price based resource allocation theory. In this thesis, we study effects of relaxing this assumption by examining networks with heterogeneous congestion control. A systematic theory is developed that includes all major properties of equilibrium such as existence, uniqueness, optimality and stability. Furthermore, a practical distributed algorithm is proposed to steer a network to the unique optimal operating point. Various experiments are provided to illustrate the theory and verify its predictions.

2 - R&D Investment Dynamics under Uncertainty: Theory and Application

Tao Yao, Assistant Professor, The Pennsylvania State University, 349 Leonhard Building, University Park, PA, 16802, United States, taoyao@psu.edu

Strategic R&D Investment under Uncertainty: Collusion and Information Time Lag. Introduce collusion equilibrium under the repeated strategic interactions. Explain several otherwise puzzling innovation market phenomena. Analyze the likelihood of tacit collusion in R&D and note implications for antitrust and merger control. Dynamic R&D Project Selection. Project selection decisions under uncertainty are often made sequentially. Use repeated options to derive optimal rules. Illustrate with a Hybrid Electric Cars vs. Hydrogen Fuel Cell Vehicles example as pursued by GM.

■ SB13

Room 313

Teaching Case Competition II

Sponsor: Education (INFORM-ED)

Sponsored Session

Chair: Tasha R. Inniss, Assistant Professor of Mathematics, Spelman College, 350 Spelman Lane, SW, Box 320, Atlanta, GA, 30126, United States, tinniss@spelman.edu

1 - Presentations of Finalists #3 and #4 for the Seventh Annual INFORMS Case Competition

Tasha R. Inniss, Assistant Professor of Mathematics, Spelman College, 350 Spelman Lane, SW, Box 320, Atlanta, GA, 30126, United States, tinniss@spelman.edu

The FOUR finalists for the 2006 INFORMS Case Competition will deliver final presentations of their teaching cases to a panel of pre-selected judges and the audience. All are welcome to attend and observe these presentations as well as ask questions of the finalists. At the end of the four presentations, the judges will select the winner of the Case Competition. The winners and runners-up will be announced and presented with plaques as well as cash awards at the INFORM-ED Annual Business Meeting.

■ SB14

Room 314

Quality Control

Contributed Session

Chair: Syed Shahabuddin, Professor, Central Michigan University, 1306 E. Preston, Mount Pleasant, MI, 48859, United States, shaha1s@cmich.edu

1 - Design Considerations and Analysis Of Multistage Split-Plot Nanomanufacturing Experiments

Navin Acharya, PhD Candidate, Pennsylvania State University, 445 Waupelani Drive, Apt D-16, State College, PA, 16801, United States, navin@psu.edu, Harriett Nembhard

Many processes in nanomanufacturing are conducted over a series of stages. Specifically, a polymerization process for the fabrication of nano-films is studied. To execute efficient experimentation and fully understand the intricacies at the nano scale, split-plot designs that can be applied effectively over multiple stages are proposed and their characteristics examined. General expressions for some of the properties of these designs and analysis are developed.

2 - Inspection and Quality Improvement in Manufacturing Systems

Jeroen Vits, Research Group Operations Management, Katholieke Universiteit Leuven, Celestijnenlaan 300A, Heverlee, 3001, Belgium, jeroen.vits@cib.kuleuven.be, Philippe Chevalier

We characterize optimal inspection and quality improvement policies for single stage systems and compute inspection and quality improvement thresholds in the presence of imperfect inspection, forgetting and natural learning. For multi-stage systems, we present and evaluate performance of heuristic un-interrupted inspection and quality improvement policies and give thresholds for inspection and quality improvement.

3 - Closed-Loop System Identification for Small Samples with Constraints

Arda Vanli, PhD Student, The Pennsylvania State University, 350 Leonhard Building, University Park, PA, 16802, United States, oav100@psu.edu, Enrique Del Castillo

The traditional approaches to the closed-loop system identification problem require using sufficiently large data sets and general enough model forms while at the same time applying some form of a dither signal to the process. We propose an identification procedure to improve model parameter estimates by incorporating prior knowledge about the process in the form of constraints without the use of a dither signal. A Monte Carlo simulation study is presented to illustrate the method.

4 - Bayesian Modeling of Call Center Arrivals

Refik Soyer, The George Washington University, Funger Hall 415, Decision Sciences, 2201 G Street, NW, Washington, DC, 20052, United States, soyer@gwu.edu, Murat Tarimcilar

A modulated Poisson process model is presented to describe arrivals to a call center. The model takes into account both covariate and time effects on call volume intensity and enables us to assess effectiveness of different advertising strategies along with predicting the arrival patterns. A Bayesian analysis of the model is developed and an extension is presented to consider heterogeneity in arrivals. The model and the methodology are implemented using real call center arrival data.

5 - Sigma Six as a Quality Control Method

Syed Shahabuddin, Professor, Central Michigan University, 1306 E. Preston, Mount Pleasant, MI, 48859, United States, shaha1s@cmich.edu

Sigma Six has been touted as a method to use for quality control. Many researchers and practitioners believe that Sigma Six should be a tool of quality control. The search of the literature shows companies claiming that the use of Sigma Six has saved money and has improved customers' satisfaction. The question many should be asking, however: Is this practical and feasible? My paper will discuss the concept of Sigma Six and the feasibility of its application in real business conditions.

■ SB15

Room 315

Procurement and Combinatorial Auctions I

Cluster: Auctions and e-Commerce

Invited Session

Chair: Aleksandar Pekec, Associate Professor, Duke University, Fuqua School of Business, 1 Towerview Drive, Durham, NC, 27708, United States, pekec@duke.edu

1 - Optimal Procurement Auctions of Divisible Goods with Capacitated Suppliers

Anuj Kumar, Industrial Engineering & Operations Research Department, Columbia University, 500 West 120th Street, New York, NY, 10027, United States, ak2108@columbia.edu, Garud Iyengar

Most of the literature, in procurement auctions (reverse auctions) assumes uncapacitated suppliers. Consequently, in a constant marginal production cost model, these auction mechanisms award the contract to a single supplier. We consider a model with capacitated suppliers where, in addition to the privately known marginal costs, the production capacities are also private information. We construct the optimal direct mechanism that maximizes the retailers expected profits in this model. The solution is closed form under {\it regularity}. The results in this paper are applicable to a number of principle-agent mechanism design problems (for example monopoly pricing with adverse selection, forward auctions) where the agents have privately known upper bound on the allocations. The sealed low bid implementation of the optimal direct mechanism is also presented in symmetric environment. The implementation requires that each supplier submit a bid consisting of the marginal payment sought and total capacity available. These bids serve as the input to a simple optimization problem that computes the quantity allocation for each firm. We extend the model to multi-product procurement with complementarities.

2 - Automated Design of Multistage Mechanisms
Tuomas Sandholm, Carnegie Mellon University, 5000 Forbes Avenue, Pittsburgh, PA, United States, sandholm@cs.cmu.edu, Vincent Conitzer, Craig Boutilier

We extend automated mechanism design to the design of multistage mechanisms. Our approach is based on algorithms for converting single-stage dominant-strategy mechanisms into multistage mechanism. For Bayes-Nash mechanisms, we prove that the preference elicitor may be better off randomizing over queries and hiding elicited results from the agents.

3 - An Evaluation of Competitive Bids in Drywall Construction Trades
Gerald H. Williams, R. Brown Consulting Group, Construction & Engineering Management Research, Inc., 2300 SW First Avenue, Suite 102, Portland, OR, 97212-5047

This paper presents the final results of a study comparing the estimated and actual labor productivity for drywall trades on 400 construction projects in the western US. We document a wide variance in estimated productivities in these trades and attempt to account for variance in actual labor productivities.

4 - Auction Theory in OR/MS Settings
Aleksandar Pekec, Associate Professor, Duke University, Fuqua School of Business, 1 Towerview Drive, Durham, NC, 27708, United States, pekec@duke.edu

Standard auction theory results are sensitive to assumptions important in MS and OR applications. Uncertainty in supply/demand has implications on equilibrium existence and revenue rankings of uniform and discriminatory multi-item auctions. Furthermore, choice of an auction information policy and supply quantities are important parameters for revenue optimization.

■ SB16

Room 316

Topics in Revenue Management and Pricing

Cluster: Dynamic Pricing and Forecasting

Invited Session

Chair: Andrew Boyd, Chief Scientist and Senior Vice President Science and Research PROS, 3100 Main Street, Suite 900, Houston, TX, 77002, United States, aboyd@prosrm.com

1 - Management Issues in Pricing and Revenue Optimization
Brenda Barnes, President, Barnes Consulting Company, 140 E. 28th Street, Suite 10H, New York, NY, 10016, United States, brendaabarnes@gmail.com

Pricing and revenue optimization systems can increase a firm's profitability by 8 to 10 percent when properly implemented and managed. However, a company's results will vary due to environment-specific factors impacting system performance, such as data integrity, analyst intervention, lack of coordination, and operational disruption. We draw on industry experience to identify factors impacting system effectiveness and actions management should take to achieve maximum financial benefits.

2 - A Monopoly's Location and Spatial Pricing Strategies
Binbin Liu, PhD Candidate, Rotman School of Management, University of Toronto, 105 St. George Street, Toronto, ON, M5S 3E6, Canada, binbin.liu02@rotman.utoronto.ca, Dmitry Krass, Oded Berman

A multi-store monopoly's simultaneous pricing and location decisions on networks are studied. Three pricing policies, discriminatory, uniform and mill pricing are considered. We establish nodal optimality of the location decision and find optimal locations and prices under mild conditions. We provide managerial insights regarding when a firm should use discriminatory pricing versus mill or uniform pricing.

3 - The Value of Attaching the Correct Revenue to an Airline Booking
Igor Cakulev, Senior Development Scientist, PROS, 3100 Main Street, Suite 900, Houston, TX, 77002, United States, icakulev@prosrm.com, Andrew Boyd

As a result of the way airline tickets are sold, carriers frequently use an approximation of the revenue they will pocket when they sell a ticket. This raises the question: what is the value of using the exact revenue? The business problem is described and ways to overcome it are discussed, and results are presented showing the achievable revenue improvements.

■ SB17

Room 317

Revenue Management Models

Contributed Session

Chair: Craig Sorochuk, University of Western Ontario, Richard Ivey School of Business, 1151 Richmond Street North, London, ON, N6A 3K7, Canada, csorochuk@ivey.ca

1 - Optimal Pricing of Finite Capacity
Amit Eynan, Professor, University of Richmond, School of Business, Richmond, VA, 23173, United States, aeynan@richmond.edu, Chakravarthi Narasimhan

A firm owns finite capacity for the delivery of services or production of customized products. When a potential buyer indicates the amount of capacity he would like to employ the firm suggests a price while being challenged by lack of exact information regarding buyer's reservation price (only its distribution is known), and future requests from additional potential buyers. Managerial insight regarding the optimal price and potential profit increase are provided.

2 - Revenue Management with Multiple Capacity Dimensions
Wei Yang, Assistant Professor, Long Island University at C.W. Post, 720 Northern Boulevard, Brookville, NY, 11548, United States, Wei.Yang@liu.edu, Baichun Xiao

In container shipping, air cargo management, trucking and health care industry products or services possess multiple capacity attributes. We formulate the revenue management problem with multiple capacity features into a continuous-time stochastic control model. We derive the optimal solution in closed form and show that considering both price and demand intensity the optimal policy is of threshold and displays a significant difference when the remaining capacity-mix varies.

3 - Revisiting Robustness of Capacity Rationing Models
Mehmet Barut, Wichita State University, 1845 Fairmount, 324 Clinton Hall, Wichita, KS, 67260-0077, United States, mehmet.barut@wichita.edu, Mehmet Bayram Yildirim, V Sridharan

The goal of this study is to investigate the power and generalizeability of the existing stochastic models, developed for capacitated order management in MTO environment; and to see if these models can be used as a tool for strategic exit. The study uses a locked two-step process: a simulation model and a mathematical model; relaxes the assumption of decreasing demand over time; and provides statistical evidence for the performance of current models under variety of demand patterns.

4 - Fencing in the Context of Revenue Management
Michael Zhang, Saint Mary's University, 903 Robie Street, Halifax, NS, B3H1Y5, Canada, mzhang@ivey.uwo.ca

Market segmentation is a key strategic element in the practice of revenue management. After being identified, market segments should be kept separate to prevent demand spillover from high priced segments to low priced segments. Tools to restrict customer migration across segments are referred as fences. The purpose of this study is to address managerial implication for RM from a fencing perspective. The pertinent issues surround fences are explored.

5 - Revenue Management in Sports
Craig Sorochuk, University of Western Ontario, Richard Ivey School of Business, 1151 Richmond Street North, London, ON, N6A 3K7, Canada, csorochuk@ivey.ca, John Wilson

While revenue management has been well-studied and applied to the airline and hotel industries for years, its applications in sports industries are relatively sparse. Given that the four major sports leagues in North America (MLB, NBA, NFL and NHL) comprise a $10 billion+ industry, there are certainly opportunities for implementation of revenue management techniques. This presentation includes a literature survey and outlines potential avenues of research of revenue management in sports.

■ SB18

Room 318

Models of Energy Markets

Sponsor: Energy, Natural Resources & The Environment

Sponsored Session

Chair: David Fuller, Professor, Department of Management Sciences, University of Waterloo, 200 University Avenue W., Waterloo, ON, N2L 3G1, Canada, dfuller@engmail.uwaterloo.ca

1 - Finding Supply Function Equilibrium in Electricity Markets using an AC Approach

Miguel Anjos, Assistant Professor, University of Waterloo, 200 University Avenue West, Waterloo, ON, N2L 3G1, Canada, anjos@stanfordalumni.org, Anthony Vannelli, Guillermo Bautista

Using an AC transmission network, oligopolistic competition in power markets is formulated as a Nonlinear Programming (NLP) problem, and characterized by a multi-leader single-follower game. The transmission network is modelled with a detailed nonlinear system. For the game setting, a supply function equilibrium approach is used.

2 - Models of Efficient Pricing Schemes in Electricity Markets

Emre Celebi, Department of Management Sciences, University of Waterloo, 200 University Avenue West, Waterloo, ON, N2L3G1, Canada, ecelebi@engmail.uwaterloo.ca, David Fuller

This presentation will examine the mixed complementarity programming models of equilibrium in competitive electricity markets that can bridge the speed of response gap between suppliers and consumers, yet adhere to the principle of marginal cost pricing. A computable equilibrium model is developed to estimate the time-of-use (TOU) prices that can be used in retail electricity markets. Also strategic interactions among suppliers are examined within this model (e.g., Cournot, Stackelberg).

3 - Variational Inequality Formulations of Energy Market Models: A Decomposition Approach

David Fuller, Professor, Department of Management Sciences, University of Waterloo, 200 University Avenue W., Waterloo, ON, N2L 3G1, Canada, dfuller@engmail.uwaterloo.ca, William Chung

We outline a new decomposition method for variational inequalities that represent a generalized Nash equilibrium, i.e., with constraints that link the Nash players. The subproblems are ordinary optimization models, which, for many energy market models, are the starting point of the modelling process; this observation simplifies the process of defining the whole VI model. We illustrate with a Nash-Cournot model of an electricity market.

4 - A Day Ahead Electricity Market with Reserve Shortage Pricing

Jichen Zhang, Department of Management Sciences, University of Waterloo, 200 University Avenue West, Waterloo, ON, N2L3G1, Canada, j36zhang@engmail.uwaterloo.ca, Samir Elhedhli, David Fuller

We present a large-scale multi-period stochastic linear programming model for scheduling the electric energy in a day-ahead electricity market. The model considers various scenarios and integrates the idea of reserve shortage pricing based on reserve shortage level in real time. Numerical results are discussed.

■ SB19

Room 319

Forestry Applications II

Sponsor: Energy, Natural Resources & The Environment

Sponsored Session

Chair: Robert Haight, Research Forester, USDA Forest Service, North Central Research Station, 1992 Folwell Avenue, St. Paul, MN, 55108, United States, rhaight@fs.fed.us

1 - Using Markowitz Portfolio Optimization to Guide Reforestation Under Multiple Climate Change Scenario

Kevin Crowe, Assistant Professor, Faculty of Forestry, Lakehead University, 955 Oliver Road, Thunder Bay, ON, P7B 5, Canada, kcrowe1@lakeheadu.ca, William Parker

A major difficulty of planned adaptation to climate change arises from the uncertainty of estimated changes in climate parameters. The general problem addressed by this study is that of designing a decision support system to select an optimal set of seed sources to be used in regenerating forests in an environment of multiple, equally plausible future climates.

2 - Multi-Objective Optimization as an Aid to Sell Non-Timber Forest Benefits in New Zealand

Sandor Toth, Assistant Professor, Oklahoma State University, Stillwater, OK, 74078, United States, sft108@psu.edu

Many argue that developing a capability to value and market the environmental benefits of forests could alleviate some of the problems associated with forest degradation and land-use conversions. Multi-objective harvest scheduling models can help landowners sell non-timber forest benefits by quantifying the tradeoffs and opportunity costs of producing these services. We will demonstrate how biodiversity and carbon credits could be marketed using this approach in New Zealand.

■ SB20

Room 320

Portfolio Decision Analysis

Sponsor: Decision Analysis Society

Sponsored Session

Chair: Jeffrey Keisler, Assistant Professor, University of Massachusetts Boston, MSIS Department, 100 Morrissey Boulevard, Boston, MA, 02125, United States, Jeff.Keisler@umb.edu

1 - Participatory Priority-Setting Processes with Robust Portfolio Modeling

Ahti Salo, Professor, Helsinki University of Technology, Systems Analysis Laboratory, PO Box 1100, Otakaari 1 M, Espoo, 02015, Finland, ahti.salo@hut.fi

The collaborative development of research priorities typically involves high uncertainties, multiple objectives and a large number of participants. We report case studies where internet-based decision aiding tools, Robust Portfolio Modelling and participatory workshops have served to inform the development of national priorities. We also discuss network-oriented portfolio decision analyses, with examples from an international consultation process involving over 400 participants from 8 countries.

2 - Constructing Organisational Preferences: Within-Criterion Weighting in Multi-Criteria Portfolio

Alec Morton, A.Morton@lse.ac.uk, Lawrence Phillips

Decision Analysis often helps people discuss what precisely constitutes value for their organisation. Decision Conferencing in particular uses multiple workshops with multiple areas of the organization to develop a value model. Locally assessed valuations may require "within-criterion weights" to arrive at a global value scale. We shall interpret these weights, and explore their ability to reduce error, and the appropriateness of different ways of structuring an intervention which uses them.

3 - Analyzing a Portfolio Decision Process

Jeffrey Keisler, Assistant Professor, University of Massachusetts Boston, MSIS Department, 100 Morrissey Boulevard, Boston, MA, 02125, United States, Jeff.Keisler@umb.edu, Jeffrey Stonebraker

We obtained summary data from prior decision analyses of the entire new product pipeline at a major pharmaceutical company. These data include success probabilities for different phases of development, and estimates of cost and market value, coupled with information about project maturity, therapeutic area, etc. We analyze this data to characterize the portfolio and identify where high quality estimates are critical. This yields recommendations for decision process improvement.

■ SB21

Room 321

Ideas Relevant to Multiattribute Decision Analysis Practice

Sponsor: Decision Analysis Society

Sponsored Session

Chair: Ralph Keeney, Research Professor, Fuqua School of Business, Duke University, Box 90120, Durham, NC, 27708-0120, United States, keeney@duke.edu

1 - The Role of Multi-Criteria Decision Analysis in Helping the Committee on Radioactive Waste

Lawrence Phillips, Professor, London School of Economics & Political Science, Department of Operational Research, Houghton Street, London, NW3 1AH, United Kingdom, larry_phillips@msn.com

This paper reports on the largest public consultation exercise ever undertaken in the United Kingdom, with emphasis on the role of multi-criteria decision analysis (MCDA) in helping the Committee on Radioactive Waste Management (CoRWM) to recommend how the country's accumulating high-level and medium-level radioactive waste should be managed.

2 - Bidirectional Utility Diagrams
Ali Abbas, Assistant Professor, College of Engineering, University of Illinois-Urbana Champaign, 104 S. Mathews Avenue, Urbana, IL, 61822, United States, aliabbas@uiuc.edu

We present a graphical representation of multiattribute utility functions that captures the asymmetric nature of utility dependence. This representation facilitates the elicitation of multiattribute utility functions and enables their decomposition into lower order terms that are easier to elicit by knowledge of utility independence relations among the attributes.

3 - Specifying Objectives for Decisions is not Easy
Ralph Keeney, Research Professor, Fuqua School of Business, Duke University, Box 90120, Durham, NC, 27708-0120, United States, keeney@duke.edu, Kurt Carlson, Samuel Bond

Our recent experiments indicate that many individuals cannot list an appropriate set of objectives for their own important decisions. Individuals identify only about half of their objectives. Furthermore, using their own priorities, they omit objectives as important as those they identify. Suggestions for improving the specification of objectives are given.

■ SB22

Room 322

Mission and Means Framework - Applications

Sponsor: Military Applications

Sponsored Session

Chair: William Yeakel, President, ORSA Corporation, 1003 Old Philadelphia Road, Suite 103, Aberdeen, MD, 21001, United States, wpy@orsacorp.com

1 - Using the Missions and Means Framework to Determine Value Added of Systems of Systems
Britt Bray, Senior Military Analyst, DRC, 106 S. 5th Street, Leavenworth, KS, 66048, United States, BBray@drc.com, Paul Tanenbaum

The MMF enables front end analysis of missions to determine required capabilities and measure effectiveness. The MMF helps analysts generate the most important questions to be answered. It provides a logical framework to store and understand the logical relationships between the data collected and document and understand the relationships between Systems of Systems (SOS) and the processes that employ them. This paper will describe how the MMF can be applied to determine value added of SOS.

2 - Missions and Means Framework (MMF): Live-Fire Test and Evaluation Strategies
Martha K. Nelson, Associate Professor, Franklin & Marshall College, Department of Business, Organizations, and Society, Lancaster, PA, 17604-3003, United States, martha.nelson@fandm.edu, Dennis C. Bely

A methodology for constructing cost-effective live-fire test and evaluation (LFT&E) programs within the MMF environment is presented. Issues addressed include the design and execution of LFT&E programs to ensure the collection of data relevant to the assessment of system vulnerability/lethality and the evaluation of test results in a format useful to decision-makers concerned with accomplishing system of systems collective tasks and achieving mission success in the joint environment.

■ SB23

Room 323

CONDIE (Committee on Next Decade in Industrial Engineering) Progress Report

Cluster: New Frontiers at the Intersection of Industrial Engineering and O.R.

Invited Session

Chair: Lawrence Seiford, Professor and Chair, University of Michigan, 1205 Beal Avenue, Ann Arbor, MI, 48109-2117, United States, seiford@umich.edu

1 - Panel: CONDIE Progress Report
Moderator: Lawrence Seiford, Professor and Chair, University of Michigan, 1205 Beal Avenue, Ann Arbor, MI, 48109-2117, United States, seiford@umich.edu

The Committee on the Next Decade in Industrial Engineering (CONDIE) was formed to help ensure that academia will be able address areas of critical need in both research and education over the coming decade. CONDIE will serve as a continuing forum for applied dialog and deliberate action focused on facilitation of a timely response to national need, while advancing the frontier of engineering research.

■ SB24

Room 324

Cultural Pragmatics in Professions

Sponsor: Organization Science

Sponsored Session

Chair: Klaus Weber, Assistant Professor of Management and Organizations, Kellogg School of Management, Northwestern University, 2001 Sheridan Rd, Evanston, IL, 60208-2001, United States, klausweber@northwestern.edu

Co-Chair: Amit Nigam, Post Doctoral Researcher, Rotman School of Management, University of Toronto, 105 St. George Street, Toronto, ON, M5S 3E6, Canada, amit.nigam@rotman.utoronto.ca

The papers in this session examine the cultural pragmatics, the skillful use of cultural elements for social outcomes, in the context of professional and occupational groups.

1 - Redefining Professional Control: Clinical Guidelines, Quality Measures and the Scope for Professional Judgment
Amit Nigam, Post Doctoral Researcher, Rotman School of Management, University of Toronto, 105 St. George Street, Toronto, ON, M5S 3E6, Canada, amit.nigam@rotman.utoronto.ca

This paper looks at the changing nature of professional controls in a period of institutional change by focusing on changes in the medical profession in the shift to managed care in the United States. It shows that the medical profession shifts from defining quality based on the training and skills of physicians, towards defining it based on clinical guidelines and quality measures. It discusses the implications of each approach to quality for professional judgment and discretion.

2- Designing a Frame: Rhetorical Strategies of Architects for Client Engagement
Candace Jones, Carroll School of Management, Boston College, Fulton Hall 510, 140 Commonwealth Avenue, Chestnut Hill, MA, 02467, United States, jonescq@bc.edu, Reut Livne-Tarandach

We examine how architectural firms framed their qualifications when competing for projects. Our exploratory analysis of firms' rhetorics identified a limited number of key words, when framing their qualification for clients. Our exploratory analyses revealed that architectural firms used a severely limited number of key words to signal multiple competencies, design among them, and to resolve competing demands such as creativity, functionality and cost.

3 - Marks of Distinction: Style as a Source of Status among Security Analysts, 1986-2005
Simona Giorgi, Northwestern University, Kellogg School of Management, 2001 Sheridan Road, Evanston, IL, 60208, United States, s-giorgi@northwestern.edu, Klaus Weber

The study examines the performative basis of status in occupational communities, status that derives from the style with which an actor performs a job. We examine status dynamics among securities analysts specializing in biotechnology using text analysis of analysts' reports. We find that stylistic elements such as the rhetorical packaging of reports are associated with status if they resonate with audience values.

■ SB25

Room 325

Panel Discussion: OR Entrepreneurship #2

Cluster: OR Entrepreneurship

Invited Session

Chair: James Kelly, CEO, OptTek Systems Inc., 1919 Seventh Street, Boulder, CO, 80302, United States, Kelly@opttek.com

1 - Panel Discussion: Entrepreneurship in OR/MS - Lessons Learned
Moderator: James Kelly, CEO, OptTek Systems Inc., 1919 Seventh Street, Boulder, CO, 80302, United States, Kelly@opttek.com, Panelists: Dennis Pegden, Ron Laughery, Mark Elder, James Franklin

Many members of INFORMS have worked in an entrepreneurial capacity. Some have started and/or grown companies on a full-time/ or part-time basis. The purpose of this session is to recount some of the stories associated with these activities and to discuss common experiences, obstacles, and strategies. This group has a particular focus on products and services related to simulation and optimization.

■ SB26

Room 326

Data Mining and Statistical Modeling in Environmental Problems

Sponsor: INFORMS Computing Society/Data Mining
Sponsored Session

Chair: Seoung Bum Kim, Assistant Professor, Industrial & Manufacturing Systems Engineering, The University of Texas at Arlington, PO Box 19017, Arlington, TX, 76019, United States, sbkim@uta.edu

1 - Space-Time Modeling of Total Column Ozone Levels
Mikyoung Jun, Assistant Professor, Department of Statistics / Texas A&M University, College Station, TX, 77843, United States, smiky1008@gmail.com

For space-time processes on global or large scales, it is critical to respect the Earth's spherical shape. The cov fns of such processes should not only be positive definite, but be capable of capturing the dynamics. We develop space-time cov fns on sphere-time that are flexible for space-time interactions, especially space-time asymmetries. Our approach yields explicit expressions for cov fns, which has great advantages in computation. We apply our model to global total column ozone levels.

2 - Characterization of Spatial and Temporal Patterns of PM2.5 in the Continental United States
Chivalai Temiyasathi, PhD Student, Industrial & Manufacturing Systems Engineering/University of Texas at Arlington, Arlington, TX, 76019, United States, chivalai.temiyasathit@uta.edu, Seoung Bum Kim

Statistical analyses for time series or spatial data have been widely used to investigate the behavior of ambient air pollutants. The main objective of this study is to characterize the spatial correlation and the temporal pattern of PM2.5. Clustering analysis with correlation distance was performed to group the monitoring stations where the clustered stations have similar temporal patterns over the monitoring period. Moreover, the temporal patterns in each clustered region were investigated.

3 - The Impact of Peaking Electrical Generating Units in Northeast
Alper Unal, MACTEC Inc., Trenton, NJ, United States, Alper.Unal@dep.state.nj.us

Electric Generating Units are one of the highest contributors of air pollutants, especially for NOX and SO2. Under certain conditions their impact on air quality might be significant. In this study, our aim is to quantify uncertainty in EGU emissions. For this we have developed unit specific temporal profiles, using hourly data for Northeastern United States. This paper will present detailed analysis emission processing as well as its implications on air quality through CMAQ model.

4 - Discovery of Preference Information via Data Mining Techniques in Multi Criteria Decision Making
Ozge Kaplan, PhD Candidate, Department of Civil, Construction and Environmental Engineering, North Carolina State University, Raleigh, NC, United States, pokaplan@eos.ncsu.edu, S. Ranji Ranjithan

An iterative method that integrates data mining algorithms with optimization methods is developed to help decision makers (DMs) find the best compromise solution. DMs' rankings of systematically generated Pareto- and near-Pareto-optimal alternatives are processed using data mining algorithms to discover DMs' implicit preferences, both in objective space and decision space. These rankings are then used in the search method. This method is being applied to a solid waste management problem.

■ SB27

Room 327

Process Mining

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: Mary Leitnaker, Professor, University of Tennessee, Department of Statistics, Knoxville, TN, 37996, United States, leitnake@utk.edu

1 - Statistical Analyses for Process Improvement: A Distillation Case Study
Nitin Kaistha, Assistant Professor, Indian Institute of Technology, Department of Chemical Engineering, Kanpur, 208016, India, nkaistha@iitk.ac.in, Mary Leitnaker

Distillation is the most ubiquitous of unit operations in the chemical industry. An array of statistical tools ranging from univariate to multivariate methods can be used to evaluate the historical data for expected column behavior and to decipher signatures in the common cause variability that indicate problems presenting opportunities for process improvement. This session focuses on the engineering issues that must be considered in tailoring the statistical analyses towards that end.

2 - EWMA and CUSUM Control Chart Using Wavelets for Complicated Functional Data
Young S. Jeong, Student, University of Tennessee, 309 EST, Knoxville, TN, 37996, United States, yjeong@utk.edu, Myong K. Jeong, Mary Leitnaker

This paper extends the adaptive thresholding to the versions of the exponentially weighted moving average (EWMA) and cumulative sum (CUSUM) control for process monitoring based on functional data. Simulation studies show that proposed methods quickly detect smaller local and vertical shifts.

■ SB28

Room 328

Best Student Paper Presentation Session

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: Judy Jin, Associate Professor, Department of Industrial and Operations Engineering, University of Michigan, IOE 2855, Ann Arbor, MI, 48109, United States, jhjin@umich.edu

1 - Robust Synthesis of Nanostructures
Tirthankar Dasgupta, PhD Student, Georgia Institute of Technology, 765 Ferst Drive NW, Atlanta, GA, 30332, United States, tdasgupt@isye.gatech.edu, Christopher Ma, Roshan Vengazhiyil, Zhong Lin Wang, Jeff C. F. Wu

An effort is made to systematically investigate the best process conditions that ensure large-scale synthesis of different types of nanostructures. Models linking the probabilities of obtaining specific morphologies to the process variables are developed. A new iterative algorithm for fitting a Multinomial GLM is proposed and used. The optimum process conditions that are robust with respect to inner noise are derived from the fitted models using Monte-Carlo simulations.

2 - Robust Parameter Design for Quality Variables and Reliability Measures
Lingyan Ruan, Ph.D. Student, Georgia Institute of Technology, Industrial and Systems Engineering, 765 Ferst Drive, Box 0205, Atlanta, GA, 30332, United States, gth668y@mail.gatech.edu, Jye-Chyi (JC) Lu

The literature in design of experiment (DOE) considering both quality and reliability metrics is scarce. Although product reliability is as important as quality, especially for electronic or semiconductor devices, robust parameter designs (RPD) are primarily applied to quality measures. Moreover, typical DOE for accelerated degradation tests (ADTs) does not explore impact of changing manufacturing conditions on product reliability. This article develops DOE plans for manufacturing variables and ADT conditions to minimize variance of parameter estimates and RPD optimizations for selecting controllable manufacturing variables to achieve longest product lifetime and reduce variations induced by environmental noise.

3 - Defect Pattern Recognition in Semiconductor Fabrication using Model-based Clustering and Bayesian
Tao Yuan, The University of Tennessee, tyuan@utk.edu, Way Kuo

Spatial defect patterns on semiconductor wafers contain useful information about potential problems in the manufacturing processes. This study proposes to use model-based clustering via Bayesian inference for detecting defect patterns. The new clustering method detects the defect clusters and identifies the pattern of each cluster automatically. Promising results are obtained through simulation studies.

4 - Design of DOE-based Automatic Process Controller with Consideration of Model Uncertainties
Jing Zhong, University of Michigan, jzhong@engin.umich.edu, Jianjun Shi, Jeff Wu

This paper developed a DOE-based automatic process control scheme considering both observation and modeling uncertainties. The simulation demonstrates that considering the uncertainties, automatic controllers can achieve better process performance than conventional off-line design, and more stable than normal APC controllers. The proposed approach is illustrated using an industrial process.

■ SB29

Room 329

Healthcare Engineering to Inform Policymakers

Cluster: Joint Cluster Healthcare/ HAS: Healthcare Engineering
Invited Session

Chair: Julie Swann, Assistant Professor, Georgia Institute of Technology, Industrial and Systems Engineering, Atlanta, GA, 30332, United States, julie.swann@isye.gatech.edu

Co-Chair: Daniel Faissol, PhD Student, Georgia Institute of Technology, School of ISyE, Atlanta, GA, 30332, United States, dfaissol@isye.gatech.edu

1 - The Benefits of a Time-Varying Objective Function: Harm Reduction Over the Course of a Drug Epidemic
Jon Caulkins, Professor of Operations Research and Public Policy, Heinz School of Public Policy and Management, Carnegie Mellon University - Qatar, PO Box 24866, Doha, Qatar, caulkins@andrew.cmu.edu, Andrea Seidl, Gernot Tragler, Dagmar Wallner

A central debate in drug policy concerns the relative merits of "harm reduction" (e.g., HIV/AIDS control) vs. "use reduction" (controlling use per se). This paper models whether shifting emphasis over the course of a drug epidemic can improve outcomes for heroin in Australia and cocaine in the US.

2 - Optimizing Pediatric Vaccine Formularies
Sheldon Jacobson, Professor, University of Illinois, 201 N. Goodwin Avenue, Urbana, IL, 61801, United States, shj@uiuc.edu, Edward Sewell, Shane Hall

This presentation introduces the Vaccine Formulary Selection with Limited Budget Problem for obtaining the optimal childhood immunization vaccine formulary. The model that is formulated allows public health policy makers and pediatricians to evaluate the combinatorial explosion of vaccine choices spawned by the development of combination vaccines.

3 - Quantifying the Routes of Transmission and Assessing Nonpharmaceutical Interventions for Influenza
Lawrence Wein, Paul E. Holden Professor of Management Science, Graduate School of Business, Stanford University, 518 Memorial Way, Stanford, CA, 94305, United States, wein_lawrence@gsb.stanford.edu, Michael Atkinson

We construct a hierarchical model for pandemic influenza, which embeds a three-compartment model of the household within a household epidemic model. We use data to quantify airborne vs. contact transmission for influenza, and assess the effectiveness of various nonpharmaceutical interventions within the household during a pandemic influenza outbreak.

4 - The Cost Effectiveness of Screening Newborns for Genetic Diseases Using Tandem Mass Spectrometry
Greg Zaric, Professor, Ivey School of Business, University of Western Ontario, London, ON, Canada, gzaric@ivey.uwo.ca, Tony Rupar, Lauren Cipriano

We developed a model to investigate the health effects, costs and cost effectiveness of using tandem mass spectrometry (MS/MS) to screen for "bundles" of up to 21 diseases. We found that it is not cost effective to use MS/MS to screen for a single disease, but there are many bundles of diseases for which the average cost effectiveness is between $50,000 and $100,000 per life year gained. It is not cost effective to screen for all diseases that can be tested for using MS/MS.

■ SB30

Room 330

Pierskalla Award Presentations

Sponsor: Health Applications Section
Sponsored Session

Chair: Julie Simmons Ivy, Assistant Professor, University of Michigan, 701 Tappan Street, Ann Arbor, MI, 48109, United States, jsimmons@bus.umich.edu

1 - A Mean-Variance Model to Optimize the Fixed vs. Open Appointment Percentages in an Open-Access Clinic
Xiuli (Shelly) Qu, Purdue University, 315 N. Grant Street, West Lafayette, IN, 47906, United States, qu@ecn.purdue.edu, Ronald L. Rardin, Julie A. S. Williams

To improve the accessibility to outpatient clinics, open access scheduling provides open appointment slots for short-notice scheduling. To determine the percentage of open appointments, we introduce a mean-variance model, and develop a procedure to search all Pareto optimal solutions to the model. Our numerical results show that provider capacity and average demand for open appointments considerably affect the Pareto optimal expectations and variances of the number of patients consulted.

2 - An Analysis of the Pediatric Vaccine Supply Shortage Problem
Sheldon Jacobson, Professor, University of Illinois, 201 N. Goodwin Avenue, Urbana, IL, 61801, United States, shj@uiuc.edu, Edward Sewell, Ruben Proano

The impact of pediatric vaccine stockpile levels on immunization coverage rates is analyzed. The results suggest that the CDC/HHS proposed vaccine stockpile levels are adequate for production interruptions that last no more than six months. However, given that recent production interruptions have lasted (on average) for over one year, the proposed stockpile levels are insufficient during such time periods, which in turn could lead to disease outbreaks.

3 - Dynamic Multi-Priority Patient Scheduling with Uncertain Demand
Jonathan Patrick, PhD, University of British Columbia, 1215 Duthie Avenue, Burnaby, BC, V5A 2R5, Canada, jonathan.patrick@sauder.ubc.ca, Martin L. Puterman, Maurice Queyranne

We present a method for scheduling multi-priority patients to a diagnostic facility in a public health setting. Rather than maximize revenue, the resource manager seeks to allocate capacity so that waiting time targets are met. Our research involves modeling the scheduling process as an MDP and applying approximate dynamic programming methods. We present the optimal linear approximation for two cost structures as well as the resulting booking policy for achieving the waiting time targets.

■ SB31

Room 331

Topics in Portfolio Optimization

Cluster: Financial Engineering and Risk Management
Invited Session

Chair: John R. Birge, Professor, University of Chicago, Graduate School of Business, 5807 S. Woodlawn Avenue, Chicago, IL, 60637, United States, john.birge@chicagogsb.edu

1 - Hedging Multi-Period Guarantees in the Presence of Transaction Costs via Stochastic Programming
Stein-Erik Fleten, Associate Professor, NTNU Norway, IØT, Alfred Getz v. 3, Trondheim, NO, NO-7491, Norway, stein-erik.fleten@iot.ntnu.no, Snorre Lindset

Multi-period guarantees are often embedded in life insurance contracts. For the multi-period guarantee there is a rather large rebalancing of the hedge portfolio as we go from one period to the next. By introducing transaction costs, the size of this rebalancing is reduced. Transaction costs may therefore be one possible explanation for why we do not see the insurance companies performing a large rebalancing of their investment portfolio at the end of each year.

2 - The Impact of Consumption and Liquidity Constraints on Optimal Consumption and Investment Decisions
Amit Bhandari, Northwestern University, 2145 N Sheridan Rd, Evanston, IL, United States, amit@iems.northwestern.edu, John R. Birge

Both individual and institutional investors face a number of constraints in their consumption and investment decisions. We look at well-motivated constraints on the consumption process as well as liquidity constraints and study their impact on optimal consumption and investment policies under a dynamic discrete time setting.

3 - Portfolio Selection Problem with Transaction Costs: An Option Pricing Approach
Zhen Liu, PhD Candidate, Northwestern University, 2145 Sheridan Road, Department of IE/MS, Evanston, IL, 60208, United States, zliu@northwestern.edu, John R. Birge

We studied the modeling and numerical solution of portfolio selection problem with various transaction costs: In analogous to American option pricing problems, our problem is modeled as buy-and-hold portfolio problems plus optimization ones. Buy-and-hold problems are solved by Local Discontinuous Galerkin method to achieve higher order of accuracy. We incorporate transaction costs in the optimization problems to find the non-trade region. Last convergence of our algorithm will be discussed.

4 - Simulation of Cointegrated Returns for Fund-of-Funds Construction Under Different Risk Measures
Alexander Galenko, University of Texas at Austin, 1 University Station, C2200, Austin, TX, 78712, United States, agalenko@gmail.com, Elmira Popova, Ivilina Popova

We construct a new sampling algorithm for cointegrated hedge funds returns and create a portfolio of funds using different risk measures. We compare the performance of this portfolio when the returns are assumed to be correlated.

■ SB32

Room 332

Consumer Level Financial Modeling

Sponsor: Financial Services

Sponsored Session

Chair: Aparna Gupta, Assistant Professor, Rensselaer Polytechnic Institute, 110 8th Street, Troy, NY, 12180, United States, guptaa@rpi.edu

1 - Credit Risk Modelling for Portfolios of Consumer Loans

Lyn Thomas, Professor of Management Science, School of Management, University of Southampton, Southampton, SO17 1 BJ, United Kingdom, L.Thomas@soton.ac.uk

There are more models on credit risk in portfolios of corporate loans compared to consumer loans, even though lending in the latter is 70% higher. We describe three approaches to building such models which have some relationship with structural models, reduced form default mode models and reduced form mark to market models in the corporate case even though they differ substantially from such models. The performance of the models using UK consumer lending data is investigated.

2 - A Wealth Risk Management Framework to Achieve Protective and Aspirational Objectives

Aparna Gupta, Assistant Professor, Rensselaer Polytechnic Institute, 110 8th Street, Troy, NY, 12180, United States, guptaa@rpi.edu, Zhisheng Li

This paper formulates a wealth allocation framework to achieve downside wealth protection as well as an upside potential of affluence. Three risk dimensions are identified from the perspective of individual investors — protective, market and aspirational — and available assets are classified into these based on their risk-return profiles. All risk dimensions are optimized simultaneously through appropriate allocation of total wealth in the three asset groups.

3 - Using Customer Goals to Determine an Appropriately Risky Strategy

Sergio Granville, Power Systems Research Institute, granville@psr-inc.com, Mike McCoy

This presentation describes the on-going search for better investment strategies when there is a perceived skew in intermediate market returns. The original implementation was to sell the missing tail of the return distribution. Marketing this idea uncovered the customer concern expressed as "picking up nickels in front of a steam roller". This reality check lead to a reshaping of the problem. Is there an investment strategy that meets customer goals, with risk tolerable to the customer?

■ SB33

Room 333

Delay Models for Aviation Operations

Sponsor: Aviation Applications

Sponsored Session

Chair: David Lovell, Associate Professor, University of Maryland, Department of Civil Engineering, 1173 Martin Hall, College Park, MD, 20742, United States, lovell@eng.umd.edu

1 - Identification and Adjustment of Inaccurate Airport Arrival Capacities

Andrew Churchill, Graduate Research Assistant, University of Maryland, College Park, MD, 20742, United States, churchil@umd.edu, David Lovell, Michael Ball, Avijit Mukherjee

Modeling flight delays and cancellations at an airport using statistical and analytical methods require as input the airport capacity during different time intervals of a day. In this paper, we present a statistical model to estimate the arrival capacity of an airport during any time interval, based on several factors such as runway configuration, meteorological conditions, etc. We show that these estimates reduce the prediction error of existing models for delays and cancellation.

2 - Relationship Between En Route Delay and System Delay in the NAS

Mark Hansen, Professor, University of California at Berkeley, Civil and Environmental Engineering, 114 McLaughlin Hall, Berkeley, CA, 94720, United States, mhansen@ce.berkeley.edu, Helen Yin

As air traffic increases, en route bottlenecks are becoming increasingly important factors in NAS operating performance. In cases where airports are also bottlenecks, the system effect of en route bottlenecks and the delays resulting from them depend on the details of their timing in relation to queuing conditions at the destination airport. We present a simple method for measuring the system effect of an en route delay and results of measurements using this method.

3 - Analysis of Air Transportation System Delay

John-Paul Clarke, Associate Professor, Georgia Institute of Technology, School of Aerospace Engineering, 270 Ferst Drive, Atlanta, GA, 30332, United States, john-paul.clarke@ae.gatech.edu, Terran Melconian

Flight delays are a growing problem in the US air transportation system. However, the complex interactive nature of the system makes it difficult to quantify the systemwide impact of specific delays from historical data. We present the results of a study where the impact of given absolute and relative delays are quantified through simulation for the different phases of operation, thereby enabling a comparison of the likely effectiveness of delay reducing technologies.

4 - Improving the Performance of Monitor Alert: Estimating Delay Distributions for Wheels-up Time

Yufeng Tu, Graduate Research Assistant, R. H. Smith School of Business, University of Maryland, College Park, MD, 20742, United States, ytu@rhsmith.umd.edu, Michael Ball, Wolfgang Jank

In this paper we present an extension of our previous approach for estimating flight departure delay distributions. Our models include componenets for seasonal trend, daily propagation and day-of-the-week effects. We also explore flight auto-correlations as a means toward creating a dynamically reactive model.

■ SB34

Room 334

Transportation Infrastructure Management

Sponsor: Transportation Science & Logistics

Sponsored Session

Chair: Pablo L. Durango-Cohen, Assistant Professor, Northwstern University, 2145 Sheridan Road, A335, Evanston, IL, 60208-3109, United States, pdc@northwestern.edu

1 - A Dynamic Infrastructure Performance Model for Evaluating Maintenance Effectiveness and Poolability

Chih-Yuan Chu, Student, Northwestern University, 2145 Sheridan Road, Evanston, IL, 60208, United States, jameschu@northwestern.edu, Pablo L. Durango-Cohen

The paper uses state-space specifications of time series and develops dynamic, stochastic, multivariate infrastructure performance models that capture the effectiveness of maintenance activities, exogenous factors and uncertainty. A fully and a partially aggregated specifications are proposed. Their predictive power and poolability of data are evaluated by a benchmark model.

2 - Determining Economic Maintenance Schedule for Interdependent Components

Pattharin Sarutipand, Student, Northwestern University, 2145 Sheridan Road, Evanston, IL, 60208, United States, p-sarutipand@northwestern.edu, Pablo L. Durango-Cohen

Optimal group maintenance policies for a system of functionally interdependent components are considered. We formulate the problem as a constrained nonlinear mixed-integer programming. A heuristic method is proposed for coordinating maintenance schedules for the clusters of components. An example is given to illustrate the method.

3 - An Analytical Solution for the Finite-Horizon Pavement Resurfacing Planning Problem

Yanfeng Ouyang, Assistant Professor, University of Illinois at Urbana-Champaign, 205 N. Mathews Avenue, Urbana, IL, 61801, United States, yfouyang@uiuc.edu, Samer Madanat

This paper presents an analytical approach for planning highway pavement resurfacing activities in the case of continuous pavement state and continuous time. It derives analytical optimality conditions and develops a simple algorithm to solve for the optimal resurfacing frequency and intensity that minimize life-cycle costs in a finite horizon.

4 - Un-Staffed Facilities in the National Airspace System: Current Status and Future Work

Jasenka Rakas, University of California at Berkeley, NEXTOR, 107B McLaughlin Hall, Berkeley, CA, 94720, United States, jrakas@berkeley.edu, Gautam Gupta

This study develops a sampling methodology to comprehensively evaluate over 9000 unstaffed facilities of the National Airspace System infrastructure assets. Because the FAA has near accurate information for some of the facilities with very high repair costs, we define a sampling methodology for the rest of the facilities based on such incomplete data. We approach the problem as an exercise in stratified sampling, with each strata representing certain set of facility over a region.

■ SB35

Room 335

Models and Methods for Road Pricing: I

Sponsor: Transportation Science & Logistics

Sponsored Session

Chair: Yafeng Yin, Assistant Professor, University of Florida, 365 Weil Hall, Box 116580, Gainesville, FL, 32611, United States, yafeng@ce.ufl.edu

1 - Dynamic Tolling Strategies for Managed Lanes

Yingyan Lou, University of Florida, Department of Civil & Costal Engineering, University of Florida, Gainesville, FL, 32611, United States, yingyan@ufl.edu, Yafeng Yin

This paper proposes two practical but sensible approaches to determine pricing strategies for operating managed or express toll lanes. The tolls vary dynamically in response to real-time traffic conditions in order to provide a superior free-flow travel service to the users of the toll lanes as well as maximize the freeway's throughput rate. A simulation study is conducted to validate and compare the proposed approaches.

2 - A Day-to-Day Dynamic Congestion Pricing Policy Towards System Optimal

Fan Yang, ESRI, Inc., 380 New York Street, Redlands, CA, 92373, United States, fyang@esri.com

This study proposed a simple and socially efficient day-to-day dynamic pricing policy for transport agencies to guide the day-to-day dynamic traffic flow movement to system optimal instead of user equilibrium, considering a more general adjustment behavior and less restrictive assumptions on the link travel time function.

3 - Agent-Based Modeling of Network Demand, Pricing, and Investment Dynamics

Lei Zhang, Assistant Professor, Civil, Construction, and Environmental Engineering, Oregon State University, 220 Owen Hall, Corvallis, OR, 97331, United States, lei.zhang@oregonstate.edu

The welfare effects of road pricing depend on the decisions by users, owners, and regulators. Built on a novel travel demand and assignment model where each traveler is capable of learning and communicating, and has unique characteristics (e.g. value of time), this paper adopts consistent agent-based techniques to model the decision-making processes of those players and their interactions to address economic and policy analysis needs.

4 - Area-Based Pricing

Siriphong Lawphongpanich, Associate Professor, Industrial and Systems Engineering, University of Florida, PO Box 11-6595, Gainesville, FL, 32611, United States, lawphong@ise.ufl.edu, Yafeng Yin

In this talk, we consider the problem of finding a one-time charge for using roads in a given area. The objective is to reduce total travel time and the area need not be contiguous or form a cut-set. However, when the area forms a cut-set and there are additional constraints on tollable roads, then the problem reduces to the cordon pricing problem in the literature.

■ SB36

Room 336

Manufacturing Facility Design

Sponsor: Transportation Science & Logistics

Sponsored Session

Chair: Rakesh Nagi, Professor, Department of Industrial & Systems Engineering, 438 Bell Hall, University at Buffalo (SUNY), Buffalo, NY, 14260, United States, nagi@buffalo.edu

1 - Redesign of Retail Store Layouts

Bryan A. Norman, PhD, University of Pittsburgh, 1033 Benedum Hall, Pittsburgh, PA, 15261, United States, banorman@pitt.edu, Alice Smith, Chen Li

This talk considers detailed layout design and optimization for retail stores. Given initial aisle settings and preliminary department assignments, we redesign the aisle structure including constructing additional aisles, changing aisle widths, and locating the departments in each sub-area of the facility with adjusted sizes to maximize the overall profit. We utilize a concave linear piecewise profit per unit area function rather than a constant one for all departments in the retail area.

2 - Toward Engineering Design of Factories

Leon McGinnis, Georgia Institute ofTechnology, 765 Ferst Drive, Atlanta, GA, 30332, United States, leon.mcginnis@isye.gatech.edu, Edward Huang, Kan Wu, Diego Tamburini

Engineers who design products routinely use powerful computer based and integrated design and analysis tools. Engineers who design factories routinely use stand alone tools like Excel, AutoCAD, and simulation, and rarely—if ever—use the results of research on factory design because it isn't an option in the tools they use. This talk describes how we can change that, and give factory designers access to the same kinds of powerful, integrated tools that product designers use.

3 - A New Mixed Integer Programming Formulation for Facility Layout Design Using Flexible Bays

Sadan Kulturel-Konak, Assistant Professor of MIS, Penn State University - Berks, Tulpehocken Rd. PO Box 7009, Reading, PA, 19610, United States, sadan@psu.edu, Abdullah Konak, Alice Smith, Bryan A. Norman

A mixed-integer programming formulation is presented to find optimal solutions for the block layout problem with unequal departmental areas arranged in flexible bays. The nonlinear department area constraints are modeled in a continuous plane without using any surrogate constraints. The formulation is extensively tested on problems from the literature.

4 - Facility Relayout to Alleviate Congestion

Rakesh Nagi, Professor, Department of Industrial & Systems Engineering, 438 Bell Hall, University at Buffalo (SUNY), Buffalo, NY, 14260, United States, nagi@buffalo.edu, Rajan Batta, Min Zhang

As product mix and volumes change, certain areas of the manufacturing facility become congested. Some of this congestion can be alleviated by rerouting flows. However, a manager needs to know when to relayout the facility to not only have reduced material handling (traditional objective function) but also reduced congestion. We present facility layout models that explicitly consider flow congestion.

■ SB37

Room 337

Business Value of Information Technology

Sponsor: Information Systems Society

Sponsored Session

Chair: Indranil Bardhan, Assistant Professor, The University of Texas at Dallas, School of Management, SM 41, 2601 N. Floyd Road, Richardson, TX, 75083-0688, United States, bardhan@utdallas.edu

1 - Managing Value and Uncertainty in Service-Driven IT Investments

Ryan Sougstad, Doctoral Student, University of Minnesota, Carlson School of Management, Minneapolis, MN, 55455, United States, rsougstad@csom.umn.edu, Robert Kauffman

Service-driven IT solutions require a shift in IT investment evaluation from methods that assess fixed costs of acquisition toward methods that emphasize variable cost-based service solutions for which contract structure is key. Contracts must balance flexibility and quality with profit and risk tolerance. We apply a technique called value-at-risk to evaluate the profitability of IT service contracts, along with the impact a portfolio of contracts will have on the firm's overall IT risk profile.

2 - Does Offshoring Impact Customer Satisfaction?

Jonathan Whitaker, Doctoral Candidate, University of Michigan, Ross School of Business, Ann Arbor, MI, United States, jwwhitak@umich.edu, M.S. Krishnan, Claes Fornell

While researchers have noted an increase in offshoring, there is limited work on the implications for firms and consumers. This research begins to address these implications by studying the relationship between firms' offshoring activities and their American Customer Satisfaction Index™ scores. We analyze panel data of 68 firms from 1997-2004, and find that offshoring is associated with an increase in perceived value and perceived quality, the two key components of customer satisfaction.

3 - Effects of Information Transparency on Supply Chain Coordination Under Competition

Kevin Zhu, Associate Professor, University of California, The Rady School of Management, San Diego, CA, 92093-0093, United States, kxzhu@ucsd.edu, Zach Zhou

Information sharing has been shown to benefit a supply chain. Developing a game theoretic model, we show that information transparency can create value, yet it affects retailers and manufacturers very differently: one side will always be hurt. This means that the theoretical benefits of information sharing will not materialize, a fundamental challenge with information sharing in supply chains. To deal with this issue, a discriminatory pricing scheme is proposed to internalize the incentives.

4 - Adoption of New Trading Technology: Firm-Specific Effects and Network Effects in Options Exchanges

Bruce Weber, Professor, London Business School, Regents Park, London, NW1 4SA, United Kingdom, bweber@london.edu

Diffusions of IT such as email, browsers, and electronic markets are sensitive to feedback. Realized impacts arise from technical progress and economic forces (adoption and installed base). The all-electronic International Securities Exchange and Boston Options Exchange, opened in 2000 & 2004, and compete with 4 US floor markets. Tobit adoption models estimated from 350 quarterly disclosures from 20 major brokers show firm-specific factors explain 60% of e-exchange use and network effects 40%.

■ SB38

Room 338

Railway Decision Support Models

Sponsor: Railroad Applications

Sponsored Session

Chair: David Hunt, Cambridge Systematics, Inc., PO Box 816, Pennington, NJ, 08534-0816, United States, dhunt@camsys.com

1 - A Web-Based Decision Support System for Railroad Service Design

Ravindra Ahuja, Professor, University of Florida, 303 Weil Hall, Gainesville, FL, 32611, United States, ahuja@ufl.edu

Railroad service design, which comprises developing a railroad's operating plan, has been one of the most challenging planning problems faced by US freight railroads and has been solved manually so far. We will describe and demonstrate a web-based interactive decision support system that enables a railroad to determine its operating plan within a week and incrementally change its current operating plan within days.

2 - A Decision Support System for Hump Yard Management

Larry Shughart, Vice President, Business Development, Innovative Scheduling, Inc., 2153 SE Hawthorne Road, Suite 128, Gainesville, FL, 32641, United States, larry@InnovativeScheduling.com, Ravindra Ahuja, Nikhil Dang, Arvind Kumar, Saurabh Mehta

Efficient hump yard operations are critical for any freight railroad. By integrating simulation with optimization, we have developed a decision support system for hump yard management that can be used for planning, strategy as well as real-time scheduling. For example, it can be used to determine the blocking and car handling capacities of a yard and the impact of yard resources (crew and locomotives) on yard performance.

3 - Algorithms for the Train Platforming Problem (TPP)

Laura Galli, PhD Student, DEIS - Universitá degli Studi di Bologna, Viale Risorgimento 2, Bologna, 40136, Italy, lgalli@deis.unibo.it, Alberto Caprara, Michele Monaci, Paolo Toth

We present an ILP model and an exact algorithm for a specific type of TPP arising in real life applications. The goal is to assign each train a platform and two paths, avoiding platform-conflicts, keeping the number of path-conflicts under a given threshold and maximizing the assignment quality. The formulation has a large number of variables and constraints, thus we use a Branch-and-Price approach and a separation procedure requiring the solution of a specialized Maximum Weight Clique Problem.

4 - Solving a Real-World Train Unit Assignment Problem

Valentina Cacchiani, PhD Student, Universita di Bologna, Viale Risorgimento 2, 40136 Bologna, Italy, vcacchiani@deis.unibo.it, Alberto Caprara, Paolo Toth

We study the problem of creating rosters for a set of traction units for a railway transportation company. The aim is to use the smallest number of traction units, so as to cover a planned timetable of trips, by imposing a minimum number of places required for each trip and other technical constraints. We propose integer linear programming models and heuristics based on the associated linear programming relaxations. Computational results on real-world instances are presented.

■ SB39

Ballroom B

Where Do We Want to Go in Research?

Cluster: Where Do We Want to Go?

(In observance of Arthur Geoffrion's retirement)

Invited Session

Chair: Charles Corbett, Associate Professor, UCLA Anderson School of Management, 110 Westwood Plaza, Los Angeles, CA, 90077, United States, ccorbett@anderson.ucla.edu

1 - Leading a Double Life

Uday Karmarkar, Professor, UCLA Anderson, 110 Westwood Plaza, Box 951481, Los Angeles, CA, 90077, United States, uday.karmarkar@anderson.ucla.edu

The difficulties of balancing research with education and practice are well known. There are a number of ways of achieving your personal goals with respect to those three areas, but most involve doing double duty, and working quite hard. Still the rewards and satisfactions are also substantial.

2 - It is Not a Fair World!

Don Ratliff, Regents and UPS Professor, Georgia Institute of Technology, School of ISyE, Atlanta, GA, 30332, United States, don.ratliff@isye.gatech.edu

If you are really smart, really want to impact practice, work really hard, and are really prolific at publishing in our great journals, it seems reasonable to expect industry to beat a path to your door. Since this "beating a path to your door" has happened to only a few researchers in our field: are these researchers smarter, do they work harder, is it just dumb luck, is there some magic formula, or is the world just not fair? This session will provide the definitive answer.

3 - Greatest Hits in Operations Research

Gerald Brown, Professor, Operations Research Department, Naval Postgraduate School, Monterey, CA, 93943, United States, GBrown@nps.edu

What makes a discovery in operations research so fundamental it demands mastery from any compleat analyst? Consider your personal collection of OR's greatest hits (you maintain one, don't you?). Regardless of medium- refereed publication, lecture, book, computer program, course handout, press interview - what motivates your selections? The list I recommend to my colleagues and students includes some obscure entries, and fewer winners of our well-known awards than you might suspect. Why is this? What are the distinguishing telltales of a fundamental contribution, and how do we use these to discover as early as possible the importance of such a signal result?

4 - Models and Managers: Then, Now, and in the Future

John Little, Professor, MIT Sloan School, Room E56-308, 38 Memorial Drive, Cambridge, MA, 02142, United States, jlittle@mit.edu

Decision support systems have evolved rapidly due to the explosion of available data, increased computer power, and advances in modeling methods. I shall review highlights of the evolution of DSSs from the point of view of managerial models, focusing on marketing, and offer a few thoughts about what may lie ahead.

■ SB40

Room 401

New Location Models and Algorithms

Sponsor: Location Analysis

Sponsored Session

Chair: Lezhou Roger Zhan, Industrial and Systems Engineering, Univeristy of Florida, 303 Weil Hall, Gainesville, FL, 32611, United States, zhan@ufl.edu

1 - Numerical and Simulation Studies on a Supply Chain Design Problem with Supply Disruptions

Lian Qi, University of Florida, 303 Weil Hall, PO Box 116595, Gainesville, FL, 32611-6595, United States, lianqi@ufl.edu, Zuo-Jun Max Shen

We study an integrated supply chain design problem that includes one supplier, one or more retailers and customers. Random disruptions at both the supplier and retailers are considered in our research. We conduct extensive numerical and simulation experiments to obtain managerial insights into this supply chain design problem.

2 - The Effects of Customer Behavior On Closed Loop Supply Chain Network Design

Kristin Sahyouni, Northwestern University, 2145 Sheridan Road, Department of IEMS, Evanston, IL, 60208, United States, kristin@iems.northwestern.edu, Mark Daskin, Canan Savaskan

We investigate how the level of customer participation in a voluntary returns collection program is influenced by the ease of the return process and financial incentives provided (or financial penalties imposed). We subsequently examine how a firm's network design decisions and various returns acceptance policies are impacted by customer behavior in a CLSC environment. Results and insights are discussed.

3 - Solution Strategies for Flexible Discrete Location Models

Stefan Nickel, Chair of Operations Research and Logistics, Saarland University, Geb A 5 3, Saarland, SL, 66041, Germany, s.nickel@orl.uni-saarland.de, Sebastian Velten, Alfredo Marin, Justo Puerto

Ordered Median problems deal, in contrast to classical location problems, with objective functions which are pointwise defined. Nearly all classical objective functions from location theory have an ordered median representation. Moreover, new objective functions can be modeled. We give a new, mixed-integer formulation of the discrete Ordered Median Problem (DOMP). A Branch-and-Cut scheme will be presented and computational results will be reported. Moreover, extensions will be discussed.

4 - Reliability Models for Facility Location: Formulations and Algorithms

Lezhou Roger Zhan, Industrial and Systems Engineering, Univeristy of Florida, 303 Weil Hall, Gainesville, FL, 32611, United States, zhan@ufl.edu, Zuo-Jun Max Shen, Jiawei Zhang

In this paper we analyze the facility location problem under the condition that some facilities are not completely reliable. That is, even if a facility is constructed, it is still subject to fail, which will force its customers to get service from a farther operational facility or subject to a penalty cost. We propose approximation algorithms for a simple model where the failure probability at each facility is the same. Some preliminary results about a more general model are also discussed.

■ SB41

Room 402

Call Centers

Sponsor: Applied Probability

Sponsored Session

Chair: Shane Henderson, Associate Professor, Cornell University, School of ORIE, 230 Rhodes Hall, Ithaca, NY, 14853, United States, sgh9@cornell.edu

1 - Routing and Staffing in Service Systems with Heterogeneous Servers and Impatient Customers

Mor Armony, Assistant Professor of Operations Management, Leonard N. Stern School of Business, New York University, 44 West 4th Street #8-62, New York, NY, 10012, United States, marmony@stern.nyu.edu, Avi Mandelbaum

Motivated by call-centers, we consider queueing systems with homogeneous customers and multiple server pools. Servers differ with respect to their speed of service. Customers are impatient and may leave the system before their service starts. For such systems we propose simple staffing and routing rules that are jointly asymptotically optimal in the sense that they minimize staffing costs subject to a constraint on the fraction of abandonment, in the limit, as the arrival rate grows large.

2 - Adaptive Routing in Multi-Skill Call Centers

Ger Koole, Professor, Vrije Universiteit, Department of Mathematics, De Boelelaan 1081a, 1081 HV Amsterdam, Netherlands, koole@few.vu.nl, Auke Pot

We introduce an adaptive routing call policy for multi-skill call centers. The objective is to satisfy the service level constraints of all job types as much as possible. This policy does not need prior information on parameter values and allows even for parameter values that change over time. We give ample numerical evidence on the effectiveness of our method.

3 - The Error in Steady-State Approximations for Time-Dependent Performance Measures

Shane Henderson, Associate Professor, Cornell University, School of ORIE, 230 Rhodes Hall, Ithaca, NY, 14853, United States, sgh9@cornell.edu, Samuel Steckley

Arrival processes to queues invariably exhibit time dependence, but such queues are difficult to analyze. Usually one adopts some kind of steady-state approximation for time-dependent performance. We develop approximations for the resulting error for a range of queueing models. The results reinforce and extend what is known about such errors.

■ SB42

Room 403

Contemporary Scheduling

Cluster: Scheduling

Invited Session

Chair: Joseph Leung, Distinguished Professor, New Jersey Institute of Computer Science, Department of Computer Science, Newark, NJ, 07102, United States, leung@oak.njit.edu

1 - Online Scheduling with Known Arrival Times

Nicholas G. Hall, Ohio State University, 2100 Neil Avenue, Columbus, OH, United States, hall.33@osu.edu, Marc Posner, Chris Potts

We consider minimizing total weighted completion time in an online scheduling environment where jobs only arrive at known times. We describe an online scheduling algorithm, and show that its competitive ratio is best possible. This result is established by constructing a system of inequalities that characterizes all possible job completion times in a schedule delivered by our algorithm. Two special cases are also studied.

2 - A Frequency Planning Problem for a Large-Scale Bus Network

Jian Yang, Assistant Professor, New Jersey Institute of Technology, Department of Industrial Engineering, Newark, NJ, 07102, United States, yang@adm.njit.edu, Steve Chien

For a large-scale bus network with known customer O-D demand levels, we make simultaneous decisions on the opening/closure of locations and link-based bus frequencies with the goal of maximizing the operating profit. We formulate the problem as a mixed integer linear programming (MIP) problem, and rely on the commercial solver LINGO as well as a post-processing heuristic to solve the problem.

3 - An Efficient Optimal Solution to the Two-Yard-Crane Scheduling Problem

Weihua Zhou, Hong Kong University of Science & Technology, Clear Water Bay, Kowloon, Hong Kong, larry@ust.hk, Chung-Yee Lee

We study a two-yard-crane scheduling problem in a yard block of a port. The two cranes can move along a lane but must maintain a safe distance between them. All containers are ready at the beginning of the period and waiting to be moved from one end of the block to another. We develop efficient algorithms to minimize the maximum tardiness and the number of tardy jobs, respectively.

4 - Cooperative Outsourcing Games with Significant Changeover Times

Tolga Aydinliyim, Case Western Reserve University, Department of Operations, Cleveland, OH, 44106-7235, United States, txa50@case.edu, George Vairaktarakis

We present a cooperative outsourcing model where manufacturers outsource their operations to a single third-party with limited production capacity represented by manufacturing windows. After all manufacturers finish their bookings the third-party offers a new schedule which minimizes the total outsourcing costs of all manufacturers. Coordinated savings are allocated to manufacturers according to a fair allocation rule.

■ SB43

Room 404

New Developments and Applications of the AHP and ANP

Cluster: Analytic Hierarchy Process

Invited Session

Chair: Claudio Garuti, General Manager, FULCRUM Ingenieria, Luis Thayer Ojeda 0180 Of.1004, Santiago, RM, Chile, claudiogaruti@fulcrum.cl

1 - Conflicts Resolution as a Game with Priorities: Multidimensional Cardinal Payoffs

Thomas Saaty, University Professor, University of Pittsburgh, 322 Mervis Hall, Pittsburgh, PA, 15260, United States, saaty@katz.pitt.edu

Two ways to consider increase the effectiveness of game theory in applications 1) By deriving priorities for the payoffs using a cardinal absolute instead of an ordinal or interval scale to do equilibrium analysis; 2) By considering how complex influences are interdependent in non-cooperative situations to derive priorities for best outcomes.

2 - Why We Need AHP/ANP in this World
Eizo Kinoshita, Dean/Professor, Meijo University, 4-3-3,Nijigaoka, Kani, 509-0261, Japan, kinoshit@urban.meijo-u.ac.jp

This paper treats human decision making from the perspective of rationality, and defines a Utility Function and Utility Theory as an instrumentally rational decision making theory and AHP as a procedurally rational decision making theory. We show that in practice it is more effective to use the AHP. In this paper we present a partial interpretation of a lasting debate on the effectiveness of Utility Function and the AHP, a debate that does not seem to be ending anytime soon.

3 - Analytical Network Process (ANP) Applications in Turkey
Birsen Karpak, Professor of Management, Youngstown State University, One University Plaza, WCBA 635, Youngstown, OH, 44555, United States, bkarpak@ysu.edu

The author has implemented Analytical Network Process (ANP) in a variety of her research projects. Two of them will be discussed. An ANP model was developed to identify the priorities of the success factors for Small and Medium-sized Industries (SMEs). An ANP based network to is used to measure the degree of readiness of Turkish industry for total quality management.

4 - Making Psychological Evaluation with AHP/ANP Support
Claudio Garuti, General Manager, FULCRUM Ingenieria, Luis Thayer Ojeda 0180 Of.1004, Santiago, RM, Chile, claudiogaruti@fulcrum.cl

We show a support tool for decision-making in the psychological assessment area, where the huge numbers of variables and knowledge to be structured, integrated and synthesized, forces the need for a system analysis process, able to deal with such complexity. The psychological evaluation system built, called "People Assessment" (PA), captures the following basic pillars: Personality, Competence, and Socio-Economical condition.

■ SB44

Room 405

Applied Probability II

Contributed Session

Chair: Monica Martinez-Canales, Principal Member of the Technical Staff, Sandia National Laboratories, PO Box 969, MS 9159, Livermore, CA, 94550, United States, mmarti7@sandia.gov

1 - Allocation of Processing Time in Multi-Channel Load Balancing Systems
Muhammad El-Taha, Professor, University of Southern Maine, 96 Falmouth Street, Deptartment of Mathematics and Statistic, Portland, ME, 04104, United States, eltaha@usm.maine.edu, Bacel Maddah

Consider a new scheme for allocating processing time in a multi-channel load-balancing system. Servers are divided into two stations where all customers join stations 1 for a fixed amount of service and if necessary join the station 2. Our system outperforms the parallel multi-server model by reducing the mean delay in heavy traffic. Applications will be discussed.

2 - Approximate Mean Value Analysis for Closed Queueing Networks with Multiple-Server Stations
Rajan Suri, Professor, ISyE Department, University of Wisconsin - Madison, 1513 University Avenue, Madison, WI, 53706, United States, suri@engr.wisc.edu, Sushanta Sahu, Mary Vernon

Closed Queueing Networks are used in manufacturing modeling e.g. for Flexible Manufacturing Systems (FMS) and CONWIP material control. Mean Value Analysis (MVA) is often used to compute the performance measures for these models. The Schweitzer-Bard (S-B) approximation improves the computational efficiency of MVA for single-server stations. We provide a simple extension to S-B MVA to enable the analysis of multiple-server stations. Comparisons with simulation show the accuracy of our approach.

3 - Incorporating Time Phased Releases into Open Queueing Networks
Diederik Claerhout, Research Assistant, University of Antwerp, Prinsstraat 13, Antwerp, 2000, Belgium, diederik.claerhout@ua.ac.be, Nico Vandaele

One of the tools to control the workload in a system is fine-tuning releases. In contrast with load limited release mechanisms, we did not find satisfying queueing models for time phased release mechanisms. The latter mechanisms can be modelled as imposing minimum cycle times at nodes without blocking servers. Currently, we are studying the impact on the departure processes. We present exact analysis for elementary single server queues and approximating numerical results for the G/G/1 queue.

4 - Multi-Player Blackjack Simulation Using a Six-Deck Shoe
Donna Retzlaff-Roberts, Professor, University of South Alabama, Mitchell College of Business, Department of Management, Mobile, AL, 36688, United States, retzlaff@usouthal.edu, Alan Chow

Previous blackjack simulations have primarily involved a single deck and a single player. None have involved the six-deck shoe that has become the current standard, and none have investigated the multi-player effect. We simulate blackjack using a six-deck shoe and multiple players to examine the table dynamics that occur in actual blackjack play.

5 - Verification, Validation and Quantification of Margins and Uncertainties for Electrical Systems
Monica Martinez-Canales, Principal Member of the Technical Staff, Sandia National Laboratories, PO Box 969, MS 9159, Livermore, CA, 94550, United States, mmarti7@sandia.gov, Genetha Gray

Increasing costs and decreasing resources is encouraging design programs to leverage smaller databases, numerical modeling and simulation activities to support qualification/accreditation assessments. To that end, verification and validation (V&V) and quantification of margins and uncertainties (QMU) must be used to determine simulation-based confidence, predictive capabilities and margin assessments. We will describe aspects of Sandia's V&V and QMU processes on an electrical circuit model.

■ SB45

Room 406

Tutorial: Math Programming Approaches to Approximate Dynamic Programming

Cluster: Tutorials

Invited Session

1 - Math Programming Approaches to Approximate Dynamic Programming
Dan Adelman, Professor of Operations Management, University of Chicago, Graduate School of Business, 5807 South Woodlawn Avenue, Chicago, IL, 60637, United States, dan.adelman@gsb.uchicago.edu

Approximate Dynamic Programming (ADP) is a new class of methods for breaking Bellman's curse of dimensionality. We summarize math programming approaches to ADP, focusing on applications in inventory control, revenue management and queueing. We derive a parsimonious, exactly solvable math program whose optimal dual prices are used to construct a value function approximation. Dual information provides economic insights, including a "price-directed" control policy.

■ SB46

Room 407

Tutorial: A Practical Approach to Pricing Optimization

Cluster: Tutorials

Invited Session

1 - A Practical Approach to Pricing Optimization
Maarten Oosten, Senior Director of Science and Research, PROS Revenue Management, 3100 Main Street, Suite 900, Houston, TX, 77002, moosten@prospricing.com, Darius Walczak

Pricing optimization generalizes traditional revenue management in that demand need not be independent across products. We define pricing optimization for multiple products facing stochastic demand over a finite time horizon. We address static controls (e.g. LP) as well as dynamic controls. We demonstrate equivalencies between general pricing formulations and traditional revenue management models, and highlight economic and managerial insights. Finally, we address some practical issues, and highlight challenges and open research problems.

■ SB47

Room 408

Risk, Financing, and Operations

Cluster: Supply Chain and Operations Engineering
Invited Session

Chair: Volodymyr Babich, Assistant Professor, University of Michigan, 1205 Beal Avenue, IOE 2783, Ann Arbor, MI, 48105, United States, babich@umich.edu

1 - Operational Hedging Strategies and Competitive Exposure to Exchange Rates
Panos Kouvelis, Professor, Washington University in St. Louis, Olin School of Business, One Brookings Drive, Campus Box 1133, St. Louis, MO, 63130-4899, United States, kouvelis@wustl.edu, Ping Su, Lingxiu Dong

We investigate the impact of operational flexibility on firms' economic exposure to currency fluctuations in the presence of global competition. We consider a global firm who sells as a monopolist in the domestic market, and also sells to a foreign market facing competition there from a local incumbent. We compare the effects of three operational strategies of the global firm: with no operational flexibility, with postponement flexibility, and with both postponement and allocation flexibility.

2 - Signaling Value Of Trade Credit
Pierre-Yves Brunet, University of Michigan, 1205 Beal Avenue, Ann Arbor, MI, 48109, United States, brunetp@umich.edu, Volodymyr Babich

Start-up firms, denied bank loans because banks are uncertain about creditworthiness of the firms, benefit from trade credit financing because it allows them to implement their production decisions in the current period and because it signals their credit quality to the banks. Using a multi-period model for the operations of the firm, we study joint procurement and financing decisions, characterize properties of the optimal policy, and compute the signaling value of trade credit financing.

3 - Coordination of Operations and Finance in a Growing Firm
Danko Turcic, WSOM, Case Western Reserve University, Cleveland, OH, 44106, United States, danko.turcic@case.edu, Matthew Sobel

We address the coordination of operations and finance in a growing firm by optimizing the expected present value of the time stream of dividends in a dynamic model in which demands comprise an ARMA process. The recurring decisions are production quantity, dividends, and short-term borrowing. We study the asymptotic properties of the optimal base-stock level policy for production-inventory. This yields insights into optimal borrowing and production planning for growing firms.

■ SB48

Room 409

Supply Chain Management - Contexts and Concepts

Sponsor: Manufacturing & Service Operations Management
Sponsored Session

Chair: Ananth Iyer, Krannert School of Management, Purdue University, West Lafayette, IN, United States, aiyer@krannert.purdue.edu

1 - Optimal Timing of Inventory Decisions Using Postponement Options
Vishal Gaur, Assistant Professor, Leonard N. Stern School of Business, New York University, 44 West 4th Street, 8-72, New York, NY, 10012, United States, vgaur@stern.nyu.edu, Sridhar Seshadri, Marti Subrahmanyam

We consider a single-period inventory model when forecasts of demand and price improve with time. We provide conditions under which postponement is optimal and those for which early exercise takes place. We also determine the impact of risk-premium and volatilities of price-demand on the optimal timing and stocking decisions.

2 - When the Competitor's Order Quantities are Revealed - Who Benefits and Who Loses?
Daniela Burkhardt, WHU - Otto Beisheim Graduate School of Management, Burgplatz 2, Vallendar, 56179, Germany, Daniela.Burkhardt@whu.edu, Arnd Huchzermeier

On receiving information on competitor's order quantities, retailers could value the information by adapting both their price and inventory decisions. We explore the benefits of this information for retailer profits and consumer welfare theoretically in a Bertrand model and empirically with scanner data of five major German retailers.

3 - Product-Line Competition: Customization vs. Proliferation
Ali Parlakturk, University of North Carolina, Kenan-Flagler Business School, McColl Building, Campus Box 3490, Chapel Hill, NC, 277599, United States, ali_parlakturk@unc.edu, Haim Mendelson

We study a market with customers that have heterogeneous preferences for product attributes. We consider two types of firms that compete on price and product variety: A traditional firm, which chooses a limited variety, and a customizing firm, which can produce any configuration. Unlike the traditional firm, the customizing firm does not carry inventory, but its customers incur waiting costs.

4 - Impact of Operational Flexibility on Aircraft Conversion at the US Coast Guard
Vinayak Deshpande, Associate Professor, Krannert School of Management, Purdue University, West Lafayette, IN, 47907, United States, vinayak@mgmt.purdue.edu, Asima Mishra, Ananth Iyer

This paper presents the impact of operational flexibility on aircraft conversion from an older to a newer version at the US Coast Guard (USCG). We consider three levels of flexibility: full flexibility, partial flexibility and no flexibility. Both optimization models and Markov Chain based models have been developed to compare aircraft performance under the above three levels of flexibility.

■ SB49

Room 410

History of OR/MS II

Cluster: History of OR and Management Science
Invited Session

Chair: Heiner Müller-Merbach, Professor, Technische Universität Kaiserslautern, Erwin-Schrödinger-Strafle, Geb. 42-434, Kaiserlautern, D-67653, Germany, hmm@bior.de

1 - German Pre-OR/MS Contributions to OR/MS
Heiner Müller-Merbach, Professor, Technische Universität Kaiserslautern, Erwin-Schrödinger-Strafle, Geb. 42-434, Kaiserlautern, D-67653, Germany, hmm@bior.de

Prior to OR/MS, some contributions to the field came from German Business Administration (GBA), such as: (i) Schmalenbach (1873-1955) calculated "shadow prices" for simple pre-LP cases. (ii) Gutenberg (1897-1984) studied pre-LP bottleneck situations and considered the influence of objectives for production scheduling problems. (iii) Grochla (1921-1986) investigated pre-JIT synchronisation of purchase logistics and production. These and more cases will be presented.

2 - Charles S. ReVelle
Richard Church, Professor, Department of Geography, University of California - Santa Barbara, Santa Barbara, CA, 93106, United States, church@geog.ucsb.edu, John Current

Charles (Chuck) ReVelle passed away last year at the age of 67 from a rare form of cancer. Chuck was a major figure in the field of INFORMS as is evidenced by being the first recipient (with Richard Francis) of INFORMS's College of Location Analysis award for lifetime achievement. During his career, Chuck wrote 9 books and nearly 200 papers and monographs spanning the fields of OR/MS, Civil Engineering, Economics, Environmental Sciences, Geography; Regional Science, and Water Resource Systems. He had many co-authors (including us), but his favorite and most important was his wife, Penelope.

3 - Fleet Composition of Commercial Jet Aircraft 1952-2005: Developments in Uniformity and Scale
Jani Kilpi, Manager, ERP Support, Finnair, Hernemäentie 16, Tuusula, 04330, Finland, jani.kilpi@kolumbus.fi, Ari P.J. Vepsäläinen

The fleet composition of an airline is an important cost driver affecting its operational performance. The fleet composition is characterised here using a fleet uniformity index and a structured way of measuring fleet scale. The history of all jet aircraft operated by commercial passenger or cargo airlines world-wide is analysed for this study, with the results showing that the uniformity of the airline fleets has been steadily decreasing, while their scale has been steadily increasing.

■ SB50

Room 411

Network Design

Sponsor: Telecommunications

Sponsored Session

Chair: S. Raghavan, Associate Professor of Management Science, Robert H. Smith School of Business, University of Maryland, 4352 Van Munching Hall, College Park, MD, 20742, United States, raghavan@umd.edu

1 - Formulations and Reformulations for Network Design Problems with Reload Costs

Luis Gouveia, Faculdade de Ciencias da Universidade de Lisboa, DEIO-CIO, Bloco c/2 - Campo Grande, Lisboa, Portugal, legouveia@fc.ul.pt, Ioannis Gamvros, S. Raghavan

We present the notion of reload costs that can appear in several network design and planning problems in telecommunication systems and the transportation industry. We discuss the challenges in modeling such costs with standard approaches and present several reformulations and comment on their strengths and weaknesses.

2 - Branch-and-Price-and-Cut for Network Design with Reload Costs

S. Raghavan, Associate Professor of Management Science, Robert H. Smith School of Business, University of Maryland, 4352 Van Munching Hall, College Park, MD, 20742, United States, raghavan@umd.edu, Luis Gouveia, Ioannis Gamvros

We present arc-flow and path-based models for network design problems with reload costs. We discuss the advantages and disadvantages of these approaches and present computational results on various problems.

3 - Regenerator Location Problem

Si Chen, Univeristy of Maryland, Van Munching Phd #29, College Park, MD, 20742, United States, Si_Chen@rhsmith.umd.edu, S. Raghavan

We address the regenerator location problem in optical networks. In the network, every node is a terminal node and can be installed a regenerator. The objective is to determine a regenerator deployment so that all the nodes are connected and the number of the regenerators is minimized. A mixed integer program is presented. Three heuristics are proposed that solves large-sized networks in seconds. We also extend the regenerator location problem to generalized networks.

4 - An Exact Algorithm for Multistage Integer Multi-Commodity Flow Problems with Demand Uncertainty

Ioannis Gamvros, Staff Consultant, ILOG, Inc., 1080 Linda Vista Avenue, Mountain View, CA, 94043, United States, igamvros@ilog.com, S. Raghavan

Multi-stage stochastic programming problems in which decision variables are integer in all stages are exceptionally hard and are typically approached with approximation algorithms. We propose a reformulation scheme and an associated branch-and-price-and-cut approach that can solve exactly stochastic multistage integer multi-commodity flow problems. We present computational results on a problem motivated from the telecommunications industry.

■ SB51

Room 412

Data Envelopment Analysis II

Contributed Session

Chair: Siew Hoon Lim, Assistant Professor of Economics, Department of Agribusiness & Applied Economics, North Dakota State University, 203B Morrill Hall, PO Box 5636, Fargo, ND, 58105, United States, siew.lim@ndsu.edu

1 - Interior Point Methods to Determine Output Prices in DEA

Jose Dula, Associate Professor, Virginia Commonwealth University, School of Business, Richmond, VA, 23284, United States, jdula@vcu.edu, Marie-Laure Bougnol, Paul Rouse

Extreme efficient and inefficient DMUs with benchmarks on lower dimensional faces generate multiple optima in multiplier LPs. They are problematic as virtual weights to determine prices. IP methods identify analytical centers of the optimal face that satisfy SCSC. These solutions offer tangible advantages, e.g. uniqueness, well-defined rates of substitution, and proper envelopment. We report on results in the health care industry.

2 - Linear Programming System Identification: Results for the General Nonnegative Parameters Case

Marvin D. Troutt, Kent State University, Box 5190, Kent, OH, 44242-0001, United States, mtroutt@kent.edu, Alan A. Brandyberry, Changsoo Sohn, Suresh K. Tadisina

Given a series of past available resources as inputs and the corresponding outputs, we seek the LP model that best explains the outputs. That is, we identify the constraint matrix and objective function of an LP model that fits the data. The maximum decisional efficiency (MDE) estimation principle is used with genetic algorithm search. This is called the Linear Programming System Identification (LPSI) method. Some comparisons with DEA are discussed.

3 - Measuring Multidimensional Performance Attributes

Padma Sastry, Project/Program Manager, The Ohio State University, Page Hall, 1810 College Road, Columbus, OH, 43210, United States, sastry.1@osu.edu

Quality is defined differently depending on the stakeholder: firm, customer or regulator. We develop a method based on DEA applied to 1994-2001 data for the local telephone industry. We analyze trends over time by defining three parameters, relative performance, orientation and cohesion. Our results suggest that the industry increased relative performance and cohesion over time, balancing company and customer perspectives, but regulatory compliance indicators lag those of other stakeholders.

4 - Evaluating Information Technology Investments on Bank Performance

Yun Chieh Chin, Graduate Student, Department of Business Administration, Chang Gung University, Taoyuan, 333, Taiwan, m9340112@stmail.cgu.edu.tw

Information technology has impacts on two main stages of bank operations, one is deposit service and the other is profit generation by investment using deposits. This research applies two-stage data envelopment analysis (DEA) to measure the operating efficiency of 32 commercial banks in Taiwan. The main findings show that older banks outperform newly established ones in each stage, and both at deposit and investing stages banks with large capitalization are more efficient than smaller ones.

5 - Profit and Productivity of U.S. Class I Railroads

Siew Hoon Lim, Assistant Professor of Economics, Department of Agribusiness & Applied Economics, North Dakota State University, 203B Morrill Hall, PO Box 5636, Fargo, ND, 58105, United States, siew.lim@ndsu.edu, Knox Lovell

This paper examines how productivity changes and price changes have contributed to profit change in the railroad industry. We find that productivity improvements and an increased scale of production contributed to increases in profit, and that variation in operating efficiency had a mixed impact on profit. We also find that relative changes in rail rates and variable input prices exerted downward pressure on profit.

■ SB52

Room 413

Revenue Management Education and Material

Sponsor: Revenue Management & Pricing

Sponsored Session

Chair: Ioana Popescu, Associate Professor of Decision Sciences, INSEAD, Boulevard de Constance, Fontainebleau, 77305, France, ioanaDOTpopescuATinseadDOTedu

1 - The Fjord Motor Custom Fleet Pricing Exercise

Robert Phillips, Nomis Solutions, robert.phillips@nomissolutions.com, J. Michael Harrison

Students are given data on 4000 past bids for fleet sales to police departments and corporations. Maximum likelihood is used to fit logit bid-response models at three levels of refinement. A second layer of Solver application gives the optimal pricing strategy under each bid-response model.

2 - MBA Revenue Management Course at Columbia University

Costis Maglaras, Associate Professor, Columbia University, Graduate School of Business, 409 Uris Hall, 3022 Broadway, New York, NY, 10027, United States, c.maglaras@gsb.columbia.edu, Garrett Van Ryzin

We present the structure of a full semester MBA elective course on Pricing and Revenue Management that we teach at Columbia, highlighting two new cases that we wrote recently.

3 - Teaching Revenue Management in the Carnegie Mellon Tepper School of Business MBA Program

Nicola Secomandi, Assistant Professor, Carnegie Mellon University, Tepper School of Business, 5000 Forbes Avenue, Pittsburgh, PA, 15213, United States, ns7@andrew.cmu.edu

This talk illustrates the speaker's experience teaching an MBA revenue-management elective at the Carnegie Mellon Tepper School of Business since 2004.

4 - Easy Profit - An Interactive Revenue Management Simulator
Ioana Popescu, Associate Professor of Decision Sciences, INSEAD, Boulevard de Constance, Fontainebleau, 77305, France, ioanaDOTpopescuATinseadDOTedu

This interactive simulation enhances intuition about the profitability of inventory rationing decisions in RM. The user is in charge of optimizing revenues from the economy cabin of an aircraft. Business/leisure arrivals follow a stochastic process, which can be controlled by the educator. Static and dynamic booking limit strategies are tested, as well as sensitivity to input parameters. The material covers one or two sessions in a revenue/service/operations management course.

■ SB53

Room 414

Dynamic Models of Selling Mechanisms

Sponsor: Revenue Management & Pricing

Sponsored Session

Chair: Jeremie Gallien, Associate Professor, Sloan School of Management, Massachusetts Institute of Technology, E53-389, 30 Wadsworth Street, Cambridge, MA, 02142, United States, jgallien@mit.edu

1 - Adaptive Online Allocation Mechanisms for Single-Valued Domains
David Parkes, Associate Professor, Harvard University, 33 Oxford Street, Cambridge, MA, 02138, United States, parkes@eecs.harvard.edu, Satinder Singh

We consider a model of adaptive online mechanisms for bidders with single-valued types in a dynamic environment. Strong monotonicity and frugality are recognized as sufficient structural properties on allocation policies for dominant-strategy equilibrium, leading to adaptive, allocatively-efficient mechanisms.

2 - Online Auctions for Market Research on Consumers' Willingness to Pay
Matthew Potoff, PhD Candidate, Ross School of Business, University of Michigan, 701 Tappan Street, Ann Arbor, MI, 48109, United States, potoff@bus.umich.edu, Damian Beil

We consider a manufacturer selling a short life-cycle product over a finite selling horizon. The manufacturer is uncertain about consumers' willingness to pay. Initially items are sold via auction and the manufacturer's priors about willingness to pay are updated. Using a DP approach we explore when the manufacturer should select a price and switch to a mass-market, fixed price channel. Consumer product adoption follows a diffusion process over the horizon.

3 - Optimal Dynamic Auctions
Mallesh Pai, Doctoral Student, Managerial Economics and Decision Sciences, Kellogg School of Management, 2001 Sheridan Road, Northwestern University, Evanston, IL, 60208, United States, m-pai@kellogg.northwestern.edu, Rakesh Vohra

We consider a dynamic auction motivated by the single-leg, multi-period revenue management problem. A monopolist sells C indivisible units over T time periods. A buyer's arrival time, desired quantity, valuation and time by which the purchase must be made are private information. We derive the revenue maximizing Bayesian incentive compatible mechanism.

■ SB54

Room 415

Inventory Games in Supply Chain

Cluster: Operations and Marketing for Emerging Markets

Invited Session

Chair: Moshe Dror, Professor, University of Arizona, MIS, Eller College of Management, Tucson, AZ, 85721, United States, mdror@eller.arizona.edu

1 - Stable Cooperation in Periodic Review Inventory Situations
Ana Meca, Professor, Universidad Miguel Hernandez, Operations Research Center, Elche, Spain, ana.meca@umh.es, Luis A. Guardiola, Justo Puerto

This paper examines coordination in periodic review inventory models in which agents can share ordering, inventory holding, and backlogging resources. We analyze the resulting cooperative game and show that the cooperation is stable (no group of agents would like to leave the system). A family of fair divisions of costs is introduced and the relation to other inventory coordination models from the literature is studied.

2 - Analyzing Capacity and Inventory Pooling Using Cooperative Game Theory
Eda Kemahlioglu-Ziya, Kenan-Flagler Business School, University of North Carolina, CB # 3490, Chapel Hill, NC, 27599, United States, Eda_KemahliogluZiya@unc.edu

In this talk, we are going to talk about how cooperative game theory can be used to model and allocate savings resulting from pooling. We are going to give examples from inventory and capacity pooling. We will especially concentrate on the Shapley value as a solution approach. In the context of inventory pooling, we will talk about the behavior induced if Shapley value is used to allocate savings.

3 - Inventory Ordering Consolidation: The Sensitivity of the Core
Moshe Dror, Professor, University of Arizona, MIS, Eller College of Management, Tucson, AZ, 85721, United States, mdror@eller.arizona.edu, Wei Cheng, Bruce C. Hartman

In a multi-item EOQ environment with two-part ordering cost composed of a constant shared cost and an item specific cost, inventory ordering consolidation cost has to be distributed among its items. It can be described as a cooperative game problem. In this talk we discuss the core of this game (a set of cost allocations that are fair) and its sensitivity to different problem parameters. The relation of concavity and inseparability of the game is examined computationally as well as other parameter properties.

■ SB55

Room 416

Supply Chain Logistics II

Contributed Session

Chair: Francisco Briones, Head of Department, Universidad Politecnica de Aguascalientes, Prol. Mahatma Gandhi Km. 2, Aguascalientes, 20280, Mexico, francisco.briones@upa.edu.mx

1 - A Multi-Echelon Inventory System with Shared Inventory Information
Xiuhui Li, PhD, Nanyang Business School, Nanyang Technological University, S3-01B-73, Nanyang Avenue, Singapore, 639798, Singapore, lixi0002@ntu.edu.sg, Qinan Wang

We consider a two-echelon supply chain consisting of a supplier and multiple identical buyers. Demand at the buyers follows Poisson process. We develop the optimal inventory replenishment policy for the supplier when on-line information on the buyers' inventory status is available. This analysis provides an exact evaluation of the value of on-line information for the system.

2 - Information Interpretation in the Supply Chain: Role of Human Decision Making on the Bullwhip Effect
David Cantor, Visiting Assistant Professor, Smeal College of Business, Penn State University, Supply Chain and Information Systems, 460 Business Building, University Park, PA, 16802, United States, dcantor@rhsmith.umd.edu, John Macdonald

We investigate the role of cognitive thinking styles in the supply chain. We theoretically draw on construal theory to test our model that the type of information given as well as cognitive thinking style contributes to the bullwhip effect. A key finding is that abstract thinkers filter local information better than concrete thinkers. However, both types of thinkers are overwhelmed with complete information, and subsequently make poor decisions which leads to the bullwhip effect.

3 - Optimization Opportunities to Improve Supply Chain Efficiency: A Practitioner's Experiences
Rajiv Saxena, Director, Supply Chain Engineering, APL Logistics, 1111 Broadway, Oakland, CA, 94607, United States, rajiv_saxena@apllogistics.com

Different companies with global supply chains are looking towards their logistics providers to help them in successfully dealing with their supply chain challenges. We discuss case studies on how we created significant efficiencies in different aspects of global supply chains of our customers through optimally engineered solutions.

4 - Inventory Management for Customers with Alternative Lead-Time Choices
Haifeng Wang, The Chinese University of Hong Kong, Room 615, Mong M. W. Engineering Building, Shatin, N.T., Hong Kong, hfwang@se.cuhk.edu.hk, Houmin Yan

This paper considers an inventory model with alternative lead-time choices. We obtain the optimal dynamic inventory commitment policy about when to deliver; and prove the optimal inventory replenishment policy to be a base-stock type. Further, we obtain that the inventory commitment policy outperforms an inventory rationing policy, and find the robustness of our policy. We use the customer choice model to characterize the risk pooling, demand induction and cannibalization effects.

5 - Petri Nets for Description of Batch Processes in Function of Coordinator Control Recipe

Francisco Briones, Head of Department, Universidad Politecnica de Aguascalientes, Prol. Mahatma Gandhi Km. 2, Aguascalientes, 20280, Mexico, francisco.briones@upa.edu.mx

Petri Nets can be adapted to describe the discrete and dynamical behavior of a Batch Process and how it can be used to formulate control strategies supported by a Coordinator Control Recipe in terms of ISA S88.02 norm.

Sunday, 1:30pm - 3:00pm

■ SC01

Room 301

Algorithms for Discrete Stochastic Optimization Models

Sponsor: Optimization/ Network and Combinatorial Optimization
Sponsored Session

Chair: David Shmoys, Professor, Cornell University, School of OR&IE, Ithaca, NY, 14853, United States, shmoys@orie.cornell.edu

1 - Data-Driven Convex Optimization with Applications to Supply Chain Management

Paat Rusmevichientong, Assistant Professor, Cornell University, 221 Rhodes Hall, Ithaca, NY, 14850, United States, paatrus@cornell.edu, W. Tim Huh

We study non-parametric stochastic inventory planning systems with lost sales and censored demand under stationary and non-stationary settings. We propose adaptive inventory policies that generate a sequence of ordering decisions over time. The decision in each period depends only on historical sales data of the past. Our adaptive algorithms converge to the optimal, and the average expected cost during the first T periods differs from the optimal cost by at most O(1 / \sqrt{T}).

2 - Transforming Stochastic Dynamic Programs to Yield a FPTAS, with an Application

Frans Schalekamp, Cornell University, School of OR&IE, Ithaca, NY, 14853, United States, frans@cs.cornell.edu, David Shmoys

Methods to transform (certain) Stochastic Dynamic Programs to yield a fully polynomial-time approximation scheme (FPTAS) are proposed. The methods are generalizations of a method proposed by Halman et al. Finally an application in option pricing is presented.

3 - Provably Near-Optimal Sampling-Based Policies for Stochastic Inventory Control Models

Retsef Levi, Assistant Professor, Massachusetts Institute of Technology, Sloan School of Management, BDG E53-389, 30 Wadsworth Street, Cambridge, MA, 02139, United States, retsef@mit.edu, Robin Roundy, David Shmoys

Consider the classical newsvendor model and its multiperiod extension, but under assumption that the exact demand distributions are not known. The only thing available is a set of samples drawn from the true distributions. We present sampling-based policies computed only based on samples and bound the number of samples required to guarantee that their expected cost is arbitrarily close to the optimal cost computed based on the true distributions. The bounds apply to any demand distribution.

■ SC02

Room 302

Joint Session Open-Source/ICS: Open-Source Optimization Packages for Engineering Design

Cluster: Open-Source Software: Open Source, Open Standards, Open Data, INFORMS Computing Society
Invited Session

Chair: William Hart, Distinguished Member of Technical Staff, Sandia National Laboratories, Mail Stop 1110, PO Box 5800, Albuquerque, NM, 87185-1110, United States, wehart@sandia.gov

1 - DAKOTA: A Toolkit for Engineering Design

William Hart, Distinguished Member of Technical Staff, Sandia National Laboratories, Mail Stop 1110, PO Box 5800, Albuquerque, NM, 87185-1110, United States, wehart@sandia.gov, Michael Eldred, Anthony Giunta

We summarize capabilities and applications of the DAKOTA toolkit for high performance computers. It provides a flexible interface between simulation software and algorithms for optimization, uncertainty quantification, parameter estimation, design of experiments, and sensitivity analysis. DAKOTA enables research in multilevel parallel computing, mixed integer nonlinear programming, surrogate-based optimization, optimization under uncertainty, and simultaneous analysis and design.

2 - Parallel Asynchronous Derivative-Free Optimization with Nonlinear Constraints

Joshua Griffin, Limited Term Employee, Sandia National Laboratories, Mail Stop 9159, PO Box 969, Livermore, CA, 94551, United States, jgriffi@sandia.gov, Tamara Kolda

We present a globally convergent, derivative-free method for nonlinear programming based on generating set search (GSS). We explore several options for handling nonlinear constraints, including an augmented Lagrangian approach. Linear constraints are straightforward, requiring only conforming search directions. All methods are implemented in parallel and asynchronously using APPSPACK. We present extensive test results using the CUTEr test set as well as real-life applications.

3 - JEGA: A Tool for Multi-Objective Optimization

John Eddy, Senior Member of the Technical Staff, Sandia National Laboratories, Mail Stop 1125, PO Box 5800, Albuquerque, NM, 87185-1125, United States, jpeddy@sandia.gov

JEGA is a software package that implements a multi-objective genetic algorithm (MOGA) for solution to multi-objective problems. JEGA is highly configurable and provides a rich set of algorithmic components for tailored optimization. It has been used successfully on many problems by users both internal and external to Sandia.

4 - OPT++: An Object-Oriented Toolkit for Nonlinear Optimization

Patricia Hough, Principal Member of Technical Staff, Sandia National Laboratories, PO Box 969, MS 9159, Livermore, CA, 94551, United States, pdhough@sandia.gov, Pamela Williams, Ricardo Oliva, Juan Meza

We describe OPT++, a C++ library for nonlinear optimization. The design is predicated on distinguishing between an algorithm-independent class hierarchy for nonlinear optimization problems and a class hierarchy for nonlinear optimization methods. The interface is designed for ease of use and extensibility to new algorithms. Several nonlinear optimization algorithms have been implemented, and example problems demonstrate the advantages of a common interface in comparing multiple algorithms.

■ SC03

Room 303

Approximate Dynamic Programming

Sponsor: Optimization/ Linear Programming and Complementarity
Sponsored Session

Chair: Daniela Pucci de Farias, MIT, pucci@mit.edu

1 - Using Stochastic Approximation to Compute Optimal Base-Stock Levels in Inventory Control Problems

Sumit Kunnumkal, Graduate Student, Cornell University, School of ORIE, 295 Rhodes Hall, Ithaca, NY, 14850, United States, sumit@orie.cornell.edu, Huseyin Topaloglu

We consider inventory control problems where base-stock policies are known to be optimal and propose stochastic approximation methods to compute the optimal base-stock levels. Existing methods guarantee convergence, but not necessarily to the optimal base-stock levels. In contrast, we prove that the iterates of our methods converge to the optimal base-stock levels. Computational experiments indicate that our methods provide significantly better solutions than existing methods.

2 - Serial Multi-Echelon Systems with Economies of Scale via Approximate Dynamic Programming

Diego Klabjan, Associate Professor, University of Illinois at Urbana-Champaign, 1206 West Green Street, Urbana, IL, 61801, United States, klabjan@mit.edu

We consider the serial multi-echelon system with transportation economies of scale. Since optimal policies are not known, we apply approximate dynamic programming to compute policies. We experiment with several value function approximations.

3 - Decentralized Approximate Dynamic Programming and Resource Allocation for Dynamic Networks of Agents

Daniela Pucci de Farias, pucci@mit.edu, Hariharan Lakshmanan

We consider stochastic control systems involving teams of agents communicating through a network with dynamic topology. We propose a decentralized approximate dynamic programming scheme and show that it can be viewed as a resource allocation problem. Motivated by this observation, we develop a fully decentralized and asynchronous algorithm for a general class of resource allocation problems that is provably convergent under mild assumptions on the structure of communication among agents.

4 - An Optimal Approximate Dynamic Programming Algorithm to a Mutual Fund Problem

Juliana Nascimento, PhD Candidate, Princeton University, Olden Street, Equad Room E-307, Princeton, NJ, 08544, United States, jnascime@princeton.edu, Warren B. Powell

We present an approximate dynamic programming algorithm to optimize the level of cash that is held by a mutual fund in order to meet redemption requests from investors. Demand for redemptions and shortfall/surplus costs are stochastic. The algorithm uses a pure exploitation scheme and does not require knowledge of the distribution of any of the random variables. A proof of convergence to an optimal policy is obtained exploring structural properties of the problem.

■ SC04

Room 304

Laboratory Experiments in Supply Chain and Operations Management

Sponsor: Manufacturing & Service Operations Management

Sponsored Session

Chair: Elena Katok, Associate Professor, Penn State University, 465 Business Building, University Park, PA, 16802, United States, ekatok@psu.edu

1 - On the Perception of Supply Contract

Mirko Kremer, University of Mannheim, Schloss, S 231, Mannheim, BW, Germany, Mirko.Kremer@bwl.uni-mannheim.de

Contradicting the normative benchmark, recent experimental research indicates that actual order behavior is differs under a revenue sharing and a buy back contract which are deemed to be technically equivalent in a simple supply chain setting with a supplier selling to a newsvendor. We extend on this matter by considering choice between contracts rather than the behavior under them. Our results are largely an issue of decision framing but can be neatly tied to established behavioral theory.

2 - Impact of Fairness on Supply Chain Contracts: A Laboratory Study

Diana Wu, University of Kansas, School of Business, Lawrence, KS, United States, yxw146@psu.edu

The topic of supply chain coordination has been much studied. While theoretical properties of various contracting mechanisms have been studied extensively, less is known about their practical performance. Using a controlled setting of an experimental laboratory, we investigate the impact of supply chain partners' equity concerns over the profit and risk divisions on the performance of different contracting mechanisms.

3 - Inventory Service Level Agreements as Coordination Mechanisms

Doug Thomas, Penn State University, 463 Business Building, University Park, PA, United States, dthomas@psu.edu, Andrew Davis, Elena Katok

A supplier balancing inventory cost and profit margin may choose a stock level that maximizes her profitability but is sub-optimal from the view of the retailer and the overall supply chain. To address this double marginalization problem, a retailer may introduce a service level agreement, offering a bonus for meeting a predetermined fill rate over a specified (finite) horizon. We experimentally investigate how such service level agreements affect supplier stocking decisions.

4 - Supply Chain Coordination with Risk-Averse Players: A Behavioral Analysis

Julie Niederhoff, Washington University in St Louis, Olin School of Business, One Brookings Drive; Campus Box 1133, St Louis, MO, 63130, United States, julieniederhoff@wustl.edu, Panos Kouvelis

We study supply chain coordination under risk-aversion. Players are measured for risk preferences and then act as profit-maximizing suppliers or retailers to determine which mechanisms are most effective. We use the two-member newsvendor supply chain. We use traditional theory of risk-neutral and risk-averse players as a benchmark to measure actual performance.

■ SC05

Room 305

Stochastic Programming

Sponsor: Optimization/ Stochastic Programming

Sponsored Session

Chair: Shabbir Ahmed, Associate Professor, Georgia Institute of Technology, 765 Ferst Drive, Atlanta, GA, 30068, United States, sahmed@isye.gatech.edu

1 - Fire-Fighting Resource Allocation for Wildfire Containment Using Stochastic Integer Programming

Lewis Ntaimo, Professor, Department of Industrial & Systems Engineering, Texas A&M University, 3131 TAMU, College Station, TX, 77840-3131, United States, ntaimo@tamu.edu, Won Ju Lee

Recent catastrophic wildfires have highlighted the need for new models to assist fire managers in containment decision-making under uncertainty. This talk presents a stochastic integer programming approach to the difficult problem of initial attack for fire containment. The problem involves determining the optimal mix of fire-fighting resources to contain a fire under uncertainty in fire growth. Deterministic models assume that fire growth is known and are therefore, inadequate for this problem.

2 - A Multilevel Resource Allocation Problem for Stream Processing Systems

Li Zhang, Manager, Systems Analysis and Optimization, IBM TJ Watson Research Center, 19 Skyline Drive, PO Box 704, Hawthorne, NY, 10532, United States, zhangli@us.ibm.com, Hanhua Feng

Data streaming applications are becoming popular due to the rapid development in sensor networks, multimedia streaming, and online data mining, etc. The incoming data streams often fluctuate at a finer time scale compared to the resource allocation decisions. We employ a multilevel resource allocation scheme to account for the different time scale and the randomness in the stream arrival rates. Stochastic programming approaches are presented to obtain the optimal resource allocation solutions.

3 - Solving Multistage Stochastic Linear Programs on the Computational Grid

Jierui Shen, PhD Candidate, Lehigh University, Industrial and Systems Engineering, 200 W. Packer Avenue, Bethlehem, PA, 18015, United States, jis6@lehigh.edu, Jeff Linderoth

We describe a solver capable of tackling large-scale multistage stochastic linear programs (MSLP). The solver is based on a nested-decomposition (ND) algorithm, and we study how to combine the algorithm with the power of grid computing. Computational results addressing the challenges of effectively implementing ND on a grid are given. Using our solver, we also study the value obtained in solving MSLP as opposed to alternative methods for dealing with uncertainty.

4 - Strong MIP Formulations of Chance Constrained Linear Programs with Random Right-hand Side

James Luedtke, PhD Student, Georgia Institute of Technology, 765 Ferst Drive, Atlanta, GA, 30332, United States, jluedtke@isye.gatech.edu, Shabbir Ahmed, George Nemhauser

We present strong mixed-integer programming formulations for the chance constrained linear program with finite sample space and random RHS. We develop valid inequalities and an extended formulation based on a single row relaxation. Computational results indicate this approach can be used to solve large scale problems, with the size of the sample space in the thousands and dimension of the random RHS in the hundreds.

■ SC06

Room 306

Constraint Programming Tools

Sponsor: INFORMS Computing Society/Constraint Programming

Sponsored Session

Chair: Laurent Michel, Assistant Professor, Computer Science & Engineering Department, University of Connecticut, Storrs, CT, 06269, United States, ldm@engr.uconn.edu

1 - Gecode - A Generic Constraint Development Environment

Christian Schulte, Associate Professor, KTH - Royal Institute of Technology, KTH/ICT/ECS, Isafjordsgatan 39, Electrum 229, Kista, 16440, Sweden, schulte@imit.kth.se

Gecode (www.gecode.org) is an open, free, portable, accessible, and efficient environment for developing constraint-based systems and applications. In this talk I will focus on what makes Gecode radically open for programming (variables, constraints, search) and why this matters for developers and users.

2 - Recent Developments in Constraint Programming at ILOG
Paul Shaw, pshaw@ilog.fr, Jean-Francois Puget, Jean-Charles Regin

ILOG Solver is the leading commercial constraint programming tool, used by industry and academia alike. In this talk, we present the recent developments in constraint programming at ILOG with respect to ease of use, search procedures and solver performance.

3 - The CHOCO Constraint Solver
Hadrien Cambazard, Ecole des Mines de Nantes, La Chantrerie - 4, rue Alfred Kastler, BP 20722, Nantes Cedex 3, France, Hadrien.Cambazard@emn.fr, Narendra Jussien, François Laburthe, Guillaume Rochart

The CHOCO constraint solver is an emanation of a French academic group. Choco is a java library for constraint satisfaction problems, constraint programming, and explanation-based constraint solving. It is built on an event-based propagation mechanism with backtrackable structures. Choco also provides explanations as both an analysing and solving tool for constraint programming, uncommon search mechanisms including the decision-repair and the logical Benders decomposition schemes, etc.

4 - Differentiability in Constraint-Based Local Search
Laurent Michel, Assistant Professor, Computer Science & Engineering Department, University of Connecticut, Storrs, CT, 06269, United States, ldm@engr.uconn.edu, Pascal Van Hentenryck

Differentiable invariants are generic structures that maintain the value of arbitrary expressions and their variable gradients. They support differentiation to evaluate the effect of moves performed within a local search procedure. The benefits of differentiable invariants are illustrated on a number of applications which feature complex, possibly reified, expressions and whose models are essentially similar to their CP counterparts. Experimental results demonstrate their practicability.

5 - Differentiable Invariants for Constraint-Based Local Search
Pascal Van Hentenryck, Professor of Computer Science, Brown University, Box 1910, 115 Waterman Street, 4th Floor, Providence, RI, 02912, United States, pvh@cs.brown.edu, Laurent Michel

This talk proposes the concept of differentiable invariants as a natural abstraction to express constraint-based local search algorithms. Differentiable invariants maintain the value of complex expressions incrementally, derive and maintain gradients for each variable, and allow efficient evaluations of local moves. Their expressive power and efficiency are demonstrated on a number of resource allocation applications.

■ SC07

Room 307

Supply Chain Management Books

Cluster: New Books

Invited Session

Chair: David Woodruff, Professor, University of California - Davis, Graduate School of Management, 155 AOB 4, Davis, CA, 95616, United States, dlwoodruff@ucdavis.edu

1 - Introduction to Computational Optimization Models for Production Planning in a Supply Chain
David Woodruff, Professor, University of California - Davis, Graduate School of Management, 155 AOB 4, Davis, CA, 95616, United States, dlwoodruff@ucdavis.edu, Stefan Voss

Managers and information technology professionals need to have an understanding of computational optimization models for production planning in a supply chain. This book provides an accessible introduction to the subject. We develop the terminology and concepts needed to understand the important issues.

2 - The New Krajewski-Ritzman-Malhotra Operations Management Text from Prentice-Hall
Lee Krajewski, Professor, University of Notre Dame, 363B Mendoza College of Business, Notre Dame, IN, 46556, United States, krajewski.2@nd.edu

The new eighth edition of Operations Management: Processes and Value Chains is slimmer and focuses more on the use of operations management for all business majors. The text features a new video interactive-case series about Starwood Hotels and reinforces the use of operations management for non manufacturing processes throughout the text. Major changes have been made to project management, supply chain strategy, location, sales and operations planning, and constraint management.

3 - Operations and Supply Management - The Core
Robert Jacobs, Professor of Operations Management, Indiana University, 1309 East Tenth Street, Bloomington, IN, 47405, United States, jacobs@indiana.edu

The new book concisely covers "core" operations management topics in 13 chapters. A theme that is carried throughout is that success for companies today requires managing the entire supply flow, from the sources of the firm, through the value added processes of the firm, and on to the customers of the firm. The first edition book will be available from McGraw-Hill during November, 2006.

4 - Randomizing and Automating Homework and Exam Grading
Jay Heizer, Jones Prof of Bus Admin, Texas Lutheran University, Dept. of Business, Seguin, Tx, 78155, United States, jheizer@tlu.edu

Software that randomizes and automates both problems and values for homework and exam delivery in now available for the Operations Course. The system also grades the material and posts to a grade book so faculty can improve their teaching, have more time for students, and research, and life.

■ SC08

Room 308

KLIC I

Sponsor: Technology Management

Sponsored Session

Chair: Nile Hatch, Assistant Professor, Marriott School, Brigham Young University, 790 TNRB, Provo, UT, 84602, United States, nile@byu.edu

1 - Exploration and Exploitation in Complex Networks: Learning Rates and Interpersonal Networks
Melissa Schilling, Associate Professor of Management, Stern School of Business, New York University, 40 West Fourth Street, New York, NY, 10012, United States, mschilli@stern.nyu.edu

The rate at which superior solutions spread through an interpersonal network is strongly influenced by the learning rate utilized by individuals and the underlying network structure. We find that very low levels of random linking increase performance, but higher levels of random linking lower performance. Small-world network properties can enhance organizational learning by enabling short path lengths and semi-isolated pockets of heterogeneous knowledge to exist simultaneously in a network.

2 - Cross-Training, Social Identity and Knowledge Sharing
Enno Siemsen, Assistant Professor of Business Administration, University of Illinois at Urbana-Champaign, Department of Business Administration, 350 Wohlers Hall, 1206 S. Sixth Street, Champaign, IL, 61820, United States, siemsen@uiuc.edu, Sridhar Balasubramanian, Aleda Roth

This research explores the relationship between cross-training and inter-employee knowledge sharing. Cross-training can increase knowledge sharing, for example by enabling better communication between employees. On the other hand, cross-training increases the functional similarity between employees, which in turn can increase the competition between them, thereby reducing knowledge sharing behavior. We explore these relationships empirically using survey data from three different companies.

3 - Dissecting Organizational Knowledge: Multimodal Apprenticeship in Vascular Surgery
Curtis LeBaron, Associate Professor, Brigham Young University, 790 Tanner Building, Marriott School, Provo, UT, 84602, United States, LeBaron@byu.edu

This is a video-based study of instruction within a surgical team. The attending surgeon, who is most expert, provides subtle visible and vocal prompts for the work of the resident, who is a novice. Such "scaffolding" behaviors are a form of practice that emerge organically within surgical activity, supporting the novice's performance as needed and to the extent needed, disappearing into the folds of interaction as the resident develops expertise.

4 - Fractal Knowledge and Technological Change in Semiconductors and Disk Drives
Roger Bohn, Professor, University of California - San Diego, 9500 Gilman Drive #0519, IR/PS, La Jolla, CA, 92093-0519, United States, Rbohn@ucsd.edu

Knowledge can be modeled as a causal graph which grows as more is learned. Such graphs are fractal: parent-child relationships become complex subgraphs as more is learned. These patterns are illustrated by semiconductor lithography and hard disk drive head design. As product generations get smaller (Moore's Law), new physical relationships become large enough to be important. Also, incremental and radical technical change can be measured by how the graph changes.

■ SC09

Room 309

Management of Innovation & New Product Development in Complex Systems Environments

Cluster: New Product Development
Invited Session

Chair: Edward Anderson, Professor, University of Texas, McCombs Business School, 1 University Station B6500, Austin, TX, 78733, United States, edward.anderson@mccombs.utexas.edu

1 - The Butterfly Effect: Systemic and Behavioral Risks in Distributed Innovation
Nitin Joglekar, Associate Professor, Boston University, 525 Commonwealth Avenue, Boston, MA, 02215, United States, joglekar@bu.edu, Edward Anderson

We explore distributed innovation decisions from systems thinking perspective. This approach enables us to link the architectural, behavioral, competitive, and demand risks though feedback mechanisms. We argue that decisions underlying such innovation structures are susceptible to the butterfly effect: path dependent amplification of small uncertainties due to feedback and dynamic complexity can lead unintended consequences such as turf building and tipping the balance within a firm's portfolio.

2 - Product Development Competitions as an Integrated Product Development Strategy
Saurabh Bansal, Graduate Student Teaching Assistant, McCombs School of Business, University of Texas - Austin, 1 University Station B6500, Austin, TX, 78712, United States, bansi@mail.utexas.edu, Edward Anderson

We present a model that considers a two-pronged strategy for new product development (NPD) at a firm: 1) Product development through an in-house team, and 2) Product development through competitions. The solutions received from the competition expedite the NPD learning process while the in-house team develops technical details to implement these solutions. Results indicate that competitions can expedite the NPD process when the technical knowledge about the new project is sparse in the firm.

3 - Adaptive Infrastructure: Learning from Open Source Communities and Toyota
Paul Carlile, Associate Professor, Boston University, 595 Commonwealth Avenue, Boston, MA, 02215, United States, carlile@bu.edu, Karim Lakhani

We compare two very innovative, but different distributed innovation systems: Open Source Software communities and Toyota. The adaptive value of their infrastructure consists of actors and artifacts and their distributed capability to identify the consequences of novel information and then make collective changes accordingly.

4 - Managing the Life Cycle Mismatch Problem
James Bradley, Associate Professor, The College of William & Mary, 118C Tyler Hall, Mason School of Business, Williamsburg, VA, 23187-8795, United States, james.bradley@mason.wm.edu, Hector Guerrero

"Life-cycle mismatch" occurs when component life cycles are shorter than the life cycles of products in which they are used. Potential responses to premature component obsolescence are expensive (e.g., product redesign, life-time component buys) and should be taken into account in the initial design of a product. We evaluate when a durable design, which is less prone to component obsolescence than a nondurable design, is optimal.

5 - Managing Risk in Alternative Energy Product Development
Geoffrey Parker, Associate Professor, Tulane University, Freeman School of Business, New Orleans, LA, 70118, United States, gparker@tulane.edu, Edward Anderson

Developing alternative energy products is inherently risky because of the volatile nature of oil prices. This volatility stems from: (1) Cycles in oil exploration, and (2) Information asymmetry because energy firms with access to the most fruitful sites for discovery of new reserves may be underestimating them due to technological or geopolitical factors. This leads us to discuss the impact of these price risks on alternative energy product development and how these risks might be mitigated.

■ SC10

Room 310

Software Demonstration

Cluster: Software Demonstration
Invited Session

1 - StatPoint, Inc. - Synchronized Data Analysis Using STATGRAPHICS Centurion and STATGRAPHICS Mobile
Neil Polhemus, StatPoint, Inc., 2325 Dulles Corner Blvd., Ste. 500, Herndon, VA, 20171, neil@statgraphics.com, Seth Wyatt

StatPoint will demonstrate the interaction between STATGRAPHICS Centurion, its award-winning desktop statistical analysis package, and STATGRAPHICS Mobile, the first serious statistical software package for Pockets PCs and other handheld devices. The presentation will include a discussion of data synchronization and an illustration of distributed forecasting using ARIMA models.

2 - Salford Systems - RandomForests and TreeNet/MART
Mikhail Golovnya, Salford Systems, 4740 Murphy Canyon Rd., #200, San Diego, CA, 92108, golomi@salford-systems.com

Salford Systems will demo both RandomForests and TreeNet/MART, Leo Breiman's and Jerome Friedman's newest advances to data mining. Both RandomForests and TreeNet enable the modeler to construct predictive models of extraordinary accuracy. Models are built up gradually through a large collection of small trees, each of which improves on its predecessors through an error-correcting strategy.

■ SC11

Room 311

OR in SpORts II

Sponsor: OR in Sports
Sponsored Session

Chair: Joel Sokol, Assistant Professor, Georgia Institute of Technology, 765 Ferst Drive NW, Industrial & Systems Engineering, Atlanta, GA, 30332-0205, United States, jsokol@isye.gatech.edu

1 - "A Different Game"? An Analysis of Scoring in the Baseball World Series and a Markovian Model
Vijay Mehrotra, Assistant Professor, San Francisco State University, College of Business, 1600 Holloway Avenue, San Francisco, CA, 94610, United States, drvijay@sbcglobal.net

Many observers assert that a team should focus on "manufacturing runs" by using tactics such as sacrifice bunting and base stealing. We use statistical methods along with data from the past twenty World Series to examine two key questions. First, we investigate whether World Series games feature (statistically) significantly lower scoring. Secondly, we utilize a Markovian model to examine the value of sacrifice bunts and stolen bases and the implications for managerial tactics.

2 - Analyzing College Football Overtime Strategy
Rick Wilson, Professor, Department of Management Science and Information Systems, Oklahoma State University, 408 BUS, Spears School of Business, Stillwater, OK, 74078, United States, rick.wilson@okstate.edu, Peter Rosen

Division I-A college football adopted "alternating possession" overtime rules in 1996. Over this 10 year period, very few teams have varied from conventional wisdom that indicates a teams' chances of winning increase if you are on defense first. We analyze game data over the past decade and show that while there is some evidence of an advantage for this strategy, it is not as pronounced as many think.

■ SC12

Room 312

Nicholson Student Paper Prize Competition, I

Cluster: Nicholson Student Paper Prize

Invited Session

Chair: Julie Swann, Assistant Professor, Georgia Insititue of Technology, Industrial and Systems Engineering, Atlanta GA 30332, United States, jswann@isye.gatech.edu

1 - Generalized Mixed Integer Rounding Valid Inequalities

Kiavash Kianfar, PhD Candidate, Department of Industrial Engineering, North Carolina State University, 458 Daniels Hall, Campus Box 7906, North Carolina State University, Raleigh, NC, 27695, United States, k_kianfar@ncsu.edu, Yahya Fathi

We present new families of valid inequalities for (mixed) integer programming (MIP) problems. These valid inequalities are based on a generalization of the 2-step mixed integer rounding (MIR), proposed by Dash and Günlük (2006). We prove that for any positive integer n, n facets of a certain (n+1)-dimensional mixed integer set can be obtained through a process which includes n consecutive applications of MIR. We then show that for any n, the last of these facets, the n-step MIR facet, can be used to generate a family of valid inequalities for the feasible set of a general (mixed) IP constraint, the n-step MIR inequalities. The Gomory Mixed Integer Cut and the 2-step MIR inequality of Dash and Günlük (2006) are simply the first two families corresponding to n=1,2, respectively. The n-step MIR inequalities are easily produced using closed-form periodic functions, which we refer to as the n-step MIR functions. None of these functions dominates the other on its whole period. Moreover, for any n, the n-step MIR inequalities define new families of facets for the finite and the infinite group problems.

2 - The G/GI/N Queue in the Halfin-Whitt Regime

Josh Reed, Georgia Institute of Technology, School of Industrial and Systems Engineering, 765 Ferst Drive NW, Atlanta, GA, 30332, je-reed@isye.gatech.edu

The many-server, heavy traffic limit for the GI/M/N queue was first discovered by Halfin and Whitt in 1981. Since then, Halfin and Whitt's results have been used extensively in research on large scale telephone call centers. However, the extension of Halfin and Whitt's results to general service time distributions has remained an open problem. In this talk, we will consider the G/GI/N queue in the Halfin-Whitt regime. Our first result will be to obtain a one-dimensional heavy traffic limit for the properly centered and scaled queue length process. We will then proceed to establish an equivalent characterization of our limiting process involving the renewal function associated with the service time distribution. Finally, we will conclude by discussing several interesting directions for future research.

3 - On Bid Price Controls for Network Revenue Management

Baris Ata, Assistant Professor, Kellogg School of Management, Northwestern University, 2001 Sheridan Road, Evanston, IL, 60208, United States, b-ata@kellogg.northwestern.edu, Mustafa Akan

We consider a network model of revenue management and propose a novel class of bid-price control mechanisms. Under mild assumptions, we show that the proposed bid-price control mechanism is optimal, and that the optimal bid prices form a martingale. Optimality and martingale property of bid-prices are robust to information distortions. In particular, we show that under semi-continuous information structures, there exist near-optimal predictable bid-price policies having the martingale property.

■ SC13

Room 313

Teaching OR/MS with Cases

Sponsor: Education (INFORM-ED)

Sponsored Session

Chair: Matthew Drake, Assistant Professor, Duquesne University, A.J. Palumbo School of Business, Donahue Graduate School of Business, Pittsburgh, PA, 15282, United States, drake987@duq.edu

1 - Case Learning

Cliff Ragsdale, Bank of America Professor, Virginia Polytechnic Institute and State University, 1007 Pamplin Hall, Blacksburg, VA, 24061, United States, cragsdal@vt.edu

This presentation focuses on lessons learned from and about teaching with cases.

2 - Teaching Management Science with Cases

Greg Zaric, Professor, Ivey School of Business, University of Western Ontario, London, ON, Canada, gzaric@ivey.uwo.ca

This talk covers the use of cases for teaching management science. The talk will briefly touch upon the following issues: classroom management and encouraging class participation; evaluating student performance; choosing cases for classes and exams; and writing good cases.

3 - INFORMS Case & Teaching Materials

Thomas Grossman, Associate Professor of Information & Decision Science, School of Business and Management, University of San Francisco, 2130 Fulton Street, San Francisco, CA, 94117, United States, tagrossman@usfca.edu

INFORMS Case & Teaching Materials peer reviews and publishes teaching cases. We will discuss our existing strategic cases, our new crop of cases, our new editorial board and reviewing system, and opportunities to submit, review, and serve as associate editor.

4 - Integrating Ethics into the OR/MS Classroom

Matthew Drake, Assistant Professor, Duquesne University, A.J. Palumbo School of Business, Donahue Graduate School of Business, Pittsburgh, PA, 15282, United States, drake987@duq.edu, David Wasieleski, James Weber

The importance of ethics instruction has been recognized by accreditation boards and many companies in recent years. Many OR/MS instructors, though, have yet to integrate ethics into their classrooms, partly because they do not think they have adequate training in the subject. We discuss ways in which even the most ethically-novice instructors can introduce ethics topics into their classrooms.

■ SC14

Room 314

Quality Monitoring

Contributed Session

Chair: Min Shi, Assistant Professor, Marist College, School of Management, 3399 North Road, Poughkeepsie, NY, 12601, United States, jackmshi@gmail.com

1 - Online Monitoring Network Characteristics Using Flexible Probing Experiments

Xiaodong Yang, Graduate Student, The University of Michigan, 1205 Beal Avenue, Ann Arbor, MI, 48109, United States, xyy@umich.edu

Large-scale network monitoring has gained increasing attention, especially in light of stringent QoS requirements of real-time applications. In this talk, after discussing some change models, efficient methods for estimating QoS parameters such as packet loss rates and delay will be examined. Various control chart procedures will be compared in terms of the power of detection. This is joint work with Drs Vijay Nair and George Michailidis.

2 - Analysis of Signal-Response Systems Using GEE and GLMM

Shilpa Gupta, Graduate Student, Arizona State University, Mail Code 5906, Department of Industrial Engineering, Tempe, AZ, 85287, United States, shilpa.gupta@asu.edu, Connie Borror, Douglas Montgomery

We illustrate the application of generalized estimating equations and the generalized linear mixed model approach to robust design and analysis of signal response systems. We propose a split-plot approach to the signal response system, characterized by two variance components - within-profile variance and between-profile variance. We demonstrate that decomposing the system variation in this manner leads to more precise point estimates with shorter confidence intervals.

3 - A Change Point Model for the Exponential Family

Marcus Perry, Assistant Professor of Operations Research, Air Force Institute of Technology, 2950 Hobson Way, Building 641, Wright-Patterson AFB, OH, 45433-7765, United States, marcus.perry@afit.edu

Many change point models used in SPC are designed under the assumption that a single disturbance is present. However, this assumption is often unreasonable as many processes are susceptible to more complicated disturbances. In this research a change point model is proposed for linear disturbances in the natural location parameter of exponential densities.

4 - Economic and Economic-Statistical Design of a Multivariate Bayesian Control Chart

Zhijian Yin, PhD Student, University of Toronto, 5 King's College Road, Toronto, ON, M5S 3G8, Canada, zhijian.yin@gmail.com, Viliam Makis

The paper presents a cost model for a MVBCCH for a long production run. The objective is to determine the control chart parameters, namely the control limit, sample size, and the sampling interval minimizing the total expected average cost. The average cost function is derived using renewal theory. Additional statistical constraints guaranteeing the average run length performance are also considered.

5 - Person-Fit Measurement Based on Adaptive Statistical Process Control

Min Shi, Assistant Professor, Marist College, School of Management, 3399 North Road, Poughkeepsie, NY, 12601, United States, jackmshi@gmail.com, Ronald Armstrong, Zachary Stoumbos

Person-fit measurement refers to statistical methods used to evaluate the fit of response patterns to tem response theory model. In this paper, a new class of cumulative sum (CUSUM) schemes based on log-likelihood-ratio statistics is developed to detect aberrant response patterns in linear tests where the dichotomous responses are independent. Extensive simulations are performed to compare the proposed CUSUM schemes with selected person-fit statistics in the literature.

■ SC15

Room 315

Procurement Auctions in OM

Cluster: Auctions and e-Commerce

Invited Session

Chair: Wedad Elmaghraby, Assistant Professor, University of Maryland, Robert H. Smith School of Business, 4352 Van Munching Hall, College Park, MD, 20742, United States, Wedad_Elmaghraby@rhsmith.umd.edu

1 - Supply Chain Coordination Under Information Acquisition

Tunay Tunca, Professor, Stanford University, Graduate School of Business, 518 Memorial Way, Stanford, CA, 94305, United States, tunca_tunay@gsb.stanford.edu, Hyoduk Shin

We consider supply chain coordination with investment in demand forecasting. We show that common pricing schemes suffer from lack of coordination in production quantities and forecast. We show that this problem can be solved through flexible pricing. However, with private information, such mechanisms suffer implementation problems. We propose a contracting scheme that utilizes market interaction and resolves the implementation problems in addition to achieving full coordination.

2 - Sole Sourcing vs. Second Sourcing: Impact of Demand Uncertainty

Cuihong Li, Assistant Professor, University of Connecticut, 2100 Hillside Road, Unit 1041, Storrs, CT, 06269, United States, Cuihong.Li@business.uconn.edu, Laurens Debo

We study the decision for a manufacturer (buyer) to select between sole sourcing and second sourcing mechanisms for a component with uncertain demand. Supplier capacity investment is required before the demand is realized. The incumbent supplier achieves cost reduction from learning. We find that a high or low capacity cost may both benefit second sourcing, and second sourcing is more favorable more when the buyer faces more demand uncertainty.

3 - Computational Analysis of Stable Coalition Structures in Sealed Bid Auctions

Kemal Guler, Senior Scientist, Hewlett-Packard Labs, HP Labs MS1140, 1501 Page Mill, Palo Alto, CA, 94304, United States, kemal.guler@hp.com, Bin Zhang

We study ex ante incentives to form coalitions in sealed-bid first-price and second-price auctions in private values environments. Auction subgames following a coalition formation stage involve asymmetries that necessitates a computational approach. We explore partitions of the set of bidders that are immune to deviations by individuals under exogenous sharing rules. We also explore the effects of risk aversion and dependence among bidder valuations on the stability of coalitions.

4 - Auction Design in the Presence of Non-Convex Costs

Wedad Elmaghraby, Assistant Professor, University of Maryland, Robert H. Smith School of Business, 4352 Van Munching Hall, College Park, MD, 20742, United States, Wedad_Elmaghraby@rhsmith.umd.edu

Auctions are increasingly becoming standard instruments for procurement. However, the performance of procurement auctions when suppliers have non-convex costs are poorly understood. We present results from a series of experiments with human subjects at the University of Maryland.

■ SC16

Room 316

Revenue Management and Pricing under Various Market Models

Cluster: Dynamic Pricing and Forecasting

Invited Session

Chair: Nicola Secomandi, Assistant Professor, Carnegie Mellon University, Tepper School of Business, 5000 Forbes Avenue, Pittsburgh, PA, 15213, United States, ns7@andrew.cmu.edu

1 - Comparing Price and Quantity Competition in Oligopolies with Differentiated Products

Amr Farahat, Johnson School, Cornell, Ithaca, NY, United States, aaf33@cornell.edu, Georgia Perakis

We consider an oligopoly market with more than two firms offering gross substitutes. We illustrate that while prices under Cournot competition remain higher than under Bertrand competition, the profit relationship is more complex and depends on the number of firms, their degree of market power, and quality differences among them. We examine several affine demand models and provide counterexamples where Bertrand profits can exceed Cournot profits along with an upper bound on the profit ratio.

2 - Estimating Choice Models from Airline Data

Garrett Van Ryzin, Columbia University, Uris Hall, New York, NY, 10027, United States, gjv1@columbia.edu, Gustavo Vulcano

We look at the results of an empirical study of estimating choice models from available airline data. We discuss both estimation methods and how the estimated choice models can be used to improve revenue management.

3 - Stochastic and Dynamic Price-Based Revenue Management with Nash Bargaining

Nicola Secomandi, Assistant Professor, Carnegie Mellon University, Tepper School of Business, 5000 Forbes Avenue, Pittsburgh, PA, 15213, United States, ns7@andrew.cmu.edu, Atul Bhandari

We consider the classical setting of a firm that sells a finite inventory of a single product within a finite number of periods. The seller negotiates the selling price with each buyer. We embed the Nash bargaining model in a dynamic and stochastic model where the seller dynamically optimizes the minimum acceptable price in each negotiation. We study properties of this model and show that its optimal value functions are higher than those obtained from the traditional posted-price model.

■ SC17

Room 317

Revenue Management Models with Customer Behavior

Contributed Session

Chair: Renato de Matta, Associate Professor, The University of Iowa, 108 PBB, Iowa City, IA, 52242, United States, renato-dematta@uiowa.edu

1 - An Adaptive Dynamic Pricing Method for Self-Storage Industry

Lijian Chen, Assistant Professor, University of Louisville, J.B. Speed School of Engineering, University of Louisville, Louisville, KY, 40292, United States, lijian.chen@louisville.edu

In the self-storage industry, the dynamic pricing is an important part for the department of revenue management. The most commonly used method is to adjust prices by the property's performances, such as occupancy, competitor price, seasonal trend, and the unexpected events. We propose an alternative, which is a math programming based, adaptive method, to optimize the pricing policy for all the franchised properties. Our model provides a quantitative way to project the company wide revenue flow.

2 - Decision Biases in Revenue Management: Some Behavioral Evidence

J. Neil Bearden, Assistant Professor, University of Arizona, Eller College of Management, Mcclelland Hall 417, Tucson, AZ, 85720, United States, jneilb@gmail.com, Amnon Rapoport, Ryan Murphy

We study a simplified revenue management problem in which offers arrive sequentially and stochastically over a finite horizon. The value of each offer is random and revealed upon arrival, and the decision maker (DM) can accept fixed number of offers. Behavioral experiments reveal that DMs employ policies of the same form of the optimal policy, but show biases to demand too much in early periods and too little in later periods. We argue that behavioral work can compliment theoretical work in RM.

3 - Optimal Allocation of Flexible Products Under Consumer Choice Behavior Model

Wenli Xiao, Fudan University, 59#501C, Lane 78, Wudong Road, Shanghai, 200433, China, 042025062@fudan.edu.cn

Flexible product is a set of two or more alternatives. Suppliers could decide which alternative should be assigned to the customer. In reality, Consumers have product preferences. Considering the influence of consumer behavior in purchasing process, we provide a model to analyze the optimal allocation of flexible products. We use numerical simulations to represent that the increased demand for specific products once the flexible product was closed could result in higher revenue.

4 - Successive Approximation Based Controls for Revenue Management Problems

Sreelata Jonnalagedda, Doctoral Student, University of Texas-Austin, 3457 Lake Austin Boulevard E., Austin, TX, 78703, United States, sree.jonnalagedda@phd.mccombs.utexas.edu

We look at perishable asset revenue management problem in the context of an airline network. We use simulation and successive approximations to get closer to optimal solution. We compare bid price policy and certain equivalent policy to our approach, we provide a practical implementation direction for real world applications

5 - Dynamic Pricing in Reputation-Based E-Commerce Retailing

Renato de Matta, Associate Professor, The University of Iowa, 108 PBB, Iowa City, IA, 52242, United States, renato-dematta@uiowa.edu, Dengfeng Zhang

We examine a revenue management problem involving a seller of perishable products in an e-commerce setting where buyers are sensitive to both price and seller reputation. Using a Markov decision process to model the problem over a finite horizon, we investigate the impact of changes in seller reputation and buyer heterogeneity on the seller's optimal pricing strategy. The managerial intuitions behind our analytical and experimental results are presented.

■ SC18

Room 318

Advances in Geometric Programming

Cluster: Geometric Programming: Research Inspired by the Work of Dick Duffin, Elmor Peterson & Clarence Zener

Invited Session

Chair: Jayant Rajgopal, University of Pittsburgh, Department of Industrial Engineering, 1039 Benedum Hall, Pittsburgh, PA, 15261, United States, rajgopal@pitt.edu

1 - The Solution of General Finite Linear Systems via Flexible New GGP Dual Variational Principles

Elmor Peterson, Systems Science Consulting, 3717 Williamsborough Court, Raleigh, NC, 27609, United States, elpeterson@alumni.cmu.edu

These principles, based on "linearly constrained generalized GP duality", provide infinitely many new "iterative methods" for solving each system of linear equations and/or inequalities, including every large-scale LP problem. Each method requires only the "unconstrained approximate minimization" of a convex function that can be "separable". This "infinite flexibility" is likely to provide serious competition for previously developed iterative methodologies, such as "interior-point methodology".

2 - Geometric Programming Based Shape-Preserving Cubic L1 Splines

Shu-Cherng Fang, Industrial Engineering and Operations Research, North Carolina State University, Raleigh, NC, 27695, United States, fang@eos.ncsu.edu, Wei Zhang, John Lavery

Splines have been widely used for real world applications. One fundamental requirement for these applications is that they should have minimum nonphysical oscillations for data with arbitrary changes in magnitude and in node spacing. We present a geometric programming based cubic L1 splines to serve this purpose.

3 - Geometric Programming Operations Management Applications

Carlton Scott, Professor, Paul Merage School of Business, University of California - Irvine, Irvine, CA, 92697, United States, chscott@uci.edu, Thomas Jefferson

Geometric Programming evolved with a focus on cost optimization in engineeering design and many of the early applications (with few exceptions) were in this area. Another area where there is a wealth of application is Operations Management. In this talk, we overview previous literature in this area as well as giving several newer applications to production inventory control and project management.

■ SC19

Room 319

Forestry Applications III

Sponsor: Energy, Natural Resources & The Environment

Sponsored Session

Chair: Sandor Toth, Assistant Professor, Oklahoma State University, Stillwater, OK, 74078, United States, sft108@psu.edu

1 - Deciding Where to Establish Fuel Breaks on Flammable Forest Landscapes

David Martell, Professor, Faculty of Forestry, University of Toronto, 33 Willcocks Street, Toronto, ON, M5S 3B3, Canada, martell@smokey.forestry.utoronto.ca, Wenbin Cui, Cristian Palma, Andres Weintraub

We partition a flammable forest landscape into cells and use a simple localized cell assessment procedure to rank cells with respect to their fire protection values. We then compare our results with the results obtained by using more exact models. Our cell ranking procedure can be used to help determine where to establish fuel breaks.

2 - Strategic Budgeting for Wildfire Management in the U.S.

Gyana Parija, IBM T.J. Watson Research Center, Yorktown Heights, NY, 10598, United States, parija@us.ibm.com, Tarun Kumar, Steve Carty

Field experiences on using an IP model and a solution approach for optimizing the initial response (IR) organization needed to maximize the effectiveness of various fire containment activities in the fire planning units (FPU's) across the US are presented. These are large-scale IP problems requiring innovative solution approaches. Solution to the budgeting problem includes an IR organization that could consist of a set of hand crews, engines, bull-dozers, and helicopters.

3 - Optimal Prevention and Detection of Invasive Species

Robert Haight, Research Forester, USDA Forest Service, North Central Research Station, 1992 Folwell Avenue, St. Paul, MN, 55108, United States, rhaight@fs.fed.us, Shefali Mehta, Robert Venette

Non-native invasive species cause substantial environmental and economic damage to forests. Losses can be reduced by preventing arrival and rapidly detecting invasions. We include prevention and detection activities in a renewal-reward process that accounts for uncertainty in pest arrival and detection. The objective is to allocate resources among prevention and detection activities to minimize expected cost of damages. Results are presented for oak wilt management in the Minnesota.

■ SC20

Room 320

The Value of Information

Sponsor: Decision Analysis Society

Sponsored Session

Chair: Erin Baker, Assistant Professor, University of Massachusetts, Mechanical and Industrial Engineering, 220 Elab, Amherst, MA, 01003, United States, edbaker@ecs.umass.edu

1 - The Value of Non-Definitive Experiments in Pure Science

Erin Baker, Assistant Professor, University of Massachusetts, Mechanical and Industrial Engineering, 220 Elab, Amherst, MA, 01003, United States, edbaker@ecs.umass.edu

Evaluating an experiment in the context of a decision problem is well understood. But this is not so well defined in a "pure science" situation, such as the goal of determining whether life ever existed on Mars. One can put a value on a definitive experiment, but many sequences of experiments result in probability distributions over the information of interest. We describe the difficulties in the situation, and propose methods for developing utility models over experiments.

2 - Information Acquisition and Technology Adoption

Canan Ulu, PhD Candidate, Fuqua School of Business, Duke University, 1 Towerview Drive, Durham, NC, 27708, United States, canan.ulu@duke.edu, James E. Smith

We consider a technology adoption model where the firm is offered a technology whose benefits are uncertain. In each period, the firm can choose to adopt or reject the technology or gather information to reduce the uncertainty about the benefits of the technology. We generalize previous technology adoption models to allow more general distributions on benefits and to allow the benefits of the technology to be changing over time. We characterize the optimal value function and optimal policies.

3 - Value of Information is Systematically Biased
Steve Greidinger, Policy Decisions Forum, PO Box 30374, Bethesda, MD, 20284, United States, steve_greidinger@hotmail.com

The expected value of imperfect information determines whether an inaccurate test or prediction is cost-effective. Unfortunately, test results may not be properly interpreted or applied by decision-makers, and so we must discount the value of information in order to account for the possibility that the results will be ignored. Value of a test may fall precipitously given political roadblocks and decision-maker indifference. Suggestions for avoiding underutilized studies will be supplied.

4 - Strength of Preference Determines the Value of Information
Philippe Delquié, Associate Professor of Decision Sciences, INSEAD, Boulevard de Constance, Fontainebleau, F-77300, France, philippe.delquie@insead.edu

Generalizing a previous result: The value of information about any and all alternatives of a decision situation is maximum when the decisionmaker is indifferent between the alternatives, and it vanishes as preference for one alternative gets stronger. This is true for any correlation structure among alternatives, utility function, and (random) wealth. This permits to define an "Intrinsic Value of Information" for any lottery: a measure of information value independent of the decision context.

■ SC21

Room 321

Panel Discussion: Decision Analysis: Foundations in Mathematics, Science, and Engineering

Sponsor: Decision Analysis Society
Sponsored Session

Chair: Ronald Howard, Professor and Director, Decisions and Ethics Center, Department of Management Science and Engineering, School of Engineering, Stanford University, Stanford, CA, 94305, United States, rhoward@stanford.edu

1 - Panel Discussion: Decision Analysis: Foundations in Mathematics, Science, and Engineering
Moderator: Ronald Howard, Professor and Director, Decisions and Ethics Center, Department of Management Science and Engineering, School of Engineering, Stanford University, Stanford, CA, 94305, United States, rhoward@stanford.edu, Panelists: Robert Winkler, James Matheson, Jim Dyer, Gordon Hazen, Ali Abbas

Decision analysis has contributed to decision-making in business, medicine, engineering, and law. Panelists discuss its origins, its relation to other disciplines, and the most appropriate academic preparation for a career in decision analysis. The panelists will first make brief presentations, then discuss among themselves, and finally invite audience participation.

■ SC22

Room 322

Air Force Supply Chain Analysis

Sponsor: Military Applications
Sponsored Session

Chair: Alan Johnson, Session Chair, Air Force Institute of Technology, AFIT/ENS, 2950 Hobson Way, Building 641, W-P AFB, OH, 45433-7765, United States, alan.johnson@afit.edu

1 - Battle Damage Assessment (BDA) Enhancement Methodology Using Situational Parameter Adjustments
Sharif Melouk, Assistant Professor of Operations Research, Air Force Institute of Technology, 2950 Hobson Way, Building 641, Wright-Patterson AFB, OH, 45433-7765, United States, sharif.melouk@afit.edu, Marcus Perry, Michael Carras

In the context of close ground combat, the perception of BDA is closely linked with a soldier's engagement decisions and has significant effects on the battlefield. This research examines the BDA process from a perception standpoint and proposes a methodology to collect pertinent data and model this perception. We propose a SME survey design and a method to model the BDA process as a discrete time Markov chain with Bayesian inference used to update probability distributions at each time step.

2 - Reliable Supply Chain Design Considering Facility Failures
Dinakar Gade, University of Arkansas, 4167 Bell Engineering Center, Department of Industrial Engineering, Fayetteville, AR, 72701, United States, dgade@engr.uark.edu, Edward Pohl

Modern Supply chains are complex and subject to disruption risks such as natural disasters or terrorist attacks. A supply chain risk profile depends on how its main components such as plants, warehouses, etc are configured. We extend Daskin and Snyder (2005) to a two-echelon supply chain design problem. Our objective is to locate the primary facilities and then find the optimal reconfiguration of the supply chain when a disruption has occurred at a facility by assigning multiple backups.

3 - Applying Distribution Network Modeling to Improve Theater Distribution Operations
Norman Reitter, Principal Logistics Engineer, Concurrent Technologies Corporation, 100 CTC Drive, Johnstown, PA, 15904, United States, reittern@ctc.com, Jamie Baer

The study team used an iterative approach, applying network transhipment modeling, simulation modeling, and logistics analysis to create and test the best distribution network configuration with results shown in a distribution blueprint format. We provide an overview of the distribution planning problem and a decision support methodology used to provide distribution asset placement, fleet sizing, and process improvements to logistics operations.

4 - Logistics Composite Model Variance Reduction
Alan Johnson, Session Chair, Air Force Institute of Technology, AFIT/ENS, 2950 Hobson Way, Building 641, W-P AFB, OH, 45433-7765, United States, alan.johnson@afit.edu, George Cole

The Air Force uses the Logistics Composite Model (LCOM) to determine aircraft maintenance manpower levels. We are investigating the extent to which variance reduction techniques can be successfully applied to this discrete event simulation, in the hope of improving the performance of existing LCOM optimizers. We discuss our progress and plans.

■ SC23

Room 323

Joint Session New Frontiers/ED: Innovative OR Teaching in Industrial Engineering from the OR Division of IIE

Cluster: New Frontiers at the Intersection of Industrial Engineering and O.R.
Invited Session

Chair: Sarah Ryan, Iowa State University, 2019 Black Engineering Bldg., Ames, IA, 50011-2164, United States, smryan@iastate.edu

1 - Using Spreadsheets to Teach Operations Research and Industrial Engineering
Raymond Hill, Associate Professor, Wright State University, 207 Russ Engineering Center, 3640 Col. Glenn Highway, Dayton, OH, 45435, United States, ray.hill@wright.edu

The modern spreadsheet has become arguably the standard analysis tool for business managers. As the analytical professionals, the Operations Research (OR)/ Industrial Engineering (IE) practitioners should also embrace the tools and capabilities of the spreadsheet. This talk covers the use of Solver for optimization applications, data analysis tools for statistical analysis and experimental design, and Visual Basic for Applications for decision support application development.

2 - Integrating O.R. Techniques Across the I.E. Curriculum
Kim Needy, University of Pittsburgh, Department of Industrial Engineering, Pittsburgh, PA, 15261, United States, kneedy@engr.pitt.edu, Bryan A. Norman, Mary Besterfield-Sacre, Jayant Rajgopal

We present two main ideas to synthesize and integrate O.R. concepts across the undergraduate I.E. curriculum: (1) The explicit use of techniques learned in a traditional O.R. course in other I.E. classes in the curriculum, and (2) An unstructured problem solving course where students work in teams and are required to integrate their O.R. skills with other techniques to address the problem. We report on our observations based on two offerings of this class.

3 - A Global Supply Chain Project for International Student Teams
Jo Min, Professor, Industrial and Manufacturing Systems Engineering, Iowa State University, 2019 Black, Ames, IA, 50011, United States, jomin@iastate.edu, Leopoldo Cardenas, Cheng-Kang Chen, John Jackman, Peter Ball

We describe the international student team project experience in modeling and analyzing a hypothetical global supply chain. The participants for this project include students at universities in Scotland, Taiwan, and Mexico as well as at the Iowa State University. Specifically, we show how the teams from the four nations are organized and managed. Also, we provide outcome assessment on various team aspects such as team dynamics and leadership. Lessons and future directions will be discussed.

4 - Ill-Structured Problem Solving in an Optimization Course
Sigurdur Olafsson, Assistant Professor, Iowa State University, Department of Industrial and Manufacturing Systems Engineering, Ames, IA, 50011, United States, olafsson@iastate.edu

Engineering problems are frequently ill-structured and many decision making problems are poorly defined with competing solutions. In optimization this occurs when assumptions and simplifications are needed for tractability. We describe an effort to bring ill-structured problem solving into a standard undergraduate optimization course. Using a web-based system, students identify the problem, make appropriate assumptions, and solve the simplified problem using standard optimization techniques.

■ SC24

Room 324

Micro-Institutional Processes

Sponsor: Organization Science
Sponsored Session

Chair: Klaus Weber, Assistant Professor of Management and Organizations, Kellogg School of Management, Northwestern University, 2001 Sheridan Rd, Evanston, IL, 60208-2001, United States, klausweber@northwestern.edu

Co-Chair: Amit Nigam, Post Doctoral Researcher, Rotman School of Management, University of Toronto, 105 St. George Street, Toronto, ON, M5S 3E6, Canada, amit.nigam@rotman.utoronto.ca

The papers in this session examine the linkages between institutional structures and local interactions and meaning making processes.

1 - Institutional Semiotics: Meaning and Markets
Roy Suddaby, Pearson Faculty Fellow, School of Business, University of Alberta, 2-32E Business Building, Edmonton, AB, T7Y 1b(, Canada, roy.suddaby@ualberta.ca

This paper focuses on the rhetorical and semiotic strategies used by publicly traded companies to communicate to market actors; competitors, regulators, shareholdeers, employees and other market participants. We draw from rhetorical theory, semiotics and neo-institutional theory to demonstrate how organizations use public market disclosure mechanisms to code and deploy rhetorical "signals" simultaneously to multiple audiences.

2 - Micromobilization: Negotiating Institutional Change in Surgery through Cycles of Challenge in Workplace Encounters
Kate Kellogg, Sloan School of Management, MIT, kkellogg@MIT.edu

Institutional scholars present contradictory evidence regarding which actors in an organization are critical to effecting an actual rather than merely symbolic change in organizational work practices in response to coercive pressure. In this 15 month ethnography, I track the process of change in response to a reform involving surgical practices in two surgical teaching hospitals. In one of the hospitals, organization members accomplished a real change in practices. The change seems to have required, however, more than the actions of powerful top managers or middle status paraprofessionals, as current literature would suggest. Instead, real change in practices was accomplished via the mobilization of a cross-rank coalition. Members with non-traditionalist identities transformed themselves from a disorganized group of individuals into an organized cross rank coalition via interactions in everyday work encounters and used this cross-rank coalition to create pressure for change. The agentic processes which were critical to the change were 1) the building of a cross-rank reformer identity, frames and solidarity across ranks, 2) the use of the reformer identity and frames to marshal resources from top managers, 3) the pressuring of traditionalists via crisis, and 4) the cross-rank creation of a positive model for change.

3 - Some Implications of Institutional Pluralism
Matt Kraatz, College of Business, University of Illinois, Urbana-Champaign, kraatz@uiuc.edu, Emily Block

This paper elaborates some of the organizational implications of institutional pluralism. Institutional pluralism is the condition confronted by organizations that operate within more than one institutional sphere at the same time. Organizations in pluralistic contexts have multiple roles, obligations, and social identities which are bestowed upon them as a result of their multiple institutional affiliations. We discuss the challenges and opportunities that pluralism creates for the organization and also consider its implications for theory.

■ SC25

Room 325

Panel Discussion: OR Entrepreneurship #3

Cluster: OR Entrepreneurship
Invited Session

Chair: Doug Samuelson, Homeland Security Institute, 8711 Chippendale Court, Annandale, VA, 22003, United States, samuelsondoug@yahoo.com

1 - Panel Discussion: OR-Based Entrepreneurship
Moderator: Doug Samuelson, Homeland Security Institute, 8711 Chippendale Court, Annandale, VA, 22003, United States, samuelsondoug@yahoo.com, Panelists: Joe Discenza, Deb Sadowski, Vijay Mehrota

While many members of INFORMS have worked in entrepreneurial firms, those who have actually started and run such companies are less numerous. These panelists, all of whom have succeeded as leaders of high-tech start-up companies, will discuss their experiences and lessons learned.

■ SC26

Room 326

Data Mining in Decision-Making

Sponsor: INFORMS Computing Society/Data Mining
Sponsored Session

Chair: Victoria Chen, Associate Professor, University of Texas, Arlington, Industrial Engineering, Campus Box 19017, Arlington, TX, 76019-0017, United States, vchen@uta.edu

1 - Convex Version of Multivariate Adaptive Regression Splines for Optimization
Dachuan Shih, PhD Candidate, University of Texas at Arlington, Dept. of Ind. & Manuf. Sys. Eng., Campus Box 19017, Arlington, TX76019, United States, dshih@uta.edu, Victoria Chen, Seoung Bum Kim

Multivariate Adpative Regression Splines (MARS) is a flexible statistical modeling method that has been used in optimization for stochastic dynamic programs, Markov decision problems, and two-stage stochastic programming. Many optimization methods depend on convexity, but a nonconvex MARS approximation is inherently possible. To ensure MARS convexity: (1) The form of interaction terms is modified. (2) Coefficients are constrained to guarantee convex functions.

2 - Platform Identification Using Data Mining for Product Family Design
Seung Ki Moon, Graduate Research Assistant, The Pennsylvania State University, 233 Leonhard Building, University Park, PA, 16802, United States, sum143@psu.edu, Timothy W. Simpson, Soundar R. T. Kumara

In this paper, we propose a methodology for identifying a platform along with variant and unique modules in a product family using fuzzy clustering. Fuzzy c-means clustering is used to determine initial clusters based on the similarity among functional features. The clustering result is identified as the platform and the modules by a fuzzy membership function and classification. We apply the proposed methodology to determine a new platform using a case study involving a single-use camera family.

3 - Discriminant Analysis and Predictive Models in Medicine
Eva Lee, Associate Professor, School of Industrial and Systems Engineering, Georgia Institute of Technology, Atlanta, GA, 30332, evakylee@isye.gatech.edu

In this talk, we describe novel optimization-based predictive models, and analyze the process of selecting critical attributes through a feature-selection algorithm. Applications to prediction of cardiovascular disease, Alzheimer's disease, human cancer, and the degree of cell membrane permeabilization via assisted ultrasound (for drug delivery) will be discussed.

4 - A Sequential Response Surface Methodology for the Aircraft Rotation Problem
Siriwat Visoldilokpun, PhD Student, Department of Industrial and Manufacturing Systems Engineering, University of Texas at Arlington, PO Box 19017, Arlington, TX, 76019, United States, siriwatvi@yahoo.com, Jay Rosenberger, Victoria Chen, H.W. Corley, Seoung Bum Kim

Most existing simulation optimization techniques are computationally intractable for large-scale problems. We develop a column generation approach for response surface methodology using multivariate adaptive regression splines (MARS). The algorithm is based upon Dantzig-Wolfe decomposition within Kelley's cutting plane algorithm. We apply the approach to an aircraft rotation problem.

■ SC27

Room 327

Joint Session QSR/ Health Applications: Quality and Statistical Decision-Making in Healthcare Applications I

Sponsor: Quality, Statistics and Reliability, Health Applications
Sponsored Session

Chair: Jing Li, Research Assistant, Department of Industrial and Operations Engineering, University of Michigan, 1205 Beal Avenue, Ann Arbor, MI, 48109, United States, jinglz@engin.umich.edu

Co-Chair: Julie Simmons Ivy, Assistant Professor, University of Michigan, 701 Tappan Street, Ann Arbor, MI, 48109, United States, jsimmons@bus.umich.edu

Co-Chair: Nicoleta Serban, Assistant Professor, ISyE, Georgia Institute of Technology, 755 Ferst Drive NE, Atlanta, GA, 30332, nserban@isye.gatech.edu

1 - Statistical Process Control for Syndromic Surveillance

Justin Chimka, Assistant Professor, University of Arkansas, Bell Engineering Center, Department of Industrial Engineering, Fayetteville, AR, 72701, United States, jchimka@uark.edu, Jia Zhou

The problem of syndromic surveillance will be considered here as one of analysis and interpretation of flu activity data collected and reported by the Influenza Branch at Centers for Disease Control and Prevention. We have measured specificity of individuals control charts for outbreak detection. Observations of isolates and influenza like illness have been analyzed alone and as functions of predictors including geographical region.

2 - Automated Time Series Forecasting for Biosurveillance

Galit Shmueli, Assistant Professor, University of Maryland, Robert H. Smith School of Business, Van Munching Hall, College Park, MD, 20742, United States, gshmueli@rhsmith.umd.edu, Howard Burkom, Sean Murphy

For robust detection performance, alerting algorithms for biosurveillance require input data free of trends, day-of-week effects, and other systematic behavior. We describe three forecast methods and compare their predictive accuracy on each of 16 authentic syndromic data streams. The methods are 1) a nonadaptive loglinear regression model using a long historical baseline, 2) an adaptive regression model with a shorter, sliding baseline, and 3) the Holt-Winters exponential smoothing method.

3 - Nursing Home Care Quality: A Bayesian Network Approach

Justin Goodson, Graduate Teaching Assistant, Department of Management Sciences, University of Iowa, S210 John Pappajohn Business Building, Iowa City, IA, 52242, United States, justin-goodson@uiowa.edu, Wooseung Jang

This study employs Bayesian networks to examine the multidimensional aspects of the quality of care in nursing homes. The findings indicate that nursing home quality is most accurately represented through a mix of structural, process, and outcome measures of quality. Furthermore, significant quality factors and their probabilistic relationships are identified.

4 - A Survey of the Statistical Methods on Health Care Fraud Detection

Jing Li, Research Assistant, Department of Industrial and Operations Engineering, University of Michigan, 1205 Beal Avenue, Ann Arbor, MI, 48109, United States, jinglz@engin.umich.edu, Kuei-Ying Huang, Judy Jin, Jianjun Shi

Frauds and abuses have incurred significant loss in the US health care expenditure. This paper conducts a comprehensive survey of existing statistical methods in health care fraud detection, focusing on the fraud characteristics, the uniqueness of health care data, the existing methods, and some discussions of opportunities for future R&D.

■ SC28

Room 328

Panel Discussion: 10 Years Anniversary for the QSR Section: Past, Current and Future

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: Judy Jin, Associate Professor, Department of Industrial and Operations Engineering, University of Michigan, IOE 2855, Ann Arbor, MI, 48109, United States, jhjin@umich.edu

Co-Chair: Jye-Chyi (JC) Lu, Professor, Georgia Institute of Technology, 765 Ferst Drive, Atlanta, GA, 30022, United States, jclu@isye.gatech.edu

1 - Panel: 10 Years Anniversary for the QSR Section: Past, Current and Future

Moderator: Judy Jin, Associate Professor, Department of Industrial and Operations Engineering, University of Michigan, IOE 2855, Ann Arbor, MI, 48109, United States, jhjin@umich.edu, Panelist: Jye-Chyi (JC) Lu

The panel is to review and access the QSR's formation and growth in the past 10years, and to identify opportunities and define the future directions of the QSR. The panel will consist of 4~5 speakers, who are selected to represent the QSR organization leaders and three focused research areas leaders in Quality, Statistics, and Reliability respectively.

■ SC29

Room 329

Stochastic Models in Health Care

Cluster: Joint Cluster Healthcare/ HAS: Healthcare Engineering
Invited Session

Chair: Elif Akcali, Assistant Professor, University of Florida, 303 Weil Hall, PO Box 116595, Gainesville, FL, 32611-6595, United States, akcali@ise.ufl.edu

1 - Patient Triage in the Aftermath of a Mass Casualty Event - A Dynamic Programming Approach

Serhan Ziya, Assistant Professor, University of North Carolina at Chapel Hill, Dept. of Statistics and Oper. Research, 213 Smith Building, CB#3180, Chapel Hill, NC, 27599, United States, ziya@unc.edu, Nilay Tanik Argon

We consider the patient prioritization (triage) problem that arises in the aftermath of mass casulaty events. Our objective is to identify effective triage decisions that maximize the expected number of lives saved, given the lifetime and treatment time distributions for patients and also the number of patients. We use stochastic dynamic programming to (partially) characterize the structure of the optimal policy. We propose a heuristic policy which is shown to work well by a numerical study.

2 - A Strategic Model for Healthcare Resource Allocation

Eylem Tekin, Assistant Professor, Texas A&M University, Industrial Engineering, College Station, TX, 77843, United States, eylem@iemail.tamu.edu

We consider the problem of service capacity allocation to new patients in multi-physican healthcare facilities. Due to random patient arrivals, the allocation of workloads to physicians may not be always balanced, resulting in long waiting times. Taking into account that some patients would like to switch from their primary physican, we provide insights on the optimal allocation policy with the objective of minimizing long-term average costs.

3 - Optimizing Emergency Room Personnel Resources

Chin-I Lin, Graduate Research Assistant, University of Florida, 303 Weil Hall, PO Box 116595, Gainesville, FL, 32611-6595, United States, cindylin@ufl.edu, Murray Côté, Elif Akcali

We examine the personnel capacity planning problem for Emergency Room (ER) with two classes of patients and two types of health care teams, which have different processing capabilities and patient class - dependent service rates. We model the ER as a preemptive priority queuing system and develop approximations to compute the patient's average system time. We then incorporate this into a network flow formulation to determine the optimal personnel capacity over a finite planning horizon.

■ SC30

Room 330

Pierskalla Award Presentations

Sponsor: Health Applications Section

Sponsored Session

Chair: Julie Simmons Ivy, Assistant Professor, University of Michigan, 701 Tappan Street, Ann Arbor, MI, 48109, United States, jsimmons@bus.umich.edu

1 - Optimization of Community Health Center Locations and Service Offerings with Statistical Needs Estimation

Paul Griffin,Professor, Georgia Institute of Technology, 765 Ferst Drive, Atlanta GA 30332, United States, pgriffin@isye.gatech.edu, Christina Scherrer, Julie Swann

Community Health Centers (CHCs) provide family-oriented health care services for people living in rural and urban medically under-served communities; they are an important part of the government's plan to make health care more affordable. We develop an optimization model to determine the best location and number of new CHCs in a geographical network, as well as what specific services each CHC should offer at which level. We maximize the weighted demand coverage of the needy population subject to budget and capacity constraints, where costs are fixed and variable. We use statistical methods on national health databases to determine important predictors of healthcare need, and we apply these methods to Census data to obtain county-based estimates of demand. Using several healthcare performance metrics, we analyze the results of the system approach to location using the state of Georgia as a prototype. We apply our model to compare policies such as access versus coverage.

2 - Improving Accessibility to Radiation Therapy for Cancer Patients

Mariel Lavieri, Student, University of British Columbia, 2053 Main Mall, Vancouver, BC, V6T 1Z2, Canada, Mariel.Lavieri@sauder.ubc.ca, Scott Tyldesley, Steven Shechter, John French, Tom Pickles, Martin Puterman

This talk describes a framework for modeling decision making for prostate cancer patients under constrained resource availability. We provide an overview of the proposed approach which will combine both clinical and operational decision making and then focus on patient specific decisions for regarding when to start radiation therapy.

3 - Statistical Surveillance and Process Control Methods in Health Care

James Benneyan, Associate Professor, Northeastern University, 334 Snell Engineering Center, Boston, MA, 02115, United States, benneyan@coe.neu.edu

Statistical control charts have many important healthcare applications, including public health, epidemiology, physiologic monitoring, and care delivery processes. We discuss national healthcare measurement trends and the use and design of SPC methods for such cases. Technical considerations, recent contributions, and emerging opportunities are discussed, including risk-adjusted surveillance, weighted sequential probability ratio tests, and statistical deadband patient control schemes.

4 - To Put a Price on Life: Deriving a Meaningful Threshold for the Cost-Effectiveness of Medicine

Chris Lee, Assistant Professor of Operations and Information Management, The Wharton School, University of Pennsylvania, 500 Jon M. Huntsman Hall, 3730 Walnut Street, Philadelphia, PA, 19104, United States, cpclee@stanford.edu, Glenn Chertow, Stefanos Zenios

Cost-effectiveness analysis is often used to evaluate new medical technology for purposes of insurance coverage. The choice of appropriate threshold is critical but most thresholds that are frequently used are unjustifiable on theoretical grounds. We derive a threshold that appeals to the foundations of welfare economics. The method uses an optimization model and tries to uncover from practice patterns the price on life implicitly placed by the society.

■ SC31

Room 331

Metaheuristics and Vehicle Routing I

Sponsor: INFORMS Computing Society/Heuristic Search

Sponsored Session

Chair: John E. Beasley, Professor, CARISMA, Brunel University, Uxbridge, UB8 3PH, United Kingdom, john.beasley@brunel.ac.uk

1 - A Genetic Algorithm for Container Loading Problem

Ali Haghani, Professor and Chairman, Department of Civil and Environmental Engineering, University of Maryland, 1173 Glen L. Martin Hall, College Park, MD, 20742, United States, haghani@umd.edu, Masoud Hamedi, Saini Yang

This paper deals with the containership stowage planning problem. The problem is stacking containers on different bays of a containership that visits several ports during a voyage. Due to its NP-Complete nature, exact algorithms for this problem are impractical. A heuristic approach based on Genetic Algorithm is proposed to deal with real world cases. Computational experiments and analysis of results as well as suggestions for future research are presented.

2 - Weight Annealing Heuristics for Solving Bin Packing Problems

Edward Wasil, Professor of Management Science, American University, Kogod School of Business, Washington, DC, 20016, United States, ewasil@american.edu, Bruce Golden, Kok-Hua Loh

We develop heuristics that use weight annealing to solve one-dimensional and two-dimensional bin packing problems. Our heuristics are easy to understand and contain a small number of parameters. We apply our heuristics to well-known problem sets and find that they quickly produce high-quality solutions that are comparable to the best solutions found in the literature.

3 - Hybrid Evolutionary Algorithms for Rich Vehicle Routing Problems

Andreas Reinholz, Chair of Systems Analysis, Department of Computer Science, University Dortmund, Schmelzer Weg, 8, Troisdorf, 53844, Germany, andreas.reinholz@gmx.de

We present a methodology for designing Hybrid Evolutionary Algorithms for hierarchical nested Rich Vehicle Routing Problems (VRP). Problem specific neighborhood generating operators, working on different levels of the problem hierarchy, using problem special coding schemes, efficient data structures and accelerated function evaluations are introduced to develop competitive solvers. Experimental results with 101 new best solutions are given for benchmarks of several VRP.

4 - A Tabu Search Algorithm for the Single Vehicle Routing Allocation Problem

John E. Beasley, Professor, CARISMA, Brunel University, Uxbridge, UB8 3PH, United Kingdom, john.beasley@brunel.ac.uk

The single vehicle routing allocation problem involves deciding a route for a vehicle (starting and ending at given locations) such that it visits some customers. Customers not visited can either be allocated to their nearest customer on the route, or can be isolated; where the objective is to minimise a weighted sum of routing, allocation and isolation costs. Our tabu search algorithm includes aspiration, path relinking and diversification. Computational results are presented.

■ SC32

Room 332

Modeling in Financial Services

Sponsor: Financial Services

Sponsored Session

Chair: Lyn Thomas, Professor of Management Science, School of Management, University of Southampton, Southampton, SO17 1 BJ, United Kingdom, L.Thomas@soton.ac.uk

1 - Procurement Strategies for Banks - Strategies for Optimizing Indirect Spend Procurement

Lars Friedrich, Johann Wolfgang Goethe-University & E-Finance Lab, Breslauer Strasse 4b, Kelkheim, D-65779, Germany, lars.friedrich@seb.de

Typically banks prefer "make" before "buy". But this attitude has changed significantly due to explosive growth in Financial Services outsourcing. Compared to other industries, such as automobile, procurement in banking is still immature. This talk describes the current status of procurement and outsourcing in banking, develops a model on business dynamics of indirect spend procurement, describes strategies to optimize procurement with illustration using three empirical examples.

2 - How Much of the Gini is Due to Segmentation?

Lyn Thomas, Professor of Management Science, School of Management, University of Southampton, Southampton, SO17 1 BJ, United Kingdom, L.Thomas@soton.ac.uk

Credit scoring systems are measured in many ways - predictive ability, power of discrimination, and accuracy of calibration. In practice a scoring system will consist of a number of scorecards - one for each subpopulation - and of vital importance is the overall ROC curve and Gini coefficient when the scorecards are combined. Part of this discrimination is due to choice of segments. This talk outlines an easily calculated bound on how much of the discrimination is due to the segmentation.

3 - Bayesian Inference for Rating Transition Models
Catalina Stefanescu, Assistant Professor of Decision Sciences, London Business School, Regent's Park, London, NW1 4SA, United Kingdom, CStefanescu@london.edu, Radu Tunaru, Stuart Turnbull

We investigate stochastic models for rating transitions and propose a Bayesian framework for calibrating these models using Markov chain Monte Carlo techniques. The methodology is applied to the analysis of a recent data set of global corporate defaults and rating transitions from Standard and Poor's, covering the period 1981 to 2004.

■ SC33

Room 333

Performance Analysis of the National Airspace System (NAS) Using Operations Forecasting

Sponsor: Aviation Applications
Sponsored Session

Chair: Dipasis Bhadra, Principal Economist, MITRE/CAASD, 7515 Colshire Avenue, McLean, VA, 22102, United States, dbhadra@mitre.org

1 - Impact of Demand Forecast Uncertainty on National Airspace System Performance Estimates
David Millner, The MITRE Corporation, 49185 Transmitter Road, Building 626, San Diego, CA, 92152, United States, dmillner@mitre.org, Jerome Freedman, Michael Callaham, Glenn Foster, William Baden

This study considers the effect of demand uncertainty on the benefits of future National Airspace System improvements. Historic variation is added to the FAA's Terminal Area Forecast (TAF) to produce future demand ranges that preserve time correlations and airport dependencies. The Fratar algorithm is used to produce future demand and delays are estimated via simulation. The results show how demand ranges provide better information about future performance than could be derived by the TAF alone.

2 - Detailed Traffic Forecasting for the National Airspace System
James Bonn, Research Analyst, The CNA Corporation, 4825 Mark Center Drive, Alexandria, VA, 22311, United States, james.ctr.bonn@faa.gov

The Federal Aviation Administration's Air Traffic Organization's Office of Strategy has been tasked with the generation of detailed future air traffic demand for the National Airspace System. We describe the process of turning Terminal Area Forecast and Enhanced Traffic Management System input data into the future forecasts using a Fratar technique. We also discuss predicted traffic levels at different Service Delivery Points.

3 - Probabilistic Forecasting at FAA's Commercial Terminals
Dipasis Bhadra, Principal Economist, MITRE/CAASD, 7515 Colshire Avenue, McLean, VA, 22102, United States, dbhadra@mitre.org, Roger Schaufele

Generally, speaking, activities forecasts are point forecasts. This is true at the FAA as well as many other parts of the federal government. In this talk, we lay out a framework within which forecasts can be made probabilistic with uncertainty bands around them when the underlying model is unknown. Using Monte Carlo simulation, we apply this framework on total operations at FAA's commercial terminals.

4 - FAA Future Demand Schedules for Air Traffic Planning
John Gulding, Senior Strategist, Federal Aviation Administration, 800 Independence Avenue SW, Washington, DC, 20591, United States, john.gulding@faa.gov

Models used to assess future shortfalls must adapt a generic forecast to operational schedules that target key limitations in NAS performance. Schedule quality improves by reflecting seasonal variation and risk ranges around alternatives. For 2006, the ATO Office of Strategy developed a set of future schedules that allows for consistent planning among FAA program offices. The purpose of this paper is report on this development including core functions, verification and user implementation.

■ SC34

Room 334

Joint Session TSL/PPP: Operations Research and Non-Profit Applications

Sponsor: Transportation Science & Logistics, Public Programs and Processes
Sponsored Session

Chair: Karen Smilowitz, Assistant Professor, Northwestern University, 2145 Sheridan Road, M233, EV3119, Evanston, IL, 60208, ksmilowitz@northwestern.edu

1 - OR/MS for Public-Sector Decisionmaking with Limited Resources: Values, Evidence and Methods
Michael Johnson, Extern, Carnegie Mellon University, Center for Economic Development, 5000 Forbes Avenue, Pittsburgh, PA, 15213-3890, United States, johnson2@andrew.cmu.edu

Public decisionmaking is a challenging enterprise: practitioners and researchers must balance concerns of politics, policy, appropriate methods and fiscal constraints. In this presentation I review applications of OR/MS methods to problems in location of community corrections centers, fire stations and affordable housing, as well as reconfiguration of public school buildings and programs. My primary finding is that both qualitative and quantitative analytical methods are useful in assisting system change, especially in fiscally-constrained and politically contentious environments. Also, I find that "OR-like" thinking can be just as useful as explicit models and methods.

2 - Last Mile Distribution Problem for Humanitarian Relief Chains
Burcu Balcik, Graduate Assistant, Department of Industrial Engineering, University of Washington, Box 352650, Seattle, WA, 98195, United States, burcub@u.washington.edu, Benita Beamon, Karen Smilowitz

We consider last mile logistical operations in the humanitarian relief chain, which involves allocating relief supplies among demand locations from local distribution centers, and determining delivery schedules and routes for each vehicle throughout the planning horizon. We present an MIP model and solution approach for the last mile distribution problem. Finally, we present computational results and practical implications.

3 - Sequential Allocation Problems for Non-Profit Agencies
Robert Lien, Doctoral Student, Department of Industrial Engineering and Management Sciences, Northwestern University, 2145 Sheridan Road, Tech C210, Evanston, IL, 60208, United States, robertlien@northwestern.edu, Seyed Iravani, Karen Smilowitz

In this paper, we consider allocation decisions that arise in sequential inventory problems. In particular, we consider the Food Rescue Program operated by the Greater Chicago Food Depository.

4 - Optimal Fundraising Categories
Kevin McCardle, Professor, UCLA Anderson School, 110 Westwood Plaza, Los Angeles, CA, 90095-1481, United States, kevin.mccardle@anderson.ucla.edu, Kumar Rajaram, Christopher Tang

We provide some data and a simple model for the setting of named categories in capital campaigns for charitable 501c3 organizations.

■ SC35

Room 335

Recent Development and Applications of the Continum Approximation Method

Sponsor: Transportation Science & Logistics
Sponsored Session

Chair: Yanfeng Ouyang, Assistant Professor, University of Illinois at Urbana-Champaign, 205 N. Mathews Avenue, Urbana, IL, 61801, United States, yfouyang@uiuc.edu

1 - Design of a Distribution Network
Anton Kleywegt, Associate Professor, Georgia Institute of Technology, School of Industrial Systems Engineering, Atlanta, GA, 30332, United States, anton@isye.gatech.edu, Jinpyo Lee, Amy Ward

We consider the design of a distribution network in which a less-than-truckload carrier transports shipments between many origins and destinations using several crossdocks. We describe a continuous approximation type approach that better captures the trade-off between the number of crossdocks that serves origins and destinations and the transportation distances than a widely used approach. We demonstrate our method with various instances.

2 - Modeling A Periodic Distribution Problem
Peter Francis, PhD Candidate, Northwestern University, Department of IE/MS, 2145 Sheridan Road, Evanston, IL, 60208, United States, pete@iems.northwestern.edu, Karen Smilowitz

We present a continuum approximation model for the Period Vehicle Routing Problem with Service Choice (PVRP-SC). The PVRP-SC is a variant of the Period Vehicle Routing Problem in which the visit frequency to nodes is a decision of the model. This variation can result in more efficient vehicle tours and/or greater service benefit to customers. The model helps evaluate the value of service choice in the strategic and tactical planning of periodic distribution systems.

3 - Discretizing Vehicle Routing Zones for Large-Scale Distribution Systems with Customer Uncertainty
Yanfeng Ouyang, Assistant Professor, University of Illinois at Urbana-Champaign, 205 N. Mathews Avenue, Urbana, IL, 61801, United States, yfouyang@uiuc.edu

This paper proposes algorithms to automatically discretize vehicle routing zones (VRZ) from continuum approximation guidelines (i.e., shape and size requirements). VRZs are useful to the planning and operation of distribution systems in several practical contexts. We utilize a combination of spatial partitioning techniques to systematically obtain optimum zone designs that conform to the guidelines.

■ SC36

Room 336

Panel Discussion: Integrating Demand and Network Models

Sponsor: Transportation Science & Logistics
Sponsored Session

Chair: Joan Walker, Boston University, 675 Commonwealth Avenue, Boston, MA, 02215, United States, joanw@bu.edu

1 - Panel Discussion: Integrating Demand and Network Models
Moderator: Joan Walker, Boston University, 675 Commonwealth Avenue, Boston, MA, 02215, United States. Panelists: Moshe Ben-Akiva, Hani Mahmassani, Srinivas Peeta, Peter Vovsha

In research and practice, there have been many advances on both the travel demand modeling (e.g., activity-based models) and travel supply modeling (e.g., traffic microsimulation and dynamic traffic assignment). However, there has been less attention to the integration of these advanced models. Current integration techniques (e.g., loose coupling of these models to transfer data from one to the other) do not take advantage of the added behavioral data available in each model, nor do they achieve consistency among parameters that are used in both demand and supply models. This panel session brings together top researchers with experience in both demand- and supply-side modeling to discuss the status of the field, critical issues, innovative research, and future directions.

■ SC37

Room 337

Economics of IS

Sponsor: Information Systems Society
Sponsored Session

Chair: Vidyanand Choudhary, Assistant Professor, University of California, Irvine, Paul Merage School of Business, SB 313, Irvine, CA, 92697, United States, VeeCee@uci.edu

1 - A Model to Compare an Online Intermediary Strategy versus an Online Direct Retailer Strategy
Fred Riggins, Assistant Professor, University of Minnesota, Carlson School of Management, 321 19th Avenue S., Minneapolis, MN, 55455, United States, friggins@csom.umn.edu

We develop a model to compare an online direct retailer with an online intermediary. In the absence of transaction cost advantages the direct retailer strategy dominates due to a supply dependency for the intermediary. However, the intermediary strategy may be better due to lower entry costs. The best strategy may be to enter the market as an online intermediary and evolve to become a direct retailer. We model how storefront technology maturity and adoption of e-commerce impacts this evolution.

2 - To Preempt or Not to Preempt? A Timing Decision Model for Software Functionality Additions
Amy Ping Wu, Carlson School of Management, University of Minnesota, Information and Decision Sciences, 321 Nineteenth Avenue South, Suite 3-365, Minneapolis, MN, 55455, United States, pwu1@csom.umn.edu, Robert Kauffman

We present a game-theoretic model to study the optimal timing for vendors to add new software functionality to their technology products. An example of such functionality additions is the expansion of portals' capabilities to provide digital photo storage. We find that when vendors face heterogeneous launching costs and different time lags in capturing profits (i.e., value latency), a vendor should compare its own launch cost and value latency with those of its rivals to decide its launch time.

3 - Is Consumer Demand Kinked? Estimating Menu Costs and Search Costs in Electronic Markets
Anindya Ghose, Assistant Professor, Stern School of Business, New York University, 44 West Fourth Street, KMC 8-94, New York, NY, 10012, United States, aghose@stern.nyu.edu, Bin Gu

The internet has significantly reduced consumers' search costs and menu costs of retailers. But little is known about the magnitude of these costs in electronic markets. Using a dataset collected from Amazon.com and Barnes & Noble, we use product-level price and demand data to estimate these costs. We also identify the impact of search costs on market competition by exploring a unique insight of Stiglitz (1989) that search costs create kinkiness in aggregate demand when firms change prices.

■ SC38

Room 338

RASIG Roundtable I - Railroad Capacity Network Allocation and Investment

Sponsor: Railroad Applications
Sponsored Session

Chair: Carl Van Dyke, Director, Mercer Management Consulting, 125 Village Boulevard, Suite 270, Princeton, NJ, 08540, United States, carl.vandyke@mercermc.com

1 - Impact of Capacity Constraints on Operating Plan Design
Alan Blumenfeld, CSX Corporation, Inc., 500 Water Street, Jacksonville, FL, 32202, United States, alan_blumenfeld@csx.com

Developing an operating plan where your network has significant areas of capacity constraints requires a different approach. This approach requires the full integration of business processes, Plan Development, Yield Management, and Tactical operations. This discussion will address how this full integration can help produce a more fluid and profitable operation.

2 - Use of Operations Research Models to Plan Capacity at Norfolk Southern
Wayne Mason, Senior Director of Strategic Planning, Norfolk Southern Corporation, 1200 Peachtree Street NE, Atlanta, GA, 30309, United States, Wayne.Mason@nscorp.com

Norfolk Southern and other North American railroads have been experiencing unprecedented growth in recent years. Facing the challenges of a growth industry, Norfolk Southern turned to Operations Research models and techniques to draw more capacity out of the existing operating plan and infrastructure. Furthermore, OR tools are being employed to identify the "choke points" in the NS transportation network and make recommendations to invest in new capacity.

3 - The Rail Network Capacity Crunch: Public and Private Goals
David Hunt, Cambridge Systematics, Inc., PO Box 816, Pennington, NJ, 08534-0816, United States, dhunt@camsys.com, Raphael Kedar

Freight volumes are at record levels, creating capacity issues for all transportation modes. The responsibility for expanding capacity on roads, ports, and airports falls on the public sector, while railroad capacity is a private sector responsibility. There is often a disconnect between public and private goals. This presentation looks at the capacity crunch and different visions for the rail network. It also explores operations research methods needed to advance public and private goals.

4 - Dynamic Planning and Implementation: Managing Emergency Rail Outages
Trent Sommers, System Manager Network Optimization, Norfolk Southern Corporation, 1200 Peachtree Street, NE, Box 158, Atlanta, GA, 30309, United States, trent.sommers@nscorp.com

An overview of Norfolk Southern's service design philosophy and systems structures. How NS utilizes its integrated transportation data systems for capacity management during rail outages will be explored, using Hurricne Katrina as an example. A look at how implementation capabilities and short time horizons impact rail transportation planning and execution strategies. Consideration of change management process during systems development will also be explored.

■ SC39

Ballroom B

Where Do We Want to Go in Education?

Cluster: Where Do We Want to Go?

(In observance of Arthur Geoffrion's retirement)

Invited Session

Chair: Christopher Tang, Professor, Anderson School, University of California - Los Angeles, 110 Westwood Plaza, Los Angeles, CA, 90095, United States, chris.tang@anderson.ucla.edu

1 - Engineering Education and Operations Research

Thomas Magnanti, Institute Professor and Dean of Engineering, Massachusetts Institute of Technology, 77 Massachusetts Avenue, 1-206, Cambridge, MA, 02139, United States, magnanti@mit.edu

Considerable national dialog during the past few years has focused on the perceived need for reforms in both the content and delivery of higher education. In particular, as reflected by the National Academy of Engineering's 2020 report, considerable attention has focused on engineering education. This talk will highlight some of these deliberations as well as their potential implications for education in operations research.

2 - Where Do We Want OR to Go in Education and Vice Versa?

John R. Birge, Professor, University of Chicago, Graduate School of Business, 5807 S. Woodlawn Avenue, Chicago, IL, 60637, United States, john.birge@chicagogsb.edu

While academics still represent the largest group of operations researchers judged by INFORMS membership and meetings attendance, education remains ironically substantially untouched by OR. Perhaps not so coincidentally, OR education also remains relatively unchanged by recent developments in education. In this talk, I will discuss possible channels for OR both to have a greater role in education developments and to benefit more from innovations in education.

3 - What Skills Does Industry Want from Our Graduates?

ManMohan Sodhi, Professor, Cass Business School, City University London, 106 Bunhill Row, London, EC1Y8TZ, United Kingdom, m.sodhi@city.ac.uk

We describe the skills that industry employers seek from graduates of OR programmes with a view to motivate discussion on what should be taught and how it should be taught in OR or OM programmes. Our results are based on content analysis of detailed job ads. We also discuss what industry (implicitly) defines OR and OM to be and therefore the possible implications on education.

■ SC40

Room 401

Medical Location Issues

Sponsor: Location Analysis

Sponsored Session

Chair: Tammy Drezner, Professor, California State University, Department of ISDS, Fullerton, CA, 92834, United States, tdrezner@fullerton.edu

1 - A Location Model of an Eyeglass Lens Adjustment Problem

Richard Francis, Professor Emeritus, Department of Industrial & Systems Engineering, University of Florida, 303 Weil Hall, Gainesville, FL, 32611, United States, francis@ise.ufl.edu

The problem is to find one (or several) best eyeglass lens adjustment(s) for an eye with double vision when the vision changes throughout the day. We model the problem as a well-known location problem, and mention some personal experience. Known theoretical results have some interesting applications, believed to be new.

2 - Incorporating Congestion in Designing Preventive Healthcare Facility Networks

Yue Zhang, PhD Candidate, McGill University, 1001 Sherbrooke Street West, Montreal, QC, H3A 1G5, Canada, yue.zhang3@mail.mcgill.ca, Oded Berman, Vedat Verter

The problem of locating an undetermined number of preventive healthcare facilities to maximize participation is proposed. Each facility is an M/M/1 queue, and each customer patronizes the facility with the minimal expected total time (travel time plus the expected time customers spend at the facility). Facilities must achieve a minimum workload requirement. Four heuristics are proposed and compared. A real life application (breast cancer screening centers in Montreal) is examined and analyzed.

3 - Solution Approaches for Facility Location of Medical Supplies for Large-Scale Emergencies

Hongzhong Jia, Research Assistant, University of Southern California, 2113 Oak Street, Los Angeles, CA, 90007, United States, hjia@usc.edu, Fernando Ordonez, Maged Dessouky

We propose models and solution approaches for locating the medical supply facilities in response to large-scale emergencies. We address the problem's uncertainty by ensuring each demand point is serviced by multiple facilities at different distances. Three heuristics are developed to solve this problem: genetic algorithm, locate-allocate, and Lagrangean relaxation heuristics. We evaluate the performance of the model and the heuristics on illustrative large-scale emergency examples.

4 - Cannibalization in a Competitive Environment

Tammy Drezner, Professor, California State University, Department of ISDS, Fullerton, CA, 92834, United States, tdrezner@fullerton.edu

When a retail chain is expanding by adding outlets, two incompatible objectives have to be adressed: 1) The total market share captured by the chain should be maximized; 2) Cannibalization of chain members' market share should be minimized. The models are formulated and analyzed.

■ SC41

Room 402

Diffusion Approximations and Applications

Sponsor: Applied Probability

Sponsored Session

Chair: Sunil Kumar, Professor of Operations, Information, and Technology, Stanford University, Graduate School of Business, 518 Memorial Way, Stanford, CA, 94305-5015, United States, Kumar_Sunil@gsb.stanford.edu

1 - Long Time Asymptotics for Constrained Diffusions in Polyhedral Domains

Amarjit Budhiraja, Professor, University of North Carolina, Statistics and Operations Research, CB # 3260, Chapel Hill, NC, 27599, United States, budhiraj@email.unc.edu, Chihoon Lee

Long time asymptotics of constrained diffusions arising in the heavy traffic analysis of queueing networks is studied. We strengthen the result of Dupuis and Williams(1994) that showed ergodicity of an SRBM by establishing geometric ergodicity. Geometric ergodicity is also obtained for a broad family of constrained diffusions with state dependent coefficients. As consequences, we obtain finite exponential moments of the invariant measure, uniform time estimates on moments and FCLTs.

2 - Critically Loaded Queueing Systems that Behave as Underloaded

Rami Atar, Associate Professor, Technion - Israel Institute of Technology, Department of Electrical Engineering, Haifa, 32000, Israel, atar@ee.technion.ac.il, Avi Mandelbaum, Gennady Shaikhet

We consider a multiclass queueing system with a fixed number of classes and a fixed number of service stations, in the Halfin-Whitt diffusion asymptotic regime. The underlying critically loaded fluid model may or may not be "throughput optimal" in a sense that can be made precise. We discover a new type of "heavy traffic behavior" where it is possible to maintain empty queues with probability approaching one. We show that this can be achieved if and only if throughput optimality does not hold.

3 - A Dual Approach to Singular Stochastic Control Problems

Sunil Kumar, Professor of Operations, Information, and Technology, Stanford University, Graduate School of Business, 518 Memorial Way, Stanford, CA, 94305-5015, United States, Kumar_Sunil@gsb.stanford.edu, Joy Rajiv

Singular stochastic control problems arise in a variety of applications ranging from economics to finance to queueing systems. Except in special cases, these problems can only be solved numerically. We outline a numerical method based on duality for solving such problems. We iteratively construct dual feasible solutions, by modifying the cost structure, that approach the primal optimal solution. We illustrate the method on two well-known problems.

4 - Asymptotic Optimality of a Fixed-Point-Based Threshold Control

David D. Yao, Professor, Department of Industrial Engineering and Operations Research, Columbia University, New York, NY, 10027, yao@ieor.columbia.edu, Heng-Qing Ye

In a prior work, Li and Yao, a stochastic network with simultaneous resource occupancy is studied, and a threshold control policy is proposed based on a fixed-point approximation. Here, we establish the asymptotic optimality of this control policy under fluid and diffusion scaling, and discuss its application in airline revenue management.

■ SC42

Room 403

Improving Scheduling Decision-Making

Cluster: Scheduling

Invited Session

Chair: Jeffrey Herrmann, Professor, University of Maryland, Department of Mechanical Engineering, College Park, MD, 20742, United States, jwh2@umd.edu

1 - Heuristics for Scheduling a Single Machine with Family-Dependent Setup Times

Reha Uzsoy, Professor, Purdue University, 315 N. Grant Street, West Lafayette, IN, 47907, United States, uzsoy@ecn.purdue.edu, Juan Diego Velasquez

We examine the problem of minimizing maximum lateness on a single machine with family dependent setup times. We develop several heuristics including a rolling horizon approach and an incomplete dynamic program based on the algorithm of Monma and Potts(1989). Computational results are provided.

2 - Scheduling Final Exams at Cornell University

Dmitriy Levchenkov, PhD Student, Cornell University, School of OR&IE, 295 Rhodes Hall, Ithaca, NY, 14853, United States, levchen@yahoo.com, Robert Bland, David Shmoys

Final exams at Cornell are scheduled in 21 periods on 7 days, by first grouping all courses into 1 of 14 groups based on their class time or, for courses with multiple sections, in one of 6 exception groups. Student complaints about taking 3 exams in a day or 2 consecutive exams prompted us to develop an IP approach to the problem. This approach has been adopted here with great success. Somewhat surprisingly, the solution of the required IPs has not been an obstacle in this work at all.

3 - Integrating Organizational, Decision-Making, and Problem-Solving Perspectives of Scheduling

Jeffrey Herrmann, Professor, University of Maryland, Department of Mechanical Engineering, College Park, MD, 20742, United States, jwh2@umd.edu

Production scheduling activities are common but complex. This leads to many different perspectives. Each has a particular scope, its own set of assumptions, and a different approach to improving production scheduling. Three important perspectives are the problem-solving perspective, the decision-making perspective, and the organizational perspective. This talk presents an integrative strategy for selecting, in a particular setting, an approach for improving production scheduling.

4 - Scheduling Reentrant Jobs

Ed Mooney, Associate Professor, Montana State University, M&IE Department, Bozeman, MT, 59717-3800, United States, emooney@ie.montana.edu, Deepu Philip

Capacitated workstations, multiple routes, sequence dependent setup times, and reentrant jobs make the reentrant flexible job shop with sequence-dependent setups (RFJSSDS) problem one of the most general and difficult shop scheduling problems. We identify several important properties of RFJSSDS and use them to couple a local search algorithm with a general shop simulator for efficient scheduling. Experiments with a set of synthetic instances demonstrate the value of the approach.

■ SC43

Room 404

AHP/ANP Applications in Operations Management

Cluster: Analytic Hierarchy Process

Invited Session

Chair: Jennifer Shang, Associate Professor, University of Pittsburgh, 254 Mervis Hall, Roberto Clemente Drive, Pittsburgh, PA, 15260, United States, shang@katz.pitt.edu

1 - Offshore Outsourcing Decision Making: A Government Policy Focus

Tammy Tjader, PhD Candidate, University of Pittsburgh, 343 Mervis Hall, Pittsburgh, PA, 15260, United States, yotst1@katz.pitt.edu

The need for US firms to stay competitive along with the job loss distress has kindled fierce debate about offshore outsourcing. To provide a satisfactory government guideline for offshore outsourcing, we investigate the pertinent factors and propose a comprehensive evaluation framework to address this sensitive and important issue.

2 - The First Ten Years of Using The Analytic Network Process (ANP): A Literature Review

Enrique Mu, Director, MIS Program, University of Pittsburgh, 345 Mervis Hall, Pittsburgh, PA, 15260, United States, enmu@katz.pitt.edu

Since its formal proposal by Saaty, ten years ago, the ANP has had only a few applications and has appeared rather sparsely in the literature. Still, the body of ANP articles is growing and at this point merits careful examination. This paper will review the current literature on ANP with an emphasis on its applications.

3 - Business Internal Audit Prioritization: A Case Study

Wen Chiang, Professor, University of Tulsa, 118-J BAH, 600 S. College Avenue, Tulsa, OK, 74104, United States, wen-chiang@utulsa.edu, Jennifer Shang

Internal audits evaluate internal control of a business through financial, operational, and compliance review. It assesses the risk of asset loss, studies business processes, and identifies opportunities to improve efficiency and effectiveness. In this paper, we apply AHP and DEA to determine the business units that need audit. The framework is comprehensive, flexible, and shows great potential for internal audit prioritization and resource allocation.

■ SC44

Room 405

JFIG Paper Competition Finalists I

Sponsor: Junior Faculty Interest Group (JFIG)

Sponsored Session

Chair: Alan Scheller-Wolf, Associate Professor, Tepper School of Business, Carnegie Mellon University, Pittsburgh, PA, 15213, United States, awolf@andrew.cmu.edu

1 - JFIG Paper Competition Finalists

In these two sessions the finalists of the 2006 JFIG paper competition will present their research. The paper competition is organized by the Junior Faculty Interest Group (JFIG) forum in INFORMS. JFIG was created in 2001 to promote the career development of tenure-track faculty in INFORMS. The goals of the paper competition are to encourage research among junior faculty and to increase the visibility of research conducted by junior faculty within the fields of operations research and management science. Six finalists are selected by the award committee and their papers are presented in these two sessions. The papers submitted for the competition are evaluated based on the importance of the topic, appropriateness of the research approach, and the significance of research contribution. Winners are announced at the JFIG lunch on Sunday at the INFORMS Annual Meeting.

■ SC45

Room 406

Tutorial: Model Uncertainty, Robust Optimization and Learning

Cluster: Tutorials

Invited Session

1 - Model Uncertainty, Robust Optimization and Learning

Andew Lim, Professor, University of California, Department of IEOR, Berkeley, CA, 94720, United States, lim@ieor.berkeley.edu, Z.-J. Max Shen, George Shanthikumar

We discuss different models of model uncertainty with variable, parameter and measure uncertainty sets, and present different approaches to robust optimization with and without bench-marking. Two alternative learning approaches, Objective Bayesian Learning and Operational Learning will be discussed. Applications considered for illustration are the classical inventory control problem, the inventory control problem with censored demand data and the portfolio selection problem.

■ SC46

Room 407

Tutorial: Enhance Your Own Research Productivity Using Spreadsheets (From Sin to Salvation)

Cluster: Tutorials

Invited Session

1 - Enhance Your Own Research Productivity Using Spreadsheets (From Sin to Salvation)

Janet Wagner, Associate Professor, University of Massachusetts-Boston, MSIS Department, 100 Morrissey Boulevard, Boston, MA, 02125, United States, janet.wagner@umb.edu, Jeffrey Keisler

Spreadsheets are preferred by many OR/MS modelers. However, user surveys indicate that most do not use basic good practices and most large spreadsheets are seriously flawed. Fortunately, solutions to many of these problems are widely

available and easy to learn. The authors, who have first hand experience with both "sin" and "salvation" in the spreadsheet kingdom, present "top ten" Excel methods and four major applications reflecting personal and professional experiences. Bring your laptops!

■ SC47

Room 408

New Supply Chain Initiatives

Cluster: Supply Chain and Operations Engineering
Invited Session

Chair: Zuo-Jun Max Shen, Professor, University of California at Berkeley, 4141 Etcheverry Hall, University of California, Berkeley, CA, 94720, United States, shen@ieor.berkeley.edu

1 - Supply Uncertainty and the Reverse Bullwhip Effect
Lawrence Snyder, Assistant Professor, Department of Industrial & Systems Engineering, Lehigh University, 200 West Packer Avenue, Bethlehem, PA, 18015, United States, larry.snyder@lehigh.edu, Zuo-Jun Max Shen, Ying Rong

We present theoretical and empirical evidence for a reverse bullwhip effect (RBWE) that occurs in a variety of situations involving supply uncertainty. In the RBWE, order volatility increases as one moves downstream in the supply chain. This is the opposite of the classical bullwhip effect, which is generally associated with demand uncertainty. We examine causes of RBWE, discuss its impact, and suggest strategies for mitigating it.

2 - Discrete Location with Discrete Choice
Chung-Piaw Teo, Associate Professor, National University of Singapore, Business School, 21 Lower Kent Ridge Road, Singapore, 119077, Singapore, bizteocp@nus.edu.sg

Consider a discrete facility location problem where each consumer has a random utility attached to each facility. Given a set of opened facilities, the consumer will choose which facility she wants to be served in. We would like to find the optimal facility location solution to maximize social welfare, after taking into account the facility setup cost. We use a new discrete choice model proposed recently by Karthik, Song and Teo to reduce this problem to a simple convex IP.

3 - An Application of Operational Statistics
Leon Chu, Assistant Professor, University of Southern California, Marshall School of Business, Los Angeles, CA, 90089, United States, leonyzhu@usc.edu, George Shanthikumar, Zuo-Jun Max Shen

Operational statistics, an approach that integrates parameter estimation and optimization, leads to better solutions comparing with the traditional approach. This can be verified analytically for some simple problems. In this talk, we illustrate how to apply operational statistics to more complex problems.

4 - Coordinating Efforts of Multiple Retailers in a Decentralized Supply Chain
Stephen Shum, PhD Candidate, Massachusetts Institute of Technology, 77 Massachusetts Avenue, E40-130, Cambridge, MA, 02139, United States, sstephen@mit.edu, David Simchi-Levi

We study the impact of effort in a supply chain with multiple retailers. The costly effort engaged by a retailer may increase or decrease the demands of other retailers. We show that traditional contracts coordinate only under very restrictive conditions. We propose revenue sharing with fixed target rebate. These contracts are shown to be both coordinating and flexible. Interestingly, similar contracts have been used in the fresh food industry to motivate retailers to promote the products.

■ SC48

Room 409

Supply Chain Management with Asymetric Information

Sponsor: Manufacturing & Service Operations Management
Sponsored Session

Chair: Izak Duenyas, Professor, Ross School of Business, 701 Tappan Street, Ann Arbor, MI, United States, duenyas@umich.edu

1 - Sealed-Bid vs. Open Total-Cost Procurement Auctions: Should the Buyer Reveal Suppliers' Quality?
Dimitris Kostamis, PhD Candidate, University of Michigan, 1205 Beal Avenue, Ann Arbor, MI, 48109, United States, dkostami@umich.edu, Damian Beil, Izak Duenyas

We compare two auctions for procurement. A supplier's effective bid is a function of their bid price and an adjustment assigned by the buyer, capturing factors such as expected quality. Each supplier's adjustment is private information to him and the buyer. The buyer can (implicitly) announce her private adjustment cost information to all suppliers via an open auction, or conceal it by running a sealed-bid auction. We characterize the buyer's choice, and study the impact of additional suppliers.

2 - Inducing Retailer Forecasting: Rebates versus Returns
Terry Taylor, Associate Professor, Columbia University, Graduate School of Business, 3022 Broadway, Uris 417, New York, NY, 10027, United States, tat2002@columbia.edu, Wenqiang Xiao

We examine how a retailer's ability to improve her demand information by exerting forecasting effort affects what type of contract a manufacturer should offer. We show whether a manufacturer should offer a contract that rewards the retailer for selling units (rebates) or a contract that rewards the retailer for not selling units (returns).

3 - Optimal Design of Supply Contracts Under Information Asymmetry
Ying-Ju Chen, Doctoral Candidate, Stern School of Business, New York University, 44 W. 4th Street KMC 8-152, New York, NY, 10012, United States, ychen0@stern.nyu.edu, Sridhar Seshadri

We consider a supply chain where multiple suppliers with heterogeneous production costs and salvage-values sell through a single retailer. The suppliers' cost structures are either independent, private but correlated, or completely known amongst themselves. We investigate the optimal procurement mechanism from the retailer's perspective under different scenarios of information asymmetry.

■ SC49

Room 410

Alan S. Manne (1925-2005): Innovative Energy, Environment and Operations Modeler

Cluster: History of OR and Management Science
Invited Session

Chair: Arthur F. Veinott, Jr., Professor, Department of Management Science & Engineering, Stanford University, 309 Terman Engineering B, Stanford, CA, 94305, United States, veinott@stanford.edu

1 - Alan S. Manne: Professional Life and Early Creative Operations Modeling
Arthur F. Veinott, Jr., Professor, Department of Management Science & Engineering, Stanford University, 309 Terman Engineering B, Stanford, CA, 94305, United States, veinott@stanford.edu

Alan was precocious, graduating from Harvard at age 18. His Ph.D. thesis, Scheduling of Petroleum Refinery Operations, influenced the oil industry's adoption of linear programming in the 1950s. In 1958 he showed how to approximate notoriously difficult multiproduct dynamic economic-lot-size models with shared capacity by a linear program. In 1960 he introduced an ingenious linear-programming approach to Markov decision chains. We review these works, his professional career and his many honors.

2 - Alan S. Manne: Early Contributions to Sectoral and Economy-Wide Planning Models
Donald Erlenkotter, Professor Emeritus, Anderson Graduate School of Management, University of California, Los Angeles, CA, United States, donald.erlenkotter@anderson.ucla.edu

During the 1960s and early 1970s, Alan Manne made fundamental contributions in the development and application of sectoral and economy-wide planning models. These included models for capacity expansion and location, and interindustry models for planning economic development. His work is exemplary in its meticulous attention to data and its interplay between theory-based applications and applications-grounded theory. We review his contributions to these areas and their impact on the field.

3 - Alan S. Manne: Energy Modeling Pioneer
John P. Weyant, Professor, Department of Management Science and Engineering, Stanford University, Terman Engineering B, Stanford, CA, 94305, United States, weyant@stanford.edu

The late 1960s and early 1970s marked the genesis of modern energy modeling. New problems were addressed, new data was collected, new algorithms were implemented, and new insights were developed. In all these areas Alan S. Manne was a trail blazer. This talk highlights Alan's contributions using early energy market analyses and energy technology assessments as examples.

4 - Alan S. Manne: Energy Vulnerability
Hung Po Chao, Director of Market Monitoring, Independent Systems Operator, New England, One Sullivan Road, Holyoke, MA, 01040, United States, hchao@iso-ne.com

Alan Manne made many fundamental contributions to energy policy issues. His work characteristically offers simple and yet profound insights. This talk highlights his prescient insights of energy vulnerability in a modern economy characterized by complex interactions, interdependence and uncertainties, a common theme that can be found in many of his path-breaking works.

5 - Alan S. Manne: Innovative Approaches to Climate Policy Design
Thomas Rutherford, 4829 Northgate Drive, Ann Arbor, MI, 48103, United States, tom@mpsge.org

Alan Manne was a pioneer in the adaptation of energy-economy models to climate policy issues. The talk will highlight aspects of these models which were pathbreaking and remain state of the art: putty-clay technology, stochastic equilibria, integrated treatments of climate and economic systems, and the solution of large-scale equilibrium models with tax distortions and public goods solved by use of iterative optimization.

■ SC50

Room 411

Network Design

Sponsor: Telecommunications
Sponsored Session

Chair: Abdullah Konak, Assistant Professor, Penn State - Berks, Tulpehocken Road, Reading, PA, 19610, United States, konak@psu.edu

1 - Models and Heuristics for the Node-Degree Constrained Minimum Spanning Tree Problem
Christophe Duhamel, Universite Blaise Pascal, LIMOS, ISIMA, Campus des Cézeaux, BP 10125, AubiËre Cedex, 63173, France, christophe.duhamel@isima.fr, Luis Gouveia, Pedro Moura, Mauricio Souza

The NDCMST problem consists in finding a minimal cost spanning tree given an upper limit on the degree of each vertex in the tree. A concave node degree cost function is added to the objective function. Starting from a valid formulation, we propose a reformulation by discretization. Then we present a lagrangean relaxation and another reformulation with the same lower bound. Upper bounds are computed using a hybrid GRASP/VND heuristic. Computational results are shown on medium-sized instances.

2 - An Optimal Algorithm for Solving a Ring-Mesh Topology Design Problem of the Optical Networks
Youngjin Kim, Korea University, Anam Dong Sungbuk Ku, Seoul, 136-701, South Korea, itmsl@dreamwiz.com, Jeonghee Han, Youngho Lee, Youngwook Kim, Kyunam Chang, Hyunjung Yun

In this paper, we develop an optimal algorithm to solve a ring-mesh topology design problem arising from the deployment of emerging optical networks. We investigate the dynamic cut generation procedure that combines the benefit of the column generation procedure with the efficiency of Lagrangian dual approach. Computational results of the lower and upper bounding procedures demonstrate the effectiveness of our solution procedure.

3 - Optimal Expansion of a Hybrid Circuit/Packet Switched Voice Telecommunications Backbone
Raghavendran Sivaraman, Doctoral Student, Massachusetts Institute of Technology, Operations Research Center, 77 Massachusetts Avenue, Cambridge, MA, 02139, United States, rags@mit.edu, Lawrence Crom, Hui Liu, Rina Schneur, Roger Tobin, Donald Smith

Verizon transports voice telephone calls on a mixed circuit-switched and packet-switched network. We describe a routing optimization tool that minimizes the capital expended annually on network growth. In the first year, expansion according to the optimizer will cost about $5M, as compared to $9M using a predecessor tool that does not optimize. Over a five-year period, capital expenditures associated with the optimizer's expansion plan should cost 30% less than those of the predecessor tool.

4 - Optimal Location of Session Border Controllers in VoIP network
Peter Kubat, Distinguished Member of Technical Staff, Verizon Laboratories, 40 Sylvan Road, Waltham, MA, 02451, United States, peter.kubat@verizon.com, Michael Weintraub

Session Border Controller (SBC) is a device which enables carriers to deliver feature-rich VoIP services securely and effectively across IP transport networks. In this talk we describe traffic modeling efforts and practical optimization technique used to select optimal location of SBCs in a metropolitan network.

■ SC51

Room 412

Applications of Data Mining/Machine Learning

Contributed Session

Chair: Bin Zhang, IBM China Research Laboratory, Building 19 Zhongguancun Software Park, Beijing, China, zbin@cn.ibm.com

1 - Operations Research and Data Mining as Complementary Modeling Approaches
Stephan Meisel, Research Associate, Technical University Braunschweig, Abt-Jerusalem-Str. 4, Braunschweig, Germany, stephan.meisel@tu-bs.de

Purpose of our work is to demonstrate that Operations Research and Data Mining are complementary approaches for the single task of modeling complex real-world operations. An integrative view on the two fields is developed on a conceptual level. Problems that cannot be treated adequately by use of strict mathematical modeling approaches only (e.g. Dynamic Vehicle Routing Problems) are supposed to be tackled according to our framework.

2 - Product Data Mining as a Tool for Improving Productivity
Pamela Ajoku, Research Assistant Professor, University of Pittsburgh, Industrial Engineering, 1048 Benedum Hall, Pittsburgh, PA, 15260, United States, pne1@pitt.edu, Bart Nnaji

Manufacturing environments have begun applying data mining methodologies as a result of the vast amounts of data that can be generated within a single plant on a daily basis. Often multiple plants and collaborative partners are connected, compounding data analysis and knowledge discovery on a national and global level. Data mining applications within the manufacturing environment include market analysis, product design, manufacturing or production and after-sales services. We present a data dimensionality reduction model for product data during different phases of the manufacturing cycle.

3 - Customer Targeting Analysis with Support Vector Machines and Neural Networks: A Comparative Study
Yaquan Xu, Assistant Professor, Virginia State University, Department of CIS, 1 Hayden Drive, Petersburg, VA, 23806, United States, yxu@vsu.edu, Haibo Wang

One of the key problems in customer targeting is to find a better way to identify and profile of households who are most likely to be interested in a particular product or service. Recent studies have shown that AI methods achieved better performance than traditional statistical methods. This article introduces SVM machine learning technique to provide a model with better decision criteria. We used artificial neural networks guided by PCA as a benchmark to the comparison.

4 - On the Performance of K-Means Type Clustering Algorithms
Altannar Chinchuluun, University of Florida, Weil 303, ISE, University of Florida, Gainesville, FL, 32611, United States, altannar@ufl.edu, Panos Pardalos

Clustering analysis plays an important role in scientific research and commercial applications. In the popular K-means algorithm, the locally optimal solution is sensitive to the initial points choice. Hence, we present two methods to find refined starting points. We compare these two methods with other refining starting condition methods through the applications of these methods to the K-means clustering algorithm based on their performances for various data sets.

5 - A Heuristic Aggregation Algorithm to Generate Geographical Business Clusters
Bin Zhang, IBM China Research Laboratory, Building 19 Zhongguancun Software Park, Beijing, China, zbin@cn.ibm.com, Minghua Zhu, Wenjun Yin, Jin Dong

Spatial clustering technologies are widely used in market analysis. However, most proposed algorithms just considered the spatial positions and the presences of obstacles and facilities. In this paper, a heuristic aggregation algorithm is presented to model the key economic and demographic factors to generate geographical business clusters for banking market analysis. The experiments show that our approach can discover the natural characters of business distribution.

■ SC52

Room 413

Topics in Revenue Management and Pricing

Sponsor: Revenue Management & Pricing

Sponsored Session

Chair: Alper Sen, Assistant Professor, Bilkent University, Department of Industrial Engineering, Bilkent, Ankara, 06800, Turkey, alpersen@bilkent.edu.tr

1 - Dynamic Pricing and Inventory Management under Advance Selling

Michelle M.H. Seref, Doctoral Student, Operations Management, Decision Information Sciences, University of Florida, Stuzin Hall 361-E, Gainesville, FL, 32611, United States, michelle.hanna@cba.ufl.edu, Aydin Alptekinoglu, Selcuk Erenguc

Advance selling allows customers to purchase a product prior to consumption. Customers decide whether to advance purchase or wait until the spot period based on their expected future valuation, the advance sales price and the spot price. We consider a single inventory order decision made at a deterministic leadtime during the advance sales period. We seek to find the optimal order quantity, dynamic advance sales pricing policy, and spot price that maximize the firm's total expected profit.

2 - Dynamic Pricing of Perishables with Renewal Demands and Menu Costs

Emre Berk, Bilkent University, Faculty of Business Administration, Bilkent University, Ankara, 06800, Turkey, eberk@bilkent.edu.tr, Ulku Gurler

We consider dynamic pricing of perishable assets in the presence of price-sensitive renewal demand processes and non-negligible price change costs with the objective of maximizing the disounted expected profit for an initial inventory of Q items. We establish some structural results on the behavior of the objective function with respect to the selling price and the horizon length. We also present some numerical results.

3 - Stochastic Models for Joint Pricing and Revenue Management

Ayse Kocabiyikoglu, Assistant Professor, Bilkent University, Department of Business Administration, Bilkent, Ankara, 06800, Turkey, aysekoca@bilkent.edu.tr, Ioana Popescu

We extend the traditional revenue management paradigm to simultaneously optimize price and capacity allocation decisions, under a stochastic price dependent demand model. We provide conditions for the monotonicity of the capacity allocation policy, as well as the uniqueness of the optimal solution. We provide bounds on the optimal revenue and the results of numerical experiments, which demonstrate significant improvements in revenue from joint price-capacity allocation optimization.

4 - Optimal Bundle Formation and Pricing of Two Products with Limited Stock

Alper Sen, Assistant Professor, Bilkent University, Department of Industrial Engineering, Bilkent, Ankara, 06800, Turkey, alpersen@bilkent.edu.tr, Ulku Gurler, Salih Oztop

We consider a retailer that sells a fixed stock of two products not only as independent items but also as a bundle over a season. The retailer decides how many bundles to form and what prices to charge for the bundle so that expected profits over season are maximized. Product demands follow a Poisson Process and customer reservation prices are assumed to have a joint distribution. We study the impact of reservation prices, inventory levels, arrival rates and bundle formation costs.

■ SC53

Room 414

Pricing and Revenue Management: New Models

Sponsor: Revenue Management & Pricing

Sponsored Session

Chair: Itir Karaesmen, Assistant Professor of Management Science, University of Maryland, Robert H. Smith School of Business, Decision and Information Technologies, College Park, MD, 20742, United States, ikaraes@rhsmith.umd.edu

1 - Profit Smoothing and Product Pricing

Mahesh Kumar, Assistant Professor, Rutgers Business School, 180 University Avenue, Newark, NJ, 07102, United States, mahesh@rbsmail.rutgers.edu, Suresh Govindaraj

We propose a new explanation for price discrimination in products and services that is based on the sellers' objective to smooth profits. We show that when sellers carry multiple products, the spread in buying and selling prices of any product depends on the profits and inventory positions of the other products. Consequently, sellers may price the same product differently depending on the range of products that they carry.

2 - Centralized vs. Decentralized Supply Chains

Ann Chan, Assistant Professor, Virginia Tech, 250 Durham Hall, Blacksburg, VA, 24061-0118, United States, achan@vt.edu

When customer demand is stochastic and price sensitive, we study the loss of expected profit due to double marginization. We also analyze and compare the supply chain performances under different operations mechanisms: buy-back, inventory sharing, coordination and competition.

3 - Dynamic Pricing with Strategic Customers: The Role of Customer Heterogeneity

Xuanming Su, Assistant Professor, University of California, Haas School of Business, Berkeley, CA, 94720, United States, xuanming@haas.berkeley.edu

We consider a firm who prices and rations a finite inventory of products over a finite time horizon, and consumers who strategically time their purchases under rational expectations of future prices and availability. The optimal policy depends critically on customer heterogeneity along two dimensions: their willingness to pay, and their willingness to wait.

4 - Market Level Price Optimization for Hotels and Gaming Resorts

Ahmet Kuyumcu, akuyumcu@prorize.com, Amar Duggasani

Many hotel chains and gaming resorts own multiple properties in close proximity and need abilities to shift demand to optimize their profits. This requires new control capabilities such as free upgrades, cross-sells, and down-sells. In addition, forecasting, overbooking, and optimization models could utilize market-level information. This presentation discusses challenges and opportunities in implementing a market-level price optimization approach.

■ SC54

Room 415

Panel Discussion: Integrated Operations and Marketing for Servng Emerging Markets

Cluster: Operations and Marketing for Emerging Markets

Invited Session

Chair: Vish Krishnan, Professor, University of California - San Diego, Rady School of Management, 9500 Gilman Drive MC 0093, La Jolla, CA, 92093, United States, vkrishnan@ucsd.edu

Paul Griffin,Professor, Georgia Institute of Technology, 765 Ferst Drive, Atlanta GA 30332, United States, pgriffin@isye.gatech.edu, Christina Scherrer, Julie Swann

1 - Panel Discussion: Integrated Operations and Marketing for Serving Emerging Markets

Moderator: Vish Krishnan,Professor, University of California - San Diego, Rady School of Management, 9500 Gilman Drive MC 0093, La Jolla CA 92093, United States, vkrishnan@ucsd.edu, Panelist: Cheryl Druehl, Uday Karmarkar, Sunder Kekre, Kamalini Ramdas, Aleda Roth

Emerging markets present new opportunities and challenges for global firms. Their size and limited penetration present growth potential. However, infrastructural and budget constraints could challenge margins and even realization of growth. This panel seeks to discuss how integrating the operations and marketing decisions can offer firms the opportunity to realize the potential of emerging markets.

■ SC55

Room 416

Supply Chain Management I

Contributed Session

Chair: A. M. M. Jamal, Professor, Department of Management, Box 10350, Southeastern Louisiana University, Hammond, LA, 70402, United States, ajamal@selu.edu

1 - Coordinating Product Development with Suppliers and Performance Impacts

Yunsook Hong, PhD Candidate, Arizona State University, Supply Chain Management Department, W. P. Carey School of Business, Tempe, AZ, 85287-4706, United States, yunsook.hong@asu.edu, John Pearson

As manufacturers turn to their suppliers for designing components, they face the problem of coordinating their inter-organizational product development efforts. We identify three strategies for manufacturers to coordinate component developments with multiple suppliers. Using a survey research methodology, we investigate the impacts of the coordination strategies on product development performance.

2 - SCM and NPD

Fouad El Ouardighi, Associate Professor, Essec Business School, BP 105, Cergy Pontoise, 95021, France, elouardighi@essec.fr, Bowon Kim

In this paper, we develop a dynamic model of collaboration between a manufacturer and its supplier, where the fundamental issue is, for each player, how to allocate own resources between improving an existing product and developing a new one. We study the optimal time path of effort allocation for each player in the non-cooperative setting, and then look into the cooperative setting.

3 - An Integrated Framework Matching Product Architecture with Supply Chain Design Policies

Femi Famuyiwa, Rumble Fellowship, Wayne State University, 4815 4th Street, Industrial and Manufacturing Engineering, Detroit, MI, 48201, United States, am3664@wayne.edu, Leslie Monplaisir

While it is widely believed that it is better to consider supply chain concerns during product development stage, however, there are few existing studies that provide a quantitative framework for making such decisions early in the architecture selection stage. This paper tries to fill this gap by proposing a quantitative framework. The optimization model will incorporate decision variables so that one can examine the impact of modularity decisions on supply chain policies.

4 - A Hybrid Solution Procedure for Design for Supply Chain (DFSC) Problems

Nuri Gokhan, PhD Student, University of Pittsburgh, Industrial Engineering, 1048 Benedum Hall, Pittsburgh, PA, 15261, United States, nmg10@pitt.edu, Kim Needy, Bryan A. Norman

This research investigates integrating product and supply chain (SC) design to maximize benefits throughout the product life cycle. Product design and SC performance are modeled in a multi-objective fashion. Differences between sequentially and simultaneously optimizing the product and SC design are analyzed. A hybrid solution procedure including MIP, GA, Tabu Search, and simulation is proposed. Preliminary models and results will be presented including solution quality and computational time.

5 - Modeling Daily Exchange Rate Movements

A. M. M. Jamal, Professor, Department of Management, Box 10350, Southeastern Louisiana University, Hammond, LA, 70402, United States, ajamal@selu.edu, Shakil Quayes

The value of international currencies traded daily is approximately 2 trillion dollars (Bank of International Settlements). In comparison, the value of goods and services would be less than 5 percent of that amount. Most econometric models of exchange rates are based on monthly or quarterly data. We will develop an econometric model for exchange rates as affected by the daily fluctuation in the factors such as interest rates and the volume of financial transactions.

Sunday, 4:30pm - 6:00pm

■ SD01

Room 301

Optimization on Graphs

Sponsor: Optimization/ Network and Combinatorial Optimization

Sponsored Session

Chair: Benjamin Van Roy, Associate Professor of Management Science and Engineering and of Electrical Engineering, Stanford University, Terman Engineering Center, Stanford, CA, 94305, United States, bvr@stanford.edu

1 - Message-Passing Algorithms for Optimization

Ciamac Moallemi, Graduate Student, Stanford University, Department of Electrical Engineering, Packard 274, Stanford, CA, 94305, United States, ciamac@stanford.edu, Benjamin Van Roy

A nonserial dynamic program is an optimization problem with an objective that decomposes according to a graphical structure. Over the past few years, there has been a growing interest in message-passing algorithms for the solution of such problems, however these methods are still poorly understood and have received little attention in the OR community. We will present such an algorithm in several settings and discuss convergence results.

2 - Lower Bounds and Metaheuristics for a Bounded Vertex Coloring Problem

Enrico Malaguti, DEIS - University of Bologna, viale Risorgimento, 2, Bologna, 40136, Italy, emalaguti@deis.unibo.it, Albert Einstein Fernandes Muritiba, Manuel Iori, Paolo Toth

We consider a bounded version of the Vertex Coloring Problem, where each vertex i has an associated positive weight w(i), and the total weight of the vertices assigned to the same color is bounded. The problem can be also seen as a Bin Packing Problem subject to compatibility restrictions. We propose new lower bounding procedures and an effective metaheuristic approach for the problem.

3 - (Fraction) Dimension of a Poset and Constraint Feedback Arc Set Problem

Kamal Jain, Senior Researcher, Microsoft Research, One Microsoft Way, Redmond, WA, 98052, United States, kjain@cc.gatech.edu, Rajneesh Hegde

The dimension of a partially ordered set (poset) is the minimum integer k such that the partial order can be expressed as the intersection of k total orders. We prove it is hard to approximate the dimension of a poset with n elements within a factor n {0.5 - \epsilon} for any *\epsilon ccc 0*. The same hardness of approximation holds for the fractional version of poset dimension. On a positive side we consider a minimum "constrained" feedback arc set problem in tournament.

■ SD02

Room 302

Joint Session Open-Source/ICS: New in COIN-OR

Cluster: Open-Source Software: Open Source, Open Standards, Open Data

Invited Session

Chair: Brady Hunsaker, Assistant Professor, University of Pittsburgh, Department of Industrial Engineering, 1036 Benedum Hall, Pittsburgh, PA, 15261, United States, hunsaker@engr.pitt.edu

1 - Cut Generator for Chvatal-Gomory Rank 1 Inequalities

Brady Hunsaker, Assistant Professor, University of Pittsburgh, Department of Industrial Engineering, 1036 Benedum Hall, Pittsburgh, PA, 15261, United States, hunsaker@engr.pitt.edu, Mustafa Baz, Craig Tovey

We present code submitted to the COIN-OR Cut Generator Library (CGL) for Chvatal Gomory rank 1 inequalities. Separation of these inequalities requires the solution of a MIP and has been explored by several researchers. We discuss the formulation used to separate the inequalities, user interface and parameters, and possible applications. We also discuss the potential use of this code as a model for other MIP-based CGL routines.

2 - LEMON: A Library of Efficient Models and Optimization in Networks

Alpár Jüttner, Eötvös University, Budapest, Pázmány Péter sétány 1/C, Budapest, H-1117, Hungary, alpar@cs.elte.hu

LEMON is an open source library written in C++ language. It provides a set of efficient and easy-to-use implementation of common data structures and algorithms in the area of optimization and helps implementing new ones. The main focus is on graph structures and graph related optimization algorithms, such as shortest paths, network flows, connectivity and matching algorithms etc. LEMON also provides a simple but powerful file format to store graphs along with attributes assigned to its elements.

3 - Components for Applied OR: k-Shortest Path
Mary Helander, IBM Research, TJ Watson Research Center, 1101 Kitchawan Road, Yorktown Heights, NY, 10598, United States, helandm@us.ibm.com

The goal of this COIN-OR project is to share codes for published k shortest path algorithms, which are often building blocks of practical OR applications in transportation, vehicle routing, facility location, telecommunication network design, social network anlaysis, and other areas. The seed contribution includes a C code for the Miaou and Chin EJOR 1991 k shortest path algorithm.

■ SD03

Room 303

Variational Inequalities, MPECs and Maximum Likelihood Estimation

Sponsor: Optimization/ Linear Programming and Complementarity
Sponsored Session

Chair: Daniel Ralph, Reader in Management Science, University of Cambridge, Judge Business School, Cambridge, CB2 1AG, United Kingdom, d.ralph@jbs.cam.ac.uk

1 - Solving Asymmetric Variational Inequalities via Convex Optimization
Michele Aghassi, maghassi@mit.edu, Georgia Perakis, Dimitris Bertsimas

Using duality, we reformulate the asymmetric variational inequality (VI) problem over a conic region as a single-level, and many-times continuously differentiable optimization problem. We give sufficient conditions for the convexity of this reformulation and identify a class of VIs, of which monotone affine asymmetric VIs over polyhedra are a special case, and can be solved using widely-available and commercial-grade convex optimization software.

2 - On a Multiclass Spatial Equilibrium Problem
Patrice Marcotte, Professor, University of Montreal, CP 6128, Succ. Centre-Ville, Montreal, QC, H3C3J7, Canada, marcotte@iro.umontreal.Ca, Michel Gendreau

We consider a multiclass extension of the spatial price equilibrium model, where each user class is characterized by its "value-of-time". We formulate the equilibrium conditions as an asymmetric and non-monotone variational inequality, for which we propose a decomposition framework that efficiently exploits the problem's structure, as is demonstrated on large-scale instances. Finally, we discuss the MPEC that consists in setting the prices of a leader firm in this context.

3 - A New Optimization Approach to Maximum Likelihood Estimation of Structural Models
Che-Lin Su, Post-Doctoral Research Fellow, CMS-EMS, Kellogg, Northwestern University, 580 Leverone Hall, 2001 Sheridan Road, Evanston, IL, 60208, United States, c-su@kellogg.northwestern.edu, Kenneth Judd

Maximum likelihood estimation of structural models is regarded as computationally difficult. This impression is due to a focus on the Rust's Nested Fixed-Point (NFXP) approach. We present a direct optimization approach to the problem and show that it is significantly faster than the NFXP approach when applied to the canonical Zurcher bus repair model. The direct optimization approach is also applicable to other structural estimation problems such as Nash games, auctions and RBC models.

4 - Some Developments in Stochastic MPECs
Daniel Ralph, Reader in Management Science, University of Cambridge, Judge Business School, Cambridge, CB2 1AG, United Kingdom, d.ralph@jbs.cam.ac.uk, Huifu Xu

We study stochastic mathematical programs with equilibrium constraints, SMPECs, where the second stage is a complementarity problem that is parametric in the first stage variables. Applications appear in energy markets. Our aim is to understand how the regularisation technique in MPECS, studied by Scholtes and others, might be adapted to sample average approximation SMPECs. Our convergence the analysis is a departure in that it makes use of MPEC multipliers. (With Huifu Xu, Southampton, UK)

■ SD04

Room 304

OM/Finance Interface

Cluster: Operations and Marketing for Emerging Markets
Invited Session

Chair: Beril Toktay, Associate Professor, College of Management, Georgia Institute of Technology, 800 West Peachtree Street, NW, Atlanta, GA, 30308, United States, Beril.Toktay@mgt.gatech.edu

1 - The Martingale Approach to Operational and Financial Hedging
Rene Caldentey, Assistant Professor in Operations Management, Stern School of Business, New York University, 44 West Fourth Street, KMC 8-77, New York, NY, 10012, United States, rcaldent@stern.nyu.edu, Martin Haugh

We describe an approach for the optimal selection of dynamic operating and financial hedging strategies when the decision maker is risk averse. Risk aversion is imposed through constraints on the feasible policies. We apply the approach to some standard operations problems.

2 - Interplay Between Operational Flexibility and Financial Hedging
Jan Van Mieghem, Harold L. Stuart Distinguished Professor of Managerial Economics, Professor of Operations Management, Kellogg School of Management, Northwestern University, MEDS Department, 2001 Sheridan Road, Evanston, IL, 60208-2009, United States, VanMieghem@kellogg.northwestern.edu, Jiri Chod, Nils Rudi

We investigate the relationship between operational flexibility and financial hedging. Flexibility influences (i) the firm's need to hedge by affecting profit variance, (ii) its ability to hedge by affecting hedging efficacy, and (iii) its valuation of hedging by increasing the firm's wealth. We show that flexibility and hedging tend to be complementary (substitutes) in reinforcing (mitigating) each other's marginal effect on the mean-variance criterion (expected exponential utility).

3 - Capacity Investment in Imperfect Markets: The Interaction of Operational and Financial Decisions
Onur Boyabatli, Doctoral Candidate, INSEAD, Boulevard de Constance, Fontainebleau, 77305, France, onur.boyabatli@insead.edu, Beril Toktay

This paper analyzes the interaction between the operational (technology choice, capacity investment, production quantity) and the financial (financial risk management and financing) decisions. We model the interplay between a firm that can raise external capital and a creditor that determines the cost of the external capital within imperfect capital markets. We demonstrate that some of the common operational insights do no continue to hold in imperfect markets.

■ SD05

Room 305

Probabilistic and Dominance-Constrained Optimization

Sponsor: Optimization/ Stochastic Programming
Sponsored Session

Chair: Andrzej Ruszczynski, Professor, Department of Management Science and Information Systems, Rutgers University, 94 Rockefeller Road, Piscataway, NJ, 00854, United States, rusz@business.rutgers.edu

1 - Bounds on the Values of Derivatives Under Partial Knowledge of the Asset Price Distribution
András Prékopa, Professor, RUTCOR, Rutgers University, 640 Bartholomew Road, Piscataway, NJ, 08854, United States, prekopa@rutcor.rutgers.edu

Bounding the value of a financial derivative comes up either because the asset price distribution is only partially known or to compute the value is hard. New bounding methods will be presented that can be used both in the single and multiple asset cases in connection with European and American options. Moment information or knowledge of the univariate marginals of distributions of asset prices are assumed to be available.

2 - Optimization Subject to Stochastic Ordering Constraints
Darinka Dentcheva, Professor, Stevens Institute of Technology, Mathematical Sciences, Castle Point on Hudson, Hoboken, NJ, 07030, United States, ddentche@stevens.edu, Andrzej Ruszczynski, Rene Henrion

We discuss stochastic optimization problems involving a continuum of probabilistic (chance) constraints. These are called also stochastic dominance of first order or stochastic ordering constraints. Necessary and sufficient conditions of optimality will be reviewed. We focus on the stability of the problem when the underlaying probability distributions are subject to perturbations, e.g., when the distributions are estimated. At the end we sketch several applications of the model.

3 - Methods for Solving Optimization Problems with Stochastic Dominance Constraints

Andrzej Ruszczynski, Professor, Department of Management Science and Information Systems, Rutgers University, 94 Rockefeller Road, Piscataway, NJ, 00854, United States, rusz@business.rutgers.edu, Nilay Noyan, Gabor Rudolf

For stochastic optimization problems involving dominance constraints of the second order, using the theory of existence of measures with given marginals, we derive specialized column generation techniques. Next, for problems with first order constraints, we develop specialized lower and upper bounds, based on conditional second order constraints, and we construct near-optimal feasible solutions. In portfolio optimization the methods yield improvements of order of magntide.

■ SD06

Room 306

Algorithmic Topics in Constraint Programming

Sponsor: INFORMS Computing Society/Constraint Programming

Sponsored Session

Chair: Irit Katriel, Professor, BRICS, University of Aarhus, Aabogade 34, Aarhus, AA, Denmark, irit@daimi.au.dk

1 - The CP(Graph) Computation Domain in Constraint Programming

Grégoire Dooms, Université Catholique de Louvain, INGI, place St Barbe, 2, Louvain-la-Neuve, 1348, Belgium, dooms@info.ucl.ac.be, Yves Deville, Pierre Dupont

CP(Graph) introduces graph variables which domain is abstracted as a graph interval and constraints over these variables. It is integrated with the finite domain and finite sets domain, allowing the reuse of constraints of these domains. Graph intervals ease the formulation and implementation of filtering algorithms for global graph constraints. We present novel graph constraints and a proof of concept available as contributed open-source code in the Gecode constraint programming library.

2 - Grammar Constraints

Meinolf Sellmann, Assistant Professor, Brown University, 115 Waterman Street, PO Box 1910, Providence, RI, 02912, United States, sello@cs.brown.edu

We introduce constraints based on grammars in the Chomsky hierarchy. We devise an arc-consistency algorithm for context-free grammars, investigate when logic combinations of grammar constraints are tractable, show how to exploit non-constant size grammars and re-orderings of languages, and study where the boundaries run between regular, context-free, and context-sensitive grammar filtering.

3 - Set Solvers Revisited

Carmen Gervet, Brown University, Box 1910, Providence, RI, 02912, United States, cgervet@cs.brown.edu, Pascal Van Hentenryck

The language of sets naturally models combinatorial designs. Our findings show that by designing set solvers in analogy with Finite Domain solvers, we can strengthen propagation effectively. A set domain is now totally ordered by length-lex ordering that directly encodes cardinality and lexicographic information essential in set problems. The solver enforces bound-consistency on all unary constraints in time O(k log k), where k is the set cardinality. The approach can be applied to multisets.

■ SD07

Room 307

Computational Approaches for Large Scale Optimization Problems

Sponsor: INFORMS Computing Society/Optimization: Computational Optimization and Software

Sponsored Session

Chair: J. Cole Smith, Associate Professor, University of Florida, ISE Department, 303 Weil Hall, Gainesville, FL, 32611-6595, United States, cole@ise.ufl.edu

Co-Chair: Gino Lim, Assistant Professor, University of Houston, 4800 Calhoun Road, E211, Engineering Building 2, Houston, TX, 77204, United States, ginolim@uh.edu

1 - Solving Large Scale Stochastic Programs Using Resampling in Stochastic Decomposition

Suvrajeet Sen, Professor, Department of Systems and Industrial Engineering, University of Arizona, Tucson, AZ, 85721, United States, sen@sie.arizona.edu, Zhihong Zhou, Kai Huang

Stochastic Decomposition provides one of the most effective methods for solving two-stage stochastic programs. We propose an extension that allows cuts based on re-sampling from a subset of outcomes that have been revealed in the past. Convergence results, and computational experiments will be reported with this new version of Stochastic Decomposition.

2 - A Comprehensive Computational Study of Scaling Techniques for Linear Programming

Joe Elble, Department of Computer Science, University of Illinois Urbana-Champaign, Urbana, IL, United States, elble@uiuc.edu, Nick Sahinidis

The scaling of linear programs, while poorly understood, is not devoid of techniques. Scaling is the most commonly used preconditioning technique in linear programming solvers. This paper presents a review and computational comparison of techniques for obtaining scaling factors for linear systems. Old and very recent scaling techniques are investigated.

3 - Effective Multistart for Reaching Feasibility in Difficult Nonlinear Programs

John Chinneck, Professor, Carleton University, Systems & Computer Engineering, Ottawa, ON, K1S 5B6, Canada, chinneck@sce.carleton.ca, Matthew MacLeod

Finding a feasible solution for a set of nonlinear constraints can be very difficult. Local solvers may fail if not started close to a feasible region, so an expensive multistart approach may be needed. Instead of using the costly local solver each time, we use cheap Constraint Consensus methods to explore the variable space. We apply a local solver only when confident that we are close to a feasible region. Experimental results are very promising.

■ SD08

Room 308

KLIC II

Sponsor: Technology Management

Sponsored Session

Chair: David Moore, Director of klicnet.org, President of Knowledge Logic LLC, 3788 Davidson Place, Boulder, CO, 80305, United States, dmoore@klicnet.org

1 - Pharmaceutical-Biotechnology R&D: Implications for Alliance Performance

Jongwook Kim, Assistant Professor, Western Washington University, 351 Parks Hall MS9075, 516 High Street, Bellingham, WA, 98225, United States, JongWook.Kim@wwu.edu

Alliance opportunities are often characterized by information asymmetry, particularly where key resources are intellectual property. In the context of biotechnology-pharmaceutical alliances, I test how alliance characteristics impact performance. The data support the claim that utilization of network ties may be informational in nature where the role of reputation and network ties in latter stages diminish as the odds of success are higher, and more emphasis is placed on firm competence.

2 - Managing Pre-Technological Knowledge: A Multi-Dimensional Approach

Charles Weber, Assistant Professor of Engineering and Technology Management, Portland State University, ETM, PO Box 751, Portland, OR, 97207, United States, webercm@gmail.com

Bohn (1994) states that many high technology industrial processes are based on pre-technological knowledge — knowledge that is incompletely characterized or cannot be measured. An empirical study suggests that high tech industrial processes are based on on subsystem knowledge and prior, architectural knowledge that has been completely characterized. However, integration knowledge is pre-technological, and may be inherently so.

3 - Patents in Practice: Systemic Failures of Knowledge Representation in the US Patent System

Tony Briggs, Doctoral Candidate, Boston University Graduate School of Management, Information Systems Department, 595 Commonwealth Avenue, Boston, MA, 02215, United States, tbriggs@bu.edu, Paul Carlile

The US patent system is charged to promote the progress of science and useful arts. While patents are managed as economic devices across firms, they are seldom used as knowledge repositories to shape innovation within firms. We use a knowledge management framework to examine 3 generic patenting practices: development, examination, and enforcement. We find that different practices lead to either knowledge obfuscation or obsolescence, resulting in the systemic failure to inform future innovation.

4 - Social Capital and the Creation of Knowledge

Claudia Gonzalez-Brambila, Business School, Instituto Technologico Autonomo, Rio Hondo 1, Mexico, D.F., 01000, Mexico, cgonzalez@itam.mx, Krackhardt David, Francisco Veloso

We examine the relation between knowledge creation, measured through published papers, and social capital, characterized through co-authorship. Using an extensive panel, analysis suggests that, contrary to previous results, structural holes are not significant; what matters are direct ties, being central, working across areas of knowledge, and being in non dense networks.

5 - Organizational Learning in Distributed Innovation Planning
Edward Anderson, Professor, University of Texas, McCombs Business School, 1 University Station B6500, Austin, TX, 78733, United States, edward.anderson@mccombs.utexas.edu, Nitin Joglekar

Using a complex systems/system dynamics perspective, we examine the coevolutionary relationship between the market, innovation, products and capabilities in distributed environments. In particular, we argue that the role of capability planning is of the highest leverage in guiding innovation. We also argue that this planning must incorporate extensive levels of risk management and flexibility because of the inherent path dependence in such complex systems.

■ SD09

Room 309

Sciences of the Artificial Since Simon 1969: Design, Problem Solving, and System Improvement in Management

Cluster: New Product Development
Invited Session

Chair: Karl Ulrich, Professor, The Wharton School, 500 Huntsman Hall, Philadelphia, PA, 19104, United States, ulrich@wharton.upenn.edu

1 - Product Development as a Problem Solving Process
Christian Terwiesch, Associate Professor, University of Pennsylvania, 548 JMHH, Philadelphia, PA, 19104, United States, terwiesch@wharton.upenn.edu

We establish a problem solving framework that towards product development. Our problem solving view, which goes back to the work by Simon, is sufficiently general that it allows us to abstain from favoring any one of the many existing academic disciplines associated with product development. It also reveals many similarities between the existing literature streams, illustrates how these streams have cross-fertilized each other, and points to fruitful areas of future research.

2 - Knowledge, Causality, and Hierarchy in System Design
Roger Bohn, Professor, University of California - San Diego, 9500 Gilman Drive #0519, IR/PS, La Jolla, CA, 92093-0519, United States, Rbohn@ucsd.edu

Although we design using hierarchies and modules, products and systems don't actually behave accordingly. Knowledge about them can be described using causal graphs, and these graphs generally contain extensive linkages among nominally independent subsystems. Such knowledge is hard to learn, but critical to good design.

3 - Creating New Enterprises as a Structured Design Problem
Karl Ulrich, Professor, The Wharton School, 500 Huntsman Hall, Philadelphia, PA, 19104, United States, ulrich@wharton.upenn.edu

Enterprises can be represented by a template or grammar using standard primitives (e.g., products, customers, transactions). By representing enterprises this way, a search space of new ventures can be made explicit and structured design methods can be used to explore this space. This framework, with its roots in Simon's Sciences of the Artificial offers the potential for a rigorous theoretical foundation to the enterprise creation process in the fields of entrepreneurship and innovation.

■ SD10

Room 310

Software Demonstration

Cluster: Software Demonstration
Invited Session

1 - JMP - The Joy of Data Analysis with JMP
Curt Hinrichs, SAS Institute, SAS Campus Drive, Cary, NC, 27513, curt.hinrichs@jmp.com

JMP is a state of the art statistical package designed for the busy professional who wants to quickly and easily analyze their data and who needs sophisticated analyses - from classical statistical methods to modern design and exploratory data mining - that only SAS can provide. Intuitive, interactive and graphical, JMP lets you focus on the insight your data can provide. We will cover some of the powerful features and intuitive navigation of JMP.

2 - Minitab, Inc. - Response Surface Optimization Using Minitab
Nicole DeFazio, Minitab, Inc., 1829 Pine Hall Road, State College, PA, 16801, Eduardo Santiago

Attendees will learn how to use Minitab Statistical Software to perform Response Surface Optimization. Tips and tricks, customizing Minitab for teaching and business as well as additional advanced capabilities will be demonstrated. Minitab Statistical Software is the ideal package for Six Sigma and other quality improvement projects and is used in over 4000 colleges and universities worldwide for the past 30 years.

■ SD11

Room 311

BUGS: Using OR to Study Baseball, Umpiring, Golf and Soccer

Sponsor: OR in Sports
Sponsored Session

Chair: Bruce Bukiet, Associate Professor of Math Sciences, New Jersey Institute of Technology, Department of Math Sciences, Newark, NJ, 07102, United States, bukiet@oak.njit.edu

1 - A Markov Model of Baseball: Applications to Two Sluggers
Mark Pankin, President, MDP Associates LLC, 1018 N. Cleveland Street, Arlington, VA, 22201, United States, mdp@pankin.com

The progress of an inning of baseball is a natural process for a Markov model. The author will discuss one he has developed that contains quite a few detailed facets of the game. One application is about the effects of the St. Louis Cardinals batting the pitcher eighth in the second half of the 1998 season in an attempt to help Mark McGwire set the new single season home run record. The second applies the model to determine when the Giant's Barry Bonds in 2001-02 should be walked intentionally.

2 - The Traveling Umpire Problem
Hakan Yildiz, Doctoral Student, Carnegie Mellon University, Tepper School of Business, Pittsburgh, 15213, United States, hakanyil@andrew.cmu.edu, Michael Trick

We introduce The Traveling Umpire Problem (TUP) as a multi-objective sports scheduling problem. Like the Traveling Tournament Problem for league scheduling, the TUP is based on the most important features in scheduling the umpires for Major League Baseball. We explore integer and constraint programming approaches to this problem, and show a relationship to graph coloring.

3 - Golf Handicap: A Moving Average of Moving Order Statistics
Tom Spencer, Professor, Walden University, School of Management, United States, tspencer@waldenu.edu, Ivan Zorych

A golf handicap can be viewed as a moving average of moving order statistics. A brief review of existing results based on the naïve assumption of i.i.d. normality of the generating sequence (i.e. your golf scores) will be given, along with a discussion of our simulations using a large multi-year data base of handicapped scores from an industrial Golf Tournament League.

4 - Modeling Tactical Changes of Formation as a Non-Zero-Sum Game in Soccer
Nobuyoshi Hirotsu, Lecturer, Juntendo University, 1-1 Hiragagakuendai, Inba, Chiba-ken, 270-1695, Japan, n_hirotsui@sakura.juntendo.ac.jp, Chikara Miyaji

In general, a sport game played by two teams or two players can be considered as a zero-sum game for the purpose of gaining a win. However, the normal system used by soccer leagues is to award three points for a win, one point for a draw and none for a defeat. From the standpoint of gaining league points, a soccer game can be modeled as a non-zero-sum game. Here, we propose a game theoretic approach to modeling tactical changes of formation. We show a solution of the game with the expected number of league points and discuss a merit of cooperation between two teams, using real data of the J League.

■ SD12

Room 312

Nicholson Student Paper Prize Competition, II

Cluster: Nicholson Student Paper Prize

Invited Session

Chair: Chung-Piaw Teo, Associate Professor, National University of Singapore, Business School, 21 Lower Kent Ridge Road,Singapore 119077, Singapore, bizteocp@nus.edu.sg

1 - Coordinating Efforts of Multiple Retailers in a Decentralized Supply Chain

Stephen Shum, PhD Candidate, Massachusetts Institute of Technology, 77 Massachusetts Avenue, E40-130, Cambridge, MA, 02139, United States, sstephen@mit.edu, David Simchi-Levi

We study the impact of effort in a supply chain with multiple retailers. The costly effort engaged by a retailer may increase or decrease the demands of other retailers. We show that traditional contracts coordinate only under very restrictive conditions. We propose revenue sharing with fixed target rebate. These contracts are shown to be both coordinating and flexible. Interestingly, similar contracts have been used in the fresh food industry to motivate retailers to promote the products.

2 - Supply Chain Coordination and Influenza Vaccination (Submitted for the 2006 Pierskalla Award)

Hamed Mamani, PhD Student, Massachusetts Institute of Technology, 77 Massachusetts Avenue, Building E40-130, Cambridge, MA, 02139, United States, hamed@mit.edu, David Simchi-Levi, Stephen Chick

Billions of dollars are being allocated for influenza pandemic preparedness. Vaccination is a primary weapon for fighting influenza outbreaks. Differences that distinguish the influenza vaccine supply chain from the typical supply chains include a nonlinear value of sales and vaccine production yield issues. We show that production risks, taken by the manufacturer, lead to an insufficient supply of vaccine and design a variant of the cost sharing contract that can coordinate the supply chain.

3 - On the Computational Complexity of MCMC-based Estimators in Large Samples

Alexandre Belloni, MIT, 77 Massachusetts Avenue, Cambridge, MA, 02139, United States, belloni@mit.edu, Victor Chernozhukov

This paper studies the computational complexity of Bayesian and quasi-Bayesian estimation in large samples carried out using a basic Metropolis random walk. Our framework covers cases where the underlying likelihood or extremum criterion function is possibly non-concave, discontinuous, and of increasing dimension, but the posterior or quasi-posterior based on it approaches a normal density in large samples. Using this central limit framework to provide structural restrictions for the problem, we show that the running time of the algorithm in large samples is bounded in probability by a polynomial in the parameter dimension *d*, and in particular is *O_p(d^3)* in the leading cases. Large sample asymptotics allows to invoke the central limit theorem to bound the deviations from continuity and concavity, in a specific manner that allows to claim that the computational complexity is polynomial.

■ SD13

Room 313

Innovations in Undergraduate Operations Research Curricula

Sponsor: Education (INFORM-ED)

Sponsored Session

Chair: David Mullin, Associate Professor of Economics, U.S. Air Force Academy, HQ USAFA/DFEG, 2354 Fairchild Drive, Suite 6K-110, USAF Academy, CO, 80840, United States, rdmullin@msn.com

1 - Online Approaches to Teaching Operations Research

David Mullin, Associate Professor of Economics, U.S. Air Force Academy, HQ USAFA/DFEG, 2354 Fairchild Drive, Suite 6K-110, USAF Academy, CO, 80840, United States, rdmullin@msn.com

This paper presents new online technology in teaching operations research with an intuitive approach in graphing standard operations research topics, such as linear programming. Graphs are automatically evaluated and graded. The system uses TeX and LoadTeX to render files that are stored in a relational database. An instructor may use pre-existing graphing problems or author new ones. This system is available through Aplia,Inc, a company that has more than 80,000 ongoing students.

2 - Lessons Learned: On-Line Education in the Undergraduate Curriculum

Christina Scherrer, Assistant Professor, Southern Polytechnic State University, 1100 S. Marietta Parkway, Atlanta, GA, 30060, United States, cscherre@spsu.edu, Patricia Carden

We present results and insights from an experiment conducted with our department's undergraduate introductory statistics course. In this experiment, two sections were taught completely on-line using live audio technology and two sections taught completely on-campus in a traditional format. All were administered equivalent examinations. Student feedback was mixed. Suggestions and strategies for the future are discussed.

3 - Integrating Systems Engineers into an Operations Research Capstone

James Lowe, Professor, 2354 Fairchild Drive, USAF Academy, CO, 80840, Jim.Lowe@usafa.af.mil

In 2006, USAFA graduated its first class of Systems Engineering majors. The students of this major were placed into several different capstone efforts. SE majors were added to the long-standing OR capstone effort with positive, yet mixed, results. We address the advantages, challenges, and future plans.

4 - Scenario-Based Examinations in a Core OR Course

Andrew Armacost, Associate Professor of OR, US Air Force Academy, 2354 Fairchild Drive, Suite 6J100, USAFA, CO, 80840, United States, Andy.Armacost@usafa.af.mil

In our core course exams, we have found that students often spend a large amount of time on trying to understand the written scenarios (which is imperative), and less time applying modeling techniques and interpreting solutions. We describe two approaches we've used to allow all three elements to occur. Both approaches involve providing scenarios in advance in a manner that encourages students to understand the scenarios before the exam and to anticipate questions that might occur on the exam.

■ SD14

Room 314

Statistical Models

Contributed Session

Chair: Connie Borror, Associate Professor, Arizona State University West, 4506 W. Kaler Circle, Glendale, AZ, 85301, United States, cborror@asu.edu

1 - Alternative to the Least Squares Regression

Subhash C. Narula, Professor, Virginia Commonwealth University, School of Business, 1015 Floyd Avenue, Richmond, VA, 23284-4000, snarula@vcu.edu, John Wellington

Because the least squares regression is very sensitive to outliers, is affected by multicollinearity among the predictor (regressor) variables, and long tailed error distributions a number of alternatives procedures have been proposed. To overcome these difficulties, a number of alternatives have been proposed. Our objective is to introduce some of the available procedures that have been proposed.

2 - Statisical Approximation of Sustainably Selective Welfare Functions

Kobi Abayomi, Visiting Professor, Haverford College, PO Box 250219, Manhattan, NY, 10025, United States, kobi.abayomi@columbia.edu

"Sustainability", in the economic sense, is a criteria in need of definition. Chichilnisky has proposed an axiomatic standard: that a welfare function is "sustainable" if, and only if, it is non-negligible on both the finite and infinite parts of its domain - the space of utility streams. I investigate statistical approaches to Chichilnisky's axiomatization, which can be regarded as finite time tests of the "sustainability" of a utility, and, thusly, a development path.

3 - Joint Determination of Optimal Process Control Policy and Warranty Length in a Supply Chain

Xiaowei Xu, Assistant Professor, MSIS, Rutgers Business School, Ackerson Hall, Room 208, 180 University Avenue, Newark, NJ, 07102, United States, xiaoweix@rbsmail.rutgers.edu

We assume that the state of a production system follows a Brownian motion and the failure time of a product follows a proportional hazard model. We show that the optimal control barrier is decreasing in warranty length and the optimal warranty length is shorter in a supply chain with asymmetric information of production technology than in a supply chain with full information.

4 - Design of Experiments with Secondary Constraints

Szu Hui Ng, Assistant Professor, National University of Singapore, 10 Kent Ridge Crescent, Singapore, 119260, Singapore, isensh@nus.edu.sg

Standard experimental designs typically assume that the factor space is cubodial or spherical. However in many situations, secondary constraints may exist, causing interdependencies among the factors and resulting in an irregular operability region. The region imposed by the constraints is often unknown a priori, rendering standard experimental designs inappropriate. Here we propose an approach to design experiments in these restricted regions and study several irregularly shaped designs.

5 - Process Capability Estimation in the Presence of Measurement Error

Connie Borror, Associate Professor, Arizona State University West, 4506 W. Kaler Circle, Glendale, AZ, 85301, United States, cborror@asu.edu

Confidence intervals are constructed on two measures of process capability, Cp and the dpm, to demonstrate the importance of considering variability present due to the measurement error. The process requires a gauge R&R study be performed prior to the collection of data for the estimation of process capability. The procedure and results will be illustrated using an example involving a two-factor model commonly encountered in gauge R&R studies.

■ SD15

Room 315

Auctions in the Wild: Field Studies of Reverse Auctions

Cluster: Auctions and e-Commerce

Invited Session

Chair: Otto Koppius, Assistant Professor of Decision and Information Sciences, RSM / Erasmus University, Department of D&IS (T9-12), PO Box 1738, Rotterdam, 3000 DR, Netherlands, O.Koppius@fbk.eur.nl

1 - Bid Analyzer: A Method for Price Discovery in Online Reverse Auctions

Sandy Jap, Caldwell Research Fellow, Goizueta Business School, Emory University, Sandy_Jap@bus.emory.edu

Online reverse auctions are a pervasive and economically significant marketing activity, generating $40 billion in annual transactional volume in a wide variety of industries. As a result of this, a plethora of point-by-point bid data exists, but there is no systematic approach to analyze it. Hence, we develop a methodology, BidAnalyzer, to estimate the underlying distributions from which bids are generated for each bidder, even if a bidder does not submit a bid in a specific period. This ability to infer the distribution of each bidder is absent in the literature on auctions, and cannot be determined by other time series approaches (e.g., method of moments or vector autoregression). BidAnalyzer also provides the optimal bid price of each bidder, enabling the buyer to understand whether a bidder has bid too aggressively (and may experience a winner's curse) or has held back (indicating that there is still "money on the table"). We illustrate its practical usefulness using two proprietary datasets and a field experiment. Thus, BidAnalyzer enriches the price discovery efforts of the buyer and provides guidance for improving industrial procurement practice.

2 - The Effects of Auction Design on the Performance of Online Markets for IT Services

Eric van Heck, Professor of Information Management and Markets, RSM Erasmus University, 50 Burg Oudlaan, Rotterdam, 3062PA, Netherlands, eheck@fbk.eur.nl, Otto Koppius, Uladzimir Radkevitch

Small business increasingly uses online marketplaces to alocate IT projects to suppliers via reverse auctions. The market and auction design affects auction outcomes and market performance. We draw on electronic markets theory and auction theory to investigate the role of entrance barriers for bidders. Transaction data from two major marketplaces are used to explore barriers' impact on market performance, i.e. percentage of awarded auctions, percentage of return buyers and buyers' satisfaction.

3 - Efficient Buyer-Seller Relations: Managing Information & Communication Processes in E-RAs

Andrea Loesch, PhD Student, Manchester Metropolitan University, Geoffrey Manton Building, Rosamund Street West - Off Oxford Road, Manchester, M15 6LL, United Kingdom, andrea.loesch@student.mmu.ac.uk, J. Siân Lambert

Four case studies were conducted in Europe & the US and analyzed using Flanagan's (1954) Critical Incident Technique. The results illustrate the crucial importance of appropriate inter- & intra-organisational information and communication processes for obtaining efficient buyer-seller relations in e-reverse auctions (e-RAs). They also show how important contextual differences between public and private sector buying may affect e-RA applicability. According suggestions managing e-RAs are given.

4 - Analyzing Bidding Dynamics in Reverse Auctions: Process Metrics and a Functional Approach

Otto Koppius, Assistant Professor of Decision and Information Sciences, Rotterdam School of Management, 50 Burg Oudlaan, Rotterdam, Netherlands, okoppius@rsm.nl, Wolfgang Jank, Galit Shmueli, Sunil Mithas, Joni Jones

The bidding dynamics during an auction play an important role in explaining auction outcome, yet remain underinvestigated due to a lack of common process metrics and analytical methods. We propose several such metrics that enable a comparison of bidding dynamics across auctions. We also show that techniques from Functional Data Analysis (FDA) yield additional insights into bidding dynamics. We illustrate our arguments with an analysis of 700+ reverse auctions in the automotive industry.

■ SD16

Room 316

Advances in Revenue Management

Cluster: Dynamic Pricing and Forecasting

Invited Session

Chair: Guillaume Roels, Assistant Professor, UCLA Anderson School of Management, 110 Westwood Plaza, Los Angeles, CA, 90077, United States, groels@anderson.ucla.edu

1 - Hard Block Code-Sharing Contracts for Airline Revenue Management

Guillermo Gallego, Professor, Industrial Engineering and Operations Research, Columbia University, New York, NY, United States, gmg2@columbia.edu, Youyi Feng

We consider capacity contracts between a marketing and operating airline where a fixed block of seats is leased at a fixed price per seat. We characterize optimal booking limits for both airlines and use the expected revenue function to determine optimal demand and supply curves for seats at a function of price. This enables the design of win-win operational contracts that do not give up control of individual airline networks.

2 - Revenue Management for Media Broadcasting

Ioana Popescu, Associate Professor of Decision Sciences, INSEAD, Boulevard de Constance, Fontainebleau, 77305, France, ioana.popescu@insead.edu, Victor Araman

Media broadcasting companies seek to allocate limited advertising space across multiple clients and markets in order to maximize profits. We provide simple models and solutions for upfont market allocation among multiple clients under audience uncertainty. We also investigate the dynamic allocation of make-goods for a single client under reversible and irreversible commitment strategies.

3 - Pricing without Market Information

Garrett van Ryzin, Columbia University, Uris Hall, New York, NY, 10027, United States, gjv@columbia.edu, Serkan Eren, Costis Maglaras

We look at a variety of classic pricing problems in the case of minimal market information. Using a competitive ratio and maximum regret criteria, we characterize pricing policies that perform well under limited market information and discuss how they relate to classical results in the literature and to industry practices.

4 - Robust Revenue Management

Guillaume Roels, Assistant Professor, UCLA Anderson School of Management, 110 Westwood Plaza, Los Angeles, CA, 90077, United States, groels@anderson.ucla.edu, Georgia Perakis

We investigate the problem of allocating fixed capacity in a network to different classes of customers, with limited information about the demand distributions. We consider two criteria for decision-making under uncertainty: maximin and minimax regret. Our approach combines an efficient solution procedure, based on linear programming, with very modest requirements for data about the demand distributions, and is therefore scalable to solve real network revenue management problems.

■ SD17

Room 317

Production & Scheduling I

Contributed Session

Chair: Dan Staley, Oregon State University, 121 Covell Hall, Corvallis, OR, 97331, United States, staleyd@onid.orst.edu

1 - A Dynamic Programming Approach for Load Control in Single-Product Tandem Manufacturing Lines

Rodrigo Caliz, PhD Student, Penn State University, 1003 West Aaron Drive, Apt. 7B, State College, PA, 16803, United States, rac296@psu.edu, Jose Ventura

This paper deals with the characterization of the optimal controlled influx rate of a single-product manufacturing line over a finite planning horizon. Deterministic approximations based on both traffic flow theory and non-stationary queueing models are used in order to model the stochastic nature of the system dynamics. Simulation is utilized to evaluate the proposed policy as compared to the non-controlled system where each job enters the system at its arrival epoch.

2 - Forecast Horizon Detection and Solvability of the Concave Cost Production Planning Problem
Timothy Lortz, Graduate Research Assistant, University of Michigan, IOE Department, 1205 Beal Avenue, Ann Arbor, MI, 48109, United States, tlortz@umich.edu, Archis Ghate, Robert Smith

We consider a class of production planning problems including the dynamic lot-size model. Under mild assumptions, we show necessary and sufficient conditions for existence of a forecast horizon. We also give a solution algorithm guaranteed to yield an infinite horizon optimal initial decision whenever the problem satisfies these conditions.

3 - A Stochastic Production Planning Problem with Approved Vendor Matrices
Ek Peng Chew, Associate Professor, National University of Singapore, 10 Kent Ridge, Singapore, 119260, Singapore, isecep@nus.edu.sg, Loo Hay Lee, Gang Sun

A disk drive production planning problem with random demands is studied. The manufacturer provides customers with the choice on their preferred suppliers for pairs of inter-dependent components through the approved vendor matrix in order to differentiate its service. We propose a solution approach that provides production plans which minimize the expected total shortage and holding costs while observing the matrix restrictions and limited components supplies.

4 - Fuzzy-Logic Based Dynamic Scheduling for Cardboard Manufacturing Company
Umut Inan, PhD Candidate, Yildiz Technical University, Department of Industrial Engineering, Huseyin Baslýgil Doktr Ogrenci, Istanbul, 34000, Turkey, umutinan@mynet.com, Mesut Yavuz

Today's fierce competition forces companies to produce numerous end-products, meeting quantities and due dates demanded by the customers. We consider a cardboard packaging company that operates a plant with several key processes in a highly dynamic environment. Currently, many orders have to be processed in a matter of days, resulting in a situation where jobs have to be frequently re-scheduled. We develop a fuzzy-logic based dynamic scheduling framework to maximize the efficiency of the plant.

5 - Properties of Buffer Allocation in Closed Cyclic Production Systems
Dan Staley, Oregon State University, 121 Covell Hall, Corvallis, OR, 97331, United States, staleyd@onid.orst.edu, David Kim

Exetensive simulation testing was conducted on buffer allocation in closed cyclic production systems. Some general rules and behavior have been observed and emprically verified. A comparison to buffer allocation in open systems is made where possible.

■ SD18

Room 318

Geometric Programming: Applications and Software

Cluster: Geometric Programming: Research Inspired by the Work of Dick Duffin, Elmor Peterson & Clarence Zener
Invited Session

Chair: Jayant Rajgopal, University of Pittsburgh, Department of Industrial Engineering, 1039 Benedum Hall, Pittsburgh, PA, 15261, United States, rajgopal@pitt.edu

1 - Solving Geometric Programing Problems with MOSEK
Ulf Worsoe, Senior Developer, MOSEK ApS, Symbion Science Park, Fruebjergvej 3, Box 16, 2100 Copenhagen, Denmark, ulf.worsoe@mosek.com

A geometric programing (GP) problem can be formulated as a convex nonlinear optimisation problem having a special structure, which means that it may be solved to optimality. A number of practical problems, e.g in analog circuit design, can be approximately modelled as geometric programming problems. In this talk we discuss how to formulate and solve large scale geometric programming problems with the software package MOSEK (www.mosek.com), and show some test results.

2 - Geometric Programming for Communication Systems
Mung Chiang, Assistant Professor, Princeton University, B328 Engineering Quad, Olden Street, Princeton, NJ, 08544, United States, chiangm@princeton.edu

This talk overviews the recent results on how geometric programming provides a powerful tool and a common language to a surprisingly wide range of problems in communication systems, from duality in information theory and performance maximization in queuing theory to wireless network power control and Internet congestion control. It also illustrates how these problems motivate further investigation in success convex approximation by GP and distributed algorithms for GP.

3 - Recent Advances in Geometric Programming
Seung-Jean Kim, Consulting Assistant Professor, Information Systems Laboratory, Department of Electrical Engineering, Stanford University, 223 Packard, 350 Serra Mall, Palo Alto, CA, 94305, United States, sjkim@stanford.edu, Kwangmoo Koh, Stephen Boyd

Geometric programming has been known since the 1970s. Recently developed solution methods can solve large-scale geometric program (GPs) extremely efficiently and reliably. At the same time, a large number of practical problems in several fields including circuit design and machine learning have been found to be equivalent to (or well approximated by) GPs. We give a brief overview of the new applications of GP and recent advances in solving large-scale GPs.

4 - On Geometric Programming for Solving Nonstochastic Uncertainty Models in Finance
Kenneth Kortanek, Visiting Professor, University of Pittsburgh, Department of Industrial Engineering, Pittsburgh, PA, 15261, United States, ken-kortanek@uiowa.edu

The underlying law of motion of a financial instrument is a linear differential equation under uncertainty with perturbations for the instrument generating the time series. The dependent variable is an integrand in a discounting mechanism involving an exponentiation, establishing a connection to a two-sided geometric programming problem. Numerical results are presented for the problem of extracting the spot interest rate continuous function from Government Bills, Notes, and Bonds data.

■ SD19

Room 319

Forestry Applications IV

Sponsor: Energy, Natural Resources & The Environment
Sponsored Session

Chair: Stephanie Snyder, USDA Forest Service, North Central Research Station, St. Paul, MN, United States, stephaniesnyder@fs.fed.us

1 - A Simulated Annealing Approach for Treatment Unit Delineation
Joseph Petroski, Pennsylvania Department of Conservation and Natural Resources, Bureau of Forestry, Inventory, and Analysis, 137 Penn Nursery Road, Spring Mills, PA, 16875, United States, jpetroski@state.pa.us, Marc McDill

Spatially explicit timber harvest scheduling requires the delineation of treatment units across a landscape. A multiple objective, simulated annealing model is presented that delineates treatment units using a triangle grid. Treatment units are built by aggregating or splitting groups of adjacent triangles.

2 - Green Up and Adjacency Issues in Forest Spatial Harvesting
Andres Weintraub, Professor, University of Chile, Department of Industrial Engineering, Santiago, Chile, aweintra@dii.uchile.cl, Marcos Goycoolea, Juan Pablo Vielma, Alan Murray

The ARM consists in imposing maximum clearcut size constraints in forest harvest scheduling problems. We discuss green-up extensions of the ARM, distinguishing between static and dynamic green-up constraints. Computational results for different formulations show these are very difficult. In addition, we discuss the impact of different adjacency definitions.

3 - Using Column Generation to Solve Spatially Explicit Forest Management
Marc McDill, Associate Professor of Forest Management, Penn State School of Forest Resources, 310 Forest Resources Building, University Park, PA, 16802, United States, mem14@psu.edu, Babu Rajasekaran

Column generation is a promising method for obtaining near-optimal solutions for large spatially-explicit forest harvest scheduling models. We test a column generation approach with 40 hypothetical problems and 2 methods of generating initial solutions to the sub-problems(seeds). For each method and subproblem, 25, 50 and 100 seeds were generated. Our tests show that both the seed generation method and number of seeds significantly influence solution time and quality of the final solution.

4 - Integer Programming Models for Tactical Harvest and Access Planning
Evelyn Richards, Associate Professor, Faculty of Forestry and Environmental Management, University of New Brunswick, Fredericton, NB, E3B 6C2, Canada, evelyn.richards@gmail.com, Eldon Gunn

The problem of scheduling clearcut harvests under adjacency constraints, simultaneous with road construction decisions, is addressed using a mixed integer optimization model. The model allows an unrestricted road network with multiple exit points. Computational results show that it is possible to solve models of practical size using a commercial solver.

■ SD20

Room 320

DA Arcade 1

Sponsor: Decision Analysis Society

Sponsored Session

Chair: Robin Dillon, Assistant Professor, Georgetown University, 418 Old North, McDonough School of Business, Washington, DC, 20057, United States, rld9@georgetown.edu

1 - A Decision Analysis Approach to Real Option Valuation

Ross Shachter, Associate Professor, Management Science and Engineering, Stanford Univeristy, 380 Panama Way, Room 351, Stanford, CA, 94305-4026, United States, shachter@stanford.edu, Stephen Derby

Standard financial option theory assumes rational individuals invest in no-arbitrage, equilibrium, complete markets. Our approach values real options without assuming market equilibrium and completeness. Market information constrains real option value without using replicating portfolios. Our method is consistent with the standard theory, therefore conforms to its major results.

2 - Avoiding Disaster Readiness Disasters

Robin Dillon, Assistant Professor, Georgetown University, 418 Old North, McDonough School of Business, Washington, DC, 20057, United States, rld9@georgetown.edu

After Hurricane Katrina, people are questioning the readiness decisions that were made. Poor decisions appear to have been made at every level, and tracing the roots of these poor decisions often leads to a discussion of how precursor events shape perceptions. This research examines how past events and currently available probability information are interpreted and examines the importance of integrating decision theory with disaster readiness to improve decision making.

3 - Combining Expert Judgment Using Structural Equation Models

Melissa Kenney, PhD Candidate, Water Quality Modeling and Decision Analysis, Duke University, Nicholas School of the Environment, Box 90328, Durham, NC, 27708, United States, m.kenney@duke.edu, Robert Clemen

We describe a method for combining multiple expert judgments using structural equation modeling. The method requires the use of a latent variable that can be viewed as an "ideal" expert judgment, where the individual experts are modeled as multiple measures of the ideal judgment. By using expert data with actual outcomes of the predicted variable and other covariates, we can estimate the relative expert weights and use them in a predictive model. We applied the method to study lake pollution.

4 - A Review of the Literature on the Concept of Value of Information

Lea Deleris, Postdoctoral Researcher, Stanford University, Math Sciences Department, IBM TJ Watson Research Center, Stanford, CA, 94305, United States, ldeleris@stanford.edu

The concept of value of information is central to the field of decision analysis: it enables to put bounds on the price to pay for information and can identify decision situations where information is useless. In an age where information is increasingly accessible but often costly, the concept of value of information represents a powerful while simple idea. In this talk, I review the decision analysis literature on the concept of value of information and identify related research directions.

■ SD21

Room 321

Decision Analysis for Healthcare Entities

Sponsor: Decision Analysis Society

Sponsored Session

Chair: Anke Richter, Associate Professor, DRMI, Naval Postgraduate School, 699 Dyer Road, Building 234, Monterey, CA, 93943, United States, arichter@nps.edu

1 - Strategic Decision-Support for Medical Technology Commercialization

Jan B. Pietzsch, President & CEO, Wing Tech Inc., 502 San Benito Avenue, Menlo Park, CA, 94025, United States, jpietzsch@wing-tech.com

The successful commercialization of medical technologies requires informed decision-making and strategy-setting by manufacturers and investors at early stages of the innovation process. This paper presents a novel framework based on systems analysis and probabilistic methods that integrates both engineering-based assessment models and health-economic considerations. The case of a new orthopedic technology is used to demonstrate application of this framework.

2 - Market Uncertainty and Innovation Incentives in Pharmaceutical R&D

John Cavallaro, PhD Candidate, Management Science & Engineering, Stanford University, Stanford, CA, 94305, United States, john.cavallaro@stanford.edu, Stefanos Zenios

The newly launched Medicare Part D has renewed both interest in pharmaceutical pricing policies and concerns about innovation incentives. This work quantifies pharmaceutical R&D risk, and then investigates how price reductions affect R&D spending and innovation. Finally, it explores how policy levers can reduce expenditures while maintaining innovation incentives.

3 - Cost-Effectivenessness of Aspirin and Statins for Primary Prevention of CHD Events in Men

Stephanie Earnshaw, Head US Health Economics, RTI Health Solutions, 200 Park Offices Drive, Research Triangle Park, NC, 27709, United States, searnshaw@rti.org, Michael Pignone, Jeffrey Tice, Mark Pletcher

A Markov model was developed to examine cost-utility of the effects of aspirin, statin, combination, and no pharmacotherapy for the primary prevention of CHD events. Men at 10-year risk for CHD (2.5% - 25%) were examined. Parameters were taken from literature. Aspirin was more effective and less costly than no treatment in 45-year-old men (7.5% 10-year risk). Addition of statin to aspirin therapy becomes more cost-effective when patient's 10-year CHD risk is higher than 10%.

4 - Decision Analytic Methods and Formulary Submissions in Canada

Greg Zaric, Professor, Ivey School of Business, University of Western Ontario, London, ON, Canada, gzaric@ivey.uwo.ca

A formulary is a list of drugs that will be reimbursed by an insurer. In Canada, the public drug plans in each province require drug manufacturers to submit an economic analysis as part of the formulary submission process. In this talk we discuss the use of cost effectiveness analysis, decision trees, Markov models and other decision analytic techniques that are commonly used by drug manufacturers to produce the required economic analyses.

■ SD22

Room 322

OR in Information Fusion

Sponsor: Military Applications

Sponsored Session

Chair: Rakesh Nagi, Professor, Department of Industrial & Systems Engineering, 438 Bell Hall, University at Buffalo (SUNY), Buffalo, NY, 14260, United States, nagi@buffalo.edu

1 - Maritime Tracking of Past Data

Les Servi, Lincoln Laboratory Technical Staff, MIT Lincoln Laboratory, 244 Wood Street, Lexington, MA, 02420-9108, United States, servi@ll.mit.edu

Determining if a ship near a US port is friendly may require inferring the ship's path during the past week. This can be done using insights from the image processing literature, e.g. Hough Transforms. This talk will present an approach and demonstration, using simulated data, of this capability.

2 - Conceptual Spaces as a Framework for Situational Assessment

Michael Holender, Student, Center for Multisource Information Fusion, University at Buffalo, Industrial & Systems Engineering, 420 Bell Hall, Buffalo, NY, 14260, United States, holender@buffalo.edu, Moises Sudit, Rakesh Nagi

We consider a geometric representation used in cognitive theory to describe human understanding called Conceptual Spaces. The theory is relevant not only to cognition, but can also handle other types of problems. Our work relates Conceptual Spaces to Data Fusion, namely at Level 2 - Situational Assessment. We introduce mathematical models used to represent Conceptual Spaces and show how they can be useful in considering situations presented by a data fusion system.

3 - Optimizing the Amount and Type of Information at Each Level of Decision-Making

Moises Sudit, Managing Director/Professor, University at Buffalo, 414 Bell Hall, Buffalo, NY, 14260, United States, sudit@eng.buffalo.edu, Adam Stotz, Rakesh Nagi

As most military decision-makers drown in data and starve for information, issues on the amount and type of data required at each level of decision-making are prevalent and can be viewed as complex optimization problems. We will present Mathematical Models as well as Information Fusion models with corresponding solution strategies that will give the appropriate situation understanding in a sample naval scenario. Extensions of such models will be used for both strategic and tactical operations.

4 - High Level Data Fusion Using Graph Matching and State Space Search

Rakesh Nagi, Professor, Department of Industrial & Systems Engineering, 438 Bell Hall, University at Buffalo (SUNY), Buffalo, NY, 14260, United States, nagi@buffalo.edu

We use attributed graph models to represent situations in Level 2 and 3 fusion (situational awareness and impact assessment). Graph matching is invoked to determine if a situation of interest to the analyst (template graph) exists in a scenario (data graph). A Truncated Search Tree heuristic is developed to perform graph matching.

■ SD23

Room 323

Strategic Decisions in Services Offshoring

Cluster: Global Services Sourcing

Invited Session

Chair: Richard Metters, Associate Professor, Emory University, 1300 Clifton Road, Atlanta, GA, 30322, United States, Richard_Metters@bus.emory.edu

1 - International Outsourcing of Services: A Business Strategy Perspective

Stephen Tallman, E. Claiborne Robins Professor of Business, University of RIchmond, Robins School of Business, 1 Gateway Road, Richmond, VA, 23173, United States, stallman@richmond.edu

Different types of International Outsourcing of Services are considered that might be undertaken by firms and costs and benefits of each are addressed. As firms are increasingly able to separate the physical and the informational aspects of business services and the commodity from the specialized in the information side of services, international outsourcing of commodity information-based services are expected to increase.

2 - Host Country Efficiency in Services Offshoring: A Comparative Approach

Eugene Hahn, Assistant Professor, Department of Information & Decision Sciences, Salisbury University, Salisbury, MD, 28101, United States, edhahn@salisbury.edu, Jonathan Doh, Kraiwinee Bunyaratavej

Service offshoring is an increasingly important aspect of the global economy. This phenomenon's growth has lead to increased interest in services offshoring from a diverse set of groups. Yet to date empirical research in services offshoring has been somewhat limited. In this study we empirically examine services offshoring capabilities of countries and compare them utilizing an efficiency-based perspective. Implications for management decision makers and governmental officials are discussed.

3 - A Typology of Offshoring and Outsourcing for Electronically Transmitted Services

Richard Metters, Associate Professor, Emory University, 1300 Clifton Road, Atlanta, GA, 30322, United States, Richard_Metters@bus.emory.edu

A normative model of the appropriate role of offshoring is proposed. We present a strategic contingency model, to be viewed at the process level, intimating that firms with the same processes should come to different solutions regarding the offshoring and outsourcing decisions.

■ SD24

Room 324

Language, Culture, and Representation in Markets

Sponsor: Organization Science

Sponsored Session

Chair: Amit Nigam, Post Doctoral Researcher, Rotman School of Management, University of Toronto, 105 St. George Street, Toronto, ON, M5S 3E6, Canada, amit.nigam@rotman.utoronto.ca

Co-Chair: Klaus Weber, Assistant Professor of Management and Organizations, Kellogg School of Management, Northwestern University, 2001 Sheridan Rd, Evanston, IL, 60208-2001, United States, klausweber@northwestern.edu

The papers in this session examine role of language, information and representational practices in core market processes.

1 - Language as a Window to Cultural and Technological Markets

Micki Eisenman, Assistant Professor, Zicklin School of Business, Baruch College, CUNY, Management Department, Box B9-240, New York, NY, 10026, United States, micki_eisenman@baruch.cuny.edu

This paper examines the increasing significance of cultural product elements in high-technology markets. Specifically, it uses computer aided verbal and pictorial content analysis to measure changes in the competitive logic of high-technology industries. Findings trace a market preference for cultural components, specifically, product aesthetics, in periods of increased cost based competition and incremental technological innovation.

2 - Arbitrage as Representation

Daniel Beunza, Assistant Professor, Graduate School of Business, Columbia University, Management Division, 708 Uris Hall, 3022 Broadway, New York, NY, 10027, United States, db2417@columbia.edu, David Stark

Existing theories of arbitrage offer a valuable but incomplete understanding of the phenomenon. One literature stream, grounded in neoclassic finance, views arbitrage as a straightforward process of linking like markets for the same security. Another stream, rooted in psychology and behavioural finance, presents arbitrage as an inherently limited in its effects. Both approaches, however, stem from a presentist, under-socialized and over-abstracted view of individual calculation that ignores Knightian uncertainty. To address this shortcoming, we undertake a three-year ethnographic study of arbitrage trading at the trading room of a Wall Street investment bank. We find that arbitrage is a cogitative and material process that emerges from the juxtaposition of information, calculative frames, visualization and social relations. In contrast to the existing views of arbitrage as perfect linking device or flawed repository for herding, our view suggests that arbitrageurs constitute a forum for resolving differences in beliefs about the economy.

3 - Market Watch: Information and Availability Cascades in the U.S. IPO Market

Tim Pollock, Associate Professor of Management, Smeal College of Business, Pennsylvania State University, 417 Business Building, University Park, PA, 16802, United States, tpollock@psu.edu, Patrick Maggitti, Violina Rindova

In this study we advance current research on the dynamics of social influence in markets by examining how information and availability cascades influence the attentional and evaluative choices that the media and investors make about newly public firms. We integrate emerging theoretical perspectives on information and availability cascades by examining the extent to which the media and investors follow the logics of each type of cascade in deciding which firms to focus their attention on and how to evaluate them. We extend current research on cascades by positing that the choices of market participants reflect both intra-cascade effects arising from imitation of others in one's own professional community, and inter-cascade effects arising from efforts to glean information from the choices of others in another relevant professional community.

■ SD25

Room 325

Select Business Modeling Case Studies in Telecommunications Industry

Cluster: OR Practice

Invited Session

Chair: Narayan Raman, Lucent Technologies, 101 Crawfords Corner Road, Holmdel, NJ, 07733, United States, narayanraman@lucent.com

1 - Analysis of Cellular and Wireline Voice Convergence in the Consumer Market

Abdol Saleh, Lucent Technologies, Business Modeling Department, 101 Crawfords Corner Road, Holmdel, NJ, 07733, United States, asaleh@lucent.com, Yuliy Baryshnikov

To provide converged Cellular/Wireline services, telecom operators seek clear economic drivers to develop service offer strategies. We study the impact of factors, such as market segment characteristics, price sensitivity, network investment, service bundling, operation cost and service differentiation in an environment where various operators adopt different go-to-market strategies. We quantify the impact of these strategies on market share acquisition and churn reduction for each operator.

2 - Business-Modeling Framework for Radio Access Network Capacity Planning in CDMA Networks

Alina Ionescu-Graff, Lucent Technologies/ Bell Labs, 101 Crawfords Corner Road, 4K-403, Holmdel, NJ, 07733, United States, aigraff@lucent.com, Doru Calin, Ednny Mari Aguilar

A Cellular Capacity Planning (CPP) service for Radio Access Networks was developed to help Service Providers plan for cellular networks to meet Service Level Agreements but without over provisioning. This paper presents a business-modeling framework to quantify the cost/benefits of the CCP Service by translating the provisioning error reductions into capital and operations savings, and revenue preservation and increase (from reduction of excess equipment, blocking, churn, customer care ops, etc)

3 - Economics of Hosted Applications
Narayan Raman, Lucent Technologies, 101 Crawfords Corner Road, Holmdel, NJ, 07733, United States, narayanraman@lucent.com

This study evaluates the benefit to a network operator of outsourcing the delivery of applications to consumer or enterprise end users. It investigates the impact of market- and supply-related uncertainties on the relative economics of the outsourcing decision.

■ SD26

Room 326

Mathematical Programming in Data Mining Machine Learning

Sponsor: Data Mining

Sponsored Session

Chair: Alkis Vazacopoulos, Director, Dash Optimization Inc., 560 Sylvan Avenue, Englewood Cliffs, NJ, 07632, United States, av@dashoptimization.com

1 - Consistent Biclustering via Fractional 0-1 Programming
Stanislav Busygin, PhD Student, Department of Industrial and Systems Engineering, University of Florida, 303 Weil Hall, Gainesville, FL, 32611, United States, busygin@ufl.edu, Oleg Prokopyev, Panos Pardalos

Biclustering consists in simultaneous partitioning of the set of samples and their features into classes. Samples and features classified together are supposed to have a high relevance to each other. We define the notion of consistent biclustering and prove that it implies separability of the classes by convex cones. We discuss both supervised and unsupervised learning algorithms. The developed models involve fractional 0-1 optimization. Computational results on microarray data are reported.

2 - Network-Based Approaches in Data Mining
Sergiy Butenko, Assistant Professor, Texas A&M University, College Station, TX, 77843, United States, butenko@tamu.edu, Svyatoslav Trukhanov, Balabhaskar Balasundaram

This talk will discuss data mining techniques based on network representations of data sets. In particular, alternative ways of representing the data as a network will be described, several models describing structural properties of the network will be introduced, and solution methods for the corresponding optimization problems will be described.

3 - Pseudo-Boolean Regression
Peter L. Hammer, Director and Professor, Rutgers University - RUTCOR, 640 Bartholomew Road, Piscataway, NJ, 08854-8003, United States, hammer@rutcor.rutgers.edu, Tibérius Bonates

Generalizing the LAD (Logical Analysis of Data) approach, an iterative procedure is proposed to construct a sequence of polynomials of binary (0-1) variables, approximating a real-valued target function with prescribed values on a set of binary vectors. Solutions with correlations exceeding 97-98% are efficiently constructed on all benchmark problems considered.

4 - Clustering by QUBO (Quadratic Unconstrained Binary Optimization)
Gabriel Tavares, Dash Optimization Inc., 560 Sylvan Avenue, Englewood Cliffs, NJ, 07632, United States, gabriel.tavares@dashoptimization.com, Peter L. Hammer, Endre Boros

Numerous algorithmic graph theory problems (MAX-CLIQUE, MIN-COV, MAX-CUT, BALANCING) are formulated as quadratic unconstrained binary optimization problems, allowing the exact solution within seconds of real life problems (coming from telecommunications, VLSI design, biological/social networks) with 500,000 (and more) vertices. Applications to clustering problems with millions of objects are presented.

■ SD27

Room 327

Sequential Analysis and Model Selection Problems

Sponsor: Quality, Statistics and Reliability

Sponsored Session

Chair: Savas Dayanik, Assistant Professor, Princeton University, ORFE, E-Quad, Princeton, NJ, 08544, United States, sdayanik@princeton.edu

1 - Structural Break Estimation for Non-Stationary Time Series Signals
Thomas Lee, Associate Professor, Colorado State University, Department of Statistics, Fort Collins, CO, 80523, United States, thomas.cm.lee@gmail.com, Gabriel Rodriguez-Yam, Richard A. Davis

This paper considers the problem of detecting break points for a broad class of non-stationary time series models. In this formulation, the number and locations of the break points are assumed unknown. Each piece is assumed to be stationary and can be modeled from a class of parametric time series models. The minimum description length is used as a criterion for estimating the number of break points, the location of break points, and the parametric model in each segment.

2 - Selecting the Best System When Systems are Revealed Sequentially
Barry Nelson, Professor, Northwestern University, Department of IEMS, 2145 Sheridan Road, Evanston, IL, 60208-3119, United States, nelsonb@northwestern.edu, L. Jeff Hong

Statistical ranking and selection (R&S) is a collection of experiment design and analysis techniques for selecting the system with the largest or smallest mean performance. The existing procedures all assume that the set of alternatives is available at the beginning of the experiment. In many situations, however, the alternatives are revealed sequentially during the experiment. We introduce new procedures that are capable of selecting the best alternative in these situations.

3 - Enhancements of the Generalized Likelihood Ratio Tests for On-Line Detection of Changes
Emmanuel Yashchin, Research Staff Member, IBM Research, T.J. Watson Research Center, Room 33-212, Box 218, Yorktown Heights, NY, 10598, United States, yashchi@us.ibm.com

We discuss the problem of monitoring in the presence of abrupt changes, such as shifts or drifts. We introduce a unified methodology based on use of likelihood ratio tests that enables one to obtain control schemes that provide both good statistical performance and are relatively easy to implement in the sense that they depend on very few design parameters and require a limited computational effort that is dynamically adjusted based on process conditions.

4 - Bayesian Sequential Detection and Isolation of an Unobservable Change
Savas Dayanik, Assistant Professor, Princeton University, ORFE, E-Quad, Princeton, NJ, 08544, United States, sdayanik@princeton.edu, Christian Goulding, H. Vincent Poor

Suppose that the characteristics of a stochastic process change suddenly at an unobservable time to one of several alternatives. The problem is to detect simultaneously the change time and change type as quickly as possible after change happens. In a Bayesian setup we describe an optimal sequential decision rule and illustrate it on numerical examples.

■ SD28

Room 328

Panel Discussion: Teaching Experimental Design and Statistical Process Control Methods

Sponsor: Quality, Statistics and Reliability

Sponsored Session

Chair: Jye-Chyi (JC) Lu, Professor, Georgia Institute of Technology, 765 Ferst Drive, Atlanta, GA, 30022, United States, jclu@isye.gatech.edu

Co-Chair: Dan Apley, Associate Professor, Northwestern University, IE/MS, 2145 Sheridan Road, Evanston, IL, 60208, United States, apley@northwestern.edu

1 - Panel Discussion: Teaching Experimental Design and Statistical Process Control Methods in IE/OR/Statistics Programs
Moderator: Jeff C. F. Wu, Professor, Georgia Institute of Technology, Industrial and Systems Engineering, 765 Ferst Drive, Campus Box 0205, Atlanta, GA, 30332, United States, jeffwu@isye.gatech.edu, Panelists: Bruce Ankenman, Jye-Chyi (JC) Lu, Russell Barton, George Runger, Yu Ding, Dan Apley

In this session a panel of faculty who teach undergraduate and graduate level courses in design of experiment (DOE) come together to present and exchange information about their courses, in terms of the course design, topics covered, data supplied, and software and text books used. This session is intended for anyone who is currently teaching or hoping to create a course on the subject of DOE.

■ SD29

Room 329

System Analysis and Design in Healthcare

Cluster: Joint Cluster Healthcare/ HAS: Healthcare Engineering
Invited Session

Chair: Yuehwern Yih, Professor of Industrial Engineering, Purdue University, 315 N. Grant Street, W. Lafayette, IN, 47907, United States, yih@purdue.edu

1 - Specialization and Competition in Healthcare Delivery Networks
Vikram Tiwari, Indiana University, Kelley School of Business, Operations & Decision Technology, Bloomington, IN, 47405, United States, vtiwari@indiana.edu, H. Sebastian Heese

Hospital networks that offer multiple services at multiple locations can improve cost and quality by creating specialized facilities; however, this may be at the cost of market share. Using a spatial model, we study when specialization is profitable, and which facilities and services provide the greatest value through specialization.

2 - Holiday Operating Room On-Call Staffing Requirements
Franklin Dexter, Professor, University of Iowa, Department of Anesthesia, 6-JCP, Iowa City, IA, 52242, United States, Franklin-Dexter@UIowa.edu

The numbers of cases starting during each holiday period is a statistically valid end-point for operating room managers to use when evaluating how busy are holidays relative to weekend days. The statistic is useful when combined with mathematically valid assessments of appropriate weekend staffing. The latter are set covering problems.

3 - A Structural Equation Model for Clinicians' Adherence to Clinical Practice Guidelines
Sze-Jung Wu, Research Assistant, Purdue University, School of Industrial Engineering, 315 N. Grant Street, W. Lafayette, IN, 47907, United States, swu@purdue.edu, Mark Lehto, Yuehwern Yih, Mindy Flanagan, Alan Zillich, Brad Boebbeling

Clinical practice guidelines (CPG) offer clinicians instructions such as which diagnostic or screening tests to order. Previous studies reported that CPG could improve health outcomes, but had limited effect on changing physicians' behavior. In order to study clinicians' adherence to CPG, we conducted a survey instrument, including clinicians' background, perceptions, and actions on CPG. Structural equation modeling was applied to validate the feasibility of our proposed conceptual model.

■ SD30

Room 330

Optimization of Medical Decisions

Sponsor: Health Applications Section
Sponsored Session

Chair: Brian Denton, Assistant Professor, Mayo Clinic College of Medicine, 200 First Street SW, Rochester, MN, 55906, United States, Denton.Brian@mayo.edu

1 - Pattern Recognition and Classification in Medical Diagnosis
Eva Lee, Associate Professor, School of Industrial and Systems Engineering, Georgia Institute of Technology, Atlanta, GA, 30332, evakylee@isye.gatech.edu

The cardiovascular system provides oxygen/nutrients to the body. Tissue ischemia, due to obstruction of arterial blood flow, can result in serious effects (vision/limb loss). Development of new vessels can fuel the progression of cancer and macular degeneration. We present a pattern recognition algorithm and an optimization-based predictive model to analyze artery patterns. We illustrate its use for disease diagnosis/monitoring via classification of healthy vs diseased microvascular networks.

2 - On the Nearest Dynamic Time Warping Neighbor for Abnormal Brain Activity Classification
W. Art Chaovalitwongse, Assistant Professor, Rutgers University, 96 Frelinghuysen Road, Piscataway, NJ, 08854, United States, wchaoval@rci.rutgers.edu, Rajesh Sachdeo, Ya-Ju Fan

Uncontrolled epilepsy poses a significant burden to society due to associated healthcare cost to treat and control the unpredictable and spontaneous occurrence of seizures. In this talk, we present a novel classification technique, Nearest Dynamic Time Warping Neighbor, used to classify normal and epileptic brain activities through quantitative analyses of electroencephalogram (EEG) recordings. This technique employs dynamic programming to excavate hidden patterns/relationships in the brain.

3 - An MDP Model for Optimizing Statin Start Times for Diabetes Patients
Murat Kurt, Doctoral Candidate, University of Pittsburgh, 4135 Murray Avenue, Pittsburgh, PA, 15217, United States, muk7@pitt.edu, Nilay D. Shah, Brian Denton, Sandra C. Bryant, Steven A. Smith

Diabetes affects approximately 7% of the U.S. population and costs more than $130 billion annually. Several risk models are used by clinicians to guide diabetes related treatment decisions.We examine an important treatment decision, the optimal start time of statins, using a Markov decision process (MDP) model. Our MDP model indicates that significant discrepancies among alternative risk models translate into significant differences in the implied optimal time to start treatment with statins.

4 - Maximizing the Efficiency of the U.S. Liver Allocation System through Region Selection (Submitted to for the 2006 Pierskalla Award)
Nan Kong, Assistant Professor, Industrial and Management Systems Engineering, University of South Florida, ENC 2505, Tampa, FL, 33620, United States, kong@eng.usf.edu, Brady Hunsaker, Andrew Schaefer, Mark Roberts

Allocating organs for transplantation has been a contentious issue in the United States for decades. One of the many remaining questions is how to cluster Organ Procurement Organizations (OPOs) into regions such that allocation efficiency at the regional level is maximized. We formulate the above problem as a large-scale set-partitioning problem and adapt branch and price to solve it. Computational results are presented in the talk.

■ SD31

Room 331

Optimization Approaches in Financial Engineering II

Cluster: Financial Engineering and Risk Management
Invited Session

Chair: Stan Uryasev, Professor, University of Florida, Department of Industrial and Systems Engineering, Gainesville, FL, 32601, United States, uryasev@ufl.edu

1 - Valuation of Electricity Generation Facilities: Optimal Exercise Boundaries Approach
Valeriy Ryabchenko, PhD Student, University of Florida, 303 Weil Hall, PO Box 116595, Gainesville, FL, 32611-6595, United States, valeriy@ufl.edu, Stan Uryasev

The paper presents an optimization approach to valuation of electricity generation assets. We build a LP model to find the optimal operation boundaries for an electricity generation plant. We consider different operational constraints: start-up and shut-down costs, ramp-up time, output dependent operating heat rate. The model is furnished with a set of monotonicity constraints on decision variables. We test the model with historical and simulated sample paths.

2 - Pricing CDO Tranches Using Reduced-Form Default Model
Alex Nakonechnyi, PhD Student, University of Florida, 303 Weil Hall, PO Box 116595, Gainesville, FL, 32611-6595, United States, nakon@ufl.edu

This research presents a framework for pricing Collateralized Debt Obligation tranches. It applies maximum entropy principle to estimating default distribution implied by the market prices (spreads) of CDO tranches. This default distribution is used to price other credit derivatives.

3 - Efficient Execution in Secondary Mortgage Market
Chung-Jui Wang, PhD Student, University of Florida, 303 Weil Hall, PO Box 116595, Gainesville, FL, 32611-6595, United States, cjwang@ufl.edu, Stan Uryasev

This paper performs secondary mortgage marketing analysis which considers functionality including the loan-level execution, guarantee fee buy-up/buy-down option, servicing retain/release option, and excess servicing fee. Retaining servicing or excess servicing fee involves uncertainty cash flows due to interest rate fluctuation and prepayment. We consider conditional value at risk (CVaR) as risk measure and perform a mean-CVaR efficient execution.

■ SD32

Room 332

Corporate Financial Modeling

Sponsor: Financial Services

Sponsored Session

Chair: Peter Meindl, PhD Candidate, Stanford University, 1038 Guinda Street, Palo Alto, CA, 94301, United States, Meindl@stanford.edu

1 - Constrained Index Tracking Using Stochastic Receding Horizon Control (SRHC)

Chang Hwan Sung, PhD Candidate, Stanford University, Terman Engineering Center, Room 479, Stanford, CA, 94305, United States, chsung@stanford.edu, James Primbs

We use SRHC as a suboptimal approach to an infinite horizon constrained index tracking problem. The dynamics are lifted to handle constraints that involve state and control information at different points in time, and the finite horizon optimizations in RHC can be written as an SDP under the structure of innovations feedback. Computational results using the historical data show that SRHC is a promising approach in solving difficult portfolio optimization problems with constraints.

2 - Corporate Bond Portfolio Optimization with Transaction Costs

Peter Meindl, PhD Candidate, Stanford University, 1038 Guinda Street, Palo Alto, CA, 94301, United States, Meindl@stanford.edu, James Primbs

We propose a methodology for corporate bond portfolio optimization in a multi-period environment with transaction costs. Our methodology melds stochastic programming with receding horizon control, essentially breaking down the portfolio optimization problem into a sequence of problems solved over time. Through Monte Carlo simulation of reduced form defaultable bonds, we demonstrate results showing our methodology can significantly outperform other methodologies.

3 - A Semidefinite Programming-Based Receding Horizon Control Approach to Portfolio Optimization

James Primbs, Assistant Professor, Stanford University, 444 Terman Engineering Center, Stanford, CA, 94305, United States, japrimbs@stanford.edu

We present a new approach to portfolio optimization based on the receding horizon control methodology. The approach involves the solution of on-line optimizations in the form of semidefinite programs that are able to incorporate various forms of constraints. Overall, it has attractive computational features and represents a promising new approach to portfolio optimization.

■ SD33

Room 333

Air Traffic Management

Sponsor: Aviation Applications

Sponsored Session

Chair: Michael Ball, Professor, Robert H. Smith School of Business, University of Maryland, College Park, MD, 20742, United States, mball@rhsmith.umd.edu

1 - Scenario-Free Approaches to the Stochastic Ground Holding Problem

Mark Hansen, Professor, University of California at Berkeley, Civil and Environmental Engineering, 114 McLaughlin Hall, Berkeley, CA, 94720, United States, mhansen@ce.berkeley.edu, P. Barry Liu

We investigate methods for solving the Stochastic Ground Holding Problem that do not require the use of a small set of capacity scenarios. The advantage of this approach that it better reflects actual capacity profiles, which evolve stochastically in a manner that is only roughly approximated by a small set of scenarios. The disadvantage is that the "curse of dimensionality" must be overcome. We present methods for doing this, and assess their performance.

2 - Command and Control Modeling for Air Traffic Flow Management

Robert Hoffman, Principal Analyst, Metron Aviation, 131 Elden Street, Herndon, VA, 20170, United States, Hoffman@metronaviation.com

In an effort to cope with air traffic demand growths and changing demand patterns, government and industry have developed simulation tools to model future concepts of air traffic management. We present a model for system-wide traffic flow management, which can be attached to existing simulation tools as a module. The model is multi-objective, considering efficiency, equity, and flexibility. Integer programs and network flow formulations are used to capture efficiency in the model.

3 - Determining the Number of Slots to Auction

David Lovell, Associate Professor, University of Maryland, Department of Civil Engineering, 1173 Martin Hall, College Park, MD, 20742, United States, lovell@eng.umd.edu, Avijit Mukherjee, Michael Ball, Andrew Churchill

We propose an integer programming model to determine the number of slots to auction during different hours of the day at an airport, to maximize the net benefit to airlines from scheduling operations. Scheduling an operation during a given hour generates revenues for airlines, while delaying and canceling causes them financial loss. The net value can be determined by subtracting the cost of flight delays and cancellations from the overall revenue that is generated from scheduling operations.

4 - Fair Allocation of Slot Leases

Michael Ball, Professor, Robert H. Smith School of Business, University of Maryland, College Park, MD, 20742, United States, mball@rhsmith.umd.edu, Ming Zhong

Under certain proposals for airport slot controls, slot access rights have limited terms. To ease future transitions, these terms should be staggered. We study the problem of creating a fair allocation such slot "leases" where fairness is measured against historical usage.

■ SD34

Room 334

Distribution Problems in Facility Logistics I

Sponsor: Transportation Science & Logistics

Sponsored Session

Chair: Andy Johnson, Assistant Professor, Department of Industrial and Systems Engineering, Texas A&M University, 241 Zachry, 3131 TAMU, College Station, TX, 77843, United States, ajgcvt@yahoo.com

1 - Airport Terminal Design Using Simulation

Cenk Tunasar, PhD, Senior Associate, Booz Allen Hamilton, 8283 Greensboro Drive, McLean, VA, 22102, United States, tunasar_cenk@bah.com, Rahmi Evlioglu

We demonstrate the use of simulation in airport terminal facility design via examples from JFK, Baltimore-Washington and Atlanta Airports. The models, developed by languages Arena and Automod, cover detailed movements of passengers and baggage. Working with architects and planners, we show that simulation can become part of the design process by evaluating multiple design options quickly. We will also share the challenges we faced and lessons learned in implementing simulation modeling.

2 - A Simulated Annealing-Based Heuristic for Outbound Door Assignment in LTL Crossdock Terminals

Hector Carlo, Instructor at University of Puerto Rico, PhD Candidate, University of Michigan, 1205 Beal Avenue, Ann Arbor, MI, 48109-2117, United States, hcarlo@umich.edu, Yavuz Bozer

We present a simulated annealing-based heuristic to obtain outbound trailer-to-door assignments that minimize the overall material handling effort in a crossdock over a specified time period. The heuristic was used to determine door assignments in a major crossdock facility operated by our corporate collaborator.

3 - Design Analysis of a New Class of Order-Picking Systems

Margarit Khachatryan, Graduate Research Assistant, School of Industrial and Systems Engineering, Georgia Institute of Technology, 765 Ferst Drive, NW, Atlanta, GA, 30332, United States, magakh@gmail.com, Leon McGinnis

We develop a formal model for the design analysis of a new class of order-picking systems: small parts high volume order picking with pick-to-buffer. Viewing the process as two stages, order picking and order assembly, leads to a tandem queuing model of performance. Analyzing the model requires new results for both picker travel time, the estimation of the squared coefficient of variation for departures from a queue with batch arrivals and model for the second stage: order assembly.

4 - Benchmarking Warehouse Performance

Andy Johnson, Assistant Professor, Department of Industrial and Systems Engineering, Texas A&M University, 241 Zachry, 3131 TAMU, College Station, TX, 77843, United States, ajgcvt@yahoo.com, Leon McGinnis

The Internet-based Data Envelopment Analysis System (iDEAs) for System-based Self-assessment of Warehouse Operations is a tool available via the Internet. It allows a user to compare the performance of their warehouse to a database of warehouses in order to understand their current performance level. This presentation will describe the most recent results of a review of 390 warehouses, the trends identified, the relationships between performance and a variety of practices and attributes.

■ SD35

Room 335

Network Design and Other Strategic Issues in Transportation

Sponsor: Transportation Science & Logistics
Sponsored Session

Chair: Ahmad Jarrah, Assistant Professor of Decision Science, University of Wyoming, College of Business Building 216, Laramie, WY, 82071, United States, Jarrah@uwyo.edu

1 - Service Based Approach for Supply Chains with Multiple Transportation Modes
Carlos Eloir Blanco Rodriguez, Universidad Autonoma de Nuevo Leon, PISIS/FIME, Av. Universidad s/n., Ciudad Universitaria AP. 076'F', San Nicolas de los Garza, NL, 66450, Mexico, eloir@yalma.fime.uanl.mx, Deniz Ozdemir

We consider a supply network management problem with multiple products, where periodic demand of nonidentical stocking locations are satisfied via multiple transportation modes. We incorporate the unexpected delays in Marine terminals due to increased traffic. We formulate the problem as MIP to find an optimal assignment of routes and transportation modes. We extend the problem formulation to stochastic case. The impact of terminal congestion is demonstrated for different scenarios.

2 - Finding the Minimum Network that Maximizes Service
Hui Chen, hui-chen@uiowa.edu, Ann Campbell, Barrett Thomas

Many national delivery providers offer delivery time commitments between cities. These commitments direct the design of the delivery network. In this network, each arc defines a direct connection between cities and represents a substantial investment. The minimum cost network that connects all cities is a tree, but a tree may not satisfy all of the delivery commitments. We find a tree that minimizes the maximum delivery time violation and present computational results based on the U.S.

3 - Allocating Costs of a Collaboration in Transportation Procurement in a Multi Carrier Environment
Okan Orsan Ozener, Graduate Research Assistant, H. Milton Stewart School of Industrial and Systems Engineering, Georgia Institute of Technology, 765 Ferst Drive NW, Atlanta, GA, 30332, United States, gtg449n@mail.gatech.edu, Özlem Ergun

Collaboration improves efficiency along-or-across supply chains by exploiting synergies between shippers and carriers. We study a network where shippers collaborate to minimize system wide repositioning costs by negotiating prices with several carriers. The problem of finding the optimal routes that minimize total cost of covering all the shippers' demand is NP-Hard. We develop an algorithm to solve this optimization problem that uses integer programming as a subroutine.

4 - Large-Scale Less-than-Truckload Service Network Design
Ahmad Jarrah, Assistant Professor of Decision Science, University of Wyoming, College of Business Building 216, Laramie, WY, 82071, United States, Jarrah@uwyo.edu, Ellis Johnson

We present a novel formulation for designing large less-than-truckload (LTL) freight networks. The model captures the network design constraints, the load plan's tree structure and other LTL-specific requirements. We fragment the massive model with up to 2 million 0-1 variables and 2 million rows, into a separate and efficient IP for each destination/ due day-of-week combination along with a master problem. Our results yield major annual savings (~ $20 million).

■ SD36

Room 336

Inventory, Production and Distribution Applications

Sponsor: Transportation Science & Logistics
Sponsored Session

Chair: Huseyin Topaloglu, Assistant Professor, Cornell University, 223 Rhodes Hall, Ithaca, NY, 14853, United States, huseyin@orie.cornell.edu

1 - Integrated Scheduling of Production and Distribution with Capacited Vehicles and Production Set-ups
Su Gao, PhD Candidate, MSIS Department, Rutgers University, PhD Program #76, 180 University Avenue, Newark, NJ, 07102, United States, speed_gao@yahoo.com, Ronald Armstrong, Lei Lei

Coordination of production and distribution is an important issue faced by many industries. We develop a cyclic scheduling model with capacited trucks and products with short-life, set-ups between productions and non-instantaneous routing. We analyze optimal properties of special cases and propose an effective approximation algorithm for the general problem. The objective is to minimize the cycle time subject to the customer demand, product lifespan and capacity constraints.

2 - A Multi-Product Network Design Model with Lead Time and Safety Stock Considerations
Karthik Sourirajan, Research Staff Member, IBM TJ Watson Research Center, 1101 Kitchawan Road, Yorktown Heights, NY, 10598, United States, ksourira@us.ibm.com, Reha Uzsoy, Leyla Ozsen

We study a multi-product network design problem in which we explicitly model the non-linear relationships between demand assigned to a DC, replenishment lead times and safety stocks. While lead time congestion can be thought of as a global network property that depends on the total demand flows, safety stock risk-pooling can be thought of as a local network property that depends on individual products' demand flows. Our model captures the trade-off between these properties.

3 - Two Product Inventory Control Systems with Substitution
Olga Ortiz, PhD Student, Georgia Institute of Technology, 765 Ferst Drive NW, Atlanta, GA, 30332, United States, oortiz@gatech.edu, Alan Erera, Chip White

Consider a two-product inventory system where demand is observed only through sales. When a stock-out occurs, substitution can take place further reducing demand observability. We present approaches based on partially observed Markov decision processes to assess the potential benefit from improving demand observability in this setting.

4 - Approximate Dynamic Programming for Inventory Allocation Under Uncertainty
Huseyin Topaloglu, Assistant Professor, Cornell University, 223 Rhodes Hall, Ithaca, NY, 14853, United States, huseyin@orie.cornell.edu, Sumit Kunnumkal

We present two approximate DP approaches for an inventory allocation problem. The first one uses linear approximations of the value function and exploits the LP formulation of the underlying DP. The second one uses Lagragian relaxation to relax the constraints that link the decisions for different production plants.

■ SD37

Room 337

Economics of IS 2

Sponsor: Information Systems Society
Sponsored Session

Chair: Vidyanand Choudhary, Assistant Professor, University of California, Irvine, Paul Merage School of Business, SB 313, Irvine, CA, 92697, United States, VeeCee@uci.edu

1 - Allocating Objects in a Network of Caches: Centralized and Decentralized Analyses
Karthik Kannan, Assistant Professor, Purdue University, 403 West State Street, West Lafayette, IN, 47907, United States, kkarthik@purdue.edu, Mohit Tawarmalani, Prabuddha De

In this paper, we analyze object allocation in a network of caches that share web content to exploit network externality benefits. The analysis is presented for both centralized and decentralized scenarios, and is carried out using operations research and game-theoretic tools. The optimal allocation is found for each case, and cache incentives are aligned with the socially optimal welfare by devising appropriate pricing mechanisms.

2 - Electronic Commerce and Local Competition
Anindya Ghose, Assistant Professor, Stern School of Business, New York University, 44 West Fourth Street, KMC 8-94, New York, NY, 10012, United States, aghose@stern.nyu.edu, Avi Goldfarb, Chris Forman

We examine how changes in the local supply of goods in the offline world changes consumer purchase behavior online. The emergence of new online retailing channels may act as a substitute for the benefits of urban concentration both by offering lower prices and by providing increased product variety. We explore these questions using data from Amazon on the top twenty books, and DVDs for over 8626 unique locations over 10 months. We discuss implications for the Long Tail.

3 - Performance Based Advertising
Jane Feng, Assistant Professor, University of Florida, Gainesville, FL, 32611, United States, jane.feng@cba.ufl.edu

Performance based pricing, where the advertisers only pay to the publisher when the advertisement generates valid results, becomes more and more popular in the internet advertising industry. How does this pricing scheme impact the publisher's quality, the advertisers' welfare, compared to the traditional impression based advertising? This paper tries to understand its basic economics.

■ SD38

Room 338

Roundtable II - Tactical and Operational Capacity Management

Sponsor: Railroad Applications
Sponsored Session

Chair: Dharma Acharya, AVP - Operations Research, CSX Transportation, Jacksonville, FL, 32202, United States, Dharma_Acharya@CSX.com

1 - Revolutionary Functionality via Evolutionary Development
Ron Lindsey, Owner, Communication Architecture, 1828 Cherry Street, Jacksonville, FL, 32205, United States, comarch@aol.com

A railroad's traffic capacity is constrained by technologies that were introduced in the first 1st and 2nd quarters of the last century, i.e., track circuits and voice radio respectively. With more timely train position and speed data available via wireless data, railroads can project traffic conflicts and re-plan accordingly, thereby increasing capacity. Such capability can be done with minimal additional infrastructure and with out taking on a railroad's current CAD platform.

2 - Factors Affecting Railroad Yard Performance
Carl Martland, Senior Research Associate, Massachusetts Institute of Technology, Room 1-153, Cambridge, MA, 02139, United States, martlan@mit.edu

The average time spent in rail freight classification yards is commonly more than 30 hours, more than 50% over the benchmarks achieved at various times and locations in the past three decades. Long yard times result primarily from strategic decisions concerning yard capacity and service design that are based in part upon perceptions of equipment, yard, and train costs. Better understanding of these costs - and of the potential for delays - could lead to a renewed concern for yard performance.

3 - Lean Production Applications at CPR Freight Classification Yards
Jeff Adams, General Manager - Yards Operations, Canadian Pacific Railway, Suite 500 Gulf Canada Square, 401 9th Avenue SW, Calgary, AB, T2P 4Z4, Canada, jeff_adams@cpr.ca

Addressing railroad capacity constraints often leads to expanded infrastructure or other hard asset investments - an extremely expensive way to buy capacity. Lean production methodologies can yield significant results without resorting to capital. Experiences and results of lean applications in freight classification yards at Canadian Pacific will be discussed.

4 - Improving Railroad Classification Terminal Performance Using Concepts of "Lean Railroading"
Jeremiah Dirnberger, Specialist, Yard Operations Performance, Canadian Pacific Railway, 401 9th Avenue SW, Suite 500, Calgary, AB, T2P4Z4, Canada, Jeremiah_Dirnberger@cpr.ca, Christopher Barkan

The high potential profitability of carload traffic suggests that railroads further grow this type of traffic by providing more reliable service. The classification terminal is a key determinant of service reliability. Performance improvement can be gained by adapting tools from manufacturing. This new approach, introduced here as "Lean Railroading," comprises the adaptation of Lean, the Theory of Constraints (TOC) and Statistical Process Control (SPC or "six sigma") to the terminal system.

■ SD39

Ballroom B

OK, Now How Do We Get There from Here?

Cluster: Where Do We Want to Go?

(In observance of Arthur Geoffrion's retirement)

Invited Session

Chair: Kevin McCardle, Professor, UCLA Anderson School, 110 Westwood Plaza, Los Angeles, CA, 90095-1481, United States, kmccardl@anderson.ucla.edu

Co-Chair: Kumar Rajaram, UCLA Anderson School, 110 Westwood Plaza, Los Angeles, CA, 90095, United States, krajaram@anderson.ucla.edu

1 - Opportunities and Challenges for OR in the Next Five Years
Karla Hoffman, Professor, George Mason University, Mail Stop 4A6, SEOR Department, 4400 University Drive, Fairfax, VA, 22030, United States, ORProfessor@gmail.com

Earlier, OR was hampered by computing costs, lack of data and the inability of our tools to provide timely answers. Now, we are inundated with data, computing is virtually free, our tools are capable of providing real-time solutions, and graphical interfaces make it easy to control the process and output the findings. Together, these developments point to many new opportunities for OR. This talk highlights some new directions and challenges for OR modelers and educators.

2 - Some Thoughts on Getting from Here to 'There'
Marshall Fisher, UPS Professor, The Wharton School, University of Pennsylvania, Philadelphia, PA, 19104, United States, fisher@wharton.upenn.edu

I'll react to earlier speakers suggestions of where we should be going and offer some specific suggested action steps of how to get there.

3 - How to Create Change within the Camelot?
Christopher Tang, Professor, UCLA Anderson School, 110 Westwood Plaza, Los Angeles, CA, 90095, United States, ctang@anderson.ucla.edu

The world is changing, and OR/MS must change along with it. Previous sessions have examined pertinent developments and emerging opportunities and challenges for OR/MS practitioners, researchers, and educators. This session discusses possible concerted actions to promote faster progress in some of these areas.

■ SD40

Room 401

Recent Developments in Location Analysis

Sponsor: Location Analysis
Sponsored Session

Chair: Robert Aboolian, Assistant Professor, California State University at San Marcos, College of Business Administration, 333 S. Twin Oaks Valley Road, San Marcos, CA, 92096, United States, raboolia@csusm.edu

1 - Location-Allocation of Service Units on a Congested Network
Oded Berman, Professor, Rotman School of Management, University of Toronto, 105 St. George Street, Toronto, ON, M5S 3E6, Canada, Berman@Rotman.Utoronto.Ca, Zvi Drezner, Robert Aboolian

We consider the problem of locating and allocating servers on a congested network. The service and demand processes are assumed to be Poisson distributed. The objective is to minimize the total fixed installation, variable, travel time and waiting time costs. Analysis of the problem, exact and approximate solution approaches are presented.

2 - Lost Demand in a Competitive Environment
Zvi Drezner, Professor, California State University, Fullerton, CA, 92834, United States, zdrezner@fullerton.edu, Tammy Drezner

In many competitive situations not all the buying power is spent at the competing facilities because there are substitute products available. These substitute products are not as desirable as the product in question, but customers will purchase the less desirable substitutes if they are more conveniently available. We construct a model that considers a decline in demand as a function of the distance to competing facilities. Solution methods are proposed and computational experiments reported.

3 - Network Location with Uniform Pricing
Dmitry Krass, Professor, Rotman School of Management, University of Toronto, 105 St. George Street, Toronto, ON, M5S 3E6, Canada, krass@rotman.utoronto.ca, Robert Aboolian, Oded Berman

We analyze the integrated location/pricing problem for a set of retail facilities on a network. All new facilities are assumed to charge the same price. Pre-existing competitive facilities may be present. Both the number and locations for the new facilities must be determined. We show that optimal pricing and location decisions can be separated, and pricing discretized, leading to efficient solutions.

4 - Constrained Center Problem with Unreliable Facilities
Mozart Menezes, Assistant Professor, Department of Operations Management & Information Technology, HEC School of Management, Paris, 1 Rue de la Liberation, Jouy-en-Josas, 78351, France, Menezes@hec.fr, Oded Berman, Dmitry Krass

This paper is an extension of the p-Center problem on a network. A facility may be unavailable, causing customers to seek service from operating facilities. Thus, customers may have to travel to a facility that is not the closest one. Every customer requires that a facility will be available with some positive probability. A heuristic approach is developed to ensure coverage feasibility while minimizing the expected maximum distance traveled in order to obtain service.

■ SD41

Room 402

Learning and Adaptive Algorithms

Sponsor: Applied Probability

Sponsored Session

Chair: Assaf Zeevi, Associate Professor, Columbia Business School, 3022 Broadway, New York, NY, 10027, United States, assaf@gsb.columbia.edu

1 - A Universal Scheme for Learning

Vivek Farias, Graduate Student, Electrical Engineering, Stanford University, 274 Packard Electrical Engineering, Stanford, CA, 94305, United States, vivekf@stanford.edu, Ciamac Moallemi, Benjamin Van Roy, Tsachy Weissman

We consider an agent interacting with an unmodeled environment. At each time, the agent makes an observation, takes an action, and incurs a cost. Actions can influence future observations and costs. The goal is to minimize long-run average cost. We propose an algorithm inspired by the Lempel-Ziv scheme for data compression. We establish that if the future is conditionally independent of the past given a finite window of actions and observations, average cost converges to the optimum.

2 - Using Proximity to Speed Up Experts Algorithms in Reactive Environments

Daniela Pucci de Farias, pucci@mit.edu, Jeremy Schwartz

"Experts algorithms" use a fixed set of strategies to make decisions sequentially in unknown environments. In reactive environments, the method matches the performance of the best expert, but bounds on convergence rate suggest a severe dependence on number of experts. We explore proximity metrics among experts to speed up convergence. A simple scheme is shown to asymptotically perform as well as the best expert. Empirical results suggest a much less dramatic dependence on number of experts.

3 - Risk Bounds and Near-Optimal Algorithms in Revenue Management with Unknown Demand Function

Omar Besbes, PhD Student, Columbia Business School, 3022 Broadway, New York, NY, 10027, United States, ob2105@columbia.edu, Assaf Zeevi

We consider a single product revenue management problem where realized demand is observed over time, but the demand function that governs these observations is not known. We define different information levels that characterize the a priori knowledge of the decision maker, and provide lower and upper bounds on the optimal performance of joint learning and pricing schemes. These results illustrate the risk-reward tradeoff with regard to the assumptions made on the underlying demand model.

4 - Bandit Problems with Side Information

Assaf Zeevi, Associate Professor, Columbia Business School, 3022 Broadway, New York, NY, 10027, United States, assaf@gsb.columbia.edu

We consider a two armed bandit problem that serves as a canonical model of sequential decision making under uncertainty, and as such exhibits a clear trade off between estimation and optimization. We show that if one endows the decision maker with suitable ``side information," then the optimal strategy and associated performance can be strikingly different than those seen in the classical setting where no side information is available.

■ SD42

Room 403

Scheduling: New Models and Metrics

Cluster: Scheduling

Invited Session

Chair: Jay Sethuraman, Associate Professor, Columbia University, 338 Mudd, IEOR Department, 500 West 120th Street, New York, NY, 10027, United States, js1353@columbia.edu

1 - Characterizing the Effect of Inexact Size Information in Size-Based Policies

Adam Wierman, acw@cs.cmu.edu

When studying policies that "prioritize small jobs" theoriticians traditionally assume that policies have exact knowledge of job sizes, which is not true in practice. In this work, we define a class of policies that formalizes the heuristic of "prioritizing small jobs" in a loose enough manner so as to include policies that schedule using inexact job sizes. We then characterize the impact of inexact job size information by bounding the behavior of this classificiation.

2 - Anticipatory Algorithms for Online Stochastic Combinatorial Optimization

Pascal Van Hentenryck, Professor of Computer Science, Brown University, Box 1910, 115 Waterman Street, 4th Floor, Providence, RI, 02912, United States, pvh@cs.brown.edu

This talk considers online stochastic combinatorial optimization (OSCO) problems where online decisions must select which requests to serve and how. These problems arise in many practical applications in networking, reservation systems, and vehicle routing and dispatching. This talk presents a class of anticipatory algorithms for OSCO applications, studies its theoretical properties, and demonstrates their applicability on a variety of complex problems.

3 - Allocation of Jobs and Resources to Pooling Centers

Hui-Chih Hung, Post-Doctoral Researcher, Ohio State University, 1971 Neil Avenue, Department of Industrial Engineering, Columbus, OH, 43210, United States, hung.63@osu.edu, Marc Posner

We partition identical and non-identical servers into parallel pooling centers and simultaneously assign job types to centers. Each job type has a distinct Poisson arrival rate and WIP weight. The goal is to minimize the total WIP cost. Heuristics are developed and are evaluated both theoretically and experimentally.

■ SD43

Room 404

AHP/ANP Theory and Applications

Cluster: Analytic Hierarchy Process

Invited Session

Chair: Birsen Karpak, Professor of Management, Youngstown State University, One University Plaza, WCBA 635, Youngstown, OH, 44555, United States, bkarpak@ysu.edu

1 - Success Factors for Small Medium Enterprises: An Analytical Network Process (ANP) Approach

Birsen Karpak, Professor of Management, Youngstown State University, One University Plaza, WCBA 635, Youngstown, OH, 44555, United States, bkarpak@ysu.edu, Ilker Topcu

Small and Medium-sized Industries play important role in most economies. There are some studies done identifying the success factors of these organizations yet no study has been done yet prioritizing these factors. Considering interdependence of these factors, the authors developed Analytical Network Process (ANP) model which attempts to find importance of a variety of factors using expert judgments for a manufacturing industry.

2 - Analytic Network Process Model for Outsourcing Decisions

Ozlem Arisoy, PhD Candidate, University of Pittsburgh, 1048 Benedum Hall, University of Pittsburgh, Pittsburgh, PA, 15232, United States, oza1@pitt.edu, Bopaya Bidanda, Larry Shuman

Outsourcing decisions encompass many different facets that are often assessed by stakeholders with conflicting objectives. In this study, we develop an Analytic Network Process (ANP) model that evaluates the multiple dimensions of outsourcing decisions within a corporate environment. The implementation of ANP is illustrated on a real life application and the results are evaluated by examining the fundamental principles of the methodology and elements of the model.

3 - An Exploratory Study: Comparing Two Decision Making Methodologies

Oyku Alanbay Isik, PhD Student, University of North Texas, College of Business Administration, Information Technology & Decision Sciences, Denton, TX, 76201, United States, alanbayo@unt.edu

An exploratory study was conducted to compare two software pieces, Expert Choice and Super Decisions, which are based on two different decision-making methodologies, Analytic Hierarchy Process(AHP) and Analytic Network Process(ANP).Applications were used with the same decision making problem. The findings indicate that software usability scale showed significant differences and respondents' results with the applications were inconsistent. Various implications and future directions are suggested.

■ SD44

Room 405

JFIG Paper Competition Finalists II

Sponsor: Junior Faculty Interest Group (JFIG)

Sponsored Session

Chair: Alan Scheller-Wolf, Associate Professor, Tepper School of Business, Carnegie Mellon University, Pittsburgh, PA, 15213, United States, awolf@andrew.cmu.edu

1 - JFIG Paper Competition Finalists

In these two sessions the finalists of the 2006 JFIG paper competition will present their research. The paper competition is organized by the Junior Faculty Interest Group (JFIG) forum in INFORMS. JFIG was created in 2001 to promote the career development of tenure-track faculty in INFORMS. The goals of the paper competition are to encourage research among junior faculty and to increase the visibility of research conducted by junior faculty within the fields of operations research and management science. Six finalists are selected by the

award committee and their papers are presented in these two sessions. The papers submitted for the competition are evaluated based on the importance of the topic, appropriateness of the research approach, and the significance of research contribution. Winners are announced at the JFIG lunch on Sunday at the INFORMS Annual Meeting.

■ SD45

Room 406

Tutorial: Electricity Deregulation: What is Wrong & How We Got There

Cluster: Tutorials

Invited Session

1 - Electricity Deregulation: What is Wrong & How We Got There

Lester Lave, Professor, Tepper School of Business, Carnegie Mellon University, 5000 Forbes Avenue, Pittsburgh, PA, 15213, United States, lave@cmu.edu, Seth Blumsack

Regulated monopolies for electricity supply worked well from 1910 until 1975, when a host of problems led to deregulation. But deregulation has produced higher prices, unreliability, and transmission congestion. Recently the emphasis on deregulation has eased and some states have returned to their original regulatory regimes. We explore reasons for current problems in electricity markets and evaluate solutions. We conclude that either regime may satisfy market demands, though neither will produce a free competitive market.

■ SD46

Room 407

Tutorial: Opt Art

Cluster: Tutorials

Invited Session

1 - Opt Art

Robert Bosch, Donald R. Longman Professor of Mathematics, Department of Mathematics, Oberlin College, Oberlin, OH, 44074, United States, bobb@cs.oberlin.edu

Optimization is concerned with finding the best way to complete a task. Many applications of optimization, such as scheduling, matching and routing, are well-known. In this tutorial, we will showcase novel applications of optimization to the area of fine art: portraits constructed out of complete sets of dominoes (via integer programming), mosaics comprised of abstract geometric tiles (via integer programming and various heuristics), and continuous line drawings (via the ``solution" of large-scale instances of the traveling salesman problem).

■ SD47

Room 408

Managing Uncertainty and Risk in Supply Chains

Cluster: Supply Chain and Operations Engineering

Invited Session

Chair: Sila Cetinkaya, Associate Professor, Texas A&M University, Industrial and Systems Engineering, College Station, TX, 77843, United States, sila@tamu.edu

1 - Capacity Disruption Risk in Production Enterprise Networks

Martin Wortman, Professor, Texas A&M University, Industrial and Systems Engineering, College Station, TX, 77843-3131, United States, wortman@mwx.tamu.edu, Alex Savachkin

The introduction of lean business practices can greatly enhance the operating efficiency of production enterprises; however, these practices can also leave production networks brittle with dramatically increased exposure to disruptions in both production and supply capacities. In this talk, we explore capacity disruption risk in large production networks. In particular, we examine structural properties of the underlying stochastic processes that characterize disruption risk.

2 - Lateral Transshipment Options in a 2-Stage Supply Chain

Gary Gaukler, Assistant Professor, Texas A&M University, Industrial and Systems Engineering, College Station, TX, 77843, United States, gaukler@tamu.edu

In this talk, we model the behavior of a 2-stage supply chain in which lateral transshipments at the second stage installations are possible. Lateral transshipments can be used to quickly react to demand (and supply) uncertainty. We derive a compound inventory control policy to determine when transshipments should be initiated and evaluate the impact on system performance.

3 - Dynamic Allocation of Flexible Resources to Market Differentiated Stochastic Demand

Eylem Tekin, Assistant Professor, Texas A&M University, Industrial Engineering, College Station, TX, 77843, United States, eylem@iemail.tamu.edu, Tao Huang

We consider a network of multiple flexible resources with fixed initial capacities that are used to satisfy demands from different market segments during a finite planning horizon. Using a dynamic programming approach, we show the structural properties of the optimal allocation policy for a two-resource case. For more general cases, we propose heuristic approaches derived from these structural properties.

4 - The Impact of Supply Quality Information and Supplier Development on Contract Design

Sila Cetinkaya, Associate Professor, Texas A&M University, Industrial and Systems Engineering, College Station, TX, 77843, United States, sila@tamu.edu, Xingchu Liu

We develop analytical models for designing optimal buyer-initiated supply contracts with supply quality and supplier development considerations while modeling private information and individual incentives explicitly. We use optimal control theory for computing the optimal contract parameters and provide a DP-based decision framework for managing supply quality information uncertainty.

■ SD48

Room 409

Game Theory Applications in Supply Chain Management

Sponsor: Manufacturing & Service Operations Management

Sponsored Session

Chair: Ravi Anupindi, Associate Professor of Operations Management, Ross School of Business, University of Michigan, 701 Tappan Avenue, Ann Arbor, MI, 48109, United States, anupindi@umich.edu

1 - Information Asymmetry and Advance Purchase Discounts in Supply Chains

Krishnan Anand, Assistant Professor, Operations and Information Management, The Wharton School, 3730 Walnut Street, Suite 500, Philadelphia, PA, 19104, United States, anandk@wharton.upenn.edu, Karan Girotra

Advance Purchase Discounts (APD) have been shown to be beneficial in acquiring early demand information from customers ((Tang et al (2004)) and in coordinating two-tier supply chains (Cachon (2001)). In this study, we investigate the administration and benefits of APDs in two-tier supply chains where the two tiers have asymmetric information. We study the effect of APD contracts on the profits of the individual agents in the supply chain, as well as on total supply chain profits and welfare.

2 - Inventory Assortment and Substitution Problems

Yehuda Bassok, Professor, University of Southern California, Marshall School of Business, Los Angeles, CA, 90089, United States, bassok@marshall.usc.edu, Feng Chen

We study a general substitution problem, in which consumers choose one of N variants. We start with a choice model that ranks the preference of each consumer. The preferences of the consumers are not known to the retailer and thus, he assumes that the demand for each variant is random. We derive the retailer's optimal stocking policy. We show that the role of safety stock is to hedge against the uncertainty in the market size but not the uncertainty in the demand for each of the variants.

3 - Referral Infomediaries Under Demand Uncertainty and Finite Stock

Li Jiang, Doctoral Student, Ross School of Business, University of Michigan, D0263 Davidson Hall, 1234, Ann Arbor, MI, 48109, United States, ljiang@umich.edu, Ravi Anupindi

We analyze the competitive dynamics of pricing and inventory strategies of two retailers who face demand from two customer segments - loyal and comparison shoppers. The two retailers reach the comparison shoppers by enrolling in a service with a "referral infomediary". We derive the equilibrium market structure - in terms of retailers' enrolment strategy with the infomediary - under various contracts.

4 - Coalition Stability in Assembly Models

Greys Sosic, Assistant Professor, University of Southern California, Marshall School of Business, Bridge Hall 401, Los Angeles, CA, 90089, United States, sosic@marshall.usc.edu, Mahesh Nagarajan

In this talk, we examine a decentralized assembly system where n component manufacturers sell to a single downstream assembler who faces deterministic price sensitive demand. We look at three types of competition — Supplier Stackelberg, Vertical Nash, and Assembler Stackelberg — and in each type allow the suppliers to freely form coalitions among themselves. Using dynamic concepts of stability, we predict the structure of the stable supplier coalitions.

■ SD49

Room 410

History of OR and Management Science

Cluster: History of OR and Management Science

Invited Session

Chair: Ernest Koenigsberg, Professor Emeritus, W. A. Haas School of Business, University of California at Berkeley, Berkeley, CA, 94720, United States, ekoenigsb@aol.com

1 - Pat Rivett (1923-2005); British OR Pioneer

Graham K. Rand, Senior Lecturer, Department of Management Science, Lancaster University Management School, Lancaster, LA1 4YX, United Kingdom, g.rand@lancaster.ac.uk

Pat Rivett was first secretary of the OR Society, built up the OR group at the National Coal Board, and founded the first Department of OR in the UK, at Lancaster. He played a leading role in the first International Conference in OR, leading to the creation of IFORS. Using his outstanding communication skills he persuaded private and public sector bodies to apply OR. The nature of OR in Britain, an emphasis on application and a society with a majority of practitioner members, is his legacy.

2 - The History of OR as a Study of Method

William Thomas, Graduate Student, Harvard University, 1 Oxford Street, History of Science Department, Cambridge, MA, 02138, United States, thomas@fas.harvard.edu

Some OR practitioners are fond of referring to the early wartime history of the discipline: OR as Blackett and Morse did it. Assuming the field has progressed, why are these roots still considered important? Drawing on early military studies and work done at MIT and Arthur D. Little, I emphasize the importance then attached to the freeform study of extant operational method as a hallmark of creative and vital work, rather than the application of some peculiar OR methodology.

3 - Constructing an American Technology Policy: The Adoption of Operations Research in the United States, 1942-1952

Erik P. Rau, Instructor of History, Department of History and Politics, Drexel University, MacAlister Hall 3025, Philadelphia, PA, 19104, erau@drexel.edu

This paper argues that the arrival in the United States in 1942 marks a broader attempt by civilian scientists, military officers, and other professionals to institute a coherent technology policy during World War II. Victory in war vindicated the general consensus on government-industry-university coordination (despite deep disagreements over its implementation), thereby paving the road for OR's postwar career as a tool in science and technology policy making.

4 - Elwood Buffa's Pioneering Contributions to the Evolution of Production and Operations Management

Martin Starr, Professor Emeritus, Crummer Graduate School of Business, Rollins College, 1000 Holt Avenue, Winter Park, FL, 32789, United States, mstarr@cfL.rr.com, Jaya Singhal, Kalyan Singhal

Elwood S. Buffa, a pioneer in production and operations management (P/OM), passed away in the summer of 2005, leaving a valuable legacy. During his academic career Buffa made lasting contributions to teaching and research of P/OM. His 1961 textbook, Modern Production Management provided structure and foundation for many P/OM courses in business schools.

■ SD50

Room 411

Wireless Systems

Sponsor: Telecommunications

Sponsored Session

Chair: Mahdi Nasereddin, Assistant Professor, Penn State University, Berks, Tulpehocken Road, PO Box 7009, Reading, PA, 19605, United States, mxn16@psu.edu

1 - A Neural Network-Based Approach for Predicting Connectivity in Wireless Networks

Mahdi Nasereddin, Assistant Professor, Penn State University, Berks, Tulpehocken Road, PO Box 7009, Reading, PA, 19605, United States, mxn16@psu.edu, Abdullah Konak, Michael Bartolacci

This research proposes a Connectivity Decision Support System based on connectivity maps generated by a neural network approach. The proposed approach creates a coverage map based on the signal strengths from active wireless users. These data are used to train a neural network to predict the signal strengths or coverage for locations for which no active user is reporting. In other words, a neural network fills in gaps in a coverage map for a given network connection point.

2 - Locating Access Points to Support Voice over Wireless Local Area

Frederick Kaefer, Associate Professor, Loyola University Chicago, 1 E. Pearson, Chicago, IL, 60611, United States, fkaefer@luc.edu

Using wireless local area networks to carry voice communications can save organizations money and support business applications. The problem of where to locate access points in a wireless local area network to support voice communications is studied. A model is developed to determine the number of access points and their locations given the number of data and voice users within a specified area.

3 - Using Kriging to Estimate Network Performance in Wireless Local Area Networks

Abdullah Konak, Assistant Professor, Penn State - Berks, Tulpehocken Road, Reading, PA, 19610, United States, konak@psu.edu

This research proposes an approach based on Kriging, which is a regression technique used in geostatistics to interpolate data, to estimate the performance indicators of wireless local area networks such as signal strength, interference, and data rate. The approach aims to remedy some drawbacks of the existing site survey software.

4 - Designing Resilient Telecommunication Networks

Michael Bartolacci, Associate Professor of IST, Penn State University - Berks, PO Box 7009, Reading, PA, 19610, United States, mrb24@psu.edu, Abdullah Konak

The authors propose an approach for designing resilient telecommunication networks based on genetic algorithms. A methodology for estimating traffic efficiency is also proposed.

■ SD51

Room 412

Implementation Issues in Data Mining/Machine Learning

Contributed Session

Chair: Onur Seref, PhD Candidate, University of Florida, 303 Weil Hall, Gainesville, FL, 32611, United States, seref@ufl.edu

1 - A Comparative Study of the K-Means Algorithm and the Normal Mixture Model for Clustering

Dingxi Qiu, PhD Candidate, Northwestern University, 2145 Sheridan Road, Room C-217, Evanston, IL, 60208, United States, d-qiu@northwestern.edu, Bruce Ankenman, Ajit Tamhane

The K-means algorithm and the normal mixture model estimated using the EM algorithm are two popular methods for clustering, but their performances have not been compared analytically. We first provide asymptotic analytical characterizations of the classification rules used by the two methods for the univariate and the bivariate cases. Next we use these characterizations to compare their expected misclassification rates. Simulation results are provided to verify the analytical results.

2 - A k-Means Clustering Procedure for Binary Classification

Stephen France, PhD Candidate, RUTGERS Business School, PhD In Management Program, 180 University Avenue, Newark, NJ, 07102-1803, United States, sfran@pegasus.rutgers.edu, J. Douglas Carroll

We develop a procedure based upon k-means clustering to carry out binary prediction on large datasets. We account for different missing data patterns by using the EM algorithm and multiple imputation. We use multidimensional scaling (MDS) with the Hamming distance metric to transform nominal and ordinal data.

3 - Multivariate Regression Models with PE Random Errors and Subset Selection Using GA and ICOMP

Minhui Liu, PhD Candidate, Department of Statistics & Management Science, University of Tennessee, 329 Stokely Management Center, Knoxville, TN, 37996, United States, mliu@utk.edu, Hamparsum Bozdogan

We develop two novel multivariate regression models with Power Exponential (PE) random errors. Our first model assumes that the observations are independent and the second model assumes that the observations are dependent. We develop method of moments and the maximum likelihood methods to estimate the model parameters. The model selection criteria such as AIC and ICOMP for both models are derived. A genetic algorithm approach is used to obtain the estimates of the model parameters.

4 - A Bayesian Methodology for Semi-Automated Task Analysis
Shu-chiang Lin, Instructor, Purdue University, School of Industrial Engineering, Grisso, 315 N Grant Street, West Lafayette, IN, 47907-2023, United States, sclin@alum.mit.edu, Mark Lehto

This 4 year study presents an effort-intensive field-based approach for the call center's naturalistic decision making's environment. A new idea by combining the Bayesian approach with task analysis methodology was proposed. Verbal information conversation narratives containing 165,000 words pertaining 55 printer models and 70 software and hardware issues were classified. The preliminary results suggested that a fuzzy Bayesian based tool would be able to learn and predict subtask categories.

5 - Selective Support Vector Machines
Onur Seref, PhD Candidate, University of Florida, 303 Weil Hall, Gainesville, FL, 32611, United States, seref@ufl.edu, Oleg Prokopyev, Panos Pardalos, O. Erhun Kundakcioglu

In this study, we introduce a classification problem in which sets x(i) of k data points, x(i) = {x(i,1), ..., x(i, k)}, are given for each class. We introduce various extensions to the core quadratic programming problem of support vector machine classifiers, such that an optimal subset of t / k points is selected from each set x(i). We show our results on neural datasets in which we use our formulation to align individual single-trial time series with each other.

■ SD52

Room 413

Competition and Pricing

Sponsor: Revenue Management & Pricing
Sponsored Session

Chair: Serhan Duran, Graduate Research Assistant, School of Industrial & Systems Engineering, Georgia Institute of Technology, Atlanta, GA, 30332, United States, gtg865i@mail.gatech.edu

Chair: Julie Swann, Assistant Professor, Georgia Institute of Technology, Industrial and Systems Engineering, Atlanta, GA, 30332, United States, julie.swann@isye.gatech.edu

1 - Optimal Supplier Contracts under Asymmetric Inventory Information
Hao Zhang, Assistant Professor, University of Southern California, 3670 Trousdale Parkway, Bridge Hall 401G, Los Angeles, CA, 90089, United States, zhanghao@marshall.usc.edu, Mahesh Nagarajan, Greys Sosic

We study a model in which a single supplier sells to a single retailer who faces stochastic demand and follows periodic review. We assume that the initial inventory and subsequent demand realizations are known to the retailer but unobservable by the supplier. Adopting the principal agent paradigm, we model the supplier's problem as a constrained optmization problem and characterize its optimal contract. Further, we compare the performances of the optimal contracts with some simpler contracts.

2 - The Effect of Competition on the Perfomances of Customer Rebates and Retailer Incentives
Ozgun Caliskan Demirag, Georgia Institute of Technology, Ferst Drive NW, Groseclose Room 347, Atlanta, GA, 30332, United States, gtg501c@mail.gatech.edu, Julie Swann, Pinar Keskinocak

In some industries, such as automotive, production costs are largely fixed and manufacturers offer promotions to increase sales and revenues. We analyze the effect of competition on the promotional and ordering decisions in a two-stage supply chain using game theory to model the interactions between competing retailers and manufacturers. We focus on "retailer incentive" and "customer rebate" promotions and find the equilibrium decisions under different demand models and market conditions.

3 - Dual Sales Channel Management with Availability-Based
Kay-Yut Chen, Principal Scientist, Hewlett-Packard Laboratories, MS 1U-2, 1501 Page Mill Road, Palo Alto, CA, 94304, United States, kay-yut.chen@hp.com, Murat Kaya, Ozalp Ozer

We present a game-theoretic model of manufacturer-retailer strategic behavior in which the manufacturer employs both a direct online channel and a retail channel. While making the purchase decision, consumers consider the waiting time in the direct channel, product availability in the retail channel. We identify three dual channel strategies for the manufacturer depending on product and market characteristics. We support our results with economics experiments with human subjects.

4 - Pricing in a Duopoly with a Lead Time Advantage
Victor Martinez de Albeniz, Assistant Professor, IESE Business School, Av. Pearson 21, Barcelona, 08034, Spain, valbeniz@iese.edu

We analyze the price competition between two suppliers offering two different lead-times to a buyer. The buyer replenishes inventory in an infinite horizon context, using a base-stock policy with each one of the suppliers. Based on the buyer's behavior, the suppliers set static prices that maximize their long-term average profit. We study the equilibrium of the pricing game.

■ SD53

Room 414

Topics in Revenue Management and Pricing

Sponsor: Revenue Management & Pricing
Sponsored Session

Chair: Christopher Anderson, Richard Ivey School of Business, University of Western Ontario, London, ON, Canada, canderson@ivey.uwo.ca

1 - A Differential Duopoly Game with Path Dependent Demand
Leo MacDonald, Richard Ivey School of Business, University of Western Ontario, London, ON, Canada, lmacdonald@ivey.uwo.ca, Christopher Anderson, Henning Rasmussen

We develop a path dependent demand model of a competitive duopoly, with the problem formulated as a differential game. One area of research where path dependent demand is relevant is strategic consumer behaviour, a subject gaining prominence in the RM literature, particularly where e-commerce is a component. We set-up and discuss the solutions for the game as well as conditions for existence, and describe policy (pricing/inventory) implications and managerial insights.

2 - Price Variation and Release Strategies of Online Auctions
Fredrik Odegaard, Sauder School of Business, University of British Columbia, 2053 Main Mall, Vancouver, BC, V6T1Z2, Canada, fredrik.odegaard@sauder.ubc.ca, Martin L. Puterman

We consider a seller who, using online auctions, wishes to sell a finite number items. The decision maker must decide when to start each auction. This decision involves a trade off between excess holding cost and price cannabilzation through simultaneous auctions. We formulate the problem as a MDP and derive some structural properties of the optimal release policy. We also include an empirical validation of model assumptions using data from several thousand online consumer electronics auctions.

3 - Dynamic Pricing for Nonperishable Products: A Game Theoretic Approach
Soheil Sidbari, Assistant Professor, Charlton College of Business, University of Massachusetts, 285 Old Westport Road, North Dartmouth, MA, 02747, United States, ssibdari@umassd.edu, David Pyke

In this study, we contribute to the dynamic pricing literature by developing a finite-horizon model for two firms offering substitutable and nonperishable products with different quality levels. Unlike the traditional studies in dynamic pricing, we assume that the products are nonperishable and can be stored by customers to be used in future. The stockpile of the products generated by customers affects the demand in future periods.

4 - Revenue Management with Last Minute Getaways
Srinivas Krishnamoorthy, Assistant Professor, Ivey School of Business, The University of Western Ontario, 1151 Richmond Street North, London, ON, N6A 3K7, Canada, skrishnamoorthy@ivey.ca

In recent years the travel industry has seen the development of a whole new market: the last minute leisure travelers. We show that the opportunity to sell "distressed" inventory through online channels to such last minute impulse travelers allows providers to increase revenues and load factor. While there is a chance of some revenue leakage because of travelers postponing purchases in anticipation of last minute sales, providers can overall benefit by this selling strategy.

■ SD54

Room 415

Interfaces Between Marketing, Operations and Technology II

Cluster: Operations and Marketing for Emerging Markets
Invited Session

Chair: Jiong Sun, Doctoral Student, Tepper School of Business, Carnegie Mellon University, 5000 Forbes Avenue, Pittsburgh, PA, 15213, United States, jiong@cmu.edu

Co-Chair: Sunder Kekre, Professor of Operations Management and Manufacturing, Tepper School of Business, Carnegie Mellon University, 5000 Forbes Avenue, Pittsburgh, PA, 15213, United States, skekre@cmu.edu

1 - The Impact of Manufacturing Offshore on Technology Trajectories
Erica Fuchs, Post-Doctoral Fellow, Massachusetts Institute of Technology, Building E38-104, 77 Massachusetts Avenue, Cambridge, MA, 02139, United States, erhf@mit.edu

This paper presents a two-case study of the impact of manufacturing offshore on the technology trajectory of the firm and the industry. It looks in particular at the automotive and optoelectronics industries. In both cases, manufacturing offshore changes which design is most economic. However, only in the optoelectronics case do the results support that manufacturing offshore is changing the path of technology development. The paper proposes a general framework to explain this difference.

2 - Design of Extended Warranties in Supply Chains
Suman Mallik, Assistant Professor, University of Illinois at Urbana-Champaign, 1206 South Sixth Street, 350 Wohlers Hall, Champaign, IL, 61820, United States, mallik@uiuc.edu, Dilip Chhajed, Kunpeng Li

Consider a supply chain involving a manufacturer and a retailer. The manufacturer produces a single product and sells it through the retailer. The extended warranty could, however, be offered by either party. We use game theoretic models to answer the following questions. What are the characteristics of optimal extended warranty policy decisions? Which scenario leads to a higher total supply chain profit, a retailer offering the extended warranty or the manufacturer?

3 - Balancing Marketability and Manufacturability in Product Line Design Optimization
Jeremy Michalek, Assistant Professor, Carnegie Mellon University, Scaife Hall 323, 5000 Forbes Avenue, Pittsburgh, PA, 15213, United States, jmichalek@cmu.edu

Product development involves communication and compromise among interacting and often competing objectives from marketing, design, and manufacturing perspectives; particularly when developing product lines for heterogeneous markets. This study demonstrates a methodology for explicitly quantifying tradeoffs between market performance and manufacturing cost for a line of consumer durables to achieve realizable product line solutions with optimal profitability.

■ SD55

Room 416

Computer Science - Applications to OR

Contributed Session

Chair: Eli Faulkner, Software Scientist/Mathematician, Quantum Leap Innovations, 3 Innovation Way, Suite 100, Newark, DE, 19711, United States, etf@quantumleap.us

1 - The Non-Stationary Data-Driven Newsvendor Problem
Gokhan Metan, PhD Student, Lehigh University, 200 W. Packer Avenue, Mohler Lab, Bethlehem, PA, 18015, United States, gom204@lehigh.edu, Aurelie Thiele

We investigate the impact of the sample size in the non-stationary newsvendor problem when the underlying demand distribution is not known, and the performance is measured by the decision-maker's average regret. We propose an iterative algorithm to determine the number of past observations that should be included in the decision-making process, provide insights into the optimal sample size and perform extensive computational experiments.

2 - Real-Time Business Process Management System
Dong-Ho Kim, u-Logistics Research Team, ETRI, 161 Gajeong-Dong, Yuseong-Gu, Daejeon, 305700, South Korea, kdh@etri.re.kr, Sung Whan Choi, Sung Wook Kim

RBPMS receives a continuous stream of filtered data from RFID Middleware and produces events that trigger business processes based on a set of conditions. Our system provides a simple, yet powerful management support for a creation and monitoring of rule objects, hence enables business experts to flexibly adapt to rapidly changing business environment and automates business process as well as data flow when adapted to RFID-based system.

3 - A RFID-Based Postal Unit Load Device Management System
Dong-Ho Kim, u-Logistics Research Team, ETRI, 161 Gajeong-Dong, Yuseong-Gu, Daejeon, 305700, South Korea, kdh@etri.re.kr, Hong-Suk Hu, Sung-Woo Jun

The Korean postal e-logistics information system(PostNet) processes very large volume of information under the bar-coding mechanism environment. The research activities are still required in order to enhance the degree of postal automation using the ubiquitous information technologies. In this paper, we propose a new postal information system architecture based on RFID technology in postal unit load device so that enhance business efficiency and overall performance.

4 - Internet Routing Under Active Congestion Control
Stanko Dimitrov, PhD Student, University of Michigan, Industrial and Operations Engineering, 1205 Beal Avenue, Ann Arbor, MI, 48109, United States, sdimitro@umich.edu, Dushyant Sharma, Marina Epelman

We present a mathematical model of Internet routing that incorporates congestion control techniques such as random early drop (RED). We show that the model is NP-hard and present numerical results for a continuous non-convex and a linear-integer formulation.

5 - The Adaptive Optimization Engine
Eli Faulkner, Software Scientist/Mathematician, Quantum Leap Innovations, 3 Innovation Way, Suite 100, Newark, DE, 19711, United States, etf@quantumleap.us, Julia Cowart

The Adaptive Optimization Engine (AOE) solves nonlinear optimization and constraint satisfaction problems by interleaving 30 different algorithms ranging from heuristic search to generic algorithms to linear programming. Black box modeling and collaborative problem solving approaches allow modelers to represent their problem without worrying about the underlying solving technique. We present the AOE architecture and provide real world examples demonstrating its power and ease of use.

Monday, 8:00am - 9:30am

■ MA01

Room 301

Optimization in Wireless Networks

Sponsor: Optimization/ Network and Combinatorial Optimization
Sponsored Session

Chair: Mohammad Taghi Hajiaghayi, Post-Doctoral Fellow, Carnegie Mellon University, Department of Computer Science, 5000 Forbes Avenue, Pittsburgh, PA, 15213, United States, hajiagha@mit.edu

1 - Improving Spatial Reuse Through Tuning Transmit Power and Data Rate in Multihop Wireless Networks
Jennifer Hou, Professor, University of Illinois Urbana-Champaign, 201 N. Goodwin Avenue, Urbana, IL, 61801, United States, jhou@cs.uiuc.edu, Tae-Seok Kim

In wireless networks, one can increase spatial reuse by reducing transmit power or increasing carrier sense threshold. However, by doing so, the SINR decreases (and the data rate sustained) as a result of smaller received signal or increased interference level. In this study, we quantify the trade-off between the increase in spatial reuse and the decrease in the data rate sustained and study the relation between transmit power and carrier sense threshold.

2 - Modeling the Impact of Wireless Interference
Lili Qiu, Assistant Professor, University of Texasa at Austin, 1 University Station C0500, Austin, TX, 78712, United States, lili@cs.utexas.edu

A fundamental problem in wireless network research is how to model the impact of wireless interference on network performance. In this talk, I present methods for computing such performance bounds by modeling wireless interference using a conflict graph. The results have significant implications on designing and optimizing wireless networks.

3 - Wired Versus Wireless Connectivity Problems
Guy Kortsarz, Associate Professor, Rutgers - Camden, Camden, NJ, 08102, United States, guyk@camden.rutgers.edu

We survey some connectivity problems in wireless systems and compared them to their counterpart in wired systems. Two problems that are of particular interest. The first is: the b-cover problem. Given a graph G and a demand b(v) for every vertex, find a min-power (min-cost) subgraph G' such that degree_G'(v)\geq b(v) for every v. The second problem is that of finding a minimum power (cost) k-connected subgraph G' of G.

4 - OURS: Optimal Unicast Routing Systems in Non-Cooperative Wireless Networks
Xiang-Yang Li, Associate Professor, Illinois Insitute of Technology, 10 West 31st Street, Chicago, IL, 60616, United States, xli@cs.iit.edu, Yu Wang, WeiZhao Wang

We propose novel solutions for the problem of routing in a wireless network that consists of selfish terminals. We design a mechanism that results in Nash equilibria rather than the traditional strategyproofness. In addition, we systematically study the \emph{unicast routing system} in which both the relay 4terminals and the service requestor could be selfish.

■ MA02

Room 302

Joint Session Open-Source/ICS: Mixed-Integer Nonlinear Programming with COIN-OR

Cluster: Open-Source Software: Open Source, Open Standards, Open Data, INFORMS Computing Society
Invited Session

Chair: Francois Margot, Professor, Tepper School of Business, Carnegie Mellon University, 5000 Forbes Avenue, Pittsburgh, PA, 15213-3890, United States, fmargot@andrew.cmu.edu

1 - A New Open-Source Solver for MINLP
Pierre Bonami, Post-Doctorate, IBM TJ Watson Research Center, 1101 Kitchawan Road, Yorktown Heights, NY, 10598, United States, pbonami@us.ibm.com

We present our work related to developing an open-source solver for Mixed Integer NonLinear Programming. This solver has been developed in a joint effort by researchers both at IBM and Carnegie Mellon University. It implements three algorithms for solving convex MINLPs: a branch-and-bound, an Outer-Approximation decomposition and an hybrid method. We present computational result comparing this algorithm to classical algorithms (as implemented both in commercial solvers and in our code).

2 - IPOPT, An Interior-Point Solver for Exploiting Structure in Large-Scale Nonlinear Programs
Carl Laird, Graduate Student, Carnegie Mellon University, Department of Chemical Engineering, 5000 Forbes Avenue, Pittsburgh, PA, 15213-3890, United States, claird@andrew.cmu.edu, Lorenz Biegler

We present the next-generation IPOPT, a large-scale interior-point solver for nonlinear programming problems available through the COIN-OR foundation (projects.coin-or.org/Ipopt). The algorithm performs all fundamental operations through a well-defined linear algebra interface. This allows development of specialized linear algebra for the efficient solution of structured problems without changes to the algorithm code. The approach will be demonstrated on a multi-scenario optimization problem.

3 - A Novel Library of Nonlinear Mixed-Integer and Disjunctive Programming Problems
Nicolas Sawaya, Carnegie Mellon University, Department of Chemical Engineering, 5000 Forbes Avenue, Pittsburgh, PA, 15213-3890, United States, nws@andrew.cmu.edu

We present a new collection of mixed-integer and disjunctive nonlinear programming problems that arise in the fields of Operations Research, Chemical Engineering and Finance. These problems, which total over 250 and are organized into 15 classes of applications, span areas such as facility layout, synthesis of process networks, chemical batch process design, water networks and portfolio optimization. These problems are available at the following webpage: http://egon.cheme.cmu.edu/ibm/page.htm

■ MA03

Room 303

Robust Optimization Theory and Applications

Sponsor: Optimization/ Linear Programming and Complementarity
Sponsored Session

Chair: Zhaosong Lu, Assistant Professor, Simon Fraser University, Department of Mathematics, Burnaby, BC, V5A 1S6, Canada, zhaosong@sfu.ca

1 - Is Robust Optimization Too Conservative?
Reha Tutuncu, Vice President, Goldman Sachs Asset Management, 32 Old Slip, 23rd Floor, New York, NY, 10007, United States, reha.tutuncu@gs.com

A common objective in robust optimization is to optimize decisions under worst possible realizations of uncertain input parameters. These formulations typically lead to overly conservative choices. This conservatism is the result of allowing unlikely scenarios in the uncertainty sets. For the case where the uncertain parameters are estimates, we explore the use of restricted sets that respect their statistical properties. We illustrate the approach using portfolio selection examples.

2 - A New Conic Programming Approach for Robust Portfolio Selection Problems
Zhaosong Lu, Assistant Professor, Simon Fraser University, Department of Mathematics, Burnaby, BC, V5A 1S6, Canada, zhaosong@sfu.ca

We introduce the ``joint" uncertainty structures for portfolio selection problem parameters, which correspond to confidence regions of market parameters constructed by the statistical procedures. Based on the joint uncertainty structures, we provide a new conic programming approach to formulate and solve robust portfolio selection problems without destroying the confidence level of the joint uncertainty strutures. The resulting portfolio is more diversified than the other approaches.

3 - Safe Tractable Approximation of Chance Constrained Randomly Perturbed LMIs
Arkadi Nemirovski, Professor, Georgia Institute of Technology, 765 Ferst Drive, NW, Atlanta, GA, 30332-0205, United States, nemirovs@isye.gatech.edu

We present an approximation scheme which allows to build tight, in certain precise sense, computationally tractable sufficient conditions for the validity of chance constrained randomly perturbed Linear Matrix Inequalities.

4 - Goal Driven Optimization
Melvyn Sim, Assistant Professor, National University of Singapore, 1 Business Link, Singapore, Singapore, dscsimm@nus.edu.sg, Wenqing Chen

We develop a goal driven stochastic optimization model that takes into account an aspiration level or target. Our model maximizes the shortfall aspiration level criterion, which encompasses the probability of success in achieving the goal and an expected level of under-performance or shortfall. The key advantage of the proposed model is its tractability. We propose a decision rule based deterministic approximation in the form of second order cone optimization problems.

■ MA04

Room 304

Lifting in Mixed Integer Programming

Sponsor: Optimization/ Integer Programming

Sponsored Session

Chair: Jean-Philippe Richard, Assistant Professor, Purdue University, 315 North Grant Street, West Lafayette, IN, 47907, United States, jprichar@ecn.purdue.edu

1 - Valid Inequalities for MIPs and Group Polyhedra from Approximate Liftings

Lisa Miller, Assistant Professor, University of Minnesota, 111 Church Street SE, 1100 Mechanical Engineering, Minneapolis, MN, 55113, United States, lmiller@me.umn.edu, Jean-Philippe Richard, Yanjun Li

We present an approximate lifting scheme to derive valid inequalities for general mixed integer programs and for the group problem. This scheme uses superadditive functions as the building block of integer and continuous lifting procedures. It yields an alternate simple derivation of new as well as known families of cuts that correspond to faces, and sometimes facets, of the group polyhedron.

2 - Cook, Kannan and Schrijver's Example Revisited

Yanjun Li, Assistant Professor, Purdue University, 403 W. State Street, West Lafayette, IN, 47907, United States, li14@purdue.edu, Jean-Philippe Richard

Cook, Kannan and Schrijver (1990) studied the split closure of polyhedron. They showed on a 3-dimensional example that the 1-term disjunctive rank of mixed-integer polytopes can be infinite. We generalize this example to a family of high-dimensional polytopes and present a close-form description of the split closures of all ranks for these polytopes. We conjecture that the k-term disjunctive rank of the (m+1)-dimensional polytope in this family is infinite for any k bbb m, where m ccc 1.

3 - MIP Lifting Techniques for Nonlinear Programs

Mohit Tawarmalani, Assistant Professor, Purdue University, School of Management, West Lafayette, IN, 47907, United States, mtawarma@purdue.edu, Jean-Philippe Richard

Lifting locally valid inequalities to make them globally valid is a successful methodology for obtaining cuts in MILPs. We extend this approach to generate cuts for nonlinear programming problems. We illustrate the approach in two different ways. First, we obtain cuts for mixed integer bilinear sets without adding variables. Partial sequence independence allows generation of exponentially many facet defining inequalities. Second, we obtain nonlinear convex hull of various disjunctive sets.

4 - Lifted Cover Inequalities for Bounded Nonlinear Purely Integer Programming

Ismael de Farias, Assistant Professor, SUNY Buffalo, 403 Bell Hall, Buffalo, NY, 14260, United States, defarias@buffalo.edu

Any bounded nonlinear purely (as opposed to mixed) integer programming problem (BNPIP) can, in theory, be formulated as a linear integer programming problem (LIP). We present a valid inequality generation procedure that can be used to obtain an initial approximate LIP for BNPIP and to improve the formulation automatically within a branch-and-cut algorithm. The procedure is based on lifting cover inequalities derived from the (possibly nonlinear) knapsack constraints of BNPIP.

■ MA05

Room 305

Sampling Methods in Stochastic Programming

Sponsor: Optimization/ Stochastic Programming

Sponsored Session

Chair: David Morton, Associate Professor, The University of Texas at Austin, Graduate Program in Operations Research, 1 University Station, C2200, Austin, TX, 78712-0292, United States, morton@mail.utexas.edu

1 - Sequential Sampling Procedures for Stochastic Integer Programs

Guzin Bayraksan, Assistant Professor, Department of Systems and Industrial Engineering, The University of Arizona, Tucson, AZ, 85721, United States, guzinb@sie.arizona.edu

We present sampling-based procedures for stochastic integer programs with integer first stage. Input to our procedures is a sequence of solutions with at least one optimal limit point. We use increasing sample sizes to assess the quality of the solutions and provide stopping rules. Our first method increases the sample size one by one. An accelerated method increases it in jumps using the current information. We discuss asymptotic properties and present preliminary computational results.

2 - Efficient Sample Sizes in Stochastic Nonlinear Programming

Johannes Royset, Professor, Naval Postgraduate School, Operations Research Department, Monterey, CA, 93943, United States, joroyset@nps.edu, Elijah Polak

A solution approach to stochastic nonlinear programs is to solve a sequence of sample average approximations (SAA). Computational issues in this approach are determination of the sample size used in each SAA and the number of iterations to be carried out on each SAA. We show that efficient sample sizes and number of iterations can be determined by solving an auxiliary minimization problem whose objective function is the computing work required to obtain a specified cost-error reduction.

3 - Assessing Solution Quality in Stochastic Programming

Amit Partani, Graduate Research Assistant, University of Texas, Graduate Program in Operations Research, 1 University Station C2200, Austin, TX, 78712, United States, partani@mail.utexas.edu, David Morton

We discuss an adaptive jackknife estimator to reduce bias. It does not require a priori knowledge regarding the order of bias. We discuss convergence properties and apply it in the context of Monte Carlo-based simulation procedures in stochastic programming. We provide a bias reduction strategy for the optimality gap estimator of a candidate decision based on the adaptive estimator. Computational results are presented to evaluate the performance of the adaptive estimator.

■ MA06

Room 306

Breaking Symmetries

Sponsor: INFORMS Computing Society/Constraint Programming

Sponsored Session

Chair: Meinolf Sellmann, Assistant Professor, Brown University, 115 Waterman Street, PO Box 1910, Providence, RI, 02912, United States, sello@cs.brown.edu

1 - Recent Advances in Lexicographic Constraints

Jean-Francois Puget, Vice President, ILOG, 7 boulevard des Moulins, Carry-le-Rouet, 13620, France, puget@ilog.fr

Adding lexicographic constraints is a way to remove all variable symmetries of a problem. However this method has many drawbacks: One needs to state one constraint per symmetry, yielding an exponential number of constraints in the worst case; The method does not handle value symmetries; The order used in the lexicographic constraints may clash with the order used during a tree search. We show how to effectively address these shortcomings using improved lexicographic constraints.

2 - Static and Dynamic Structural Symmetry Breaking

Justin Pearson, Senior Lecturer, Uppsala University, Department of Information Technology, Box 337, SE-751 05, Uppsala, Sweden, justin.pearson@it.uu.se, Pascal Van Hentenryck, Meinolf Sellmann, Pierre Flener

We reconsider the idea of structural symmetry breaking. We show that dynamic dominance checks have a static counterpart: there exists a set of constraints that can be posted at the root node and that break all pairwise variable and value symmetries. Moreover, static and dynamic symmetry breaking coincide for static variable and value orderings. This is the first time that static symmetry breaking has been shown capable of breaking variable and value symmetries at the same time.

3 - Structural Symmetry Breaking Restarted

Meinolf Sellmann, Assistant Professor, Brown University, Waterman Street, PO Box 1910, Providence, RI, 02912, United States, sello@cs.brown.edu, Daniel Heller

We wish to assess how symmetry breaking and restarts interact with one another. We find that the improvements to be gained by restarting are far smaller for full symmetry breaking methods than those that can be obtained for methods that break only some symmetries or none at all. Surprisingly, the combination of restarts and breaking value symmetry only is often competitive with complete symmetry breaking.

■ MA07

Room 307

High Throughput Optimization

Sponsor: INFORMS Computing Society

Sponsored Session

Chair: John Chinneck, Professor, Carleton University, Systems & Computer Engineering, Ottawa, ON, K1S 5B6, Canada, chinneck@sce.carleton.ca

1 - Parallel and Distributed Optimization in Comet

Pascal Van Hentenryck, Professor of Computer Science, Brown University, Box 1910, 115 Waterman Street, 4th Floor, Providence, RI, 02912, United States, pvh@cs.brown.edu, Laurent Michel

Distributed computing is increasingly important at a time when Moore's law cannot be sustained much longer. Unfortunately, it also places significant conceptual and implementation burden on programmers. This talk aims at addressing this challenge and presents abstractions that allows distributed optimization programs to be close to their sequential and parallel counterparts. A preliminary implementation Comet exhibits significant speed-ups.

2 - The GAMS Grid Computing Facility

Alexander Meeraus, GAMS Development Corporation, 1217 Potomac Street, NW, Washington, DC, 20007, United States, AMeeraus@gams.com

As multiple CPUs and High Performance Computing Grids are becoming available more widely, the GAMS language has been extended to take advantage of these new environments. New language features facilitates the management of asynchronous submission and collection of model solution tasks in a platform independent fashion. A simple architecture, relying on existing operating systems functionality allows for rapid introduction of new environments and provides for an open research architecture.

3 - Decomposition and High Throughput Solution of Equilibrium Problems

Michael Ferris, Professor, University of Wisconsin-Madison, 1210 W. Dayton Street, Madison, WI, 53706, United States, ferris@cs.wisc.edu, Thomas Rutherford

Decomposition approaches enable solution of otherwise intractable mathematical programming problems. We describe a decomposition approach for large scale complementarity problems arising from applied general equilibrium problems in economic analysis. We report on their solution using a variety of distributed algorithms in combination with the grid extensions of GAMS, the (high throughput) distributed computational resources of Condor and the PATH solver.

4 - Opportunities for Parallelism in Optimization Algorithms

David M. Gay, Principal Member of Technical Staff, Sandia National Laboratories, Mail Stop 0370, PO Box 5800, Albuquerque, NM, 87185-0370, United States, dmgay@sandia.gov

Algorithms for large-scale optimization problems can exploit parallelism in various ways. Expensive function evaluations can sometimes be done in parallel, as can linear algebra. Branch-and-bound (and cut) algorithms may seek incumbents independently of branching and could terminate some branches when a parallel branch finds a sufficiently improved incumbent. What is worthwhile depends on the parallel constructs available and their relative costs. Many constructs have been proposed.

■ MA08

Room 308

Joint Panel Discussion TMS/NPD: Early Career Strategies in Interdisciplinary Areas - Perspectives from TMS and NPD

Sponsor: Technology Management, New Product Development

Sponsored Session

Chair: Christian Terwiesch, Associate Professor, University of Pennsylvania, 548 JMHH, Philadelphia, PA, 19104, United States, terwiesch@wharton.upenn.edu

Co-Chair: Francisco Veloso, Assistant Professor, Carnegie Mellon University, Engineering & Public Policy, Pittsburgh, PA, 15213, United States, fveloso@cmu.edu

1 - Panel Discussion: TMS/NPD: Early Career Strategies in Interdisciplinary Areas - Perspectives from TMS and NPD

Moderator: Christian Terwiesch, Associate Professor, University of Pennsylvania, 548 JMHH, Philadelphia, PA, 19104, United States, terwiesch@wharton.upenn.edu, Panelists: Christoph Loch, Ashish Arora, Francisco Veloso

This Panel brings together several scholars to discuss strategies and approaches towards building a successful carreer working in the interdisciplinary areas that span the members of the TMS and NPD commununities. Issues to be discussed include managing the tension between interdisciplinary interests and disciplinary journals, building recognition and focus across disciplines and developing succesful tenure records.

■ MA09

Room 309

Emerging Issues in Innovation

Cluster: New Product Development

Invited Session

Chair: Vish Krishnan, Professor, University of California - San Diego, Rady School of Management, 9500 Gilman Drive MC 0093, La Jolla, CA, 92093, United States, vkrishnan@ucsd.edu

1 - Social Preferences and Fair Process

Christoph Loch, Professor of Technology Management, INSEAD, Boulevard de Constance, Fontainebleau, France, christoph.loch@insead.edu, Yaozhong Wu

An emerging theme in operations is that people care not only about their payoffs in decisions, but also about the social interactions involved. For example, much empirical evidence suggests that "fair process", or transparency and employee engagement, enhances organizational performance. We build a model that links fair process to social preferences, explains why fair process may enhance performance, and predicts when it should not be used (which is absent from the empirical work so far).

2 - Appropriateness of Sequential and Simultaneous Innovation

Karthik Ramachandran, The University of Texas at Austin, 4580 Huggins Street, San Diego, CA, United States, karthikr@Mail.utexas.edu

While simultaneous creation of multiple variants allows leveraging complementarities in the product platform, sequential pursuit of improving variants enables focused execution of product development projects. We study the sequential vs simultaneous innovation problem faced by firms in developing products for multiple market segments. We show that the optimal simultaneity in development depends on resources available, technological characteristics, and most importantly, the maturity of the firm.

3 - Managing Co-Development Processes

Stylianos Kavadias, Assistant Professor, Georgia Institute of Technology, 800 West Peachtree Street, Atlanta, GA, 30308, United States, Stylianos.Kavadias@mgt.gatech.edu, Sanjiv Erat

Recently, Delta Airlines collaborated with 3M to develop a flame-resistant paper that could potentially be licensed to airline carriers. The study considers settings where two companies collaborate to develop a new product/technology. Our results suggest that NPD variables such as performance and cost uncertainty have important implications to when the revenue sharing contracts should be signed (i.e., before, during, or after the project).

■ MA10

Room 310

Software Demonstration

Cluster: Software Demonstration

Invited Session

1 - statistics.com - Teaching Data Mining Using Excel with XLMiner

Peter Bruce, statistics.com, 612 N. Jackson St., Arlington, VA, 22201, pbruce@statistics.com

With XLMiner, you can take advantage of Excel's familiar environment and short learning curve to teach data mining. For classification and precision XLMiner offers neural nets, k-nearest-neighbor, logistic and linear regression, Naive Bayes, decision trees and discriminant analysis. Plus association rules, clustering, and utilities for sampling and partitioning data.

2 - Palisade Corporation - From Software to Solutions in Statistics and Risk Analysis

Shawn Harahush, Palisade Corporation, 798 Cascadilla Street, Ithaca, NY, 14850, sharahush@palisade.com

Palisade, famous for its Monte Carlo simulation software, @RISK, offers a suite of powerful and sophisticated analytical data software tools that are useful both independently and in conjunction with one another. These tools fall into 4 main categories: Risk and decision analysis, data analysis, optimization, and developer kits.

■ MA11

Room 311

Joint Session Minority/ Optimization: Discrete Optimization I

Sponsor: Minority Issues, Optimization/Interger Programming, Optimization/Network and Combinatorial Optimization

Sponsored Session

Chair: Illya Hicks, Associate Professor, Texas A&M University, Industrial and Systems Engineering MS 3131, Zachry Engineering Center, College Station, TX, 77843-3131, United States, ivhicks@tamu.edu

1 - Travel-Time Minimization in Transportation Networks by Near-Optimal Tollbooth Placement

Mauricio Resende, AT&T Labs Research, 180 Park Avenue, Room C241, Florham Park, NJ, 07932, United States, mgcr@research.att.com, Luciana Buriol, Michael Hirsch, Tania Querido, Panos Pardalos

We present a memetic algorithm to place K tollbooths and set corresponding tolls on a capacitated transportation network such that when travelers take a least-cost route, their expected travel time is minimized. We illustrate the algorithm on five real networks: Sioux Falls, Anaheim, Stockholm, Barcelona, and Winnipeg.

2 - The Branchwidth of Graphs and their Cycle Matroids

Illya Hicks, Associate Professor, Texas A&M University, Industrial and Systems Engineering MS 3131, Zachry Engineering Center, College Station, TX, 77843-3131, United States, ivhicks@tamu.edu, Nolan McMurray

In this talk, we prove a conjecture stating that the branchwidth of a graph and the branchwidth of the graph's cycle matroid are equivalent if the graph has a cycle of length at least two.

3 - A Constructive Approach for Multidimensional Superadditive Lifting

Bo Zeng, PhD Candidate, Purdue University, 223 Arnold Drive, West Lafayette, IN, 47907, United States, bzeng@ecn.purdue.edu, Jean-Philippe Richard

Lifted cuts from single constraint of 0-1 MIPs have been proven to be very effective. We present a framework to efficiently and systematically build superadditive approximation of higher dimensional lifting function from the superadditive approximation of lower dimensional one. This framework can be used to generate cuts based on multiple constraints. Applications on several variations of classical knapsack and single node flow problems as well as 2-D knapsack problem will be presented.

4 - New Cuts for 0-1 Programming Problems

Osman Oguz, Assoc. Prof., Bilkent University, Ankara, 06800, Turkey, ooguz@bilkent.edu.tr

Cuts separating noninteger extreme point solutions from the solution set of the LP relaxation of a 0-1 programming problem are introduced. These cuts are similar to cover cuts in function, however the logic behind their derivation is different. Some experimental results on the use of the cuts will also be reported.

■ MA12

Room 312

Mentoring: Perspectives of Winners of the Award for the Advancement of Women in OR/MS

Sponsor: Women in OR/MS

Sponsored Session

Chair: Sila Cetinkaya, Associate Professor, Texas A&M University, Industrial and Systems Engineering, College Station, TX, 77843, United States, sila@tamu.edu

1 - Mentoring

Cynthia Barnhart, Professor, MIT, 77 Massachusetts Avenue, Room 1-235, Cambridge, MA, 02139, United States, barnhart@mit.edu

As a Professor of Civil and Environmental Engineering, Industrial and Systems Engineering, Engineering Systems, and Co-Director of the MIT's Operations Research Center and the MIT Center for Transportation and Logistics, I have had several "mentoring" experiences, both on the giving and receiving end. I will try to describe some of lessons I have learned, and my assessment of what works and what doesn't work.

2 - 2006 WORMS Award Winner: Growing Up as an OR Professional - Role of Mentors, Role Models, Friends

Radhika Kulkarni, Director, Operations Research R&D, Analytical Solutions Division, SAS Institute Inc., Cary, NC, 27513, United States, Radhika.Kulkarni@sas.com

Building a successful Operations Research group, whether in Academia or in Industry, is a challenging experience. The journey is enriched by interactions with colleagues in several roles; some are close friends, others are advisors, and yet some others are role models. Not every interaction may appear to be a mentoring activity, but every one of them provides an opportunity to learn a valuable lesson. Some experiences and lessons learned will be described.

■ MA13

Room 313

Teaching Decision Support System (DSS) Development

Sponsor: Education (INFORM-ED)

Sponsored Session

Chair: Michelle M.H. Seref, Doctoral Student, Operations Management, Decision Information Sciences, University of Florida, Stuzin Hall 361-E, Gainesville, FL, 32611, United States, michelle.hanna@cba.ufl.edu

1 - Decision Support Services with Excel

Cliff Ragsdale, Bank of America Professor, Virginia Polytechnic Institute and State University, 1007 Pamplin Hall, Blacksburg, VA, 24061, United States, cragsdal@vt.edu

This presentation discusses Excelís evolution as an enterprise-wide DSS tool and associated implications for educators.

2- Using IT to Deliver Operations Research Solutions

Mark Eisner, Cornell University, me35@cornell.edu

Decision support systems are a frequent delivery vehicle for OR solutions. "Developing" such a DSS involves many issues beyond computer programming. This talk will describe a Cornell University course that introduces students to these issues with the objective of increasing the success of OR-based projects in their professional careers.

3- Key DSS Skills for Operations Management Majors at University of Dayton

Michael Gorman, Associate Professor, University of Dayton, Department of MIS, OM and DSC, 300 College Park, Dayton OH 45419-2130, United States, michael.gorman@udayton.edu

In this talk, I will discuss the key DSS skill sets required for the successful operations management major at the University of Dayton. We discuss important underlying tool skills, new DSS skill requirement for the major, and how these skills are used in some of our operations management capstone projects and beyond in the students' first jobs. We find these skills to be essential for students to conduct productive and efficiently analytical work of meaningful scale.

4 - A Course on Developing Spreadsheet-Based Decision Support Systems (DSS)

Michelle M.H. Seref, Doctoral Student, Operations Management, Decision Information Sciences, University of Florida, Stuzin Hall 361-E, Gainesville, FL, 32611, United States, michelle.hanna@cba.ufl.edu, Ravindra Ahuja

To develop a spreadsheet-based DSS, a student needs to learn the definition of a DSS, the functionalities of a spreadsheet software, the technology of a supporting coding language, and the process of constructing a complete DSS application. In our course, we teach these components using course lectures, in-class assignments, homework exercises, and a midterm exam followed by a full DSS project assignment. We find that students leave the course equipped to develop high-quality DSS applications.

■ MA14

Room 314

Procurement and Combinatorial Auctions II

Cluster: Auctions and e-Commerce

Invited Session

Chair: David Parkes, Associate Professor, Harvard University, 33 Oxford Street, Cambridge, MA, 02138, United States, parkes@eecs.harvard.edu

1 - Iterative Combinatorial Auctions with Linear Prices: Results of Numerical Experiments

Martin Bichler, Roland Berger & o2 Germany Professor of Internet-based Information Systems (IBIS), Department of Informatics, I18 Technische Universitaet Muenchen, Boltzmannstrasse 3, D-85748, Garching, Germany, martin.bichler@in.tum.de

Iterative combinatorial auctions exhibit a number of desirable economic properties. Some auction designs are based on linear prices. Although, exact linear prices are often impossible to calculate, these auction formats have performed very well in the laboratory. In this paper, we analyze the economic properties of these mechanisms in simulations.

2 - Core Payment Mechanisms for Combinatorial Auctions
Robert Day, Assistant Professor, Operations and Information Management, University of Connecticut, 2100 Hillside Road, U-1041, Storrs, CT, 06269, United States, Bob.Day@business.uconn.edu, S. Raghavan

In this talk I will summarize recent results on "Core" payment mechanisms for combinatorial auctions and their merits relative to the VCG and other mechanisms. Equilibrium bidding behavior, complexity, algorithmic techniques, and connections to shill bidding and collusion will be discussed.

3 - Shake it up Baby: Scheduling with Package Auctions
Kan Takeuchi, PhD Candidate, University of Michigan, Department of Economics, 611 Tappan Street, Ann Arbor, MI, 48109, United States, Yan Chen, John Lin, Thomas Finholt

We study the problem of scheduling the use of scientific equipments when there is synergy among contiguous time slots. The environment is based on the resource allocation problem faced by the Network for Earthquake Engineering Simulation (NEES). In this environment, we evaluate three mechanisms in the laboratory, RAD (Kwasnica et al, 2005), generalized Vickrey auction, and a knapsack ranking mechanism which is a best-case representation of current scientific equipment time allocation methods. We find that, while the RAD and Vickrey mechanism produces higher efficiency than knapsack, the Vickrey and knapsack mechanisms achieve higher equity level among participants than RAD.

4 - ICE: A Scalable and Expressive Iterative Combinatorial Exchange
David Parkes, Associate Professor, Harvard University, 33 Oxford Street, Cambridge, MA, 02138, United States, parkes@eecs.harvard.edu, Benjamin Lubin, Adam I. Juda, Jeffrey Shneidman

Combinatorial exchanges facilitate trade between multiple buyers and sellers that need to express complex preferences on bundles of items. Applications are to spectrum reallocation, airport slots, supply chain and logistics. ICE incorporates the following features: (a) a tree-based bidding language, (b) elicitation via refinement of cccbounds, (c) linear price feedback, (d) threshold-based payments.

■ MA15

Room 315

Prediction Markets I

Cluster: Auctions and e-Commerce

Invited Session

Chair: Anthony Kwasnica, Assistant Professor, Penn State University, 332 Business Building, University Park, PA, 16802, United States, kwasnica@psu.edu

1 - Decision Markets and Moral Hazard
Shimon Kogan, Assistant Professor of Finance, Carnegie Mellon University, Tepper School of Business, Pittsburgh, PA, United States, kogan@andrew.cmu.edu, Anthony Kwasnica, Roberto Weber

We study the use of markets as a forecasting tool for internal firm decision making. In this setting, it is likely that the participants in the market will also have the ability to affect the outcome of the market through some private, unobservable actions. We conduct laboratory experiments where subjects participate in both a coordination game and a market designed to predict the outcome of the coordination game.

2 - Prediction Markets in Theory and Practice
Justin Wolfers, Assistant Professor of Business and Public Policy, The Wharton School, Steinberg-Dietrich Hall, Suite 1400, 3620 Locust Walk, Philadelphia, PA, 19106, United States, jwolfers@wharton.upenn.edu, Eric Zitzewitz

Prediction Markets allow participants to trade contracts with payoffs tied to future events, thereby yielding prices that can be interpreted as market-aggregated forecasts. We highlight recent theoretical contributions that emphasize the possibility that these markets efficiently aggregate disperse information, and the lessons from empirical applications which show that market-generated forecasts typically outperform most moderately sophisticated benchmarks.

3 - Comparing Costs and Benefits of Prediction Markets
Robin Hanson, Associate Professor, George Mason University, MS 1D3, Carow Hall, 4400 University Drive, Fairfax, VA, 22030-4444, United States, rhanson@gmu.edu

Most attempts to create prediction markets have focused on keeping costs low and traders interested. Such topics can make good sandboxes, but they need not be where most of the untapped value lies. We qualitatively review the main costs and benefit drivers of prediction markets, in order to help identify the high value application areas.

4 - The Performance of Virtual Stock Markets in Institutional Forecasting
Gary Lilien, Distinguished Research Professor of Management Science, Penn State University, 484 Business Building, University Park, PA, 16802, United States, glilien@psu.edu, Gerrit Van Bruggen, Martin Spann, Bernd Skiera

We study the performance of Virtual Stock Markets (VSMs) in institutional forecasting. We find that VSMs can be effectively applied in an environment with a small number of knowledgeable informants. Our results show that where there is high knowledge-heterogeneity, the VSM outperforms the Combined Judgmental Forecasts approach. Our results provide insight into when each of the approaches might be most effectively applied.

■ MA16

Room 316

Revenue Management with Demand Learning

Cluster: Dynamic Pricing and Forecasting

Invited Session

Chair: Costis Maglaras, Associate Professor, Columbia University, Graduate School of Business, 409 Uris Hall, 3022 Broadway, New York, NY, 10027, United States, c.maglaras@gsb.columbia.edu

1 - Dynamic Pricing of New Experience Goods
Dirk Bergemann, Campbell Professor of Economics, Department of Economics, Yale University, 28 Hillhouse Avenue, New Haven, CT, 06511, United States, dirk.bergemann@yale.edu, Juuso Valimaki

We develop a dynamic model of experience goods pricing with independent private valuations. We show that the optimal paths of sales and prices can be described in terms of a simple dichotomy. In a mass market, prices are declining over time. In a niche market, the optimal prices are initially low followed by higher prices that extract surplus from the buyers with a high willingness to pay.

2 - Blind Nonparametric Revenue Management
Omar Besbes, PhD Student, Columbia Business School, 3022 Broadway, New York, NY, 10027, United States, ob2105@columbia.edu, Assaf Zeevi

We consider a general class of network revenue management problems where the decision maker is "blind" to the underlying demand function. We develop nonparametric pricing algorithms that learn this function "on the fly," and prove that, in a regime where the sales volume grows large, these algorithms achieve the optimal revenues generated by pricing policies that "know" the demand function a priori.

3 - Sequential Demand Learning and Dynamic Pricing
Rene Caldentey, Assistant Professor in Operations Management, Stern School of Business, New York University, 44 West Fourth Street, KMC 8-77, New York, NY, 10012, United States, rcaldent@stern.nyu.edu, Victor Araman

A retailer is planning to introduce a new product into the market but does not know if there is enough demand and decides to test the market. He chooses a small set of representative locations (learning phase) where he offers the product for a short time. Based on this information he decides whether to launch the product in the entire market (revenue phase) or not. We assume that initial inventory is fixed and that dynamic pricing is used in both the learning and revenue phases.

4 - Revenue Management Heuristics Under Limited Market Information: A Maximum Entropy Approach
Serkan Eren, PhD Student, Columbia Business School, 435 West 119th Stree Apt. 3F, New York, NY, 10027, United States, se2027@columbia.edu, Costis Maglaras

We propose a tractable and intuitive approach based on maximum entropy (ME) distributions for revenue optimization problems in settings where firms have limited and/or censored market information. In this talk we illustrate the approach in the context of the single-resource capacity control problem, benchmarking it against other solutions based on some form of worse-case analysis, and showing how it can incorporate censored sales data in an intuitive manner and avoid the "spiral-down" phenomenon

■ MA17

Room 317

Simulation-Based Shop Floor Control

Sponsor: Simulation

Sponsored Session

Chair: Jeffrey Smith, Professor, Auburn University, 207 Dunstan Hall, Auburn, AL, 36849, United States, jsmith@auburn.edu

1 - Dynamically-Integrated Planning and Control for the Distributed Enterprise

Young-Jun Son, Associate Professor, The University of Arizona, Systems and Industrial Engineering, Tucson, AZ, 85721, United States, son@sie.arizona.edu

We present a multi-scale federation of simulation and decision models that support planning and control with dynamic updating through sensed and streamed data. Planning and control models are updated both from real-world sensed data and from simulations. While the real world may yield parameters such as current costs or inventory status, the simulation model, in synchronization with other federates in the supply network, will be used to compute lead times and effective resource availabilities.

2 - A Simulation Infrastructure for Procurement and Distribution

Rick Wysk, Professor, Penn State University, Department of Industrial Engineering, University Park, PA, 16802, United States, rwysk@psu.edu, Jianrui (Jerry) Wang

Today's warehouse and procurement centers face challenges in all aspects of service from procurement, to processing and logistics. This paper proposes a location based services infrastructure for forecasting, coordinating, and monitoring distributed simulation federations with real time location information. The infrastructure will significantly improve the performance of procurement and distribution, especially in case of critical needs such as nature disaster or terrorist attack.

3 - Simulation-Based Commissioning of Factory Control Systems

Jeffrey Smith, Professor, Auburn University, 207 Dunstan Hall, Auburn, AL, 36849, United States, jsmith@auburn.edu

Commissioning involves proving/demonstrating that a control system works as designed, intended and contracted. For complex factory control systems, commissioning is a time-consuming and expensive process. However, the commissioning process is critical from the contractual, performance, and safety points of view. This presentation discusses the opportunities for applying discrete-event simulation technology to the general factory control system commissioning process.

■ MA18

Room 318

Operations Research and Homeland Security

Cluster: Counter Terrorism and OR

Invited Session

Chair: Lawrence Wein, Paul E. Holden Professor of Management Science, Graduate School of Business, Stanford University, 518 Memorial Way, Stanford, CA, 94305, United States, wein_lawrence@gsb.stanford.edu

1 - Deadly Games: Suicide Bombings and Targeted Killings in the Israeli-Palestinian Conflict

Edward Kaplan, William N. and Marie A. Beach Professor of Management Sciences, Yale School of Management, Yale School of Medicine, Yale Faculty of Engineering, New Haven, CT, 06520-8200, United States, edward.kaplan@yale.edu, Daniel F. Jacobson

Suicide bombers murdered hundreds of Israeli civilians during the past six years. Israeli countertactics range from intelligence-driven arrests, to targeted killings of terror operatives (that have also led to civilian casualties), to last-minute interceptions. We develop a family of game theory models to examine suicide bombings and targeted killings in the Israeli-Palestinian conflict, and generate several results that aid in understanding the associated "cycle of violence."

2 - Large-Scale Dispensing for Emergency Response to Bioterrorisim and Infectious Disease Outbreak

Eva Lee, Associate Professor, School of Industrial and Systems Engineering, Georgia Institute of Technology, Atlanta, GA, 30332, evakylee@isye.gatech.edu, Siddhartha Maheshwary

A simulation and decision support system, RealOpt, for planning large-scale emergency dispensing clinics to respond to biological threats and infectious disease outbreaks is described. RealOpt incorporates efficient optimization seamlessly interfaced with a simulation module. It allows public health administrators to investigate clinic design and staffing scenarios quickly for operational and strategic planning. Experience of using RealOpt for actual Anthrax drill planning will be analyzed.

3 - Trilevel Models for Protecting Critical Infrastructure

Kevin Wood, Professor, Operations Research Department, Naval Postgraduate School, Monterey, CA, 93943, United States, kwood@nps.edu, Gerald Brown, Matthew Carlyle, Javier Salmeron

We describe a tri-level Stackelberg game for planning the defense of critical infrastructure. (1) A "defender" chooses a budget-limited set of infrastructure components to harden. (2) An "attacker" sees the hardened system and attacks it using limited resources. (3) The defender operates the damaged system as best possible. The defender, at level 1, seeks to maximize system functionality after a worst-case attack. We illustrate with a realistic electric power-transmission problem.

4 - Designing Radiation Detection-Interdiction Systems to Protect Cities from a Nuclear Terrorist Attack

Michael Atkinson, Graduate Student, Institute for Computational and Mathematical Engineering, Stanford University, Durand 105A, Mail Code: 4042, 496 Lomita Mall, Stanford, CA, 94305, United States, mpa33@stanford.edu, Zheng Cao, Lawrence Wein

We consider a Stackelberg game in which a terrorist drives a nuclear weapon toward a city and chooses when to detonate, and the government chooses the number of neutron sensors and interdiction vehicles deployed. One layer of sensors and 10-20 vehicles can mitigate the damage from a plutonium weapon.

■ MA19

Room 319

Forestry Applications V

Sponsor: Energy, Natural Resources & The Environment

Sponsored Session

Chair: Marc McDill, Associate Professor of Forest Management, Penn State School of Forest Resources, 310 Forest Resources Building, University Park, PA, 16802, United States, mem14@psu.edu

1 - Effects of Improved Search Space Representation on Optimal Road Network

Hans R. Heinimann, Professor of Forest Engineering, ETH Zurich, Universitaetsstrasse 16, CHN K 72.2, Zurich, 8805, Switzerland, hans.heinimann@env.ethz.ch, Juerg Stueckelberger

The problem of optimal road network layout is challenging. Most of the previous models use a grid representation that considers only the eight closest neighbor cells to define feasible road links. We present an improved search space and alignment constraints representation mapped on a mathematical graph for better forest road network design. Our model provides enhanced vertical and horizontal road alignments - especially in steep terrain - and reduces the construction cost by 20% to 70%.

2 - Land Acquisition and Restoration Strategies for Prairie-Obligate Butterfly Species

Stephanie Snyder, USDA Forest Service, North Central Research Station, St. Paul, MN, United States, stephaniesnyder@fs.fed.us, James Miller, Adam Skibbe, Robert Haight

We develop a multi-objective land acquisition model to identify habitat protection and restoration strategies for prairie-obligate butterflies in suburban Chicago. Species' persistence depends upon the provision of grasslands and open wetlands in close proximity. Both protection and restoration of wetlands are considered. Buffering requirements for wetlands are explored using clique constraints. Trade-offs between total area of protected habitat and distance to existing reserves are explored.

3 - Dynamic Reserve Site Selection Under Contagion Risk of Deforestation

Daniel Spring, Research Fellow, Monash University, School of Biological Sciences, PO Box 18, Clayton, Victoria 3800, Australia, Daniel.Spring@sci.monash.edu.au, Regis Sabbadin

Land development often takes the form of a contagion process in which sites most likely to be developed are near sites already developed. To consider nature reserve site selections in such cases, we propose an algorithm that uses a graph representation of the sites network and parameterised reinforcement learning to consider dynamic selection problems involving many sites. The method outperforms previously proposed heuristics in terms of the average number of species conserved.

■ MA20

Room 320

Joint Session DAS/ENRE: R&D. Electricity, and Climate Change

Sponsor: Decision Analysis Society, Energy, Natural Resources & The Environment

Sponsored Session

Chair: Erin Baker, Assistant Professor, University of Massachusetts, Mechanical and Industrial Engineering, 220 Elab, Amherst, MA, 01003, United States, edbaker@ecs.umass.edu

1 - Assessing Potential Electricity R&D Projects in the Context of Climate Change

Erin Baker, Assistant Professor, University of Massachusetts, Mechanical and Industrial Engineering, 220 Elab, Amherst, MA, 01003, United States, edbaker@ecs.umass.edu, Jeffrey Keisler

We will present the results of expert assessments on specific climate change technologies that probabilistically relate focused R&D expenditures to specific technological advances. We analyze a limited number of electricity sector technologies which are candidates for investment, including technologies in the categories of advanced solar, carbon capture and sequestration, nuclear fission and fusion, bio-energy, wind, transmission and the grid, and combustion.

2 - Innovation, Uncertainty and Instrument Choice for Climate Policy

Thomas Rutherford, 4829 Northgate Drive, Ann Arbor, MI, 48103, United States, tom@mpsge.org, Christoph Böhringer

Climate change is a long-term problem. Efficient policy responses involve the choice of policy instruments and their timing. We present an intertemporal framework where we can study the trade-off between emission taxes and innovation (R&D) subsidies as a means to cope with long-term emission constraints. A stochastic programming setting allows us to investigate how policy choices are affected by uncertainties on the future availability of clean energy technologies.

3 - How to Stimulate Technology Breakthroughs in an World with Endogenous Uncertainty

Valentina Bosetti, FEEM, C.so Magenta 63, Milano, It, Italy, valentina.bosetti@feem.it, Massimo Tavoni

In this paper we analyze optimal energy R&D investments meant to foster technological breakthroughs -modelled as endogenous random phenomena- in a setting characterized by climate change mitigation goals. We employ solution methods enabling to incorporate endogenous uncertainty. Such a setting allows to analyze climate policy actions -especially those affecting R&D investments- as directly influencing the success rate. We are thus able to derive optimal short term R&D profiles.

■ MA21

Room 321

Eliciting, Evaluating, and Combining Expert Judgments

Sponsor: Decision Analysis Society

Sponsored Session

Chair: Casey Lichtendahl, Assistant Professor of Business Administration, University of Virginia, Darden School of Business, Charlottesville, VA, 22902, United States, lichtendahlc@darden.virginia.edu

1 - Scoring Rules, Competition Among Forecasters, and Probability Reconciliation

Robert Winkler, Professor, Duke University, 317 Fuqua School of Business, Durham, NC, 27708, United States, rwinkler@duke.edu

We study how competition among forecasters can cause reported probabilities to be more extreme even if proper scoring rules are used and investigate how a decision maker should revise her probabilities after seeing these reported probabilities. The results have prescriptive implications for forecasters who care about relative performance and for decision makers using reported forecasts as well as descriptive implications related to overconfidence.

2 - Averaging Opinions: When Does it Work Well, and When Do People Do it?

Jack Soll, Assistant Professor of Management, Duke University, Fuqua School of Business, 1 Towerview Drive, Durham, NC, 27708, United States, jsoll@duke.edu, Richard Larrick, Al Mannes

People tend to "chase the expert," preferring a chosen expert's forecast to an average of several. Averaging can be highly effective, depending on variation in expertise, correlated errors, and the validity of cues to expertise. To some extent, people adapt their aggregation strategies to the environment. Still, they would do well to average more often. Chasing the expert is appealing psychologically, and the feedback environment often makes it difficult to learn the benefits of averaging.

3 - Elicitation of Likelihoods, Priors and Utilities

Jay Kadane, Professor, Carnegie Mellon University, Department of Statistics, Pittsburgh, PA, 15213, United States, kadane@stat.cmu.edu

This talk reviews the current state of frameworks and methods for elicitation. As our ability to compute advances, our ability to elicit is likely to become a most urgent issue for the advancement of Bayesian methods.

4 - Bayesian Opinion Pools

Casey Lichtendahl, Assistant Professor of Business Administration, University of Virginia, Darden School of Business, Charlottesville, VA, 22902, United States, lichtendahlc@darden.virginia.edu, Robert Winkler

Opinion pools are popular ways used in practice to combine expert forecasts of a continuous random quantity into a single forecast. We propose several Bayesian opinion pools as directly assigned posteriors of the random quantity given an expert's forecast and compare the implied likelihoods to likelihoods in other Bayesian combination models.

■ MA22

Room 322

Joint Session MAS/DAS: Military Decision Analysis

Sponsor: Military Applications, Decision Analysis Society

Sponsored Session

Chair: Gregory Parnell, Professor of Systems Engineering, United States Military Academy, Department of Systems Engineering, West Point, NY, 12520, United States, gregory.parnell@usma.edu

1 - Dynamic Risk Management for Real-Time Decision Support of Network Centric Systems

Paul West, Assistant Professor, United States Military Academy, Department of Systems Engineering, West Point, NY, 10996, United States, paul.west@usma.edu

The emergence of network-centric systems of knowledgeable, autonomous, yet interdependent nodes has created unique problems for decision makers, especially in a military environment that is complex, dynamic, and characterized by uncertainty, ambiguity, and friction. This paper explores multi-attribute decision analysis methods for managing NCS in an asymmetric competitive environment and presents a real-time, values-oriented decision support system for NCS based on risk management techniques.

2 - Using Decision Analysis to Determine Objective Function Weights for Capital Budgeting Problems

Paul Ewing, Assistant Professor, Naval Postgraduate School, 1411 Cunningham Road, Monterey, CA, 93943, United States, paul.ewing@us.army.mil

There are often competing multiple objectives when planning military resource allocation. Many times, the measures of effectiveness (MOE) and tradeoffs used in the optimization objective function are ill-defined or non-existent. We discuss applications where decision analysis has been used to help prioritize the MOE's and define weights for the objective function.

3 - Multiple Objective Decision Analysis for Systems Engineering

Gregory Parnell, Professor of Systems Engineering, United States Military Academy, Department of Systems Engineering, West Point, NY, 12520, United States, gregory.parnell@usma.edu

We present and illustrate a system decision process using multiple objective decision analysis for evaluation and improvement of system design alternatives. This methodology is developed in our new textbook used for our introductory course for all majors and three course sequencers in our Systems Engineering Department at West Point.

4 - Analytical Support to 3ACR in Iraq

Michael Kwinn, Associate Professor, DSE, USMA, West Point, NY, 10996, United States, michael.kwinn@usma.edu, Jason Wolter

Authors will present analytical work conducted in Iraq in support of the 3rd Armor Cavalry Regiment whose operations in Tal Afar were noted by many senior leaders, including President Bush. Analysis dconducted on operations center layout and design and operational level assessments.

■ MA23

Room 323

Emergent Models and Factors that Drive Efficiency Gains

Cluster: Global Services Sourcing
Invited Session

Chair: Ravi Aron, Assistant Professor, The Wharton School, 545 Jon M. Huntsman Hall, 3730 Walnut Street, Philadelphia, PA, 19104, United States, raviaron@wharton.upenn.edu

Co-Chair: Praveen Pathak, Assistant Professor, University of Florida, 362 Stuzin Hall, PO Box 117169, Gainesville, FL, 32611, United States, Praveen@ufl.edu

1 - Effectiveness of Instruments Of Governance in Off-Shore Outsourcing of Services
Ying Liu, The Wharton School, University of Pennsylvania, 3730 Walnut Street, Suite 500, Philadelphia, PA, 19104, United States, yliu@wharton.upenn.edu, Ravi Aron

We investigate the comparative effectiveness of different governance instruments used by firms to improve the output quality of services outsourced offshore. Based on primary data collected using survey instruments, we find that real-time monitoring such as the manager's monitoring effort are in general more effective than contracting such as the incentive or penalty clauses. Other findings include buyer firm's monitoring advantage and its relationship with service process codifiability.

2 - Monitoring in Offshored Processes
Subhajyoti Bandyopadhyay, shubho.bandyopadhyay@gmail.com, Praveen Pathak, Ravi Aron

The emergence of a new class of technology-enabled monitoring - thanks to recent advances in Information Technology and telecommunications - has enabled organizations to effectively track the quality of outsourced processes. We present a game-theoretic model to analyze this new development, especially in the context of offshore processes. A multi-year survey across several countries back our analytical results.

3 - Offshore Sourcing of Services - Impact of Distributed Monitoring Systems
Praveen Pathak, Assistant Professor, University of Florida, 362 Stuzin Hall, PO Box 117169, Gainesville, FL, 32611, United States, Praveen@ufl.edu, Ravi Aron

Internet enabled distributed monitoring systems allows firms to source services globally. Buyers of such services can monitor the execution of processes in real time. They can thus exert managerial control over information workers located in distant region. We present the results of survey conducted over 3 years across 3 continents. Our analysis shows that internet enabled monitoring has allowed forms to move to what we term as Efficient Monitoring Frontier.

■ MA24

Room 324

Product Development I

Contributed Session

Chair: Wenge Zhu, Assistant Professor, Troy University, Bib Graves 207, Troy, AL, 36082, United States, wzhu@troy.edu

1 - Outsourcing is the Vehicle of Global Productivity Improvements
Mohammed Quasem, Associate Professor, Howard University, 2600 6th Street, NW, Washington, DC, 20059, United States, quasem2@hotmail.com, Daniel Owunwanne, Karmal Argarwal

Outsourcing is a practice used by companies to reduce costs by transferring portions of their works to outside suppliers rather than completing them internally. The goals of outsourcing are to reduce costs while achieving higher profits. In this article, outsourcing will be examined to determine whether or not it is really the vehicle of global productivity improvement based on some empirical data. Through the use of appropriate statistical test, a conclusion will be drawn.

2 - Framework of Investing in Downstream Research Effort for Overlappng Activities in Product Development
Che-Ping (Jack) Su, Assistant Professor, The Anderson School of Management, MSC05 3090, 1 University of New Mexico, Albuquerque, NM, 87131, United States, su@mgt.unm.edu

Develop dynamic model using optimal control theory to capture the trade-offs of overlapping product devlopment activites and provide managerial insights about how to invest in downstream activites to maximize the profit.

3 - Compression of Project Activities
Abdelghani Elimam, Professor, San Francisco State University, 1600 Holloway Avenue, San Francisco, CA, 94132, United States, aelimam@sfsu.edu, Bajis Dodin

Normally, only critical project activities are crashed. In this paper, we identify and model project management situations that can benefit from crashing non-critical activities. We also treat crashing of activities with stochastic durations. Model Characterization and computational results on activities crashing are presented.

4 - Brand Reputation, Warranty, and Product Quality
Kunpeng Li, PhD Candidate, University of Illinois at Urbana-Champaign, 1206 South Sixth Street, Champaign, IL, 61820, United States, kli@uiuc.edu, Dilip Chhajed, Suman Mallik

We examine the interaction between warranty, brand reputation, and product quality in both one period and two-period models. We model a monopolist who tries to convery unobservable product quality through signals such as warranty and brand reputation. Heterogeneous consumers perceive the signals and form quality beliefs. Under this framework, we study the manufacturer's optimal decisions of price, warranty, and quality in various decision-making situations.

5 - A Tabu Search Approach to Product Line Design
Wenge Zhu, Assistant Professor, Troy University, Bib Graves 207, Troy, AL, 36082, United States, wzhu@troy.edu, Haitao Li

The traditional problem of product line design has been proved to be NP-hard. Many approaches have been attempted to solve the problem more efficiently and incorporate more realistic factors. Our paper contributes to the literature by attacking the problem with a novice approach and with a more realistic model.

■ MA25

Room 325

Integer Programming

Contributed Session

Chair: Amandeep Parmar, Student, Georgia Institute of Technology, 755 Ferst Drive, Atlanta, GA, 30332, United States, aparmar@isye.gatech.edu

1 - A Knapsack Cryptosystem Secure Against Attacks Using Basis Reduction and Integer Programming
William Webb, Professor, Washington State University, PO Box 643113 WSU, Pullman, WA, 99164-3113, United States, webb@math.wsu.edu, Bala Krishnamoorthy, Nathan Moyer

We propose a knapsack cryptosystem which does not have an underlying superincreasing sequence (each coefficient greater than the sum of all the previous ones). This property was used for mounting attacks on the traditional knapsack cryptosystem. We also add restrictions on 0-1 variables. Application of shortest vector calculations using basis reduction will not break this cryptosystem. Standard integer programming methods fail to solve these problems as well, as shown by computational results.

2 - Cut Generation Techniques within the Branch & Price Scheme
Deepak Warrier, Doctoral Student, Texas A&M University, 501 Sycamore Lane Apt #1121, Euless, TX, 77840, United States, deepakwarrier@hotmail.com, Wilbert Wilhelm

We present an approach for generating cutting planes within the Branch & Price scheme by exploiting the Facet Generation Procedure.

3 - A Math Programming Approach to a Class Timetabling Problem: A Case Study with Gender Policies
Salem Al-Yakoob, Assistant Professor, Department of Mathematics and Computer Science, College of Science, Khaldyah, Kuwait University, PO Box 5969, Safat 13060, Kuwait, salem@al-yakoob.com, Hanif D. Sherali

This paper considers the class scheduling and timetabling problem faced at Kuwait University (KU). The principal focus is to design efficient class offering patterns while taking into consideration newly imposed gender policies. We formulate a mathematical programming model that assigns offered classes to time-slots and addresses gender issues by defining appropriate surrogate constraints along with objective penalty terms.

4 - Maintenance Scheduling Optimization Model for a Vehicle Fleet
Fabian Giraldo, DecisionWare, Calle 114 56 75 Of. 606, Bogota, Colombia, fabian.giraldo@gmail.com, Carlos Osorio Ramirez, Jesus Velásquez

In this paper, an integer programming model is presented for solving the scheduling problem of the maintenance operations for a vehicle fleet.

5 - An Integer Programming Approach for the OSPF Weight Setting Problem

Amandeep Parmar, Student, Georgia Institute of Technology, 755 Ferst Drive, Atlanta, GA, 30332, United States, aparmar@isye.gatech.edu, Joel Sokol, Shabbir Ahmed

Open Shortest Path First (OSPF) protocol routes flow in an IP network on the shortest paths between source and destination. Shortest path is based on pre-assigned weights on the links. The OSPF weight setting problem is to determine a set of weights such that, if flow is routed as per OSPF protocol, network congestion is minimized. We present an integer programming based solution strategy for this problem. We develop a family of valid inequalities for the IP and also present numerical results

■ MA26

Room 326

Joint Session DM Invited/DM Sponsored: New Approaches and Problems for Data Mining

Cluster: Data Mining and Automated Learning, Data Mining

Invited Session

Chair: Alan Montgomery, Associate Professor, Carnegie Mellon University, Tepper School of Business, 5000 Forbes Avenue, 255A Posner Hall, Pittsburgh, PA, 15213, United States, alanmontgomery@cmu.edu

1 - Searching in Graphs Containing Both Data and Text

William Cohen, Associate Research Professor, Carnegie Mellon University, School of Computer Science, Pittsburgh, PA, 15213, United States, wcohen@cs.cmu.edu, Einat Minkov

Similarity measures for text are vital tool in information retrieval. Here I describe similarity metrics for graphs that contain a heterogeneous mixture of textual and non-textual objects. These similarity queries can be easily formulated by a naive user, and subclasses of these queries can be used to solve several interesting problems, such finding the referents for entity names in context. Tuning similarity search with learning leads to excellent performance on many problems.

2 - The Support Vector Decomposition Machine

Geoff Gordon, Carnegie Mellon University, School of Computer Science, Department of Machine Learning, Pittsburgh, PA, 15213, United States, ggordon@cs.cmu.edu

In learning problems with many more features than training examples, dimensionality reduction can be essential. Some previous work has treated such problems in two phases: first reduce dimensionality using, e.g., an SVD, then classify using, e.g., an SVM. Instead, we combine the two phases into a single learning objective, and present an algorithm which optimizes this objective directly. We demonstrate our algorithm classifying fMR brain images according to what subjects are thinking about.

3 - Emerging Business Applications of Data Mining

Rayid Ghani, Researcher, Accenture Technology Labs, 161 North Clark Street, Chicago, IL, 60601, United States, rayid.ghani@accenture.com

New and growing sources of data, improved learning algorithms, and the increasing ability of businesses to act on the results of these algorithms has enabled new business applications. I will talk about some recent projects at Accenture Technology Labs including extracting product attributes from descriptions, predicting end-price of auctions to offer price insurance, and learning individual consumer models for personalized promotions.

■ MA27

Room 327

Prognostics and Adaptive Decision Making

Sponsor: Quality, Statistics and Reliability

Sponsored Session

Chair: Nagi Gebraeel, Assistant Professor, University of Iowa, 3131 Seamans Center, Iowa City, IA, 52242, United States, gebraeel@engineering.uiowa.edu

1 - Sensory-Driven Prognostic Models for Adaptive Spare Parts Logistics

Alaa Elwany, University of Iowa, Iowa City, IA, 52242, United States, alaa-elwany@uiowa.edu, Nagi Gebraeel

Logistical decisions in maintenance management are among the most important decisions in the scope of Supply Chain Management. This research focuses on the development of adaptive decision models related to equipment replacement and spare part inventory using real-time prognostic information. The proposed framework is used to determine optimal replacement and component ordering times in a sense and respond environment.

2 - Preventive Maintenance Based on Residual-Life Distribution Updates

Lisa Maillart, Assistant Professor, University of Pittsburgh, lisa.maillart@case.edu, Nagi Gebraeel

Recent developments in condition-monitoring, the process of collecting sensor data to gauge the health of a system more accurately than what results from a priori knowledge alone, include Bayesian procedures for updating the residual life distribution of a system in real time. We present a cost-rate minimizing optimal-stopping decision model to determine, after each residual life distribution update, whether to perform preventive maintenance or to continue to the next observation time.

3 - Simultaneous Optimization of SPC and PM Policies Under an Economic Objective

Thomas Yeung, Assistant Professor, Department of Automation and Production, Ecole des Mines de Nantes, France, tyeung@uark.edu, Richard Cassady

We formulate a partially observable, discrete-time Markov decision process in order to obtain the near-optimal combined preventive maintenance/statistical process control policy that minimizes the costs associated with maintenance, sampling, and poor quality. We develop transition probabilities for the various states of the infinite horizon problem and a solution algorithm for finding the best policy. It is shown that in almost every case a combined PM and SPC policy is the most cost efficient.

4 - Simulation-Based Analysis of Maintenance Policies for Lean Manufacturing

Kevin Kaiser, Research Assistant, University of Iowa, 3131 Seamans Center, Iowa City, IA, 52242, United States, kevin-kaiser@uiowa.edu, Nagi Gebraeel

The success and effectiveness of modern lean manufacturing concepts requires robust and reliable machinery. We develop a simulation study to compare the performance of a manufacturing system under three different maintenance polices: a reliability-based preventive maintenance policy, a degradation-based predictive maintenance policy and a sensory-driven prognostic maintenance policy. System performance and maintenance costs are analyzed under several system reliability levels.

5 - Degradation-Based Prognostics via Phase-Type Approximations

Jeffrey Kharoufeh, Associate Professor, Air Force Institute of Technology, 2950 Hobson Way (AFIT/ENS), Wright Patterson AFB, OH, 45433-7765, United States, Jeffrey.Kharoufeh@afit.edu

We present a degradation-based procedure for estimating the full and residual lifetime distribution of a system experiencing degradation induced by a semi-Markov environment. The hybrid approach uses degradation measures and phase-type approximations to numerically estimate the distributions. Numerical examples are provided to illustrate the procedure.

■ MA28

Room 328

Robust Parameter Design: New Ideas and Applications

Sponsor: Quality, Statistics and Reliability

Sponsored Session

Chair: Roshan Vengazhiyil, Assistant Professor, Georgia Institute of Technology, Industrial and Systems Engineering, 755 Ferst Drive, Atlanta, GA, 30332, United States, roshan@isye.gatech.edu

1 - A Dual-Response Approach to Robust Parameter Design for a Generalized Linear Model

William Brenneman, Senior Statistician, The Procter & Gamble Company, 8700 Mason-Montgomery Road, Mason, OH, 45040, United States, brenneman.wa@pg.com, William Myers, Raymond Myers

Robust Parameter Design has been studied and applied, in most cases, assuming a linear model under standard assumptions. More recently, RPD has been considered in a generalized linear model (GLM) setting. In this paper we apply a general dual response approach when using RPD in the case of a GLM. We motivate the need for exploring both the process mean and process variance, by discussing situations when a compromise between the two is necessary.

2 - A Bayesian Adaptive Control Approach to Robust Parameter Design

Arda Vanli, PhD Student, The Pennsylvania State University, 350 Leonhard Building, University Park, PA, 16802, United States, oav100@psu.edu, Enrique Del Castillo

In the dual response approach to RPD, the optimal operating settings are determined based on (static) regression models. These settings, however, may be ineffective in minimizing the process variability if the noise factors have strong autocorrelation or if they are nonstationary. We propose a Bayesian predictive

approach to RPD in which the optimal settings of the controllable factors are adjusted during the operation of the process according to the levels of the response and noise factors.

3 - Robust Synthesis of Nanostructures
Tirthankar Dasgupta, PhD Student, Georgia Institute of Technology, 765 Ferst Drive NW, Atlanta, GA, 30332, United States, tdasgupt@isye.gatech.edu, Christopher Ma, Roshan Vengazhiyil, Zhong Lin Wang, Jeff C. F. Wu

An effort is made to systematically investigate the best process conditions that ensure large-scale synthesis of different types of nanostructures. Models linking the probabilities of obtaining specific morphologies to the process variables are developed. A new iterative algorithm for fitting a Multinomial GLM is proposed and used. The optimum process conditions that are robust with respect to inner noise are derived from the fitted models using Monte-Carlo simulations.

■ MA29

Room 329

Health Care Systems Optimization

Cluster: Joint Cluster Healthcare/ HAS: Healthcare Engineering
Invited Session

Chair: Leyuan Shi, Professor, University of Wisconsin-Madison, 1513 University Avenue, Madison, WI, 53706, United States, leyuan@engr.wisc.edu

1 - A Model and Algorithm for Robust Optimization in Cancer Treatment Planning
Stephen Wright, Professor, University of Wisconsin-Madison, 1210 West Dayton Street, Madison, WI, 53706, United States, swright@cs.wisc.edu, Arinbjorn Olafsson

We describe a formulation of IMRT cancer treatment planning that takes account of uncertainties in organ location and dose calculation, and present an algorithm for solving the resulting optimization problem efficiently.

2 - Using Nested Partitions for Beam Angle Selection in Intensity-Modulated Radiation Therapy
Hao Zhang, PhD Student, University of Wisconsin-Madison, 1513 University Avenue, Madison, WI, 53706, United States, haoz@cae.wisc.edu, Leyuan Shi, Warren D'Souza, Robert Meyer

Modern treatment technologies allow clinicians to develop complex treatment plans for a wide array of illnesses, including many forms of cancer. In this research we describe results obtained by applying the Nested Partitions (NP) metaheuristic to the problem of selecting beam angles for radiation delivery in Intensity-Modulated Radiation Therapy (IMRT). Our metaheuristic has led to significant reductions in treatment complexity and delivery time.

3 - Optimizing the Allocation of Surgeries to ORs in an Open-Booking Scheduling System
Brian Denton, Assistant Professor, Mayo Clinic College of Medicine, 200 First Street SW, Rochester, MN, 55906, United States, Denton.Brian@mayo.edu, Andrew Miller, Huschka Todd

Hospitals that operate according to open-booking policies allocate large numbers of procedures across many operating rooms each day. The allocation problem is analogous to a stochastic bin-packing problem, where the objective includes expected costs of overtime and fixed costs of opening ORs. We describe our model, solution methods, and numerical results based on real data.

■ MA30

Room 330

OR in Nurse Planning

Sponsor: Health Applications Section
Sponsored Session

Chair: Jay Rosenberger, Assistant Professor, The University of Texas at Arlington, PO Box 19017, Arlington, TX, 76019, United States, jrosenbe@uta.edu

1 - Short-Term Adjustment of Nurse Schedules Using Branch and Price
Jonathan Bard, Professor, The University of Texas, 1 University Station C2200, Mechanical Engineering, Austin, TX, 78712, United States, jbard@mail.utexas.edu, Hadi Purnomo

In most hospitals, the nursing staff is given a midterm schedule that specifies their daily work assignments. Emergencies, call-outs, and normal fluctuations in personnel requirements, though, can play havoc with the schedule. As a result, it is necessary to make short-term adjustments, either by reallocating resources when shortages exist or by canceling assignments when demand drops. This problem is formulated as an integer program and solved with a branch-and-price algorithm.

2 - A Stochastic Programming Model for Nurse Assignment
Prattana Punnakitikashem, The University of Texas at Arlington, PO Box 19017, Arlington, TX, 76019, United States, prattana.punnakitikashem@uta.edu, Jay Rosenberger

Our research focuses on the last stage of nurse planning, which makes daily decisions on assigning nurses to patients. We develop a stochastic integer programming model for nurse assignment with an objective to minimize excess workload on nurses. The problem is solved using a Benders' decomposition approach, in which a greedy algorithm is implemented to solve the recourse subproblem. We propose sets of valid inequalities to strengthen the relaxed master problem. Computational results are presented.

3 - A Data-Integrated Simulation Model for Nurse Activity (Submitted for the 2006 Pierskalla Award)
Durai Sundaramoorthi, Graduate Research Associate, The University of Texas at Arlington, 400 Yates Street, #217, Arlington, TX, 76010, United States, dsundaramoorthi@uta.edu, Victoria Chen, Jay Rosenberger, Seoung Bum Kim

This research develops a novel approach for constructing simulation models based on a real data set provided by Baylor Regional Medical Center (Baylor) in Grapevine, Texas. Kernel density estimates and trees were utilized to extract important knowledge about the workload of nurses from an encrypted data set provided by Baylor for four care units. Results from this data-integrated simulation of nurse-patient assignments are discussed.

4 - Nurse-To-Patient Ratios: A Queuing Perspective
Francis de Véricourt, Associate Professor, Duke University, 1 Towerview Road, Durham, NC, 27708, United States, fdv1@duke.edu, Otis Jennings

The motivation of this presentation is California Bill AB 394, a piece of legislation which mandates fixed nurse-to-patient staffing ratios as a means to address the current crisis in the quality of health care delivery. With a predictive queuing analytic approach we seek to determine whether or not ratio policies are effective and, if not, to provide an alternative staffing paradigm.

■ MA31

Room 331

Finance and Stochastics

Cluster: Financial Engineering and Risk Management
Invited Session

Chair: Erhan Bayraktar, Assistant Professor of Mathematics, University of Michigan, Mathematics Department, 530 Church Street, 1043, Ann Arbor, MI, 48109, United States, erhan@umich.edu

1 - Affine Point Processes for Multi-Name Credit
Kay Giesecke, Assistant Professor, Management Science & Engineering, Stanford University, Stanford, CA, 94305, United States, giesecke@stanford.edu

The value of any credit derivative is a function of market wide risk factors generated by the complex web of relationships in the economy. To incorporate these factors, we value credit derivatives from the top down by modeling the dynamics of aggregate losses directly. We make this approach computationally tractable within the affine point process framework. Affine point processes account for both cyclical dependence and contagion. They support Fourier transform based pricing and implementation.

2 - A Moving Boundary Approach to American Option Pricing
Kumar Muthuraman, Assistant Professor, Purdue University, 315 North Grant Street, West Lafayette, IN, 47906, United States, kumar@purdue.edu

This talk presents a computational method to find the optimal exercise boundary (policy) and the price of an American option. The method uses a boundary guess and the associated value of using the guessed boundary, to construct an improved boundary. It can be shown that the sequence of boundaries obtained is monotone and converges to the optimal exercise boundary. I will also demonstrate the generality of this approach to other problems in finance.

3 - How Much Does it Help if You Are Aware of the Default?
Xin Guo, Assistant Professor, UC Berkeley/Cornell, xinguo@ieor.berkeley.edu, Arijit Ckakrabarty

It is well recognized that filtration expansion/shrinkage plays a critical role in information-based credit risk modelling, especially for default intensity estimate. In this talk, we show for the first time in explicit forms the impact and difference of filtration expansion on optimization problems involving default risk.

4 - Optimal Portfolio with Regime Switching and Transaction Costs
Jussi Keppo, Assistant Professor, University of Michigan, College of Engineering, 1205 Beal Avenue, Ann Arbor, MI, 48109, United States, keppo@umich.edu, Erhan Bayraktar

We consider the portfolio and consumption optimization problem when the risky asset price follows a regime switching process and when the agent faces transaction costs. The optimal solution is compared with the cases without the transaction costs and/or regime switching.

■ MA32

Room 332

Portfolio Optimization and Firm Valuation

Sponsor: Financial Services

Sponsored Session

Chair: Dessislava Pachamanova, Assistant Professor, Babson College, 319 Babson Hall, Babson Park, MA, 02457, United States, dpachamanova@babson.edu

1 - Mean-Risk Models Using Two Risk Measures: A Multi-Objective Approach

Gautam Mitra, Professor, CARISMA, Brunel University, School of Mathematical Sciences, John Crank Building, Uxbridge, Middlesex, UB8 3PH, United Kingdom, gautam.mitra@brunel.ac.uk, Ken Darby-Dowman, Diana Roman

We propose a model for portfolio optimization in which distributions are described and compared using three statistics: mean, variance and CVaR at a specified confidence level. The purpose is to improve on mean-variance and mean-CVaR efficient solutions. The problem is multi-objective and transformed into a single objective problem. In the case of scenario models, the problem is a quadratic program. The model is tested on real data drawn from the FTSE 100 index.

2 - Tractable Portfolio VaR Optimization

Dessislava Pachamanova, Assistant Professor, Babson College, 319 Babson Hall, Babson Park, MA, 02457, United States, dpachamanova@babson.edu, Melvyn Sim, Karthik Natarajan

We discuss a computationally tractable parametric method for portfolio Value-at-Risk (VaR) optimization based on robust optimization techniques. The method uses optimization of a modified risk measure that is coherent, and is thus desirable from a financial theory perspective as well. Numerical experiments suggest that the approach outperforms other parametric and sample-based approaches for VaR optimization used in practice, especially when return distributions are skewed.

3 - Robust Portfolio Selection with Uncertain Exit Time

Dashan Huang, PhD Student, Department of Applied Mathematics and Physics, Graduate School of Informatics, Kyoto University, Kyoto 606-8501, Japan, dhuang@amp.i.kyoto-u.ac.jp, Masao Fukushima, Frank Fabozzi

To deal with the two types of uncertainties in the distribution of exit time and in the distribution of portfolio return conditional on exit time, we propose a tractable approach for the robust portfolio section problem by applying worst-case VaR strategy to the case where partial information on the exit time distribution and on the conditional distribution of portfolio return is available, and formulate the corresponding problems as semidefinite programs which can be efficiently solved.

4 - Volatility and Valuation of Early Stage Firms with Jump Risk

Nalin Kulatilaka, Wing Tat Lee Family Professor of Management, Professor of Finance, Boston University, School of Management, 595 Commonwealth Avenue, Boston, MA, 02215, United States, nalink@bu.edu, Feng Shu

We model early-stage firms as sequences of call options leading to mature firms, thus, volatility is critical to proper valuation. Ignoring jumps due to innovations or failure results in over-estimates of volatility. The impact on firm value also depends on whether the option is away-from or at-the money (investment requirement). Our results explain why volatility of firms undergoes discrete reductions when clearing investment stages and provide new insights regarding over- and under-valuation.

■ MA33

Room 333

Joint Session Aviation App./TSL: Models for Managing Air Traffic Delays

Sponsor: Aviation Applications, Transportation Science & Logistics

Sponsored Session

Chair: Michael Ball. Professor, Robert H. Smith School of Business, University of Maryland, College Park, MD, 20742, United States, mball@rhsmith.umd.edu

1 - A Probabilistic Framework for Weather-Based Rerouting and Delay Estimations

Michael McCrea, Lieutenant Colonel, U.S. Army/Virginia Tech, #5 Staff Village, Radford, VA, 24141, United States, mvmccrea@vt.edu, Hanif D. Sherali, Antonio Trani

We present a severe weather-modeling paradigm within the context of a large-scale Airspace Planning and Collaborative Decision-Making Model in order to reroute flights with respect to a specified probability threshold of encountering severe weather, subject to collision safety, airline equity, and sector workload considerations. Our modeling constructs include the development of discretized representations of weather phenomena along with a probabilistic delay assessment methodology.

2 - Real-Time Inter-Modal Substitution as an Airport Congestion Management Strategy

Mark Hansen, Professor, University of California at Berkeley, Civil and Environmental Engineering, 114 McLaughlin Hall, Berkeley, CA, 94720, United States, mhansen@ce.berkeley.edu, Yu Zhang

We explore the potential for inter-modal substitution to reduce flight traffic and delays when there is a temporary shortfall in airport capacity. In our scheme, airlines cancel short-haul flights and rebook passengers on surface transport modes when delay savings from reduced flight traffic justify this. We demonstrate an optimization model that chooses which flights to cancel, as well as a more complex model that considers missed connections, surface vehicle routing, and other issues.

3 - Algorithms for Planning Ground Delay Programs Under Uncertainty in Capacity Forecasts

Avijit Mukherjee, University of Maryland, 3117 A.V. Williams Building, Institute for Systems Research, College Park, MD, 20740, United States, avijit@isr.umd.edu, Michael Ball, Robert Hoffman

Ground delay programs (GDPs) are implemented to mitigate arrival demand - capacity imbalance, mostly due to adverse weather, at an airport. Here we present algorithms that address both equity and efficiency while planning GDPs under uncertainty in capacity. We propose an algorithm that essentially favors long-haul flights over short-hauls while assigning slots to individual flights, and show that this minimizes expected delay when there is a possibility of earlier termination time of a GDP.

4 - Matchings in Connection with Ground Delay and Airspace Flow Programs

Thomas Vossen, Assistant Professor, University of Colorado, Leeds School of Business, UCB419, Boulder, CO, 80309, United States, Thomas.Vossen@Colorado.edu, Michael Ball, Geir Dahl

This presentation discusses matchings that arise within the allocation of airport arrival slots during Ground Delay Programs and airspace entry time slots during so-called Airspace Flow Programs, which have recently been proposed for managing en-route congestion. We introduce procedures for allocating flights to slots, discuss fundamental properties of the resulting matchings, and describe how the resulting methods can be used to determine which flights should be canceled or rerouted.

■ MA34

Room 334

Joint Session TSL/Counter Terrorism: Urban Transportation Planning Models I: Transportation System Risk, Security, and Emergency Response

Sponsor: Transportation Science & Logistics, Counter Terrorism and OR

Sponsored Session

Chair: James Moore, Professor and Chair, Epstein Department of Industrial & Systems Engineering, University of Southern California, GER 240; MC 0193, Los Angeles, CA, 90089, United States, jmoore@usc.edu

1 - Modeling Spatial Concentration of Transportation Systems to Assess Vulnerability to Natural Hazard and Terrorist Threats

Carlos E. Restrepo, Research Scientist, New York University, Wagner/295 Lafayette St. 2nd Fl, New York, NY, United States, cer202@nyu.edu, Zvia S. Naphtali, Jeffrey S. Simonoff, Rae Zimmerman

Spatial concentration of transportation facilities, capacity, usage and value are important indicators of transportation vulnerability to consequences of catastrophic events. Regional economic measurements and models to discern patterns in concentration are applied to U.S. air, sea, and land transport of people and goods, as well as the transport of energy products. Policy implications and transferability of decision tools are described.

2 - Virtual Simulation Technology Applied to Transportation Safety and Security
Carl Berkowitz, FASCE, PhD, PE, AICP, Professor and Director of the Center for Intermodal Transportation Safety and Security at Florida Atlantic University, John D. McArthur Campus, 5353 Parkside Drive - SR 236, Jupiter, FL, 33458, cmberkowitz@hotmail.com, Clifford Bragdon

A key analysis tool for transportation safety and security is advanced simulation technology that depicts the air-land-sea access and potential vulnerabilities in a virtual real-time format. This simulation process makes it possible to identify vulnerabilities, create realistic scenes for examination, view elevations at various multi eye-points, and evaluate advanced technologies.

3 - Application of GIS and Optimization to the Distribution of Emergency Medical Supplies in an Urban Area
Harry Bowman, Center for Risk and Economic Analysis of Terrorism Events, 3710 McClintock Avenue, Room 314, University of Southern California, Los Angeles, CA, 90089, United States, hbowman@usc.edu

In the event of a major disease outbreak or bioterror event, local officials must plan for emergency distributions of medicine to the population. Dispensing locations must be selected, and supplies delivered to those locations before dispensing. Geographic analysis and optimization techniques can be applied to several parts of this problem.

■ MA35

Room 335

Hazard Management and Evacuation I

Sponsor: Transportation Science & Logistics
Sponsored Session

Chair: Kevin Taaffe, Assistant Professor, Clemson University, 110 Freeman Hall, Clemson, SC, 29634, United States, taaffe@CLEMSON.EDU

1 - Optimal Signal Control for Corridor-Based Emergency Evacuation
Ying Liu, Research Assistant, University of Maryland, Department of Civil Engineering, College Park, MD, 20742, United States, lyng@wam.umd.edu, Xiaorong Lai, Gang-Len Chang

This study presents two mixed-integer models for design of signal control strategies for corridor-based evacuation. The models take into account various operational complexities, such as selection of critical intersections for control of turning movements, design of signal settings, and rerouting of traffic from origins to critical intersections or between corridors. The numerical results for two networks in Washington D.C. have revealed the models' potential for use in real-world applications.

2 - A Cell-Based Dynamic System Optimal Model and Its Heuristic Solution Method for Emergency Evacuation
Henry Liu, Assistant Professor, University of Minnesota, Department of Civil Engineering, 500 Pillsbury Drive SE, Minneapolis, MN, 55123, United States, henryliu@umn.edu, Xiao-Zheng He, Jeff Ban

In this talk, we present a dynamic system optimal (DSO) model to identify routes and schedules to evacuate affected populations to safety zones in the event of natural disasters or terrorist attacks. The DSO model embeds the cell transmission model for traffic flow representation and considers departure time as one of the decisison variables. To reduce the computational cost for solving the DSO, a heuristic solution approach is proposed to provide a close approximation of system optimum.

3 - Planning for Evacuation of Low-Mobility Groups: Model Framework and the Pickup Location Problem
Mark Hickman, Associate Professor, University of Arizona, PO Box 210072, Tucson, AZ, 85721-0072, United States, mhickman@engr.arizona.edu, Chi Pak Chan

We consider the challenges of using public vehicles to evacuate low-mobility persons in an emergency, including the problems of determining the location of evacuation sites and the subsequent vehicle routing. For the selection of evacuation sites, we provide a mathematical formulation and identify heuristic techniques to solve the problem. We also illustrate the solution technique on several test problems.

4 - Allocating and Scheduling Resources During Hospital Evacuations
Kevin Taaffe, Assistant Professor, Clemson University, 110 Freeman Hall, Clemson, SC, 29634, United States, taaffe@CLEMSON.EDU, Esengul Tayfur

We study the allocation of hospital resources during evacuations in which a staged response is possible, most notably for hurricanes. The evacuating hospital must determine the best use of its medical staff and transport vehicles to move patients to any number of sheltering facilities. Each of these facilities has a limited capacity for accepting various levels of patient acuity. We propose an optimization model and solution algorithm that can minimize either evacuation time or cost.

■ MA36

Room 336

Urban Transportation Planning Models II: Land Use and Transportation

Sponsor: Transportation Science & Logistics
Sponsored Session

Chair: Heng Wei, Assistant Professor, Department of Civil & Environmental Engineering, University of Cincinnati, 792 Rhodes Hall ML-0071, Cincinnati, OH, 45221, United States, heng.wei@uc.edu

1 - Dynamic Games in Complex Transportation Networks
Jürgen Scheffran, ACDIS, Adjunct Associate Professor, Political Science and Atmospheric Sciences, University of Illinois, 359 Armory Building, MC 533, 505 East Armory Avenue, Champaign, IL, 61820, scheffra@uiuc.edu, Kieran Donaghy

A framework of complex dynamic transportation networks is presented to examine the evolution of goods movement and network externalities, including the increased fragmentation of production processes. Based on data, we analyze the solutions to non-cooperative dynamic games between producers (shippers), carriers, and environmental policy makers.

2 - Unit-Performance-Reliability Based Optimization Model for Prioritizing Improvement Alternatives of a Mixed Traffic Network under Cost Constraint using Genetic-Algorithm
Yanyan Chen, Professor, Beijing Transportation Engineering Key Laboratory, Beijing University of Technology, No.100 Pingleyuan, Chaoyang District, Beijing, China, cdyan@bjut.edu.cn, Heng Wei, Ying Liang

We present a method to prioritize the improvement alternatives for a mixed traffic roadway network given cost constraints. Unit performance reliability, which describes the performance of a network link or intersection, is used to establish the objective of an optimization model that systematically maximizes the performance of the entire network.

■ MA37

Room 337

ISR Special Issue Session

Sponsor: Information Systems Society
Sponsored Session

Chair: Anindya Ghose, Assistant Professor, Stern School of Business, New York University, 44 West Fourth Street, KMC 8-94, New York, NY, 10012, United States, aghose@stern.nyu.edu

1 - Capabilities of the IS Applications Portfolio and Relational Value in Inter-Firm Partnerships
Nilesh Saraf, Assistant Professor, Simon Fraser University, 8888 University Drive WMC 3323, Burnaby, BC, Canada, nsaraf@sfu.ca, Sanjay Gosain, Christoph Schlueter Langdon

We examine how the Information Systems applications portfolio contributes to the performance of business units, specifically focusing on process coupling and knowledge sharing in the extended enterprise as mediating mechanisms. Cross-sectional survey-based data shows that IS integration contributes to both mediators, which in turn contribute partially to performance. IS flexibility is a foundational capability contributing indirectly by enabling greater inter-firm IS integration.

2 - Understanding the Sourcing Choices for Business Processes
Prabhudev Konana, Associate Professor, University of Texas at Austin, 2100 Speedway #B6500, CBA 5.202, Austin, TX, 78712, United States, Prabhudev.Konana@mccombs.utexas.edu, Huseyin Tanriverdi, Ling Ge

Business process characteristics impact production and transaction costs and, hence, sourcing choices. This research develops two new constructs - unbundling readiness and IT-business coupling - and adapts transaction cost economics-based human and intellectual capital specificity to show impact on firm choices. The hypotheses are supported using multinomial logit and 93 data samples.

3 - Impact of Internet Referral Services on the Supply Chain
Anindya Ghose, Assistant Professor, Stern School of Business, New York University, 44 West Fourth Street, KMC 8-94, New York, NY, 10012, United States, aghose@stern.nyu.edu, Tridas Mukhopadhyay, Uday Rajan

In many industries, internet referral services, hosted either by independent third-party infomediaries or by manufacturers, serve as digitally enabled lead-generators in electronic markets, directing consumer traffic to downstream

retailers in a distribution network. We model competition between retailers in a supply chain with such digitally enabled institutions, and consider their impact on the optimal contracts between the manufacturer, referral intermediary and the retailers.

■ MA38

Room 338

Experiences and Opportunities in Rail Fleet and Crew Management

Sponsor: Railroad Applications
Sponsored Session

Chair: Sami Gabteni, Senior Consultant, Jeppesen, Middlex Business Centre, Imm. Lumiere, 40 av. des Terroirs de France, Paris, 75012, France, sami.gabteni@jeppesen.com

1 - Decision Support System for Crew Planning at CSX Transportation

Kamalesh Somani, Manager - Operations Research, CSX Transportation, 3019 Warrington Street J500, Jacksonville, FL, 32254, United States, Kamalesh_Somani@csx.com, Dharma Acharya, Vidya Verma

Crew planning is done at strategic and tactical levels. On strategic level the interest is in finding number of crews required to operate scheduled and unscheduled train network. On tactical level the task is to determine crew rotation and deadhead (taxi) moves for a given time period. We present a web-based information system and network flow optimization model to assist in crew planning.

2 - New Opportunities Based on Recent Experiences in Rail Crew Management

Michael Forbes, CTO, Carmen Systems, Level 4, 54 Jephson Street, Toowong, QL, 4066, Australia, mforbes@carmensystems.com

We analyse recent experiences in deploying crew management systems for strategic planning and day of operations at Amtrak and SNCF. The system deployed makes extensive use of optimisation and decision support and has facilitated significant process change. We will highlight the benefits achieved at these railways. Finally, we will discuss how the same processes, with different time scales, can be used to achieve similar benefits at any other railway. An opportunity not to be missed!

3 - Next Generation Approach for Rolling Stock Scheduling Optimization

Sami Gabteni, Senior Consultant, Jeppesen, Middlex Business Centre, Imm. Lumiere, 40 av. des Terroirs de France, Paris, 75012, France, sami.gabteni@jeppesen.com

Traditional rolling stock scheduling optimizers reason at an elementary level: fleet units are assigned to scheduled tasks. We present the approach developed for the Danish State Railways (DSB), which handles compositions of units (consists) and sequences of tasks to capture the network dimension of the problem. Based on the evaluations performed by DSB, we will discuss the benefits of this approach, and the opportunities for other railways.

■ MA39

Ballroom B

Ethics in OR

Contributed Session

Chair: Saul I. Gass, Professor, University of Maryland, Robert H. Smith School of Business, College Park, MD, 20742, United States, sgass@rhsmith.umd.edu

1 - The Ethical Implications of Designing Computational Models to be Transparent

William Wallace, Professor, Rensselaer Polytechnic Institute, 110 8th Street, Troy, NY, 12180, United States, wallaw@rpi.edu, Kenneth Fleischmann

Computational models are not pure abstractions, but rather are only as good as their inputs and assumptions. The role of ethics and values in computational modeling can have far-reaching consequences, yet this is still a significantly understudied topic in need of further research. This presentation focuses on one particular value, transparency, documenting both how models can be transparent and why models should be transparent.

2 - Implementing Transparency in Computational Models

Andrew Crapo, Information Engineer, GE Global Research, K-1 5C10A, One Research Circle, Niskayuna, NY, 12309, United States, crapo@crd.ge.com, Kenneth Fleischmann, William Wallace

Semantic technology is utilized to capture the context of a model, providing a networked representation of information that allows users to explore the meaning of content and examine the values embedded within the model. An example is given that uses an ontologically structured and visually perceivable and navigable representation of contextual information.

3 - A Computational Model of a Group of Individuals Resolving an Ethical Dilemma: Virtual Experiments

Russell Robbins, Assistant Professor, Marist College, 3399 North Road, Poughkeepsie, NY, 12601, United States, robbins.russ@gmail.com, William Wallace

We will describe the development, verification and validation of a computational model of a group of individuals resolving an ethical dilemma. We ran virtual experiments based upon varying individual values and personality and group size, composition, and decision rules. We studied the number of suggestions within the "discussion" and the group "decision" and will report results. We also submit this as an Interactive Presentation.

4 - Exploration of Values and Group Formation Using the Enron Email Corpus

Yingjie Zhou, Research Assistant, Rensselaer Polytechnic Institute, 110 8th Street, CII 5015, Troy, 12180, United States, zhouy5@rpi.edu, William Wallace, Kenneth Fleischmann, Jeffery Baumes, Malik Magdon-Ismail, Mark Goldberg

This study uses the Enron email corpus to examine the role of values in group formation. Content analysis is used to code the values according to ten value types. The hypothesis for this study is that individuals having similar values tend to communicate. Overlapping clusters are identified, followed by value counts for each type within clusters. This method makes it possible to statistically test the hypothesis. As a result, more can be learned about how values influence social interaction.

■ MA40

Room 401

Joint Session SOLA/Minority Issues/ Public Programs: Public-Sector Facility Location and Urban Planning

Sponsor: Location Analysis, Minority Issues, Public Programs and Processes
Sponsored Session

Chair: Michael Johnson, Extern, Carnegie Mellon University, Center for Economic Development, 5000 Forbes Avenue, Pittsburgh, PA, 15213-3890, United States, johnson2@andrew.cmu.edu

1 - Identifying Decision Opportunities in Building Design through Value-Focused Thinking

Yun-Shang Chiou, Doctoral Student, School of Architecture, Carnegie Mellon University, 5000 Forbes Avenue, Pittsburgh, PA, 15213-3890, United States, ychiou@andrew.cmu.edu, Michael Johnson, Khee Poh Lam, Cliff Davidson

Building design decisions often focus on alternatives. These decisions are intended to provide design solutions to meet defined criteria, and do not examine whether these criteria fully address design objectives. We apply "value-focused thinking" to the "green building" rating system and a high-profile construction project at a major university. We demonstrate how VFT can help designers regain a focus on values and objectives as well as identify decision opportunities that would have otherwise gone unnoticed.

2 - Mathematical Models for Reconstruction Planning in Urban Areas

Changmi Jung, Doctoral Student, Heinz School of Public Policy & Management, Carnegie Mellon University, 5000 Forbes Avenue, Pittsburgh, PA, 15213-3890, United States, changmi@andrew.cmu.edu, Michael Johnson

After a natural disaster, urban planners must design a restoration strategy. We develop math programming models for this purpose to maximize social welfare. First, we construct a measure of neighborhood-level viability, calibrated with real-world data for the city of New Orleans. Second, we construct and evaluate a neighborhood development model to maximize the total viability of neighborhoods by optimally assigning land uses subject to budget, contiguity and spatial orientation constraints.

3 - Covering Models for Sensor Placement in Water Distribution Systems under Uncertainty

Jianhua Xu, Doctoral Candidate, Department of Engineering and Public Policy, Carnegie Mellon University, 5000 Forbes Avenue, Pittsburgh, PA, 15213-3890, United States, mumu@cmu.edu, Jeanne VanBriesen, Michael Johnson, Paul Fischbeck, Mitchell Small

We present math programming models for location of sensors across a water distribution network. Multiple objectives include minimizing placement cost, maximizing system coverage and minimizing the population at risk, all subject to probability thresholds on detection time. The model is applied to distribution systems of varying sizes. Computational results and policy implications are reported.

4 - How Much Does it Pay to Use Models for Affordable Housing Development?
Michael Johnson, Extern, Carnegie Mellon University, Center for Economic Development, 5000 Forbes Avenue, Pittsburgh, PA, 15213-3890, United States, johnson2@andrew.cmu.edu

Math programming models for affordable housing development choose the size and location of housing to optimize social welfare and equity objectives. In this paper data from an affordable housing provider is used to create more accurate estimates of social benefits and costs and validate current planning models. The current configuration of the provider's affordable housing stock is shown to be suboptimal. Substantial social returns may be associated with the use of prescriptive planning models.

■ MA41

Room 402

Joint Session AP/Minority: Queues and Call Centers

Sponsor: Applied Probability, Minority Issues

Sponsored Session

Chair: Mark Lewis, Associate Professor, School of Operations Research and Industrial Engineering, Cornell University, 226 Rhodes Hall, Ithaca, NY, 14853, United States, mel47@cornell.edu

1 - Staffing of Time-Varying Queues to Achieve Time-Stable Performance
William Massey, Professor, Dept. of Operations Research and Financial Engineering, Princeton University, Engineering Quadrangle, Princeton, NJ, 08544, United States, wmassey@Princeton.EDU, Zohar Feldman, Avi Mandelbaum, Ward Whitt

We introduce a simulation-based iterative-staffing algorithm (ISA) for multiserver queues with time varying arrival rates and customer abandonment. For Markovian queues, we prove that ISA always converges. Moreover, our simulation experiments show that the ISA yields time-stable delay probabilities across a wide range of target probabilities. Other call center performance measures, such as agent utilizations, abandonment probabilities and mean waiting times, are stable as well.

2 - IT Application Portfolio Management Using a Finite State Markov Decision Process
Robert Hampshire, PhD Candidate, Princeton University, Princeton, NJ, 08544, United States, rhampshi@Princeton.EDU

Managing IT application portfolios is an important and ongoing process that impacts the efficiency of business enterprises. A sequential decision model for application portfolio management is presented. The output of the model is an optimal asset management plan. A state space approximation is used and evaluated for the efficient computation of the optimal asset management plan.

3 - Diffusion Limit of Overloaded Multiclass FIFO Queues with General Abandonments
Otis Jennings, Assistant Professor, Duke University, 1 Towerview Drive, Durham, NC, 27708, United States, otisj@duke.edu, Josh Reed

Consider a sequence of overloaded multiclass FIFO queues with abandonment, indexed by n. The sequence of arrival and service rates are linear in n, whereas the abandonment distribution is constant. All r.v.'s have general distributions. In the limit, the diffusion-scaled, abandonment-filtered virtual waiting time process is an OU process whose drift is proportional to the traffic intensity-weighted sum of the abandonment densities, each evaluated at the limiting deterministic waiting time value.

4 - Control of a Two-Class Call Center with Upgrades
Mark Lewis, Associate Professor, School of Operations Research and Industrial Engineering, Cornell University, 226 Rhodes Hall, Ithaca, NY, 14853, United States, mel47@cornell.edu, Doug Down

Consider a call center with two classes, modeled as parallel queues, and (random) customer upgrades from the second class to the first class. We study the problem of resource allocation in this system under several decision-making scenarios. In the first, a single decision-maker must allocate finite capacity between each class. We then extend to multiple servers at each station. Structural results are obtained via sample path and MDP arguments.

■ MA42

Room 403

Advances in Multi-Machine Scheduling

Cluster: Scheduling

Invited Session

Chair: Phil Kaminsky, Associate Professor, Department of Industrial Engineering and Operations Research, University of California, Berkeley, CA, 94720, United States, kaminsky@ieor.berkeley.edu

1 - Job Shop Scheduling with Earliness, Tardiness and Intermediate Inventory Holding Costs
Kerem Bulbul, Assistant Professor, Manufacturing Systems & Industrial Engineering, Sabanci University, Engineering & Natural Sciences, Orhanli, Tuzla, Istanbul, 34956, Turkey, bulbul@sabanciuniv.edu

We consider a job shop scheduling problem with the objective of minimizing the sum of tardiness, earliness (finished goods inventory holding) and intermediate (work-in-process) inventory holding costs. We develop a shifting bottleneck heuristic to minimize the total cost and demonstrate its effectiveness computationally.

2 - Coordinated Scheduling of Customer Orders with Decentralized Machine Locations
Jinwen Ou, PhD Candidate, The Hong Kong Polytechnic University, Department of Logistics, Kowloon, Hong Kong, 03900425r@polyu.edu.hk, Chung-Lun Li

We consider a scheduling model with two machines at different locations. Each job is composed of two tasks where each task must be processed by a specific machine. The finished tasks are shipped to a distribution center in batches before they are bundled together and delivered to customers. The objective is to minimize the sum of the delivery cost and customers' waiting costs. We develop polynomial-time heuristic algorithms for this problem and analyze their worst-case performance.

3 - MTS-MTO Production Systems in Supply Chains
Phil Kaminsky, Associate Professor, Department of Industrial Engineering and Operations Research, University of California, Berkeley, CA, 94720, United States, kaminsky@ieor.berkeley.edu, Onur Kaya

We consider a two facility supply chain featuring a manufacturer served by a single supplier, both of which need to decide which items to produce to order, and which items to produce to stock. MTS Inventory levels must be set, MTO due dates must be quoted, and sequencing decisions must be made. We design algorithms for various versions of these models, and use these algorithms to assess the value of joint MTS-MTO systems, and the value of centralized control.

4 - Solving a Class of Parallel Machine Scheduling Problems with Nonlinear Cost Functions
Thomas Sharkey, PhD Student, University of Florida, ISE Department, PO Box 116595, Gainesville, FL, 32608, United States, sharkeyt@ufl.edu, H. Edwin Romeijn

We consider a capacitated parallel machine scheduling problem which minimizes the sum of assignment costs of jobs to machines and the sum of convex functions of the makespans of the machines. We propose a greedy heuristic based on the dual multipliers associated with the optimal solution of a relaxation of the problem that allows each job to be split between machines, as well as an algorithm to solve that relaxation. We also perform a computational study of the performance of these algorithms.

■ MA43

Room 404

AHP/ANP Applications

Cluster: Analytic Hierarchy Process

Invited Session

Chair: Claudio Garuti, General Manager, FULCRUM Ingenieria, Luis Thayer Ojeda 0180 Of.1004, Santiago, RM, Chile, claudiogaruti@fulcrum.cl

1 - Comparing AHP and ANP Shiftwork Models: Hierarchy Simplicity V/S Network Connectivity
Isabel Spencer, Fulcrum Ingenieria, L.T. Ojeda 0180 Of.1004, Santiago, Chile, isabelspencer@fulcrum.cl, Claudio Garuti

The method called Analytic Network Process (ANP), is a mathematical extension of the AHP method, where the feedback process is allowed, moreover, you can connect any criteria with any other one (even with himself) in different ways. These new groups, called clusters, may have a set of criteria or alternatives (now called nodes) inside. Once the model is built, we continue by entering the judgments or pairwise comparisons of elements with respect to each of the influenced element.

2 - The Difficulty of Applying Fuzzy Set Number Crunching to Decision Making
Thomas Saaty, University Professor, University of Pittsburgh, 322 Mervis Hall, Pittsburgh, PA, 15260, United States, saaty@katz.pitt.edu

Fuzzy logic has difficulty producing valid answers in decision-making. Absent are theorems to prove its workability by crunching numerical representations of judgments to produce results already known and estimated with judgments. The numerical representation of judgments in the AHP is already fuzzy. Fuzzifying judgments does not lead to a better outcome and often a worse one.

3 - Interval Judgments and Euclidean Centers
Luis Vargas, Professor, University of Pittsburgh, 314 Mervis Hall, Pittsburgh, PA, 15260, United States, lgvargas@pitt.edu, Ami Arbel

We formulated the problem of finding a priority vector from an interval reciprocal matrix as an Euclidean center problem. This formulation always has a solution and provides knowledge about the feasible region. We show that, if the Euclidean center objective function is positive, there are multiple plausible solutions, if it is negative, there no feasible solutions, and if it is equal zero, the feasible region consists of a single point.

4 - Real Life AHP. Issues and Trouble Shooting
Claudio Garuti, Fulcrum Ingenieria, L.T. Ojeda 0180 Of.1004, Santiago, Chile, cgaruti@fulcrum.cl, Isabel Spencer

This presentation try to put light in the way that we are using AHP in real life problems. What are his benefits and what his claim. His application area and its limitations. Also put some light in few of the criticisms made. The most of them, due to a bad understanding of the method and its axioms, resulting in a lack of modelling knowledgement for real life problems representation.

■ MA44

Room 405

The Resilient Enterprise - Challenges in Supply Chain Security and Resilience

Sponsor: Junior Faculty Interest Group (JFIG)
Sponsored Session

Chair: Yossi Sheffi, Professor of Engineering Systems, Massachusetts Institute of Technology, 1 Amherst Street, Cambridge, MA, 02139, United States, sheffi@MIT.EDU

1 - The Resilient Enterprise - Challenges in Supply Chain Security and Resilience
Yossi Sheffi, Professor of Engineering Systems, Massachusetts Institute of Technology, 1 Amherst Street, Cambridge, MA, 02139, United States, sheffi@MIT.EDU

The Book "The Resilient Enterprise: Overcoming Vulnerability for Competitive Advantage" (MIT Press, Oct. 2005) describes how flexible supply chain designs can help companies plan for and recover from high impact/low probability disruption. The book got rave reviews in the New York Times, The Wall Street Journal, The Economist and numerous trade publications. It was mentioned as one of the best business books of 2005 by the Financial Times. The book was the culmination of a four year research project at MIT. It is based on dozens of examples and case studies, many of which will be covered in the talk by the author, Yossi Sheffi. The talk will also lessons for general supply chain management, covering lessons from recent disruptions as well as research challenges in the areas of security and resilience.

■ MA45

Room 406

Tutorial: Semidefinite and Second Order Cone Programming and Their Application to Shape Constrained Regression and Density Estimation

Cluster: Tutorials
Invited Session

1 - Semidefinite and Second Order Cone Programming and their Application to Shape Constrained Regression and Density Estimation
Farid Alizadeh, Associate Professor, Management Science and Information Systems and RUTCOR Rutgers, State University of New Jersey, 640 Bartholomew, Piscataway, NJ, 08854, United States, alizadeh@rutcor.rutgers.edu

Many statistical analyses require the approximation of a functional relationship between explanatory and response variables, subject to certain "shape constraints". This implies a connection between shape-constrained regression and semidefinite programming. In this tutorial, we introduce semidefinite programming and second order cone programming, review specific statistical problems amenable to solution via semidefinite programming, and discuss extensions and limitations to this method.

■ MA46

Room 407

Panel Discussion: Marketing your OR/MS Skills

Contributed Session

Chair: Candi Yano, Professor, University of California at Berkeley, 4141 Etcheverry Hall, Berkeley, CA, 94720-1777, United States, yano@ieor.berkeley.edu

1 - Panel Discussion: Marketing your OR/MS Skills
Moderator: Candi Yano, Professor, University of California at Berkeley, 4141 Etcheverry Hall, Berkeley, CA, 94720-1777, United States, yano@ieor.berkeley.edu, Panelists: Seth Bonder, Ann Bixby, Warren B. Powell

Panelists will share their experience and offer advice on how to market your OR/MS skills based on their experiences in a variety of different industries and in several different roles, including staff consultant, business owner and university researcher. There will be ample time for questions from the audience.

■ MA47

Room 408

Integrated and Robust Planning for Freight Transportation

Cluster: Supply Chain and Operations Engineering
Invited Session

Chair: Amy Cohn, Assistant Professor, University of Michigan, 2797 IOE Building, 1205 Beal Avenue, Ann Arbor, MI, 48109, United States, amycohn@umich.edu

1 - Using Composite Variable Modeling to Solve Integrated Freight Transportation Planning Problems
Sarah Root, University of Michigan, 1205 Beal Avenue, Ann Arbor, MI, United States, seroot@umich.edu, Amy Cohn

Developing plans for a small package carrier is a complex process, with many interdependent and constrained resources. As a result, the process is often decomposed into sequential steps, which can greatly impact solution quality. We present a modeling approach, solution techniques, and computational results to integrate three of these sequential sub-problems: the assignment of packages to trailer types, the routing and matching of trailers, and the balancing of empties.

2 - Robust Optimization Methods for Large-Scale, Network-Based Resource Allocation Problems
Lavanya Marla, PhD Candidate, Massachusetts Institute of Technology, 77 Massachusetts Avenue, 1-235, Cambridge, MA, 02139, United States, lavanya@mit.edu, Cynthia Barnhart

We consider large-scale, network-based resource allocation problems under uncertainty. By modeling data uncertainties in service time, resource availability, supplies and demands, we generate more robust solutions, that is, solutions that are more likely to be executed or easier to repair when disrupted. We solve our model using a new decomposition scheme, geared specifically for large-scale problems and evaluate our approach using data provided by a large-scale carrier.

3 - Designing Membership and Allocation Mechanisms for Air Cargo Alliances
Lori Houghtalen, PhD Student, School of Industrial and Systems Engineering, Georgia Institute of Technology, 765 Ferst Drive, Atlanta, GA, 30332, United States, lhoughta@isye.gatech.edu, Özlem Ergun, Joel Sokol

We address causes of suboptimal behavior among carriers in air cargo alliances, and design mechanisms that may be used to promote compliance with the system optimal solution. In particular, we develop algorithms for fair revenue allocation from among alliance members and investigate implications for member carriers operating different types of networks.

4 - Incorporating Implementation Complexity in Periodic Vehicle Routing Problems
Karen Smilowitz, Assistant Professor, Northwestern University, 2145 Sheridan Road, M233, EV3119, Evanston, IL, 60208, ksmilowitz@northwestern.edu, Peter Francis, Michal Tzur

In this talk, we discuss methods to quantify implemenation complexity for periodic vehicle routing problems and show how these metrics can be used in routing decisions.

■ MA48

Room 409

Service Management

Sponsor: Manufacturing & Service Operations Management
Sponsored Session

Chair: Martin Lariviere, Associate Professor, Kellogg School of Management, Northwestern University, 2001 Sheridan Road, Evanston, IL, 60208, United States, m-lariviere@kellogg.northwestern.edu

1 - New Product Introduction and Services

Gad Allon, Assistant Professor, Northwestern University, Kellogg School of Management, 2001 Sheridan Road, Evanston, IL, 60208, United States, g-allon@kellogg.northwestern.edu, Achal Bassamboo

We consider a monopoly that sells a durable product and a complementary perishable product or service. We first study the pricing problem under the assumptions that customers form rational expectation regarding future prices and quality levels of the service. We then study the "new product introduction" problem faced by the monopolist in the presence of aftermarket products or services.

2 - Advance Selling with Asymmetric Information on Quality

Hyun-Soo Ahn, University of Michigan, 701 Tappan Street, Ann Arbor, 48104, United States, hsahn@umich.edu, Roman Kapuscinski, Man Yu

We consider a monopolistic seller whose product can be sold both in advance and at the time of consumption. The quality of the product is a private knowledge of the seller. The seller needs to decide whether to sell in advance, how much to offer, and at what price. We show how the buyers' beliefs on product quality, as well as, limited capacity influence the seller's optimal pricing and rationing policy.

3 - Outsourcing Contracts for a Call Center

Sameer Hasija, Simon School of Business, University of Rochester, Rochester, NY, 14627, United States, hasijas1@simon.rochester.edu, Robert Shumsky, Edieal Pinker

We study contracts to co-ordinate the capacity decision of a vendor who has been hired by a client to provide call center support. We consider different types of contracts based on our observations of contracts used by one large vendor. We show when these contracts are coordinating and how coordination can be achieved under information asymmetry about the vendor's productivity. Under each contract type we also consider how profits are allocated between the client and the vendor.

4 - Incentives for Quality through Endogenous Routing

Lauren Xiaoyuan Lu, PhD Student, Kellogg School of Management, Northwestern University, MEDS Department, 2001 Sheridan Road, Evanston, IL, 60208, United States, lauren-lu@kellogg.northwestern.edu, Jan Van Mieghem, Canan Savaskan

This paper investigates how incentives and endogenous rework routing can induce effort and improve a firm's quality and profits. We consider quality control and rework routing policies of a firm implementing piece rate compensation. In general, cross routing generates the highest profit rate when appraisal, internal failure, or external failure costs are high, while self routing performs the best when gross margins or disutilities of effort are high.

■ MA49

Room 410

Integration in Closed-Loop Supply Chains

Cluster: Closed-Loop Supply Chains and Reverse Logistics
Invited Session

Chair: Olga Kaminer, PhD Student, York University, 4700 Keele Street, Toronto, ON, M3J 1P3, Canada, okaminer@schulich.yorku.ca

1 - Design and Analysis of Robust Service Networks

Rajesh Piplani, Associate Professor, Nanyang Technological University, School of MAE, Centre for SCM, 50 Nanyang Avenue, N3-2C-84, Singapore, 639798, Singapore, mrpiplani@ntu.edu.sg, Rommert Dekker

Design and operation of service networks should take into account service and demand dynamics, and uncertainty inherent in the parameters. We present the development of a network design methodology where first MIP models are used to generate solutions considering multi-level product and component sharing. Then scenarios of uncertainty are defined which will be used in the robust optimizaiton models.

2 - Designing Customer Return Policies to Optimize Overall Channel Profitability

Prashant Yadav, Professor of Supply Chain Management, MIT-Zaragoza International Logistics Program, Zaragoza Logistics Center, Zaragoza, AR, 50009, Spain, pyadav@MIT.EDU, Sweta Thota

A large fraction of the return flows in the supply chain consist of non-defective returned products. Using different consumer choice models, we investigate the impact of credit returned and duration of return time allowed on the profits of retailers and manufacturers. The insights are useful for retail managers involved in setting terms of their return policy and for logistics managers in building their case for restricted returns.

3 - Customers' Role in Enhancing Environmental Performance of Suppliers

Olga Kaminer, PhD Student, York University, 4700 Keele Street, Toronto, ON, M3J 1P3, Canada, okaminer@schulich.yorku.ca, Ashwin Joshi, Murat Kristal, Markus Biehl

In order to stay environmentally friendly, manufacturing companies have to ensure that inputs to their products and/or processes that come from outside suppliers, are environmentally friendly. In the current study we present results of a large scale quantitative survey that investigates different mechanisms that can be employed by customers (manufacturers) in order to enhance their suppliers' environmental performance.

4 - Sharing Product Responsibility Across the Supply Chain

Brian Jacobs, Doctoral Student, College of Management, Georgia Tech, 800 West Peachtree Street NW, Atlanta, GA, 30332, United States, brian.jacobs@mgt.gatech.edu, Ravi Subramanian

Product take-back - a policy tool within Extended Producer Responsibility, typically holds producers responsible for take-back of post-consumer products, despite emphasis on the need to involve all supply chain actors. We investigate the impact of shared responsibility for product take-back across the supply chain by developing and analyzing a two-stage supply chain model with key policy specifications of recycling, collection, and shared responsibility.

5 - Framework of Decision Support System for Intelligent Maintenance Systems

Haixia Wang, University of Cincinnati, 598 Rhodes Hall, Center for IMS, Cincinnati, OH, 45221, United States, haixiaw2001@hotmail.com, Jay Lee

Decision support system in Intelligent Maintenance Systems is to use predicted machine health information as well as historical data to optimize maintenance plans in a systematic way. It can be defined in three levels: equipment intelligence, synchronization intelligence, and operations intelligence. This presentation will present methodology, tools, and examples on how to realize the operations intelligence with least maintenance cost while maintaining service quality and productivity.

■ MA50

Room 411

Network Resilience and Reliability

Sponsor: Telecommunications
Sponsored Session

Chair: Halit Uster-, Assistant Professor, Texas A&M University, Industrial and Systems Engineering, College Station, TX, 77843, United States, uster@tamu.edu

1 - Studies on the Reliability of Ad-Hoc Networks

Jose Ramirez-Marquez, Assistant Professor, Stevens Institute of Technology, Castle Point on Hudson, Hoboken, NJ, 07030, United States, Jose.Ramirez-Marquez@stevens.edu, Jason Cook

Ad-hoc networks are employed for the flexibility provided to network users and ease of deployment. The lack of infrastructure allows for the rapid configuration changes because only wireless communication devices are necessary. This attribute violates basic assumptions on which existing reliability methods are founded. This study describes the unique characteristics of ad-hoc networks and current research developed to account for their effects in the determination of reliability.

2 - Design of Resilient Network Topologies with Balanced Rings

Halit Uster, Assistant Professor, Texas A&M University, Industrial and Systems Engineering, College Station, TX, 77843, United States, uster@tamu.edu, Sarath Sasi Kumar

We consider the design of telecommunications network topologies with ring components balanced with respect to various criteria. We provide efficient heuristic solution approaches and present promising computational results.

3 - Assignment of Network Services Considering Risk

Abdullah Konak, Assistant Professor, Penn State - Berks, Tulpehocken Road, Reading, PA, 19610, United States, konak@psu.edu

Most networks today use the client-service paradigm to provide services to users in distributed manner. In this model, an entity that uses a service called client and an entity that provides service(s) is called server. This work introduces the problem of assigning network services to network nodes to minimize a risk measure in the case of catastrophic events.

■ MA51

Room 412

Environmental Issues, Innovation and Supply Chain Management

Sponsor: Manufacturing & Service Operations Management
Sponsored Session

Chair: Erica Plambeck, Professor, Stanford Graduate School of Business, 518 Memorial Way, Stanford, CA, 94305, United States, plambeck_erica@gsb.stanford.edu

1 - The Diffusion of No-Regrets Environmental Technologies

Karl Ulrich, Professor, The Wharton School, 500 Huntsman Hall, Philadelphia, PA, 19104, United States, ulrich@wharton.upenn.edu

The International Panel on Climate Change reports that global greenhouse gas emissions could be reduced by more than 2 gigatonnes of carbon per year at no net cost. This analysis is met with skepticism by most economists. This talk reports on empirical research to understand the extent to which "no regrets" environmental innovations actually exist in practice and to explain the way these innovations diffuse.

2 - Optimal Return Policies and Information Provision

Jeff Shulman, Assistant Professor, University of Washington Business School, 252 MacKenzie Hall Box 353200, Seattle, WA, 98195, United States, jshulman@u.washington.edu, Canan Savaskan, Anne Coughlan

In this paper, we merge research streams from marketing and operations by developing an analytical model that describes how consumer purchase and return decisions are affected by a firm's pricing and restocking fee decisions. We identify the value to the firm of investing in marketing efforts to inform consumers of the best purchase decision in order to eliminate returns. Surprisingly, we find that informing consumers of product fit is not always optimal, even if it were free to do so.

3 - OEM Strategies on the Secondary Market

Beril Toktay, Associate Professor, College of Management, Georgia Institute of Technology, 800 West Peachtree Street, NW, Atlanta, GA, 30308, United States, Beril.Toktay@mgt.gatech.edu, Mark Ferguson, Nektarios Oraiopoulos

We study a monopolist's incentives to manipulate the secondary market through modifying the cost of remanufacturing. A high remanufacturing cost discourages remanufactures and thus eliminates future competition. A low remanufacturing cost, however, will result in high salvage values since remanufacturers will have an interest in acquiring the used products. This, in turn, creates additional value for the consumers of new products and therefore allows the monopolist to extract additional profits.

4 - Competitive Equilibrium under Restrictions on Hazardous Substances

Erica Plambeck, Professor, Stanford Graduate School of Business, 518 Memorial Way, Stanford, CA, 94305, United States, plambeck_erica@gsb.stanford.edu, Terry Taylor

New laws restrict sale of electronics containing hazardous substances. Manufacturers may test competitors' products and thus prevent sale of noncompliant products. We characterize the equilibrium in the manufacturers' investments to eliminate toxics, testing of competitors' products, and sales quantities. The new laws may cause entry by noncompliant, nonbranded manufacturers.

■ MA52

Room 413

Risk and Uncertainty in Revenue Management

Sponsor: Revenue Management & Pricing
Sponsored Session

Chair: Aurelie Thiele, P.C. Rossin Assistant Professor, Lehigh University, 200 W. Packer Avenue, Bethlehem, PA, 18015, United States, aut204@lehigh.edu

1 - Risk in Revenue Management and Dynamic Pricing

Yuri Levin, Assistant Professor, School of Business, Queen's University, 143 Union Street, Kingston, ON, K7L 3N6, Canada, ylevin@business.queensu.ca, Jeffrey McGill, Mikhail Nediak

We present a model for optimal dynamic pricing of perishable products that incorporates a simple loss-probability risk measure that permits control of the probability that total revenues fall below a minimum acceptable level. This model is particularly appropriate for inventory clearance of high-value items, sales of single-class transportation services or hotel accommodations.

2 - Robust Revenue Management with Dynamic Budgets of Uncertainty

Aurelie Thiele, P.C. Rossin Assistant Professor, Lehigh University, 200 W. Packer Avenue, Bethlehem, PA, 18015, United States, aut204@lehigh.edu

We present an approach to dynamic pricing with imperfect demand information based on robust optimization techniques and the sequential update of a budget of uncertainty, whose initial value quantifies the decision-maker's risk aversion. At each time period the manager decides whether to use some of his budget to protect against present uncertainty or to keep it for later use. We connect our results with traditional dynamic programming and the optimal pricing strategy in that framework.

3 - Risk-Averse Newsvendor Networks: Resource Flexibility, Sharing, and Hedging

Jan Van Mieghem, Harold L. Stuart Distinguished Professor of Managerial Economics, Professor of Operations Management, Kellogg School of Management, Northwestern University, MEDS Department, 2001 Sheridan Road, Evanston, IL, 60208-2009, United States, VanMieghem@kellogg.northwestern.edu

We discuss how differences in risk exposure and risk attitude affect optimal resource levels in a multi-product network. While the focus is on theory, results may apply to capacity controls on recent flexible revenue management products. Ideas are illustrated by two networks that serve two markets through two dedicated or one flexible resource but differ in the position of the flexible resource. Revenue maximization suggests to increase (decrease) parallel (serial) flexibility.

4 - Pricing Dynamics of Competitors Whose Models Ignore Competition

Anton Kleywegt, Associate Professor, Georgia Institute of Technology, School of Industrial Systems Engineering, Atlanta, GA, 30332, United States, anton@isye.gatech.edu, William L. Cooper, Tito Homem-de-Mello

We study a duopoly in which sellers do not have the correct model specification. The demand model that each seller estimates with the seller's data, models the quantity demanded as a function of the price of the seller, and these models do not include the price of the other seller. We compare the resulting dynamical behavior with the outcomes in other settings, such as equilibria of well informed competitors, the outcomes of collaborators, and the outcomes when there is asymmetric information.

■ MA53

Room 414

Inventory Management: Lead Time and Yield Uncertainty

Contributed Session

Chair: Keli Feng, Assistant Professor, St. Cloud State University, 720 Fourth Avenue South, St. Cloud, MN, 56301, United States, kfeng@stcloudstate.edu

1 - Continuous Review Inventory Policies with Supplier Risk: Partial Yield and Supply Stoppage

Xinmin Wu, PhD Candidate, North Carolina State University, Operations Research Programs, Raleigh, NC, 27695, United States, xwu@ncsu.edu, Arun Gupta, Robert Handfield

We examine the impact of (Q,r) policies by a supplier with two stages of partial yield and one stage of supply off. In additional to Poisson demand, we assume that each supply stage duration is exponentially distributed. An efficient heuristics based on pattern search is put forward to search for the optimal policy with fill rate constraint. Numerical examples and Monte Carol simulation results are presented to evaluate our approaches.

2 - An Inventory System with Two Randomly Available Suppliers and Stochastic Lead Times

Esmail Mohebbi, Assistant Professor, Department of Industrial & Management Systems Engineering, University of Nebraska - Lincoln, Lincoln, NE, 68588-0518, United States, emohebbi@unlnotes.unl.edu, Nicolas Robayo

We consider the problem of sole versus dual sourcing in a continuous-review inventory system with stochastic demand and non-zero lead time where each supplier alternates randomly between an available and an unavailable state. We examine the merit of dual sourcing as a means of alleviating the impact of such uncertainty in the supply process and present some results based on an analytical model.

3 - Modeling Inventory Systems with Random Demand and Random Lead Times in Regional Supply Chains

Elena Valentina Gutierrez, Assistant Teacher, Universidad de Antioquia, Calle 67 No. 53-108 Udea - B.21-OF405, Medellin, Colombia, evlaila@udea.edu.co, Carlos Julio Vidal Holguìn, Hector Hernan Toro Diaz

Randomness of demand and lead times is not yet considered in the design of inventory systems in most Colombian companies. We developed a model that incorporates these factors and that allows defining coordinated inventory policies for final products and raw materials. Considering a periodic review system and using the Sample Average Approximation method (SAA), we developed a computational tool for the model, and applied it in a food company located in Valle del Cauca, Colombia.

4 - Goal-Driven Inventory Management

Geoffrey Bryan Chua, PhD student, National University of Singapore, Department of Decision Sciences, NUS, BIZ2 Building, #01-02, 1 Business Link, Singapore, 117592, Singapore, geoffreychua@nus.edu.sg, Melvyn Sim

Current inventory theory encompasses a rich collection of deterministic and stochastic models, multi-period models, and models with alternative decision objectives. Our paper adds to the literature on alternative objectives by using a goal-driven optimization framework, which combines an aspiration level criterion with a penalty for intensity of goal violation. Interestingly, our results show that the optimal policies from the expected profit case are preserved under our proposed framework.

5 - Safety Stocks In MRP: A Two Moment Approximation

Keli Feng, Assistant Professor, St. Cloud State University, 720 Fourth Avenue South, St. Cloud, MN, 56301, United States, kfeng@stcloudstate.edu, Uday Rao

We examine a single end product, discrete time inventory replenishment problem in a material requirements planning (MRP) environment with demand uncertainty and supply capacity limits on replenishment orders. We develop a stochastic programming model to determine replenishment orders over the planning horizon. We propose a novel two-moment approximation approach and evaluate order-up-to inventory policy as well. We also provide computational results and managerial insights on this problem.

■ MA54

Room 415

Pricing: The Interface of Operations and Marketing

Cluster: Operations and Marketing for Emerging Markets

Invited Session

Chair: Burak Kazaz Assistant Professor, University of Miami, School of Business, 414 Jenkins Building, Coral Gables, FL, 33124, United States, bkazaz@miami.edu

1 - Dynamic Joint Pricing and Inventory Control with Multiplicative Demand and Fixed Order Cost

Yuyue Song, Faculty of Business Administration, Memorial University, St. John's, NL, A1B 3X5, Canada, ysong@mun.ca, Saibal Ray, Tamer Boyaci

We consider the dynamic joint pricing and inventory control problem with multiplicative price-sensitive stochastic demand and fixed order cost. For both the lost sale model and the backlogging model with non-stationary parameters, we show that an (s, S, A, p) policy is optimal. For some special cases, we show that either (s, S, P) policy or base-stock policy is optimal.

2 - Vertical Integration with Price-Setting Competitive Newsvendors

Chongqi Wu, Assistant Professor, Alabama A&M University, PO Box 429, Normal, AL, 35762, United States, cqwu72@yahoo.com, Dilip Chhajed, Nicholas Petruzzi

Consider two manufacturers, each producing a substitutable product and selling it through either a decentralized or an integrated retailer, modeled as a price-setting newsvendor. A multiplicative demand function incorporating a uniform random factor is assumed. Under a uniform distribution on [0, x], the equilibrium design does not depend on x; under a uniform distribution on [1-r, 1+r], an increase in r favors the integrated structure and hurts the decentralized one.

3 - Structural Properties of Buyback Contracts for Price-Setting Newsvendors

Saibal Ray, Desautels Faculty of Management, McGill University, 1001 Sherbrooke Street West, Montreal, H3A1G5, Canada, Saibal.Ray@McGill.ca, Shanling Li, Yuyue Song

This paper studies a buyback contract in the Stackelberg framework of a manufacturer selling to a price-setting, newsvendor retailer. Using an analytical model which focuses on a multiplicative demand form, we generalize previous results and produce new structural insights. We identify the necessary and sufficient conditions for the optimal contract to be distribution-free, and for a no-buyback contract to be optimal from the manufacturer's perspective.

4 - Pricing and Production Planning under Yield Uncertainty with Multiple Customer Segments

Burak Kazaz, Assistant Professor, University of Miami, School of Business, 414 Jenkins Building, Coral Gables, FL, 33124, United States, bkazaz@miami.edu, Brian Tomlin, Nenad Jukic

This paper investigates the combined pricing and production planning decisions for a producer of medical supplies that serves two customer segments and faces yield uncertainty. The model considers the new regulation that requires producers to make available the price information of lower-level customer segments to its higher-level customers. The sharing of price information is done by using an information system that features a database with polyinstantiated data.

5 - Efficient Contract Design in Multi-Principal Multi-Agent Supply Chains

Thomas Weber, Assistant Professor, Stanford University, Management Science and Engineering, Terman Engineering Center, Stanford, CA, 94305-4026, United States, webert@stanford.edu, Hongxia Xiong

We consider a general multi-principal multi-agent contracting game in a complete-information supply-chain setting and determine coordinating equilibrium transfer schedules in closed form. We allow for multidimensional actions and arbitrary payoff externalities between all members of the supply chain. For the coordinating contracts to exist it suffices that all payoff functions are continuous on the compact action sets in a general sense that accommodates discrete action sets.

■ MA55

Room 416

Technical Issues in DEA

Cluster: Data Envelopment Analysis

Invited Session

Chair: Hiroshi Morita, Professor, Department of Information and Physical Sciences Graduate School of Information Science and Technology, Osaka University, 2-1 Yamadaoka, Suita, 565-0871m, Japan, morita@ist.osaka-u.ac.jp

1 - DEA Model for Supply Chain Network Redesign

Seungkee Baek, GRIPS, 7-22-1, Roppongi, Minatoku, Tokyo, Japan, seungkee@grips.ac.jp, Kaoru Tone

Well designed supply chain network will guarantee successful performance of supply chain members. We evauate relative efficiency of supply chain network using DEA and propose strategic approach for performance improvement.

2 - Which Strategy to Adopt in Boom and Bust? A DEA Analysis on Software Companies: 1995-2004

Shanling Li, Associate Professor, McGill University, 1001 Sherbrooke Street West, Montreal, PQ, H3G 1A5, Canada, shanling.li@mcgill.ca, Sandra Slaughter, Jennifer Shang

For software companies, the correct choice, implementation and evolution of a business strategy can provide considerable competitive advantages. This research sets out to discover exactly how different business strategies influenced the three capabilities: marketing, operations and R&D, in economic boom and bust. Both DEA window analysis and stochastic efficiency frontier approaches are used and compared. We derive managerial insights and discuss strategic implications.

3 - Variable Selection by SN Ratio for Data Envelopment Analysis

Hiroshi Morita, Professor, Department of Information and Physical Sciences Graduate School of Information Science and Technology, Osaka University, 2-1 Yamadaoka, Suita, 565-0871m, Japan, morita@ist.osaka-u.ac.jp

We introdude the concept of SN ratio into variable selection for data envelopment analysis, where the suitable variables should be selected according to the external information of efficiency. SN ratio is used at Mahalanobis Taguchi system to discrimination problem of two populations. As a case study, we adopt the Nikkei financial data to establish the evaluation model of the firm's performance by selecting appropriated variables.

Monday, 10:00am - 11:30am

■ MB01

Room 301

Online Network Design

Sponsor: Optimization/ Network and Combinatorial Optimization
Sponsored Session

Chair: Seffi Naor, Professor, Technion - Israel Institute of Technology, Computer Science Department, Haifa, 32000, Israel, naor@cs.technion.ac.il

1 - Oblivious Network Design
Anupam Gupta, Professor, Carnegie-Mellon University, Computer Science Department, 5000 Forbes Avenue, Pittsburgh, PA, 15213, United States, anupamg@cs.cmu.edu

We consider a network design problem in which the cost of the flow routed between sources and sinks is a concave cost function; the goal is to minimize the total cost incurred. The routing has to be oblivious: when a terminal pair makes its routing decisions, it does not know the current flow on the network nor the identity of the other pairs in the system. We develop a framework to model oblivious network design problems and give algorithms with poly-logarithmic competitive ratio.

2 - Online Network Design with Economies of Scale
Adam Meyerson, Professor, University of California, Los Angeles, 4732 Boelter Hall, Los Angeles, CA, 90095, United States, awm@cs.ucla.edu

The steiner tree problem where edge costs are concave increasing functions in the demand is considered. Finding a minimum-cost flow in this model has received a great deal of attention and poly-logarithmic approximation results are known. The online variant of these problems, where demand arrives gradually and must be routed upon arrival, is somewhat less studied. In this talk a poly-logarithmic competitive algorithm for the single commodity variant is presented.

3 - How to Distribute Antidote to Control Epidemics in a Network
Amin Saberi, Professor, Stanford University, Management Science and Engineering, Stanford, CA, 94305, United States, amin.saberi@gmail.com

Thresholds for an infection to become an epidemic are know to exist in mathematical epidemiology. Recent work on heterogeneous networks showed that they can be prone to infection spread at arbitrarily low infection rates. As many real-world networks exhibit this behavior, we consider strategies for distributing curing resources in such networks. We show that distributing vaccine or antidote in proportion to the connectedness of an individual ensures a non-zero threshold.

■ MB02

Room 302

Joint Session Open-Source/ICS: Open-Source Branch-and-Bound Solvers from Sandia National Laboratories

Cluster: Open-Source Software: Open Source, Open Standards, Open Data, INFORMS Computing Society
Invited Session

Chair: Cynthia Phillips, Distinguished Member of Technical Staff, Sandia National Laboratories, Mail Stop 1110, PO Box 5800, Albuquerque, NM, 87185-1110, United States, caphill@sandia.gov

1 - ACRO: A Common Repository for Optimizers
William Hart, Distinguished Member of Technical Staff, Sandia National Laboratories, Mail Stop 1110, PO Box 5800, Albuquerque, NM, 87185-1110, United States, wehart@sandia.gov

We give an overview of Acro, an open-source software project integrating many optimization software packages including libraries and frameworks developed at Sandia National Laboratories and publicly available third-party libraries. Acro software packages are grouped into projects providing support for global and local optimization and mixed-integer programming. Parallel optimizers support DOE applications. Acro supports portability tests, nightly build tests, and software quality assessment.

2 - PICO: Parallel Integer and Combinatorial Optimizer
Cynthia Phillips, Distinguished Member of Technical Staff, Sandia National Laboratories, Mail Stop 1110, PO Box 5800, Albuquerque, NM, 87185-1110, United States, caphill@sandia.gov, Jonathan Eckstein, William Hart

We will summarize the capabilities of the PICO mixed-integer programming solver and PEBBL, the general branch-and-bound framework upon which PICO is built. PICO and PEBBL were built to exploit the thousands of processors available on DOE's massively-parallel machines, but they can run in serial. We will emphasize recent new capabilities such as checkpointing, enumeration of near-optimal solutions, cut support, performance enhancement, and software quality activities.

3 - Customizing PICO Searches Using Multidimensional Symbols
Jonathan Berry, Principal Member of Technical Staff, Sandia National Laboratories, Mail Stop 1110, PO Box 5800, Albuquerque, NM, 87185-1110, United States, jberry@sandia.gov, Cynthia Phillips, William Hart

Mathematical programming languages like AMPL allow developers to express a mixed-integer program (MIP) using natural multidimensional variables rather than the linear representation of general MIP solvers. The PICO solver provides scripts to automatically generate derived PICO C++ classes aware of names from an AMPL model. We show examples of custom heuristics and cut generation algorithms using these names. PICO can use free glpk software to interpret AMPL models.

4 - GNLP, an Open-Source Package for Rigorous Global Nonlinear Programming on Parallel Machines
David M. Gay, Principal Member of Technical Staff, Sandia National Laboratories, Mail Stop 0370, PO Box 5800, Albuquerque, NM, 87185-0370, United States, dmgay@sandia.gov, Pradeep Polisetty, Edward Gatzke, William Hart

This talk gives an overview of GNLP, a branch-and-bound code for rigorous global optimization of algebraically specified nonlinear functions subject to nonlinear constraints involving bounded continuous or discrete variables. GNLP builds on PICO's facilities for parallel computing, rewrites expression graphs to obtain convex or linear bounding functions, and uses some facilities from COCONUT (another open-source global-optimization project). We give preliminary results from work in progress.

■ MB03

Room 303

Advances in Large-Scale Nonlinear Optimization

Sponsor: Optimization/ Nonlinear Programming
Sponsored Session

Chair: Richard Waltz, President, Ziena Optimization, Inc., Northwestern University, 2145 Sheridan Road, Evanston, IL, 60208, United States, rwaltz@ece.northwestern.edu

1 - General-Purpose Optimization Techniques for Partial-Differential-Equation-Constrained Problems
Frank Curtis, Graduate Student, Northwestern University, 2145 Sheridan Road, C230, Evanston, IL, 60208, United States, fecurt@gmail.com, Jorge Nocedal

We investigate optimization-specific issues that arise when attempting to apply a SQP method to equality-constrained problems defined by systems of differential equations. A major obstacle for employing such an approach is often the inability to explicitly form the constraint Jacobian and, consequently, to factor the KKT matrix. We study alternatives to direct factorization and remark on related issues such as inertia control, inexactness in step computation, and appropriate merit functions.

2 - QPPAL: A Friendly Solver for Large-Scale QPs
Sven Leyffer, Computational Mathematician, Argonne National Laboratory, 9700 S. Cass Avenue, Argonne, IL, 60439, United States, leyffer@mcs.anl.gov, Michael Friedlander

Our new approach for solving quadratic programs (QPs) is based on gradient projection, augmented Lagrangian, and filter methods. Using gradient projection, we approximately minimize the augmented Lagrangian to estimates the optimal active set. This active set estimate is explored further by approximately solving an equality constrained QP. Global convergence is promoted through a filter. Our implementation is based on the large-scale toolboxes TAO and PETSc.

3 - Preconditioning Interior-Point Methods for Nonlinear Optimization
Richard Waltz, President, Ziena Optimization, Inc., Northwestern University, 2145 Sheridan Road, Evanston, IL, 60208, United States, rwaltz@ece.northwestern.edu, Long Hei, Jorge Nocedal

Interior-point methods that use an iterative approach (such as the conjugate gradient method) may be needed when solving constrained problems with large, dense Hessian matrices. If in addition the Hessian is ill-conditioned, preconditioners may be needed to improve the efficiency. This talk will look at some general purpose preconditioners for interior-point methods. Numerical results will be presented using the KNITRO software package.

4 - Duality and Exact Penalization via A Generalized Augmented Lagrangian Function

Xiaoqi Yang, Professor, Hong Kong Polytechnic University, Department of Applied Mathematics, Hung Hom, Kowloon, Hong Kong, mayangxq@polyu.edu.hk

In this talk, we will discuss the existence of an optimal path and its convergence to the optimal set of a primal problem of minimizing an extended real-valued function via a generalized augmented Lagrangian and corresponding generalized augmented Lagrangian problems, in which no convexity is imposed on the augmenting function. We will show that these results further imply a zero duality gap property between the primal problem and the generalized augmented Lagrangian dual problem. A necessary and sufficient condition for the exact penalty representation in the framework of a generalized augmented Lagrangian is obtained. In the context of constrained programs, we will show that generalized augmented Lagrangians present a unified approach to several classes of exact penalization results.

■ MB04

Room 304

Advances in Integer Programming

Sponsor: Optimization/ Integer Programming

Sponsored Session

Chair: Ahmet B. Keha, Assistant Professor, Department of Industrial Engineering, Arizona State University, PO Box 875906, Tempe, AZ, 85287-5906, United States, ahmet.keha@asu.edu

1 - Uncapacitated Lot-Sizing with Backlogging: The Convex Hull

Simge Kucukyavuz, Assistant Professor, University of Arizona, Systems and Industrial Engineering, Tucson, AZ, 85721, United States, simge@sie.arizona.edu, Yves Pochet

In this talk, we give facets of the uncapacitated lot-sizing polyhedron with backlogging that subsume all known inequalities for this polyhedron. We show that these inequalities are enough to give the convex hull of solutions. We give an efficient combinatorial separation algorithm for an important special case. Finally, we summarize our computational results.

2 - Branch-and-Cut for Piecewise Linear Optimization

Ismael de Farias, Assistant Professor, SUNY Buffalo, 403 Bell Hall, Buffalo, NY, 14260, United States, defarias@buffalo.edu, Hongxia Zhao, Justin Yates, Ming Zhao

Any nonlinear optimization problem can be formulated approximately as a piecewise linear optimization problem (PLOP). We will discuss representability, modeling, and cutting planes for continuous and discontinuous PLOP and a branch-and-cut algorithm for them.

3 - Polyhedral Aspects of Nonconvex, Lower Semicontinuous Piecewise Linear Optimization

Juan Pablo Vielma, School of Industrial and Systems Engineering, Georgia Institute of Technology, 765 Ferst Drive, NW, Atlanta, GA, 30332-0205, United States, jvielma@isye.gatech.edu, George L. Nemhauser, Ahmet B. Keha

We present a SOS2 based branch-and-cut algorithm for solving linear problems with nonconvex lower semi-continuous separable piecewise linear cost functions. We show how valid inequalities (cuts) previously introduced by Keha et. al. for the continuous case can be extended to the lower semi-continuous case. We then introduce a simple generalization of one of these cuts and two new cuts for fixed charge jumps. Finally, we present computational results showing the effectiveness of these cuts.

4 - Monitoring Progress of Branch-and-Bound Algorithms

Osman Ozaltin, Graduate Student, University of Pittsburgh, 1048 Benedum Hall, Pittsburgh, PA, 15261, United States, ozaltn@yahoo.com, Brady Hunsaker

The most common methods to monitor the progress of branch-and-bound algorithms have drawbacks, particularly the fact that they do not improve monotonically. We consider new methods for monitoring the progress of branch-and-bound algorithms using the data extracted from the branch-and-bound tree. Our goal is to provide users with more useful information about the progress of the algorithm as well as the likelihood of it finding better solutions.

■ MB05

Room 305

Sampling-Based Methods for Stochastic Integer Programs

Sponsor: Optimization/ Stochastic Programming

Sponsored Session

Chair: Guzin Bayraksan, Assistant Professor, Department of Systems and Industrial Engineering, The University of Arizona, Tucson, AZ, 85721, United States, guzinb@sie.arizona.edu

1 - Bounds on the Value of Stochastic Mixed-Integer Programs

Nan Kong, Assistant Professor, Industrial and Management Systems Engineering, University of South Florida, ENC 2505, Tampa, FL, 33620, United States, kong@eng.usf.edu, Andrew Schaefer, Burhaneddin Sandikci

We consider a general two-stage stochastic mixed-integer program with discrete distribution and finite support. We derive a class of bounds for the optimal objective value of this problem by solving a number of truncated deterministic equivalent problems, each of which corresponds to a subset of scenarios. For the cases where the number of scenarios is large, we apply sampling techniques. Computational results for several stochastic linear and integer programs are presented.

2 - Stochastic Approximation Algorithms and Max-Norm Projections

Huseyin Topaloglu, Assistant Professor, Cornell University, 223 Rhodes Hall, Ithaca, NY, 14853, United States, huseyin@orie.cornell.edu, Sumit Kunnumkal

If the iterates of a stochastic approximation algorithm are constrained to lie in a closed and convex set W, then the standard approach is to project the iterates onto this set. In this talk, we consider the case where the projection of the vector z onto W is chosen as a vector v in W that minimizes the max norm of z-v. We show how our results can be used to improve the performance of Q-learning algorithm.

3 - Accelerating Cut Generation in D2 and D2-BAC Algorithms for Stochastic Mixed-Integer Programs

Suvrajeet Sen, Professor, Department of Systems and Industrial Engineering, University of Arizona, Tucson, AZ, 85721, United States, sen@sie.arizona.edu, Yang Yuan

The D2 and D2-BAC algorithms use strong disjunctive cuts in each iteration of the respective algorithms. However, these cuts can be somewhat time-consuming when the number of outcomes are very large. We show to speed-up the cut generation process. This capability is particularly critical for sampled decomposition algorithms for stochastic mixed-integer programs.

■ MB06

Room 306

Project Management

Contributed Session

Chair: Roel Leus, Assistant Professor, Katholieke Universiteit Leuven, Research Center for OR & Business, Naamsestraat 69, Leuven, 3000, Belgium, roel.leus@econ.kuleuven.be

1 - Adaptive Scheduling of Projects with Stochastic Activity Durations

Vera Tilson, PhD Candidate, Case Western Reserve University, 10900 Euclid Avenue, Cleveland, OH, 44106, United States, VeraT@alum.mit.edu, Joseph Szmerekovsky, Matthew Sobel

We investigate adaptive scheduling that seeks to maximize EPV. It is assumed that the tasks are exponentially distributed, and there is an outlay of funds at the start of each task, and a payoff at the end of the project. We report on the computational performance of our algorithm, and compare our results with the performance of the late start time heuristic.

2 - The Evaluation and Implementation of DSpace at the Intercontinental Hotels Group: Project Management

Michael King, Research Assistant, University of Virginia, 6108 Laura Lane, Crozet, VA, 22932, United States, michael.king@comm.virginia.edu

The Intercontinental Hotels Group NYSE:IHG is the world's largest hospitality and accommodation provider by room count. In 2004, IHG had $4.23 B in revenue. IHG's primary business model is franchising. The company's flagship franchise is the Holiday Inn brand. 2002 was a banner growth year for IHG and the volume of CRM projects posed a digital retention problem. The DSS department initiated a digital repository project and managed the project with a departmental project portfolio process.

3 - A Mathematical Programming Approach for Critical Path Analysis with Fuzzy Activity Times

Matthew Liberatore, Professor, Department of Decision and Information Technology, Villanova University, 800 Lancaster Avenue, Villanova, PA, 19085, United States, matthew.liberatore@villanova.edu

Fuzzy logic has been proposed as an alternate approach for quantifying uncertainty relating to project activity duration. The extension principle of fuzzy logic leads to the development of a mathematical programming approach that constructs the fuzzy set of critical path lengths and fuzzy activity and path criticality indices. Computational studies based on a subset of the Patterson problems demonstrate the applicability of the suggested solution approach.

4 - Using Critical Chain Methodology to Improve Management of Plant Maintenance Operations

Samir Shah, Graduate Student, Rutgers School of Business, 227 Penn Street, Camden, NJ, 08102, United States, sshahmd@camden.rutgers.edu, Rajiv Misra, Alok Baveja, Ajai Kapoor

This work discusses the implementation of robust critical chain project management (CCPM) principles in a plant maintenance environment involving one of the larger steel manufacturers in the world. Traditional project management techniques did not yield target reduction in machine downtimes which in turn had a significant impact on the profitability of this organization. Implementation of CCPM dramatically improved throughput, reduced lead times and increased profits by as much as 25%.

5 - R&D-Project Scheduling with Technology Risks

Roel Leus, Assistant Professor, Katholieke Universiteit Leuven, Research Center for OR & Business, Naamsestraat 69, Leuven, 3000, Belgium, roel.leus@econ.kuleuven.be, Bert De Reyck, Pascale Crama

Due to technological risks a typical R&D project may have to be terminated before completion, each of its stages having a specific likelihood of success. In the project-scheduling literature this technological uncertainty has typically been ignored. In this paper we examine how to schedule projects in order to maximize their expected net present value when the project activities have a probability of failure and when an activity's failure leads to overall project termination.

■ MB07

Room 307

The Science of (Optimizing) Better

Sponsor: INFORMS Computing Society

Sponsored Session

Chair: Hans D. Mittelmann, Professor, Arizona State University, Box 871804, Tempe, AZ, 85287-1804, United States, MITTELMANN@asu.edu

1 - Benchmarking of Continuous Optimization Software

Hans D. Mittelmann, Professor, Arizona State University, Box 871804, Tempe, AZ, 85287-1804, United States, MITTELMANN@asu.edu

In this talk we will present results from evaluating continuous optimization software, in particular in areas of recent interest such as semidefinite programming.

2 - MIPLIB 20XX: On the Difficulties to Find a Good Set of MIP Instances for Benchmarking

Thorsten Koch, Senior Scientist, Konrad-Zuse-Zentrum für Informationstechnik Berlin, Takustrafle 7, 14195 Berlin-Dahlem, Germany, koch@zib.de, Alexander Martin, Tobias Achterberg

Benchmarking MIP solvers is difficult at best. How could we compare the performance of two solvers in a fair and meaningful way? What are suitable criteria for selecting problem instances in a benchmark? Only difficult to solve instances? Constructing unsolvable instances is always possible. Only real-world examples? People who want results tend to use models that work well with existing solver technology. We will try to propose some answers to these questions. Discussion welcome.

3 - Performance Analysis of Grid-Enabled GAMS

Steven Dirkse, GAMS Development, 1217 Potomac Street NW, Washington, DC, 20007, United States, sdirkse@gams.com

GAMS is grid-enabled, i.e. independent solver jobs run in parallel with the results collected as they become available, allowing the user to take advantage of cheap and powerful computational grids with no programming effort. We demonstrate this by partitioning a MIP model for solution on a grid. Using the GAMS performance analysis tools (www.gamsworld.org/performance) we measure the importance of the parameters involved (e.g. partitioning algorithm, MIP solver, grid nodes used).

4 - State-of-the-Optimization Using Xpress-MP v2006

Alkis Vazacopoulos, Director, Dash Optimization Inc., 560 Sylvan Avenue, Englewood Cliffs, NJ, 07632, United States, av@dashoptimization.com, Gabriel Tavares, Richard Laundy

The state of the Xpress-MP v2006 Linear Programming (LP) and Mixed Integer Programming (MIP) solvers is analyzed in this study. Some new features of v2006 will be described including: the addition of in-tree cuts for parallel MIP, a feasibility pump heuristic, a 64 bit version, and improved solutions and preprocessing interfaces.

■ MB08

Room 308

KLIC III

Sponsor: Technology Management

Sponsored Session

Chair: Anita Tucker, Assistant Professor, University of Pennsylvania, 551 Huntsman Hall, 3730 Walnut Street, Philadelphia, PA, 19066, United States, tuckera@wharton.upenn.edu

1 - Knowledge Management for Product and Process Design Teams

Cheryl Gaimon, Regents' Professor, Georgia Institute of Technology, College of Management, 800 West Peachtree Street, Atlanta, GA, 30308-0520, United States, Cheryl.Gaimon@mgt.gatech.edu, Gulru Ozkan

We consider strategies for managing product and process design team knowledge. Net revenue is a function of knowledge. Each team's knowledge increases from learning-by-doing, knowledge transfer, and induced learning. We determine the optimal rate and direction for knowledge transfer and the optimal rate that induced learning should be pursued over time. Key results include conditions that drive different managerial strategies including the delay in knowledge creation.

2 - Myopia of Selection: Does Organizational Adaptation Limit the Efficacy of Population Selection?

Hart Posen, Assistant Professor of Strategy, Ross School of Business, University of Michigan, 701 Tappan Street, Ann Arbor, MI, 48109, United States, hposen@umich.edu, Daniel Levinthal

A central tenet of the evolutionary analogue in organization theory is that selection disproportionately removes less fit firms. However, the analogue is imperfect because variation is not blind - firms engage in adaptive learning. Is the efficacy of selection invariant to the nature of the adaptation process? We find that learning intended to enhance the performance of individual firms may have the unintended consequence of reducing the efficacy of selection in identifying superior firms.

3 - Riffing: The Multivocality of Innovative Action

David Obstfeld, Assistant Professor, University of California, Irvine, The Paul Merage School of Business, Irvine, CA, 92697, United States, DObstfel@uci.edu

Riffing refers to verbal representations by one individual of the voice or lived-in experience of another individual or category of individuals. Riffing is a variant of knowledge articulation whereby knowledge is made more explicit, usable, or relevant to the situation at hand. Field observations in an automotive manufacturer suggest innovation advocates exhibit a propensity to riff and draw from a repertoire of voices to make compelling depictions of existing and envisioned business processes.

4 - Learning While Sourcing: Productivity Gains While Coordinating Software Development

Paulo Gomes, Assistant Professor, Universidade Nova de Lisboa, Campus de campolide, Lisbon, 1099-032, Portugal, pgomes@fe.unl.pt, Steve Rosenthal, Nitin Joglekar

Organization theory makes a distinction between work conducted within an organization's technical core and coordination processes that buffer this core from the environment. We build on this distinction to look for evidence of learning while sourcing. Learning is not observed in terms of total effort. Segregation yields significant effects: learning associated with the management of distributed software development is significant for coordination tasks and less pronounced for technical tasks.

■ MB09

Room 309

Innovation and the Management of the Development Process

Cluster: New Product Development

Invited Session

Chair: Gary Pisano, Professor of Business Administration, Harvard Business School, Morgan Hall 417, Boston, MA, 02163, United States, gpisano@hbs.edu

1 - R&D Portfolio Strategy, Diversification and Performance: An Information Perspective

Gary Pisano, Professor of Business Administration, Harvard Business School, Morgan Hall 417, Boston, MA, 02163, United States, gpisano@hbs.edu, Francesca Gino

In this paper, we take an information-based approach to R&D diversification. Projects with similar information processing problems belong to the same "information regime." Using project-level data from the pharmaceutical industry, we find evidence that firms diversify their portfolios across different information regimes. We also find that there are performance costs of such diversification.

2 - Team Experience and Returns to Management in Software Services
Brad Staats, Doctoral Candidate, Harvard Business School, Morgan Hall 428A, Boston, MA, 02163, United States, bstaats@hbs.edu, David Upton, Robert Huckman

Using data from an Indian software services firm we examine the returns to project-level management and team experience.

3 - Resource Allocation in the Pharmaceutical Development Process
Christian Terwiesch, Associate Professor, University of Pennsylvania, 548 JMHH, Philadelphia, PA, 19104, United States, terwiesch@wharton.upenn.edu, Karl Ulrich, Karan Girotra

We present a dynamic capacity allocation model that supports the portfolio planning process in the pharmaceutical industry.

■ MB10

Room 310

Software Demonstration

Cluster: Software Demonstration

Invited Session

1 - Imagine That, Inc. - ExtendSim
Dave Krahl, Imagine That Inc., 6830 Via Del Oro, Suite 230, San Jose, CA, 95119, davek@imaginethatinc.com

See the future of the Extend simulation application. Introducing ExtendSim 7Ö with its revolutionary new simulation technology and 3D animation. Core ExtendSim features including hierarchical model building, user interface creation, and interactive modeling will also be showcased.

2 - Decisioneering, Inc. - Crystal Ball Software
Tracy Manchego, Decisioneering, Inc., 1515 Arapahoe Street, Suite 1300, Denver, CO, 80202, tmanchego@crystalball.com

Crystal Ball® is a suite of Microsoft® Excel-based applications for Monte Carlo simulation, forecasting, optimization and real options analysis. Crystal Ball transforms your spreadsheets into dynamic models that solve almost any problem involving uncertainty, variability and risk. We provide software, training and consulting services to understand, communicate and manage risk.

■ MB11

Room 311

Joint Session Minortiy/Optimization: Discrete Optimization II

Sponsor: Minority Issues, Optimization/Integer Programming, Optimization/Network and Combinatorial Optimization

Sponsored Session

Chair: Illya Hicks, Associate Professor, Texas A&M University, Industrial and Systems Engineering MS 3131, Zachry Engineering Center, College Station, TX, 77843-3131, United States, ivhicks@tamu.edu

1 - MIR Inequalities, Mixed Integer Knapsack Problems and the Closure of Single-row Systems : Part I
Ricardo Fukasawa, PhD Student, Georgia Institute of Technology, 765 Ferst Drive, NW, Atlanta, GA, 30332, United States, rfukasaw@isye.gatech.edu, Marcos Goycoolea, William Cook

The purpose of this work is to develop a fast algorithm for optimizing over single row systems and use it as a subroutine to perform exact separation over such systems, extending the work of Andrew Boyd to this more general case. With such a tool in hand we will be able to analyze the practical potential of valid inequalities derived from single-row Mixed Integer Programs (in particular Mixed Integer Rounding inequalities) and potentially use it to generate cuts for general MIP's.

2 - Generalization of Cliques, Independent Sets and Coloring
Balabhaskar Balasundaram, PhD Candidate, Texas A&M University, Industrial and Systems Engineering, College Station, TX, 77843, United States, baski@tamu.edu, Sergiy Butenko, Illya Hicks

In this talk we will present a graph theoretic generalization of a clique, known as a k-plex, originally introduced in social network analysis. Based on this model, systematic generalizations for independent sets and coloring are also introduced. Computational complexity results, integer programming formulation and facets and valid inequalities for the associated polytope are presented. Branch-and-cut approaches are discussed and computational test results are provided.

3 - Generalized Mixed Integer Rounding Inequalities for Integer Programming Problems
Kiavash Kianfar, PhD Candidate, Department of Industrial Engineering, North Carolina State University, 458 Daniels Hall, Campus Box 7906, North Carolina State University, Raleigh, NC, 27695, United States, k_kianfar@ncsu.edu, Yahya Fathi

We present a new class of valid inequalities for the mixed integer programming problem. These valid inequalities are based on a generalization of the concept of mixed integer rounding that has been extensively discussed in the open literature. We present theoretical properties of these valid inequalities, compare them with existing valid inequalities, and discuss their relationship with facets of the master cyclic group polyhedra.

4 - MIR Inequalities, Mixed Integer Knapsack Problems and the Closure of Single-row Systems: Part II
Marcos Goycoolea, Universidad Adolfo IbaÒez, Santiago, Chile, marcos.goycoolea@uai.cl, Ricardo Fukasawa, William Cook

In this talk we focus on a key component of the exact separation algorithm for single row systems: an LP based branch-and-bound algorithm for solving mixed integer knapsack problems. The main feature of this algorithm is that it exploits cost and lexicographic dominance in order to significantly improve solution times. We compare the algorithm performance with CPLEX and discuss possible extensions of the approach.

■ MB12

Room 312

Leadership in Service Activities

Sponsor: Women in OR/MS

Sponsored Session

Chair: Sila Cetinkaya, Associate Professor, Texas A&M University, Industrial and Systems Engineering, College Station, TX, 77843, United States, sila@tamu.edu

1 - You Want to be a Journal Editor?
Candi Yano, Professor, University of California at Berkeley, 4141 Etcheverry Hall, Berkeley, CA, 94720-1777, United States, yano@ieor.berkeley.edu

This presentation will describe successful strategies for becoming involved in journal review processes and for moving up the levels of responsibility, from associate editor to department editor to journal editor. Responsibilities, obligations and expectations of the various editorial ranks will be described, along with professional development that is necessary or helpful in each of these roles.

2 - Lessons from the Founding of JFIG and Other Service Activities
Julie Swann, Assistant Professor, Georgia Institute of Technology, Industrial and Systems Engineering, Atlanta, GA, 30332, United States, jswann@isye.gatech.edu

As a junior faculty, many of us want to give back to our community, but this may conflict with our need to ensure time is spent on tenure-promoting activities. I will discuss my experiences in co-founding JFIG and participating in other service activities, offering any lessons learned on how to balance the competing tensions.

3 - Getting Involved in OR Education Initiatives and Activities
James Cochran, Louisiana Tech University, College of Administration & Business, PO Box 10318, Ruston, LA, 71055, United States, jcochran@cab.latech.edu

I will discuss my involvement with various INFORM-ED (the Education Forum of INFORMS) initiatives and activities and other OR education initiatives and activities. I will explain how I initially became involved, where my involvement has led me, how you can get involved, and the potential benfits of involvement.

4 - Volunteering, Social Capital and Professional Leadership
Michael Trick, General Chair, INFORMS Anuual Meeting, Carnegie Mellon University, Tepper School of Business, 5000 Forbes Avenue, Pittsburgh, PA, 15217, United States, trick@cmu.edu

Service in organizations can come about through unexpected directions. I'll talk about how an inability to remember web addresses led to a year of being president of INFORMS, and the key social capital aspects involved.

■ MB13

Room 313

Tutorial: Teaching a Traditional Optimization Course in a Non-traditional Manner

Sponsor: Education (INFORM-ED)

Sponsored Session

Chair: James Orlin, Professor, Massachusetts Institute of Technology, Operations Research Center, E53-363, Cambridge, MA, 02139, United States, jorlin@MIT.EDU

1 - Teaching a Traditional Optimization Course in a Non-Traditional Manner
James Orlin, Professor, Massachusetts Institute of Technology, Operations Research Center, E53-363, Cambridge, MA, 02139, United States, jorlin@MIT.EDU, Michael Metzger

This tutorial will share what we have learned in teaching an undergraduate optimization course at MIT over the past decade. While the syllabus is traditional, the presentation of class material is not. We will share how to use PowerPoint animation for teaching algorithms and other subject material. We will also discuss a variety of approaches for keeping students engaged and interested while they learn both traditional modeling and algorithms.

■ MB14

Room 314

Online Auctions I

Cluster: Auctions and e-Commerce

Invited Session

Chair: John Morgan, Professor, University of California at Berkeley, Haas School of Business, Berkeley, CA, 94720, United States, morgan@haas.berkeley.edu

1 - How Can You Price a Phrase? Search Engine Auctions as Evolving Practices

Charles W. Smith, charles.smith@qc.cuny.edu

Sponsored word/phrase Internet search engine auctions, like many emerging Internet markets, deal with what might be called virtual commodities that defy normal spatial-temporal parameters. These markets are also highly dependent upon modern computer and digital technologies. Perhaps most importantly, many of these markets are engaged in definitional transformations that involve not only changes in the ranking and values of parameters, but the introduction of new parameters. While a number of word/phrase auctions, each with its own peculiarities, are presently operative, the discussion that follows will deal exclusively with the two largest auctions: one sponsored by Overture and the other by Google.

2 - The Geography of Trade on eBay and MercadoLibre.com

Asis Martinez-Jerez, Assistant Professor, Morgan Hall 397, Harvard Business School, Soldiers Field Road, Boston, MA, 02163, United States, amartinezjerez@hbs.edu, Ali Hortacsu, Jason Douglas

This paper analyzes the geographic patterns of trade in two large online auction sites, eBay and MercadoLibre. The online auction environment can be considered "frictionless" in certain important dimensions, so trade should not be distance-dependent. However, we find that distance has a very negative and non-linear effect on trade as commerce is abnormally high within the city limits and abnormally low across borders.

3 - How Much is a Dollar Worth? Tipping versus Equilibrium Coexistence on Competing Online Auction Sites

John Morgan, Professor, University of California at Berkeley, Haas School of Business, Berkeley, CA, 94720, United States, morgan@haas.berkeley.edu

The equilibrium model of Ellison, Fudenberg, and Möbius (2004) predicts that, if two competing auction sites are coexisting, then: Seller revenues and buyer-seller ratios on each site should be approximately equal. We examine these hypotheses using field experiments selling identical items on the eBay and Yahoo auction sites. We find evidence that is inconsistent with the equilibrium hypotheses, and suggest that the eBay-Yahoo market is in the process of tipping. Robust statistical tests indicate that revenues on eBay are consistently 20 to 70 percent higher than those on Yahoo. In addition, eBay auctions attract approximately two additional buyers per seller than equivalent Yahoo auctions. We also vary the Yahoo ending rule from a hard close to soft close but find no statistically- or economically-significant changes in revenue or numbers of bidders. Moreover, the magnitude of the revenue and buyer-seller ratio disparity remains inconsistent with the notion of equilibrium coexistence even after accounting for various "frictions"associated with switching between the sites.

■ MB15

Room 315

Prediction Markets II

Cluster: Auctions and e-Commerce

Invited Session

Chair: Anthony Kwasnica, Assistant Professor, Penn State University, 332 Business Building, University Park, PA, 16802, United States, kwasnica@psu.edu

1 - Predicting Influenza

George Neumann, Professor of Economics, University of Iowa, Department of Economics, W388 Pappajohn Business Building, Iowa City, IA, 52242, United States, george-neumann@uiowa.edu, Forrest Nelson, Philip Polgreen

The official position of the CDC is that influenza outbreaks are not predictable. Using emergency room doctors and nurses as well as epidemiologists and clinical microbiologists we demonstrate that influenza is predictable. Using the state of Iowa and employing prediction markets to aggregate the information possessed by these health practitioners we show that useful predictions of influenza prevalence can be obtained 4 weeks in advance of an outbreak.

2 - Information Mechanisms

Paul J. Healy, Assistant Professor, Carnegie Mellon University, Tepper School of Business, 5000 Forbes Avenue, Pittsburgh, PA, 15213, United States, phealy@cmu.edu, Richard Lowery, John Ledyard

Markets are just one way to elicit predictions and to aggregate information from groups. Other mechanisms include pari-mutuel processes, voting, scoring rules, polls, etc. We examine the performance of many mechanisms in both simple and moderately complex environments. We find that markets and pari-mutuel mechanisms perform less well than usually advertised. Suitably designed polls and market scoring rules perform better - yielding more accurate and faster information aggregation.

3 - Security Design and Information Aggregation

Yiling Chen, Yahoo! Research, 45 W. 18th Street, 6th Floor, New York, NY, 10011, United States, cheny@yahoo-inc.com, Anthony Kwasnica

With two differently designed securities, we examine the impact of security design on the information aggregation ability of markets in laboratory experiments. Results show that markets with one security aggregate information signicantly better than markets with the other security, implying that information aggregation ability of markets is affected by the security design. Behavior of individual participants is then investigated to understand the observed market behavior.

■ MB16

Room 316

Dynamic Pricing: Issues and Challenges

Cluster: Dynamic Pricing and Forecasting

Invited Session

Chair: Soulaymane Kachani, Professor, Columbia University (IEOR Department), S.W. Mudd Building Room 334, New York, NY, United States, kachani@ieor.columbia.edu

1 - An MPEC Approach to Dynamic Pricing with Learning Under Competition

Carine Simon, PhD Student, MIT Operations Research Center, 77 Massachusetts Avenue, E40-149, Cambridge, MA, 02139, United States, casimon@mit.edu, Georgia Perakis, Soulaymane Kachani

We consider an oligopoly for multiple perishable products where each firm dynamically updates its optimal prices (resp. allocations), while learning the demand (resp. price) function, using observed data. We formulate the problem as a Mathematical Problem with Equilibrium Constraints (MPEC) and design a solutions algorithm. We prove that as the horizon increases, learning is achieved and discuss computational results.

2 - Approximation Algorithms for Stochastic Revenue Management

Ana Radovanovic, Research Staff Member, Stochastic Analysis Group, IBM, Mathematical Sciences Department, IBM TJ Watson Research Center, 1101 Kitchawan Road, Route 134, Yorktown Heights, NY, 10598, United States, aradovan@us.ibm.com, Retsef Levi

We consider a system with a single resource pool of capacity C that is facing demands from M different classes of customers. Each customer requests one unit of the resource for a certain period of time which is a-priori random; if served, he/she is willing to pay for the resource. Our goal is to find admission policies that (i) Can be computed efficiently; (ii) Are intuitive conceptually; (iii) Admit worst-case performance guarantees for any value of capacity C.

3 - Optimal Pricing and Production Planning for Subscription-Based Products

Ali Sadighian, PhD Student, Columbia IEOR, 325 Mudd Building, 500 W. 120th Street, New York, NY, 10027, United States, as2446@columbia.edu, W. Tim Huh, Soulaymane Kachani

In this talk, we address the problem of jointly setting production quantities, single-copy and subscription prices for subscription-based products such as magazines. We consider both the finite and infinite horizon cases, and provide a dynamic programming formulation for which we propose a single stage reduction. We extend the analysis to the competitive case and report on computational results.

4 - Network Capacity Management Competition

Houyuan Jiang, Professor, Judge Business School, University of Cambridge, Trumpington Street, Cambridge, CB2 1AG, United Kingdom, h.jiang@jbs.cam.ac.uk

We consider airline capacity management games where passengers can purchase same class tickets from competing airlines if they do not get tickets from their preferred airline. Four models are developed. We provide conditions for existence of a Nash or generalized Nash equilibrium for all four games and uniqueness of a Nash equilibrium for two games. For generalized Nash games, we propose a numerical algorithm that combines penalty and smoothing techniques and establish a convergence result.

■ MB17

Room 317

Simulation

Sponsor: Simulation

Sponsored Session

Chair: Bahar Biller, Assistant Professor, Carnegie Mellon University, Tepper School of Business, 5000 Forbes Avenue, Posner Hall 360, Pittsburgh, PA, 15213, United States, billerb@andrew.cmu.edu

1 - Multivariate Input Models for Asymmetric Dependence Structures

Bahar Biller, Assistant Professor, Carnegie Mellon University, Tepper School of Business, 5000 Forbes Avenue, Posner Hall 360, Pittsburgh, PA, 15213, United States, billerb@andrew.cmu.edu

Despite its flexibility in capturing a wide variety of distributional shapes, we show that the Vector-Autoregressive-To-Anything input model falls short in representing asymmetric dependence structures and extend it to work for such dependence structures via the use of copula theory, which has been used primarily for random vectors, for multivariate time-series input modeling. The resulting input models lead to fast and efficient sampling algorithms for driving stochastic simulations.

2 - Adaptive Control Variates Techniques for Steady-State Simulation

Sujin Kim, Cornell University, 206 Rhodes Hall, Ithaca, NY, 14853, United States, sk329@cornell.edu, Shane Henderson

We introduce an adaptive control variate scheme for estimating steady-state performance measures for stochastic systems using simulation. We use a procedure based on sample average approximation for tuning the control variate estimators. The underlying processes are assumed to be regenerative which allows establishing consistency of these estimators in an efficient way under mild conditions.

3 - Bootstrap Methods for Capturing Simulation Input Distribution Uncertainty

Russell Barton, Professor, Penn State University, Smeal College of Business, University Park, PA, 16802, United States, rbarton@psu.edu, Lee Schruben

In simulation, input distributions are usually constructed using finite samples of real data. This introduces an error component in the simulated performance that is not usually captured in the analysis of simulation output data, which affects the coverage probability of confidence intervals. Often this error dominates the error caused by the finite length of the simulation run. Under certain conditions bootstrap methods can provide intervals with approximately correct coverage.

4 - Simulation Optimization with Industrial Strength COMPASS

Barry Nelson, Professor, Northwestern University, Department of IEMS, 2145 Sheridan Road, Evanston, IL, 60208-3119, United States, nelsonb@northwestern.edu, Jie Xu

We present an algorithm for optimizing the expected performance of stochastic simulations with respect to integer-ordered decision variables. The algorithm combines the convergence theory of COMPASS (Convergent Optimization via Most Promising Area Stochastic Search), heuristic search techniques to enhance practical performance,and statistical procedures to provide inference on the estimated optimal solution.

■ MB18

Room 318

Joint Session Counter Terrorism/DAS: Risk and Decision Analysis Applications for Homeland Security I

Cluster: Counter Terrorism and OR, Decision Analysis Society

Invited Session

Chair: Henry Willis, Policy Researcher, RAND Corporation, 201 N. Craig Street, Suite 102, Pittsburgh, PA, 15217, United States, hwillis@rand.org

1 - Evidence-Theory Based Parameter Assessment for Homeland Security Risk Analysis

William McGill, Center for Technology and Systems Management, University of Maryland, College Park, MD, 20742, United States, wmcgill@umd.edu, Bilal Ayyub

This paper applies the Transferable Belief Model to estimate parameter distributions for probabilistic risk assessments based information from previous analyses, expert opinion, and qualitative assessments (i.e., evidence). The proposed methodology is demonstrated with an example that estimates the physical vulnerability of a critical infrastructure asset.

2 - Rationale and Development of a Security Assurance Index and its Application to Cyber Attacks on Control Systems

Martin Michael Plum, Advisory Engineer/Economist, Idaho National Engineering and Environmental Laboratory, PO Box 1625, Idaho Falls, ID, 83415-3878, United States, Martin.Plum@inl.gov, George A. Beitel

Assurance categories were developed to support the Department of Homeland Security's efforts in the mitigation of Cyber Attacks on Control System. Defined according to the risk of life and economic loss, the minimum range is designated by policy; whereas, the maximum limit seems to be constrained only by limits and interdependencies of the controlled systems. This paper will present an overview of some existing scales of disaster and security assurance and the rationale behind the development of the Security Assurance Index (SAI). Use of the SAI and its associated security assurance levels (SAL) has proven helpful in managing risk due to the index's ease in use, communication, and understanding. As a test of reasonableness, SAL-1 meets the minimum threshold limits of DHS interest and responsibility as defined by HSPD-7; whereas, SAL-5 is consistent with the 9-11 attack on the World Trade Center. The addition of higher risk categories will be discussed for its applicability to other WMD events such as bio-terror events or the detonation of nuclear weapons in densely populated areas.

3 - Critical Infrastructure Protection Decision Support System

Michael Samsa, Decision and Risk Analysis Group Leader, Argonne National Laboratory, Building 900, 9700 South Cass Avenue, Argonne, IL, 60439-4832, United States, msamsa@anl.gov

The Critical Infrastructure Protection Decision Support System is a set of system dynamics models that estimate interdependent consequences from infrastructure disruptions, coupled with a multi-attribute decision model that can reflect the value trade-offs and risk attitudes of the decision making organization. A hypothetical infectious disease case is used to illustrate how the model is used to inform decision makers.

4 - Guiding Resource Allocations Based on Terrorism Risk

Henry Willis, Policy Researcher, RAND Corporation, 201 N. Craig Street, Suite 102, Pittsburgh, PA, 15217, United States, hwillis@rand.org

With every regulatory or funding decision for a risk management program, society decides whether or not risk is tolerable. We compare estimates of terrorism risk in urban areas that received homeland security grants to other federal risk management decisions. Allocations are generally consistent with other federal risk management decisions. However, terrorism risk in several cities that received funding is below levels that are often tolerated in other risk management contexts.

■ MB19

Room 319

Mining Applications

Sponsor: Energy, Natural Resources & The Environment

Sponsored Session

Chair: Alexandra Newman, Assistant Professor, Colorado School of Mines, Division of Economics and Business, Golden, CO, 80401, United States, anewman@mines.edu

1 - Long- and Short-Term Production Scheduling at LKAB's Kiruna Mine

Alexandra Newman, Assistant Professor, Colorado School of Mines, Division of Economics and Business, Golden, CO, 80401, United States, anewman@mines.edu

We describe an optimization model that plans production both at the strategic and at the operational level for a large underground sublevel caving mine. We present optimization-based heuristics to expedite solution time for this large mixed-integer programming model, and supporting numerical results.

2 - Modeling the Mining Production Chain

Rafael Epstein, Associate Professor, University of Chile, Department of Industrial Engineering, PO Box 2777, Santiago, Chile, repstein@dii.uchile.cl, Andres Weintraub, Rodrigo Caro

Based on our experience in modeling Chilean open pit and underground copper mines, we discuss the importance of modeling in an integrated way the production chain from the initial extraction to delivery of final product. Such a model incorporates different intermediate processes, often nonlinear.

3 - The Design of a Decline Using a Decline Optimisation Tool

Doreen Thomas, Associate Professor, The University of Melbourne, Department of Electrical Engineering, Victoria, 3010, Australia, d.thomas@ee.unimelb.edu.au

This paper describes applying a Decline Optimisation Tool to find the best decline design to connect from three possible breakouts on an existing mine infrastructure to nominated points on the perimeter drives of a nominated stope. In addition the decline had to avoid a number of mineralized zones.

4 - Production Scheduling with Uncertain Supply: Example from Mining Orebodies
Roussos Dimitrakopoulos, Professor, McGill University, Department of Mining Engineering, Montreal, Quebec, Canada, roussos.dimitrakopoulos@mcgill.ca

The presentation considers production scheduling under uncertain supply for metal mines. Orebodies mined are uncertain in metal contained; a production schedule must be defined to ensure supply of ore in all production periods so that net present value is maximised. A new framework for mine production scheduling based on stochastic integer programming is outlined along with the concept of supply risk discounting, leading to substantial improvements of net present value of production schedules.

■ MB20

Room 320

Carnegie Mellon University: Decision Models

Sponsor: Decision Analysis Society
Sponsored Session

Chair: Kara Morgan, Senior Advisor for Risk Analysis, US FDA, 5600 Fishers Lane, HFP-20, 15-62, Rockville, MD, 20857, United States, kara.morgan@fda.hhs.gov

1 - Evidence Synthesis for the Risk of Adverse Reproductive Outcomes Due to DBPs in Drinking Water
Royce Francis, Graduate Research Assistant, Department of Engineering and Public Policy, Carnegie Mellon University, Baker Hall 129, 5000 Forbes Avenue, Pittsburgh, PA, 15232, United States, rafranci@andrew.cmu.edu, Mitchell Small

We demonstrate a method allowing regulatory research planners to combine judgment about methodological differences across epidemiological studies to synthesize epidemiological evidence. The impact of a decision maker's prior perception of the body of evidence is demonstrated using an example scenario facing a decision maker by using simple Bayesian Belief Networks.

2 - An Options Theory Method to Value Emissions Control Devices
Dalia Echeverri, PhD Student, Engineering and Public Policy, Carnegie Mellon University, 5000 Forbes Avenue, Pittsburgh, PA, 15213, United States, dpe@andrew.cmu.edu

In responding to uncertain future air-emissions regulations, decision makers in the electricity industry face tremendous uncertainty and incur significant financial risk. We show how decision makers may value certain options as hedges against these risks. More generally, we demonstrate how a method of options-valuation can inform the choices of the electricity industry and policy makers.

3 - An Interactive Tool to Compare Traffic Risks
David Gerard, Executive Director, Center for the Study & Improvement of Regulation, Engineering & Public Policy, Carnegie Mellon University, Pittsburgh, PA, 15213, United States, dgerard@andrew.cmu.edu, Paul Fischbeck

This talk presents a general framework in which motor vehicle travel risks can be systematically estimated, flexibly displayed, and interactively compared. Drawing upon existing data (FARS and NHTS), this tool determines risk estimates using per mile, per trip, or per minute measures for millions of attribute combinations (age, gender, time of day, day of week, month, vehicle type, geographic region, etc.).

4 - Model to Select More Valuable Weatherization Investments Before an On-Site Audit
Amelia MacSleyne, Carnegie Mellon University, 5032 Forbes Avenue #1073, Pittsburgh, PA, 15289, United States, amacsleyne@cmu.edu, Paul Fischbeck

In this talk, we present an evaluation of utility-sponsored energy conservation programs, specifically low-income household weatherization. Decision analysis tools are developed that improve the cost-effectiveness of this program. Through our investigation of the engineering and behavioral components of energy conservation, we formulate a set of policy guidelines that could be implemented by the state in an effort to make the program more efficient.

■ MB21

Room 321

Bringing Decision Skills to Youth

Sponsor: Decision Analysis Society
Sponsored Session

Chair: Carl Spetzler, Chairman, Strategic Decisions Group, 735 Emerson Street, Palo Alto, CA, 94301, United States, cspetzler@sdg.com

1 - Reaching Out to Juvenile Detention Centers
Ali Abbas, Assistant Professor, College of Engineering, University of Illinois-Urbana Champaign, 104 S. Mathews Avenue, Urbana, IL, 61822, United States, aliabbas@uiuc.edu

We will discuss our experience reaching out with decision skills to teens in Juvenile Detention Centers in central Illinois and the lessons learnt. Topics of (i) Owning my decision, (ii) Decision fitness, and (iii) Framing my decisions were among the most important messages to convey.

2 - Extending Good Decision-Making Skills Education Beyond Classrooms
Chris Spetzler, Program Director, Decision Education Foundation, 745 Emerson Street, Palo Alto, CA, United States, chris@decisioneducation.org

Decision Education Foundation (DEF) is working with Riekes Center for Human Enhancement to integrate decision-making skills into Riekes' innovative programs in Athletic Fitness, Creative Arts and Nature Studies. Riekes helps students define and accomplish their goals and improve character, self-confidence, and peer relationships. Collaborating with Riekes extends decision skills training into an alternative (out of school) environment where youth utilize decision skills to attain their goals.

3 - Declaring a Decision - An Important Life Skill
Steven Tani, Partner, Strategic Decisions Group, 735 Emerson Street, Palo Alto, CA, 94301, United States, stani@sdg.com

A common source of poor decision-making among young people is the failure to think consciously about making a choice before taking action. An important decision-making skill that we teach to young people is called Declaring a Decision. This skill includes taking personal responsibility for the choices that affect one's life and being alert to decision triggers that signal the need to stop and think about the choices rather than simply "go with the flow".

4 - Decision Fitness — The Skill of Making Better In-the-Moment Decisions.
Carl Spetzler, Chairman, Strategic Decisions Group, 735 Emerson Street, Palo Alto, CA, 94301, United States, cspetzler@sdg.com

We use our current decision habits and decision fitness for making the myriad of in-the-moment decisions that we face. In this session we will cover how we are helping youth to understand their current decision fitness and to become more decision fit.

5 - Decision Skills within the English Classroom
Daniel Slack, 591 Brookwood Road, Wayne, PA, 19087, United States, dgslack@gmail.com

To help students learn the importance of good decision making, the Decision Education Foundation is developing a grade 5 through 12 curriculum that integrates English and decision skills. Through character studies in literature, personal writing, and public speaking exercises, students will learn how to identify significant decisions, how to be creative in the way that they explore choices, and how to use a full array of critical thinking skills in their approach to a decision.

■ MB22

Room 322

Maintenance Modeling and Analysis

Sponsor: Military Applications
Sponsored Session

Chair: Edward Pohl, Associate Professor, University of Arkansas, Bell Engineering Center, Department of Industrial Engineering, Fayetteville, AR, 72701, United States, epohl@engr.uark.edu

1 - Rapidly Deployable Sensory-Based Prognostic Models
Nagi Gebraeel, Assistant Professor, University of Iowa, 3131 Seamans Center, Iowa City, IA, 52242, United States, gebraeel@engineering.uiowa.edu

Successful deployment of prognostic models requires prior knowledge of degradation processes. This information is available in databases consisting of degradation-based signals. Unfortunately, these databases may not be available for legacy systems, and their development can be very expensive. This research proposes a mathematical framework that enables the development of adaptive prognostic models for predicting residual life distributions in the absence of prior degradation information.

2 - Operational Readiness as a Function of Maintenance Personnel Skill Level
Justin Chimka, Assistant Professor, University of Arkansas, Bell Engineering Center, Department of Industrial Engineering, Fayetteville, AR, 72701, United States, jchimka@uark.edu, Heather Nachtmann

Independent variables measuring maintenance personnel skill level including the numbers and percentages of 3, 5, 7 and 9 level maintainers, and dependent variables including mission capable rate, utilization variables, and reliability and

maintainability variables are identified. Correlation and regression analyses result in a set of candidate regression models, and final models are selected by examining linear fit, efficiency, and adherence to model assumptions.

3 - Simulation-Optimization of Control Chart and Preventive Maintenance Policies

Rajesh Swaminathan, Graduate Student, University of Arkansas, Bell Engineering, Fayetteville, AR, 72701, United States, rswamin@engr.uark.edu, Edward Pohl

The problem combines the economic design of a control chart with the optimization of preventive maintenance policies. The research areas of control chart design and preventive maintenance have received a great deal of attention separately in the quality and reliability research communities. Our problem investigates the use of GA's and ant colony optimization in simultaneously selecting parameters for a control chart (X-bar, EWMA) as well as the best replacement period for equipments.

4 - Valuing Flexibility in Maintenance Policies

Thomas Yeung, Assistant Professor, Department of Automation and Production, Ecole des Mines de Nantes, France, tyeung@uark.edu

Real options analysis is used to value the flexibility provided by the option to perform preventive, condition-based maintenance in a manufacturing process outside of a strict age-based policy. Contingent claims analysis and option pricing theory are used to value these maintenance options in terms of expected cost savings. This research develops a methodology for properly valuing these options and incorporates the values into a model to determine the optimal maintenance policy.

■ MB23

Room 323

Service Quality and Customer Satisfaction in Global Services Sourcing

Cluster: Global Services Sourcing

Invited Session

Chair: Aliza Heching, IBM TJ Watson Research Center, PO Box 218, Yorktown Heights, NY, 10598, United States, ahechi@us.ibm.com

1 - The Managers Problem Under Uncertainty

Anshul Sheopuri, PhD Student, Stern Business School, 44th West 4th Street, New York, NY, 10012, United States, asheopur@stern.nyu.edu, Eitan Zemel

We study a single decision maker, single period problem which has wide applications in the study of crime, service level and inventory decisions. We study important properties of this problem and identify conditions for uniqueness of the solution. Finally, we extend the analysis to a non-linear case and study the finite horizon version of problem.

2 - Business Process Outsourcing and "Off-Shoring": The Globalization of Information-Intensive Services

Uday Karmarkar, Professor, UCLA Anderson, 110 Westwood Plaza, Box 951481, Los Angeles, CA, 90077, United States, uday.karmarkar@anderson.ucla.edu, Uday Apte

Information-intensive services are being globalized as corporations take advantage of the opportunities made available by the progress of information technology and respond to the challenge of increasing global competition. After analyzing the role that information technology plays in globalizing information-intensive services, the paper reviews a wide range of illustrative examples where information-intensive services have been globalized. Based on this analysis, the paper proposes a theoretical framework that identifies the criteria and guidelines for successfully selecting service activities to be globalized and for choosing the appropriate country location.

3 - Call Center Outsourcing: Coordinating Staffing Levels and Service Quality

Justin Ren, Assistant Professor, Boston University School of Management, 595 Commonwealth Avenue, Boston, MA, 02215, United States, ren@bu.edu, Yong-Pin Zhou

In this paper we study the contracting issues in an outsourcing supply chain consisting of a user company and a call center that does outsourcing work for the user company. We model the call center as a G/G/s queue with customer abandonment. Our results suggest that managers pay close attention to service quality and its contractibility in seeking call center outsourcing.

■ MB24

Room 324

Daniel H. Wagner Prize Competition

Cluster: The Daniel H. Wagner Prize for Excellence in Operations Research

Invited Session

Chair: Joe Discenza, President and CEO, SmartCrane LLC, 2 Eaton Street Suite 500, Hampton, VA, 23669, United States, jhdiscenza@smartcrane.com

1 - The Daniel H. Wagner Prize for Excellence in Operations Research Practice

Five finalist teams have been selected for 2006 and these five will be presented in three sessions on Monday and the winning entry announced on Tuesday morning.

2 - Optimal Control of an Inventory with Simultaneous Obsolescence

Markus Emsermann, Operations Research Analyst, Jeppesen, 55 Inverness Drive East, Englewood, CO, 80112, markus.emsermann@jeppesen.com, Burton Simon

We consider the problem of determining the optimal ordering and reordering policy for an inventory where the entire stock will simultaneously become obsolete at some time, T. Many businesses face the challenge of maintaining inventories that suddenly become obsolete. These circumstances render traditional inventory analysis unsuitable for balancing reordering costs with the costs of overstocking. We construct a mathematical model of an inventory with simultaneous obsolescence, and a new method for determining its optimal control policy.

3 - A Periodic Review Modeling Approach for Guaranteed Service Supply Chains

John M. Bossert, Senior Research Scientist, Optiant, 4 van de Graaff Drive, Burlington, MA, 01803, United States, john.bossert@optiant.com, Sean Willems

We extend the guaranteed service supply chain modeling framework to allow for an arbitrary integer review period or ordering frequency at each stage. We accommodate three different periodic review operating policies - constant base stock, constant safety stock, and adaptive base stock. We apply the model to real-world data and show that inventory metrics of the new model differ by more than 30% from those derived through the simpler modeling approach of aggregating a review period into leadtime.

■ MB25

Room 325

OR Practice in Semiconductor Manufacturing

Cluster: OR Practice

Invited Session

Chair: James Wuerfel, Optimization Program Coordinator, Intel, CH3-113, 5000 W. Chandler Boulevard, Chandler, AZ, 85225, United States, james.r.wuerfel@intel.com

1 - Production Scheduling in a Fully Automated Semiconductor Fab

Nirmal Govind, Intel Corporation, 5000 W. Chandler Boulevard., Chandler, AZ, 85226, United States, nirmal.govind@intel.com

The talk will describe the implementation of a near real-time production scheduler at one of Intel's fully automated fabrication facilities, including the modeling challenges encountered and business process changes that were required.

2 - Scheduling Engineering and Production Lots in Wafer Fabrication

Reha Uzsoy, Professor, Purdue University, 315 N. Grant Street, West Lafayette, IN, 47907, United States, uzsoy@ecn.purdue.edu, Kristy Crist, Brian Kelly

We present a simulation study examining the performance of different scheduling policies for allocating machine capacity between production and engineering lots in a semiconductor wafer fab. Our results indicate the basic tradeoffs involved in this problem, and suggest a broader view of the problem is required for effective solutions.

3 - Optimization to Fully Synchronized Manufacturing

Peng Qu, Senior Industrial Engineer, AMD, 5204 E Ben White Boulevard, MS 563, Austin, TX, 78741, United States, peng.qu@amd.com, Shekar Krishnaswamy

In full automated 300mm wafer fabs,scheduling system is incapable to be the only decision making point of material flow. It needs comprehend contradictive information from other manufacturing systems(e.g. AMHS,process control,yield management,etc.) to create a fully synchronized manufacturing environment to ensure the fab running with high availability, low inventory, high process stability and yield performance. This presentation discusses the potential role of optimization in such environment.

4 - Extending Performance Metric from Factory View to Global Manufacturing Networks
Hans Ehm, Principal Logistics Systems, Infineon, Am Campeon 1-12, Neubiberg, Ge, 85579, Germany, hans.ehm@infineon.com, Ralf Lelickens

Managing the Characteristic Curve enabled: short cycle time and a high capacity utilization. Can this approach be transferred to a multifab multi supply chain production network? Yes, but it requires the extension of the Characteristic Curve from a factory approach to global production network. This is demonstrated on the example of factory capacity planning (the IFX HTCP - Harmonized Test Capacity Planning - project).

5 - Matching Supply from Multiple Components to Competing Demands with Changing Attributes
Alfred Degbotse, IBM, 1000 River Street, Essex Junction, VT, 05452, United States, adegbo@us.ibm.com, Robert Orzell, Brent Elmer, Chi-Tai Wang, R. John Milne

Demand attributes such as quantity and priority can vary as a function of delivery date. We describe an element of our Supply Chain software which assigns supply to demand in the situation where demand attributes vary and multiple components are present. The software is used to plan IBM's semiconductor operations and those of an external client.

■ MB26

Room 326

Education Panel: Data Mining from Statistical and OR Perspectives

Sponsor: Data Mining
Sponsored Session

Chair: Janet Twomey, Associate Professor, Industrial & Manufacturing Engineering, Wichita State University, Wichita, 67206, United States, janet.twomey@wichita.edu

1 - Education Panel: Data Mining from Statistical and OR Perspectives
Moderator: Janet Twomey, Associate Professor, Industrial & Manufacturing Engineering, Wichita State University, Wichita, 67206, United States, janet.twomey@wichita.edu, Panelists: Jayant Rajgopal, Jye-Chyi (JC) Lu, George Runger, Marietta Tretter

In this session a panel of faculty who teach undergraduate and graduate level courses in data mining come together to present and exchange information about their data mining courses, in terms of the course design, topics covered, data supplied, software and text books used. Faculty share their experiences and offer some lessons learned in the development of their courses. This session is intended for anyone who is currently teaching or hoping to create a course on the subject of data mining.

■ MB27

Room 327

Predicative Modeling and Control of Manufacturing Quality

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: Qiang Huang, Assistant Professor, University of South Florida, 4202 East Fowler Avenue, ENB 118, Tampa, FL, 33620, United States, huangq@eng.usf.edu

1 - Predicting the Sum of All Evils: Aggregate Level Modeling of Non-Conformances
Vittal Prabhu, Associate Professor, Penn State University, 348 Leonhard Building, University Park, PA, 16802, United States, prabhu@engr.psu.edu, Nazrul Shaikh

Estimating the potential number of non-conformances in a product is critical for compliance and quality management. It is also a measure of the efficacy of the monitoring and control strategies associated with the process. In this work, a growth model for describing the observed non-conformances is developed and tested empirically. The model captures the interplay between maintenance strategies and reliability, and can be used as an early warning system for non-conformances and warranty costs.

2 - Error Equivalence Methodology in Quality Prediction and Control
Qiang Huang, Assistant Professor, University of South Florida, 4202 East Fowler Avenue, ENB 118, Tampa, FL, 33620, United States, huangq@eng.usf.edu, Hui Wang

Error equivalence, an engineering phenomenon concerning the mechanism that different error sources result in identical dimensional variation patterns, impacts almost every stage of quality control, from tolerance synthesis in engineering design to root cause identification in manufacturing. This proposed research seeks to establish the science basis for quantitatively analyzing the error equivalence phenomenon to achieve better control of product dimensional quality.

3 - Predictive Modeling and Control Using Approximate Dynamic Programming
Rajesh Ganesan, Assistant Professor, George Mason University, 4400 University Drive, ST2, MS4A6, Fairfax, VA, 22030, United States, rganesan@gmu.edu, Tapas K. Das

Many process controllers rely on good process models that are seldom available for many complex large-scale nonlinear engineering systems fraught with uncertainties. Even with good models, the issue becomes the speed of execution during online applications, which ultimately forces model simplification and resultant suboptimal control. Hence, there is a need for model free approaches, which can dynamically and efficiently predict the uncertainties, and provide a path for optimal control.

4 - Discrete Event Sequence Data Monitoring Using Rank Test
Zhiguo Li, Research Assistant, University of Wisconsin, Madison, College of Engineering, 1513 University Avenue, Madison, WI, 53706, United States, zhiguoli@wisc.edu, Shiyu Zhou

Discrete event sequence data has become an important type of data in the service and maintenance. This paper, without any distributional assumption for the event history data, develops a monitoring procedure for the hazard rate of failures using the rank test. Based on the asymptotic properties of the rank statistic, a generic formula for the operating-characteristic of the control chart is derived to show the relationship of the type-I error, type-II error, sample size and hazard rate change.

■ MB28

Room 328

IIE Transactions/Quality and Reliability Engineering

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: Susan Albin, Professor, Department of Industrial & Systems Engineering, Rutgers University, Piscataway, NJ, 08904, United States, salbin@rci.rutgers.edu

1 - Online Automatic Process Control Using Observable Noise Factors for Discrete-part Manufacturing
Judy Jin, Associate Professor, Department of Industrial and Operations Engineering, University of Michigan, IOE 2855, Ann Arbor, MI, 48109, United States, jhjin@umich.edu, Yu Ding

Different from offline robust parameter design (RPD) method, this research is to develop automatic process control methodology (APC) based on DOE response models for process variation reduction. A cautious control strategy, which explicitly considers the observation uncertainty in adjusting the settings of controllable factors, makes the system performance consistently more favorable when compared with the certainty equivalence control strategy and RPD.

2 - Automatic Feature Selection for Unsupervised Clustering of Cycle-Based Signals
Shiyu Zhou, Assistant Professor, University of Wisconsin-Madison, 1513 University Avenue, Madison, WI, 53706, United States, szhou@engr.wisc.edu, Judy Jin

A cycle-based signal refers to an analog or digital signal that is obtained during each repetition of operation cycles in a manufacturing process. Different from the available supervised classification approaches that depend heavily on the training dataset or the engineering field knowledge, this paper aims to developing an automatic feature selection method for unsupervised clustering of cycle-based signals. The technique is a data pre-processing technique for process monitoring and diagnosis.

3 - Effects of Estimation Errors on Cause-Selection Charts
Fugee Tsung, Professor, Hong Kong University of Science and Technology, IELM Department, Kowloon, Hong Kong, season@ust.hk, Lianjie Shu, K-L Tsui

The cause-selecting chart (CSC) is a statistical process control (SPC) tool for analyzing multistage processes. It distinguishes between incoming and outgoing quality problems by establishing a relationship between input and output measurements. In practice, the model relating the input and output must first be estimated before the CSC is implemented. This paper investigates the effect of parameter estimation errors on the performance of CSCs and presents some useful results.

4 - Process-Oriented Tolerancing for Multistation Assembly Systems
Yu Ding, Assistant Professor, Texas A&M University, College Station, TX, 77843, United States, yuding@iemail.tamu.edu, Darek Ceglarek, Judy Jin, Jianjun Shi

In multi-station manufacturing systems, the quality of final products is significantly affected by both product design as well as process variables. Historically, however, tolerance research primarily focused on allocating tolerances based on product design characteristics of each component. The concept of process-oriented tolerancing expands the current tolerancing practices, which bound errors related to product variables, to explicitly include process variables.

■ MB29

Room 329

Optimization in Medicine and Biology

Cluster: Joint Cluster Healthcare/ HAS: Healthcare Engineering
Invited Session

Chair: Gino Lim, Assistant Professor, University of Houston, 4800 Calhoun Road, E211, Engineering Building 2, Houston, TX, 77204, United States, ginolim@uh.edu

1- Computational Approaches for Beam Angle and Fluence Map Optimization in IMRT
Gino Lim, Assistant Professor, University of Houston, 4800 Calhoun Road, E211, Engineering Building 2, Houston TX 77204, United States, ginolim@uh.edu

We present computational approaches for optimizing beam angles and fluence maps in IMRT planning for cancer patients. A mixed integer programming (MIP) model and a linear programming (LP) model are used to find an optimal set of beam angles and their corresponding fluence maps. The LP model is solved using the interior point method while the MIP model is solved using branch-and-bound. In order to reduce the computational burden for solving the optimization models, we introduce iterative beam angle elimination algorithms in which an insignificant beam angle is eliminated in each iteration.

2 - Edge Weighting Ethics in Maximum Matchings on Graphs for Kidney Paired Donation
Sommer Gentry, Assistant Professor, Mathematics, U.S. Naval Academy, 572-C Holloway Road, Mailstop 9E, Annapolis, MD, 21402, United States, gentry@usna.edu, T. S. Michael, Dorry Segev

Arranging kidney exchanges requires matching on a graph. Maximum cardinality matchings are desirable, but the relative utility of kidney exchanges must be represented by edge weights. Setting edge weights within a narrow range that we have characterized precisely guarantees that a maximum edge weight matching will also have maximum cardinality.

3 - Graph-Theoretical Approach to the Study of Abnormal Brain Network
W. Art Chaovalitwongse, Assistant Professor, Rutgers University, 96 Frelinghuysen Road, Piscataway, NJ, 08854, United States, wchaoval@rci.rutgers.edu, Wichai Suharitdamrong, Panos Pardalos

The investigation of brain synchronization with application in epilepsy has raised many research challenges in optimization, due to a large number of combinations among electrodes which exponentially increases with the number of electrodes. It is difficult to visualize specific coupling patterns from each individual group of electrodes. We will present a brain similarity network (BSN), derived from a graph-theoretical approach, to investigate natural clusters of the brain network.

4 - Robust Radiotherapy Optimization via Parameterized Edge-Enhancements
Timothy Chan, PhD Student, Massachusetts Institute of Technology, 77 Massachusetts Avenue, E40-130, Cambridge, MA, 02139, United States, tcychan@mit.edu, Thomas Bortfeld, John Tsitsiklis

We consider the problem of radiotherapy treatment planning under uncertainty and use a parameterized approach to deliver a robust solution. We analyze the relationship between uncertainty and solution structure, deriving simple bounds on the uncertainty that identify the resulting complexity of the robust solution. These results can be used to guide medical physicists in producing treatments plans that will be robust to the variety of uncertainties realized in practice.

■ MB30

Room 330

Decision Support Models

Sponsor: Health Applications Section
Sponsored Session

Chair: Michael Carter, Professor, University of Toronto, 5 King's College Road, Toronto, ON, M5S 3G8, Canada, carter@mie.utoronto.ca

1 - A Case Study of a Simulation-Based Decision Support Tool for Surgical Scheduling
Michael Carter, Professor, University of Toronto, 5 King's College Road, Toronto, ON, M5S 3G8, Canada, carter@mie.utoronto.ca, Hai Ein (Jean) Yong

A simulation tool was developed to determine the surgical booking policy for allocating caediac operating room time. In practice, it was rather difficult to get the surgeons and the managers to quantitatively describe the current processes. Much of the effort on the project was focused on translating practice into a set of rules that could then be used to predict future behaviour.

2 - Simulating Resource Allocation at The Ottawa General Hospital: A System Dynamics Approach
Sonia Vanderby, PhD Candidate, University of Toronto, 5 King's College Road, Toronto, ON, M5S 3G8, Canada, sonia@mie.utoronto.ca, Michael Carter

In this study, a simulation was constructed using system dynamics to determine what could be done to alleviate the pressure within the Ottawa General Hospital's ED. The goal of this model is to enable scenario testing through altering demand patterns as well as resource levels and distribution. It provides a high-level image of the potential outcomes of various resource allocation decisions, enabling hospital administrators to make informed decisions and forecast for future demand.

3 - Turnover Times Between Surgeries Vary with Time of the Day
David Strum, Associate Professor Anesthesiology, Queen's University, Department of Anesthesiology, KGH, 76 Stuart Street, Kingston, ON, K7L 2V7, Canada, dstrum1@cogeco.ca, Luis Vargas

Surgical scheduling is complicated by variability inherent in the turnover times (TT) between surgeries. We investigated TT with the goal to describe variability in TT and the associated factors that might be predicted, controlled, or altered to improve surgical scheduling. Our results suggest TT are specific to time of the day and knowledge of the sources of variability in TT are important to improve surgical scheduling and reduce sub-optimal utilization of costly operating rooms.

4 - Modeling and Analysis of Surgical Demand in the Operating Room
Ian Moore, Queens University, Dept. Math and Stats., Kingston, ON, Canada, icmoore@mast.queensu.ca, David Thomson, David Strum

We investigated daily surgical demand at a large trauma hospital using Thomson's multitaper spectral estimator method and a harmonic F-test to extract the periodic components from the time series. We employed an ARIMA model to investigate model residuals and showed the residuals were close to Gaussian post extraction. Finally we will present an analytical description of our model in state space format and discuss issues with detecting variance patterns in the remaining residuals.

■ MB31

Room 331

Risk Management and Operations

Cluster: Financial Engineering and Risk Management
Invited Session

Chair: Jussi Keppo, Assistant Professor, University of Michigan, College of Engineering, 1205 Beal Avenue, Ann Arbor, MI, 48109, United States, keppo@umich.edu

1 - What Is a Good Measure of Risk: The Controversies and a Different Set of Axioms
Steve Kou, Associate Professor, Industrial Engineering and Operations Research, Columbia University, 312 S.W. Mudd, New York, NY, 10027, United States, sk75@columbia.edu, Xianhua Peng, Chris Heyde

Axioms-based coherent risk measures have been widely used in mathematical finance. In this paper we point out some controversies of the axioms. We then suggest a different set of axioms and derive risk measures based on the axioms.

2 - Optimal Dividend Payments under Fixed Cost and Implementation Delays for Various Models
Erhan Bayraktar, Assistant Professor of Mathematics, University of Michigan, Mathematics Department, 530 Church Street, 1043,

Ann Arbor, MI, 48109, United States, erhan@umich.edu, Masahiko Egami

We solve the dividend optimization problem for a corporation when the managers are facing (regulatory) implementation delays. We consider several cash reservoir models for the firm including two mean-reverting processes: Ornstein-Uhlenbeck and square-root processes. We provide our solution via a new characterization of the value function for one-dimensional diffusions and provide easily implementable algorithms to find the optimal control and the value function.

3 - Hiring, Firing and Employment Protection

Tim Maull, PhD Candidate, Department of Industrial and Operations Engineering, University of Michigan, Ann Arbor, MI, 48109, United States, timmaull@umich.edu, Jussi Keppo

We analyze how hiring and firing costs as well as firing delays affect a firm's labor market demand. We solve the firm's optimal hiring and firing policies by using stochastic control. Then we study the properties of the optimal solution as well as comparative statics. Finally we perform a cross-sectional analysis over selected OECD countries.

4 - Financial Hedging of Operational Risk

Mike Ludkovski, Assistant Professor of Mathematics, University of Michigan, East Hall, 530 Church Street, Ann Arbor, MI, 48109, United States, mludkov@umich.edu

We study the optimal behavior of a manager that has control over a physical asset/plant, as well as opportunity for imperfect hedging on futures markets. We solve the combined problem by separating the continuous and impulse controls and passing to a sequence of stochastic control with discretionary stopping sub-problems. A complete numerical implementation is then given for CARA risk-preferences where we obtain a recursive formula in terms of conditional expectations.

■ MB32

Room 332

Project Scheduling

Cluster: Project Management
Invited Session

Chair: Willy Herroelen, Professor, K.U.Leuven, Research Center for OM, Naamsestraat 69, Leuven, B-3000, Belgium, Willy.Herroelen@econ.kuleuven.be

1 - Acceptance and Planning of Dynamically Arriving Offers in an Over-Demanded Organization.

Jade Herbots, K.U.Leuven, Research Center for OM, Naamsestraat 69, Leuven, B-3000, Belgium, jade.herbots@econ.kuleuven.be, Willy Herroelen, Roel Leus

When a project is offered to an over-demanded organization, a quick acceptance decision is often required, while the company has only little knowledge of the project under discussion. We develop an approach that integrates order acceptance and resource capacity loading. Therefore we use a dynamic programming method that optimizes the company's expected profits. Here from we derive insights about the optimal allocation of capacity when accepting projects.

2 - Proactive Resource Allocation Heuristics for Robust Project Scheduling

Filip Deblaere, K.U.Leuven, Research Center for OM, Naamsestraat 69, Leuven, B-3000, Belgium, Filip.Deblaere@econ.kuleuven.be, Erik Demeulemeester, Willy Herroelen

The resource-constrained project scheduling problem involves the determination of a predictive schedule of the project activities satisfying the precedence relations and resource constraints while minimizing the project duration. During execution of the project, activity duration disruptions may disturb this schedule. We propose procedures for allocating resources to activities in order to maximize schedule stability. We report on computational results obtained on a set of benchmark problems.

3 - Building Robust Project Schedules in an Environment Subject to Resource Uncertainties

Olivier Lambrechts, K.U.Leuven, Research Center for OM, Naamsestraat 69, Leuven, B-3000, Belgium, olivier.lambrechts@econ.kuleuven.be, Willy Herroelen, Erik Demeulemeester

In practice, project execution is subject to disruptions. Our aim is to generate baseline project schedules that are as well as possible protected against the impact of disruptions caused by resource breakdowns. Optimally building robust schedules is hard due to the stochasticity of the problem and interactions between disruptions. Therefore, we impose additional constraints allowing us to develop good solution procedures for subproblems of the RCPSP with stochastic resource availabilities.

4 - Heuristic Procedures for Reactive Project Scheduling

Stijn Van de Vonder, K.U.Leuven, Research Center for OM, Naamsestraat 69, Leuven, B-3000, Belgium, stijn.vandevonder@econ.kuleuven.be, Erik Demeulemeester, Francisco Ballestin, Willy Herroelen

This paper describes new reactive procedures that may be used to repair resource-constrained project baseline schedules when activity duration disruptions occur during project execution. We aim to minimize the deviations between the baseline schedule and the actually realized schedule. We discuss computational results obtained with priority-rule based schedule generation schemes, a sampling approach and a weighted earliness tardiness heuristic on a set of randomly generated project instances.

■ MB33

Room 333

Applications in Airline Operations Recovery

Sponsor: Aviation Applications
Sponsored Session

Chair: Tina Shaw, Sabre Holdings, 3150 Sabre Drive, Southlake, TX, 76092, United States, tina.shaw@sabre.com

1 - Airlines Schedule Recovery During Irregular Operations: An Integrated Framework

Khaled Abdelghany, Assistant Professor, Southern Methodist University, PO Box 750335, Dallas, TX, 75205, United States, khaled@engr.smu.edu, Ahmed Abdelghany

A framework for proactive airlines schedule recovery during irregular operations is presented. The framework integrates a schedule simulation methodology and a resource assignment optimization model. Implementations issue and application examples are also presented.

2 - Tactical Crew Recovery During Irregular Airline Operations

Chunhua Gao, PhD Student, Georgia Institute of Technology, 765 Ferst Drive, Atlanta, GA, 30332, United States, cgao@isye.gatech.edu, Alex Kalyta

During irregular operations it is often possible to revise schedules, reroute aircraft, and reaccommodate passengers to get back to normal operations by the next morning. However, this is not the case for crew. It typically takes several days to get crew back onto their planned rosters. We discuss tactical crew recovery.

3 - Integrated Crew Pairing and Roster Recovery: Case Studies

Tina Shaw, Sabre Holdings, 3150 Sabre Drive, Southlake, TX, 76092, United States, tina.shaw@sabre.com

Several case studies from our earlier work are presented to illustrate that fully legal and deployable crew recovery solutions can be obtained by simultaneously recreating duties, pairings, and crew rosters. Implementations issues and specific techniques designed to improve runtimes while maintaining good solution quality are discussed.

■ MB34

Room 334

Hazard Management and Evacuation II

Sponsor: Transportation Science & Logistics
Sponsored Session

Chair: Yi-Chang Chiu, Assistant Professor, University of Arizona, PO Box 210072, Tucson, AZ, 85721, United States, chiu@utep.edu

1 - Pre-Positioning of Emergency Supplies for Disaster Response

Carmen Rawls, Graduate Research Assistant, Cornell University, 310 Hollister Hall, Ithaca, NY, 14853, United States, cgr7@cornell.edu, Mark Turnquist

We describe a two-stage stochastic optimization model for determining locations and amounts of emergency supplies for disaster preparation. The model includes uncertainty in demands, locations, transportation network capacity, and the possibility that some of the pre-positioned supplies might be destroyed by the event. An illustrative case study is included.

2 - A Methodology for Consolidating Multiple Fire Stations with Traffic Signal Preemption

Bryan A. Norman, PhD, University of Pittsburgh, 1033 Benedum Hall, Pittsburgh, PA, 15261, United States, banorman@pitt.edu, Lin Wang, Ming-En Wang

Many cities in the U.S. are now facing the difficult decision of closing some of their firehouses due to budget cuts. We investigate methods to decide which firehouses to close in a given fire district in order to minimize the increase in the average response time. We also consider which traffic locations should receive Traffic Signal Preemption equipment to help mitigate the effect of firehouse closures. Numerical examples based on a map of the City of Pittsburgh show results for each scenario.

3 - A Case Study of Ambulance Location and Relocation
Rahul Nair, Graduate Assistant, Department of Civil & Environmental Engineering, University of Maryland, 1173 Glenn Martin Hall, College Park, MD, 20742, United States, rahul@umd.edu, Elise Miller-Hooks

We solve a multi-objective, integer program to assess whether or not there is significant benefit in relocating ambulances. A relocation strategy involves repositioning ambulances in response to an emergency call or in anticipation of future demand. We present methodology to overcome practical issues in solving a real-world optimization problem and results from simulation runs to test output strategies.

4 - A Staircase Formulation and Solution Procedure for Cell-Based Dynamic System Optimal Evacuation
Yi-Chang Chiu, Assistant Professor, University of Arizona, PO Box 210072, Tucson, AZ, 85721, United States, chiu@utep.edu, Hong Zheng

We propose a staircase formulation for the cell-based simultaneous evacuation destination, flow assignment and departure schedule problem. The staircase formulation exhibits an internal structure that can be exploited to decompose the original large-scale problem into smaller sub-problems. A solution algorithm is presented to compare the solution quality and computational efficiency.

■ MB35

Room 335

Urban Transportation Planning Models III: Goods Movement

Sponsor: Transportation Science & Logistics
Sponsored Session

Chair: Jose Holguin-Veras, Professor, Rensselaer Polytechnic Institute, 110 8th Street, Room JEC 4030, Troy, NY, 12180, United States, jhv@rpi.edu

1 - Algorithmic Solutions for the Common Carrier Case of the Integrative
Jose Holguin-Veras, Professor, Rensselaer Polytechnic Institute, 110 8th Street, Room JEC 4030, Troy, NY, 12180, United States, jhv@rpi.edu, Ellen Thorsn

This talk will focus on the description of the solutions developed for the common carrier case of the Integrative Freight Market Simulation. The IFMS is a comprehensive modeling framework for urban goods modeling that represents the only applucation of Spatial Price Equilirium to urban goods and discrete mathematics.

2 - The Vehicle Routing Problem with Variable Pickup Locations
Stephen Hill, PhD Candidate, The University of Alabama, Box 870226, Tuscaloosa, AL, 35487, United States, shill@cba.ua.edu, John Mittenthal

In this research we introduce the vehicle routing problem with variable pickup locations (VRPVPL), an extension of the vehicle routing problem with pickups and deliveries. We propose a formulation for the VRPVPL and consider a practical instance of the problem.

3 - Modeling Truck Lane Restriction on Major Urban Freeways
Renatus Mussa, P.E., Associate Professor & Director of Traffic Engineering Laboratory, Department of Civil and Environmental Engineering, FAMU-Florida State University College of Engineering, 2525 Pottsdamer Street, Room 129, Tallahassee, FL, 32310, United States, mussa@eng.fsu.edu

To improve safety and efficiency of traffic flow on urban freeways, some agencies have imposed restriction of trucks from certain lanes. This research determines the safety and operational benefits of truck lane restrictions in peak and off-peak periods considering whether the freeway corridor has a high occupancy vehicle (HOV) lane.

■ MB36

Room 336

Traffic Network Design Modeling Advances

Sponsor: Transportation Science & Logistics
Sponsored Session

Chair: Satish Ukkusuri, Assistant Professor, Department of Civil and Environmental Engineering, Rensselaer Polytechnic Institute, JEC-4032, 110 8th Street, Troy, NY, 12180, United States, ukkuss@rpi.edu

1 - Incorporating Environmental Justice Measures into Equilibrium-Based Transportation Network Design
Jen Duthie, PhD Student, University of Texas, Austin, 1 University Station C1761, Austin, TX, 78705, United States, jduthie@mail.utexas.edu, S. Travis Waller

The environmental justice (EJ) order passed a decade ago has far-reaching impacts for the transportation industry by requiring all projects that receive federal funding to show no disproportionately adverse impact to all protected populations. This presentation focuses on incorporating EJ analysis into transportation project selection. A heuristic method is presented to select network improvement projects that maximize accessibility for each protected population.

2 - Effect of Load Transfers on Carrier Collaboration: A Network Design Formulation
Salvador Hernandez, Research Assistant, Purdue University, School of Civil Engineering, 550 Stadium Mall Drive, West Lafayette, IN, 47907, United States, shhernan@purdue.edu, Srinivas Peeta

A single carrier (small to medium) seeks to collaborate with other carriers to ship demand it cannot fully serve. The goal of the carrier is to identify the routes that minimize the sum of the collaborative path costs which include transfer costs. A mixed integer formulation is presented, issues are identified, and solution directions are discussed.

3 - Robust Traffic Signal Setting Design
Ampol Karoonsoontawong, PhD Candidate, Department of Civil Engineering, The University of Texas at Austin, ECJ 6.202, Austin, TX, 78712, United States, ampolk@mail.utexas.edu, S. Travis Waller

We formulate the robust traffic signal setting design based on dynamic user equilibrium when accounting for long-term O-D demand uncertainty. This approach enhances the traditional pre-timed signal setting design in the operational planning by providing an optimal solution that is the least sensitive to the demand variation. We develop diverse metaheuristic algorithms for this problem, and also compare the deterministic, stochastic and robust solutions using limited test networks.

4 - Accounting for Flexibility in Transportation Network Design Under Uncertainty
Gopal Patil, PhD Candidate, Rensselaer Polytechnic Institute, 4002 JEC, Department of Civil Engineering, Troy, NY, 12180, United States, patilg@rpi.edu, Satish Ukkusuri

We study a multiperiod flexible network design problem (F-NDP) accounting for demand uncertainty. Here the planner gets the flexibility of increasing/reducing the investment on any link at later stages based on the available recourse. We introduce the concept of transportation network flexibility and present two MPEC formulations for F-NDP. The implications of the model and results on test network are discussed.

5 - Stochastic System Optimal Network Design Problem
Gopal Patil, PhD Candidate, Rensselaer Polytechnic Institute, 4002 JEC, Department of Civil Engineering, Troy, NY, 12180, United States, patilg@rpi.edu, Satish Ukkusuri

We address the issue of demand uncertainty in the transportation NDP by formulating the System Optimal Network Design Problem (SONDP) as a two-stage stochastic program with recourse. Our focus in this paper is on accounting for stochasticity and hence we adopt the relatively simple SO approach instead of more realistic UE approach. We formulate the SONDP as a two stage stochastic programming formulation. In the first stage of the stochastic SONDP, improvement and path flows are decided. The second stage penalizes the deviation in the demand realization. One key contribution of this work is in arriving at appropriate penalty functions for this problem. Computational results on multiple transportation networks show the benefit of accounting for stochasticity in the proposed formulation.

■ MB37

Room 337

IT Value

Sponsor: Information Systems Society
Sponsored Session

Chair: Sanjeev Dewan, Associate Professor, Information Systems, University of California at Irvine, Paul Merage School of Business, Irvine, CA, 92697, United States, sdewan@uci.edu

1 - A Model of Search Intermediaries and Paid Referrals
Thomas Weber, Assistant Professor, Stanford University, Management Science and Engineering, Terman Engineering Center, Stanford, CA, 94305-4026, United States, webert@stanford.edu, Zhiqiang (Eric) Zheng

We develop a simple two-stage model of a search intermediary in a vertically differentiated product market. After the intermediary chooses a ranking function, competing firms place their bids for each referral by the search engine. The revenue-maximizing search-engine design bases rankings on a weighted average of product performance and bid amount; the intermediary has an interest to obfuscate search results and thus reduce consumer surplus compared to a socially optimal design.

2 - Antecedents and Consequences of Internet Use in Procurement: An Empirical Investigation

Abhay Mishra, Assistant Professor, University of Maryland, 4325 Van Munching Hall, Robert H. Smith School of Business, College Park, MD, 20742, United States, amishra@rhsmith.umd.edu, Prabhudev Konana, Anitesh Barua

This paper examines the antecedents and consequences of Internet use in the procurement process. Drawing upon the resource-based view of the firm and the technology, organization and environment framework, we develop an integrative model that examines the antecedents and consequences of Internet use in two stages of the procurement process. The model enables us to deconstruct both the usage and the performance aspects of IT use and to provide insights into the enablers of use and business value.

3 - Risk and Return of Information Technology Initiatives: Evidence from Electronic Commerce Announcements

Fei Ren, PhD Candidate, University of California, Irvine, The Paul Merage School of Business, University of California, Irvine, CA, 92697, United States, fren01@merage.uci.edu, Sanjeev Dewan

This paper jointly examines wealth and risk effects of eCommerce announcements using event study. We estimate a generalized model allowing both systematic and unsystematic risk changes on 1996-2002 data. A striking result is wealth effects are not significant, inside or outside the Internet bubble, after controlling contemporaneous risk changes, which are quite significant. With a variety of robustness tests, it contributes to our nascent understanding of how IT affects firm risk-return profile.

■ MB38

Room 338

Issues in Real Time Train Dispatching Systems

Sponsor: Railroad Applications

Sponsored Session

Chair: Roger Baugher, Director, BNSF Railway, 2600 Lou Menk Drive, Fort Worth, TX, 76131, United States, Roger.Baugher@BNSF.com

1 - Brief Summary of Real Time Meet-Pass Planning Implementations

Roger Baugher, Director, BNSF Railway, 2600 Lou Menk Drive, Fort Worth, TX, 76131, United States, Roger.Baugher@BNSF.com

To put the other presentations in perspective, the author will summarize past experience in implementing meet-pass planning algorithms in real time dispatching systems in the U. S.

2 - Optimized Tactical Traffic Planning: What is Required for Success?

Frank Boyle, Union Switch & Signal Inc., 1000 Technology Drive, Pittsburgh, PA, 15219, United States, cfboyle@switch.com

US&S' Optimizing Traffic Planner (OTP) is a tactical traffic planning system that optimizes the movements of trains in real time. Successful development of such a system and its deployment across a class 1 railroad's network present significant challenges ranging from technical to practical to organizational, and even philosophical. This presentation is a recounting of the major hurdles one can expect when undertaking a project of this kind and how to clear them.

3 - Movement Planner: A System for Improving Network Capacity

Melih Arpaci, Director of Engineering, Siemens Transportation Systems, Ackerstrasse 22, Braunschweig, 38122, Germany, melih.arpaci@siemens.com, Iris Jungherr

Increased network velocity and an optimized traffic flow can be realized through an online Movement Planning system. As soon as disruptions occur in operations (e.g. routes are not available), rescheduling measures are to minimize the extent of the effects involved and reduce their timescale (e.g. search for alternative routes). This paper introduces Siemensí approach for a movement planner system. It was designed specifically for automatic train dispatching without manual intervention.

■ MB39

Ballroom B

Great Unsolved Problems in OR - I

Cluster: Great Unsolved Problems in OR

Invited Session

Chair: Arjang Assad, Professor, University of Maryland, Robert H. Smith School of Business, College Park, MD, 20742, United States, aassad@rhsmith.umd.edu

1 - Representing Uncertainty in Decision Support

Harvey Greenberg, Professor, University of Colorado at Denver, Mathematics Department, Denver, CO, 173364, United States, Harvey.Greenberg@cudenver.edu

There are more than 20 measures of uncertainty — probability, possibility, plausibility, rough sets, and more. How do we know which is the right choice in an OR/MS situation? Once we decide measurement, how do we represent it in a model — recourse, chance-constrained, robust, [C]VaR, or some other risk metric? The problem I shall address is how to make that decision. I do not know how to do this, so my talk will merely organize what needs to be done.

2 - Large-Scale Dynamic Stochastic Programming

John R. Birge, Professor, University of Chicago, Graduate School of Business, 5807 S. Woodlawn Avenue, Chicago, IL, 60637, United States, john.birge@chicagogsb.edu

While practical decision making requires the integration of many complex inputs, uncertain responses, and dynamic revisions, most OR/MS results pertain only to systems with simple relationships, certain or predictable responses, and limited opportunities for revision. Optimization of fully dynamic and stochastic systems remains an ongoing challenge. We address reasons for this persistent gap in practical optimization, potential developments to aid in its closure, and future needs.

3 - Computational Global Optimization

János D. Pintér, President and Research Scientist, Pinter Consulting Services Inc., 129 Glenforest Drive, Halifax, NS, B3M 1J2, Canada, jdpinter@hfx.eastlink.ca

Global optimization - the task of finding the best possible solution in multi-modal problems - is one of the toughest numerical challenges. The theoretical foundations of GO have been followed by algorithmic advances and recent software implementations for compilers, spreadsheets, modeling languages and integrated computing systems. In this talk we review these developments, and illustrate both the current state-of-the-art and some significant areas in need of GO technology.

■ MB40

Room 401

Location Models

Sponsor: Location Analysis

Sponsored Session

Chair: Oded Berman, Professor, Rotman School of Management, University of Toronto, 105 St. George Street, Toronto, ON, M5S 3E6, Canada, Berman@Rotman.Utoronto.Ca

1 - Locating Multiple Facilities in a Competitive Environment

Zvi Drezner, Professor, California State University, Fullerton, CA, 92834, United States, zdrezner@fullerton.edu, Atsuo Suzuki, Tammy Drezner

We investigate the location of one or more facilities anywhere in an area in which several competing facilities already exist. The attractiveness of each facility is modeled by a utility function. Each customer selects the facility with the greatest utility function value. As a case study we find the best locations of new convenience stores in the city of Seto, Japan.

2 - Competitive Pricing and Location with Differentiated Products

Binbin Liu, PhD Candidate, Rotman School of Management, University of Toronto, 105 St. George Street, Toronto, ON, M5S 3E6, Canada, binbin.liu02@rotman.utoronto.ca, Dmitry Krass, Oded Berman

We study the duopoly's simultaneous pricing and location game with differentiated products. Customers' valuation of a product increases in quality, and decreases in price and distance. We derive Nash Equilibrium pricing, location and product differentiation strategies. Different kinds of equilibriums results are shown, with insights from these Equilibrium results discussed.

3 - Inventory-Location Problems in the Presence of Time-Sensitive Consumer Demand

Mozart Menezes, Assistant Professor, Department of Operations Management & Information Technology, HEC School of Management, Paris, 1 Rue de la Liberation, Jouy-en-Josas, 78351, France, Menezes@hec.fr, Dmitry Krass, Oded Berman

We consider a problem of serving customer demand from a set of facilities where demand may be lost if the delivery cannot be made in time. Thus, both inventory and location decisions must be made simultaneously, taking into account fixed location costs, inventory-related costs and opportunity costs for lost demand. Such problems are often faced by internet-based retailers, such as Amazon.com. Both theoretical and computational results will be presented.

4 - An Alternative Modeling and Solution Approach for Planar Multi-Facility Location-Allocation Problem

Alper Murat, Assistant Professor, Wayne State University, 4815 Fourth Street, Detroit, MI, 48202, United States, alper@eng.wayne.edu, Vedat Verter

We consider a single-echelon, fixed-charge, planar facility location-allocation problem with large number of customers. We represent the customer demand with a continuous demand density function. After projecting location decisions into the allocation decision space and we demonstrate how this approach accommodates a wide-range of modeling features such as capacity constraint and non-linear cost functions. Lastly, we illustrate exact and heuristic solution methods for these extensions.

■ MB41

Room 402

The Applied Probability Society Markov Lecture

Sponsor: Applied Probability

Sponsored Session

Chair: Mor Armony, Assistant Professor of Operations Management, Leonard N. Stern School of Business, New York University, 44 West 4th Street #8-62, New York, NY, 10012, United States, marmony@stern.nyu.edu

Co-Chair: David Gamarnik, Assistant Professor, MIT Sloan School of Management, E53-353, 77 Massachusetts Avenue, Cambridge, MA, 02139, gamarnik@mit.edu

1 - On Connections Between Network Coding and Stochastic Network Theory - An Introduction

Bruce Hajek, b-hajek@uiuc.edu

Randomly generated coded information blocks form the basis of novel coding techniques used in communication networks. The most studied case involves linear coding, in which coded blocks are generated as linear combinations of data blocks, with randomly chosen coefficients. Digital fountain codes, including Luby's LT codes, and Shokrollahi's Raptor codes, involve coding at the source, while network coding involves coding within the network. Recently Maneva and Shokrollahi found a connection between the analysis of digital fountain codes, and fluid and diffusion limit methods, such as in the work of Darling and Norris. A simplified description of the connection is presented, including fluid and diffusion approximations, with implications for code design.

2 - Fluid Limit Approximations to Combinatorial Algorithms

R. W. R. Darling, Applied Research Mathematician, National Security Agency, P. O. Box 535, Annapolis Junction, MD, 20701, United States, rwdarli@nsa.gov

The coding theory examples presented in Bruce Hajek's Markov Lecture will be used to illuminate the possibilities for building a parsimonious and accurate differential equations model, in cases where a simple combinatorial algorithm is applied to a large (usually sparse) data set. Suitable references and study materials will be suggested for those wishing to try fluid limits.

3 - On Applications of Digital Fountain Codes

Michael Mitzenmacher, Harvard, 33 Oxford Street, Cambridge, MA, 02138, United States, michaelm@eecs.harvard.edu

Fountain codes were originally designed for multicast applications, but have since been proposed for several other related applications. We review major potential applications of fountain codes, focusing on the potential benefits coding gives over solutions without coding. We also discuss the impediments to fountain code adoption, and consider the tradeoffs between fountain codes and network coding.

■ MB42

Room 403

Supply Chain Scheduling & Related Problems

Cluster: Scheduling

Invited Session

Chair: Zhi-Long Chen, Associate Professor, University of Maryland, Robert H. Smith School of Business, College Park, MD, 20742, United States, ZChen@rhsmith.umd.edu

1 - Production and Transportation Integration for a Make-to-Order Manufacturing Company

Xuying Zhao, PhD Student, University of Texas at Dallas, School of Management, Richardson, TX, 75083, United States, xuying.zhao@student.utdallas.edu, Kathryn Stecke

To reduce shipping costs paid to a third party logistics company, a make-to-order manufacturer can take advantage of slow shipping modes through proper scheduling. We analyze such an integration problem for different distribution scenarios. When partial delivery is allowed, a non-preemptive EDD schedule is proved to be optimal. When partial delivery is not allowed, efficient and effective heuristic algorithms with numerical experiments are given following an NP-hard complexity analysis.

2 - Responding to Excess Demand in a Two Stage Supply Chain

Zhixin Liu, Ohio State University, Department of Management Sciences, 2100 Neil Avenue, Columbus, OH, 43210, United States, liu.573@osu.edu, Nicholas G. Hall

Consider a multiple product supply chain with one manufacturer and several distributors, where capacity constraints prevent the manufacturer from meeting all its orders. We model the manufacturer's problem as a combined scheduling and negotiation problem. We model the distributors' problem as a cooperative game, where the distributors make revised decisions about order quantities. We discuss the value of information sharing and cooperation in the supply chain, and provide managerial insights.

3 - Discrete-Time Economic Lot Scheduling Problem on Multiple, Non-Identical Machines

Ramesh Bollapragada, Professor, College of Business, San Francisco State University, 1600 Holloway Avenue, San Francisco, CA, 94132, United States, rameshb@sfsu.edu, Federico DellaCroce, Marco Ghirardi

We develop a general discrete time dynamic demand model to solve the real time resource allocation, lot-sizing, and scheduling in a multimachine environment. We consider the problem of apportioning item production to distinct manufacturing lines with different costs and capabilities. We will model the problem quantitatively, develop and test several alternative solution methods, and build managerial insights on problem parameters from computational experimentation.

4 - Integrated Production-Distribution Scheduling: Some Open Problems

Zhi-Long Chen, Associate Professor, University of Maryland, Robert H. Smith School of Business, College Park, MD, 20742, United States, ZChen@rhsmith.umd.edu

In the last couple of years, we have seen a growing interest in integrated production-distribution scheduling models. The computational complexity of many models have been clarified in the recent literature. In this talk, we will present a number of problems with unknown complexity.

■ MB43

Room 404

AHP/ANP Group Consensus and Multi-Decisions Decision Making

Cluster: Analytic Hierarchy Process

Invited Session

Chair: Luis Vargas, Professor, University of Pittsburgh, 314 Mervis Hall, Pittsburgh, PA, 15260, United States, lgvargas@pitt.edu

1 - Priorities for Multiple Decisions Multi-Decisions Decision Making

Thomas Saaty, University Professor, University of Pittsburgh, 322 Mervis Hall, Pittsburgh, PA, 15260, United States, saaty@katz.pitt.edu

High level governmental and corporate decisions require choosing, ordering and allocating resources to many decisions in a multi-decisions decision making process. Actions are improvised to deal with crises. Much politics and committee work determine the outcome. Measurement of intangible basic criteria provides a scientific basis for prioritization and resource allocation of multiple decisions.

2 - The AHP, a Multicriteria Decision Making Methodology for Shiftwork Prioritization

Claudio Garuti, General Manager, FULCRUM Ingenieria, Luis Thayer Ojeda 0180 Of.1004, Santiago, RM, Chile, claudiogaruti@fulcrum.cl

The objective of this paper is to show a very powerful methodology for decision-making, specifically in the Shiftwork area, where the huge numbers of variables and knowledge to be structured, integrated and synthesized, forces the need for a system analysis process, capable of dealing with such complexity.

3 - Dispersion of Group Judgments

Luis Vargas, Professor, University of Pittsburgh, 314 Mervis Hall, Pittsburgh, PA, 15260, United States, lgvargas@pitt.edu, Thomas Saaty

To achieve a decision with which the group is satisfied, the group members must accept the judgments, and ultimately the priorities. This requires that (a) The judgments be homogeneous, and (b) The priorities of the individual group members be compatible with the group priorities. In this paper we study the homogeneity of group preference for a single paired comparison (monogeneity) and the impact it has on group priorities.

■ MB44

Room 405

Supply Chain Security and Vulnerability

Sponsor: Junior Faculty Interest Group (JFIG)

Sponsored Session

Chair: Gal Raz, Assistant Professor, Australian Graduate School of Management (AGSM), Australian Graduate School of Management, UNSW, Sydney, NS, Australia, galr@agsm.edu.au

1 - Supply and Demand Uncertainty in Multi-Echelon Supply Chains

Lawrence Snyder, Assistant Professor, Department of Industrial & Systems Engineering, Lehigh University, 200 West Packer Avenue, Bethlehem, PA, 18015, United States, larry.snyder@lehigh.edu, Zuo-Jun Max Shen

We discuss the effects of both demand and supply uncertainty in multi-echelon supply chains. We demonstrate that, in many cases, the optimal strategy for coping with supply uncertainty is exactly opposite to the conventional wisdom from the OM literature on coping with demand uncertainty. Using a combination of analytical and simulation studies, we illustrate this contrast in various settings, including risk pooling, inventory placement, supplier diversification, and others.

2 - Strategies for Managing Supply Uncertainty

Brian Tomlin, Assistant Professor, University of North Carolina, McColl Building, CB3490, Chapel Hill, NC, 27599, United States, brian_tomlin@unc.edu

This talk will focus on the management of supply uncertainty, with a particular emphasis on supply disruptions. We will discuss such tactics as inventory, sourcing, pricing, and insurance. Findings from a number of papers will be presented along with potential directions for future research.

3 - Perspectives on Research in Supply Chain Security and Resiliency

Alan Erera, Assistant Professor, Georgia Institute of Technology, 765 Ferst Drive, NW, Atlanta, GA, 30332, United States, alan.erera@isye.gatech.edu

This talk will provide some perspectives on the role of operations research and management science in the area of supply chain security and resiliency. Using examples, the presentation will attempt to identify interesting problem domains for study, and where enhancements are needed in exisiting methodological solution approaches. Some ideas generated from an NSF workshop on this topic will also be discussed.

■ MB45

Room 406

Tutorial: Robust and Data-Driven Optimization: Modern Decision-Making Under Uncertainty

Cluster: Tutorials

Invited Session

1 - Robust and Data-Driven Optimization: Modern Decision-Making Under Uncertainty

Dimitris Bertsimas, Boeing Professor of Operations Research, Massachusetts Institute of Technology, Sloan School of Management Room E53-363, 77 Massachusetts Avenue, Cambridge, MA, 02139, United States, dbertsim@mit.edu, Aurelie Thiele

We present a mathematical approach to decision-making under uncertainty incorporating limited information on the sources of randomness and decision-makers' risk attitudes. We review recent developments in robust and data-driven optimization, where random variables represent uncertain parameters in a convex uncertainty set and the decision-maker protects the system against their worst-case values. We also address construction of sets using historical data and connections with coherent risk measures.

■ MB46

Room 407

Incentive Issues in Supplier Management

Cluster: Supply Chain and Operations Engineering

Invited Session

Chair: Serguei Netessine, Assistant Professor, The Wharton School, 3730 Walnut Street, Suite 500, Philadelphia, PA, 19104, United States, netessine@wharton.upenn.edu

1 - Long Term Contracts Under the Threat of Supplier Failure

Robert Swinney, Doctoral Student, University of Pennsylvania, 3730 Walnut Street, Suite 500, Philadelphia, PA, 19104, United States, rswinney@wharton.upenn.edu, Serguei Netessine

We address the issue of how to contract with suppliers facing the threat of failure when the probability of failure is directly influenced by contract terms (e.g., price and length of contract). We model this dynamic through a two period contracting game with two suppliers, a single buyer, and uncertain production costs. We determine when it is optimal to commit to a long-term relationship, and how this decision is affected by suppliers under the threat of failure.

2 - Contracting for Supply Flexibility Under Asymmetric Information

Tianjun Feng, University of California-Irvine, The Paul Merage School of Business, Irvine, CA, 92697, United States, fengt@uci.edu, Fuqiang Zhang

This paper studies a buyer's procurement problem when there are either one or multiple potential suppliers with private cost information. The market demand is uncertain and the supplier needs to make capacity decisions before demand is realized. We derive the optimal procurement mechanism for the buyer and also identify simple mechanisms that perform well.

3 - Resilient Supply Chains: Diversification vs. Dedicated Supplier Procurement Strategies

Volodymyr Babich, Assistant Professor, University of Michigan, 1205 Beal Avenue, IOE 2783, Ann Arbor, MI, 48105, United States, babich@umich.edu, Luz Caudillo

Using a dynamic, stochastic model which combines procurement and financial subsidies decisions, this paper examines the tradeoffs of a manufacturing firm between two strategies for managing supply default risks: diversification of the supplier base vs. financial subsidies to a few dedicated suppliers. We describe properties of the optimal policies and derive conditions under which the firm prefers capital concentration to diversification.

4 - Inventory or Reliability? Contracting Strategies in After-Sales Service Supply Chains

Sang-Hyun Kim, Doctoral Student, 3730 Walnut Street, Suite 500, Philadelphia, PA, 19104, United States, shkim@wharton.upenn.edu, Morris Cohen, Serguei Netessine

In a performance based contracting environment of after-sales service supply chains, the service provider who is rewarded for performance enhancement (e.g. increase in spare parts availability) faces two choices: invest in parts inventory or invest in reliability improvement. We identify a tradeoff between these two choices, and analyze commonly used contracts and their impacts on supply chain efficiency.

■ MB47

Room 408

Supply Chain Optimization I

Cluster: Supply Chain and Operations Engineering

Invited Session

Chair: H. Edwin Romeijn, Associate Professor, University of Florida, ISE Department, 303 Weil Hall, PO Box 116595, Gainesville, FL, 32611-6595, United States, romeijn@ise.ufl.edu

1 - Logistics Contracts in Manufacturing

Osman Engin Alper, University of California, IEOR, Berkeley, CA, 94530, United States, engin@ieor.berkeley.edu, Hyun-Soo Ahn, Phil Kaminsky

The value of integrating production and logistics operations is increasingly appreciated by managers, while at the same time logistics outsourcing is becoming a more prevalent across many industries. Motivated by this observation, we develop models of logistics contracts in manufacturing systems, characterize optimal policies, provide computational results, and summarize practical implications.

2 - Inventory Pooling to Satisfy Multiple Service Levels

Aydin Alptekinoglu, Assistant Professor, Department of Decision & Information Sciences, Warrington College of Business, University of Florida, Gainesville, FL, 32611, United States, aalp@ufl.edu, Anand Paul

What are the optimal ordering and allocation policies that minimize the inventory level when a pool of inventory is used to satisfy individual type-one service levels for multiple customers? In seeking an answer to this research question, we find that pooling helps even when the demands are perfectly positively correlated, and that the aggregate service level (the probability that the pooled inventory exceeds the total demand) is generally less than the minimum of the individual service levels.

3 - The Economic Lot-Sizing Problem with a Remanufacturing Option

Wilco van den Heuvel, PhD Student, Econometric Institute, Erasmus School of Economics, Erasmus University, PO Box 1738, 3000 DR, Rotterdam, Netherlands, wvandenheuvel@few.eur.nl

We present an extension of the classical economic lot-sizing (ELS) model. In the ELS model there is a known demand for a fixed number of periods which has to be satisfied by manufacturing items at minimal cost. In our extended model, besides manufacturing new items, demand can be satisfied by remanufacturing returned items. Costs include setup cost, unit (re)manufacturing cost and holding cost. We derive polynomial time algorithms and complexity results for different model assumptions.

4 - Lot-Sizing Problems Integrating Production, Transportation, Inventory, and Pricing Decisions

Mehmet Onal, PhD Student, University of Florida, Industrial and Systems Engineering, Gainesville, FL, 32611, United States, monal@ufl.edu, H. Edwin Romeijn

Through pricing decisions the demand levels a firm should satisfy can be controlled and higher profits can be obtained. We consider a lot-sizing problem where production, inventory, transportation, and pricing decisions are integrated to maximize profits. We assume general concave revenue functions and fixed charge production cost functions. We develop polynomial-time solution approaches to solve these problems under a number of different inventory holding and transportation cost structures.

■ MB48

Room 409

Managing Operations in Health Care Industry

Sponsor: Manufacturing & Service Operations Management

Sponsored Session

Chair: Sergei Savin, Associate Professor, Columbia Business School, 3022 Broadway, 404 Uris Hall, New York, NY, 10027, United States, svs30@columbia.edu

1 - Optimization of Surgical Suite Scheduling Decisions Under Uncertainty

Hari Balasubramanian, Research Associate, Mayo Clinic, 200 First St. SW, Rochester, MN, United States, Hari.Balasubramanian@asu.edu, Ahmed Rahman, Brian Denton

Appointment scheduling systems are used by many health care providers to balance the utilization of resources with patient waiting time. In this talk we describe a stochastic optimization model for a commonly encountered outpatient surgery scheduling problem in specialty care clinics. We present insights about the model structure, special cases, and numerical results based on real data that illustrates the potential impact of our model in a clinical environment.

2 - Multiplexing Patients in Chronic Illness Facilities: Optimal Capacity Overbooking

Donald Lee, PhD Student, Management Sci & Eng, Stanford University, Stanford, CA, 94305, United States, dkklee@stanford.edu, Stefanos Zenios

Individuals suffering from chronic illnesses require periodic treatment. For example, those afflicted with kidney disease require dialysis thrice weekly. Complications from treatment also cause frequent patient hospitalizations, a significant source of revenue loss. Modeling the system with a migration network, we propose that clinics should overbook capacity to maintain optimal utilization while pooling spare resources with those of nearby facilities to hedge the risk of overflow.

3 - Appointment Management in Presence of Patient & Provider Preferences

Diwakar Gupta, Professor, Department of Mechanical Engineering, University of Minnesotta, Twin Cities, MN, United States, guptad@me.umn.edu

Patients (providers) make different choices when booking (controlling access to) appointment slots. Some patients visit only their designated doctor, whereas others visit any doctor who is available at a convenient time. Some providers routinely double book and work overtime to accommodate urgent demand, whereas others work fixed hours. This talk will summarize author's efforts to model the resulting booking control problems in several different health care settings.

4 - How Advanced Should Advanced Access Be?

Sergei Savin, Associate Professor, Columbia Business School, 3022 Broadway, 404 Uris Hall, New York, NY, 10027, United States, svs30@columbia.edu, Linda Green

Advanced access has been advocated to decrease appointment delays and increase utilization in healthcare facilities. The goal is to be able to offer a same-day appointment to the vast majority of patients. In this talk, we consider the general appointment management problem for a facility that permits patients to get an appointment within a fixed number of days, T, with a high probability and establish the optimal values of T under various conditions.

■ MB49

Room 410

Optimization in Closed-Loop Supply Chains

Cluster: Closed-Loop Supply Chains and Reverse Logistics

Invited Session

Chair: Elif Akcali, Assistant Professor, University of Florida, 303 Weil Hall, PO Box 116595, Gainesville, FL, 32611-6595, United States, akcali@ise.ufl.edu

Co-Chair: Halit Uster, Assistant Professor, Texas A&M University, Industrial and Systems Engineering, College Station, TX, 77843, United States, uster@tamu.edu

1 - To Repair or to Replace? Optimal Repair Durations for Short Lifecycle Products

Kristin Sahyouni, Northwestern University, 2145 Sheridan Road, Department of IEMS, Evanston, IL, 60208, United States, kristin@iems.northwestern.edu, Canan Savaskan, Mark Daskin

We consider a repair operation in which defective warranty items arrive to an OEM over a known period and must be repaired using spare parts procured from a third party supplier or replaced with a comparable next generation alternative. We show how facility costs, inventory holding costs, replacement costs, and variable repair costs affect a firm's optimal decision. Extensions consider arrival rate uncertainty, supplier contracting options, and the value of information over the lifecycle.

2 - Closed Loop Supply Chain Network Design Problem with Multi-Product Remanufacturing

Gopalakrishnan Easwaran, PhD Student, Department of Industrial and Systems Engineering, Texas A&M University, College Station, TX, 77843, United States, egopalakrishnan@tamu.edu, Halit Uster, Elif Akcali, Sila Cetinkaya

We consider a remanufacturing network design problem under the closed loop supply chain setting. We provide mathematical formulation for optimization of strategic decisions involving facility locations and coordinated product flows in the forward and reverse channels of this network. We develop efficient solution procedures based on decomposition approaches. We also present computational results on the performance of the solution methods for test problem instances.

3 - Reverse Production Systems: Centralized vs. Decentralized Models

Jane Ammons, Associate Dean of Engineering for Faculty Affairs and Professor, Georgia Institute of Technology, Industrial and Systems Engineering, Atlanta, GA, 30332, United States, jane.ammons@isye.gatech.edu, Jane Ammons, Matthew Realff

A reverse production system is a network of transportation logistics and processing functions to collect, consolidate, refurbish, and demanufacture end-of-life products. We examine centralized and decentralized models of decision-making for material flows and associated transaction prices for these networks. The centralized approach may overestimate of system material flows and profit if the system planner utilizes a centralized view to predict behaviors of independent entities in the system.

■ MB50

Room 411

Wireless Networks

Sponsor: Telecommunications

Sponsored Session

Chair: Eli Olinick, Associate Professor, Southern Methodist University, PO Box 750123, Dallas, TX, 75275, United States, olinick@engr.smu.edu

1 - Reliable W-CDMA Network Design with Sectorization

Eli Olinick, Associate Professor, Southern Methodist University, PO Box 750123, Dallas, TX, 75275, United States, olinick@engr.smu.edu, Jeffery Kennington, Qibin Cai, Joakim Kalvenes

We present a comprehensive planning model for W-CDMA networks. Our model involves the simultaneous selection of base station location and antenna type combinations, MTSO and PSTN gateway locations, construction of the backbone network, and assignment of service of subscriber locations to antenna sectors while satisfying reliability,capacity, and QoS requirements. An extensive empirical analysis is performed with multiple strategies to obtain good feasible solutions and tight upper bounds.

2 - Tower Location for CDMA Networks Under Demand Uncertainty

Jay Rosenberger, Assistant Professor, The University of Texas at Arlington, PO Box 19017, Arlington, TX, 76019, United States, jrosenbe@uta.edu, Eli Olinick

Designing Code division multiple access networks includes determining an optimal location of radio tower. We describe a deterministic model for tower location and a stochastic model to optimize revenue given a set of constructed towers. We integrate these models in a stochastic integer programming problem that optimizes the location of towers under demand uncertainty. We develop algorithms and heuristics using Benders' reformulation, and we provide computational results.

3 - A Multiple-Network Choice System for Mobile Telephones
David Shallcross, Senior Research Scientist, Telcordia Technologies, 1 Telcordia Drive, RRC-1C305, Piscataway, NJ, 08854, United States, davids@research.telcordia.com

Mobile wireless devices such as cell phones may now have the ability to communicate to a central network via several different access networks, such as WiFi hot spots and GSM cells. We investigate a system whereby the network can balance the load among different access methods, for example to reduce overall blocking.

4 - Distributed Control of Multihop Wireless Networks for Full Utilization
Atilla Eryilmaz, Post-Doctoral Associate, LIDS, Massachusetts Institute of Technology, 77 Massachusetts Avenue, 32-D566, Cambridge, MA, 02139, United States, eryilmaz@mit.edu, Eytan Modiano, Asuman Ozdaglar

We develop a generic randomized Routing-Scheduling-Flow Control Algorithm that can be implemented for a large class of interference models. We prove that the algorithm achieves 100% throughput efficiency and fairness across flows. For a two-hop interference model, we develop specific distributed algorithms with polynomial complexity that fits into the proposed generic framework. This is the first distributed algorithm in this context that guarantees full utilization of the resources.

■ MB51

Room 412

Designing and Managing Product and Service Variety

Sponsor: Manufacturing & Service Operations Management
Sponsored Session

Chair: Jay Swaminathan, Professor, University of North Carolina, Chapel Hill, Kenan Flagler Business School, Chapel Hill, NC, 27599, United States, msj@unc.edu

1 - Seeking Closure: Competition in Complementary Markets
H. Sebastian Heese, Assistant Professor, Indiana University, Kelley School of Business, Bloomington, IN, 47405, United States, hheese@indiana.edu, Kyle Cattani

Firms that compete in markets for complementary products must consider the interdependence across markets as well as the competition within markets. When does a strategy based on preclusion make sense, and when would firms be better off by accepting a common standard? We address these questions employing standard game theoretic analysis to a simple spatial model that captures aspects of both inter-market externalities and intra-market competition.

2 - Inventory Substitution Model with Competition
Raj Rajagopalan, Professor, University of Southern California, Marshall School of Business, Los Angeles, CA, 90089, United States, srajagop@marshall.usc.edu, Mahesh Nagarajan

We look at a duopoly model where two newsvendors selling substitutable products with negatively correlated demand compete by setting inventory levels. We consider both static and dynamic versions of this game and show some interesting properties of the equilibrium inventory policy. In particular, we specify conditions when players may ignore their competitor's inventory levels and potential substitution demand.

3 - Capacity Allocation Under Vertical Differentiation
H. Muge Yayla, PhD Student, University of North Carolina at Chapel Hill, CB#3490 McColl Building, UNC-CH, Chapel Hill, NC, 27599-3490, United States, yaylah@kenan-flagler.unc.edu, Jay Swaminathan, Ali Parlakturk

In this paper, we study a firm that has to allocate its fixed capacity between two offerings that are vertically differentiated. The customer base is sensitive to both quality and prices. We find the optimal capacity allocation to the two classes under alternative cost, quality and capacity usage assumptions under monopoly and duopoly.

4 - Empirical Evidence on the Impact of Component Standardization on Product Quality
Kamalini Ramdas, Associate Professor, Darden School, 189 FOB, 100 Darden Boulevard, Charlottesville, VA, 22902, United States, Ramdask@Darden.virginia.edu, Taylor Randall

We report on an empirical study that examines the impact of component standardization on product reliability, in the context of automotive braking systems. We find that depending on how it is done, standardization can either help or hurt reliability. We also discuss how standardization can impact quality in other industries.

■ MB52

Room 413

Revenue Management Theory

Sponsor: Revenue Management & Pricing
Sponsored Session

Chair: Garrett van Ryzin, Columbia University, Uris Hall, New York NY 10027, United States, giv1@columbia.edu

1 - Choice Based Demand Forecasting in Airline Revenue Management Environment
B. Venkateshwar Rao, Sabre Airline Solutions, 3150 Sabre Drive, Southlake, TX, 76092, beju.rao@sabre.com

Bookings data observed in a revenue management environment is not the true underlying demand. Passengers often end up booking on flights that are not their first preference, due to capacity and/or fare class availability restrictions. Spilled demand from a closed fare classes is either sold up to a higher fare class, or recaptured on other flights. We present a customer choice model based framework for obtaining the first choice, untruncated demands for various services at different fare values. The forecasting methodology is applicable in restriction free pricing as well as in traditional environments. We provide measures to evaluate forecast accuracy. We discuss benefits associated with a choice based forecasting as well as challenges associated with the implementation.

2 - On Bid Price Controls for Network Revenue Management
Baris Ata, Assistant Professor, Kellogg School of Management, Northwestern University, 2001 Sheridan Road, Evanston, IL, 60208, United States, b-ata@kellogg.northwestern.edu, Mustafa Akan

We consider a network model of revenue management and propose a novel class of bid-price control mechanisms. Under mild assumptions, we show that the proposed bid-price control mechanism is optimal, and that the optimal bid prices form a martingale. Optimality and martingale property of bid-prices are robust to information distortions. In particular, we show that under semi-continuous information structures, there exist near-optimal predictable bid-price policies having the martingale property.

3 - Stock-Outs and Consumer Search Behavior for Products with Quality Uncertainty
Laurens Debo, Assistant Professor, Carnegie Mellon University, Tepper School of Business, 5000 Forbes Avenue, Pittsburgh, PA, 15213, United States, laurdebo@andrew.cmu.edu, Garrett van Ryzin

A stock-out contains information for a consumer who is uncertain about the quality of the product. It is an indication that the product is likely of high quality as many other consumers have bought the product. This may motivate the consumer to search for the product in other stores. We discuss how the equilibrium consumer search and purchasing behavior depends on the costs of information gathering for the consumer and the store replenishment rates.

4 - Stochastic Programming and the Option of Doing it Differently
Stein W. Wallace, Professor, Molde University College, PO Box 2110, NO-6402, Molde, Norway, Stein.W.Wallace@hiMolde.no

Option theory and stochastic programming are tightly linked. Most options can be analyzed in both frameworks, and the two approaches support each other in many slightly more complex situations. But this similarity hides some central differences in perspective: Option theory can be applied only to options already identified, while stochastic programming is able to help us find options in contexts where it is not at all clear what they are, and where finding might be more important than valuing.

5 - Product Positioning without Market Information
Serkan Eren, PhD Student, Columbia Business School, 435 West 119th Stree Apt. 3F, New York, NY, 10027, United States, se2027@columbia.edu, Garrett van Ryzin, Costis Maglaras

Traditional pricing and product positioning models assume that firms have full information about the market demand and consumer preferences. In practice, however, one rarely has such accurate information, which raises the important question of how to make decisions under limited market information. We study five classical settings where the firm has limited information. Several results correspond to common policies observed in practice. This talk will concentrate on product positioning models.

■ MB53

Room 414

Inventory Management: Role of Information

Contributed Session

Chair: Ron Tibben-Lembke, Associate Professor, Supply Chain Management, University of Nevada, MGRS / 028, Reno, NV, 89557, United States, rtl@unr.edu

1 - Optimal Production and Rationing Decisions in a Supply Chain with Information Sharing

Boray Huang, Assistant Professor, University of Mississippi, Holman 349, PO Box 1848, University, MS, 38677, United States, bhuang@olemiss.edu, Seyed Iravani

We consider a two-level capacitated supply chain with a upstream supplier and two non-identical downstream retailers. The retailers are of different importance and share their inventory information with the supplier. The supplier has to decide: How much inventory to keep and how to allocate the on-hand inventory to arriving orders. We characterize the optimal production and stock rationing policies. We also study how retailers' order sizes affect the benefit of stock rationing.

2 - Optimal Ordering and Learning Policies for a Fashion Good Retailer

Tong Wang, PhD Candidate, INSEAD, Boulevard de Constance, Fontainebleau, 77305, France, tong.wang@insead.edu, Nils Rudi

A retailer sells a single fashion good to end consumers. The selling season is one single period, and she acts as a newsboy. Before the season there are T periods that she can replenish inventory, acquire signals, and learn the demand. She need tradeoff between low ordering cost in early periods and low demand uncertainty in late periods. We show the optimal ordering policy is base-stock policy, and the base-stock level is a linear function of signal realizations.

3 - Optimal Ordering Policies for Stochastic Inventory Problems with Observed Information Delays

Qi Feng, Assistant Professor, The University of Texas at Austin, 1 University Station, B5000, Austin, TX, 78705, United States, annabelle.feng@mccombs.utexas.edu, Alain Bensoussan, Metin Cakanyildirim, Suresh Sethi

We consider a newsvendor who plans his ordering strategy based on cost-efficiency and long-term customer satisfaction. A two-stage newsvendor model is formulated to study this problem. The vendor commits his long-term standing order at the first stage, and makes short-term adjustment (either upward or downward) at the second stage. We characterize the cost-optimal ordering strategy that meets a long-term service target. We also discuss various managerial insights and policy behaviors.

4 - Optimal Inventory Policies of a Censored Newsvendor

Arnab Bisi, Assistant Professor of Management, Purdue University, Krannert School of Management, 403 W. State Street, West Lafayette, IN, 47907-2056, United States, abisi@mgmt.purdue.edu

We address the problem of computing the optimal policies in a periodic-review inventory model with unobservable lost sales. Demand distribution is unknown and needs to be updated based on sales data. We develop a method for computing the optimal ordering policies for this censored newsvendor problem.

5 - The Bayesian Newsboy Problem with Seasonal Demand

Ron Tibben-Lembke, Associate Professor, Supply Chain Management, University of Nevada, MGRS / 028, Reno, NV, 89557, United States, rtl@unr.edu

We consider a finite-horizon newsboy problem where the mean and standard deviation are unknown, using Bayesian updating to generate better estimates of the demand distribution. We consider the case where expected demands each period are not constant. This allows us to consider the finite-length, seasonal demand pattern experienced by many retail products. We extend the solution to the case where the seasonal indexes are not known with certainty, a priori.

■ MB54

Room 415

Design and Operation of Distribution Channels

Cluster: Operations and Marketing for Emerging Markets

Invited Session

Chair: Stephen Gilbert, Associate Professor, The University of Texas at Austin, McCombs School of Business, Austin, TX, 78712, United States, Steve.Gilbert@mccombs.utexas.edu

1 - The Value of Losing Control: Competition in Markets for Complements

Hubert Pun, PhD Candidate, Indiana University, Kelley School of Business, Bloomington, IN, 47405, United States, hpun@indiana.edu, H. Sebastian Heese

Manufacturers that sell complementary products can benefit from considering the resulting interdependencies. While using independent retailers makes it difficult to internalize this positive externality, it leads to double marginalization which mitigates within-market competition. We use standard game theoretic analysis to determine the optimal distribution channel structure (through independent retailers or integrated) for competing manufacturers that participate in markets for complements.

2 - Comparative Analysis of Distribution Channels for Innovative Durable Goods

Genaro Gutierrez, Associate Professor, The University of Texas at Austin, McCombs School of Business, Austin, TX, 78712, United States, Genaro.Gutierrez@McCombs.utexas.edu, Xiuli(Sophia) He

We compare the desirability of direct, indirect, and hybrid channel structures for the distribution of a durable good for which consumer demand follows a price sensitive Bass-type diffusion process. We examine the desirability each of these distribution channel structures as a function of the relative brand/retailer influence on the consumer, distribution costs, inventory costs, and after sale profit opportunities such as sale of service contracts and sale of complementary products.

3 - Incentives for Information Flows in a Vertical Contract

Manu Goyal, Assistant Professor, University of Maryland, 4350 Van Munching Hall, College Park, MD, 20742, United States, mgoyal@rhsmith.umd.edu, Krishnan Anand

In practical settings, material and information flows are intertwined, calling for their joint optimization to maximize channel efficiency. We analyze one such setting where material and information flows intersect through the mechanism of information leakage (non-consensual sharing of information), and study its effect on the joint determination of material flows (the order quantities) and information flows (acquisition and dissemination of demand information) in a vertical contract.

4 - Implications of Product Lifecycle and Channel Structure Upon Optimal Investment in Durability

Sreekumar Bhaskaran, Assistant Professor, Southern Methodist University, Cox School of Business, Dallas, TX, 75275, United States, sbhaskar@cox.smu.edu, Stephen Gilbert

We investigate how the use of intermediaries in the channel of distribution affects a manufacturer's investment in the durability of a product. Depending upon the product and technology lifecycles, we show that a manufacturer can have an incentive to invest more in durability when he sells through intermediaries than when he sells directly. We also explore how this incentive to invest in durability is affected by the intensity of competition among the dealers.

■ MB55

Room 416

Modeling Issues in DEA

Cluster: Data Envelopment Analysis

Invited Session

Chair: John Ruggiero, J. Robert Berry Endowed Faculty Fellow, University of Dayton, 517 Miriam Hall, Department of Economics and Finance, Dayton, OH, 45469, United States, John.Ruggiero@notes.udayton.edu

1 - Orientation Issues in Data Envelopment Analysis

Andy Johnson, Assistant Professor, Department of Industrial and Systems Engineering, Texas A&M University, 241 Zachry, 3131 TAMU, College Station, TX, 77843, United States, ajohnson@isye.gatech.edu

There have been at least four different orientations for measuring efficiency suggested in the data envelopment analysis literature. This talk will address the issue of selecting an orientation in the short-run analysis and suggest methods for estimating the parameters of the directional distance function.

2 - Evaluating U.S. State Police Performance Using Data Envelopment Analysis

Michael Gorman, Associate Professor, University of Dayton, Department of MIS, OM and DSC, 300 College Park, Dayton, OH, 45419-2130, United States, michael.gorman@udayton.edu, John Ruggiero

We evaluate the efficiency of state police services in the US using a multiple-stage data envelopment analysis model. Technical and scale efficiency are calculated for the 49 continental states. We allow for environmental factors of production and control for these nondiscretionary inputs. Our results indicate that most states are technically efficient, but nearly half are operating at less than optimal scale size.

3 - Technical Efficiency Estimation with Multiple Inputs and Multiple Outputs Using Regression Analysis

John Ruggiero, J. Robert Berry Endowed Faculty Fellow, University of Dayton, 517 Miriam Hall, Department of Economics and Finance, Dayton, OH, 45469, United States, John.Ruggiero@notes.udayton.edu

Regression and linear programming are two popular techniques for estimating efficiency. A purported disadvantage of the regression based models is the inability to allow multiple outputs without additional data on input prices. In this paper, a multiple output regression model is developed. Notably, technical efficiency can be estimated using Corrected OLS in multiple-input, multiple-output environments without input price data.

Interactive Session
Monday, 12:30pm-1:30pm

Ballroom Foyer

Chair: Miguel Lejeune, Assistant Professor, Carnegie Mellon University, 5000 Forbes Avenue, Tepper School of Business, Pittsburgh PA 15213, United States, miejeune@andrew.cmu.edu

1 - Computer Implementation of EMS Deployment Models

Rashid Al-Jalahema, Department of Systems and Industrial Engineering, 111 Engineering, Tucson, AZ, 85721, United States, rashid@email.arizona.edu, Jeff Goldberg

We will demonstrate computer models for evaluating system and grid coverage under static and dynamic deployment for EMS systems. The model interface allows the user to design systems, solve a model to estimate performance, and then graphically display results using a geographic information system. Performance calculators that can be deployed on a dispatcher's desktop to evaluate re-deploy decisions will also be presented.

2 - A Multi-Agent Complex Systems Modelling Framework for Improving Supply Chain Resilience

Partha Datta, Doctoral Scholar, Cranfield University, Wharley End, Cranfield, MK43 0AL, United Kingdom, partha.datta.phd.03@cranfield.ac.uk, Peter Allen, Martin Christopher

Effective supply chain management in dynamic environment calls for building resilient supply chains which can maintain good control over performance variability in the face of disturbances. This paper conceptualizes supply chains as complex systems with multiple autonomous agents and suggests methods of improving resilience, in the context of a real life paper tissue manufacturing company.

3 - Bayesian Sequential Change Diagnosis: Detection and Identification of a Change in a Random Sequence

Christian Goulding, Princeton University, ORFE, E-Quad, Princeton, NJ, 08544, United States, cgouldin@Princeton.EDU, Savas Dayanik, H. Vincent Poor

Sequential change diagnosis is the joint problem of detection and identification of a sudden and unobservable change in the pdf of a sequence of i.i.d. random variables to one of finitely many alternative pdf's. The objective is quick detection of the change and accurate inference of the ensuing pdf. Following a Bayesian approach, a new sequential decision strategy for this problem is revealed and is proven optimal. Geometrical properties of this strategy are demonstrated via numerical examples.

4 - Production Planning With Start-Time Dependent Variable Costs

James Luedtke, PhD Student, Georgia Institute of Technology, 765 Ferst Drive, Atlanta, GA, 30332, United States, jluedtke@isye.gatech.edu, George Nemhauser

We present a multi-period planning model in which the variable costs are determined by the technology available when activities are begun. This leads to a natural mixed integer bilinear programming formulation, which we reformulate in different ways to obtain linear models. We study the associated polyhedra and present computational results.

5 - Process to Expedite Admission Decisions

Luciano Fleischfresser, OSSM - ATC, 1201 West Willow Road, Enid, United States, l_fle@alumni.ou.edu

A scoring system to rank prospective applicants is being developed. Coined PEAD (Process to Expedite Admission Decisions), the procedure evaluates three aspects for each candidate: (I) application forms; (II) personal interviews; and (III) multiple-choice test results. PEAD is used with a group sample and the results discussed.

6 - Optimal Job Releasing for a Benchmark Reentrant Line

Jose Ramirez-Hernandez, Ph.D Student, University of Cincinnati, 707 MLK Dr. W, Apt. 506E, Cincinnati, Oh, 45220, United States, ramirejs@ececs.uc.edu, Dr. Emmanuel Fernandez

We study the problem of optimal job releasing for a benchmark reentrant line with exponential arrival and processing times. System and optimization models are presented under the framework of an infinite horizon discounted cost criterion, and optimality conditions and optimal policies are derived. The application of approximate dynamic programming methods is also discussed.

7 - Optimal Planning Quantities for Product Transition

Hongmin Li, Ph.D. student, MIT Sloan School of Management, E53-384, 30 Wadsworth Street, Cambridge, MA, 02142, United States, hmli@mit.edu

We study the inventory planning decisions for product upgrades when there is no replenishment opportunity during the transition period and we allow product substitutions. The optimal substitution decision is a time-varying threshold policy. We can then find the optimal planning quantities for a stochastic transition date and non-stationary demand. Further, we determine the optimal transition delay given the inventory of old product.

8 - Design and Analysis of Large-Scale Networks

Hari Prasad Thadakamalla, Student, The Pennsylvania State University, 310 Leonhard Bldg., University Park, PA, 16802, United States, hpt102@psu.edu, Soundar R. T. Kumara, Reka Albert

During the last few years we have witnessed the emergence of many networks with large number of nodes. Few examples include the Internet, the World Wide Web and Military logistics network. The sheer size of these networks poses unique challenges in their design and analysis. We discuss an approach based on statistical physics (complex networks theory) for design and optimization in such large networks. In specific, we study the problem of robustness and routing on these networks.

9 - Screening with Externalities

Thomas Weber, Assistant Professor, Stanford University, Management Science and Engineering, Terman Engineering Center, Stanford, CA, 94305-4026, United States, webert@stanford.edu

We consider a general screening model with payoff externalities and type-dependent constraints. The principal can design contract instruments of arbitrary dimension to influence each agent's valuation of the proposed transaction, which also depends on the anticipated choice of other agents. We characterize the class of all implementable menus and provide necessary optimality conditions for the general multiattribute fulfilled-expectations screening problem.

10 - Vessel Traffic Modeling and Risk Analysis for the Istanbul Strait

Ozgecan Uluscu, Ph.D. Student, Rutgers, The State University of New Jersey, 96 Frelinghuysen Road, CoRE Building, Room 201, Piscataway, NJ, 08854, United States, ozgecanu@yahoo.com, Tayfur Altiok

We have developed a detailed simulation model of the vessel traffic including various classes of dangerous cargo in the Istanbul Strait. The purpose is to analyze various scheduling policies to allow vessels to enter the Strait with the purpose of minimizing various risk measures and vessel waiting times.

11 - An Investigation of the Performance Effects of Internal Capabilities and Supplier Linkage

Xiaosong Peng, Ph.D student, University of Minnesota, 321 19th Ave S, Room 3-150, Minneapolis, MN, 55455, United States, dpeng@csom.umn.edu, Rachna Shah, Roger Schroeder

This research investigates the individual and joint effects of two intra-firm capabilities namely improvement and innovation and two types of supplier linkage namely supplier quality linkage and supplier design linkage. It draws on the relational view (Dyer and Singh, 1998) to explain the joint effects of internal capabilities and supplier linkage on performance. Regression was used to test the proposed model.

12 - An Integrated Procedure for Supply Chain Network Designs with Scale Economies

Michael Bucci, PhD student, Industrial Eng., North Carolina State University, 3300 Drexel Hill Court, Apex, NC, 27539, United States, mbucci@nc.rr.com, Michael Kay, Donald Warsing

We present a meta-heuristic approach for supply chain network design that builds off of the alternate location-allocation (ALA) procedure. Unlike more traditional mixed-integer programming-based formulations, our method permits nonlinear costs - allowing a full solution of network design problems that can incorporate production, transportation, and inventory pooling economies of scale. We compare the speed and quality of our near-optimal solutions with other methods.

13 - The Impact of Process Flexibility on First-Mover Advantages

Bin Shao, University of Illinois at Urbana Champaign, 1206 S Six St, Champaign, 61820, United States, binshao@uiuc.edu, Dilip Chhajed

We explores the impact of several operational issues such as, change-over flexibility, experience curve, and production cost on first-mover advantages and product-design decisions in duopoly setting with customers making repeat purchases. We decide each firm's design policies and provide the criteria under which the first entrant enjoys the first-mover advantages. We also find that when the first entrant has more flexibility, the competitor may benefit more.

14 - Observation, Theory, and Simulation of Integrated Concurrent Engineering
John Chachere, Ph.D. Student, Stanford University, 1311 Ulloa St., San Francisco, CA, 94116, United States, chachere@stanford.edu

We observed a team that designs space missions at a greatly accelerated pace using methods that resemble mission operations. Existing organizational theory and models do support their performance claims, but do not explain how and when their method is effective. We assert that aligning ten factors shortens information response latency and dramatically compresses project schedule. We propose response latency as a unifying theoretical principle to describe, evaluate and manage accelerated engineering collaboration.

15 - A Visual Tour of Music
Arpi Mardirossian, University of Southern California, Dept. Industrial & Systems Engineering, Los Angeles, CA, 90089, United States, mardiros@usc.edu, Elaine Chew

We present computational ways to accurately assess, quantify, and visualize the degree of similarity between two samples of music. The music properties we examine to determine similarity are key frequencies and average time in key. Users may select two pieces from a database for similarity assessment.

16 - When Can Manipulations Be Avoided in Two-Sided Matching Markets? Maximal Domain Results
Fuhito Kojima, PhD Candidate, Department of Economics, Harvard University, 1875 Cambridge Street, Cambridge, MA, 02138, United States, kojima@fas.harvard.edu

We study conditions for the student-optimal stable mechanism (SOSM) and the college-optimal stable mechanism (COSM) to be immune to manipulations via capacities and pre-arranged matches. For SOSM, the classes of strongly monotone preferences in populations and weakly maximin preferences are the maximal domains of college preferences guaranteeing immunity to these manipulations, respectively. In contrast, COSM is susceptible to both manipulations whenever colleges have multiple positions.

17 - An OR Approach to Business Calculus
Audrey Borchardt, Villanova University, Department of Mathematical Sciences, 800 Lancaster Avenue, Villanova, PA, 19085, United States, afborchardt@comcast.net, Bruce Pollack-Johnson

We describe a federally-funded re-engineering of a business calculus course organized around the process of solving real-world problems using math models, calculus, and technology. Students learn OR-style post-optimality analysis, including verification, validation, and sensitivity analysis, in doing student-generated projects on topics from their own lives. Excel templates have been developed for 3-D graphing, finding logistic models, and testing solutions for local and global optimality.

18 - RAMP for the Linear Ordering Problem
Dorabela Gamboa, Assistant Professor, Polytechnic of Porto, ESTGF, Apt. 205, Felgueiras, 4610-156, Portugal, dgamboa@estgf.ipp.pt, Cesar Rego, Fred Glover

A RAMP algorithm for the Linear Ordering Problem is proposed. The algorithm combines cross-parametric relaxation with scatter search to create a primal-dual RAMP approach. Computational tests disclose 58 new best solutions found by the RAMP algorithm for the 175 instances in the testbed for which the optimal solution is unknown.

19 - System Contents and Delay in Discrete-time Queues — Performance Assessment of Communication System
Peixia Gao, Dr., Ghent University, St-Pietersnieuwstraat 41, Gent, 9000, Belgium, pg@telin.ugent.be, Sabine Wittevrongel, Herwig Bruneel, Koenraad Laevens

The analysis of system contents and packet delay of discrete-time queueing systems is very important for the performance evaluation of communication systems. We present some methodologies for the analysis of those two quantities. It has been shown that our methodologies are extremely suitable and efficient.

20 - Impact of Using Designated Secure Rest Facilities on Single Lane Truck Dispatching Productivity
Steven Morris, Georgia Institute of Technology, 1536 Walton Lane, Smyrna, GA, 30082, United States, smorris@gatech.edu, Alan Erera

A mixed integer program for determining optimal rest area locations and a set of heuristics for determining feasible load-to-driver assignments are analyzed on sample data sets. Results indicate that for lanes of realistic length the productivity impact of restricting rest to a small number of discrete locations is likely to be small.

21 - Closed Form Harmonic Prior Bayes Estimators for the Multivariate Normal Mean
Juntian Xu, The Wharton School, University of Pennsylvania, 3730 Walnut Street, 400 Huntsman Hall, Philadelphia, PA, 19104, United States, juntianx@wharton.upenn.edu, Lawrence Brown

This paper derives explicit closed form expressions for harmonic prior Bayes estimators of the mean of a multivariate normal distribution. They facilitate practical application of the minimax competitor to the James-Stein estimator and associated confidence sets obtained as Gaussian approximations.In particular, we show by a numerical study that such confidence sets are good competitors to the usual confidence spheres in terms of smaller size for nearly equal frequentist coverage.

22 - Revenue Management in Mobile Communication Networks
Joakim Kalvenes, Cox School of Business, SMU, PO Box 750333, Dallas, TX, 75275, United States, kalvenes@smu.edu, Neil Keon

We propose a revenue management approach to improve the performance of real-time service systems where there is no possibility of advance reservations. We study the user equilibrium for our proposed revenue management pricing mechanism and its effects on a queuing model of the service system. With mobile communication services as an example, we show that the revenue management scheme can increase traffic carrying capacity by as much as 25% over the original system capacity.

23- Agent-Based Simulation of Mass Egress
Doug Samuelson, Homeland Security Institute, 871 1 Chippendale Court, Annandale VA 22003, United States, samuelsondoug@yahoo.com, Ric Blacksten, Owen Densmore, Stephen Guerin, Loren Miller, Matthew Parker, Stacey Pommerenck, Brett Steele, Josh Thorp, Austin Zimmerman

For the Science and Technology Directorate, U S Department of Homeland Security, we constructed agent-based simulation models of mass egress from a stadium (PNC Park, in Pittsburgh) and a subway station following detonation of one or more improvised explosive devices. We offer hands-on demonstrations of these models and discuss their application and planned expansion to identify promising counter-IEDs technologies, to support preparedness and planning, and to help manage incidents.

Monday, 1:30pm - 3:00pm

■ MC01

Room 301

Optimization in Network Coding

Sponsor: Optimization/ Network and Combinatorial Optimization
Sponsored Session

Chair: Muriel Medard, Associate Professor, Massachusetts Institute of Technology, Room 32-D626, 77 Massachusetts Avenue, Cambridge, MA, 02139, United States, medard@mit.edu

1 - Coding and Queueing Asymptotics in Large Networks
Sanjay Shakkottai, Assistant Professor, The University of Texas of Austin, ECE Department, Austin, TX, 78712, United States, shakkott@ece.utexas.edu

Traditionally, network buffer resources have been used at routers to queue transient packets. In contrast, we propose a scheme where intermediate routers have no buffers for queueing transient packets. Instead, network storage (memory) is used only at source and destination nodes to encode/decode packets using random linear coding over time. In this paper, we show that coding at end hosts yields better performance (packet delay tail probability) in a large multi-hop network.

2 - Distributed Optimization Algorithms for Network Coding
Edmund Yeh, Associate Professor, Yale University, PO Box 208267, New Haven, CT, United States, edmund.yeh@yale.edu, Yufang Xi

We consider the problem of finding the minimum-cost multicast scheme based on network coding. We present a set of node-based distributed algorithms which iteratively adjust local control variables so as to converge to the optimal coding subgraph and congestion control configuration. We then discuss the application of our algorithms to wireless networks where minimum-cost multicast must be achieved by jointly optimizing network coding subgraphs with power control and congestion control schemes.

3 - Back Pressure Methods for Network Coding Optimization
Tracey Ho, Assistant Professor, California Institute of Technology, 1200 East California Boulevard, Pasadena, CA, 91125, United States, tho@caltech.edu

We show how back pressure methods, originally used to find asymptotically optimal solutions to multicommodity routing problems, can be generalized to network coding. We overview our range of techniques covering multicast (intra-session) and non-multicast (inter-session) network coding, wired and wireless network models, and independent and correlated sources, and discuss in detail the non-multicast case.

4 - On Serving Multiple Unicast Sessions with Inter-Session Network Coding

Atilla Eryilmaz, Post-Doctoral Associate, LIDS, Massachusetts Institute of Technology, 77 Massachusetts Avenue, 32-D566, Cambridge, MA, 02139, United States, eryilmaz@mit.edu, Desmond Lun

We propose a dynamic Routing-Scheduling-Coding Strategy for serving multiple unicast sessions in networks when linear network coding is allowed across sessions. Noting that the set of stabilizable throughput levels in this context is an open problem, we prove that our strategy supports any point in a recently characterized achievable rate region. This work also provides a theoretical framework in which performance of intersession network coding and pure routing can be compared.

■ MC02

Room 302

Joint Session Open-Source/ICS: Cuts & Constraints

Cluster: Open-Source Software: Open Source, Open Standards, Open Data, INFORMS Computing Society

Invited Session

Chair: Lou Hafer, Simon Fraser University, School of Computing Science, Burnaby, BC, V5A 1S6, Canada, lou@cs.sfu.ca

1 - Piecewise Linear Optimization with COIN-OR

Ismael de Farias, Assistant Professor, SUNY Buffalo, 403 Bell Hall, Buffalo, NY, 14260, United States, defarias@buffalo.edu, Ming Zhao, Justin Yates, Hongxia Zhao

Any nonlinear optimization problem can be approximated to an arbitrary degree of accuracy as a piecewise linear optimization problem (PLOP). We discuss modeling and a branch-and-cut approach to continuous and discontinuous PLOP. We discuss the implementation of our theory in COIN-OR and we present computational results.

2 - Computational Study of Aggregation Procedure for Two-Step MIR Inequalities

Joao Goncalves, IBM Research, 1101 Kitchawan Road, Yorktown Heights, NY, 10598, United States, jpgoncal@us.ibm.com, Oktay Gunluk

We study the application of the aggregation procedure for mixed-integer rounding (MIR) inequalities proposed by Marchand and Wolsey (2001) to the two-step MIR inequalities proposed by Dash and Gunluk (2003). We describe our implementation and present computational results.

3 - Cutting Planes in SCIP

Tobias Achterberg, Zuse Institute Berlin, Takustr. 7, Berlin, 14195, Germany, achterberg@zib.de, Kati Wolter

We give an overview of the cutting plane techniques included in the constraint integer programming framework SCIP. Implementational and numerical issues of several cutting plane separation algorithms are discussed. Additionally, we show how cut selection is performed in SCIP. Computational results show the impact of the different types of cutting planes and the cut selection strategy.

■ MC03

Room 303

Advances in Large-Scale Numerical Optimization

Sponsor: Optimization/ Nonlinear Programming

Sponsored Session

Chair: Dominique Orban, Ecole Polytechnique de Montreal, CP 6079 Succ. Centre-Ville, Montreal, QC, H3C-3A7, Canada, Dominique.Orban@polymtl.ca

1 - New Filter Methods for Large-Scale Optimization

Sven Leyffer, Computational Mathematician, Argonne National Laboratory, 9700 S. Cass Avenue, Argonne, IL, 60439, United States, leyffer@mcs.anl.gov

We present a new active set method for large-scale nonlinear optimization. The method employs an unconstrained minimization to identify the optimal active set followed by an equality QP solve to promote fast local convergence. We enforce global convergence through the use of a trust-region and a filter.

2 - Quasi-Newton Techniques for Nonlinear Optimization

Long Hei, Northwestern University, Evanston, IL, United States, lhei@ece.northwestern.edu, Jorge Nocedal

For large scale problems users cannot afford to operate the Hessian matrix, or sometimes are unwilling to invest effort to define it. Limited memory quasi-Newton methods are considered. It can be shown the quasi-Newton matrix overestimates the curvature along the eigenvectors corresponding to the small eigenvalues of the Hessian. We propose ideas on improving the convergence of quasi-Newton methods by incorporating spectral information into the algorithm.

3 - Use of Approximate Derivatives in the Filter-Trust-Region Method for Unconstrained Optimization

Caroline Sainvitu, Facultés Universitaires Notre-Dame de la Paix, Rempart de la Vierge, 8, Namur, 5000, Belgium, caroline.sainvitu@math.fundp.ac.be, Philippe Toint

This talk will focus on defining a filter-trust-region method designed for solving unconstrained nonlinear optimization problems. The main idea is to let the filter play the major role when convexity is present and to fall back on the classical trust-region method only if things do not go well or if non-convexity is encountered. We will mainly analyze the use of approximate derivatives in the algorithm. Numerical experiments carried out on small-scaled unconstrained problems will be presented.

4 - First-Order Primal-Dual Algorithms for Cone Programming

Renato Monteiro, Professor, ISyE, Georgia Institute of Technology, Atlanta, GA, United States, monteiro@isye.gatech.edu, Guanghui Lan, Zhaosong Lu

In this talk, we discuss first-order algorithms for solving cone programming problems. The algorithm consists of applying well-known first-order methods by Nesterov and Nemirovski to suitable reformulations of the cone programming problem. We compare the different variants obtained in this manner among themselves and compare the performance of the most efficient variant against the low-rank method of Burer and et al.'s on a set of randomly generated semidefinite programming problems.

■ MC04

Room 304

Advances in Mixed Integer Programming

Sponsor: Optimization/ Integer Programming

Sponsored Session

Chair: Santanu Dey, School of Industrial Engineering, Purdue University, West Lafayette, IN, 47907, United States, sdey@purdue.edu

1 - Branchwidth via Integer Programming

Illya Hicks, Associate Professor, Texas A&M University, Industrial and Systems Engineering MS 3131, Zachry Engineering Center, College Station, TX, 77843-3131, United States, ivhicks@tamu.edu, Elif Kolotoglu

Branch decomposition based algorithms have been used in a practical setting to solve NP-hard problems modelled on graphs. The essential element of a branch decomposition based algorithm is an input branch decomposition whose width is close to the branchwidth for the input graph. We present an integer programming formulation for solving the optimal branch decomposition and branchwidth problem. Some preliminary computational results are also presented.

2 - Conflict Hypergraphs in Integer Programming

Siddhartha Maheshwary, Georgia Institute of Technology, Industrial & Systems Engineering, Atlanta, GA, 30332, United States, sid@isye.gatech.edu

We study the facial structure of the independent set polytope using conflict hypergraphs. Various structures such as cliques, odd holes, odd antiholes, webs and antiwebs are identified on the conflict hypergraph, and valid inequalities are derived.

3 - A General Framework for Intersection Cuts

Anureet Saxena, PhD Student, Tepper School of Business, 5000 Forbes Avenue, Pittsburgh, PA, United States, anureets@andrew.cmu.edu, Gabor Pataki

Given an extreme point x of the LP-relaxation of a mixed integer program (MIP), the basis cone centered at x has been at the focus of integer programming in the past two decades. Several classes of well-known cutting planes such as intersection cuts, MIG cuts, split cuts etc can be obtained by careful examination of the conic relaxation. This paper presents a detailed investigation of the class of cutting planes which can be obtained from the conic relaxation using arbitrary disjunctions.

4 - Two Families of Facets for Two Dimensional Infinite Group Problems

Santanu Dey, School of Industrial Engineering, Purdue University, West Lafayette, IN, 47907, United States, sdey@purdue.edu, Jean-Philippe Richard

We present the first two proven families of facet-defining inequalities for two-dimensional infinite group problems (2DIGP). The first family uses inequalities of the one dimensional infinite group problem as building blocks. This construction provides a complete characterization of piecewise linear facets of the 2DIGP that have two gradients. The second family has three gradients. The coefficients of its continuous variables are not dominated by those of one-dimensional group cuts.

■ MC05

Room 305

Risk Analysis in Military Applications

Sponsor: Optimization/ Stochastic Programming

Sponsored Session

Chair: Michael Zabarankin, Assistant Professor, Stevens Institute of Technology, Castle Point on Hudson, Department of Mathematical Sciences, Hoboken, NJ, 07030, United States, mzabaran@stevens.edu

1 - Multi-Sensor Target Tracking: A Probabilistic Combinatorial Analysis

Paul Krokhmal, Assistant Professor, University of Iowa, 2403 SC, Iowa City, IA, 52242, United States, krokhmal@engineering.uiowa.edu

We consider a random Multidimensional Assignment Problem in application to multi-sensor tracking of multiple mobile targets. A probabilistic analysis of the problem, including convergence of optimal value, estimation of the number of local minima, properties of the solution landscape, etc. is presented.

2 - Optimal Security Inspection with a Single-Server Queue

Michael Zabarankin, Assistant Professor, Stevens Institute of Technology, Castle Point on Hudson, Department of Mathematical Sciences, Hoboken, NJ, 07030, United States, mzabaran@stevens.edu

An optimization problem for security inspection with a single-server queue subject to a constraint on the average time spent in a system has been formulated and solved for the M/G/1 queue for two specific performance functionals for exponential, shifted-exponential and triangular inspection-time distributions. A version of the Pollaczek-Khinchin formula for the steady-state waiting-time distribution for the M/G/1 queue has been derived in the framework of Riemann boundary-value problems.

3 - Quantile-Based Deviation Measures

Bogdan Grechuk, Ph.D. student, Stevens Institute of Technology, Castle Point on Hudson, Department of Mathematical Sciences, Hoboken, NJ, 07030, United States, bgrechuk@stevens.edu, Michael Zabarankin, Anton Molyboha

Quantile-based deviation measures as a class of general deviation measures, defined by Rockafellar et al., have been introduced, and the main properties of this class have been studied. Under the condition of equal means for random variables to be ordered, quantile-based deviation measures have been shown to be SSD consistent. For this class of deviation measures, the classical Chebyshev's and Rao-Blackwell theorems have been generalized, and Chebyshev's inequalities have been obtained.

4 - Optimal Sensor Placement for Underwater Threat Detection

Anton Molyboha, Ph.D. student, Stevens Institute of Technology, Castle Point on Hudson, Department of Mathematical Sciences, Hoboken, NJ, 07030, United States, amolyboh@stevens.edu, Michael Zabarankin

Mathematical models for underwater acoustic sensors have been proposed. Single-period and multi-period statistical models for threat detection by a network of sensors have been suggested. Optimization approaches for optimal sensor placement within an urban harbor have been developed. The limit theorem about optimality of quasi regular sensor placement under certain conditions has been proved, and numerical experiments illustrating this result have been conducted.

■ MC06

Room 306

Finance-Risk Management I

Contributed Session

Chair: Dominic Nocera, Senior Manager, Supply Chain, Lucent Technologies, 6200 East Broad Street, Columbus, OH, 43213, United States, dnocera@lucent.com

1 - Dynamics of International Financial Networks with Variable Weights Multicriteria Decision-making

Jose Cruz, Assistant Professor, University of Connecticut, 2100 Hillside Road, Storrs, CT, 06269, United States, jcruz@business.uconn.edu, Dmytro Matsypura

In this paper, we consider the dynamics of international financial networks with intermediaries in which both the sources of financial funds as well as the intermediaries are multicriteria decision-makers. In particular, we assume that these decision-makers seek not only to maximize their net revenues but also to minimize risk with the risk being penalized by a variable weight. The framework also allows for the modeling and theoretical analysis of the dynamics of prices and product transactions.

2 - Learning from Price Optimization: Applications to Other Problems

Frank Bria, Vice President, Response Analytics, 4615 E Buckboard Ct, Gilbert, AZ, 85297, United States, frank.bria@responseanalytics.com

There has been a significant amount of work done building demand models and solving the resulting price optimization problem. However, price isn't the only strategic lever available to product managers to generate more volume and ensure better margins. The lessons of price optimization can be leveraged to other strategic problems such as improved customer retention, increased line utilization, and negotiated pricing.

3 - Multi-Objective and Dynamic Optimization of Stocks Portfolios

Bartosz Sawik, M.Sc., AGH University of Science and Technology, Faculty of Management, Department of Systems Analysis & Computer Modeling, al. Mickiewicza 30, Kraków, 30-059, Poland, b_sawik@yahoo.com

This paper presents multi-objective and dynamic optimization models based on the classical Markowitz and Sharpe problems with modifications in the objective functions and with additional constraints. Computational experiments have been made for selected stocks in portfolio structures. The theory of selection the optimal portfolio structure from classical models and data from Warsaw Stock Exchange and Zurich SMI were used as a tool for the analysis. Selected investment periods were considered.

4 - Playing Bankrolls for Poker Players

Gary Carson, MathandPoker.com, 315 N. Violet, Cushing, 74023, United States, garycarson@alumni.northwestern.edu

People have used a variety of models, with a variety of assumptions, to determine bankroll requirements for poker players. Models based on classical ruin problems, interval estimation, optimal bet size with fractional betting, and insurance/dam problems have all been applied. I review some of those models and some of the player behavioral assumptions used in those models.

5 - Shareholder Value Based Decision Model as Applied to Supply Chain Re-Design Alternatives

Dominic Nocera, Senior Manager, Supply Chain, Lucent Technologies, 6200 East Broad Street, Columbus, OH, 43213, United States, dnocera@lucent.com

A real world example of investment decision-making as applied to the global re-design of returns and repair processes of a Fortune 500 telecommunications company. The model incorporates variable discounted cash flows, risks, stochastic modeling, and sensitivity analysis to determine the optimal course of action among alternatives. Benefits to attendees include a review of financial concepts, format to apply a similar analysis, and instruction on how to create a "no-cost" excel simulation.

■ MC07

Room 307

Applications of Semidefinite Programming

Sponsor: INFORMS Computing Society/Optimization: Computational Optimization and Software

Sponsored Session

Chair: Brian Borchers, Professor, New Mexico Institute of Mining and Technology, 801 Leroy Place, Socorro, NM, 87801, United States, borchers@nmt.edu

1 - An SDP-Based Approach for Anchor-Free 3D Graph Realization

Kim-Chuan Toh, Associate Professor, National University of Singapore, Department of Mathematics, 2 Science Drive 2, Singapore, 117543, Singapore, mattohkc@nus.edu.sg, Yinyu Ye, Pratik Biswas

A distributed algorithm for solving anchor-free Euclidean metric realization problems arising from 3D graphs is proposed. We first subdivided the graph into smaller subgraphs, then use a regularized SDP relaxation method to localize each subgraph. Finally, the clusters are assembled together. We test our method on finding the 3D molecular configurations of proteins based on limited number of given pairwise distances between atoms. The results show that our method is robust and efficient.

2 - Globally Optimal Solutions for Large Single-Row Facility Layout Problems

Miguel Anjos, Assistant Professor, University of Waterloo, 200 University Avenue West, Waterloo, ON, N2L 3G1, Canada, anjos@stanfordalumni.org, Anthony Vannelli

We consider the single-row facility layout problem which asks for a placement of facilities with varying lengths on a straight line so as to minimize the total weighted pairwise distances. We consider semidefinite programming relaxations and prove that for a specific relaxation, a significant number of facet-defining inequalities of the underlying integer polytope implictly hold. Using this relaxation, we obtain the first globally optimal layouts for large instances with up to 30 departments.

3 - Semidefinite Relaxations in Constraint Programming
Willem-Jan van Hoeve, Cornell University, 4130 Upson Hall, Ithaca, NY, 14853, United States, vanhoeve@cs.cornell.edu, Carla Gomes, Lucian Leahu

We first show how semidefinite relaxations can be integrated effectively as search heuristics in constraint programming. Then we investigate the predictive power of semidefinite relaxations when they are used as such. Both issues are illustrated with experimental results.

4 - An SDP-Based Branch and Bound Code for the Maximum Independent Set Problem
Brian Borchers, Professor, New Mexico Institute of Mining and Technology, 801 Leroy Place, Socorro, NM, 87801, United States, borchers@nmt.edu

We present a branch and bound code for maximum independent set problems that uses semidefinite programming bounds. The SDP bound is much tighter than linear programming bounds and computational results show that this approach can outperform conventional integer linear programming approaches. Results are presented for several large instances arising from coding theory.

■ MC08

Room 308

KLIC IV

Sponsor: Technology Management
Sponsored Session

Chair: Charles Weber, Assistant Professor of Engineering and Technology Management, Portland State University, ETM, PO Box 751, Portland, OR, 97207, United States, webercm@gmail.com

1 - Exploring Unique Learning in Bio-Pharmaceutical Innovation
Deborah Dougherty, Professor, Rutgers University, 1169 Lincoln Ct, Long Branch, NJ, 07740, United States, doughert@rbsmail.rutgers.edu, Danielle Dunne

Discovering and developing a new medicine requires ongoing alignment of disparate systems of knowing and doing - sciences, technologies, strategy, and operations - over 16 years and across multiple firm boundaries. This process cannot be simplified in the usual way (no paths, feedback, or modularity). We tease out unique learning for compounds and pipeline management, and suggest ways to enhance learning in this science-based industry that can also inform innovation management in general.

2 - The Effect of Information Technology on Knowledge Retention in Organizations
Linda Argote, Carnegie Mellon University, 5000 Forbes Avenue, Pittsburgh, PA, 15213, United States, argote@andrew.cmu.edu, Michael Ashworth, Tridas Mukhopadhyay

Our research examines whether new information technology (IT) contributes to an organization's ability to retain knowledge. We conducted a cross-sectional time series analysis monthly data spanning five years at six financial institution payment processing facilities. Results indicate that the IT enhances the retention of knowledge about productivity.

3 - Choices and Outcomes: The Effects of Improvement Project Portfolio Choices
Anita Tucker, Assistant Professor, University of Pennsylvania, 551 Huntsman Hall, 3730 Walnut Street, Philadelphia, PA, 19066, United States, tuckera@wharton.upenn.edu, Richard Bohmer, Ingrid Nembhard

Healthcare organizations strive to improve the quality of care they deliver. For many, the first step is to develop a portfolio of improvement projects. We present data from 44 intensive care units that created such portfolios by selecting among 93 practices they had collaboratively developed. We examine the effects of three portfolio choices - number of practices, type of practices and project team - and interactions among choices, on patient length of stay, infection rates and mortality.

■ MC09

Room 309

Simulation I

Contributed Session

Chair: Michael Kuhl, Associate Professor, Rochester Institute of Technology, 81 Lomb Memorial Drive, Industrial & Systems Engineering Dept., Rochester, NY, 14623, United States, mekeie@rit.edu

1 - Variance Estimation in Steady-Sate Simulations Using Linear Regression
Vivek Gupta, Student, Georgia Institute of Technology, 6640 Akers Mill Rd, Apt #3526, Atlanta, GA, 30339, United States, vkg378@gmail.com, Sigrún Andradóttir, Dave Goldsman

We propose a new variance estimator for steady-state simulations that is computed using linear regression. We show that the estimator thus obtained has good statistical properties. The regression approach can also be used for estimation of bias in time-series based estimators. We use this idea to develop a new sequential stopping rule for steady-state simulations. Numerical results indicate that the new sequential stopping rule is quite effective in practice.

2 - Designing a Database to Support Electrical Circuit Validation
Genetha Gray, Senior Member of the Technical Staff, Sandia National Laboratories, PO Box 969, MS 9159, Livermore, CA, 94550, United States, gagray@sandia.gov, Monica Martinez-Canales

Experiments are a critical component of simulation code validation activites. However, rising costs dictate that experiments should specifically address the available resources, code capability, and required predictive confidence for the intended application. Moreover, experiments should produce statistically meaningful data. In this talk, we will discuss the generation of a database supporting the validation of an electrical circuit model.

3 - Discrete Optimization via Simulation in the Presence of Regularity
Eunji Lim, Stanford University, 321 Terman Engineering, Stanford University, Stanford, CA, 94305, United States, eunji96@stanford.edu, Peter W. Glynn

We propose a stochastic approximation-type algorithm, originally proposed for continuous optimization, that can be shown to be convergent for discrete problems for which the objective is submodular and integrally convex. This assumption is known to hold in a number of important problem contexts. We shall also discuss generalizations of this idea to other settings in which regularity of the objective is known to hold.

4 - Performance Evaluation of Comparison-with-a-Standard Procedures
E. Jack Chen, Senior Staff Specialist, BASF Corporation, 333 Mount Hope Avenue, Rockaway, NJ, 07866, United States, e.jack.chen@basf.com

We investigate the performance of several comparison-with-a-standard procedures. The goal is to identify the best design, and if the chosen best design is not the standard, to determine whether the chosen best design is better than the standard. We give preferential status to the standard because there are costs and time involved in replacing the standard. We accomplish this goal by extending indifference-zone selection procedures.

5 - Simulation Analysis of Dispatching Rule Behavior in Reentrant Production Systems
Michael Kuhl, Associate Professor, Rochester Institute of Technology, 81 Lomb Memorial Drive, Industrial & Systems Engineering Dept., Rochester, NY, 14623, United States, mekeie@rit.edu, Katie McConky

Reentrant production systems occur in many industries, and are typical of systems in semiconductor manufacturing. One variable that affects system performance is the dispatching rule chosen to control the selection of the next item for processing from a machine's queue. This study utilizes simulation methods to characterize and analyze the performance of dispatching rules under various conditions. The results are compared with non-reentrant systems to test hypotheses about rule behavior.

■ MC10

Room 310

Software Demonstration

Cluster: Software Demonstration
Invited Session

1 - LINDO Systems, Inc. - Efficient Tools for Optimization Modeling
Mark Wiley, LINDO Systems, Inc., 1415 North Dayton, Chicago, IL, 60622, mwiley@lindo.com

LINDO Systems will demonstrate the latest enhancements to LINDO API, LINGO and What'sBest - their popular linear, integer, quadratic, general nonlinear and global optimization tools. Find out how easy it is to: —Quickly build complex optimization models —Effortlessly access data in Excel and databases — Seamlessly embed optimization into your own applications.

2 - Maximal Software, Inc. - Introducing New Release of MPL Modeling System for Optimization with New and Enhanced Features
Bjarni Kristjansson, Maximal Software, 2111 Wilson Boulevard #700, Bjarni@maximalsoftware.com

We will demonstrate the newest release of MPL, one of the fastest and most scalable modeling languages on the market today. The innovative OptiMax 2000 Component Library has been augmented to include several new objects and methods. The speed and scalability of the model generation has been greatly enhanced, and with the new 64-bit Itanium version capable of solving much larger models than ever before. Several new solvers have been added and existing solvers updated.

■ MC11

Room 311

Energy

Contributed Session

Chair: Fernando Oliveira, CEMPRE - FEP.UP and University of Warwick, Rua Dr. Roberto Frias, Porto, NA, 4200-464, Portugal, Fernando.Oliveira@wbs.ac.uk

1 - Unit Commitment and Market Strategies for Distributed Generation

Ralph Badinelli, Professor, Virginia Tech, Dept. of BIT 0235, Virginia Tech, Blacksburg, VA, 24061, United States, ralphb@vt.edu

Distributed generation within electricty grids offers the potential of a cheaper and more reliable electricity supply system. However, the market structure for the sale and purchase of distributed generation power is still being debated. This paper defines the decision models that would apply to various market structures for the trading of distributed generation power and the implications of these models for the behavior of market participants and the performance of the electric power market.

2 - Validation of Simulation Models for Policy Analysis Illustrated

Hassan Qudrat-Ullah, York University, 282 Atkinson, 4700 Keele St., Toronto, ON, M3J 1P3, Canada, hassanq@yorku.ca

This paper argues that structural validity of the simulation model -right behavior for the right reasons- is a stringent measure to build confidence in a simulation model regardless of how well the model passes behavior validity tests. That leads to an outline of formal structural validity procedures available but less explored in system dynamics modeling "repertoire". Finally, some conclusions on the increased appeal for simulation models for policy analysis are presented.

3 - Development of Finite Automata Models of Energy Firms

Fernando Oliveira, CEMPRE - FEP.UP and University of Warwick, Rua Dr. Roberto Frias, Porto, NA, 4200-464, Portugal, Fernando.Oliveira@wbs.ac.uk

In this paper we look at the problem of modelling the strategic behaviour of an energy firm by formalising it as a bundle of finite automata. (Finite automata represent conditional decision rules.) We show that these finite automata can be used to develop complex models of interacting policies, such as product pricing, long-term contracting, investment, and vertical integration, enabling a better understanding of the interactions and interdependencies between these policies within a firm.

■ MC12

Room 312

Joint Session WORMS/INFORMS-ED: Academia and Industry Collaboration: Research and Development

Sponsor: Women in OR/MS, Education (INFORM-ED)

Sponsored Session

Chair: Sila Cetinkaya, Associate Professor, Texas A&M University, Industrial and Systems Engineering, College Station, TX, 77843, United States, sila@tamu.edu

Co-Chair: Jill Hardin, Assistant Professor, Virginia Commonwealth University, 1001 W. Main Street, PO Box 843083, Richmond, VA, 23284-3083, United States, jrhardin@vcu.edu

1 - The Role of "Men of Power" and "Men of Insights"

Elif Akcali, Assistant Professor, University of Florida, 303 Weil Hall, PO Box 116595, Gainesville, FL, 32611-6595, United States, akcali@ise.ufl.edu

For successful industry-academia collaboration, it is important to establish contact with both "men of power" and "men of insights" in industry. While the men of power, i.e., the executives of corporate management, can ensure institutional support, the men of insights, i.e., the members of the middle management or engineers, can facilitate the transfer of institutional knowledge. In this talk, we will talk about some strategies on how to establish contact with both "men."

2 - How to Collaborate Effectively with Industry

Sridhar Tayur, Ford Distinguished Research Professor, Carnegie Mellon University, Forbes Avenue, Pittsburgh, PA, 15213, United States, stayur@andrew.cmu.edu

This talk will discuss some examples of collaboration where the industrial project created value, and the resulting work was published enthusiastically both in academic journals as well as business magazines.

3 - Transforming Academic Research into Software Products

Ravindra Ahuja, Professor, University of Florida, 303 Weil Hall, Gainesville, FL, 32611, United States, ahuja@ufl.edu

Over a period of 8 years, the speaker has evolved from a theoretician to an applied researcher to an entrepreneur aiming to build a major software product development company (www.InnovativeScheduling.com) in transportation using cutting-edge OR. In this talk, the author will describe this evolution and share his bitter/sweet experiences in working with companies, hurdles faced in winning their business, obtaining federal funds to start a company, and monitoring its growth.

4 - Industry-University Relationships: Some Lessons Learned

Leon McGinnis, Georgia Institute ofTechnology, 765 Ferst Drive, Atlanta, GA, 30332, United States, leon.mcginnis@isye.gatech.edu

After thirty years of experience in starting and managing industry-university partnerships, I've learned a few key lessons. This talk will summarize those lessons in an easy to use format.

■ MC13

Room 313

Education

Contributed Session

Chair: Robert Kilmer, Faculty, Walden University, 13 Donegal Drive, Carlisle, PA, 17013, United States, rkilmer@walden.edu

1 - Introducing Liberal Arts Students to OR/MS

Dawn Strickland, Assistant Professor, Mathematics, Winthrop University, 156 Bancroft Hall, Rock Hill, SC, 29733, United States, stricklandd@winthrop.edu

Are you interested in spreading the word about OR to talented students at institutions near your own? We have created a presentation aimed to inform students of the methods, applications, and need for OR/MS in the world today. In this talk, we will demonstrate the presentation itself, how you can individualize it, and where you can use it. Please join us in marketing the "Science of Better."

2 - SCM Process Map for Effective Teaching of Supply Chains

Divakar Rajamani, Professor & Managing Director of C4ISN, University of Texas at Dallas, PO Box 830688, Mail Stop: SM 26, Richardson, TX, 75083, United States, divakar@utdallas.edu, Ertunga Ozelkan

A new framework named "Supply Chain Management (SCM) Process Map" is presented and shown that it can be helpful for teaching and managing supply chains effectively. SCM Process Map establishes a unifying relation between the end-to-end supply chain processes (such as create, source, make, move, store, market, sell, return and service) and the strategic, tactical and operational decision phases of SCM. An example from the soft goods supply chain is presented to illustrate the proposed framework.

3 - A Statistics and Geography Clustered Pair Experiment at Carthage College

Thomas Groleau, Associate Professor, Carthage College, 2001 Alford Park Drive, Kenosha, WI, 53140, United States, tgroleau@carthage.edu

To meet students' interdisciplinary studies general education requirement, Carthage offers block enrollment in two separate but related courses called "clustered pairs". With a single group of students, both instructors attend both classes and work together to create explicit links between the subjects. This paper reports on a pairing of business statistics and geographic information systems in Spring 2006.

4 - What Needs to be Taken into Account When Validating a Business Simulation Game?

Juuso Töyli, Professor, Helsinki School of Economics, PO Box 1210, Helsinki, FIN-00101, Finland, juuso.toyli@hse.fi

Presents the validation framework and process used when developing a business simulation game, SIMBU, used to train about 1,700 students and managers. The framework consists of primary (learning, realism, balance, experienced realism, experienced balance, developer dependency, and facilitator dependency) and supportive dimensions (briefing, motivation, de-briefing, complexity, challenge, and usability). Observations, interviews, questionnaires, and feedback reports were used to gather the data.

5 - Grade Inflation and Operations Research

Robert Kilmer, Faculty, Walden University, 13 Donegal Drive, Carlisle, PA, 17013, United States, rkilmer@waldenu.edu

Grade inflation is a complicated issue that most institutions of higher education pretend does not exist. For non-quantitatively oriented administrators this appears to be the easiest and safest approach. To those open to quantitative approaches there are systematic procedures that could be used to facilitate analysis and discussion of grades among administrators, faculty and students. This session examines a Grade Inflation Measurement Analysis and Discussion model.

■ MC14

Room 314

Sponsored Search

Sponsor: e-Business

Sponsored Session

Chair: De Liu, Assistant Professor, University of Kentucky, 455Y Gatton Business and Economics, Lexington, KY, 40502, United States, de.liu@uky.edu

1 - Efficient Allocation of Online Advertising Resources

Thomas Weber, Assistant Professor, Stanford University, Management Science and Engineering, Terman Engineering Center, Stanford, CA, 94305-4026, United States, webert@stanford.edu, Abhishek Bapna

We provide a general mechanism for the allocation of a finite number of divisible online advertising resources to a finite number of heterogeneous firms. The mechanism is ex-post efficient and dominant-strategy incentive compatible. The mechanism is robust in the sense that equilibrium bid functions do not depend on any assumptions about other players except for smoothness and monotonicity of their otherwise arbitrary payoff functions.

2 - Competing Keyword Auctions

Jianqing Chen, The University of Texas at Austin, CBA 5.202, IROM, Austin, TX, 78712, United States, chenjq@mail.utexas.edu, De Liu, Andrew B. Whinston

Most research done on keyword auctions is under monopoly settings. This paper models an unaddressed but critical issue: the competition between search engines in the keyword advertising market. We analyze the advertisers' equilibrium participation and bidding strategies and the auctioneers' strategies on the ranking rules, and eventually predict the market segmentation under the competition.

3 - Quality Uncertainty And Adverse Selection In Online Sponsored Search Markets

Siva Viswanathan, Assistant Professor, University of Maryland, 4313 Van Munching Hall, RH Smith School of Business, College Park, MD, 20742, United States, sviswana@rhsmith.umd.edu, Vandana Ramachandran, Animesh Animesh

Yahoo! and Google employ different mechanisms to rank bidders' advertisements in their sponsored search listings. This provides an unprecedented opportunity to test earlier predictions relating quality and advertising. Using data from sponsored search auctions we examine the relationship between advertisers' quality and their advertising intensity. We find significant differences in the quality-advertising relationships across product categories as well as across the two market mechanisms.

4 - Inferring Competitive Measures on the Web from Aggregate Usage Data

Zhiqiang (Eric) Zheng, Assistant Professor, University of Texas at Dallas, School of Management, SM33, Richardson, TX, 75083-0688, United States, ericz@utdallas.edu, Balaji Padmanabhan, Peter Fader

In this paper we present methods for learning various competitive measures such as market share for electronic commerce. Rather than estimating these numbers from detailed customer level Web browsing data, the methods presented here derive the measures from simple aggregate data that is assumed to be available freely. Based on data from ComScore we show empirically that our methods perform well in inferring key diagnostic measures such as market share and share of requirement.

5 - Shopbots and Online Consumer Search

Jie Zhang, Jennifer.zhang@utoledo.edu

Online price comparison agents (shopbots) allow consumers to instantaneously receive price and other information from many online retailers. Intuitively consumers are expected to search less because shopbots have displayed prices and other relative information from retailers on the search result page(s). Surprisingly, this study demonstrates consumers are actually visiting more online retailer web sites after using shopbots. The empirical finding is explained by an analytical model.

■ MC15

Room 315

Online Auctions II

Cluster: Auctions and e-Commerce

Invited Session

Chair: Peter Popkowski Leszczyc, Associate Professor of Marketing, School of Business, University of Alberta, Edmonton AB, T6G 2R6, Canada, ppopkows@ualberta.ca

1 - An Empirical Comparison of Three Auction Strategies for Multiple Products

Michael Shen, yshen@ualberta.ca, Peter Popkowski Leszczyc, Gerald Häubl, Paul Messinger

This study investigates bidders' bidding strategies and the relative profitability of three auction strategies: one bundled auction, two simultaneous separate auctions, and two sequential separate auctions. We study how bidders' bids and seller's revenue are affected by: product complementarity, heterogeneity in valuations across bidders, and the number of bidders.

2 - Is Overbidding in Online Auctions the Result of a Pseudo-Endowment Effect?

James R. Wolf, Fisher College of Business, Ohio State University, 400 Fisher Hall, 2100 Neil Avenue, Columbus, OH, 43210, wolf.206@osu.edu, Hal R. Arkes, Waleed A. Muhanna

Possession of an item increases an owner's valuation of it; a phenomenon termed the endowment effect. We hypothesize that temporarily being the high bidder during an auction may induce a related pseudo-endowment effect. To test this, we examine eBay bid data and conduct a variation of the classic mug experiment.

3 - Bidder Regret, Sniping, and the Sequential Auction Problem on eBay

Adam I. Juda, PhD Candidate, Harvard University, Wyss Hall, Harvard Business School, Boston, MA, 02163, United States, ajuda@hbs.edu

Bidders on eBay have no dominant bidding strategy when faced with multiple auctions each offering the same item. An analysis of 10,151 bidders in 1,956 auctions for a Dell E193FP LCD monitor demonstrates a large number of bidding "mistakes" which are likely hampering the efficiency of the market system.

■ MC16

Room 316

Pricing and Demand Models in Revenue Management

Cluster: Dynamic Pricing and Forecasting

Invited Session

Chair: Rene Caldentey, Assistant Professor in Operations Management, Stern School of Business, New York University, 44 West Fourth Street, KMC 8-77, New York, NY, 10012, United States, rcaldent@stern.nyu.edu

Co-Chair: Gabriel Bitran, Professor, Massachusetts Institute of Technology, Memorial Drive 50, Cambridge, MA, 02142, United States, gbitran@MIT.EDU

1 - Optimal Dynamic Pricing of Account-Based Services with Customer Switching Costs

Garrett van Ryzin, Columbia University, Uris Hall, New York NY 10027, United States, giv1@columbia.edu, Qian Liu

We look at a model of pricing account-based services, such as telecome service and financial services, in which switching costs play a critical role. We show the optimal pricing strategy can be characterized simply in terms of a critical account level. We then analyze a duopoloy version of the model.

2 - Pricing and Capacity Rationing with Stragetic Customers

Matulya Bansal, Graduate Student, Columbia Business School, 3022 Broadway, New York, NY, 10027, United States, mb2431@columbia.edu, Costis Maglaras

We consider a retailer that faces a market of heterogeneous customers that strategize over their time of purchase in response to the retailer's dynamic pricing and capacity rationing strategies. We formulate the retailer's revenue maximization problem as one of mechanism design, which allow us to unify old results, and derive several new insights about the structure of the optimal policies.

3 - Dynamic Pricing and Inventory Control Through Robust Optimization

Georgia Perakis, J. Spencer Standish Associate Professor of Operations Research, Massachusetts Institute of Technology, Sloan School of Management, Cambridge, MA, 02139, United States, georgiap@mit.edu, Elodie Adida

We study a make-to-stock manufacturing system where demand is a linear function of the price, with uncertain parameters. We consider a dynamic setting where multiple products share production capacity. A key part of the model is that no backorders are allowed. We consider and compare various approaches that deal with demand uncertainty and give rise to closed loop policies such as adjustable robust optimization and dynamic programming. We discuss our insights.

■ MC17

Room 317

Statistical Methods, Quality Control, and Simulation

Sponsor: Simulation

Sponsored Session

Chair: Hong Wan, Assistant Professor, School of Industrial Engineering, Purdue University, 315 N. Grant Street, West Lafayette, IN, 47907, United States, hwan@purdue.edu

1 - Factors Here, Factors There, Interactions Everywhere!

Susan Sanchez, Professor, Naval Postgraduate School, Operations Research Department, 1411 Cunningham Road, Monterey, CA, 93943, United States, ssanchez@nps.edu, Paul Sanchez

We describe a simple method for generating highly efficient, resolution-V fractional factorial and central composite designs. This is part of an ongoing effort to study simulations involving hundreds of input factors. Our portfolio of designs has yielded insights for a variety of defense and homeland security issues.

2 - A Distribution-Free Tabular CUSUM Chart for Correlated Data with Automated Variance Estimation

James Wilson, Professor, North Carolina State University, Edward P Fitts Industrial & Systems Engineering Department, Campus Box 7906, Raleigh, NC, 27695-7906, United States, jwilson@ncsu.edu, Joongsup (Jay) Lee, Christos Alexopoulos, Dave Goldsman, K-L Tsui, Seong-Hee Kim

A distribution-free tabular CUSUM chart, DFTC-VE, is designed to include automated variance estimation so as to detect shifts in the mean of a correlated process. Extensive experimentation shows that the performance of DFTC-VE compared favorably with that of other competing process-monitoring schemes for correlated processes.

3 - A Polytope Method for Efficiently Identifying Mean and Dispersion Effects

Russell Cheng, Professor of Operational Research, University of Southampton, School of Mathematics, Highfield, Southampton, NA, SO17 1BJ, United Kingdom, rchc@maths.soton.ac.uk, Bruce Ankenman, Susan Lewis

We consider how to identify important factors influencing a response in a simulation experiment, where the number of factors is large and factors can affect both dispersions and means; the directions of the effects being known. We present a method using a polytope construction that efficiently makes use of all available information to estimate both dispersion and mean effects. Numerical examples are given showing its improved performance compared with sequential bifurcation.

4 - Multi-Product Cycle Time and Throughput Evaluation via Simulation on Demand

Feng Yang, Assistant Professor, Industrial and Management Systems Department, West Virginia University, Morgantown, WV, 26506, United States, feng.yang@mail.wvu.edu, Bruce Ankenman, Barry Nelson

Cycle time and throughput are important performance measures for manufacturing. We seek to estimate the cycle-time measure as a function of throughput and product mix via simulation for semiconductor manufacturing. The proposed methodology exploits our early success in the generation of cycle time-throughput (CT-TH) curves for a fixed product mix. Experiment design strategies are derived for covering the product-mix space, and techniques for interpolating among CT-TH curves are developed.

■ MC18

Room 318

Joint Session Counter Terrorism/DAS: Risk and Decision Analysis Applications for Homeland Security II

Cluster: Counter Terrorism and OR, Decision analysis Society

Invited Session

Chair: Doug Samuelson, Homeland Security Institute, 8711 Chippendale Court, Annandale, VA, 22003, United States, samuelsondoug@yahoo.com

1 - Risk Management and Decision Analysis Tools for Military and Homeland Security Applications

Igor Linkov, Senior Scientist, Cambridge Environmental, 58 Charles Street, Cambridge, MA, 02141, United States, Linkov@cambridgeenvironmental.com, F. Kyle Satterstrom

Available frameworks for homeland security risk management are often applied without adjustment for unique environmental, social, political, and economic conditions. This presentation will illustrate several case studies which apply MCDA tools to homeland security and related areas. It will also report the results of the NATO workshop on current practices and options to address the complex challenges of protecting infrastructure at industrial ports.

2 - Estimated Consequences and Mitigation Effectiveness For Release of a Toxic Industrial Chemical

Tony Barrett, Graduate Research Assistant, Doctoral Student, Department of Engineering and Public Policy, Carnegie Mellon University, Pittsburgh, PA, 15213, United States, tonybarrett@cmu.edu

Parametric analysis is performed on potential acute fatalities and injuries from terrorist-caused release of a toxic industrial chemical in an urban location, using atmospheric dispersion and human effects models and a focus on high-consequence scenarios. These models are used to assess the effectiveness of fatality and injury mitigation measures. Adding information on costs and other tradeoffs of mitigation allows multi-criteria decision analysis of strategies.

3 - Physical and Data-Driven Screening Systems for Security: Systems Analysis and Risks

David Ortiz, RAND Corporation, 1200 South Hayes Street, Arlington, VA, 22202, United States, David_Ortiz@rand.org

This presentation examines the limitations of networked systems to screen persons when presenting themselves at a controlled checkpoint. We present a framework for evaluating the risk in networked screening systems using as examples the Transportation Security Administration's Secure Flight system and the Department of Homeland Security's US-VISIT program. We show that all components of the systems can function as described, but that as a whole each system can fail to satisfy its goals.

■ MC19

Room 319

Joint Session ENRE/Optimization: Optimization/Equilibrium Models and Algorithms in Energy

Sponsor: Energy, Natural Resources & The Environment, Optimization/Linear Programming and Complementarity

Sponsored Session

Chair: Steve Gabriel, Assistant Professor, Department of Civil & Environmental Engineering, University of Maryland, 1143 Martin Hall, College Park, MD, 20742, United States, sgabriel@umd.edu

1 - Forward Markets in Electricity, Do They Increase Total Supply?

Fred Murphy, Professor, Temple University, The Fox School of Business, 108 Speakman Hall, 1810 N. 13th Street, Philadelphia, PA, 19122, United States, fmurphy@temple.edu, Yves Smeers

Allaz and Vila proved that adding a futures market leads to an increase in production. They model a two-stage game with futures positions taken before spot decisions. This work has led to belief that a futures market can reduce market power in electricity markets. With a third stage added to the game, prior to futures positions, production can either increase or decrease and a futures market can lead to multiple equilibria. Thus, a futures market is no panacea for a lack of competition.

2 - Methods for Stochastic Complementarity Models of Natural Gas Market Equilibria

Steve Gabriel, Assistant Professor, Department of Civil & Environmental Engineering, University of Maryland, 1143 Martin Hall, College Park, MD, 20742, United States, sgabriel@umd.edu, Jifang Zhuang, Ruud Egging

We present a detailed model of the natural gas market where certain components are stochastic (e.g., inverse demand function coefficients). Combined within a Nash-Cournot framework for the market players, the resulting model is an instance of a stochastic complementarity problem. As such both game theoretic and risk elements are addressed. We describe recent numerical efforts to solve these and related stochastic games using scenario reduction techniques.

3 - Custom Power Contract Portfolio Optimization with CVAR Constraints

Roy Kwon, Prof, University of Toronto, 5 Kings College Rd., Toronto ON, Canada, kwon@mie.utoronto.ca, Scott Rogers, Sheena Yau

This paper considers a stochastic IP model that jointly considers the problem of selecting custom contracts and finding the optimal procurement strategy of meeting contract obligations under spot price uncertainty. We use a two stage stochastic programming model with CVAR constraints. It will be shown that the CVAR model will allow acceptance of contracts at lower prices compared to the risk-neutral model as a hedge against mis-specified arbitrage.

4 - The Cost of Anarchy in Self-Commitment Based Electricity Markets

Ramteen Sioshansi, Graduate Student, IEOR Department, University of California at Berkeley, Berkeley, CA, 94720-1777, United States, ramteen@queue.IEOR.Berkeley.EDU, Richard O'Neill, Shmuel Oren

We compare the efficiency and distributional implications of centralized unit commitment based on multipart offers in competitive day-ahead electricity markets to a self-commitment approach with one part energy offers. In the centralized approach generators are paid hourly marginal energy clearing prices plus a daily "make-whole" payment to cover revenue shortfalls. Under self-commitment, all costs are covered by energy payments based on hourly marginal clearing prices.

■ MC20

Room 320

Joint Session DAS/Health Applications: Decision Modeling in Health Care Applications

Sponsor: Decision Analysis Society, Health Applications Section
Sponsored Session

Chair: Elissa Ozanne, Instructor, Harvard Medical School, Institute for Technology Assessment, 101 Merrimac Street, 10th Floor, Boston, MA, 02114, United States, elissa@mgh-ita.org

1 - Can the Human Inclination Toward Fairness Help Employers Manage the Cost of Prescription Drugs?

Robert Nease, Vice President of Knowledge Management, Express Scripts, 13900 Riverport Drive, Maryland Heights, MO, 63043, United States, RNease@express-scripts.com

Employers often consider changes to the pharmacy benefit to manage costs. However, concern about employee reaction stops many plans from making such changes. This concern is based largely on the assumption that people are self interested. We briefly review evidence to the contrary, focusing on the anomalous human desire towards fairness. We speculate as to a possible evolutionary explanation for this anomaly, and present example communications that take advantage of this human attribute.

2 - Estimating HIV Incidence in the United States from HIV/AIDS Surveillance Data and Less-Sensitive HIV

Edward Kaplan, William N. and Marie A. Beach Professor of Management Sciences, Yale School of Management, Yale School of Medicine, Yale Faculty of Engineering, New Haven, CT, 06520-8200, United States, edward.kaplan@yale.edu, Ruiguang Song, John Karon, Ron Brookmeyer

Development of a less-sensitive HIV test that detects recent infection has enabled the US Centers for Disease Control and Prevention to develop new estimators for annual HIV incidence in the United States based on HIV reporting data. We develop statistical models noting that: individuals choose how frequently to get tested; test frequency varies among individuals; only HIV+ test results are reported; and prior HIV-negative testing dates can be obtained from supplementary data sources.

3 - Productivity of Tuberculosis Control

Stephen Resch, PhD Candidate, Harvard University, 718 Huntington, Boston, MA, 02115, United States, resch@fas.harvard.edu, Milton Weinstein, Megan Murray, Joshua Salomon

Endemic TB is a major public health problem in dozens of nations, killing an estimated 2 million people per year. Policymakers face a decision regarding how to distribute available resources across sequentially connected components of TB control programs: population coverage, case recruitment, diagnosis, and treatment. With an objective of minimizing deaths, we explore tradeoffs in allocating resources across these program activities using a state-transition model and deterministic simulation.

4 - Decision Analysis in Support of Clinical Trial Protocol Decisions

Joseph Kahn, Novartis Pharmaceuticals, 1 Health Plaza, East Hanover, NJ, 07936, United States, joseph.kahn@novartis.com

Presentation will illustrate via a case study for a phase IIa/b adaptive program design how modelers can use decision analysis to more productively assist clinical teams with protocol decisions. Topics include: Framing and developing a manageable set of compelling alternatives; Assuring information is relevant and has credence; Salient value measures; Analytic methods and software useful for implementation; Achieving buy-in from both clinical teams and colleagues in statistics.

■ MC21

Room 321

MARA 2006 - An International Initiative in Decision Analysis

Sponsor: Decision Analysis Society
Sponsored Session

Chair: Martin Schilling, PhD Candidate, London School of Economics, Department of Operational Research, Houghton Street, London, NW3 1AH, United Kingdom, m.schilling@lse.ac.uk

Co-Chair: Cornelius Schaub, PhD Candidate, London School of Economics & Political Science, Department of Economics, Houghton Street, London, WC2A 2AE, United Kingdom, c.schaub@lse.ac.uk

1 - MARA 2006: Core Idea

Cornelius Schaub, PhD Candidate, London School of Economics & Political Science, Department of Economics, Houghton Street, London, WC2A 2AE, United Kingdom, c.schaub@lse.ac.uk, Martin Schilling

MARA 2006 is a project organised by international (PhD) students to contribute to the internationalization of decision analysis. With the support of experienced academics, such as Bob Clemen, Ralph Keeney, Gregory Parnell, Larry Phillips and Detlof von Winterfeldt, the MARA group members trained 30 international participants from ten different countries to subsequently conduct decision analyses in five projects in Germany. In addition to the core idea of MARA, we introduce in this presentation, two MARA cases at the interface between decision analysis and HR strategy.

2 - Public Management: Appraising Infrastructure Funding Requests for the Berlin Government Senate Department for Economics (SenWAF)

Dinah Vernik, PhD Candidate, Fuqua School of Business, Duke University, 1 Towerview Drive, Durham, NC, 27708, United States, dinah.vernik@duke.edu, Felix Ruebcke

In the face of increasingly tight financial constraints, the Berlin Government Senate engaged a team from MARA 2006 to develop an MCDA-based approach to evaluate and prioritise its business-related infrastructure funding requests. In this presentation, we summarize the results of the SenWAF case in the context of MARA 2006.

3 - R&D: Analyzing Research Directions in the Area of Optoelectronics for the Ferdinand-Braun-Institute in Berlin

Dolchai La-Ornual, PhD Student, Decision Sciences, INSEAD, Boulevard de Constance, Fontainebleau, 77305, France, Dolchai.LA-ORNUAL@insead.edu

A socio-technical approach incorporating MCDA, assisted leaders at a prominent research institute to evaluate prospective research directions. The decision makers gained understanding and insights into conflicting criteria that determine each option's potential benefits and costs. In this presentation, we highlight the insights gained for the institute's strategic research plans.

4 - MARA Effectiveness Research: Decision Analyses in the Context of Strategy Development

Martin Schilling, PhD Candidate, London School of Economics, Department of Operational Research, Houghton Street, London, NW3 1AH, United Kingdom, m.schilling@lse.ac.uk, Nadine Oeser

The evaluation of the effectiveness of socio-technical decision analyses in strategy development contexts is the research focus of MARA 2006. The across-project research results of MARA 2006 are the topic of this presentation.

■ MC22

Room 322

Agent Based Modeling and Simulation for National Security Analysis

Sponsor: Military Applications
Sponsored Session

Chair: Isaac Porche, Senior Analyst, RAND, 4570 Fifth Avenue, Suite 600, Pittsburgh, PA, 15213, United States, porche@rand.org

Co-Chair: Matthew Koehler, MITRE, 7515 Colshire Drive, MS: H305, McLean, VA, 22102, United States, mkoehler@mitre.org

1 - Leveraging Agent-Based Models for Military Analysis and Decision-Support: Techniques and Application

Matthew Koehler, MITRE, 7515 Colshire Drive, MS: H305, McLean, VA, 22102, United States, mkoehler@mitre.org

We have investigated the use of agent-based models for military decision-support and applied these models in a number of domains. This paper will address some techniques used in our investigations and two applications of agent-based models. The techniques include methods for examining large parameter spaces inherent within agent-based models and use of data within an agent-based model. The specific applications include Course of Action Analysis, and Acquisition and Capabilities Analysis.

2 - Applying Effects-Based Thinking to Complex Problems Using SEAS

Alok Chaturvedi, Professor of Management & Director of PHSI, Purdue University, 403 W. State Street, West Lafayette, IN, 47906, United States, alok@purdue.edu

Effect Based Thinking (EBT) provides a complete understanding of the strategic, operational, and tactical issues of an environment viewed as a complex adaptive system. This paper describes the process of creating a synthetic environment for analysis and simulation (SEAS) that mirror "real world" counterparts in all their key aspects. By combining millions of artificial agents with a small number of human agents, SEAS captures both detail and strategic interactions.

3 - Impact of Networking on Warfighter Effectiveness: A Study Using the MANA Agent-Based Simulation Tool

Isaac Porche, Senior Analyst, RAND, 4570 Fifth Avenue, Suite 600, Pittsburgh, PA, 15213, United States, porche@rand.org

The objective of the research effort described in this presentation is to quantify the marginal impact of networking as part of an effort to evaluate the concept of network-centric operations. Specifically, this presentation analyzes networking concepts and uses simulation results from agent-based combat models to quantify and assess the marginal benefit of networking concepts with respect to warfighter effectiveness at the tactical level.

4 - Reviewing a Hardware, Human In The Loop Experiment Using an Agent Based Model

Bradley Wilson, Research Programmer, RAND, 4570 Fifth Avenue, Suite 600, Pittsburgh, PA, 15212, United States, bradleyw@rand.org, Isaac Porche

This paper reports on the findings and lessons learned from a hardware and human-in-the-loop experiment conducted in May 2006 for the Joint Staff. The experiment linked a network simulation called QualNet with a human-in-the-loop version of the agent based tool Map Aware Non-Uniform Automata. Several areas will be investigated, such as the choice of models, design of experiments, analysis of similar efforts, as well as the technical challenges encountered in modifying the model for HITL use.

■ MC23

Room 323

Sourcing Models in a Global Economy: Comparing R&D, BPO, and IT Services

Cluster: Global Services Sourcing
Invited Session

Chair: Natalia Levina, Assistant Professor, New York University, 2 Washington Square Village, #13R, New York, NY, 10012, United States, nlevina@stern.nyu.edu

1 - Global Product Development Processes

Steven Eppinger, Professor and Deputy Dean, MIT Sloan School of Management, 50 Memorial Drive, Cambridge, MA, 02142, United States, eppinger@mit.edu, Anshuman Tripathy

This research explores various modes of implementing global product development, including the outsourcing and offshoring of engineering services. We have observed two distinct ways to distribute work: process decomposition and component decomposition. Through several case studies, we have identified particular challenges for coordinating the product development process deriving from each type of work decomposition.

2 - Offshore Business Process Outsourcing

Amiya Chakravarty, Philip McDonald Chair and Professor, Northeastern University, 214 Hayden Hall, Northeastern University, Boston, MA, 02115, United States, akc@neu.edu

Options for ownership and operations of an offshore facility include the captive center, offshore-development center (ODC), and build-operate-transfer (BOT). We compare capacity strategies of ODC and BOT. Further, we study improvements in productivity, employing the principal/agent model. We are interested in managerial insights addressing the desirability of BOT over ODC, behavior of optimal prices and investments, and incentive compatibility.

3 - Collaborating Effectively on Globally Sourced IT Projects

Natalia Levina, Assistant Professor, New York University, 2 Washington Square Village, #13R, New York, NY, 10012, United States, nlevina@stern.nyu.edu

It has been argued that offshoring complex and poorly defined IT projects is best accomplished through captive centers. I will discuss the case of a large global bank which used both captive centers and 3rd party vendors. Surprisingly, the data indicated that project effectiveness did not depend on whether the project was kept within firm boundaries. Instead, it depended on an effective engagement of mid-level managers in specific boundary-spanning practices.

■ MC24

Room 324

Daniel H. Wagner Prize Competition

Cluster: The Daniel H. Wagner Prize for Excellence in Operations Research
Invited Session

Chair: Joe Discenza, President and CEO, SmartCrane LLC, 2 Eaton Street Suite 500, Hampton, VA, 23669, United States, jhdiscenza@smartcrane.com

1 - The Daniel H. Wagner Prize for Excellence in Operations Research Practice

Five finalist teams have been selected for 2006 and these five will be presented in three sessions on Monday and the winning entry announced on Tuesday morning.

2 - Warranty Inventory Optimization for Hitachi Global Storage Technologies, Inc.

John Khawam, Graduate Student, Management Science & Engineering Department, Stanford University, Stanford, CA, 94305, United States, jkhawam@stanford.edu, Warren Hausman

Warranty inventory must cope with random replacement demands and three sources of resupply with differing lead times: no defect found (NDF), remanufacturing of returned units, and purchase of new product. By modeling NDF and Remanufacturing as negative demand, we create a heuristic order-up-to inventory model for this setting and use the model to show the payoffs from reducing lead times and reducing batching in remanufacturing. We also describe who the customer is, how and why the work was initiated, who the "users" are, and how the results are applied in practice.

3 - Solving Real-Life Railroad Blocking Problems

Jian Liu, Innovative Scheduling, Inc., Gainesville, FL, liujian@InnovativeScheduling.com, Krishna Jha, Ravindra Ahuja

The railroad blocking problem, an important railroad planning problem, is a very large-scale multi-commodity flow network design and routing problem containing billions of decision variables. This paper describes a novel Very Large-Scale Neighborhood (VLSN) Search Algorithm to solve it to near-optimality within one to two hours of computer time. Use of this algorithm has resulted in significant cost savings for several large US freight railroads.

■ MC25

Room 325

Portfolio Optimization

Cluster: OR Practice
Invited Session

Chair: Rajesh Tyagi, GE Global Research, 1 Research Circle, Niskayuna, NY, 12309, United States, rajesh.tyagi@research.ge.com

1 - An Examination of Correlation Assumptions Under CreditMetrics

Sung-Ho Ahn, Wachovia Bank, 201 South College Street, Charlotte, NC, 28244, United States, sung-ho.ahn@wachovia.com

Models of portfolio credit risk based on CreditMetrics utilize obligor asset correlations in loss distribution calculations. Given the computational burden of directly estimating the complete correlation matrix for all obligors, a factor model is typically employed to reduce the dimensionality of the problem. This article examines several issues that arise in counterparty risk attribution as a result of the assumptions behind the factor modeling and their impact on portfolio optimization.

2 - Decision Support Tools for Commercial Real Estate Portfolio Management

Rajesh Tyagi, GE Global Research, 1 Research Circle, Niskayuna, NY, 12309, United States, rajesh.tyagi@research.ge.com

Commercial real estate companies must meet financial target by selling invested properties to realize gains. To maintain a healthy portfolio, this target must be achieved without giving away too much recurring income and future potential gains. We developed a suite of decision support tools that help decision-makers. The tools were integrated into a web-based enterprise platform and is used by financial, risk and asset managers.

3 - The Academics of OR Practice

Karen Holness, PhD Student, University at Buffalo, 435 Bell Hall, Department of Industrial Engineering, Buffalo, NY, 14260, United States, holness@eng.buffalo.edu

The interdisciplinary nature of OR warrants an investigation into the core skills required for successful OR project work. This research examines the key practitioner skills identified in the OR, MS and Industrial Engineering literature and correlates them with those obtained from our empirical questionnaire and interview studies.

■ MC26

Room 326

Joint Session DM Invited/DM Sponsored: Applications of Machine Learning

Cluster: Data Mining and Automated Learning, Data Mining
Invited Session

Chair: Artur Dubrawski, Systems Scientist/Adjunct Professor, Robotics Institute, Carnegie Mellon University, 5000 Forbes Avenue, Pittsburgh, PA, 15213, United States, awd@cs.cmu.edu

1 - Learning Bayesian Networks: Methodology and Applications

Marek J. Druzdzel, Professor, University of Pittsburgh, Decision Systems Laboratory, 135 North Bellefield Avenue, Pittsburgh, PA, 15260, United States, marek@sis.pitt.edu

I will summarize the existing techniques for learning directed probabilistic models, such as Bayesian networks, from data. I will give examples of applications and point out possible pitfalls related to learning models from data. Finally, I will demonstrate GeNIe, a computer program developed in the Decision Systems Laboratory, University of Pittsburgh and available at http://genie.sis.pitt.edu/, that allows for learning models from data and using them to support decisions under uncertainty.

2 - Machine Learning in in vivo CNS Drug Discovery

Jeff Schneider, Associate Research Professor, Carnegie Mellon University, 5000 Forbes Avenue, Pittsburgh, PA, 15213, United States, schneide@cs.cmu.edu

Machine learning has had success in modeling and optimizing commercial processes. A recent trend is to observe that the scientific method is a process that can be approached similarly. We consider discovery of CNS drugs using in vivo behavioral testing. We discuss: kernel density estimators for improved probabilities in multi-class problems; semi-supervised learning for training data with uncertain class labels; and active learning to control experimentation for drug discovery.

3 - Evolving Fuzzy Models to Identifying the Best and Worst Units in a Fleet

Piero Bonissone, Computer Scientist, Coolidge Fellow, General Electric Global Research, One Research Circle K1-5C32A, Niskayuna, NY, 12309, United States, bonissone@crd.ge.com

We use local fuzzy models to determine remaining life for each vehicle in a fleet. We identify clusters of peers, similar units with comparable use and performance, and create a local fuzzy model per cluster. We combine this approach for model generation with evolutionary search for model maintenance. We generate competing models, evaluate them with actual data, refine them with evolutionary search, and select the best one. We repeat this process periodically to produce updated models.

4 - Early Detection of Emerging Patterns of Adverse Events

Artur Dubrawski, Systems Scientist/Adjunct Professor, Robotics Institute, Carnegie Mellon University, 5000 Forbes Avenue, Pittsburgh, PA, 15213, United States, awd@cs.cmu.edu

We review the use of selected machine learning techniques in early detection of emerging patterns of adverse events in spatio-temporal and event-based data. These techniques have been successfully applied in support of monitoring food safety and bio-surveillance, where reliable and rapid detection is the key to effective protection of public health. We discuss performance, implementation issues and we hint on possible applications of the presented methods beyond their original deployment areas.

■ MC27

Room 327

Joint Session QSR/ Health Applications: Quality and Statistical Decision-Making in Healthcare Applications II

Sponsor: Quality, Statistics and Reliability, Health Aplications Section
Sponsored Session

Chair: Jing Li, Research Assistant, Department of Industrial and Operations Engineering, University of Michigan, 1205 Beal Avenue, Ann Arbor, MI, 48109, United States, jinglz@engin.umich.edu

Co-Chair: Julie Simmons Ivy, Assistant Professor, University of Michigan, 701 Tappan Street, Ann Arbor, MI, 48109, United States, jsimmons@bus.umich.edu

Co-Chair: Nicoleta Serban, Assistant Professor, ISyE, Georgia Institute of Technology, 755 Ferst Drive NE, Atlanta, GA, 30332, nserban@isye.gatech.edu

1 - Improving Patient Flow and Resource Allocation Through Healthcare Decision-Making

José Zayas-Castro, Professor & Chairperson, Industrial & Management Systems Engineering, 4202 E Fowler Avenue ENB 118, Tampa, FL, 33620, United States, josezaya@eng.usf.edu, Michael Weng, Alcides Mercado, Jana Iezzi, Abhik Bhattacharya

Various operational decisions are made by the medical staff in a hospital. Statistical analysis and process mapping are used to improve and standardize decisions. Studies are being conducted at two major hospitals to investigate both inpatient and outpatient processes. The objective is to improve patient flow and resource allocation through enhanced decision-making processes.

2 - Measurement Error Models in Survival Data

Ciprian Crainiceanu, Assistant Professor, Johns Hopkins University, 615 N. Wolfe Street, E3636, Baltimore, MD, 21208, United States, ccrainic@jhsph.edu

Cox regression is a major statistical tool for analysis of survival data. An essential problem in many studies is that some of the risk factors are measured with error, which typically leads to biased effect estimates of relative risk and invalid tests of statistical significance. We propose a new, computationally usable, methodology for the analysis of survival data with risk factors subject to measurement error and nonlinear log hazard function.

3 - Difference Between Reported and Expected Nursing Hours in Wisconsin Nursing Facilities

Jenya Antonova, University of Wisconsin-Madison, 1175 WARF Building, 610 Walnut Street, Madison, WI, 53726, United States, Jenya_Antonova@chsra.wisc.edu, David Zimmerman, Karen Reilly, Jim Robinson

The nursing home industry experiences severe staff shortages. There is no optimal standard staffing requirement in nursing homes. We analyzed staffing standards associated with the Resource utilization groups — the instrument used by the Medicare for nursing home reimbursement — and compared them to staffing levels reported by nursing homes.

4 - Detection of Physiologic Condition Changes Based on Synchronization Patterns

Qiang Huang, Assistant Professor, University of South Florida, 4202 East Fowler Avenue, ENB 118, Tampa, FL, 33620, United States, huangq@eng.usf.edu, Hui Wang

The synchronization is a fundamental phenomenon in physiologic systems. It has long been recognized as an important mechanism by which the brain codes and processes information. Defining "synchronization patterns" of neuronal groups under different physiologic conditions may provide great implications to health condition monitoring and treatment of neurological diseases. This study presents a method to detect synchronization changes using a new nonlinear dynamics model.

■ MC28

Room 328

Wavelets, Data Mining, and Statistical Modeling

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: Myong K. Jeong, Assistant Professor, University of Tennessee, 311 East Stadium Hall, Knoxville, TN, 37996, United States, mjeong@utk.edu

1 - Bayesian Mean and Variance Wavelet Thresholding for Multiple Complicated Functional Data
Jye-Chyi (JC) Lu, Professor, Georgia Institute of Technology, 765 Ferst Drive, Atlanta, GA, 30022, United States, jclu@isye.gatech.edu, Myong K. Jeong, Cuizhen Shen

This talk uses a Bayesian hierarchical model to describe data trend and variation for several complicated functional curves. In particular, a wavelet based random-effect model enables us to characterizes local variations between curves. Our work develops a wavelet thresholding procedure for both mean and variance parameters. Bayes factors makes the hypothesis testing for parameter thresholding simple. A real-life example from antenna manufacturing illustrates the developed methods.

2 - A Spatial Autocorrelation Analysis in Semiconductor Wafer Maps
Seong-Jun Kim, Visiting Scholar, University of Tennessee, Knoxville, TN, 37996, United States, skim47@utk.edu, Young S. Jeong, Myong K. Jeong

Wafer map is a graphical illustration to represent the locations of defective chips on the wafer. Defective chips are likely to exhibit a spatial dependence across the wafer map, in which useful information about integrated chip (IC) fabrication processes is contained. By incorporating a join-count statistic with spatial lags, this paper presents a novel approach to detecting the presence of spatial dependences on the wafer map.

3 - Restricted Error Regression - Some Preliminary Results
James Cochran, Louisiana Tech University, College of Administration & Business, PO Box 10318, Ruston, LA, 71055, United States, jcochran@cab.latech.edu

We consider the benefits and ramifications of restricting regression analyses so the error terms satisfy the conditions necessary for valid inference (homoskedasticity, normality, independence, and linearity/fit). Specifically, we assess the difficulty and time required to solve the resulting constrained nonlinear optimization problem. We appraise the validity of standard summary statistics and hypothesis tests for the restricted error regression.

■ MC29

Room 329

Optimization

Contributed Session

Chair: Dan Stratila, Operations Research Center, MIT, 77 Massachusetts Avenue, E40-129, Cambridge, MA, United States, dstrat@mit.edu

1 - On the Application of Network Optimization: The Case of a National Food Supply System
Nguyen Huu Trung, PhD Candidate, National Graduate Institute for Policy Studies - GRIPS, 7-22-1 Roppongi, Minato-ku, Tokyo, 106-8677, Japan, d0412@stu.grips.ac.jp, Tatsuo Oyama, Kunihisa Yoshii

The paper proposed a new networked structure of a National Food Supply System (NFSS) to investigate the situation of food availability in a given country. In this NFSS, "food export" was not considered from the supply side, but as a demand sector. A food security optimal model, then, was built up to solve different food problems. The case of Vietnam was studied with objectives focusing on increasing exports while maintaining the people's diet in the context of future demands.

2 - Strongly Polynomial Primal-Dual Algorithms for Concave Cost Combinatorial Optimization Problems
Dan Stratila, Operations Research Center, MIT, 77 Massachusetts Avenue, E40-129, Cambridge, MA, United States, dstrat@mit.edu, Thomas Magnanti

Primal-dual algorithms (PDA) for uncapacitated fixed charge combinatorial optimization problems often possess attractive properties, yet do not generalize to problems with concave costs and arbitrary demands. Our result yields a PDA for a concave cost problem whenever one exists for its fixed charge special case. As a result, we obtain new approximation algorithms for concave cost facility location and inventory problems, and new heuristics for concave cost multicommodity flows.

■ MC30

Room 330

HIV Models

Sponsor: Health Applications Section
Sponsored Session

Chair: Steven Shechter, University of British Columbia, 2053 Main Mall, Vancouver, BC, Canada, steven.shechter@sauder.ubc.ca

1 - S4HARA: System for HIV/AIDS Resource Allocation
Arielle Lasry, Prevention Effectiveness Fellow, Center for Disease Control, Division of HIV/AIDS Prevention, 1600 Clifton Road, Atlanta, GA, 30333, United States, alasry@cdc.gov, Michael Carter, Greg Zaric

HIV/AIDS resource allocation decisions are influenced by political, social, ethical and other non-quantifiable factors. Therefore, rational models of HIV/AIDS resource allocation have had limited impact on actual spending decisions. We propose S4HARA, decision-support system that takes into account both principles of efficient resource allocation and the role of non-quantifiable influences on the decision-making process for HIV/AIDS resource allocation. We demonstrate S4HARA by an example.

2 - Incorporating Toxicity Information in HAART Therapy Initiation
Robert Koppenhaver, PhD Student, University of Pittsburgh, 1048 Benedum Hall, Pittsburgh, PA, 15261, United States, rzk9@pitt.edu, Andrew Schaefer, Steven Shechter, Mark Roberts, R. Scott Braithwaite

HAART is very effective in improving key health metrics for HIV patients. However it introduces an increased death rate from non-HIV related causes. We consider the question of when to start therapy by explicitly incorporating toxicity information into the patient's health transitions. Using a discrete event simulation we examine how toxicity can lead to delayed initiation of therapy for various starting conditions. We also will discuss possible improvements to the model and future work.

3 - An MDP Model of the Optimal Time to Initiate HIV Therapy as a Function of Two Variables
Steven Shechter, University of British Columbia, 2053 Main Mall, Vancouver, BC, Canada, steven.shechter@sauder.ubc.ca, Mark Roberts, Andrew Schaefer, Matthew Bailey, Scott Braithwaite

National guidelines policies for the best time to initiate HIV therapy consider two primary measures of HIV infection: the CD4 blood cell count and the level of HIV virus in the blood. We present a MDP model that considers both factors in a two-dimensional state space and develop structural properties in this context. For example, we present conditions that lead to a two-dimensional version of a control-limit policy. We also discuss the use of real clinical data to solve the MDP model.

4 - Clinical Benefits and Cost-Effectiveness of Antiretroviral Therapy in Resource-Poor Settings
Heather Hsu, Research Assistant, Section of Decision Science and Clinical Systems Modeling, University of Pittsburgh, 200 Meyran Avenue, 2nd Floor, Pittsburgh, PA, 15213, United States, hsuhe@upmc.edu, Rochelle Walensky, Jon Kaplan, Kenneth Freedberg, Sue Goldie, Yazdan Yazdanpanah, Elena Losina, Milton Weinstein, Xavier Anglaret, April Kimmel, Charles Holmes

As antiretroviral therapy (ART) is increasingly utilized in resource-limited settings, questions remain regarding treatment timing and use of diagnostic tests to guide clinical decisions. Our aim was to assess the cost-effectiveness of ART for HIV-infected adults in Côte díIvoire and similar settings. We present a state-transition simulation model of HIV, incorporating CD4 and HIV RNA as predictors of disease progression, to project long-term clinical, cost, and cost-effectiveness outcomes.

■ MC31

Room 331

New Directions in Risk Management and Hedging

Cluster: Financial Engineering and Risk Management
Invited Session

Chair: Farid AitSahlia, Assistant Professor, Industrial and Systems Engineering, University of Florida, Gainesville, FL, 32611, United States, farid@ise.ufl.edu

1 - Default Risk Premia and Asset Returns
Antje Berndt, Assistant Professor of Finance, Tepper School of Business, GSIA 335, Carnegie Mellon University, Pittsburgh, PA, 15213, United States, aberndt@andrew.cmu.edu, Iulian Obreja, Aziz Lookmann

We investigate the source for common variation in the portion of returns on corporate debt that is not explained by changes in risk-free rates or expected default losses. We extract a latent common component from firm-specific changes in default risk premia that is orthogonal to known systematic risk factors. Asset pricing tests suggest that our DRP factor is priced in the corporate bond market, and helps explaining returns on short-term, OTM put options. For equity markets, results are mixed.

2 - Efficient Monte Carlo Methods for Convex Risk Measures in Portfolio Credit Risk Models

Stefan Weber, Assistant Professor, School of OR&IE, Cornell University, 279 Rhodes Hall, Ithaca, NY, 14853, United States, sweber@orie.cornell.edu

We discuss efficient Monte Carlo methods for the estimation of convex risk measures in portfolio credit risk models. These risk measures do not share the deficiencies of the current industry standard Value at Risk (VaR). In the present paper we demonstrate that importance sampling with an exponential twist can be used to construct numerically efficient estimators within the framework of the credit risk models CreditRisk+ and CreditMetrics.

3 - Option Pricing: A Matroid Theory Perspective

Farid AitSahlia, Assistant Professor, Industrial and Systems Engineering, University of Florida, Gainesville, FL, 32611, United States, farid@ise.ufl.edu

In this talk I show how matroid theory provides a unifying framework for diverse approaches to option pricing theory in incomplete markets. Algorithmic implications are also discussed.

4 - Optimal Hedging Under Convex Risk Measures and Application to Shortfall Risk

Antoine Toussaint, Princeton University, ORFE, Princeton, NJ, United States, atoussai@Princeton.EDU, Ronnie Sircar

We study the hedging of contracts in an incomplete financial model. The criteria for optimal hedging is determined by a suitable convex risk measure. Under some assumptions on the set of trading strategies, we prove the existence of optimal hedging strategies and we give an expression for the minimum capital requirement. Applied to the framework of shortfall risk, it provides a bridge to minimal variance pricing.

■ MC32

Room 332

Real Options in Project Governance

Cluster: Project Management

Invited Session

Chair: Scott Mathews, Lead, Computational Finance and Stochastic Modeling, The Boeing Company, PO Box 3707 MC 45-93, Seattle, WA, 98124-2207, United States, scott.h.mathews@boeing.com

1 - Real Metrics: Using Real Program Value for Development Program Management

Murray Cantor, Distinguished Engineering, IBM Software Group, 340 W. 72nd Street, Apt. 6A, New York, NY, 10023, United States, mcantor@us.ibm.com

Classical program management measures such as “earned value” do not account for the statistical nature of the program variables and so do not drive behavior that drives program success. In this talk, I discuss the use of the Datar and Mathews Real Program Value measures to derive a set of program development measures, Real Metrics that drive effective development management, enable staged program investment, and provide a means for evaluating development organization value creation.

2 - Government Decisions and Real Options: Cases and Potential

Scott Farrow, Professor & Chair, Department of Economics, University of Maryland, 1000 Hilltop Circle, Baltimore, MD, 21250, United States, Farrow@umbc.edu

Many Government program and project decisions involve uncertainty, irreversibility, and flexibility in timing. Examples include oil and gas leasing, regulations, and major procurements. In contrast to many private sector applications, market data are frequently lacking. Existing and potential applications are discussed.

3 - Finding and Valuing “What’s Next” Technology

Chris Johnson, Manager, Risk & Value Technologies Lab, GE Global Research, 1 Research Circle, Niskayuna, NY, 12301, United States, johnsonch@crd.ge.com

What’s next and why? If our objectives include creating economic value for our projects, there exists a need to describe the context and risk/return of the requisite investment. Both the systemic approach to finding what should be next and our communication are critical to build commitment for action. A simulation and optimization based approach that incorporates the path dependencies and stochastic nature of potential scenarios into a financial objective function is presented.

4 - Integrating Real Options Business Engineering into Manufacturing Investment Decisions

Scott Mathews, Lead, Computational Finance and Stochastic Modeling, The Boeing Company, PO Box 3707 MC 45-93, Seattle, WA, 98124-2207, United States, scott.h.mathews@boeing.com

Boeing has developed and patented a set of strategic investment decision-modeling methods and tools based on real option techniques. These methods and tools appropriately value investment and risk of opportunities while assessing the likelihood of future events, and thereby aid decision makers in designing strategies that select high-benefit outcomes while minimizing risks. At Boeing real options help make real investment decisions for product design, risk management and allocation of resources.

■ MC33

Room 333

Next Generation Air Transportation System (NGATS)

Sponsor: Aviation Applications

Sponsored Session

Chair: Dipasis Bhadra, Principal Economist, MITRE/CAASD, 7515 Colshire Avenue, McLean, VA, 22102, United States, dbhadra@mitre.org

1 - Portfolio Analysis of NGATS

Shahab Hasan, Program Manager, LMI Government Consulting, 2000 Corporate Ridge, McLean, VA, 22102, United States, shasan@lmi.org, Dan Goldner

This presentation would demonstrate an analysis of planned JPDO operational improvements, time-phased, to show how benefits accrue as we proceed to full implementation of NGATS (end state or Segment 7).

2 - Constraints Analysis

Kevin James, Senior Scientist, NASA, Ames Research Center, Moffett Field, CA, 94035, United States, kjames@mail.arc.nasa.gov

This is related to the investment portfolio under NGATS, but would look at how various facets of the NAS constrain performance, starting with the current system and then applying NGATS improvements. The idea being to make sure JPDO is addressing the critical issues and in the right order.

3 - Real Time Probabilistic Weather

George Hunter, Senior Scientist, Sensis Corporation, 1700 Dell Avenue, Campbell, CA, 95008, United States, george.hunter@sensis.com, Kris Ramamoorthy, Benjamin Boisvert

This presentation summarizes JPDO research efforts in improving probabilistic weather modeling, evaluation and use in traffic flow management decision support tools. We present an equity-based traffic flow management solution and ProbTFM, a realtime traffic flow management evaluation platform.

4 - Cost-Benefit and Business Case Development for NGATS

Richard Golaszewski, Executive Vice President, GRA Inc., 115 West Avenue, Suite 201, Jenkintown, PA, 19046, United States, richg@gra-inc.com, David Ballard

The presentation would cover broad areas of business case development under NGATS. Developing advanced air traffic control system requires complemantaary investments by industry and government. These parties differ in what they consider to be benefits and costs, as well as in time horizon for investments. This session will review business case development for both industry and government.

■ MC34

Room 334

Routing Applications I

Sponsor: Transportation Science & Logistics

Sponsored Session

Chair: Ann Campbell, Associate Professor, Department of Management Sciences, University of Iowa, Iowa City, IA, 52242, United States, ann-campbell@uiowa.edu

1 - A VRP Application to a Large Convenience-Store Distribution Application

Arianne Trudeau, ari_chic@yahoo.com, Teodor Gabriel Crainic

We examine the centralized distribution problem of a convenience-store chain that covers a large territory with significant diversity among regions in population and store density. We focus on the modelling aspects of the problem and their relations to the transformation processes taking place in the firm. Computational experiments will also be reported.

2 - An Analysis of Network Structures for the Robust Vehicle Routing Problem

Ilgaz Sungur, PhD Candidate, University of Southern California, 3715 McClintock Avenue, Los Angeles, CA, 90089, United States, sungur@usc.edu, Fernando Ordonez, Maged Dessouky

We apply robust optimization methodology on the Vehicle Routing Problem to address the uncertainty in demand and cost. We develop robust counterparts and use performance measures to compare the robust and deterministic solutions. We experimentally analyze demand uncertainty using an open source solver. Our results on both literature and random instances show that for certain network structures, robust solution benefits from strategic allocation of the slack in vehicles with little extra cost.

3 - Applying the Attribute-Based Hill Climber Heuristic to the Vehicle Routing Problem

Ulrich Derigs, Professor, WINFORS - University of Cologne, Pohligstrasse 1, Köln, 50969, Germany, derigs@informatik.uni-koeln.de, Raimund Kaiser

The attribute based hill climber method (ABHC) proposed by Whittley and Smith [2004] is a variant of the general tabu-search principle. We will show that a straightforward implementation of the ABHC-concept to the Vehicle Routing Problem leads to results which are competitive with the best-known / state-of-the-art algorithms from literature. At the same time this new approach shows a striking simplicity: easy to understand, easy to code, and independent on any obscure parameter settings.

■ MC35

Room 335

Integrated Logistics Network Design and Inventory Management

Sponsor: Transportation Science & Logistics

Sponsored Session

Chair: Erhan Kutanoglu, Assistant Professor, The University of Texas at Austin, 1 University Station, C2200, Austin, TX, 78712, United States, erhank@mail.utexas.edu

1 - A Dynamic Spatial Hydrogen Facility Penetration Model

Tony Wu, Lawrence Livermore National Lab, 7000 East Avenue, L-644, Livermore, CA, 94550, United States, wu26@llnl.gov, Jeffrey Stewart, Alan Lamont, Gene Berry

Hydrogen is considered as a possible fuel carrier for transportation vehicles nationally and in the State of California. To evaluate infrastructure transition to serve the potential hydrogen demand, we need to dynamically and spatially model the hydrogen facility penetration. We develop a network flow model with fixed charges on the arcs. The objective function is to minimize total cost under scenarios set by sponsors the State of California and the Department of Energy.

2 - Multicommodity Logistics Network Design Models with Inventory Stocking and Part Commonality

Vishv Jeet, PhD candidate, The University of Texas at Austin, 1 University Station, C2200, Austin, TX, 78712, United States, vjeet_a@mail.utexas.edu, Erhan Kutanoglu

We address problems with strong interactions between network design and inventory decisions in service parts logistics. Expanding our analysis with variable substitution and outer approximation for single part models, we analyze the multi-product multi-part settings. The challenge is to satisfy time-based product-level service constraints for geographically dispersed customers when locating/stocking facilities with parts common across products. We present bounding and exact solution techniques.

3 - Integrated Logistics Network Design and Inventory Management in SPL for Customer-Centric Service

Mehmet Ferhat Candas, PhD Candidate, University of Texas at Austin, 3370 Lake Austin Boulevard Apt. D, Austin, TX, 78703, United States, mfcandas@mail.utexas.edu, Erhan Kutanoglu

We study the integrated logistics network design and inventory stocking problem in SPL with customer centered service levels, where each customer requires a certain time-based service level. Our analysis show that the model with customer centered service constraints has polynomially solvable subcases, but even the general setting in this case is still a challenging problem, for which we provide a Lagrangian-relaxation based approach that provides extremely tight lower and upper bounds.

4 - Integrated Logistics Network Design and Inventory Stocking with Customer-Dedicated Facilities

Ilyas Iyoob, PhD Candidate, University of Texas at Austin, ETC 5.124, C2200, Austin, TX, 78705, United States, iiyoob@mail.utexas.edu, Erhan Kutanoglu

Most of the work on logistics network design considers locating only one type of facilities. However, companies may prefer to have a variety of facilities. This paper expands earlier integrated network design and inventory models by explicitly considering two types of stocking facilities, one type serving multiple customers, and the other dedicated to a single customer. Computational results show that considering dedicated facilities may improve service, solution quality and time.

■ MC36

Room 336

Dynamic Programming Applications in Transportation Logistics

Sponsor: Transportation Science & Logistics

Sponsored Session

Chair: Huseyin Topaloglu, Assistant Professor, Cornell University, 223 Rhodes Hall, Ithaca, NY, 14853, United States, huseyin@orie.cornell.edu

1 - Dynamic Analysis of Multi-Item Freight Consolidation

Ali Ulku, PhD Student, Department of Management Sciences, University of Waterloo, 200 University Avenue West, N2L 3G1, Waterloo, ON, Canada, maulku@uwaterloo.ca, James Bookbinder

Consolidation is a common practice: Small shipments are aggregated and dispatched in the same load. We consider stochastic arrivals of items varying in size and cost parameters. Via dynamic programming, we analyze the optimality structures of shipment consolidation policies based on expected total cost/unit volume, and sensitivities to truck capacity and length of holding period.

2 - Integration of Count Data Analysis in Dynamic Programming Approach for Stochastic Truckload Routing

Ginny Miori, Assistant Professor, Department of Decision & System Sciences, St. Joseph's University, 333 Mandeville Hall, 5600 City Avenue, Philadelphia, PA, 19131, United States, vmiori@comcast.net

We discuss the integration of econometric count data regression into the stochastic truckload routing problem (TRP). A penalty method is applied to the TRP, which is then reformulated as a Markov process. This facilitates a solution using dynamic programming (DP)techniques. The two outpus of count data, predicted counts and the likelihood of those counts, are employed as transition probabilities (likelihoods) and in the generation of the expected cost-to-go for the DP solution.

3 - A Parallelizable Dynamic Fleet Management Model with Random Travel Times and Multiple Vehicle Types

Huseyin Topaloglu, Assistant Professor, Cornell University, 223 Rhodes Hall, Ithaca, NY, 14853, United States, huseyin@orie.cornell.edu

We present a fleet management model to handle random load arrivals, random travel times and multiple vehicles types. Our model decomposes the problem into a sequence of time-indexed subproblems by formulating it as a dynamic program and uses approximations of the value function. To handle random travel times, the state variable of our dynamic program includes all decisions over a portion of the history, but we approximate this high-dimensional value function in a tractable manner.

■ MC37

Room 337

Piracy and Copyright Issues in Markets for Information Goods

Sponsor: Information Systems Society

Sponsored Session

Chair: Michael Smith, Associate Professor, Carnegie Mellon University, 4800 Forbes Avenue, HBH 2105D, Pittsburgh, PA, 15213, United States, mds@cmu.edu

1 - Competing with Free: Impact of Movie Broadcasts on DVD Sales and Internet Piracy

Michael Smith, Associate Professor, Carnegie Mellon University, 4800 Forbes Avenue, HBH 2105D, Pittsburgh, PA, 15213, United States, mds@cmu.edu, Rahul Telang

Movie studios have long argued that TV broadcasts serve as a substitute to media purchases, and a complement to Internet piracy. We empirically analyze these concerns and find exactly the opposite effect. DVD sales increase by an average of 360-410% immediately after a movie is shown on broadcast TV. Furthermore,

TV broadcasts are not associated with a statistically significant increase in either the supply of or demand for pirated movies on popular Internet file-sharing networks.

2 - Trading Higher Software Piracy for Higher Profits: The Case of Phantom Piracy

Ram Gopal, Professor, University of Connecticut, School of Business, Storrs, CT, 06269, United States, ram.gopal@business.uconn.edu, Alok Gupta

This paper analytically explores the effect of software bundling on software piracy. We develop an economic model of software piracy and product bundling and derive results for optimal level of piracy and profits for individual products as well as for the bundle. Our results indicate that it is possible to trade off the piracy level of one product for overall higher profits, i.e., a seller can derive higher profits even with higher levels of piracy for one of the products in the bundle.

3 - Complementary Benefits of Software Piracy - An Empirical Analysis of Piracy and PC Ownership

Bin Gu, Assistant Professor, University of Texas at Austin, CBA 5.202, B6500, Austin, TX, 78712, United States, Bin.Gu@mccombs.utexas.edu, Prabhudev Konana

This study considers the benefits of software piracy to the PC industry. Using a panel data on piracy and PC ownership from 77 countries from 1994 to 2002, we find that software piracy brings significant benefits to the PC industry. The effects are particularly pronounced for developing countries. The result indicates that prior studies may have overestimated the cost of piracy without taking into consideration its benefits to complementary industries.

■ MC38

Room 338

Emerging Trends in Intermodal Transportation

Sponsor: Railroad Applications

Sponsored Session

Chair: Krishna Jha, Director, R&D, Innovative Scheduling, Gainesville Technology Enterprise Center, 2153 SE Hawthorne Road, Suite 128, Gainesville, FL, 32641, United States, krishna@innovativescheduling.com

1 - New Approaches to Solve Load Planning Problem

Krishna Jha, Director, R&D, Innovative Scheduling, Gainesville Technology Enterprise Center, 2153 SE Hawthorne Road, Suite 128, Gainesville, FL, 32641, United States, krishna@innovativescheduling.com, Ashish Nemani, Ravindra Ahuja

This paper deals with the load planning problem, one of the most important problem in intermodal transportation by railroads. The solution to this problem assigns containers and trailers to railcars. We have formulated this problem as a multicommodity flow problem. We solve the IP formulation to obtain optimal solution. We have also developed several heuristic algorithms.

2 - Optimizing the Aerodynamic Efficiency of Intermodal Freight Trains

Yung-Cheng Lai, Graduate Research Assistant, University of Illinois at Urbana Champaign, B-118 Newmark Lab, 205 N. Matthews Avenue, Urbana, IL, 61801, United States, lai3@uiuc.edu, Yanfeng Ouyang, Hayri Onal, Christopher Barkan

An IP model was developed to optimize aerodynamic efficiency of intermodal trains using available loads. More effective solutions may be possible with advance information on arriving loads and trains. We extend the model to optimize at the system level, and develop a rolling horizon scheme for 24/7 terminal operations.

3 - Capacity Challenges = OR Opportunities

Erick Wikum, Director of Engineering, Schneider National, Inc., 3101 S. Packerland Drive, Green Bay, WI, 54306, United States, wikume@schneider.com

In an attempt to stretch available capacity, railroads have recently implemented various measures including incentives for shipping containers v. trailers, daily ramp inbound limits, and detention charges. Schneider National, an asset-based intermodal provider, is utilizing statistical analysis, optimization, and other OR techniques to respond to the resultant challenges.

■ MC39

Ballroom B

Great Unsolved Problems in OR - II

Cluster: Great Unsolved Problems in OR

Invited Session

Chair: Saul I. Gass, Professor, University of Maryland, Robert H. Smith School of Business, College Park, MD, 20742, United States, sgass@rhsmith.umd.edu

1 - Need and Potential for Real-Time Integer Programming

George Nemhauser, Professor, Georgia Institute of Technology, Department of Industrial Engineering, Atlanta, GA, 30332-0205, United States, gnemhaus@isye.gatech.edu

Until recently, most applications of integer programming have been to planning models where solution time is not an issue. Significant improvements in methodology, high-speed computing and data availability have made it possible to apply integer programming at the operational level where solution time may take minutes. The next challenge is real-time integer programming. In this talk we discuss some applications for which optimality in real-time is important and some ideas for making real-time integer programming a reality.

2 - Problems in Air Transportation

Michael Ball, Professor, Robert H. Smith School of Business, University of Maryland, College Park, MD, 20742, United States, mball@rhsmith.umd.edu

As air transportation demand creeps closer to system capacity, congestion and associated poor service levels are becoming widespread, particularly in the US and Europe. Addressing this global problem involves fundamental systems questions and as such clearly falls within the domain of operations research. We define several specific challenges including construction of highly reactive control mechanisms, integrating technical and economic controls and modeling and quantifying safety.

3 - Recent Results and Unsolved Problems in Computational Biology

James Orlin, Professor, Massachusetts Institute of Technology, Operations Research Center, E53-363, Cambridge, MA, 02139, United States, jorlin@MIT.EDU

Computational biology is a field that is rich in analytical problems of great significance. Great strides have been made over the past 15 years including a sequencing of the human genome and other genomes. All of this data provides opportunities for addressing fundamental problems. This talk, which will be based on interviews with those in computational biology, will be a description of some of the key problems in the field as well as descriptions of some recent successes.

■ MC40

Room 401

Location Modeling

Sponsor: Location Analysis

Sponsored Session

Chair: Rajan Batta, Professor and Associate Dean, Department of Industrial and Systems Engineering, University at Buffalo (SUNY), 438 Bell Hall, Buffalo, NY, 14260, United States, batta@eng.buffalo.edu

1 - Approaches to Wireless Sensor Network Design and Routing for Prolonged Network Life

Halit Uster, Assistant Professor, Texas A&M University, Industrial and Systems Engineering, College Station, TX, 77843, United States, uster@tamu.edu, Hui Lin

We present a general model and its variations to consider various objectives that define policies for wireless sensor network design and routing that promote efficiency in energy usage. The objectives include combinations of maximum and average energy usage at a sensor node and the remaining energy distribution at the sensor nodes. We present algorithmic approaches, an analysis of objectives with respect to energy distribution characteristics and computational results.

2 - Ambulance Deployment for Maximum Survival

Armann Ingolfsson, Associate Professor, University of Alberta School of Business, 4-30K Business Building, Edmonton, AB, T6G2R6, Canada, armann.ingolfsson@ualberta.ca, Gunes Erdogan, Erhan Erkut

We propose location models for emergency medical services (EMS) that incorporate survival functions into existing covering models. Survival functions map EMS response times into probability of survival and allow the calculation of tangible outcome measures, e.g., the expected number of cardiac arrest survivors in case of cardiac arrests. We demonstrate empirically the superiority of survival-maximizing models over covering models using data from the Edmonton EMS system.

3 - A Resource Allocation Model for Protecting Supply System Facilities with Capacity Restrictions

Paola Scaparra, Lecturer in Management Science, University of Kent, Kent Business School, Canterbury, United Kingdom, M.P.Scaparra@kent.ac.uk, Richard Church

We consider a service-supply system where the facilities have finite capacities and develop an optimization model for identifying the most cost-effective way of protecting the facilities against worst-case scenario disruptions due to intentional attacks. We formulate the problems as a tri-level mixed-integer program. We then show how this model can be reduced to a bi-level model and solved through an implicit enumeration approach. Computational results are presented for some benchmark problems.

4 - Performance Evaluation for Current Aeromedical Base Locations of New Mexico with Managerial Insights

Elif Tokar Erdemir, Research Assistant, SUNY at Buffalo, 60 Maple Court Apt. 1, Amherst, NY, 14226, United States, et5@buffalo.edu, Peter Rogerson, Alan Blatt, Rajan Batta, Marie Flanigan, Seth Spielman

The current aeromedical system of New Mexico is designed without considering path demand, i.e. traffic roads with a weight signifying relative crash occurrence. From this perspective, we analyze the loss in accident coverage and location error for current aeromedical bases. We also provide managerial insights that will show the relevance of considering path demand. Additionally, we address the tradeoff issues in adding new trauma centers vs. new aeromedical bases to the current system.

■ MC41

Room 402

Asymptotic Limit Theorems for Stochastic Networks

Sponsor: Applied Probability

Sponsored Session

Chair: Kavita Ramanan, Associate Professor, Carnegie Mellon University, 6208 Wean Hall, Department of Mathematical Sciences, Pittsburgh, PA, 15213, United States, kramanan@asdf5.math.cmu.edu

1 - Fluid Limits of GI/GI/N Queueing Systems with Many Servers

Haya Kaspi, Professor, William Davidson Faculty of Industrial Engineering and Management, Technion, Haifa, 32000, Israel, iehaya@techunix.technion.ac.il, Kavita Ramanan

The talk focuses on a fluid limit of a GI/GI/N queueing system when the number of servers coverges to infinity. To describe the evolution of the system we use a measure valued process that keeps track of the time in the service of the various customers in service, and in addition a variable that describes the total number of customers in the system. We show that the limiting pair satisfies an evolution equation and discuss some of its properties. This is joint work with Kavita Ramanan.

2 - Accuracy of State Space Collapse for Earliest-Deadline-First Queues

John Lehoczky, Professor of Statistics, Carnegie Mellon University, Pittsburgh, PA, 15213, United States, jpl@stat.cmu.edu, Steven Shreve, Lukasz Kruk

We consider a real-time queueing system in which the customers have deadlines, and the performance measure is the fraction of customers who meet their deadlines using the earliest-deadline-first queue discipline. This paper first reviews the heavy traffic approximation of the system's performance. The main result is the development of a second-order analysis that gives the accuracy of the heavy traffic approximation and the rate of convergence to the heavy traffic limit.

3 - Fluid Limits for SRPT Queues

Christian Gromoll, Assistant Professor, University of Virginia, Department of Mathematics, Charlottesville, VA, 22904, United States, gromoll@math.stanford.edu, Doug Down, Amber Puha

Consider a GI/GI/1 queue in which the server employs the SRPT policy: it works on the job with the Shortest Remaining Processing Time, allowing preemption by arriving jobs. We propose a fluid model, and present a functional limit theorem justifying it as an approximation of this system. A key step is to keep track of the frontier, the largest service time of any job that has been in service during the current busy period. This is accomplished using a measure valued state description.

4 - Fluid Limit of Transport Processes, and Applications to Queues with Impatient Customers

Pascal Moyal, CEREMADE- Université Paris Dauphine, Place du Maréchal DeLattre de Tassigny, Paris, 75016, France, pascal.moyal@ceremade.dauphine.fr, Laurent Decreusefond

We study a queueing system with impatient customers, represented by a measure-valued process keeping track of the residual time-credits of the customers. This process is a Feller Process whose generator emphasises an integral transport equation. We prove the convergence in distribution of a normalized sequence of such processes towards a fluid limit using compactness/uniqueness techniques, and apply this result to derive the fluid limits of the congestion and lost processes in some cases.

■ MC42

Room 403

Discrete Manufacturing Problems

Cluster: Scheduling

Invited Session

Chair: Nicholas G. Hall, Ohio State University, 2100 Neil Avenue, Columbus, OH, United States, hall.33@osu.edu

1 - A Complete Polyhedral Description for the K-Median Problem when K=n-2

Wenhui Zhao, Graduate Research Associate, The Ohio State University, 1971 Neil Avenue, Columbus, OH, 43210, United States, zhao.108@osu.edu, Marc Posner

The polyhedral structure of the K-median problem for an arbitrary graph is examined. An extended formulation with integral polytope is presented. Then, we project out some of the extended variables. Finally, for K = n - 2, we project out all the extended variables and hence find the complete polyhedral description.

2 - Minimizing Makespan in Two-Machine Flowshops with Exact Delays

Joseph Leung, Distinguished Professor, New Jersey Institute of Computer Science, Department of Computer Science, Newark, NJ, 07102, United States, leung@oak.njit.edu, Hairong Zhao, Haibing Li

We consider two-machine flowshops with exact delays with the goal of minimizing the makespan. We first show that the problem is strongly NP-hard even if there are only two delay values. We then show that some special cases are solvable in polynomial time. Finally, we design constant approximation algorithms for the general case.

3 - Search for a Computationally Tractable Formulation for Contiguous Cave Formation

Anita Parkinson, PhD Student, University of British Columbia, 2053 Main Mall, Vancouver, BC, V6T 1Z2, Canada, anita.parkinson@sauder.ubc.ca, S. Thomas McCormick, Maurice Queyranne

In planning the period-by-period development of a block cave mine, the most challenging constraint is that the open drawpoints form a contiguous cave. Since these mines and the resulting models are very large, finding an integral formulation is of great interest. In this paper we compare several formulations and other computational approaches on several sets of actual mine data.

4 - Selection of Layouts: Flow Lines vs. Job Shop

Kejian Yang, The Ohio State University, 1971 Neil Avenue, Columbus, OH, 43210, United States, yang.12@osu.edu, Marc Posner

We study a problem of selecting a layout, where each job is assigned either to a dedicated Flow Line or a Job Shop. The objective is to minimize total cost. We develop a heuristic and provide an attainable constant worst-case bound. A computational study is conducted.

■ MC43

Room 404

Operations Research in Public Sector

Sponsor: Public Programs and Processes

Sponsored Session

Chair: Zachary Waltz, IBM Global Business Services, Fairfax, VA, 22033, zwaltz@us.ibm.com

Co-Chair: Qingying (Ally) Lu, IBM Global Business Services, Fairfax, VA, 22033, qingying.lu@us.ibm.com

1 - Operations Research in The Public Sector

Christer Johnson, IBM Global Business Services, Fairfax, VA, christer.johnson@us.ibm.com, Paul Thompson

Exciting opportunities for OR analysis have recently emerged in the public sector, including emergency management, homeland security and military logistics. Advances in computer technology and mathematical science are allowing OR to move into real-time decision-making. We discuss what the OR professional needs to successfully meet these challenges.

2 - Scheming the Postal Service: An Algorithm for Delivery Point Sequencing
Mariah Jeffery, IBM Global Business Services, Fairfax, VA, mjeffery@us.ibm.com, Michael Gibbs

We discuss the development of a tool for creating sort schemes for the United States Postal Service's Delivery Point Sequencing (DPS) operation. The tool uses a polynomial time algorithm to assign ZIP codes to DPS machines for processing with an objective of minimizing the total equipment required while meeting service standards.

3 - A Column Generation Approach for Heterogeneous Workforce Tour Scheduling
Hua Ni, IBM Global Business Services, Fairfax, VA, huani@us.ibm.com, Hernan Abeledo

We present an IP model for heterogeneous workforce tour scheduling, which has wide range of applications in public services. Its modeling capabilities include multiskill workforce, productivity, multiple tour types, variable start-times, and multiple breaks. We report on the computational performance of a column generation approach to solve this model efficiently.

4 - Business Mail Discount Verification for the U.S. Postal Service
Zachary Waltz, IBM Global Business Services, Fairfax, VA, 22033, zwaltz@us.ibm.com

This discussion will focus on the business mail environment and the Operation Research techniques employed in the U.S. Postal Serviceís new method to verify the validity of claimed work share discounts.

■ MC44

Room 405

An Interactive Panel/Audience Discussion: Balancing Research and Teaching - An Academic Dilemma (Joint JFIG/ED Session)

Sponsor: Junior Faculty Interest Group (JFIG), Education (INFORM-ED)

Sponsored Session

Chair: Gal Raz, Assistant Professor, Australian Graduate School of Management (AGSM), Australian Graduate School of Management, UNSW, Sydney, NS, Australia, galr@agsm.edu.au

1 - An Interactive Panel/Audience Discussion: Balancing Research and Teaching - An Academic Dilemma
Moderator: Gal Raz, Assistant Professor, Australian Graduate School of Management (AGSM), Australian Graduate School of Management, UNSW, Sydney, NS, Australia, galr@agsm.edu.au, Panelists: Gilvan Souza, Tasha R. Inniss, Feryal Erhun

In this interactive panel discussion, we will discuss the balance of research and teaching. Panel members will discuss their experiences as junior faculty in managing this balance in different environements such as business schools, Engineering departments and OR/Math Departments. A large part of the panel will be dedicated to interactive discussion with the Audience.

■ MC45

Room 406

Tutorial: Agent-Based Modeling and Simulation

Cluster: Tutorials

Invited Session

1 - Tutorial on Agent-Based Modeling and Simulation
Charles M. Macal, Center for Complex Adaptive Agent Systems Simulation (CAS2) Decision & Information Sciences Division, Argonne National Laboratory, 9700 S. Cass Avenue, Building 900, Argonne, IL, 60439, United States, macal@anl.gov, Michael North

Agent-based modeling and simulation (ABMS) is a new approach to modeling systems comprised of autonomous, interacting agents. Complex adaptive systems, emergent behavior, and self-organization are a few of the notions from ABMS. Applications are growing rapidly in fields ranging from modeling the stock market to predicting the spread of epidemics. This tutorial covers the foundations of ABMS, development toolkits and methods, practical aspects, and the relationship of ABMS to conventional OR.

■ MC46

Room 407

Supply Chain Disruptions

Cluster: Supply Chain and Operations Engineering

Invited Session

Chair: Lawrence Snyder, Assistant Professor, Department of Industrial & Systems Engineering, Lehigh University, 200 West Packer Avenue, Bethlehem, PA, 18015, United States, larry.snyder@lehigh.edu

1 - Disruption-Management Strategies for Short Life-Cycle Products
Brian Tomlin, Assistant Professor, University of North Carolina, McColl Building, CB3490, Chapel Hill, NC, 27599, United States, brian_tomlin@unc.edu

Diversification, contingent sourcing, and demand management are key building blocks of a disruption-management strategy. In this paper, we investigate the influence of key attributes of the firm, its supplier(s), and its products on the firm's preference for various strategies. These attributes include supplier reliability, supplier failure correlation, payment responsibility, product contribution margin, product substitutability, demand uncertainties and correlation, and loss aversion.

2 - Supply Risk, Information Asymmetry, and Backup Production Option
Zhibin (Ben) Yang, PhD Candidate, Department of Industrial and Operations Engineering, University of Michigan, 1205 Beal Avenue, Ann Arbor, MI, 48109, United States, zhibiny@umich.edu, Volodymyr Babich, Goker Aydin, Damian Beil

We consider a one-period model in which the supplier is subject to random disruptions. The probability of a disruption, high or low, is known to the supplier but not to the buyer. In case of a disruption, the supplier either pays a penalty or uses a backup production source to meet the order. We derive the buyer's optimal contract, find that it may penalize the less reliable supplier while forcing the more reliable supplier to use the backup source, and compute the cost of information asymmetry.

3 - A Hurricane-Supplies Stocking Problem with Wind-Speed Information Updates
Emmett Lodree, Assistant Professor, Auburn University, Industrial and Systems Engineering, 207 Dunstan Hall, Auburn, AL, 36849, United States, elodree@auburn.edu, Selda Taskin

Several manufacturing, service, and government agencies are involved with responding to needs that arise after a hurricane makes landfall. These organizations are responsible for ensuring the availability of critical supplies needed to successfully carry out emergency response and recovery activities. This presentation defines a procurement/production problem characterized by information updates associated with hurricane wind speeds and describes algorithms for solving the problem optimally.

4 - Infinite-Horizon Models for Inventory Control Under Yield Uncertainty and Disruptions
Amanda Schmitt, PhD Student, Lehigh University, 1859 Mansfield Street, Hellertown, PA, 18055, United States, amanda@lehigh.edu, Lawrence Snyder

We analyze the costs and optimal policies for an inventory system with an unreliable supplier that is subject to regular variance in supply as well as complete disruptions. We also consider a second, reliable (but more expensive) supplier. We compare the optimal policies to those us found using two common approximations: horizon trucation and variance bundling. We show that these approximations distort the order quantities, under-utilize the reliable supplier, and increase costs.

■ MC47

Room 408

Equilibrium and Allocation Models in Operations

Cluster: Supply Chain and Operations Engineering

Invited Session

Chair: Sriram Dasu, Assistant Professor, University of Southern California, Marshall School of Business, Los Angeles, CA, 90089, United States, sriram.dasu@marshall.usc.edu

1 - Dynamic Pricing and Input Control in Multi-Class Queues
Sriram Dasu, Assistant Professor, University of Southern California, Marshall School of Business, Los Angeles, CA, 90089, United States, sriram.dasu@marshall.usc.edu, Chunyang Tong

We consider multiple servers system with multiple customer classes. The duration of service is class dependent. We are interested in pricing and input control policies that maximize revenues. Based on diffusion approximations we derive properties of the optimal policies

2 - Computing Stable Farsighted Outcomes in Coalitional Games
Mahesh Nagarajan, Assistant Professor, University of British Columbia, 2053 Main Mall, Vancouver, BC, V6T 1Z2, Canada, Mahesh.Nagarajan@sauder.ubc.ca

We provide the first set of results on the computational complexity of computing stable outcomes in dynamic coalitional games, namely the LCS and EPCF. We present a set of sufficient conditions that ensure that computing the LCS is NP hard. We then propose algorithms that approximately compute the LCS in an asymptotic sense. We discuss implications to computation of the EPCF and applications to supply chain games.

3 - A Stochastic Programming Duality Approach to Inventory Centralization Game
Xin Chen, Assistant Professor, University of Illinois, 1206 West Green Street, 224 MEB, MC-244, Urbana, IL, 61801, United States, xinchen@uiuc.edu, Jiawei Zhang

A class of cooperative games arising from inventory centralization is studied in this paper. The optimization problems corresponding to the inventory games are formulated as stochastic programs. We observe that the strong duality of stochastic linear programming not only directly leads to a series of recent results concerning the non-emptiness of the cores of such games, but also suggests a way to find an element in the core.

4 - Duality Approach to Economic Lot Sizing Game
Jiawei Zhang, Assistant Professor, New York University, Stern School of Business, New York, NY, 10012, United States, jzhang@stern.nyu.edu, Xin Chen

We use duality to analyze economic lot sizing game with concave ordering cost. The standard formulation of the corresponding optimization problem is a concave minimization problem and hence linear programming duality does not directly apply. However, we present a new formulation for the problem and construct a dual of it without duality gap.

■ MC48

Room 409

MSOM Fellows: Awards and Presentations

Sponsor: Manufacturing & Service Operations Management
Sponsored Session

Chair: Fangruo Chen, Ira Rennert Professor of Business, Columbia Business School, 3022 Broadway, Uris Hall, Room 407, New York, NY, 10027, United States, fc26@columbia.edu

1 - MSOM Fellows: Awards and Presentations

Every year the MSOM Society recognizes outstanding research and scholarship in operations management by presenting the MSOM Fellows Award to a few individuals (no more than three). This year the winners are Professors Linus Schrage and Harvey Wagner. This session provides a rare opportunity for members of the society to hear their lifelong contributions to the field of operations management.

■ MC49

Room 410

Consumer, Production and Sustainability: Topics in Closed Loop Supply Chains

Cluster: Closed-Loop Supply Chains and Reverse Logistics
Invited Session

Chair: Pranab Majumder, Assistant Professor of Operations, Duke University, Fuqua School of Business, Durham, NC, 27708, United States, majumder@duke.edu

1 - Optimal Manufacturing-Remanufacturing Policies in a Lean Production Environment
Sergio Rubio, Assistant Professor, University of Extremadura, Department of Business Management, Escuela de Ingenierias Industriales, Badajoz, 06071, Spain, srubio@unex.es, Albert Corominas

This study analyses a production-management model that considers the possibility of implementing a reverse-logistics system in a lean production environment, as opposed to models that use EOQ approaches. Decision variables are identified (including manufacturing and remanufacturing capacities) and optimal policies are determined. The conclusion drawn is that mixed policies can be optimal unlike the results published in earlier studies, which are based on more restrictive assumptions.

2 - The Role of Leadership in Encouraging Sustainability in Agro-Based Supply Chains
Pranab Majumder, Assistant Professor of Operations, Duke University, Fuqua School of Business, Durham, NC, 27708, United States, majumder@duke.edu, Ashok Srinivasan

We examine the issue of promoting sustainability in long supply chains with agricultural inputs, which has a high impact on the environment. Sustainability in also includes reliability of supply from marginal farmers. We use a model where the leader has the ability to offer contracts to any other member of the chain. Our model shows that by directly offering contracts to the input producer, the supply chain leader can promote sustainability; in many cases the chain efficiency also increases.

■ MC50

Room 411

Econometric Applications in Operations Management

Sponsor: Manufacturing & Service Operations Management
Sponsored Session

Chair: Christian Terwiesch, Associate Professor, University of Pennsylvania, 548 JMHH, Philadelphia, PA, 19104, United States, terwiesch@wharton.upenn.edu

1 - Incentives, Information and Supply Chain Performance
Taylor Randall, Associate Professor, University of Utah, 201 South Presidents Circle, Salt Lake City, UT, 84112, United States, acttr@business.utah.edu, Shoshanah Cohen, Susan Kulp

This research examines the crucial role of incentives and information sharing in the supply chain. We posit that greater use of incentives and information will be associated with supply chain performance, but that the effect will be contingent on the organizational structure of the firm. We test these hypotheses using performance data collected from 37 make-to-stock manufacturing firms.

2 - Inventory Productivity and Financial Performance in the US Retail Sector
Vishal Gaur, Assistant Professor, Leonard N. Stern School of Business, New York University, 44 West 4th Street, 8-72, New York, NY, 10012, United States, vgaur@stern.nyu.edu, Marshall Fisher, Ananth Raman

We use public financial data on US retailers to investigate whether high inventory turnover is positively associated with financial performance as measured by contemporaneous and abnormal stock returns of firms.

3 - Estimating the Impact of Stock-Outs on Demand: An Empirical Analysis of a Spanish Retailer
Marcelo Olivares, PhD Student, Operations and Information Management, The Wharton School, University of Pennsylvania, 3730 Walnut Street, Suite 500, Philadelphia, PA, 19104, United States, maolivar@wharton.upenn.edu, Christian Terwiesch, Andres Musalem, Eric Bradlow, Daniel Corsten

We present a large scale empirical study on the effect of stock-outs on demand. Using a unique, proprietary data set, we measure specifically what percentages of demand are lost, back-ordered, or substituted to other SKUs. We present and evaluate various estimation models, including a store level estimation method and a consumer level estimation models.

4 - The Impact of New Product Introduction on Assembly Productivity in the N.A Automotive Industry
Manu Goyal, Assistant Professor, University of Maryland, 4350 Van Munching Hall, College Park, MD, 20742, United States, mgoyal@rhsmith.umd.edu, Matthew Reindorp, Serguei Netessine

Choosing the right manufacturing facility is a key element in the launch of a new or updated automotive product. From a study of recent data on North American automobile production, we find that prior productivity is a significant predictor of productivity during launch and positively influences a plant's chances of being chosen as a launch site. We also demonstrate that productivity during launch is improved when the launch is larger and/or flexible production methods are employed.

■ MC51

Room 412

Joint Session Planning & Responding/Counter Terrorism: Planning for and Responding to Explosive Terrorist Attacks

Cluster: Planning for and Responding to Disasters, Counter Terrorism and OR
Invited Session

Chair: Moshe Kress, Professor, Naval Post Graduate School, 1 University Circle, Monterey, CA, 93943, United States, mkress@nps.edu

1 - Nature Plays with Dice - Terrorists Do Not: Allocating Resources to Counter Strategic and Probabilistic Risks
Boaz Golany, golany@ie.technion.ac.il, Edward Kaplan, Abraham Marmur, Uriel G. Rothblum

Probabilistic uncertainty is caused by ``chance" whereas strategic uncertainty is caused by an adverse interested party. Using linear impact functions, the problems of allocating a limited resource to defend sites that face either probabilistic risk or strategic risk are formulated as optimization problems that are solved explicitly. The resulting optimal policies differ — under probabilistic risk, the optimal policy is to focus the investment of resources to priority sites where they yield the highest impact, while under strategic risk, the best policy is to spread the resources so as to decrease the potential damage level of the most vulnerable site(s). Neither solution coincides with the commonly practiced proportionality allocation scheme.

2 - The Bombs Bursting in Air?: Explosions Aboard Commercial Aircraft
Arnie Barnett, abarnett@mit.edu

The Transportation Security Administration has identified explosive devices as the greatest current threat to US aviation. In recent years, bombs have been smuggled onto airplanes within checked luggage, in carry-on bags, in cargo, and strapped to the bodies of suicidal terrorists. In 2004, simultaneous bombings in Russia caused the destruction of two passenger jets. We discuss some security measures now taken—and others not taken—aimed at preventing such horrors, and explore whether existing policies make sense from a cost-benefit perspective.

3 - Search for a Malevolent Needle in a Benign Haystack
Donald P. Gaver, Operations Research Department, Naval Postgraduate School, Monterey, CA, 93943, United States, dgaver@nps.edu, Patricia A. Jacobs, Moshe Kress

Terrorist suicide attacks occur in small, crowded arenas, or in larger maritime domains. Suppose one such terrorist (Red) is present and moves randomly and clandestinely to avoid detection and locate vulnerable target groupings. Blue searches for and detains suspicious elements. We model the probability that Blue neutralizes Red before detonation.

4 - Scheduling Policies for Counter-Terrorist Surveillance System
Kyle Lin, Assistant Professor, Operations Research Department, Naval Postgraduate School, Glasgow Hall 260, Monterey, CA, 93943, United States, kylin@nps.edu, Moshe Kress, Roberto Szechtman

A counter-terrorist surveillance system usually does not have the capacity to screen all suspects in an open area. If the sojourn time distribution of a terrorist is different from that of the others, then potentially we can improve the probability of catching a terrorist by carefully choosing which suspect to inspect. We use a queueing model and develop a heuristic policy that works well in an area with heavy traffic.

■ MC52

Room 413

Panel Discussion: Is Revenue Management Working in Practice?

Sponsor: Revenue Management & Pricing

Sponsored Session

Chair: Tito Homem-de-Mello, Associate Professor, Industrial Engineering & Management Sciences, Northwestern University, Evanston, IL, 60208, United States, tito@northwestern.edu

Co-Chair: Anton Kleywegt, Associate Professor, Georgia Institute of Technology, School of Industrial Systems Engineering, Atlanta, GA, 30332, United States, anton@isye.gatech.edu

1 - Is Revenue Management Working in Practice?
Moderator: Anton Kleywegt, Associate Professor, Georgia Institute of Technology, School of Industrial Systems Engineering, Atlanta, GA, 30332, United States, anton@isye.gatech.edu, Panelists: Garrett van Ryzin, Robert Phillips, Andrew Boyd

Revenue management has been an important application area of operations research for several decades, and revenue management is often touted as one of the success stories of operations research. All of these are for good reasons. However, some recent findings and episodes have led some to question the validity of those techniques. The purpose of the panel discussion is to shed some light on this issue. Particular topics that deserve critical evaluation include difficulties with demand modeling, consumers' perception (real or imagined) of dynamic pricing practices as unfair, and new practices from airline companies such as simplification of the fare structure.

■ MC53

Room 414

Inventory Management I

Contributed Session

Chair: Suresh Sethi, Ashbel Smith Professor, University of Texas at Dallas, School of Management, SM30, 2601 N. Floyd Road, Richardson, TX, 75080, United States, sethi@utdallas.edu

1 - Modeling the Service Level of a Two Customer Make-to-Stock Production System
Sean Willems, Assistant Professor of Operations Management, Boston University, School of Management, SMG 673, 595 Commonwealth Avenue, Boston, MA, 02215, United States, willems@bu.edu, Feng Tian

We model a single product make-to-stock production system with two-priority customers. The inventory rationing policy is studied for the system. Different service level criterion, such as order filling rate, and average waiting time, are derived. The focus is on the relationship between system parameters and the service level that different customers can experience. We also take a look at whether the optimality of the rationing policy will change when customers' service level requirements exist.

2 - A Mixed Lost-Sales Backordering Inventory Problem with Two Customer Classes
Paul Enders, PhD student, Tepper School of Business, Carnegie Mellon University, 5000 Forbes Avenue, Pittsburgh, PA, 15213, United States, penders@cmu.edu, Geert-Jan Van Houtum, Ivo Adan

We study a prioritized inventory model with rationing, inspired by spare parts management. High priority demand is met from stock if possible, otherwise lost. Low priority demand is satisfied if stock is above a critical level, otherwise backordered. We show how the performance of an inventory policy can be determined using a two-dimensional Markov process with level dependent transition rates. We develop an efficient algorithm to find the optimal policy, and perform computational experiments.

3 - An Embedded Markov Chain Approach to the Analysis of Inventory Systems Under Rationing
Murat Fadiloglu, Professor, Bilkent University, Bilkent Universitesi, Endustri Muh. Bol. Oda:309, Ankara, 06800, Turkey, mmurat@bilkent.edu.tr, Onder Bulut

We propose a new method for the analysis of inventory systems with backorders under rationing. We show that if such a system is sampled at multiples of supply leadtime, the state of the system evolves according to a Markov chain. We provide a recursive procedure to generate the transition probabilities of the embedded chain. We demonstrate that it is possible to obtain the steady-state probabilities of interest with desired accuracy by considering a truncated version of the infinite chain.

4 - Lot Sizing with Random Yield and Different Qualities
Bacel Maddah, Assistant Professor, American University of Beirut, Engineering Management Program, AUB, PO Box 11-0236, Riad El Solh, Beirut, 1107 2020, Lebanon, bacel.maddah@aub.edu.lb, Moueen Salameh

This paper considers an inventory system where items produced/purchased are of different qualities: Type A and Type B. Type A items are of perfect quality, and Type B items are of imperfect quality; but not necessarily defective; and have a lower selling price. The percentage of Type A (the yield rate) is assumed to be a random variable with a known distribution. We extend the classical newsvendor and EOQ models by accounting for random supply and for imperfect quality (Type B) items.

5 - On the Optimal Control of Partially Observed Inventory Systems: A Review
Suresh Sethi, Ashbel Smith Professor, University of Texas at Dallas, School of Management, SM30, 2601 N. Floyd Road, Richardson, TX, 75080, United States, sethi@utdallas.edu, Alain Bensoussan, Metin Cakanyildirim

We review recent developments in the analysis of inventory systems with partial observations. System states are conditional distributions evolving over time. Unnormalized probabilities are introduced to reduce nonlinear state transition equations to linear ones to prove the existence of the optimal feedback policies. In some cases, it is possible to give a sufficient statistic to serve as a state, but in most cases, further analysis is needed to develop computational methods for the solution.

■ MC54

Room 415

Interface of Operations and Marketing I

Cluster: Operations and Marketing for Emerging Markets
Invited Session

Chair: Mei Xue, Assistant Professor, Boston College, 350 Fulton Hall, 140 Commonwealth Avenue, Chestnut Hill, MA, 02467, United States, xueme@bc.edu

1 - Marketing and Operations in Emerging Markets: A Research Agenda
Aleda Roth, Arizona State University, W.P. Carey School of Business, Main Campus, PO Box 874706, Tempe, AZ, 85287, United States, Aleda.Roth@asu.edu

This session will discuss strategies for linking operations and marketing in emerging market countries, and how they differ from strategies for industrialized countries. We describe new areas for operations management and supply chain management research.

2 - Does Hospital-Level Management Drive Service Quality?
Justin Ren, Assistant Professor, Boston University School of Management, 595 Commonwealth Avenue, Boston, MA, 02215, United States, ren@bu.edu, Xin Wang

A hospital has multiple medical units treating different diseases. It has been observed that there exists wide variation in service quality across those medical units within a hospital. This brings to the question: Does hospital-level factors such as upper-level management matter in improving the service quality for all medical units?

3 - Optimal Strategies for Exploiting Product Innovations
Sinan Erzurumlu, Doctoral Student, University of Texas at Austin, McCombs School of Business, Austin, TX, 78712, United States, Sinan.Erzurumlu@phd.mccombs.utexas.edu, Karthik Ramachandran, Stephen Gilbert

We analyze the issue of when and how an innovator would transfer its technology to another firm with which he also competes in the product market. Our analysis focuses on the structure of the network effects, the transferability of the innovation, and the market position of the innovator, and we explore how these parameters affect the optimal strategy for exploiting an innovation.

4 - An Empirical Study: Service Capacity and Demand
Mei Xue, Assistant Professor, Boston College, 350 Fulton Hall, 140 Commonwealth Avenue, Chestnut Hill, MA, 02467, United States, xueme@bc.edu, Lorin Hitt, Jun Zhang

This paper presents an empirical study of the relationship between service capacity and demand in a multi-channel service delivery system with internal (inter-channel) and external competition using a large panel data set from retail banking. In addition, it studies how customer characters important to service operations, e.g. customer efficiency, influence the relationship.

■ MC55

Room 416

Data Envelopment Analysis and Resource Allocation

Cluster: Data Envelopment Analysis
Invited Session

Chair: Nicole Adler, Assistant Professor, School of Business Administration, Hebrew University of Jerusalem, Mount Scopus 91905, Israel, msnic@huji.ac.il

1 - A DEA Approach to the Allocation of Funding for Regional Ambulance Service
Tarja Joro, Assistant Professor, University of Alberta School of Business, 3-40F Business Building, Edmonton, AB, T6G2R6, Canada, tarja.joro@ualberta.ca, Susan Budge, Armann Ingolfsson

In March of 2004, the Government of Alberta made the decision to transfer the governance and funding of emergency medical services from municipalities to the regional health authorities. We take a DEA approach and examine the relevant inputs and outputs of ambulance service in Alberta in order to construct an appropriate allocation of funding for a regional ambulance service.

2 - Using the DEA to Achieve A Fair Globalization
Ruzanna Tarvedyan, Research Economist, International Labour Office, 4 Route des Morillons, CH-1211 Geneva 22, 1204, Switzerland, tarverdyan@ilo.org, Nicole Adler

Delivering on U.N. declarations for an integrated analysis of development goals, capturing not only economic but also non-economic dimensions of well-being, we propose analyzing globalization through the use of DEA. We develop a surveillance instrument aimed at improving country performance and policy effectiveness and a management tool identifying optimal policies and ensuring policy coherence that will enable countries to maximize the benefits and minimize the costs of globalization.

3 - Global Millennium Development Goals: Which Policies are Effective?
Nicole Adler, Assistant Professor, School of Business Administration, Hebrew University of Jerusalem, Mount Scopus 91905, Israel, msnic@huji.ac.il

We benchmark developing countries and analyze which are most effective in achieving the United Nations agreed Millennium Development Goals using data envelopment analysis. These goals range from eradication of extreme poverty, provision of universal primary education, promotion of gender equality and reduction in child and maternal mortality rates. The second stage analysis utilizes regression to explain the efficiency scores in an attempt to identify useful policy measures.

Monday, 4:30pm - 6:00pm

■ MD01

Room 301

Matching Markets

Sponsor: Optimization/ Network and Combinatorial Optimization
Sponsored Session

Chair: Nicole Immorlica, Microsoft Research, One Microsoft Way, Redmond, WA, 98052, United States, nickle@microsoft.com

1 - Fair Allocation Over Time
Stergios Athanassoglou, PhD Student, Columbia University, IEOR Department, 500 West 120th Street, Room 313 Mudd Building, New York, NY, 10027, United States, sa2164@columbia.edu, Jay Sethuraman

We consider the problem of allocating a divisible resource over a fixed time horizon. We assume a continuum of agents, competing for the same infinitesimal fraction of the resource in each period. An agent decides to demand the resource after observing his utility for the resource. In the interest of fairness, priority classes are determined by the number of times an agent has chosen to participate in the past. We describe the equilibrium of this game and ways to compute it in special cases.

2 - Incentives and Stability in Large Two-Sided Matching Markets
Fuhito Kojima, PhD Candidate, Department of Economics, Harvard University, 1875 Cambridge Street, Cambridge, MA, 02138, United States, kojima@fas.harvard.edu

The paper analyzes the scope for manipulation in college admission problems under the student-optimal stable mechanism when the number of participants is large. The fraction of colleges that have incentives to misrepresent their preferences approaches zero as the market becomes large. Truthful reporting is an approximate equilibrium in large markets that are sufficiently thick, a condition that allows for certain types of heterogeneity in the distribution of student preferences.

3 - Pairwise Kidney Exchange and Beyond
Utku Unver, Assistant Professor, University of Pittsburgh, Department of Economics, 4506 Posvar Hall, 230 S. Bouquet Street, Pittsburgh, PA, 15260, United States, uunver@pitt.edu, Alvin Roth, Tayfun Sonmez

Initially, kidney exchanges are likely to be between just two patient-donor pairs. We show that, although this constraint eliminates some potential exchanges, there is a wide class of constrained-efficient mechanisms that are strategy-proof when patient-donor pairs and surgeons have 0-1 preferences. This includes deterministic mechanisms and stochastic mechanisms.

4 - Random Popular Matchings
Mohammad Mahdian, Microsoft Research, One Microsoft Way, Redmond, WA, 98052, United States, mahdian@gmail.com

We consider matching markets where a centralized authority must find a matching between agents (with preferences) and items (without preferences). The objective is to find a popular matching, or a matching that is preferred by a majority of the agents to any other matching. The main drawback of this concept is that popular matchings sometimes do not exist. We partially address this issue by proving that in a probabilistic setting popular matchings almost surely exist.

■ MD02

Room 302

Joint Session Open-Source/ICS: Open Source, Distributed Computing, and Operations Research

Cluster: Open-Source Software: Open Source, Open Standards, Open Data, INFORMS Computing Society

Invited Session

Chair: Jeff Linderoth, Assistant Professor, Lehigh University, 200 W. Packer Avenue, Bethlehem, PA, 18015, United States, jtl3@Lehigh.edu

1 - A Library Hierarchy for Implementing Scalable Parallel Search Algorithms

Yan Xu, SAS Institute Inc., SAS Campus Drive, Cary, NC, 27519, United States, yan.xu@sas.com, Ted Ralphs, Matt Saltzman, Laszlo Ladanyi

We discuss a library hierarchy for implementing scalable parallel search algorithms: ALPS, BiCePS and BLIS. ALPS forms the base layer, which is also the search handling layer, BiCePS is the data handling layer, and BLIS implements LP-based branch and bound algorithms. We present computational results for solving large integer programs.

2 - Incorporating Cutting Planes into the PICO Mixed Integer Solver

Jonathan Eckstein, Professor, Rutgers University, 640 Bartholomew Road, Piscataway, NJ, 08854, United States, jeckstei@rutcor.rutgers.edu, William Hart, Cynthia Phillips

PICO is an open source, massively parallel branch-and-bound search framework under development at Sandia National Labs. This talk focuses on the incorporation of cutting planes into PICO's mixed integer programming layer. We describe our cut finder scheduling strategy, experience with COIN's Cut Generation Library (CGL), new general cutting planes implemented in PICO, support for user-defined cutting planes, and parallelization issues.

3 - MW—Master-Worker Middleware for Grids

Jeff Linderoth, Assistant Professor, Lehigh University, 200 W. Packer Avenue, Bethlehem, PA, 18015, United States, jtl3@Lehigh.EDU, Greg Thain

MW is an open-source software package that enables master-worker computations to be carried out on computational grids. We will give an overview of the MW design, discuss recent software enhancements, and provide success stories in using MW to solve large-scale numerical optimization problems on a computational grid.

■ MD03

Room 303

Large-Scale Nonlinear Optimization

Sponsor: Optimization/ Nonlinear Programming

Sponsored Session

Chair: Michael Friedlander, Assistant Professor, University of British Columbia, Department of Computer Science, Vancouver, BC, Canada, mpf@cs.ubc.ca

1 - Box-Constrained Least-Squares and Nonlinear Optimization

Michael Friedlander, Assistant Professor, University of British Columbia, Department of Computer Science, Vancouver, BC, Canada, mpf@cs.ubc.ca

Box-constrained least-squares problems in their own right represent a rich class of applications. They also arise as subproblems in algorithms for optimization. We describe BCLS, a software package specially designed for the solution of such problems.

2 - Interior-Point Methods for Nonconvex Nonlinear Programming: Regularization and Warmstarts

Hande Benson, Assistant Professor, LeBow College of Business, Drexel University, Academic Building, 2nd Floor, Philadelphia, PA, 19104, United States, hvb22@drexel.edu, David Shanno

In this talk, we investigate the use of an exact primal-dual penalty approach within the framework of an interior-point method for nonconvex nonlinear programming. This approach provides regularization and relaxation, which can aid in solving ill-behaved problems and in warmstarting the algorithm. We present details of our implementation within the LOQO algorithm and provide extensive encouraging numerical results.

3 - The Zoom Strategy for Accelerating and Warm-Starting Interior Methods

Michael Saunders, Professor, Department of Management Science & Engineering, Stanford University, 380 Panama Way, Stanford, CA, 94303-4026, United States, saunders@stanford.edu, Leo Tenenblat

Interior methods using iterative solvers for each search direction can require drastically increasing work per iteration as higher accuracy is sought. The Zoom strategy solves first to low accuracy, and then solves for a correction to both primal and dual variables, again to low accuracy. We "zoom in" on the correction by scaling it up, thus permitting a cold start. The same strategy applies to warm-starting in general.

4 - An Interior-Point l_2 Penalty Method for Large Scale Nonlinear Programming

Lifeng Chen, Student, Columbia University, IEOR Department, New York, NY, 10027, United States, lc2161@columbia.edu, Donald Goldfarb

We present an interior-point l_2 penalty method for large scale nonlinear programming. A detailed description of the algorithm is provided, including computation of search directions, backtracking line search, second-order corrections and heuristics for motivating faster convergence. A comprehensive numerical study with several options of regularization and line search is presented. A comparison is provided with state-of-the-art interior-point codes for nonlinear programming.

■ MD04

Room 304

Recent Advances in Integer Programming

Sponsor: Optimization/ Integer Programming

Sponsored Session

Chair: Yanjun Li, Assistant Professor, Purdue University, 403 W. State Street, West Lafayette, IN, 47907, United States, li14@mgmt.purdue.edu

1 - Separation and the Stable-Set Polytope

Illya Hicks, Associate Professor, Texas A&M University, Industrial and Systems Engineering MS 3131, Zachry Engineering Center, College Station, TX, 77843-3131, United States, ivhicks@tamu.edu, Sandeep Sachdeva, Benjamin McClosky

A k-separation of a graph G is a pair of edge disjoint subgraphs whose union of nodes and edges form G and whose intersection of vertices has order k. We offer preliminary research for a facet generation procedure for the well-studied stable set polytope of a graph G that contains a 3-separation. The procedure is based upon the composition of polyhedra corresponding to two subgraphs of G related to a 3-separation of G. This work is based upon the earlier work of Barahona and Mahjoub.

2 - New Facets of the (Directed) Cycle Polytope

Egon Balas, Professor, Tepper School of Business, Carnegie Mellon University, 5000 Forbes Avenue, Pittsburgh, PA, 15213, United States, eb17@andrew.cmu.edu, Ruediger Stephan

Earlier work on the directed cycle polytope P showed how to lift and project facets of the asymmetric traveling salesman polytope (ATSP) into facets of P. Here we introduce a different class of facets, unrelated to the ATS polytope, whose support spans the entire digraph and whose defining inequality is tight for every two-cycle.

3 - Cutting Planes Selection

Miroslav Karamanov, PhD, Carnegie Mellon University, 5000 Forbes Avenue, Pittsburgh, PA, 15213, United States, miroslav@andrew.cmu.edu, Gerard Cornuejols

Cutting planes have established their important role for improving the performance of branch and bound. Today, improved algorithms and increased computational power allow generation of a large number of cuts in a short time. Selecting a subset of them while preserving the cutting power of the pool of cuts is a problem of great practical importance. We address this problem from several different points of view and discuss the effectiveness of different cut selection rules.

4 - A Benders Decomposition Approach to Solving an Evacuation Problem

J. Cole Smith, Associate Professor, University of Florida, ISE Department, 303 Weil Hall, Gainesville, FL, 32611-6595, United States, cole@ise.ufl.edu, April Andreas

Consider a network in which individuals are evacuated to a safe point. Source nodes could represent offices, and the safe node could represent any point away from danger. We consider methods of modeling capacity and objectives, focusing on the minimization of the latest evacuation time. To capture evacuation dynamics, we examine a time-expanded network, and employ Benders decomposition using implied dual values to avoid directly solving optimization problems over the temporal dimension.

■ MD05

Room 305

Control and Analysis of Queues

Sponsor: Applied Probability

Sponsored Session

Chair: David Kaufman, Postdoctoral Associate, Industrial Engineering, University of Pittsburgh, 1048 Benedum Hall, Pittsburgh PA 15261, United States, davidk@engr.pitt.edu

1 - Approximating Time-Dependent Ph_t and MAP_t Queueing-Models

Michael Taaffe, Graduate Program Director, Associate Professor, The Grado Department of Industrial and Systems Engineering, Durham Hall, Virginia Tech, Blacksburg, VA, 24061, United States, taaffe@vt.edu, Walid Nasr, Javier Rueda

We develop numerical methods based on partial-moment differential equations and closure approximations for time-dependent moments of the system state and the distribution function and moments of virtual sojourn time for queueing nodes having Ph_t, MAP_t, and MSP_t arrival/service processes. We discuss our approximation for [M_t/M_t/s]^K queueing networks. We also allow for time-based control of system parameters (number of servers and queue capacity) and entity arrivals/deletions.

2 - Tandem Lines with Collaborative Flexible Servers

Hayriye Ayhan, Associate Professor, School of Industrial and Systems Engineering, Georgia Institute of Technology, Atlanta, GA, 30332-0205, United States, hayhan@isye.gatech.edu, Sigrún Andradóttir, Doug Down

Consider a tandem queueing network with two stations, infinite supply of jobs in front of station 1, infinite room for completed jobs after station 2, finite buffer between stations, and two flexible servers. Under the assumption that two servers can work together on a single job, we study how the optimal dynamic server assignment policy changes as a function of how well these two servers work together.

3 - Staffing a Helpdesk with Two Queues Connected by Abandonment

Yusik Kim, PhD Student, University of California at Berkeley IEOR, 4141 Etcheverry Hall, Berkeley, CA, 94720-1777, United States, ykim@ieor.berkeley.edu, Ronald Wolff, Rhonda Righter, Vijay Mehrota

Consider a helpdesk that has two methods of providing customer service: replying to email and answering phone calls. Each service has its own queue and arrival process, but customers may abandon the email queue to enter the phone queue. We analyze the system under the assumption of exponential service, inter-arrival and abandonment times, develop a cost model as a function of the number of servers and discuss its convexity structure. We also study properties of the optimal staffing levels.

4 - Dynamic Load Balancing in Parallel Networks with Heavy-Tailed Service Distributions

Luz Caudillo, PhD Candidate, University of Michigan IOE, 1205 Beal Avenue, Industrial and Operations Engineering, Ann Arbor, MI, 48109-2117, United States, fuentesl@umich.edu, Mark Lewis, David Kaufman

We consider dynamic load balancing for parallel processing networks (PPNs) with service times that follow a heavy-tailed distribution. With non-exponential services, the control problem is intractable. As an approximation, we consider a two station, two class exponential model with "usual" and "slow" customers. This amounts to a hyper-exponential approximation of the service times. Structural results for the exponential model are used to develop a heuristic for the original model.

■ MD06

Room 306

Quality Management

Contributed Session

Chair: Bernardo Villarreal, Professor, Universidad de Monterrey, Avenue I. Morones Prieto 4500 Pte., Sn Pedro Garza Garcia, 66238, Mexico, bvillarreal@udem.edu.mx

1 - The Causality of EFQM Model in Public Management of Turkey

Baris Çarikci, Researcher, Kosulolu Cad Baris Mah No 48 TUSSIDE, Gebze, Turkey, bcarikci@yahoo.com, Orhan Dursun

EFQM Model is the most known and used model in Europa for public and private institutions to improve organizational excellence. Although the validity of the model is definite, the causality among the criterians are not clear. In our project, we try to propose a model to explain the causality of the EFQM Model for Turkish public instutions.

2 - A Model for Analyzing the Competitive Strategy in Environments Hyper-Competitives

Maria Auxiliadora Melo, Universidade Federal de Pernambuco/Departamento de Engenharia de Produção, Av. Acadêmico Hélio Ramos, s/n, Cidade U, Recife, Pe, 50740-530, Brazil, madonmelo@hotmail.com, Denise de Medeiros

The aim of this paper is to present a formulation of the System of Competitive Intelligence that is up-to-date and which enables the constant upgrading and improvement of business management practices, so that a competitive edge may be maintained and a market differentiation established. The system is based on the intelligence cycle and also on the four areas of competition described by D'Aveni for the analysis of businesses which operate in highly competitive arenas.

3 - Design of Manufacturing Systems with Complex Configurations for Product Variety and Change

Jeonghan Ko, University of Michigan, 2250 GG Brown, 2350 Hayward Street, Ann Arbor, MI, 48109, United States, jeonghan@umich.edu, S. Jack Hu

Classical line design methods have usually concerned serial configurations and single-generation products, while product variety and model changes are increasing. To design a manufacturing system for product variety, we are developing new configuration-design methods for systems that asymmetrically branch. We are also developing new mathematical models for task-machine assignment and workload balancing over multiple generations of products to minimize the impact of product changes on systems.

4 - The Effect of Six Sigma Projects on Customer Satisfaction

Mahour Parast, Assistant Professor, University of South Dakota, 414 E. Clark Street, Vermillion, SD, 57069, United States, mahour.parast@usd.edu, Anthony Williams, Stephanie Adams

The paper investigates the effect of Six Sigma process improvements on customer satisfaction. Five constructs have been developed to measure customer satisfaction: reliability, availability, completeness, responsiveness, and professionalism. This research attempts to examine the relationship between customer satisfaction and the five constructs and how Six Sigma implementation affects customer satisfaction. The results show that all constructs are significantly related to customer satisfaction.

5 - Manufacturing Lead Time Reduction: A Simulation Approach

Bernardo Villarreal, Professor, Universidad de Monterrey, Avenue I. Morones Prieto 4500 Pte., Sn Pedro Garza Garcia, 66238, Mexico, bvillarreal@udem.edu.mx

It is well known that manufacturing lead time is vital to determine the degree of responsiveness of a firm to satisfy market demand. The prioritization of investment projects in a resource-constrained environment is of major concern, and in particular if our objective is to become faster and more flexible to respond to customers requirements. This paper proposes a scheme to rank investment projects with the goal of minimizing manufacturing lead time utilizing simulation.

■ MD07

Room 307

Software for Semidefinite Programming

Sponsor: INFORMS Computing Society/Optimization: Computational Optimization and Software

Sponsored Session

Chair: Brian Borchers, Professor, New Mexico Institute of Mining and Technology, 801 Leroy Place, Socorro, NM, 87801, United States, borchers@nmt.edu

1 - Infeasibility Detection in SeDuMi

Imre Pólik, PhD Student, McMaster University, 1280 Main Street W., Department of Mathematics, Hamilton, ON, L8S 4K1, Canada, poliki@mcmaster.ca, Tamás Terlaky

While infeasibility detection is a routine task in linear optimization, conic optimization solvers often have difficulty dealing with it. The problem is further complicated by weakly infeasible conic models. We present a new set of stopping criteria for interior point conic optimization methods with self-dual embedding. The technique preserves the polynomial complexity of the interior point method and it can be further enhanced by preprocessing. The method is illustrated with the SeDuMi package.

2 - Recent Developments in SDP and SOCP Software

Hans Mittelmann, Professor, Arizona State University, Box 871804, Tempe, AZ, 85287-1804, United States, beck@plato.la.asu.edu

After an intense development period some years ago, further improvements of SDP and SOCP codes have taken considerable time. We will try to assess the current state-of-the-art.

3 - A Conic Interior Point Decomposition Approach for Block Angular Semidefinite Programs

Kartik Krishnan Sivaramakrishnan, Assistant Professor, Department of Mathematics, North Carolina State University, Box 8205, Raleigh, NC, 27695, United States, kksivara@ncsu.edu

We recently developed a conic IPM approach for block angular SDPs. The idea is to solve such an SDP using existing primal-dual IPMs in an iterative fashion between a mixed conic master problem over linear and smaller dimensional semidefinite cones; and decomposed and distributed subproblems (smaller SDPs) in a high performance computing environment. In this talk, we present our algorithm, discuss issues for an efficient implementation, and also our computational experiences with the algorithm.

4 - The Continuing Development of CSDP

Brian Borchers, Professor, New Mexico Institute of Mining and Technology, 801 Leroy Place, Socorro, NM, 87801, United States, borchers@nmt.edu

CSDP is a subroutine library and stand-alone solver for semidefinite programming problems that has been under development since 1997. The software is now being made available as an open source project through the COIN-OR repository. The current status of CSDP and future development plans will be described. Computational results will also be presented.

■ MD08

Room 308

TMS Distinguished Speaker

Sponsor: Technology Management

Sponsored Session

Chair: Diane Bailey, Assistant Professor, Stanford University, Management Science and Engineering, 428 Terman Engineering, Stanford, CA, 94305, United States, diane.bailey@stanford.edu

1 - Technology as a Tradable Commodity? Unresolved Questions in Markets for Technology

Ashish Arora, Professor of Economics and Public Policy, Heinz School of Public Policy & Management, Carnegie Mellon University, Pittsburgh, PA, 15213, United States, ashish@andrew.cmu.edu

In this session, TMS Distinguished Speaker Ashish Arora will discuss important questions that remain unresolved in the area of markets for technology. In considering the conditions under which technology can be made into a tradable commodity, Ashish will explore when and why integration has value. The organization of inventive activity and the subsequent efficiency effects are a central issue in this discussion.

■ MD09

Room 309

Open Innovation, Open Source, Networks

Cluster: New Product Development

Invited Session

Chair: Christian Terwiesch, Associate Professor, University of Pennsylvania, 548 JMHH, Philadelphia, PA, 19104, United States, terwiesch@wharton.upenn.edu

1 - Markets for Innovation: An Equilibrium Models of R&D Contests

Christian Terwiesch, Associate Professor, University of Pennsylvania, 548 JMHH, Philadelphia, PA, 19104, United States, terwiesch@wharton.upenn.edu, Yi Xu

We present an analytical model of a community of R&D problem solvers. Firms can post R&D problems to this community and offer potential rewards for satisfactory solutions. We explain why such markets exist, how the function, and how the should me managed.

2 - Portfolio Management and Organizational Structure in Software Development

Manuel Sosa, Professor of Technology and Operations Management, INSEAD, Boulevard de Constance, Fontainebleau, 77305, France, manuel.sosa@insead.edu

Portfolio management decisions typically result in the execution of a mix of incremental and radical innovation projects. Using a sociometric approach in a distributed software development firm, I investigate the organizational implications of concurrently working on both incremental and radical innovation.

3 - Startup Strategies for Participation in Open Innovation Systems

Lee Fleming, Professor, Harvard Business School, 485 Morgan Hall, Boston, MA, 02163, United States, lfleming@hbs.edu, Dave Waguespack

While research has shown why individuals contribute to open innovation communities, little research has considered why a firm would contribute. We investigate how firms should engage open innovation communities and demonstrate strong causal effects upon liquidity events for startups in telecommunications technology.

■ MD10

Room 310

Software Demonstration

Cluster: Software Demonstration

Invited Session

1 - Ziena Optimization, Inc. - An Overview of the KNITRO Optimization Solver

Richard Waltz, Ziena Optimization, Inc., 1801 Maple Avenue, Evanston, IL, 60201, waltz@ziena.com

This software demonstration will provide an overview of how to effectively use KNITRO in a variety of environments and applications. The presentation will demonstrate usage of KNITRO as both an embeddable callable library and through various modeling languages. The demonstration will highlight some of the newer and most relevant features.

2 - Lumina Decision Systems, Inc. - Analytica: What It Does That Spreadsheets Can't

Max Henrion, Lumina Decision Systems, Inc., 26010 Highland Way, Los Gatos, CA, 95033, henrion@lumina.com

A rare chance to see Analytica demonstrated by its originator: users prefer Analytica to spreadsheets because of its transparency, flexibility for multiple dimensions, efficient Monte Carlo, scalability and its powerful new Optimizer. Analytica models are typically 10 to 100 times more compact than equivalent spreadsheets, and correspondingly easier to build, understand and audit.

■ MD11

Room 311

New Methods in Economic and Environmental Modelling

Sponsor: Minority Issues

Sponsored Session

Chair: Kobi Abayomi, Visiting Professor, Haverford College, PO Box 250219, Manhattan, NY, 10025, United States, kobi.abayomi@columbia.edu

1 - Sustainably Selective Welfare Functions

Kobi Abayomi, Visiting Professor, Haverford College, PO Box 250219, Manhattan, NY, 10025, United States, kobi.abayomi@columbia.edu

"Sustainability", in the economic sense, is a criteria in need of definition. Chichilnisky has proposed an axiomatic standard: that a welfare function is "sustainable" if, and only if, it is non-negligible on both the finite and infinite parts of its domain - the space of utility streams. I investigate statistical approaches to Chichilnisky's axiomatization, which can be regarded as finite time tests of the "sustainability" of a utility, and, thusly, a development path.

■ MD12

Room 312

Work Life Balance

Sponsor: Women in OR/MS

Sponsored Session

Chair: Sila Cetinkaya, Associate Professor, Texas A&M University, Industrial and Systems Engineering, College Station, TX, 77843, United States, sila@tamu.edu

1 - Work Life Balance - A Mom's Perspective

Alice Smith, Professor and Chair, Department of Industrial & Systems Engineering, Auburn University, 207 Dunstan Hall, Auburn, AL, 36849, United States, aesmith@eng.auburn.edu

Combining an academic career, parenting and personal life is the topic. Achieving success with all while maintaining sanity, and even serenity, is the goal. Synergies of academic work with home life is an occasional, and welcome, byproduct.

2 - Some Personal Observations Regarding an Academic Career in Operations Research
Martin Wortman, Professor, Texas A&M University, Industrial and Systems Engineering, College Station, TX, 77843-3131, United States, wortman@mwx.tamu.edu

Over a 20 year academic career, there have been occasions upon which the author asked himself, "What was I thinking?" In this talk, we will review some of the approaches taken by the author to achieve a balanced and well ordered career that were not entirely successful.

3 - Juggling Tasks: Mine, Yours and Ours...
Reha Uzsoy, Professor, Purdue University, 315 N. Grant Street, West Lafayette, IN, 47907, United States, uzsoy@ecn.purdue.edu, Lucia Mendez

We show that the NP-hardness of simple scheduling problems achieves completely new heights when applied to families involving professional parents with children. We present some empirical observations from the field, and discuss directions for future research into this important open problem.

■ MD13

Room 313

Joint Session INFORMS-ED/WORMS: Academia and Industry Collaboration: Education and Training

Sponsor: Education (INFORM-ED), Women in OR/MS
Sponsored Session

Chair: Jill Hardin, Assistant Professor, Virginia Commonwealth University, 1001 W. Main Street, PO Box 843083, Richmond, VA, 23284-3083, United States, jrhardin@vcu.edu

Co-Chair: Sila Cetinkaya, Associate Professor, Texas A&M University, Industrial and Systems Engineering, College Station, TX, 77843, United States, sila@tamu.edu

1 - Partnerships in Training
Jill Hardin, Assistant Professor, Virginia Commonwealth University, 1001 W. Main Street, PO Box 843083, Richmond, VA, 23284-3083, United States, jrhardin@vcu.edu, Jason Merrick, Russell Walker

Capital One Financial Corporation partnered with Virginia Commonwealth University to develop three training courses in forecasting, optimization, and simulation for their analysts. These courses have been well received and have led to considerable early return on investment with one class project forecasted to reduce costs at the firm's Richmond, Virginia, mail center by more than $2 million annually. We discuss the partnership and the course designs.

2 - Industry/University Collaboration: The Use of Design and Project Courses
Karla Hoffman, Professor, George Mason University, Mail Stop 4A6, SEOR Department, 4400 University Drive, Fairfax, VA, 22030, United States, khoffman@gmu.edu

Seniors in systems engineering take a one-year design course, while all graduate students take a one-semester project course. We divide classes into teams working with an industrial partner. These courses have improved our student's analytic skills and enhanced our relationships with multiple companies. This talk describes the successes and challenges of running such courses.

3 - Lean Academy: Using Rockwell Collins as a Real-Time Case Study
Barrett Thomas, Assistant Professor, Department of Management Sciences, University of Iowa, 108 John Pappajohn Business Building, Iowa City, IA, 52242, United States, barrett-thomas@uiowa.edu, Philip Jones, Tom Bednar

This talk discusses the Lean Academy offered through the University of Iowa's Tippie College of Business in conjunction with Rockwell Collins and the Lean Aerospace Initiative. Key features of the course are the tours, senior executive lectures, and practitioner interviews that Rockwell offers to students in the course.

■ MD14

Room 314

Empirical Studies of e-Commerce

Sponsor: e-Business
Sponsored Session

Chair: Mu Xia, Assistant Professor, University of Illinois, Department of Business Administration, 1206 S. Sixth Street, Champaign, IL, 61822, United States, mxia@uiuc.edu

1 - Member Dynamics In an Online Sharing Community: An Empirical Analysis
Mu Xia, Assistant Professor, University of Illinois, Department of Business Administration, 1206 S. Sixth Street, Champaign, IL, 61822, United States, mxia@uiuc.edu, Yun Huang, Andrew B. Whinston, Wenjing Duan

A great number of online sharing communities have emerged and thrived in the past decade. Many of them are member-based and voluntary, and they allow users to share files with one another. In this research, we use a five-year log data set collected in an online music sharing community to examine how different types of users affect each other's activities and how their individual behavior is affected by the community overall.

2 - Internet Exchanges for Information Goods
Michael Smith, Associate Professor, Carnegie Mellon University, 4800 Forbes Avenue, HBH 2105D, Pittsburgh, PA, 15213, United States, mds@cmu.edu, Rahul Telang

We use a unique dataset documenting new and used markets for CDs and DVDs at Ama-zon.com, to analyze the degree to which sales of these used products cannibalize new sales. Our results show that the cross price elasticity of new product sales with respect to used product prices is significantly higher for CDs and DVDs than for books. One implication of these find-ings is that used product markets pose a larger threat to the CD and DVD industries than they do to the book publishing industry.

3 - Price Dispersion in Electronic Markets: New Evidence from Transaction Prices
Anindya Ghose, Assistant Professor, Stern School of Business, New York University, 44 West Fourth Street, KMC 8-94, New York, NY, 10012, United States, aghose@stern.nyu.edu, Yuliang Oliver Yao

We use transaction prices for more than 30,000 products, collected from both the electronic and traditional markets to re-evaluate price dispersion. We find price dispersions in the electronic market is as small as 0.03%, a level substantially lower than those reported in the literature. We estimate the consumer surplus gain from the use of the electronic market is about $181 millions per year.

■ MD15

Room 315

Online Auctions III

Cluster: Auctions and e-Commerce
Invited Session

Chair: Peter Popkowski Leszczyc, Associate Professor of Marketing, School of Business, University of Alberta, Edmonton AB, T6G 2R6, Canada, ppopkows@ualberta.ca

1 - A Semi-Parametric Investigation of the Effect of Reserve Prices on Selling Prices Using Identical Auctioned Items from eBay
Dawit Zerom, Assistant Professor of Business Statistics, School of Business, University of Alberta, Business Building 2-43, Edmonton, Alberta, T6G 2R6, Canada, dawit.ZeromGodefay@ualberta.ca, Peter Popkowski Leszczyc

In this paper we investigate the nature of the effect of reserve prices on the price of internet auctions with a semi-parametric model where a) all continuous covariates that affect the auction outcome are allowed to enter non-parametrically b) number of bidders is allowed to be endogenous, and c) the response variable can be censored. We apply the proposed model to data on five identical items from eBay.

2 - Analysis of Sellers' Behavior in the eBay Marketplace
Paulo Goes, Professor, University of Connecticut, 2100 Hillside Road, Storrs, CT, 06269, United States, Paulo.Goes@business.uconn.edu, Yanbin Tu, Alex Tung

While the behavior of bidders has received widespread attention, sellers' behavior in online auctions has not been well studied in the literature. In this study, we find that new sellers have higher listing error rates, lower auction success rates, lower auction prices, lower positive feedback rates, higher negative feedback rates, and higher frustration rates than experienced sellers.

3 - Charitable Intent and Bidding in Charity Auctions
Michael H. Rothkopf, Professor, Rutgers, The State University of New Jersey, 640 Bartholomew Road, Piscataway, NJ, 08854, United States, rothkopf@rutcor.rutgers.edu, Peter Popkowski Leszczyc

We modeled and conducted controlled field studies of regular and charity auctions. Results indicated that charity auctions had fewer bidders but higher revenue. The data are consistent with our model in which bidders in charity auctions act like volunteer shills, increasing prices. Bidders in charity auctions paid relatively higher prices for common value items and frivolous items.

■ MD16

Room 316

Revenue Management and Pricing

Cluster: Dynamic Pricing and Forecasting

Invited Session

Chair: Kristin Fridgeirsdottir, Assistant Professor, London Business School, Regent's Park, London, NW1 4SA, United Kingdom, kfridgeirsdottir@london.edu

1 - Robust Revenue Management: Booking Control with Limited Demand Information
Itir Karaesmen, Assistant Professor of Management Science, University of Maryland, Robert H. Smith School of Business, Decision and Information Technologies, College Park, MD, 20742, United States, ikaraes@rhsmith.umd.edu, Yingjie Lan, Huina Gao, Michael Ball

We analyze the single resource (leg) revenue management problem when no or limited demand information is available. We devise both static and dynamic policies via competitive analysis of online algorithms. The policies come with performance guarantees. We further test the average performance of these policies are using extensive computational experiments.

2 - On the Multi-Product Competitive Price-Setting Newsvendor Problem
Soulaymane Kachani, Professor, Columbia University (IEOR Department), S.W. Mudd Building Room 334, New York, NY, United States, kachani@ieor.columbia.edu, Kyrylo Shmatov

We address the problem of simultaneous determination of pricing and inventory decisions for multiple firms, where each firm offers a line of complementary and substitute products with multiple attributes, under stochastic demand. We consider several models of consumer demand and propose an iterative relaxation algorithm that computes Nash equilibrium solutions. We study a large-scale real-life problem and compare "cooperative" and "competitive" situations.

3 - An Efficient Approach for Solving the Revenue-Maximizing Mixed Bundling Problem
Mihai Banciu, PhD Candidate, University of Pittsburgh, 343 Mervis Hall, Pittsburgh, PA, 15260, United States, mibanciu@katz.pitt.edu, Prakash Mirchandani

The mixed-bundling problem (MB) entails finding the optimal revenue-maximizing prices for product lines consisting of individual products, or bundles of these products combined in any proportion. We investigate MB in a monopolistic setting with limited product availability, develop a decomposition approach derived from the underlying mathematical programming model, and present encouraging preliminary results.

4 - Online Advertising: Revenue Management Approach
Kristin Fridgeirsdottir, Assistant Professor, London Business School, Regent's Park, London, NW1 4SA, United Kingdom, kristin@london.edu, Victor Araman

Internet advertising is the fastest growing area in the advertising industry. Webhosts providing advertising space for their customers face complex problems of advertising planning, pricing and capacity management. We develop a stylized model for revenue management of a webhost considering the uncertainty of both the demand and supply side.

■ MD17

Room 317

Data and Pricing

Cluster: Dynamic Pricing and Forecasting

Invited Session

Chair: W. Tim Huh, Assistant Professor, Columbia University, 500 W. 120th Street, MC4704, New York, NY, 10028, United States, th2113@columbia.edu

1 - Dynamic Learning and Optimization with Operational Statistics
George Shanthikumar, Professor, University of California at Berkeley, Department of IEOR, Berkeley, CA, 94720, United States, shanthikumar@ieor.berkeley.edu, Andew Lim, Zuo-Jun Max Shen

Consider a stochastic system characterized by a parametric model with unknown parameters. The classical approach is to assume that parameters are known, find the optimal policy, and implement it using estimated values for parameters. When data available is limited, or the underlying uncertainty is nonstationary, these policies may not perform well. We use Operational statistics to find the optimal policies directly from the data. Inventory control and dynamic auctions are considered.

2 - Stochastic Choice Models of Demand and Applications to Pricing
Catalina Stefanescu, Assistant Professor of Decision Sciences, London Business School, Regent's Park, London, NW1 4SA, United Kingdom, CStefanescu@london.edu, Guillermo Gallego

In this paper we investigate several classes of stochastic models for customer choice, and their calibration from shopping data. We discuss different specifications of these models in terms of choice attributes, and study the implications for ticket pricing. These methodologies are exemplified with a large data set of customer purchases of airline tickets.

3 - Capacity Contracts in Air-Cargo Revenue Management
Kannapha Amaruchkul, Doctoral Student, University of Minnesota, Department of Mechanical Engineering, Room 1101 MechE 0691, 111 Church Street, SE, Minneapolis, MN, 55455, United States, amar0017@me.umn.edu, William L. Cooper, Diwakar Gupta

We study air-cargo capacity contracts between a carrier and a freight forwarder in settings where the forwarder possesses some private information. Working in the principal-agent paradigm, we propose contract schemes that overcome inefficiencies associated with the asymmetric information.

4 - Dynamic Pricing and Inventory Control: Centralized and Decentralized Analysis of Dual-Channel Supply
Tao Yao, Assistant Professor, Pennsylvania State University, 310 Leonhard Building, University Park, PA, 16802, United States, tyy1@engr.psu.edu, Terry Friesz, Yongma Moon

We deal with manufacturer°Øs redesign of traditional channel structures by engaging in direct internet sales. Consumer demand for the two channels depends on the prices and customer acceptance of these channels. For a vertical integration case, a continuous time optimal control problem is modeled and necessary (sufficient) conditions are provided. For a competition situation, a differential variational inequality formulation is applied to solve it as a Cournot-Nash-Bertrand game.

■ MD18

Room 318

Joint Session Counter Terrorism/DAS: Risk and Decision Analysis Applications for Homeland Security III

Cluster: Counter Terrorism and OR, Decision Analysis Society

Invited Session

Chair: Susan Martonosi, Assistant Professor, Harvey Mudd College, 301 Platt Boulevard, Claremont, CA, 91711, United States, martonosi@math.hmc.edu

1 - Equity and Uniformity of the U.S.-Mexico Border Inspections Process
Patrick Gurian, Assistant Professor, Department of Civil, Architectural, and Environmental Engineering, Drexel University, 3141 Chestnut Street, Philadelphia, PA, 19104, United States, pgurian@drexel.edu, Ward Nicholas Dudley, Cheryl Howard, Hilma Villegas, Josiah Heyman

Observations of non-commercial vehicle inspection as the U.S.-Mexico border indicate that most of the inspections were of limited duration and detail. A number of policy options are considered to improve the border inspection process. While none of these options have the potential to completely resolve concerns over equity and thoroughness of the process, several are amenable to incremental implementation at minimal cost.

2 - Analyzing Official Advice for Sheltering from Nuclear Fallout
H. Keith Florig, Senior Research Engineer, Carnegie Mellon University, 5000 Forbes Avenue, Pittsburgh, PA, 15213, United States, kf0f @andrew.cmu.edu

Several federal agencies have published advice on how to prepare for or react to an act of terrorism involving a nuclear explosive. In this presentation, this advice is analyzed from the perspective of the user. Advice on preparing a shelter in the home is subjected to a household cost-benefit test. Advice on sheltering vs. fleeing is evaluated in light of expectations for the dispersion of radioactive fallout and speed of flight. Finally, official advice is assessed for completeness.

3 - The Critical Asset and Portfolio Risk Analysis Methodology: Overview, Implementation, and Directions

William McGill, Center for Technology and Systems Management, University of Maryland, College Park, MD, 20742, United States, wmcgill@umd.edu, Bilal Ayyub

This paper describes the Critical Asset and Portfolio Risk Analysis (CAPRA) methodology for informing critical infrastructure protection resource allocation decisions. The results from the CAPRA analysis are communicated to all relevant stakeholders as actionable risk assessments. A case study highlighting implementation issues will be provided.

4 - Deterring the Determined: Quantitative Models for the Deterrence of Terrorists

Susan Martonosi, Assistant Professor, Harvey Mudd College, 301 Platt Boulevard, Claremont, CA, 91711, United States, martonosi@math.hmc.edu, Daniel Walton

Many homeland security models focus on system reliability in the event of an attack and neglect deterrence: terrorists might choose not to attack, or might shift their focus to less desirable targets, if the costs of attack become too high relative to the benefits. We present a model for resource allocation in which a defender must invest in protecting a target knowing that the attacker will either respond with heightened effort or give up. We characterize the optimal defender and attacker strategies and find that it is never optimal to leave the target undefended.

■ MD19

Room 319

Risk Management in Energy Markets

Sponsor: Energy, Natural Resources & The Environment
Sponsored Session

Chair: Shi-Jie Deng, Associate Professor, Georgia Institute of Technology, 765 Ferst Drive, Atlanta, GA, 30332, United States, deng@isye.gatech.edu

1 - Systematic Optimistic Biases in Energy Market Equilibria

Ming-Che Hu, PhD Student, Johns Hopkins University, 313 Ames Hall, 3400 N. Charles Street, Baltimore, MD, 21218, United States, mchu@jhu.edu, Benjamin Hobbs

The well-known Winner's Curse in auctions and the less familiar Optimizer's Curse in mathematical programming are closely related phenomena that arise from errors in objective function coefficients and lead to systematic optimistic biases. They are important because they lead people to be overoptimistic about the actual performance of solutions. This paper will extend these ideas to consider optimistic biases in competitive and oligopolistic Cournot market equilibria.

2 - Price Volatility in Electricity Auctions: A Strategic Analysis

Shanshan Hu, PhD Candidate, University of Michigan Ross School of Business, 2007 Huron Parkway, Apt. 9, Ann Arbor, MI, 48104, United States, husz@bus.umich.edu, William Lovejoy, Roman Kapuscinski

The wholesale electricity markets have exhibited great price volatility and are of regulatory and practical interests. We directly model the electricity auction and show that price stochasticity results jointly from demand uncertainty and bidders' strategic randomization. Based on numerical studies, we establish the profiles of demand variability, capacity utilizations and price volatility.

3 - Shipper Valuation and Hedging of Network Contracts for Natural Gas Pipeline Transport Capacity

Nicola Secomandi, Assistant Professor, Carnegie Mellon University, Tepper School of Business, 5000 Forbes Avenue, Pittsburgh, PA, 15213, United States, ns7@andrew.cmu.edu, Xiaofeng Wang

In the U.S., natural gas shippers buy the commodity at supply market hubs and contract with pipeline companies to transport it to demand market hubs where they sell it. This talk illustrates optimization-based models to value and hedge pipeline network contracts, consisting of multiple receipt points connected to multiple delivery points, as real options on natural gas futures prices.

4 - Stochastic Co-Optimization for Hydro-Electric Power Generation

Shi-Jie Deng, Associate Professor, Georgia Institute of Technology, 765 Ferst Drive, Atlanta, GA, 30332, United States, deng@isye.gatech.edu, Haibin Sun, Youxun Shen

We propose a stochastic programming framework for solving the optimal scheduling problem faced by a profit-maximizing hydro-electric power producer who simultaneously participates in multiple markets. The impact of market uncertainties on the co-optimization problem over a pre-specified time horizon is analyzed through the stochastic programming formulation incorporating both market participation and price uncertainties.

■ MD20

Room 320

DAS Awards

Sponsor: Decision Analysis Society
Sponsored Session

Chair: Eva Regnier, Assistant Professor, Naval Postgraduate School, Defense Resources Management Institute, 699 Dyer Road, Monterey, CA, 93943, United States, eregnier@nps.edu

1 - 2006 Decision Analysis Society Practice Award Winner and Finalists

Kazuo Ezawa, PhD, R&D Decision Analysis, Daiichi Sankyo Pharma Development, 399 Thornall Street, Edison, NJ, 08837, United States, kezawa@daiichisankyo-us.com

The Decision Analysis Society (DAS) of INFORMS is seeking entries for the DAS Practice Award competition every year. The intent of this award is to recognize, promote, and publicize good decision analysis practice. We will announce the winner of DAS Practice Award for 2006.

2 - Decision Analysis Student Paper Award

Jeffrey Stonebraker, Decision Sciences, A2RT — Analysis Applications, Research and Technologies, Biomedical Data Sciences, GlaxoSmithKline, jeffrey.s.stonebraker@gsk.com

The Student Paper Competition Award is given annually to the best decision analysis paper by a student author, as judged by a panel of the Decision Analysis Society of INFORMS. Students who did not complete their Ph.D. prior to May 1, 2005 are eligible for this year's competition.

3 - 2006 Decision Analysis Publication Award

Vicki Bier, Professor, University of Wisconsin-Madison, 1550 Engineering Drive, Room 3158 Engineering Centers Building, Madison, WI, 53706, United States, bier@engr.wisc.edu

The Decision Analysis Publication Award is given annually to the best decision analysis article or book published two years earlier. To be considered for this year's award, a work must have been published during 2004. The intent of the award is to recognize the best publication in decision analysis, broadly definedóincluding theoretical work on decision analysis methodology, descriptions of applications, and/or experimental studies.

4 - Ramsey Award

James Dyer, University of Texas at Austin, McCombs Business School, 1 University Station B6500, Austin, TX, 78712, United States, j.dyer@mccombs.utexas.edu

The Frank P. Ramsey Medal is the highest award of the Decision Analysis Society. It was created to recognize distinguished contributions to the field of decision analysis. The medal is named in honor of Frank Plumpton Ramsey, a Cambridge University mathematician who was one of the pioneers of decision theory in the 20th century. The Ramsey Medalists are recognized for having made substantial further contributions to that theory and its application to important classes of real decision problems.

■ MD21

Room 321

Bring OR into Your Local High School: Mission Not Impossible

Sponsor: Education (INFORM-ED)
Sponsored Session

Chair: Kenneth Chelst, Chairman, Dept of Industrial and Mechanical Engineering, Wayne State University, 4815 Fourth Street, Detroit, MI, 48201, United States, kchelst@wayne.edu

1 - Workshop on Reaching Out to High Schools

Kenneth Chelst, Chairman, Dept of Industrial and Mechanical Engineering, Wayne State University, 4815 Fourth Street, Detroit, MI, 48201, United States, kchelst@wayne.edu

We present a set of OR activities that were designed to enrich high school math. The session will provide guidance on reaching out to your local high schools. INFORMS goal is to create a network of like-minded operations researchers interested in outreach and can nurture this mission. We provide an update of efforts in North Carolina and Georgia. All attendees committed to outreach receive a complimentary copy of the book, Does this line ever move? Everyday Applications of Operations Research.

■ MD22

Room 322

Military Logistics Research at RAND (Session 1 of 2)

Sponsor: Military Applications

Sponsored Session

Chair: Ronald McGarvey, Operations Researcher, RAND, 4570 Fifth Avenue, Pittsburgh, PA, 15213, United States, ronm@rand.org

1 - Littoral Combat Ship Modularity: Exploring Operational and Logistical Opportunities

Brien Alkire, Operations Researcher, RAND Corporation, 1776 Main Street, Santa Monica, CA, 90407-2138, United States, brien@rand.org, John Birkler

The Littoral Combat Ship will be capable of defeating anti-access and asymmetric threats in the littorals. Its modular design allows a core seaframe to be reconfigured in a matter of days with an antisubmarine, surface or mine warfare mission package. We describe the methods and models we developed to examine operational, logistical and cost implications of the number of mission packages of each type acquired and the locations of homeports and installation sites.

2 - Improving Health Departmentsí Abilities to Receive and Utilize the Strategic National Stockpile

Edward Chan, Associate Operations Researcher, RAND Corporation, 1776 Main Street, Santa Monica, CA, 90407-2138, United States, echan@rand.org

RAND is developing tools to assess and increase the readiness of local health departments to provide medical countermeasures to its citizens in a public health emergency. In this presentation we will talk about the approach we have used in designing a set of assessments that includes checklists, simulations, and exercises. The goal is a portfolio of tools that is economically feasible and where the strengths and weaknesses of the various assessments complement one another.

3 - Global Combat Support Basing: Prepositioning Strategies for Air Force War Reserve Materiel

Ronald McGarvey, Operations Researcher, RAND, 4570 Fifth Avenue, Pittsburgh, PA, 15213, United States, ronm@rand.org, Tom Lang, Louis Luangkesorn, Rachel Rue

The US Air Force relies on prepositioned War Reserve Materiel, stored at multiple sites across the globe, to enable global responsiveness via rapid deployments. RAND has worked with the Air Force over a number of years, building optimization models that can help to identify prepositioning postures that can achieve the desired responsiveness at minimum cost. Of particular interest to the current research are an examination of alternative packaging configurations and maintenance options.

■ MD23

Room 323

Implementing Best Practices for Sourcing

Cluster: Global Services Sourcing

Invited Session

Chair: Mark Paulk, Senior Systems Scientist, Carnegie Mellon University, IT Services Qualification Center, 5000 Forbes Avenue, Pittsburgh, PA, 15213, United States, mcp@cs.cmu.edu

1 - Operations Management and Strategic Outsourcing: Coordinating the Relationship for Success

Bill Phifer, EDS Fellow, EDS, 1101 Shadow Wood Drive, Downingtown, PA, 19335, United States, bill.phifer@eds.com

The explosion of outsourcing of non-core business functions and its mixed results in operations management is explored, with a focus on the client and service provider relationship. Of primary concern is the ability of the business to effectively outsource appropriate functions, meet operational expectations, and maintain control. The eSourcing Capability Models® will be considered as best practices for clearly establishing and managing performance objectives, governance, and transparency.

2 - Multi-Site Implementation of the eSourcing Capability Model for Service Providers

Keith Heston, Accenture, Penn Center West, Building 8, Suite 100, Pittsburgh, PA, 15276, United States, keith.m.heston@accenture.com

The purpose of this paper is to provide an overview of considerations and approaches to implementing eSCM-SP across multiple sites and geographies. It will discuss issues associated with culture, commitment, and terminology, as well as degree of process change required between sites.

3 - Performance Improvements by Implementing Best Practices in an IT Outsourcing Service Provider

William Hefley, Associate Teaching Professor & Associate Director, IT Services Qualification Center, Carnegie Mellon University, 5000 Forbes Avenue, Pittsburgh, PA, 15213, United States, hefley@cmu.edu

The eSourcing Capability Model for Service Providers (eSCM-SP) is a best practices model for IT-enabled services. This case addresses the impact of eSCM-SP adoption on both service delivery and business effectiveness. This case addresses two units of LG CNS, located in Korea, that first achieved certification against the eSourcing Capability Model for Service Providers (eSCM-SP) in late 2003.

4 - Knowledge Transfer and Quality Practices in the Implementation of a Capability Model for Outsourcing

Bryon Balint, PhD Student, Carnegie Mellon University, Tepper School of Business, 5000 Forbes Avenue, Pittsburgh, PA, 15213, United States, bbalint@andrew.cmu.edu, Chris Forman, Sandra Slaughter, Elaine Hyder, Mark Paulk

We examine the factors influencing the implementation of the eSourcing Capability Model (eSCM-SP) in a large multinational offshore service provider. The eSCM-SP is a quality program that enables outsourcing service providers to improve their existing capabilities in both service design and delivery. We study how implementation success is influenced by such factors as knowledge characteristics, implementation of prior quality practices, and characteristics of the knowledge recipient.

■ MD24

Room 324

Daniel H. Wagner Prize Competition

Cluster: The Daniel H. Wagner Prize for Excellence in Operations Research

Invited Session

Chair: Joe Discenza, President and CEO, SmartCrane LLC, 2 Eaton Street Suite 500, Hampton, VA, 23669, United States, jhdiscenza@smartcrane.com

1 - The Daniel H. Wagner Prize for Excellence in Operations Research Practice

Five finalist teams have been selected for 2006 and these five will be presented in three sessions on Monday and the winning entry announced on Tuesday morning.

2 - Development of a Codeshare Flight Profitability System at Delta Air Lines

Jerome W. O'Neal, oneal.jerry@gmail.com, Michael Jacob, Adam Farmer, Kristi G. Martin

Airlines form alliances to expand the network of markets each carrier can serve through a process known as codesharing. Codesharing allows a carrier to place its marketing code on alliance partner's flights. Codeshare flights can then be sold by a carrier even though they are operated by their alliance partner. Alliances can improve the revenue streams of their members; however, the amount of revenue increase depends significantly on which flights are chosen for codeshare. A codeshare flight profitability system can automate the codeshare selection process by choosing a set of codeshare flights that maximize total system revenue for a carrier while satisfying the rules that have been set by the alliance, the government and the airlines' unions.

■ MD25

Room 325

OR Aplications at HP

Cluster: OR Practice

Invited Session

Chair: Dirk Beyer, Principal Scientist, Hewlett-Packard Laboratories, 1501 Page Mill Road, MS 1140, Palo Alto, CA, 94598, United States, dirk.beyer@gmail.com

1 - Hewlett Packard's Personal Systems Group Shapes its Distribution Strategy Using Optimization

Alper Sen, Assistant Professor, Bilkent University, Department of Industrial Engineering, Bilkent, Ankara, 06800, Turkey, alpersen@bilkent.edu.tr, Dirk Beyer, Shailendra Jain

In 2005, HP's PSG decided to evaluate its supply chain strategy in North America for its commercial division and investigate opportunities to decrease its supply chain costs and improve its order cycle times. As part of a larger project, a detailed optimization model was set up to help PSG develop a distribution strategy. A software tool is created to evaluate various distribution alternatives and understand the trade-off between the transportation costs and order cycle times.

2 - Workforce Planning Under Uncertainty
Pano Santos, Senior Scientist, Hewlett Packard Labs, 1501 Page Mill Road, MS 1140, Palo ALto, CA, 94304, United States, cipriano.santos@hp.com, Dirk Beyer, Ernesto Brau, Qi Feng, Shailendra Jain

Workforce planning under uncertainty is done based on a funnel of project opportunities. We compute the probability distribution of workforce demand at each period of the planning horizon, and determine an allocation of available workforce to opportunities. Gaps between workforce requirements and availability are fulfilled by determining a minimum cost policy of training or hiring.

3 - Building Customer Response Models from Transaction Data
Dirk Beyer, Principal Scientist, Hewlett-Packard Laboratories, 1501 Page Mill Road, MS 1140, Palo Alto, CA, 94598, United States, dirk.beyer@gmail.com, Troy Shahoumian, Hsiu-Khuern Tang, Alex Zhang

In order to use transaction data as training data for customer response models, it needs to be transformed into records describing the state of a customer at the time of an interaction. In this talk, we are describing a solution that enables the user to easily describe the transformations desired without writing DB queries, to generate rich training dataset and to automatically build customer response models across different classes of models.

■ MD26

Room 326

Multidimensional Scaling and Manifold Learning

Sponsor: INFORMS Computing Society/Data Mining
Sponsored Session

Chair: Michael Trosset, Professor, Indiana University, Department of Statistics, Bloomington, IN, 47405, United States, trosset@math.wm.edu

1 - Local Multidimensional Scaling for Nonlinear Dimension Reduction, Graph Layout & Proximity Analysis
Andreas Buja, The Liem Sioe Liong/First Pacific Company Professor of Statistics, University of Pennsylvania, The Wharton School, Department of Statistics, 3730 Walnut Street, 400 JMHH, Philadelphia, PA, 19104, United States, buja@wharton.upenn.edu, Lisha Chen

We introduce a new nonlinear dimension reduction method, called Local Multidimensional Scaling (LMDS). Its novel feature is that it uses ideas from the area of graph layout to balance attractive forces between near points and repulsive forces between non-near points against each other. Our methods generally do a superior job compared with LLE and Isomap. Our work contributes to, and ties together, three areas: non-linear dimension reduction, graph layout, and proximity analysis.

2 - How to Extend an Inner Product Embedding
Michael Trosset, Professor, Indiana University, Department of Statistics, Bloomington, IN, 47405, United States, trosset@math.wm.edu

It is well known that squared Euclidean distances can be transformed to Euclidean inner products. Classical multidimensional scaling (CMDS) applies this transformation to squared dissimilarities, then approximates the resulting matrix with a matrix of inner products. Suppose that, after CMDS has been performed, we observe dissimilarities of new objects from the original objects. We consider how to embed the new objects without disturbing the original configuration.

3 - Extensions of Classical Multidimensional Scaling for Molecular Embedding Problems
Robert Michael Lewis, Associate Professor, College of William & Mary, Department of Mathematics, PO Box 8795, Williamsburg, VA, 23187-8795, United States, buckaroo@math.wm.edu, Michael Trosset, Ian Grooms

We discuss an approach to the embedding problem in structural molecular biology. For an n-atom molecule we treat the n(n-1)/2 interatomic distances (dissimilarities) as independent variables. We use the strain criterion from classical MDS to steer the dissimilarities to a set of physically realizable interatomic distances. Our approach results in a large-scale constrained nonconvex spectral optimization problem. As we discuss, the solution of this problem is computationally tractable.

■ MD27

Room 327

Reliability Optimization 1

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: David Coit, Associate Professor, Rutgers University, Industrial & Systems Engineering, Piscataway, NJ, 08844, United States, coit@rutgers.edu

1 - Optimization of Accelerated Life Testing Plans with Multiple Stresses
Elsayed Elsayed, Professor, Department of Industrial and System Engineering, Rutgers University, 96 Frelinghuysen Road, Piscataway, NJ, 08854-8018, United States, elsayed@rci.rutgers.edu, Hao Zhang

Multiple-stress-type ALTs have been employed as a means of overcoming such difficulties. In this paper, we design optimum multiple-stress-type ALT plans based on the proportional odds model. The optimum combinations of stress levels and the optimum number test units allocated to each combination are determined such that the variance of the reliability prediction of the product over a pre-specified period of time is minimized. The proposed ALT plans are illustrated by numerical example.

2 - Stochastic Optimal Dispatch of Electricity Considering Transmission Line Failures
Mainak Mazumdar, Professor, University of Pittsburgh, 1048 Benedum Hall, Pittsburgh, PA, 15206, United States, mmazumd@engr.pitt.edu, Lizhi Wang

We present a procedure for dispatching electricity with a view to providing protection against transmission line failures. This optimal dispatch procedure has the following features: (1) Credit contingencies are determined by considering individual transmission line reliabilities and network topology. (2) Preventive and corrective actions are integrated to protect the system in both pre- and post-contingency phases. (3) It models the probability of cascading failures after a contingency occurs.

3 - Reliability of Weighted Voting Systems from a Multistate Perspective
Jose Emmanuel Ramirez-Marquez, Assistant Professor, Stevens Institute of Technology, Castle Point on Hudson, Hoboken, NJ, 07030, United States, jmarquez@stevens.edu

This research presents reliability modeling, estimation and optimization techniques for Weighted Voting Systems. The functional structure of WVS is used to model its reliability as a multi-state system. Next, an exact computational approach based on multi-state minimal cut and path vectors is introduced. Similarly, a Monte-Carlo simulation approach that estimates system reliability efficiently is provided. Finally, an optimization heuristic is presented for maximizing the reliability of WVS.

4 - Multiobjective Multi-State Genetic Algorithm for Power Systems Reliability Optimization Problems
Heidi Taboada, Graduate Student, Rutgers University, Department of Industrial Engineering, 96 Frelinghuysen Road, Piscataway, NJ, 08854-8018, United States, heidita@eden.rutgers.edu, David Coit, Jose Espiritu Nolasco

A multiobjective multi-state genetic algorithm (MOMS-GA) was developed to solve multiple objective reliability optimization design problems of multi-state power systems. The multiobjective genetic algorithm developed uses the universal moment generating function approach (UMGF) to evaluate the different reliability indices of the power system. The solution to the multiobjective multi-state (MOMS) problem is a set of solutions, known as Pareto front.

■ MD28

Room 328

IEEE Transactions on Automation Science and Engineering Paper Session

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: Yu Ding, Assistant Professor, Texas A&M University, College Station, TX, 77843, United States, yuding@iemail.tamu.edu

Co-Chair: Jianjun Shi, Professor of IE/OR, Department of Industrial and Operations Engineering, The University of Michigan Ann Arbor, 1205 Beal Avenue IOE1784, Ann Arbor, MI, 48109-2117, United States, shihang@umich.edu

1 - The Sensor Selection Problem for Bounded Uncertainty Sensing Models

Volkan Isler, Assistant Professor, Rensselaer Polytechnic Institute, 110 8th Street, Lally 207, Troy, NY, 12180, United States, isler@cs.rpi.edu, Ruzena Bajcsy

We address the problem of selecting sensors so as to minimize the error in estimating the position of a target. In our model, the measurements are polygonal, convex subsets of the plane which are merged by intersecting corresponding subsets. After presenting an approximation algorithm which guarantees that the resulting error is within factor 2 of the least possible error, we conclude the talk with an overview of recent results for related sensor management problems.

2 - Semidefinite Programming Approaches for Sensor Network Localization with Noisy Distance Measurements

Pratik Biswas, Graduate Student, Stanford University, Department of Electrical Engineering, Stanford, CA, 94305, United States, pbiswas@stanford.edu, Kim-Chuan Toh, Yinyu Ye

A sensor network localization problem is to determine the positions of the sensor nodes in a network given incomplete and inaccurate pairwise distance measurements. We describe a general semidefinite programming (SDP) based approach for solving the graph realization problem, of which the localization problem is a special case. We investigate the performance of this method on problems with noisy distance data and propose ideas to improve the estimation accuracy.

3 - Sensory-Updated Residual Life Distributions for Components with Exponential Degradation Patterns

Nagi Gebraeel, Assistant Professor, University of Iowa, 3131 Seamans Center, Iowa City, IA, 52242, United States, gebraeel@engineering.uiowa.edu

Research on the interpretation of sensory data streams and their utilization in making critical logistical decisions stands to provide significant advancements across various application domains. We develop a stochastic degradation modeling framework for computing and continuously updating component residual life distributions - in support of a sense and respond logistics environment - by combining population specific degradation characteristics with real-time component specific sensory data.

■ MD29

Room 329

Applications of Operations Management in Acute Care Settings

Cluster: Joint Cluster Healthcare/ HAS: Healthcare Engineering
Invited Session

Chair: Ayse Pinar Gurses, University of Maryland, agurs001@umaryland.edu

1 - Optimizing State Access to Trauma Centers

Charles Branas, Assistant Professor, University of Pennsylvania, 936 Blockley Hall, 423 Guardian Drive, Philadelphia, PA, 19104, United States, cbranas@cceb.med.upenn.edu, Justin Williams

The TRAMAH model seeks to optimize the locations of trauma centers and ambulances in terms of the number of severely injured people that can reach a trauma center in a short period of time. The first phase of the model was tested in a single state. The second phase was applied to 13 states in a multi-objective framework that considers coverage of severely injured people and patient volumes per trauma center. The third phase applies portions of the model to all states in a web-based platform.

2 - An Empirical Analysis of New Practice Implementation in Intensive Care Units

Anita Tucker, Assistant Professor, University of Pennsylvania, 551 Huntsman Hall, 3730 Walnut Street, Philadelphia, PA, 19066, United States, tuckera@wharton.upenn.edu, Ingrid Nembhard, Amy Edmondson

We investigate learning activities undertaken by improvement-project teams in neonatal intensive care units (NICUs). To test our hypotheses, we surveyed 23 NICUs that implemented new practices. We find that a high level of supporting evidence for a unit's portfolio of improvement projects was associated with implementation success. Learn-how activities were positively associated with implementation success. Psychological safety mediated the link between learn-how and implementation success.

3 - Benchmarking in the Intensive Care Unit

Brian Nathanson, OptiStatim LLC, PO Box 60844, Longmeadow, MA, 01116, United States, brian.h.nathanson@att.net

There have been recent advances in benchmarking based on frontier estimation that are underutilized in critical care. A revised Rapoport-Teres Graph for benchmarking will be presented that is now based on regression models derived from 124,855 patients in the Project IMPACT database from 2001-2004: the Mortality Probability Model (MPM0 - III) and a length of stay model. Frontier efficiency models will then be introduced as alternatives and their benefits and limitations will be discussed.

4 - Performance Obstacles in Intensive Care Units

Ayse Pinar Gurses, University of Maryland, agurs001@umaryland.edu, Pascale Carayon

We investigated the impact of performance obstacles on workload, quality of working life (QWL) and quality of care in ICUs. A cross-sectional, survey study was conducted among 300 nurses from 17 ICUs. Obstacles (e.g., misplaced charts, inadequate information) were significantly related to higher workload, lower QWL and quality of care. High workload increased stress and tension of ICU nurses and had a negative impact on quality of care. Findings have implications for ICU redesign efforts.

■ MD30

Room 330

Panel Discussion: Operational Issues Facing Health Care Practitioners

Sponsor: Health Applications Section
Sponsored Session

Chair: Murray Côté, Associate Professor, University of Colorado at Denver and Health Sciences Center, Health Care Policy and Research, 13611 East Colfax Avenue, Suite 100, Aurora, CO, 80045, United States, murray.cote@uchsc.edu

1 - A Panel Discussion: Operational Issues Facing Health Care Practitioners

Moderator: Murray Côté, Associate Professor, University of Colorado at Denver and Health Sciences Center, Health Care Policy and Research, 13611 East Colfax Avenue, Suite 100, Aurora, CO, 80045, United States, murray.cote@uchsc.edu, Panelists: Sandra Sullivan, M.D., Dave Eitel, M.D., Keith Willoughby, Ph.D.

Given the growing interest in applying management science/operation research techniques in health care, this session will consider important operational issues in health care delivery from the perspective of health care practitioners. A panel of three experts (two physicians, one senior operations research consultant) will share their views and experiences on this topic and lead a discussion to assist us in becoming better versed in health care issues.

■ MD31

Room 331

Frontiers of Financial Engineering

Cluster: Financial Engineering and Risk Management
Invited Session

Chair: Jim Primbs, Assistant Professor, Stanford University, 444 Terman Engineering Center, Stanford, CA, 94305-4026, United States, jim.primbs@stanford.edu

1 - Utility Indifference Valuation of Weather Derivatives and Their Hedge Effect on Energy Businesses

Yuji Yamada, Associate Professor, Graduate School of Business Sciences, University of Tsukuba, 3-29-1 Otsuka, Bunkyo-ku, Tokyo, 112-0012, Japan, yuji@gssm.otsuka.tsukuba.ac.jp

We develop two types of pricing approaches based on the utility indifference valuation and the non-parametric trend prediction, and estimate their hedge effect on energy businesses using empirical data. First, we consider an OTC market for weather derivatives between an insurance company and an industry that run a project affected by a weather index, and derive the equilibrium price and volume. We then analyze the hedge effect of weather derivatives on energy businesses.

2 - Finance and Revenue Management of Callable Products
Steve Kou, Associate Professor, Industrial Engineering and Operations Research, Columbia University, 312 S.W. Mudd, New York, NY, 10027, United States, sk75@columbia.edu, Guillermo Gallego, Robert Phillips

A callable product is a unit of capacity sold to self-selected low-fare customers who willingly grant the capacity provider the option to ``call" the capacity at a pre-specified recall price. We show that callable products provide a riskless source of additional revenue to the capacity provider. We illustrate how the benefits from offering callable products can be significant, especially when high-fare demand uncertainty is large.

3 - Comparisons of Taxable Index-Fund Portfolios to Individual-Asset Portfolios
John R. Birge, Professor, University of Chicago, Graduate School of Business, 5807 S. Woodlawn Avenue, Chicago, IL, 60637, United States, john.birge@chicagogsb.edu, Song Yang

Optimizing taxable portfolios of many assets presents a considerable computational challenge due to the exponential increase in the state space as the number of assets grows. We developed an approach to approximate the many-asset portfolio with an asset-continuum portfolio. In this talk, we will present comparisons of this approach with optimal decisions for an index-fund portfolio that holds a single index fund for each factor.

4 - Efficient Simulation for American Option Pricing Under Stochastic Volatility
Farid AitSahlia, Assistant Professor, Industrial and Systems Engineering, University of Florida, Gainesville, FL, 32611, United States, farid@ise.ufl.edu

In this talk I will present a Markov Chain Monte Carlo approach that integrates the Longstaff-Schwartz technique to price American options when the volatility of the underlying is stochastic.

■ MD32

Room 332

Exploring the Meaning of Project Control: Panelists' Perspectives & Research Recommendations

Cluster: Project Management

Invited Session

Chair: Laurie Kirsch, Associate Professor, University of Pittsburgh, Katz Graduate School of Business, Roberto Clemente Drive, Pittsburgh, PA, 15260, United States, lkirsch@katz.pitt.edu

1 - Project Governance and Control
Ray Henry, Professor, Clemson University, Department of Management, 101 Sirrine Hall, Clemson, SC, 29634, United States, rhenry@clemson.edu

The assignment of authority and accountability is a question of project governance that has important implications for understanding the enactment of control. When projects include multiple groups the determination of roles can be complex, leading to questions about how and by whom controls are implemented. The results of a study looking at the distribution of governance in large IT projects will be presented and used discuss the relationship between project governance and project control.

2 - An Extended Model of IS Project Control
Cecil Eng Huang Chua, Assistant Professor, Nanyang Technological University, Nanyang Avenue, Singapore, Singapore, aehchua@ntu.edu.sg

This paper demonstrates that indifference curve theory can be applied to explain the relative quantities of all modes of project control, because it can model control modes as simultaneous complements and substitutes. Furthermore, indifference curve theory is compatible with and obtains identical results as existing theory. Furthermore, the mathematical nature of indifference curves enable us to simulate control problems, and helps to explain why minimum levels of formal control are preferred.

3 - Two Observations on Control from an Agency Theory Perspective
John Harry Evans III, Professor, University of Pittsburgh, Katz Graduate School of Business, Pittsburgh, PA, 15260, United States, jhe@katz.pitt.edu

Agency theory is the prevailing paradigm for understanding control in organizations from an economic perspective. Agency theory provides a rigorous general perspective for analyzing how organizations reconcile the conflicting objectives of principals and agents. This presentation discusses two recent sources of empirical evidence concerning the results of applying the agency paradigm in interesting specific applications. The first is an experimental budgeting application. The second concerns the transformation of a large government bureaucracy.

■ MD33

Room 333

Airline Industry Applications I

Sponsor: Aviation Applications

Sponsored Session

Chair: Judy Pastor, Principal, OR&DS, American Airlines, 4333 Amon Carter Boulevard, MD 5358, Fort Worth, TX, 76155-2664, United States, judy.pastor@aa.com

1 - Local and Connecting Traffic in Single and Multiple Airport Cities
Cumhur Gelogullari, Operations Research Analyst, American Airlines, 4333 Amon Carter Boulevard MD 5358, Fort Worth, TX, 76155, United States, Cumhur.Gelogullari@aa.com, Tassio Carvalho

The presence of commercial service at multiple airports in a metro area is frequently due to capacity constraints at the main facility. We present a study on the impact of the presence of commercial service at multiple facilities on local and connecting traffic in large metro areas.

2 - Improving the Transfer Baggage Operation at American Airlines
Tuell Green, American Airlines, 4333 Amon Carter Boulevard, MD 5358, Fort Worth, TX, 76155-2664, United States, tuell.green@aa.com, June Ma, Alejandro Scalise

We present an approach using simulation and optimization to analyze and improve the connecting baggage operation of American Airlines at DFW airport. We will include a description of the simulation model and some simulation results, an overview of the optimization approach and some sample test cases, and some observations regarding the transition from laboratory to daily operations.

3 - Using Multi-Dimensional Plots to Examine Passenger Behavior and Applications to RM
Judy Pastor, Principal, OR&DS, American Airlines, 4333 Amon Carter Boulevard, MD 5358, Fort Worth, TX, 76155-2664, United States, judy.pastor@aa.com

We will use trellis plots in the software package, R, to examine patterns in PNR attributes. Airline RM models can take advantage of these patterns to detect sell-up opportunities.

■ MD34

Room 334

Urban Transportation Planning Models V: Public Transit

Sponsor: Transportation Science & Logistics

Sponsored Session

Chair: Grisselle Centeno, Assistant Professor, University of South Florida, 4202 E. Fowler Avenue, Tampa, FL, 33620, United States, gcenteno@eng.usf.edu

1 - Parking Capacity Planning Models Considering Transit Availability
Grisselle Centeno, Assistant Professor, University of South Florida, 4202 E. Fowler Avenue, Tampa, FL, 33620, United States, gcenteno@eng.usf.edu, Aldo Fabregas

We present a synthesis for parking capacity planning models incorporating demand uncertainty, and public bus transportation availability. Efforts include developing mathematical programming formulations to evaluate strategies that may increase the use of transit services. Models will assist decision-makers when determining future parking expansions in terms of timing, dimensions, and locations.

2 - Route Design in a Fast-Bus Urban Transportation System
Andrés L. Medaglia, Centro de Optimización y Probabilidad Aplicada (COPA) Departamento de Ingeniería Industrial Universidad de los Andes, amedagli@uniandes.edu.co, German Riano, Juan Camilo Acero

We present a mixed-integer programming model to design the set of routes for a fast-bus urban transportation system by minimizing overall passenger travel time while limiting the number of routes so that the system remains manageable and understandable. Several solution techniques are explored taking advantage of the model's structure.

3 - Admission Regulation of Traffic to Improve Public Transport in Urban Areas
Carlos Bispo, Assistant Professor, Instituto Superior Técnico, Av. Rovisco Pais, 1049-001 Lisboa, Portugal, cfb@isr.ist.utl.pt

We correlate rate of entering traffic in Lisbon, Portugal, and the speed of buses. The admission rate was reduced by varying green and red light times at one entry point of the city, permitting buses on some routes to maintain constant average speed during rush hour, rather than dropping.

4 - Mobility Allowance Shuttle Transit (MAST) Services: Description, Formulation and Optimization

Luca Quadrifoglio, Assistant Professor, Zachry Department of Civil Engineering, Texas A&M University, College Station, TX, 77843, quadrifo@usc.edu

Mobility Allowance Shuttle Transit (MAST) vehicles follow a fixed route with checkpoints, but deviate from the path to pick up and drop off passengers. The static MAST scheduling problem is formulated as an NP-Hard mixed integer linear program. Three sets of logic cuts greatly speed up the optimal solution search.

■ MD35

Room 335

Urban Transportation Modeling Session IV: New Problems and Methods

Sponsor: Transportation Science & Logistics

Sponsored Session

Chair: James Moore, Professor and Chair, Epstein Department of Industrial & Systems Engineering, University of Southern California, GER 240; MC 0193, Los Angeles, CA, 90089, United States, jmoore@usc.edu

1 - Stochastic Network Retrofit with Recourse

Changzheng Liu, Yueyue Fan, Department of Civil and Environmental Engineering, University of California, Davis, czliu@ucdavis.edu

Our research explores retrofitting strategies for highway bridge networks considering uncertainties in natural and human-induced hazards, and their impacts. We formulate a 2-stage stochastic integer program with recourse that minimizes total system operation and recourse cost caused by nonanticipativity of random events. An L-shaped solution method and examples are presented.

2 - Approximation of GEV Models Using Mixed Models with Error Components

Laurie Garrow, Assistant Professor, School of Civil and Environmental Engineering, Georgia Institute of Technology, 790 Atlantic Drive, NW, Atlanta, GA, 30332, United States, laurie.garrow@ce.gatech.edu, Tudor D. Bodea

Mixed models with error components are approximate correlation structures of GEV models. Convergence of mixed models and recovery this structure depends critically on the number of observations, the frequency of chosen alternatives, and the correlation in the nests. Even when convergence is reached, we observe systematic bias in correlation estimates.

3 - Evaluating Capacity Investments Using a GIS-Based Tool - Network-Wide Full Marginal Cost Approach

Kaan Ozbay, Associate Professor, Rutgers University, 623 Bowser Road, Piscataway, NJ, 08854, United States, kaan@rci.rutgers.edu, Ozlem Yanmaz-Tuzel, Sandeep Mudigonda, Bekir Bartin

We propose a constrained k-shortest path algorithm to estimate the trip-based FMC of a trip along a set of feasible paths between each O-D pair. The tool is developed in ArcGIS, using Visual Basic and C-programming. In the developed tool, origin and/or destination of a trip can be either a single node, or a set of nodes within a Traffic Analysis Zone/county/whole-network. In addition, the developed tool assesses short term impacts of infrastructure investments on the FMC of trips.

4 - Risk Analysis in Transportation Infrastructure Investments

Joseph (Yossi) Berechman, CN Chair Professor in Transportation and International Logistics, Sauder School of Business, 2053 Main Mall, University of British Columbia, Vancouver, BC, V6T 1Z2, Canada, Berechman@sauder.ubc.ca

Transportation infrastructure investments are quite complicated to plan and built and require huge amounts of capital. Once committed to politically, legally and financially, these investments are irreversible and thus represent considerable sunk costs. On the demand side, travel demand tends to vary significantly over time and space and across modes. Hence, the risks of cost over-runs, delayed schedules, lower than expected demand and, at times, even financial insolvency. Against this background, this paper focuses on the three key questions. First, how to define and measure the various risk components of a transportation investment project and, subsequently, its overall risk level? Second, in the context of Public Private Partnership projects, how should risk be shared? Third, how should risk analysis be incorporated into the overall process of project evaluation?

■ MD36

Room 336

Warehousing and Facility Logistics

Sponsor: Transportation Science & Logistics

Sponsored Session

Chair: Samir Amiouny, Senior Consultant, ILOG Inc., 8545 Orphee, Brossard, QC, J4Y 3E3, Canada, samiouny@ilog.com

1 - Warehouse Order Picking with Cart Constraints

Samir Amiouny, Senior Consultant, ILOG Inc., 8545 Orphee, Brossard, QC, J4Y 3E3, Canada, samiouny@ilog.com

We describe a warehouse order picking optimization problem in which there are constraints on the placement of boxes on picking carts. We present a solution based on generating a number of promising feasible pick routes and selecting the best among them using CPLEX. The implementation at a national retailer resulted in substantial improvements in picking efficiency.

2 - Optimal Design of Discrete Order Picking Technologies Along a Line

Donald Eisenstein, Professor of Operations Management, University of Chicago, Graduate School of Business, 5807 South Woodlawn Avenue, Chicago, IL, 60637, United States, don.eisenstein@chicagogsb.edu

In discrete order picking a single worker picks all items in an order. There are two ways to reduce the walking distance: The use of technology - convey or systems and/or the ability to transmit order information via mobile device. And through design - where best to locate depots (where workers receive pick lists and deposit completed orders) and how best to lay out the product. We build a stochastic model to determine how to minimize walk time for various configurations.

■ MD37

Room 337

Tutorial — Social Networks and e-Markets: Incentives and Monetization

Sponsor: Information Systems Society

Sponsored Session

Chair: Ravi Bapna, Associate Professor, Department of Operations and Information Management, University of Connecticut, Storrs, CT, 06269, United States, ravi.bapna@business.uconn.edu

1 - Complex Networks in Business and Economics

Arun Sundararajan, Professor, New York University, 44 West 4th Street, KMC 8-93, New York, NY, 10012, United States, asundara@stern.nyu.edu

This session will feature a joint tutorial (with Professor Ravi Bapna)on the applications of ideas from complex network theory to problems in OR, business and economics. Assuming a basic understanding of graph theory and random graphs, we will cover selected recent advances in the theory of complex networks that can be used in applied problems, and outline promising high-impact open research areas. This tutorial is especially recommended for doctoral students.

2 - Building Loyalty and Reducing Friction in e-Markets Using Social Networks

Ravi Bapna, Associate Professor, Department of Operations and Information Management, University of Connecticut, Storrs, CT, 06269, United States, ravi.bapna@business.uconn.edu

We distinguish between buyer-side, seller-side, trading and personal network structures in the context of a social network based e-market. We show how these different network structures play different roles in building market loyalty, reducing friction and accelerating growth.

■ MD38

Room 338

Academic Contributions to Railroad Operations Research

Sponsor: Railroad Applications

Sponsored Session

Chair: Christopher Barkan, Associate Professor, University of Illinois at Urbana-Champaign, 1201 Newmark Lab, 205 N. Mathews Avenue, Urbana, IL, 61801, United States, cbarkan@uiuc.edu

1 - Optimizing Ballast Sourcing and Delivery Operations

Xiajun Pan, University of Texas at Austin, McCombs School of Business, 1 University Station B6000, Austin, TX, 78712, United States, Xiajun.Pan@phd.mccombs.utexas.edu, Brian Roth, Anant Balakrishnan

Given the ballast requirements for geographically-dispersed track maintenance jobs, we develop an integer-programming model to select the source quarry for each job and route available trains to deliver ballast on time at minimum total purchasing and transportation cost. We propose valid inequalities to strengthen the model, and report computational results.

2 - Optimal Production Gang Scheduling for Railway Maintenance Operations

Gang Li, PhD Student, The University of Texas at Austin, McCombs School of Business, 1 University Station B6000, Austin, TX, 78712, United States, gang.li@mail.utexas.edu, Brian Roth, Anant Balakrishnan

Given a set of railway maintenance jobs with time windows and inter-job coordination requirements, production gang scheduling seeks to select and assign production gangs to jobs, sequence the jobs, and route the gangs between jobs to minimize the total cost for employing, assigning, and re-positioning gangs. We formulate the problem as a large-scale integer program, develop valid inequalities to strengthen the model, and report computational results using real data.

3 - Optimal Location of Railroad Wayside Defect Detection Installations

Yanfeng Ouyang, Assistant Professor, University of Illinois at Urbana-Champaign, 205 N. Mathews Avenue, Urbana, IL, 61801, United States, yfouyang@uiuc.edu, Yung-Cheng Lai, Christopher Barkan

This paper presents network optimization models that select cost-effective installation sites for wayside defect detection systems over a rail network. These systems monitor the mechanical health and performance of railcars and can help prevent derailments. We develop efficient solution techniques to solve the problems and present case studies with empirical data.

4 - Tank Car Safety Design vs. Infrastructure Improvements in Reducing Hazardous Materials Transportation Risk

Mohd. Rapik Saat, Graduate Research Assistant, University of Illinois at Urbana-Champaign, 205 N. Matthews, B-118, Urbana, IL, 61801, United States, mohdsaat@uiuc.edu, Christopher Barkan

This study analyzed the marginal benefits in reducing hazardous materials transportation risk by improving tank car safety design versus improving railroad infrastructure. A cost-benefit model is being developed that compares tank car replacement to railroad accident rate reduction to determine the conditions when one is more effective than the other.

■ MD39

Ballroom B

Great Unsolved Problems in OR - III

Cluster: Great Unsolved Problems in OR

Invited Session

Chair: Arjang Assad, Professor, University of Maryland, Robert H. Smith School of Business, College Park, MD, 20742, United States, aassad@rhsmith.umd.edu

1 - Responsibility of OR/MS for Disaster Management

Martin Starr, Professor Emeritus, Crummer Graduate School of Business, Rollins College, 1000 Holt Avenue, Winter Park, FL, 32789, United States, mstarr@cfL.rr.com

Disasters occur in three ways: first, by intentional malevolence; second, by human errors and technological failures; third, by acts of nature (e.g., hurricanes and tsunamis). Such regional disasters often trigger catastrophes such as dams breaking. This paper starts to examine how OR/MS models can begin to structure the three types of situations before they occur, during emergency periods, and after their occurrence. Emphasis is on the before scenarios.

2 - Are We There Yet? The Marriage Between Simulation and Optimization

Michael Fu, Professor, Robert H. Smith School of Business, University of Maryland, College Park, MD, 20742, United States, mfu@rhsmith.umd.edu

Arguably the two most powerful operations research techniques implemented in software are simulation and optimization, so it is natural to consider wedding these two techniques, and over the past decade most commercial simulation software packages began offering some sort of an "optimization" module. However, continuing a theme in my 2002 INFORMS Journal on Computing Feature Article, I argue that current software offers mainly marriages of convenience rather than well-integrated partnerships.

3 - Can There be a Unique OR Paradigm?

Heiner Müller-Merbach, Professor, Technische Universität Kaiserslautern, Erwin-Schrödinger-Strafle, Geb. 42-434, Kaiserlautern, D-67653, Germany, hmm@bior.de

Will or can the "Science of Better" campaign in the US bring about some unification of the OR understanding within the OR community and outside: i.e. a step toward a unique OR paradigm? And is this at all desirable? (i) I doubt that it will happen, due to the many different schools (and sub-schools) of thought within OR; (ii) It is not desirable because unification can easily kill any vivid competition between the schools. No single science seems to have a unique paradigm.

■ MD40

Room 401

Location and Layout

Sponsor: Location Analysis

Sponsored Session

Chair: Zvi Drezner, Professor, California State University, Fullerton, CA, 92834, United States, zdrezner@fullerton.edu

1 - The Variable Radius Covering Problem

Oded Berman, Professor, Rotman School of Management, University of Toronto, 105 St. George Street, Toronto, ON, M5S 3E6, Canada, Berman@Rotman.Utoronto.Ca, George O. Wesolowsky, Dmitry Krass, Zvi Drezner

We propose a covering problem where the covering radius of a facility is controlled by a decision maker. The problem is to cover all demand points at a minimum cost by finding optimal number, locations and coverage radii for the facilities. Both, the planar and network versions of the model are considered.

2 - Cost and Aggregation Error Tradeoff Analysis for Some Location

Richard Francis, Professor Emeritus, Department of Industrial & Systems Engineering, University of Florida, 303 Weil Hall, Gainesville, FL, 32611, United States, francis@ise.ufl.edu, Tim Lowe

Every mathematical modeler faces the problem of how much detail to build into the model. We consider this problem for a class of location models, where detail is inversely proportional to demand point aggregation error. We show the problem can be formulated, and analyzed, as a multicriteria decision problem. The law of diminishing returns plays an important role.

3 - Models of Facility Reliability

Michael Lim, PhD Student, Northwestern University, 2145 Sheridan Road, Evanston, IL, 60201, United States, m-lim2@northwestern.edu, Mark Daskin, Sunnil Chopra

We extend the fixed charge facility location model to account for reliable and unreliable facilities. We derive structural results from the analytic variant of the model and show how the discrete model may be effectively solved using Lagrangian relaxation. Computational results are provided for moderate sized datasets.

4 - Multi-Story Space Assignment Problem

J. MacGregor Smith, Professor, Department of Mechanical and Industrial Engineering, University of Massachusetts, Amherst, MA, 01003, United States, jmsmith@snail.ecs.umass.edu, Peter Hahn

We provide a formulation of the Multi-Story Space Assignment Problem (MSAP) which allows one to model the location of activities with multi-story facilities as a Generalized Quadratic Assignment Problem (GQAP). The MSAP also inlcudes the evacuation planning for the facility. The formulation and its transformation into a GQAP along with some preliminary computational results are presented.

5 - The Hub Covering Flow Problem

Thaddeus Sim, Graduate Research Assistant, Tippie College of Business, University of Iowa, S210 Pappajohn Business Building, Iowa City, IA, 52240, United States, thaddeus-sim@uiowa.edu, Timothy J. Lowe

We develop a hub location model that solves for hub locations by minimizing hub installation costs and total flow costs subject to distance constraints. The model allows for the use of multiple coverage radii with transportation costs depending upon coverage zones. The model can be used to assist in the design of hub-and-spoke networks and in the selection of types of carriers to serve demand points from hubs.

■ MD41

Room 402

Many-Server Queues in the QED Regime

Sponsor: Applied Probability

Sponsored Session

Chair: Josh Reed, Georgia Institute of Technology, School of Industrial and Systems Engineering, 765 Ferst Drive NW, Atlanta, GA, 30332, United States, je-reed@isye.isye.gatech.edu

Co-Chair: Tolga Tezcan, Assistant Professor, Georgia Institute of Technology, 765 Ferst Drive NW, Atlanta, GA, 30332, United States, ttezcan@isye.isye.gatech.edu

1 - Fixed-Queue-Ratio Routing in Call Centers

Itay Gurvich, PhD Student, Columbia Business School, Uris Hall, 3022 Broadway, New York, NY, 10027, United States, ig2126@columbia.edu, Ward Whitt

We study large call centers with multiple customer classes and agent pools. In order to balance the service levels for the different classes, we propose a fixed-queue-ratio (FQR) routing scheme. Together with a very simple staffing rule, FQR is asymptotically optimal for minimizing the total staffing level subject to per-class service-level constraints. The asymptotic optimality is proved in the QED many-server heavy-traffic regime via state-space collapse.

2 - Steady-State Analysis of a Multi-Server Queueing System in QED Regime

David Gamarnik, Assistant Professor, MIT Sloan School of Management, E53-353, 77 Massachusetts Avenue, Cambridge, MA, 02139, gamarnik@mit.edu, Peter Momcilovic

We consider a multi-server GI/GI/N queueing system in Halfin-Whitt (QED) regime. The analysis of this system for the case of non-exponentially distributed service times presents a significant challenge. We consider the case of discrete service time distributions and show that in the large N limit the queue length process can approximated by a simple discrete time continuous state Markov chain. We then establish an interchange of steady state and large N limits using tightness arguments.

3 - The G/GI/N Queue in the Halfin-Whitt Regime

Josh Reed, Georgia Institute of Technology, School of Industrial and Systems Engineering, 765 Ferst Drive NW, Atlanta, GA, 30332, je-reed@isye.gatech.edu

Consider the G/GI/N queue in the Halfin-Whitt regime. Our first result is to obtain a one dimensional limiting approximation for the properly centered and scaled queue length process. We then proceed to establish an equivalent characterization of our limiting process involving the renewal function associated with the service time distribution. Finally, we conclude by discussing several interesting directions for future research.

4 - Optimality of a Static Priority Policy in an N-Model with Many Servers

Tolga Tezcan, Georgia Institute of Technology, Industrial & Systems Engineering, 765 Ferst Drive NW, Atlanta, GA, 30332, gte778y@mail.gatech.edu, Jim Dai

We consider a parallel-server system that consists of two customer classes and two server pools. The servers in one of the pools can only process jobs from one buffer, whereas the servers in the other server pool can process jobs from either buffer. Service times are assumed to have exponential distribution and to depend only on the server pool providing the service. We show that a static priority scheduling rule is asymptotically optimal in the Halfin-Whitt many-server regime.

■ MD42

Room 403

Recent Advances in Scheduling Research

Cluster: Scheduling

Invited Session

Chair: Chung-Lun Li, Professor, The Hong Kong Polytechnic University, Hung Hom, Kowloon, Hong Kong, lgtclli@polyu.edu.hk

1 - Scheduling Under Stochastic Order

Xiaoqiang Cai, Professor, Department of Systems Engineering and Engineering Management, The Chinese University of Hong Kong, Shatin, N.T., Hong Kong, xqcai@se.cuhk.edu.hk, Liming Wang, Xian Zhou

We study the problem of scheduling a set of jobs on a single machine, to minimize the maximum lateness ML under stochastic order. The processing time, the due date, and the weight of each job may all be random variables. We obtain the optimal sequences in a number of situations.

2 - A Decomposition Technique for Speeding Up Single Stage Scheduling Algorithms

Stefan Bock, Professor, University of Paderborn, Warburger Strafle 100, D-33098, Paderborn, Germany, stbo@uni-paderborn.de, Michael Pinedo

We propose a new decomposition technique that restricts the use of unforced idle time in an optimal schedule for single stage systems with equal processing times and release dates. Based on the decomposition technique, we can solve a variety of well-known single stage scheduling problems $O(n^3)$ times faster if p is constant.

3 - Scheduling Competing Agents with Controllable Processing Times

Guohua Wan, Faculty of Business Administration, University of Macau, Information Systems Program, Taipa, Macau, ghwan@umac.mo

We consider several scheduling problems for competing agents, each having a set of jobs and an objective function, and competing for common processing resources. The processing times of jobs are controllable with additional cost. We study the complexity issues and provide some algorithms for the problems.

4 - Minimizing Weighted Completion Time on a Two-Machine Flowshop

Ya-Mei Tian, PhD Student, National Chiao Tung University, Institute of Information Management, 1001 University Road, Hsinchu, 300, Taiwan, ytian2@gmail.com, Bertrand M.T. Lin

This study considers minimizing weighted completion time in a two-machine flowshop. In view of strong NP-hardness,an efficient exact solution algorithm is demanded. Several branch-and-bound algorithms for the uni-weighted counterpart have been suggested in the literature. We propose a branch-and-bound algorithm incorporating a lower bound and several dominance properties for the weighted version. Computational experiments demonstrate improvement of execution time for composing optimal solutions.

5 - Level Workforce Schedules for 2-Stage Transfer Lines

George Vairaktarakis, Associate Professor, Case Western Reserve University, Weatherhead School of Management, 10900 Euclid Avenue, Cleveland, OH, 44106, United States, gxv5@case.edu, Joseph Szmerekovsky

We define two different workforce leveling objectives for transfer lines - maximin workforce size and range - which seek schedules that minimize workforce size fluctuations from cycle to cycle. For maximin size we develop a polynomial algorithm. The range problem is NP-complete. We develop a very fast optimal alg by finding Hamiltonian cycles in bipartite graphs. We show that range schedules minimize size fluctuations with minor increase in the workforce size.

■ MD43

Room 404

Threats to Life and Limb in 2006

Sponsor: Public Programs and Processes
Sponsored Session

Chair: Arnie Barnett, abarnett@mit.edu

1 - Evaluating the Allocation of Homeland Security Grants
Edward Kaplan, William N. and Marie A. Beach Professor of Management Sciences, Yale School of Management, Yale School of Medicine, Yale Faculty of Engineering, New Haven, CT, 06520-8200, United States, edward.kaplan@yale.edu, Boaz Golany

"Al Qaida and its allies do not attack based on a formula." So stated Sen. Dianne Feinstein in arguing for new legislation mandating that the Department of Homeland Security allocate grants to states based on risk. Comparing the (formula-based) 2005 and (risk-based) 2006 grant allocations reveals no change in the state shares of the homeland security grants pie, with awards remaining proportional to population. Whether such appropriations are appropriate is the subject of this talk.

2 - Modelling Drug Market Supply Disruptions: Where Do All the Drugs Not Go?
Jon Caulkins, Professor of Operations Research and Public Policy, Heinz School of Public Policy and Management, Carnegie Mellon University - Qatar, PO Box 24866, Doha, Qatar, caulkins@andrew.cmu.edu, Haijing Hao

This model predicts how illicit drug production deficits will be "allocated" across downstream markets. Plausible parameterization suggests cocaine markets outside the US serve as a sort of "shock absorber", partially shielding US markets from supply fluctuations, limiting US source country control efforts' ability to reduce domestic drug use.

3 - Exploration of Parole as a Transient State Between Prison and Liberty in the Community
Al Blumstein, University Professor and J. Erik Jonsson Professor of Urban Systems and Operations Research, Heinz School of Public Policy and Management, Carnegie Mellon University, Pittsburgh, PA, 15213, United States, ab0q@andrew.cmu.edu

We examine cross-state variation in the parole process, whereby California is seen to churn their offenders considerably more than others, but their recommitments for new crimes in not anomalous. This study also involves extension of an earlier study of the factors contributing to the dramatic growth of the U.S. incarceration rate.

■ MD44

Room 405

Panel Discussion: The Industry Job Search

Cluster: Job Placement Committee
Invited Session

Chair: Bala Shetty, Professor and Associate Dean, Texas A&M University, INFO Department, 322 Wehner Building, College Station, TX, 77843-4217, United States, b-shetty@tamu.edu

1 - Panel Discussion: The Industry Job Search
Moderator: David Kim, Associate Prof., Oregon State University, 121 Covell, Corvallis, OR, 97330, United States, david.kim@orst.edu, Panelists: Stephan Biller, Alicia Wilson, Rajiv Saxena

The panel will discuss the industry interview process and do's and don'ts associated with the job search. In addition to comments by current and former recruiters, time will be provided for questions and answers.

■ MD45

Room 406

Tutorial: Decision Making Under Conflicting Criteria

Cluster: Tutorials
Invited Session

1 - Decision Making Under Conflicting Criteria
Ravi Ravindran, Professor, The Pennsylvania State University, Department of Industrial Engineering, 310 Leonhard, University Park, PA, 16802, United States, aravi@psu.edu, Jyrki Wallenius

Multiple Criteria Mathematical Programming (MCMP) involves simultaneous optimization of several objective functions, usually conflicting, subject to a system of constraints. We will define MCMP terminology, provide introductory examples, discuss basic concepts, and present general formulations. Then, methods for the solution of MCMP problems will be reviewed. Goal programming, Compromise Programming and Interactive Methods will be discussed as examples of broad categories of MCMP approaches.

■ MD46

Room 407

Applications of Robust Optimization

Cluster: Supply Chain and Operations Engineering
Invited Session

Chair: Daniel Bienstock, Professor, Columbia University, Department of IEOR, New York, NY, 10027, United States, dano@columbia.edu

1 - Robust Inventory Management and Piecewise Linear Optimization
Aurelie Thiele, P.C. Rossin Assistant Professor, Lehigh University, 200 W. Packer Avenue, Bethlehem, PA, 18015, United States, aut204@lehigh.edu

We investigate piecewise linear models that arise in inventory management and present robust optimization approaches to incorporate demand uncertainty without the precise knowledge of the underlying demand distributions. We explain why some models may lead to overconservatism and develop techniques to achieve a tradeoff between the number of parameters deviating from their mean and the robustness of the resulting solution.

2 - Robust Knapsack Polyhedron
Alper Atamturk, Associate Professor, University of California at Berkeley, 4141 Etcheverry Hall, Berkeley, CA, 94720, United States, atamturk@ieor.berkeley.edu, Muhong Zhang

We present a polyhedral study of a knapsack problem with uncertain coefficients in the objective and constraint. We discuss the strength of the valid inequalities and the corresponding separation problems. We also give some simple special cases.

3 - Robust Inventory Management Problems
Nuri Ozbay, nso2001@columbia.edu

We consider setting inventory control policies when the demand is uncertain, in a robust framework. Unlike traditional inventory models which assume that the demand is random with a known distribution, there exists an adversary who picks the demand from a deterministic uncertainty set. We consider the problem for several different types of inventory control policies such as basestock policies and safety stock policies. We present algorithms that scale well to large scale problems.

4 - Popularity versus Optimality: A Consensus Solution for Models of Uncertainty
Geoffrey A. Chua, NUS Business School, Mabel Chou, Melvyn Sim

We propose a new approach for modeling decisions under uncertainty. Our framework integrates the concept of certainty equivalent from expected utility theory with the notion of target setting from the satisfying literature. Given a decision with an uncertain payoff, different decision makers will have varying assessments due to differences in risk attitudes. In response to this, we offer a consensual solution obtained via approval voting, i.e. one that maximizes the number of decision makers who find the proposed solution acceptable in terms of some target certainty equivalent. Interestingly, our results show that the consensus model preserves the problem complexities of convex optimization, discrete optimization, and dynamic programming. Moreover, an appealing by-product of the model is its robustness with a provision for adjusting the conservatism level using the target certainty equivalent. Finally, we provide examples to illustrate the applicability of our model to a wide range of problems.

■ MD47

Room 408

Relational Contracts, Information-sharing and Negotiation

Cluster: Supply Chain and Operations Engineering
Invited Session

Chair: Feryal Erhun, Assistant Professor, Stanford University, MS&E, Stanford, CA, 94305, United States, ferhun@stanford.edu

Co-Chair: Erica Plambeck, Professor, Stanford Graduate School of Business, 518 Memorial Way, Stanford, CA, 94305, United States, plambeck_erica@gsb.stanford.edu

1 - Sharing Forecast Information in a Long-Term Supply Chain Relationship

Justin Ren, Assistant Professor, Boston University School of Management, 595 Commonwealth Avenue, Boston, MA, 02215, United States, ren@bu.edu, Morris Cohen, Teck-Hua Ho, Christian Terwiesch

It is well known that forecast sharing in a supply chain using linear price contracts often leads to inefficiencies as the buyer has an incentive to inflate demand forecasts to ensure sufficient supply. In this paper, we establish conditions under which a buyer operating with a linear price contract reveals demand information truthfully assuming that his business relationship with the supplier is long-term.

2 - Interacting Vertical Capacity Investments: Complements vs. Substitutes

Ozge Islegen, PhD Student, Stanford University, Graduate School of Business, Operations, Information and Technology, Stanford, CA, 94305, United States, oislegan@stanford.edu, Erica Plambeck

In the solar photovoltaic and airplane industries, the timing and level of capacity investment by a manufacturer influences her supplier's capacity investment. When the supplier has complementary capacity and little bargaining power, the manufacturer should build more capacity early. Otherwise, the manufacturer should delay her investment.

3 - Renegotiation-Proof Relational Contracts in Supply Chains

Harish Krishnan, Assistant Professor of Operations and Logistics, Sauder School of Business, University of British Columbia, 2053 Main Mall, Vancouver, BC, V6T 1Z2, Canada, Harish.Krishnan@sauder.ubc.ca, Xuan Zhao, Derek Atkins

Relational contracts often rely on trigger strategies: a permanent breakdown in the relationship is threatened as a response to any deviation. But this is not renegotiation-proof: once punishment starts, firms have an incentive to let bygones be bygones. We propose a "punishment-fits-the-crime" strategy which is renegotiation-proof. This approach can also be viewed as defining the set of self-enforcing Nash-bargaining outcomes. Supply chain applications and extensions of our model are discussed.

4 - Delegation vs. Control of Component Procurement Under Multi-level Asymmetric Information

Enis Kayis, Graduate Student, Stanford University, Management Science and Engineering, Stanford, CA, 94305, United States, ekayis@stanford.edu, Erica Plambeck, Feryal Erhun

Should a manufacturer delegate component procurement to her contract manufacturer, or contract with the component supplier directly, given that both have private cost information? Under simple price-only contracts or complex optimal contracts, the manufacturer should maintain control. We recommend simple-but-effective quantity discount contracts, under which delegation becomes optimal under general conditions.

■ MD48

Room 409

Competitive Inventory Models

Sponsor: Manufacturing & Service Operations Management
Sponsored Session

Chair: Tava Olsen, Associate Professor, Washington University in St. Louis, 1 Brookings Drive, St. Louis, MO, 63130, United States, olsen@wustl.edu

Co-Chair: Rod Parker, Assistant Professor, Yale School of Management, PO Box 208200, New Haven, CT, 06520-8200, United States, rodney.parker@yale.edu

1 - Subsidizing a Supply Chain to Facilitate Coordination

Nicolas Stier-Moses, Assistant Professor, Columbia University, Uris Hall 418, 3022 Broadway, New York, NY, 10027, United States, stier@gsb.columbia.edu, Patrick Maille

It is well known that self-interested agents may introduce inefficiencies in a supply chain. We consider a mechanism based on subsidies that allows agents to redistribute the gains arising from a coordinated solution. Indeed, the budget for subsidies comes from the savings arising from the more efficient solution. The main insight is that the inefficiency of an equilibrium can be reduced by the correct selection of subsidies.

2 - Price and Inventory Competition Between New and Old Technologies

Fernando Bernstein, Associate Professor, Duke University, PO Box 90120, Durham, NC, 27708, United States, fernando@duke.edu, Preyas Desai

We consider a retailer that sells a manufacturer's product line over multiple periods. Upon the introduction of a new product, the manufacturer sets the terms of trade and the retailer selects the price and stocking quantities for both the old and new technologies. We investigate the impact of offering competing technologies on the efficiency of the channel and on the retailer's decisions regarding the breadth of product offerings.

3 - Inventory and Pricing Competition with Strategic Consumers

Gerard Cachon, Professor of Operations and Information Management, University of Pennsylvania, 543 JMHH, Philadelphia, PA, 19104, United States, cachon@wharton.upenn.edu, Robert Swinney

We consider a model with a retailer selling to consumers, some of whom are strategic. A strategic consumer forms rational expectations regarding prices and availability during a selling season and chooses the optimal time to make a purchase. We study how the presence of strategic consumers influences the retailers quantity and pricing decisions. We also consider how a retailer performs if the retailer is unaware of the presence of strategic consumers.

4 - Inventory Management Under Market Size Dynamics

Rod Parker, Assistant Professor, Yale School of Management, PO Box 208200, New Haven, CT, 06520-8200, United States, rodney.parker@yale.edu, Tava Olsen

We investigate the situation where a customer experiencing an inventory stockout at a retailer potentially leaves the firm's market. In classical inventory theory a unit stockout penalty cost has been used as a surrogate to mimic the economic effect of such a departure; in this study we explicitly represent this aspect of consumer behavior, incorporating the diminishing effect of the consumers leaving the market upon the stochastic demand distribution in a time-dynamic context.

■ MD49

Room 410

Planning and Control Issues in Closed-Loop Supply Chains

Cluster: Closed-Loop Supply Chains and Reverse Logistics
Invited Session

Chair: Gilvan Souza, Associate Professor, University of Maryland, Smith School of Business, College Park, MD, 20742, United States, gsouza@rhsmith.umd.edu

1 - The Optimal Disposition Decision for Product Returns
Gilvan Souza, Associate Professor, University of Maryland, Smith School of Business, College Park, MD, 20742, United States, gsouza@rhsmith.umd.edu, Luk N. Van Wassenhove, Evrim Didem Gunes, V. Daniel R. Guide, Jr.

We model the optimal disposition decision for consumer returns: remanufacturing versus recycling. High congestion in the remanufacturing facility delays the product sale at the secondary market, making recycling more attractive. We show that the optimal policy is: if remanufacturing time is larger than k*, then the product is recycled; otherwise it is remanufactured. Our policy provides a 25% median profit improvement compared to a policy that ignores the time value of money.

2 - Remanufacturing Planning with Different Quality Levels for Product Returns
Mark Ferguson, Assistant Professor, Georgia Institute of Technology, College of Management, 800 W. Peachtree Street NW, Atlanta, GA, 30308, United States, Mark.Ferguson@mgt.gatech.edu, Gilvan Souza, Daniel Guide

We consider a remanufacturing production planning problem observed in such firms as Pitney Bowes and HP. Returns are categorized into a finite number of quality categories. Cost depends on the quality category; it is higher at worse levels of returns quality. We solve for the amount of each quality type return to remanufacture, inventory, or recycle each period so that all demand is met and total cost is minimized. Comparisons in costs are made against traditional production planning methods.

3 - Cascade Reuse Over Product Life Cycle
Kate Li, Doctoral Student, Penn State University, 419A Business Building, University Park, PA, 16802, United States, jzl120@psu.edu, Gilvan Souza, Daniel Guide

We explore the options for product reuse over the life cycle of a product by taking into account volume, quality and timing of product returns, technology diffusion, and market potential. We develop a model focused on profit maximization for reverse supply chains based on the system of cascade reuse.

■ MD50

Room 411

Adaptive Inventory Policies in Information-Rich Supply Chains

Sponsor: Manufacturing & Service Operations Management
Sponsored Session

Chair: Yossi Aviv, Associate Professor of Operations Management, Washington University, Campus Box 1133, 1 Brookings Drive, St. Louis, MO, 63141, United States, aviv@olin.wustl.edu

Co-Chair: Julia Miyaoka, Assistant Professor, San Francisco State University, 1600 Holloway Avenue, San Francisco, CA, 94132, United States, jmiyaoka@sfsu.edu

1 - Dynamic Work Release Control in an E-Tailer Warehouse
Jeremie Gallien, Associate Professor, Sloan School of Management, Massachusetts Institute of Technology, E53-389, 30 Wadsworth Street, Cambridge, MA, 02142, United States, jgallien@mit.edu, Theophane Weber

We consider the release control of picking work into a semi-automated pick-to-pack process used by a large e-tailer. The objective is to achieve a high average throughput while maintaining the probability of congestion-induced collapse under an acceptable threshold. Our methodology involves the transient analysis of a serial queueing model, approximate dynamic programming, and simulation. This applied study was conducted in collaboration with an industrial partner.

2 - Optimal Policies and Approximations for a Bayesian Linear Regression Inventory Model
Julia Miyaoka, Assistant Professor, San Francisco State University, 1600 Holloway Avenue, San Francisco, CA, 94132, United States, jmiyaoka@sfsu.edu, Katy Azoury

We consider the periodic review inventory problem where the demand in each period is modeled by a normal simple linear regression model. The state space includes a backward look due to the Bayesian approach and a forward look due to the regression modeling of demand. We show that a base stock policy is optimal and give some strucural results. We also propose a heuristic that provides near optimal results.

3 - New Product Introduction and the Role of Inventory Control
Ozalp Ozer, Assistant Professor, Stanford University, Management Science and Engineering, Terman Engineering Center, Stanford, CA, 94305-4026, United States, oozer@stanford.edu, Onur Uncu

To bring a new product to the market at the right time to ensure profitability is critical for many high technology companies. We will present a stochastic programming framework used to optimize time-to-market and inventory decisions in a high tech firm. We will discuss how inventory decisions impact the strategic NPI decision and the firm's profitability.

4 - Collaborative Forecasting in Supply Chains: Can Trading Partners Trust Each Other?
Yossi Aviv, Associate Professor of Operations Management, Olin School of Business, Washington University, Campus Box 1133, 1 Brookings Drive, St. Louis, MO, 63141, United States, aviv@wustl.edu

We discuss the authenticity of information transferred under an ongoing (multi-period) collaborative forecasting (CF) partnership. Our supply chain consists of two trading partners that are privy to private streams of information that they suppose to share under a CF agreement. However, in equilibrium, actual information shared may be distorted by the parties. Our models enable us to explore conditions under which collaboration may or may not be effective.

■ MD51

Room 412

Planning for and Responding to a Flu Pandemic

Cluster: Planning for and Responding to Disasters
Invited Session

Chair: Richard C. Larson, Professor, Massachusetts Institute of Technology, Engineering Systems Division, E40-231b, Cambridge, MA, 02139, United States, rclarson@mit.edu

1 - Modeling the Transmission of Pandemic Influenza
Marc Lipsitch, Associate Professor, Harvard School of Public Health, Department of Epidemiology, 677 Huntington Avenue, Boston, MA, 02115, United States, mlipsitc@hsph.harvard.edu, Christina E. Mills

Mathematical/computational epidemiology has been pushed to new frontiers by the effort to prepare for pandemic influenza. Key findings will be presented in the context of what questions remain, with examples including logistics, decision-making, ecological understanding, and mathematical characterization of the transmission system.

2 - The Sick Supply Chain: When the Pandemic Hits
Yossi Sheffi, Professor of Engineering Systems, Massachusetts Institute of Technology, 1 Amherst Street, Cambridge, MA, 02139, United States, sheffi@MIT.EDU

How will supply chains be affected by an pandemic outbreak? The US is now more dependent on Chinese manufacturing than on Mideast oil! Which products will be affected by an outbreak in that region of the world? How will US retailers, manufacturers and distributors react? We will discuss these and related questions.

3 - Social Distancing Models to Reduce the Spread of Pandemic Influenza
Richard C. Larson, Professor, Massachusetts Institute of Technology, Engineering Systems Division, E40-231b, Cambridge, MA, 02139, United States, rclarson@mit.edu, Karima Robert Nigmatulina, Katsunobu Sasanuma, Kelley M. Bailey

'Social distancing' implies policies aimed to reduce proximate contacts between healthy people and those who might be infected and contagious. Examples include school closings, tele-commuting, isolation and quarantine. Mathematical reasoning and historical analyses of the 1918-1919 "Spanish Flu" and the more recent SARS demonstrate the effectiveness of social distancing measures to reduce spread of flu infection.

■ MD52

Room 413

Topics in Revenue Management and Pricing

Sponsor: Revenue Management & Pricing

Sponsored Session

Chair: Giuseppe Paleologo, IBM Research, Yorktown Heights, NY, 10598, United States, gappy@us.ibm.com

1 - A Model on Decentralized Dynamic Price and Lead-Time Quotation

Pinar Keskinocak, Associate Professor, ISYE, Georgia Institute of Technology, 765 Ferst Drive, NW, Atlanta GA 30332, United States, pinar@isye.gatech.edu, Banu Yuksel Ozkaya

We study the impact of decentralized decision making within the context of dynamic price and leadtime quotation in a market where the customers are sensitive to quoted price and leadtime. We consider the effect of different market characteristics, decision-making sequences on the optimal decisions and profitability of the system and analyze the inefficiencies that are due to the decentralization of the pricing and lead time decisions.

2 - Right Product, Right Price, Right Time - A Framework for Profitable New Product Introduction

Duru Ahanotu, Decision Architect, Rapt Inc., 625 2nd Street, 2nd Floor, San Francisco, CA, 94107, United States, duru.ahanotu@rapt.com, Michael Goldbach

New product introductions (NPIs) are the life blood of growth in many segments. In high-tech, products introduced within 18 months often contribute over 50 percent of revenue. While mispricing at introduction can have a devastating impact on margin, these pricing decisions are often the most uncertain due to lack of data. This session introduces a framework to improve NPI decisions by providing a typology of NPI decisions each calling for a different pricing strategy and analytical technique.

3 - Theories of Behavior in Principal-Agent Relationships with Hidden Action

Claudia Keser, Research Staff Member, IBM, T.J. Watson Research Center, 1101 Kitchawan Road, Yorktown Heights, NY, 10598, United States, ckeser@us.ibm.com, Marc Willinger

In a laboratory experiment on a principal-agent game we evaluate the predictive success of agency theory to and the FAIR-OFFER theory suggested by Keser/Willinger (2000). We find that fair-offer theory generally predicts observed contract offers better than agency theory. However, the predictive success of the fair-offer theory decreases, while the one of standard agency theory increases when we increase the agent's effort costs (i.e. reduce expected net surplus of a contract).

■ MD53

Room 414

Inventory Management II

Contributed Session

Chair: Oguzhan Vicil, PhD Candidate, School of Operations Research and Industrial Engineering, Cornell University, 285 Rhodes Hall, Cornell University, Ithaca, NY, 14853, United States, ov24@cornell.edu

1 - Integrated Capacity-Inventory Management with Capacity Acquisition Lead Times

Gergely Mincsovics, Technische Universiteit Eindhoven, PO Box 513, Eindhoven, NB, 5600MB, Netherlands, g.z.mincsovics@tm.tue.nl, Tarkan Tan, Osman Alp

We discuss an integrated model for inventory and flexible capacity management under non-stationary, stochastic demand and positive lead times for temporary capacity acquisition. We analyze the characteristics of the optimal policy and evaluate the value of utilizing flexible capacity as well as the value of shortening acquisition lead times.

2 - Inventory Policies for Selective Assembly

Tim Urban, Professor, The University of Tulsa, Operations Management, 600 South College Avenue, Tulsa, OK, 74104, United States, urbantl@utulsa.edu

Selective assembly entails classifying and matching two or more mating components prior to assembly in order to achieve a high-precision assembly with relatively low-precision components. A great deal of research has been conducted on identifying suitable binning strategies for selective assembly, yet very little has been done on determining appropriate inventory-control policies. We present a stochastic inventory model in which the relevant quality characteristic follows a known distribution.

3 - Learning and Forgetting in Setups: Algorithm, Forecast Horizons and Managerial Insights

Sunantha Teyarachakul, Assistant Professor, Minnesota State University Moorhead, 1104 Seventh Avenue South, Moorhead, MN, 56563, United States, teyarach@mnstate.edu, Suresh Chand

Our paper addresses the impacts of learning and forgetting in setups on the batch-sizing decisions. Our optimal dynamic-programming algorithm and the important model properties are applicable to any realistic functional forms of learning and forgetting in setups. A number of interesting properties result in computation reduction. Finally, we are the first to analyze the issue of decision/forecast horizon under the presence of setup learning and forgetting.

4 - Managing Stochastic Inventory with Free Shipping Option

Bin Zhou, PhD Candidate, Rutgers University, 180 University Avenue, Newark, NJ, 07102, United States, zhou@rbs.rutgers.edu, Michael Katehakis, Yao Zhao

We consider a periodic-review inventory model where the ordering cost is a linear function of the order quantity, and the shipping cost is a fixed constant whenever the order size is less than the minimum free shipping quantity (MFS), and it is zero whenever the order size is larger than MFS. Demands in different time periods are independent random variables. We present the optimal policy and its structural properties. An efficient heuristic policy of simple structure is also provided.

5 - An Exact Optimal Solution to a Threshold Inventory Rationing Model for Two Priority Demand Classes

Oguzhan Vicil, PhD Candidate, School of Operations Research and Industrial Engineering, Cornell University, 285 Rhodes Hall, Cornell University, Ithaca, NY, 14853, United States, ov24@cornell.edu, Peter Jackson

We consider a model consisting of two priority demand classes exhibiting mutually independent stationary Poisson demand, i.i.d order lead times, an (S-1,S) ordering policy, and a threshold level-based allocation and backorder clearing policy. Heuristic solutions for this model have been proposed in the past. Our contribution is an exact analysis of the stationary probabilities and an efficient algorithm for finding the minimal stock required to satisfy demand class-specific fill rate constraints.

■ MD54

Room 415

Interface of Operations and Marketing II

Cluster: Operations and Marketing for Emerging Markets

Invited Session

Chair: Mei Xue, Assistant Professor, Boston College, 350 Fulton Hall, 140 Commonwealth Avenue, Chestnut Hill, MA, 02467, United States, xueme@bc.edu

1 - The Effect of Capital Budgeting on a Multi-Product Stocking Problem

Avi Giloni, Associate Professor, Sy Syms School of Business, Yeshiva University, 500 West 185th Street, New York, NY, 10033, United States, agiloni@ymail.yu.edu, Vishal Gaur, Ganesh Janakiraman

We model the inventory decisions of a retailer serving demand for several products, and facing a capital budget constraint. Demand processes evolve with time requiring forecast updating by the retailer. Our analysis shows the impact of product variety and capital budgeting on the bullwhip effect along with methods to mitigate this effect. The paper is motivated by a production planning problem encountered at a bicycle manufacturer selling through multiple independent small-scale retailers.

2 - Supply Chain Contracting Under Asymmetric Information and Competition

Shilu Tong, Department of ISMT, 408A, Tower B, HKUST, Hong Kong, China, tongsl@ust.hk, Albert Ha

We consider the problem of designing optimal contracts for supply chains under horizontal competition and asymmetric information. Based on a three-stage contracting game model, we conduct a comprehensive comparison of the performance of the supply chains as well as the individual firms under different information structures. We also consider the issue of investing in vertical information sharing in the context of supply chain competition.

3 - Pricing and Inventory Control with Two-Sided Uncertainty

Thomas Weber, Assistant Professor, Stanford University, Management Science and Engineering, Terman Engineering Center, Stanford, CA, 94305-4026, United States, webert@stanford.edu, Claire Tomkins

We consider the optimal pricing and inventory control in the presence of correlated supply and demand uncertainty. The results are applied to the pricing and inventory decisions of a large intermediary in the California water market.

4 - Optimal Capacity Investment of a Multiple Channel Service Delivery System

Jun Zhang, Assistant Professor, Tulane University, A. B. Freeman School of Business, New Orleans, LA, 70123, United States, jzhang4@tulane.edu, Mei Xue

We study the optimal capacity investment problem of a multiple channel service delivery system that consists of a physical employee- serviced channel and one substitutable virtual self-serviced channel. We study the impact of demand variability and customer efficiency on the capacity investment levels.

■ MD55

Room 416

Technology Management Applications in Service Industry

Contributed Session

Chair: Avnish Rastogi, Providence Health Care System, 11308 SW 68th Parkway, Tigard, OR, 97223, United States, avnish.rastogi@providence.org

1 - Roadmapping Technologies for Energy Services

Tugrul Daim, Portland State University, Portland, OR, 97201, United States, tugrul@etm.pdx.edu, Mike Hoffman

Technology roadmapping (TRM) is a comprehensive approach for strategy planning to integrate science/technological considerations into product and business aspects as well as to provide a way to identify new opportunities in achieving a desired objective from the development of new technologies. This paper presents a technology roadmap developed for Energy Efficiency and Power Transmission at Bonneville Power Administration (BPA). The paper presents the technology roadmaps developed through workshops with experts to identify the important R&D items to accomplish in the next few years for energy efficiency and power transmission in the northwest.

2 - Impact of Information Technology on Competitiveness in Financial Services

Ferhan Cebi, Technical University, cebife@itu.edu.tr, Dundar Kocaoglu

This paper presents the results of an exploratory study to measure and evaluate the benefits of IT and its impact on competitiveness of organizations in the financial services sector. More than 1,900 executives in U.S. financial institutes were contacted to identify the "Competitiveness Factors" resulting from IT, and to develop a series of indices such as the Factor Index, the Competitiveness Measure Index, and the System Competitiveness Index to quantify the judgments of the decision makers about the impacts of IT in banks, insurance companies and other financial institutions.

3 - Optimizing Decisions for Improved Health: Applications in Childbirth and Domestic Violence Patient Decision-Making

Karen Eden, Assistant Professor, Oregon Health & Science University, BICC, Portland, OR, 97239, United States, edenk@ohsu.edu, Dondar F. Kocaoglu

Basic concepts in decision sciences are now emerging in healthcare. This paper describes two computerized decision aids developed and deployed on childbirth and domestic violence, based on the analytic hierarchy process. Decision aid feedback is matched with appropriate community and healthcare resources to aid the user in optimizing her decision for improved health.

4 - Exploring Emerging Technologies in Health Care Services

Avnish Rastogi, Providence Health Care System, 11308 SW 68th Parkway, Tigard, OR, 97223, United States, avnish.rastogi@providence.org, Tugrul Daim

Emerging technologies in healthcare are converging to revolutionize home and self-care systems in the United States. These technologies are making it possible for people to play a greater role in maintaining their health. These systems are stirring towards a proactive prevention-oriented, consumer-driven model for healthcare that includes innovations such as "smart devices" that can "think" for themselves, customized wearable devices, electronic patient records, and wireless Internet-linked systems - all expected to deliver convenient, user-friendly, intelligent health care in the home. This paper explores emerging technologies in healthcare services and utilizes technology forecasting tools to determine their adoption in the market.

Tuesday, 8:00am - 9:30am

■ TA01

Room 301

Information Aggregation

Sponsor: Optimization/ Network and Combinatorial Optimization
Sponsored Session

Chair: Moses Charikar, Assistant Professor of Computer Science, Princeton University, 305 Computer Science Building, 35 Olden Street, Princeton, NJ, 08540, United States, moses@cs.princeton.edu

1 - Aggregating Inconsistent Information: Ranking and Clustering
Nir Ailon, Institute for Advanced Study, School of Mathematics, Einstein Drive, Princeton, NJ, 08540, United States, nir.ailon@gmail.com, Moses Charikar, Alantha Newman

A ranking of web pages is to be computed from outputs of several search engines. A clustering of microarray data is to be computed from outputs of several clustering heuristics. More generally: How do we combine possibly contradicting information from different sources? These questions are in the intersection of combinatorial optimization and social choice theory. I will survey recent work related to their computational aspects and present new and improved approximation algorithms.

2 - Common Voting Rules as Maximum Likelihood Estimators
Vincent Conitzer, Assistant Professor, Levine Science Research Center, Box 90129, Duke University, Durham, NC, 27708, United States, conitzer@cs.cmu.edu, Tuomas Sandholm

One view of voting/rank aggregation is the following. There exists a ``correct" outcome (winner/ranking), and each voter's vote corresponds to a noisy perception of this correct outcome. If we are given the noise model, then for any vector of votes, we can compute the maximum likelihood estimate of the correct outcome. We study the following question: For which common voting rules does there exist a noise model such that the rule is the maximum likelihood estimator for that noise model?

3 - Model Free Stability Results in Clustering
Marina Meila, Assistant Professor, University of Washington, Department of Statistics, Box 354322, Seattle, WA, 98195, United States, mmp@stat.washington.edu

If we have found a "good" clustering C of data set X, can we prove that C is not far from the (unknown) best clustering C* of this data set? Perhaps surprisingly, the answer to this question is sometimes yes. We can show bounds on the distance(C, C*) for two clustering cost functions: the Normalized Cut and the squared distance cost of K-means clustering. These bounds exist in the case when the data X admits a "good" clustering for the given cost.

4 - Aggregating Forecasts of Probability from Incoherent and Abstaining Experts
Joel Predd, RAND Corporation, 4570 Fifth Avenue, Suite 600, Pittsburgh, PA, 15213, United States, jpredd@rand.org, Sanjeev Kulkarni, Daniel Osherson, H. Vincent Poor

In this talk, an algorithm is developed for aggregating forecasts of probability from incoherent and abstaining experts. The algorithm approximately solves an NP-Hard problem, admits a provable performance guarantee, and is demonstrated to be orders of magnitude faster than existing tools when tested on several real-world data sets. The tool is practically relevant to risk analysis, since it enables an elicitation methodology in which judges have freedom to choose the events they assess.

■ TA02

Room 302

Joint Session Open-Source/ICS: Open Source Modeling Tools

Cluster: Open-Source Software: Open Source, Open Standards, Open Data, INFORMS Computing Society
Invited Session

Chair: Leo Lopes, Assistant Professor, University of Arizona, 1127 E. James E. Rogers Way, Room 111, Tucson, AZ, 85721, United States, leo@sie.arizona.edu

1 - Exporting Models as POAMS Web Services
Victor Foulk, Systems and Industrial Engineering, University of Arizona, Tucson, AZ, 85721, United States, vfoulk@email.arizona.edu, Leo Lopes

The POAMS system contains some interface libraries designed to export a Mathematical Model, as opposed to an Instance, as a Web Service. In this talk, we will illustrate two aspects of POAMS web services: the benefits this approach affords to users of mathematical programming models; and the steps model creators must take to enable their models to be exported as Web Services.

2 - Extending an Open Source Algebraic Modeling Software to Support a Algorithm Development
Suleyman Karabuk, Assistant Professor, University of Oklahoma, School of Industrial Engineering, 200 West Boyd, Room 124, Norman, OK, 73019, United States, karabuk@ou.edu

We propose extending algebraic modeling languages so that solution algorithms that are based on iteratively modifying, manipulating, and solving a model are supported at a high abstraction level. We specifically focus on Stochastic Programming models and mathematical decomposition algorithms. We identify the necessary language constructs, and develop a design based on the open source modeling software APLEpy.

3 - ZIMPL: A Solver Independent Open Source Modelling Language
Thorsten Koch, Senior Scientist, Konrad-Zuse-Zentrum für Informationstechnik Berlin, Takustrafle 7, 14195 Berlin-Dahlem, Germany, koch@zib.de

ZIMPL is a freely available open source algebraic modelling language for describing linear mixed integer programs. It is very portable and can be used either standalone, embedded into an application, or linked to a solver. We will give an overview of the language itself and its interfaces, mention unique features, discuss recent and planned enhancements, and report experiences made when using ZIMPL in courses and industry pro8jects.

■ TA03

Room 303

Discrete and Continuous Global Optimization

Sponsor: Optimization/ Global Optimization
Sponsored Session

Chair: Hanif D. Sherali, W. Thomas Rice Chaired Professor of Engineering, Virginia Tech, 250 Durham Hall, Blacksburg, VA, 24061, United States, hanifs@vt.edu

1 - An Improved Linearization Strategy for 0-1 Quadratic Programming Problems
J. Cole Smith, Associate Professor, University of Florida, ISE Department, 303 Weil Hall, Gainesville, FL, 32611-6595, United States, cole@ise.ufl.edu, Hanif D. Sherali

We present a new linearized model for the 0-1 quadratic programming problem, whose size is linear in terms of the number of variables in the original nonlinear problem. In this talk, we discuss three alternative reformulations, each varying in model size and tightness. We also discuss the theoretical relationship of our models to the standard linearization of such problems, and provide computational results that test the relative efficacy of each formulation.

2 - Convex Extensions, Inclusion Certificates and Disjunctive Programming
Mohit Tawarmalani, Assistant Professor, Purdue University, School of Management, West Lafayette, IN, 47907, United States, mtawarma@purdue.edu

We define inclusion certificate based on convex multipliers required to assert the inclusion of a point in the convex hull of a disjunctive set. The inclusion certificates are shown to be related to the product-factors used in relaxation schemes such as Lift-and-Project and the Reformulation Linearization Techniques. Insights into relaxation hierarchies are developed.

3 - On Continuous Formulations of Discrete Optimization Problems
Sergiy Butenko, Assistant Professor, Texas A&M University, College Station, TX, 77843, United States, butenko@tamu.edu, Balabhaskar Balasundaram

This talk will present alternative continuous formulations of several optimization problems on graphs. Some of these formulations will be used to derive optimality conditions, heuristics and bounds on the optimal values.

4 - Quantum Control of Multi-Particle Simulated Annealing
Orcun Molvalioglu, Graduate Student, University of Washington, Industrial Engineering, Seattle, WA, 98195, United States, orcun@u.washington.edu, Zelda Zabinksy, Wolf Kohn

We represent the state evolution of Multi-Particle Simulated Annealing as a quantum system using the Schrödinger equation. We investigate feedback control strategies for generating efficient particle trajectories. As a part of the multi-particle algorithm we design a meta-controller compatible with the quantum representation of the algorithm.

■ TA04

Room 304

Functions of Binary Variables and Integer Programming

Sponsor: Optimization/ Integer Programming
Sponsored Session

Chair: Peter L. Hammer, Director and Professor, Rutgers University - RUTCOR, 640 Bartholomew Road, Piscataway, NJ, 08854-8003, United States, hammer@rutcor.rutgers.edu

1 - A Unified View of Lift-and-Project Type Procedures
Endre Boros, Professor, RUTCOR, Rutgers University, 640 Bartholomew Road, Piscataway, NJ, 08854-8003, United States, boros@rutcor.rutgers.edu

We prove a common generalization of several lift-and-project type approaches. This result also can be viewed as an algebraic realization of disjunctive programming in the binary case.

2 - Approximating Pseudo-Boolean Functions
Guoli Ding, Professor, Louisiana State University, Department of Mathematics, Baton Rouge, LA, 70803, United States, ding@math.lsu.edu

The purpose of this talk is to present explicit formulas for approximating a pseudo-Boolean function with linear and other low degree functions. These formulas generalize earlier results of Hammer-Holzman and Grabisch-Marichal-Roubens, as well as a result of Charnes-Golany-Keane-Rousseau on Shapley values.

3 - Generating All Maximal Feasible Binary Solutions to Monotone Systems
Vladimir Gurvich, Visiting Professor, RUTCOR - Rutgers University, 640 Bartholomew Road, Piscataway, NJ, 08854, United States, gurvich@rutcor.rutgers.edu

Lawler, Lenstra and Rinnooy Kan (1980) showed that all maximal binary solutions of a knapsack problem can be efficiently generated, and conjectured that the same is not possible for multi-knapsack problems, unless P=NP. We show that in fact this generation problem can be solved "efficiently," in some sense.

4 - On Finding Compact Tree-Based Representations from Observed Dynamic Data
Michel Minoux, Professor, University of Paris, 4 Place Jussieu, Paris Cedex 05, F-75252, France, michel.minoux@lip6.fr

Many dynamic optimization problems require models of time-dependent data (such as temperature, prices on markets, etc.) based on past observations or on anticipated 'scenarios'. We discuss 0-1 integer formulations of the problem of inferring, from given lists of scenarios, compact tree-based models representing such dynamic processes.

5 - Discriminants and Risk Scores in Logical Analysis of Data (LAD)
Tibérius Bonates, Teaching Assistant, Rutgers University - RUTCOR, 640 Bartholomew Road, Piscataway, NJ, 08854-800, United States, tbonates@rutcor.rutgers.edu, Peter L. Hammer

Pseudo-Boolean discriminants represented as weighted sums of LAD patterns are constructed by column generation and shown to accurately separate positive and negative observations. A discriminant-based risk index allows efficient risk stratification, being highly correlated with the probability of adverse events. Applications are presented in medical prognosis and financial risk assessment.

■ TA05

Room 305

Business Process Risk Management

Contributed Session

Chair: Katri Karjalainen, PhD Student, Helsinki School of Economics, Runeberginkatu 14-16, PO Box 1210 FIN-00101, Helsinki, 00101, Finland, katri.karjalainen@hse.fi

1 - Process Improvement: Distributor Usage of e-Commerce Tools
G.G. Hegde, Associate Professor, Katz Graduate School of Business, 348 Mervis Hall, University of Pittsburgh, Pittsburgh, PA, 15260, United States, hegde@pitt.edu, Keith Bittner, Jen Shang

In an effort to decreas after-sales support costs, industrial product manufacturer is encouraging the usage of e-commerce tools among its distributors. Based on a survey of its distributors, the manufacturer prioritizes the e-commerce tools and implements process improvement steps, thereby decreasing the costs of after sales support. The study details the process improvement benefits among the distributors and the manufacturer.

2 - Business Process Management Maturity Model in Service industry
Halime Sarihan, Wells Fargo Bank, William Barnhart Center, Beaverton, OR, 97006, United States, halimei@etm.pdx.edu

This paper provides overview of a Process Management Maturity Model development in service industry based on system science and holistic approach.The model development effort includes several case studies and expert panels for defining the five core factors, i.e. process, metrics, organization, culture and technology. The model has five maturity levels; chaotic, reactive, managed, optimized and excellence.

3 - Risk Management in Business Process Design
Xue Bai, PhD Candidate, Heinz School of Public Policy and Management, Carnegie Mellon University, 4800 Forbes Avenue, Pittsburgh, PA, 15213, United States, xbai@andrew.cmu.edu, Rema Padman, Ramayya Krishnan

We develop a approach to assess the risk of errors in the data in a business process in a graphical modeling context. And we propose an optimization-based method to determine cost-effective ways of embedding controls - procedures that mitigate such risk - in a business process to meet desired risk thresholds. We illustrate our work using risk analysis of an order fulfillment process in a functioning, online pharmacy.

4 - Conflicting Goals in Centralized Organizational Buying
Katri Karjalainen, PhD Student, Helsinki School of Economics, Runeberginkatu 14-16, PO Box 1210 FIN-00101, Helsinki, 00101, Finland, katri.karjalainen@hse.fi

Centralized purchasing is driven by expected cost savings. However, the benefits of centralization do not materialize equally and as fast to all internal units. Differing goals of units can cause suboptimal behavior which hinders transition to the centralized structure and can delay the benefits for the whole organization. Besides prior literature in organizational theory and purchasing, case studies are used to develop a conceptual framework on the internal conflicts of centralized purchasing.

■ TA06

Room 306

Metaheuristics and Vehicle Routing II

Sponsor: INFORMS Computing Society/Heuristic Search
Sponsored Session

Chair: John E. Beasley, Professor, CARISMA, Brunel University, Uxbridge, UB8 3PH, United Kingdom, john.beasley@brunel.ac.uk

1 - Solving a Practical Newspaper Delivery Problem
Tonci Caric, Assistant Professor, University of Zagreb, Faculty of Transport and Traffic Engineering, Vukeliceva 4, Zagreb, HR, 10000, Croatia, tonci.caric@fpz.hr, Ante Galic, Hrvoje Gold

Newspaper distribution company daily delivers newspapers to news stands in Zagreb, Croatia. Problem is recognized as the Pick-up and Delivery VRPTW. Initial solution for the problem is obtained by CWTDH algorithm which is further optimized using SA metaheuristics and lambda-interchange heuristics. Also, post optimisation technique was used for single route improvements. To validate the calculated solution, a test drive was performed to insure that every news stand will be served on time.

2 - Combining Heuristics and Column Generation for Large Bus Driver Scheduling Problems
Leena Suhl, University of Paderborn, Warburger Strasse 100, Paderborn, 33098, Germany, suhl@upb.de, Ingmar Steinzen

The bus driver scheduling problem aims to cover a given set of tasks with crew duties at minimum cost. We formulate the problem as a set partitioning (or covering) model which can be solved using column generation. We have implemented a black-box rule checker to cover work regulations arising in practice. We discuss special hybrid IP heuristics that combine local search and column generation techniques. Computational results for real-world instances for European cities will be reported.

3 - Configuring a Paired-Vehicle Recourse Strategy for the VRP with Stochastic Demand using Tabu Search
Alan Erera, Assistant Professor, Georgia Institute of Technology, 765 Ferst Drive, NW, Atlanta, GA, 30332, United States, alan.erera@isye.gatech.edu, Aykagan Ak

We present a paired-vehicle recourse strategy for the vehicle routing problem with stochastic demands (VRPSD), in contrast to existing research that uses recourse strategies where each vehicle operates independently. A tabu search heuristic is developed to find good solutions given this alternative recourse strategy, and a computational study reveals that the paired recourse strategy may lead to expected travel cost savings of 3% to 17%.

4 - A Cluster-Lightening Route Reduction Strategy for the Vehicle Routing Problem with Time Windows

Monica Gentili, Assistant Professor, University of Salerno, Via Ponte Don Melillo, Fisciano, SA, 84084, Italy, mgentili@unisa.it, Raffaele Cerulli, Francesco Carrabs

We propose a new technique to improve the route elimination phase of any heuristic for the Vehicle Routing Problem with Time Windows and its variants. Test results show the efficacy of our technique in improving the final solution of existing heuristics.

■ TA07

Room 307

Decomposition Methods in Integer Programming

Sponsor: INFORMS Computing Society/Optimization: Computational Optimization and Software

Sponsored Session

Chair: Matthew Galati, Optimization Developer, SAS Institute, 100 SAS Campus Drive, Cary, NC, 27513, United States, matthew.galati@sas.com

1 - Redundancy Generation Strategy in Solving a Class of MIP Problems Using Benders Decomposition Method

Changyong Zhang, PhD Student, Department of Mathematics, University of Southern California, 3620 S. Vermont Avenue, KAP 108, Los Angeles, CA, 90089, United States, changyoz@usc.edu

When Benders decomposition is used to solve a MIP problem, the master problem is usually an IP problem. By simply decomposing the problem into a master problem and subproblems, it may take a significant number of iterations to search the optimal solution, due to the possible looseness of the feasible region. In this abstract, a strategy of generating redundant constraints to tighten the feasible region of the master problem is introduced, based on the study of a typical MIP problem.

2 - Branch-and-Cut-and-Price Methods for Logistics Problems with Limited Risk

Heesu Hwang, PhD Student, The University of Texas at Arlington, PO Box 19017, Arlington, TX, 76019, United States, hhwang@uta.edu, Jay Rosenberger

There exist many uncertainties in a logistics system, e.g., unknown demand, unsteady fuel cost, and machine breakdowns. We present set-packing models that limit risk and develop a lagrangian decomposition method as well as a branch-and-cut-and-price algorithm for medium-sized ship-scheduling problems. We compare the lagrangian decomposition approach with the branch-and-cut-and-price algorithm. Computational results are provided, and extensions are discussed.

3 - DECOMP: A Framework for Decomposition in Integer Programming

Matthew Galati, Optimization Developer, SAS Institute, 100 SAS Campus Drive, Cary, NC, 27513, United States, matthew.galati@sas.com, Ted Ralphs

Decomposition techniques such as Lagrangian Relaxation and Dantzig-Wolfe decomposition are well-known methods of developing bounds for discrete optimization problems. We draw connections between these classical approaches and techniques based on dynamic cut generation. We discuss methods for integrating cut generation and decomposition in a number of different contexts and present DECOMP, an open-source framework that provides a uniform interface for implementation of these various techniques.

4 - Global Optimization of a Class of Non-convex Mixed Integer Non-Linear Programs with Decomposable Structures

Ramkumar Karuppiah, Graduate Student, Department of Chemical Engineering, Doherty Hall, Carnegie Mellon University, 5000 Forbes Avenue, Pittsburgh, PA, 15213, United States, rkaruppi@andrew.cmu.edu, Ignacio Grossmann

We present a specialized deterministic branch and cut algorithm for globally optimizing large-scale non-convex Mixed Integer Non-linear Programming models with block-diagonal structures encountered in two-stage problems. Bounds on the global optimum are obtained by solving convex relaxations of these models, which include cuts derived from Lagrangean decomposition of these models.

■ TA08

Room 308

Management of Innovation and Technological Change

Sponsor: Technology Management

Sponsored Session

Chair: Pedro Oliveira, Assistant Professor, Universidade Catolica Portuguesa, FCEE, Lisbon, Portugal, poliveira@fcee.ucp.pt

Co-Chair: Enno Siemsen, Assistant Professor of Business Administration, University of Illinois at Urbana-Champaign, Department of Business Administration, 350 Wohlers Hall, 1206 S. Sixth Street, Champaign, IL, 61820, United States, siemsen@uiuc.edu

1 - The Siren's Call of Complexity

Enno Siemsen, Assistant Professor of Business Administration, University of Illinois at Urbana-Champaign, Department of Business Administration, 350 Wohlers Hall, 1206 S. Sixth Street, Champaign, IL, 61820, United States, siemsen@uiuc.edu

We model a product design decision context in which a project manager chooses between designs with different levels of complexity. We show that managers with career concerns will under certain conditions voluntarily reduce their probability of succeeding with a project by choosing a complexity level greater than the minimum necessary to deliver the productís customer value.

2 - Mechanisms of Effective Error Detection in Product Development

Phil Gouel, University of Michigan, pgouel@umich.edu, Sebastian Fixson

The development of complex products is a multi-year process involving thousands of engineers. Most established organizations have elaborated systems to detect and correct errors. Using a detailed study in the automotive setting in this paper we investigate empirically the effectiveness of various error detection mechanisms. We provide managerial guidelines for structuring error detection systems.

3 - Technology Interdependence

Diane Bailey, Assistant Professor, Stanford University, Management Science and Engineering, 428 Terman Engineering, Stanford, CA, 94305, United States, diane.bailey@stanford.edu, Jan Chong, Paul Leonardi

Organizational studies of interdependence typically focus on task interdependence while studies of workplace technology almost uniformly investigate a single tool. We unite these literatures by considering how the full range of technologies employed by working engineers are interdependently linked in "design flows." How engineers either "bridge" or "close" gaps in the flow proves instrumental in engineers' work and figures strongly in how technology interdependence shapes their work practices.

4 - Introducing Innovations in Small Economies

Pedro Oliveira, Assistant Professor, Universidade Catolica Portuguesa, FCEE, Lisbon, Portugal, poliveira@fcee.ucp.pt, João B. Assunção

We explore how firm's strategy is shaped by the nature of the environment they operate in. Specifically we study whether smaller economies constitute a major obstacle to the introduction of innovations. A second issue deals with the public policies that are likely to be effective in smaller economies.

■ TA09

Room 309

Multi-Firm New Product Development

Cluster: New Product Development

Invited Session

Chair: Svenja Sommer, Assistant Professor of Management, Krannert School of Management, Purdue University, 403 W. State Street, West Lafayette, IN, 47907, United States, ssommer@purdue.edu

1 - Work Design Choices, Project Characteristics & Project Management Style: A Configuration Approach

Anant Mishra, Doctoral Candidate, Carlson School of Management, 321-19th Avenue S., 3-150 CSOM, Minneapolis, MN, 55414, United States, amishra@csom.umn.edu, Kingshuk Sinha

The tremendous growth in information technology hardware and software has opened up a number of alternatives for designing knowledge based work (e.g. R & D) with work design transcending the boundaries of organizations, professions and countries. We propose that the performance implications from a particular choice of work design, is depends on its fit with project characteristics and the project management style. We use the configuration theory for exploring the meaning of fit in our study.

2 - Managing Technology Uncertainty under Multi-Firm New Product Development

Sreekumar Bhaskaran, Assistant Professor, Southern Methodist University, Cox School of Business, Dallas, TX, 75275, United States, sbhaskar@cox.smu.edu, Vish Krishnan

In this paper, we conceptualize and formulate the co-development of products involving two firms and examine the implications of two collaboration mechanisms found in industrial practice which involve sharing of the development cost and sharing of the development work. We consider both exogenous and endogenous technology uncertainty, and study the impact of these mechanisms on a firm's technology consideration set, product qualities, and profits.

3 - The Firm-Boundary Decision and Its Performance In the Double Helix Model

Jin-Kyu Park, Assistant Professor, Industrial and Systems Engineering, Florida International University, 10555 West Flagler Street / EC 3100, Miami, FL, 33174, United States, jinkp@engin.umich.edu, Young Ro

This study incorporates the concepts of technological uncertainty and the Double Helix Model to investigate how various product architectures affect a firm's boundary decisions. Through industry observations, we test the hypotheses that product architecture and firm boundary are interrelated and that their joint effect plays a critical role in firm dominance. Test results supporting our propositions are mixed.

4 - Organizational Decisions in Co-Development

Svenja Sommer, Assistant Professor of Management, Krannert School of Management, Purdue University, 403 W. State Street, West Lafayette, IN, 47907, United States, ssommer@purdue.edu

In many industries the same supplier develops similar parts for several manufacturers. This creates a risk of information leakage, both about parts developed by the supplier and about final product characteristics. To prevent this, the aircraft industry typically requires its suppliers to create separate organizations, adding substantial costs by doing so. This research explores the circumstances under which requiring separate organizations at the supplier site benefits the manufacturers.

■ TA10

Room 310

Software Demonstration

Cluster: Software Demonstration

Invited Session

1 - Syncopation Software - DPL 7.0 Preview: Portfolio Analysis and More!

Chris Dalton, Syncopation Software, 1623 Main Street, Concord, MA, 01742, CDalton@Syncopation.com

Get a preview of the powerful new features in DPL 7.0! See how you can glean more insights with the Initial Decision Alternatives Tornado and Option Value Diagram. Save time in the pre-presentation crunch with the new endpoint replay capability. Go beyond project-level analysis by analyzing a portfolio of opportunities.

2 - Frontline Systems, Inc. - Simulation Optimization, Excel 2007 and the Premium Solver Platform

Daniel H. Fylstra, Frontline Systems Inc., PO Box 4288, Incline Village, NV, 89450, United States, dfylstra@frontsys.com

See the just-released Premium Solver Platform V7.0, with new support for Excel 2007 and million-row worksheets, large-scale multi-worksheet models, multiple solutions for integer programming and global optimization problems, a new object-oriented API, and a special focus on new simulation optimization capabilities, 10 to 100 times faster than existing tools.

■ TA11

Room 311

Economic Healthcare Models

Contributed Session

Chair: Daesung Ha, Associate Professor, Marshall University, One John Marshall Drive, Huntington, WV, 25755, United States, ha@marshall.edu

1 - Cost-Effective Use of Pharmaceuticals Under a Price-Volume Agreement

Hui Zhang, PhD Candidate, Ivey School of Business, Apt. 537, 291 Windermere Road, London, ON, N6G 2J9, Canada, hzhang@ivey.ca, Gregory Zaric

In this study, we analyze a cost-containment mechanism called price-volume agreement between the government payer and a pharmaceutical manufacturer. We investigate how this agreement is designed and how it influences the pricing and marketing efforts from the drug makers. The results show the value of different pricing methods and information.

2 - Depression and Increased Healthcare Cost

David Czerwinski, MIT Operations Research Center, Room E40-130, 77 Massachusetts Avenue, Cambridge, MA, 02139, United States, dczerwin@MIT.edu, Chris Kryder, Dimitris Bertsimas, Charles Welch

This study focuses on the association between chronic diseases and depression. We studied 11 chronic diseases using a medical claims database consisting of medical and pharmacy insurance claims for 900,000 people over 12 months. Among the findings are that: the largest cost increases occur in diseases involving high utilization of inpatient services; in other diseases prescription costs dominate; and within a disease the prevalence of depression increases linearly with the treatment cost.

3 - Algorithmic Prediction of Health Care Costs and Discovery of Medical Knowledge

Margret Bjarnadottir, Sloan School of Management, Massachusetts Institute of Technology, 77 Massachusetts Avenue, MIT E40-149, Cambridge, MA, 02139, United States, margret@mit.edu, Dimitris Bertsimas, Grant Wang, Michael Kane, Chris Kryder, Rudra Pandey, Santos Vempala

Rising health care costs is one of the world's most important problems. Correspondingly, predicting such costs with accuracy is a significant first step in addressing this problem. In this study we utilize modern data mining methods, classification trees and clustering and claims data from close to half a million members to predict individual health care costs. We furthermore demonstrate through two examples how new medical knowledge can be obtained with our methods.

4 - Optimization of Colorectal Cancer Colonoscopy Strategies Using a Multiobjective Evolutionary Method

Ali Tafazzoli, PhD Student, North Carolina State University, 2002 Gorman Street, Raleigh, NC, 27606, United States, atafazz@ncsu.edu

Colonoscopy is currently known as the most effective method of screening which can reduce both the incidence and mortality associated with colorectal cancer (CRC). Employing a CRC natural history discrete-event simulation model, a state-of-art robust evolutionary algorithm, Non-dominated Sorting Genetic Algorithm-II, is used to develop the set of Pareto-optimal solutions for colonoscopy strategies. Cost, effectiveness, and CRC mortality are three objectives considered in our optimization.

5 - The Effects of Research and Development and Advertising on Firm Value in Pharmaceutical Industry

Daesung Ha, Associate Professor, Marshall University, One John Marshall Drive, Huntington, WV, 25755, United States, ha@marshall.edu, Yoonhee Ha

The study investigates how firm's spending on research and development and advertising affect firm value in pharmaceutical industry. Using panel data regression models, we examine the relationship between firm performance and research and development and advertising expenditures. We find evidence that research and development and advertising have positive and consistent effects on the firm value.

■ TA12

Room 312

Spreadsheet Engineering and Auditing

Sponsor: Spreadsheet Productivity Research

Sponsored Session

Chair: Stephen Powell, Professor, Tuck School of Business, Dartmouth College, Hanover, NH, 03755, United States, Stephen.G.Powell@Dartmouth.EDU

1 - Can Test-Driven Development (TDD) Work for Spreadsheet Engineering?

Alan Rust, Postgraduate Research Student, Dundalk Institute of Technology, Dundalk, Ireland, alan.rust@dkit.ie, Kevin McDaid, Brian Bishop

It is widely accepted that the absence of a structured approach to spreadsheet engineering is a key factor in the high level of spreadsheet errors. This paper proposes and investigates the application of TDD to the creation of spreadsheets. Through a pair of case studies we demonstrate that TDD can be applied to the development of spreadsheets. A supporting tool under development is documented along with proposed research to determine the effectiveness of the methodology and the associated tool.

2 - An Auditing Protocol for Spreadsheets

Stephen Powell, Professor, Tuck School of Business, Dartmouth College, Hanover, NH, 03755, United States, Stephen.G.Powell@Dartmouth.EDU, Barry Lawson, Kenneth Baker

Spreadsheets are routinely used in important business situations, despite the evidence that errors are prevalent. However, little research is available on the best approaches to finding errors. We have developed a formal spreadsheet auditing protocol and applied it to 50 spreadsheets from a wide range of sources. We report on the errors discovered with the protocol. We provide recommendations for best practices in auditing, and in building spreadsheets that make auditing easier.

3 - Detecting Errors in Spreadsheets
Kenneth Baker, Professor, Dartmouth College, Hanover, NH, 03755, United States, Kenneth.R.Baker@Dartmouth.edu, Stephen Powell, Barry Lawson

Previous research on spreadsheet errors has suggested that 2-5 percent of cells contain errors. However, little has been published on what types of errors were discovered, how they were discovered, how they were created, and how users might avoid creating them. We have audited 50 spreadsheets from the field using a repeatable auditing protocol and two types of auditing software. We report on the types of errors we have found and how they were discovered during the auditing process.

4 - How to Create Spreadsheets that are Almost Certainly Correct
Max Henrion, Lumina Decision Systems, Inc., 26010 Highland Way, Los Gatos, CA, 95033, henrion@lumina.com

Even the most careful auditing may not reveal all errors in a spreadsheet. Instead, we translate the spreadsheet into Analytica, fixing any errors (after confirming with authors). The result is two models giving identical results, and high (and appropriate) confidence that both the spreadsheet and Analytica model are correct.

■ TA13

Room 313

Tutorial: Pedagogical Research - An Introductory How-to Workshop

Sponsor: Education (INFORM-ED)
Sponsored Session

Chair: Donna Llewellyn, Director, Georgia Institute of Technology, CETL, 225 North Avenue, Suite 4, Atlanta, GA, 30332-0383, United States, donna.llewellyn@gatech.edu

1 - Pedagogical Research - An Introductory How-To Workshop
Donna Llewellyn, Director, Georgia Institute of Technology, CETL, 225 North Avenue, Suite 4, Atlanta, GA, 30332-0383, United States, donna.llewellyn@gatech.edu

There are many reasons why faculty do educational research. There are even more reasons why faculty should do so. This session is for faculty who are interested in getting started. We will do a brief intro to what is ed. research , how to start a project, & how to think about publishing it. We will provide resources, & do activities to get people started. So, come, network with other like-minded faculty, and bring some questions that you have about what in your teaching is working or not.

■ TA14

Room 314

e-Commerce and the Internet Market

Sponsor: e-Business
Sponsored Session

Chair: Wenjing Duan, Assistant Professor, Department of Information Systems & Technology Management, School of Business, The George Washington University, Washington, DC, 20052, United States, wduan@gwu.edu

1 - Online Consumer Search Depth: Theory and New Findings
Jie Zhang, Jennifer.zhang@utoledo.edu, Olivia Sheng, Xiao Fang

This paper extends the classic search model to analyze online consumer search behavior. The analytical results suggest that search depth is influenced by a variety of factors such as search cost, individual consumer difference, and product characteristics. Evidence is provided by clickstream data related to shopping music CDs, computer hardware and air tickets from July 2002 to December 2002.

2 - On Two Dimensional Product Differentiation and Use of Personalization Technology
Sunil Wattal, Doctoral Candidate, Carnegie Mellon University, 5000 Forbes Avenue, Pittsburgh, PA, 15213, United States, swattal@andrew.cmu.edu, Rahul Telang, Tridas Mukhopadhyay

In this research, we examine the economics of personalization in the case of information goods. We consider a more general 2 dimensional model of product differentiation where consumers attach different importance to various product attributes. We also examine different market structures based on the locational differentiation. We report the equilibrium in terms of the "Quality-Fit" Ratio, which measures the relative strength of consumer preferences on each dimension of product differentiation.

3 - An Empirical Analysis of the Role of Dealers in Electronic Markets
Wenjing Duan, Assistant Professor, Department of Information Systems & Technology Management, School of Business, The George Washington University, Washington, DC, 20052, United States, wduan@gwu.edu, Andrew B. Whinston, Bin Gu

It has been suggested by many scholars that the Internet or electronic markets will eliminate intermediaries by lowering search cost and allowing direct and efficient interactions between sellers and buyers. However, a close examination of the market mechanism indicates that many functions provided by intermediaries are indispensable. This study examines the dealers' role in price discovery and trust building in online auction markets.

■ TA15

Room 315

Online Auctions IV

Cluster: Auctions and e-Commerce
Invited Session

Chair: Wedad Elmaghraby, Assistant Professor, University of Maryland, Robert H. Smith School of Business, 4352 Van Munching Hall, College Park, MD, 20742, United States, Wedad_Elmaghraby@rhsmith.umd.edu

1 - Quantifying Bid Shading in Online Auctions via A Functional Approach
Galit Shmueli, Assistant Professor, University of Maryland, Robert H. Smith School of Business, Van Munching Hall, College Park, MD, 20742, United States, gshmueli@rhsmith.umd.edu, Ravi Bapna, Wolfgang Jank

Winner's curse is a property of common-value auctions where the winner overbids if he bids his truthful value. To avoid over-bidding, bidders must shade their bid. Bid shading has been investigated empirically by several authors. We show that the current test, a regression model that uses only bids from the auction end, has several shortcomings. Our proposed method is based on a functional representation of an auction. It better captures the data structure and models bid dynamics directly.

2 - Market Segmentation within Consolidated E-Markets: A Generalized Combinatorial Auction Approach
Joni Jones, Assistant Professor, University of South Florida, Information Systems and Decision Science, 4202 E. Folower Avenue, CIS1040, Tampa, FL, 33620, United States, jjones@coba.usf.edu, Gary J. Koehler, Robert F. Easley

We analyze an e-market allowing multiple market segments to be served simultaneously with a single generalized combinatorial auction. The mechanism uses rule-based bids that accommodate various kinds of bidders, such as price sensitive or more restricted in their requirements. We demonstrate experimentally, using agent-based simulation, that the rule-based approach handles the wide range of market segments, while maintaining buyer and seller surplus and efficiently allocating goods.

3 - Competition in Sponsored Search Auctions: Do High Quality Firms Bid More?
Siva Viswanathan, Assistant Professor, University of Maryland, 4313 Van Munching Hall, RH Smith School of Business, College Park, MD, 20742, United States, sviswana@rhsmith.umd.edu, Animesh Animesh, Vandana Ramachandran

Sponsored search mechanisms that enable low quality bidders to be listed at the top of the search listings can adversely affect consumer welfare. This study examines the performance of sponsored search mechanisms as measured by the quality of sellers who bid to be listed on Yahoo! and Google.

4 - Managing Online Sales: The Simultaneous Use of Posted Price and Open-Bid Auctions
Hila Etzion, Assistant Professor of Business Information Technology, University of Michigan, Stephen M. Ross School of Business, 701 Tappan Street, Ann Arbor, MI, 48109, United States, etzionh@bus.umich.edu, Erik Johnston, Scott Moore

Extending on previous analytical work, an agent-based simulation is used to derive profits from selling consumer goods online using auctions and posted price in parallel. We first validate our simulation by replicating the known analytical results for a dual channel with sealed-bid auctions. The simulation is then used to explore the profitability and design of dual channels with open ascending-bid auctions, when consumers have heterogeneous delay costs and use a variety of bidding strategies.

■ TA16

Room 316

Revenue Management: Methods and Applications

Cluster: Dynamic Pricing and Forecasting
Invited Session

Chair: Victor Araman, Assistant Professor, New York University, Henry Kaufman Management Center, 44 West 4th Street, New York, NY, 10012, United States, varaman@stern.nyu.edu

1 - On the Value of Dynamic Pricing

Miguel Lobo, Assistant Professor, Duke University, 1 Towerview Drive, Durham, NC, 27708, United States, mlobo@duke.edu

In problems with model uncertainty, dynamic pricing policies with learning are potentially valuable. I define a typology of problems and prove bounds on the value of dynamic pricing for each type and make pricing policy recommendations. Learning is only valuable in uncapacitated problems with elasticity uncertainty, and in capacitated problems with magnitude uncertainty. Price exploration is only valuable in uncapacitated problems where the elasticity uncertainty is above a given level.

2 - Robust Multiproduct Pricing and Learning

Andew Lim, Professor, University of California, Department of IEOR, Berkeley, CA, 94720, United States, lim@ieor.berkeley.edu, George Shanthikumar, Thaisiri Watewai

We consider the problem of robust pricing and discuss an interesting duality relationship that arises in the context of this problem. The duality is a nontrivial extension of the well known equivalence between ``risk-sensitive control'' and ``robust control'' and involves in an essential way the notion of revenue sharing (which comes about because of resource sharing). If there is time, we also consider the problem of robust pricing and learning.

3 - Dynamic Pricing and Customers Reluctance Behavior

Victor Araman, Assistant Professor, New York University, Henry Kaufman Management Center, 44 West 4th Street, New York, NY, 10012, United States, varaman@stern.nyu.edu

We consider the problem of pricing a finite capacity when customers exhibit reluctant behavior, i.e. an arriving customer spends random time observing the price before making a decision to buy or leave the system. We suggest a modeling framework, compute optimal policies and show that neglecting information about "in-the-system" potential sales may lead to suboptimal pricing decisions.

■ TA17

Room 317

Simulation in Financial Engineering

Sponsor: Simulation
Sponsored Session

Chair: Shane Henderson, Associate Professor, Cornell University, School of ORIE, 230 Rhodes Hall, Ithaca, NY, 14853, United States, sgh9@cornell.edu

1 - Malliavin Greeks without Malliavin Calculus

Nan Chen, Assistant Professor, The Chinese University of Hong Kong, Room 709A, William M. W. Mong Engineering Building, Shatin, N. T., Hong Kong, nc2005@columbia.edu, Paul Glasserman

In this paper, we derive and analyze Monte Carlo estimators of Greeks (i.e., price sensitivities). A recent line of work derives estimators through Malliavin calculus. The question of whether one should discretrize first and then differentiate, or differentiate first and then discretize is raised. We show that in several important cases the first route produces the same estimators found through Malliavin calculus, but using only traditional elementary techniques.

2 - An Adaptive Procedure for Estimating Coherent Risk Measures Based on Generalized Scenarios

Barry Nelson, Professor, Northwestern University, Department of IEMS, 2145 Sheridan Road, Evanston, IL, 60208-3119, United States, nelsonb@northwestern.edu, Vadim Lesnevski, Jeremy Staum

Coherent risk measures based on generalized scenarios can be viewed as estimating the maximum expected value from among a collection of simulated "systems." We present a procedure for generating a fixed-width confidence interval for this coherent risk measure. The procedure improves upon previous methods by being reliably efficient for simulation of generalized scenarios and portfolios with heterogeneous characteristics.

3 - Adaptive Control Variates for Pricing Multi-Dimensional American Options

Samuel Ehrlichman, PhD Student, Cornell University, School of ORIE, 294 Rhodes Hall, Ithaca, NY, 14850, United States, se52@cornell.edu, Shane Henderson

We explore a class of control variates for the American option pricing problem. Using regression splines, we approximate the option's value function at each time step and combine the resulting functions to construct a martingale that approximates a "perfect" control variate. Significant variance reduction is possible even in a high-dimensional setting. The technique is applicable to a wide variety of option contract specifications and underlying stochastic processes.

■ TA18

Room 318

Joint Session Counter Terrorism/DAS: Terrorism Risk Analysis

Cluster: Counter Terrorism and OR, Decision Analysis Society
Invited Session

Chair: Detlof von Winterfeldt, Professor, University of Southern Califonia, RTH 310, University Park, Los Angeles, CA, 90089, United States, detlof@aol.com

1 - Advances in Terrorism Risk Analysis

Detlof von Winterfeldt, Professor, University of Southern Califonia, RTH 310, University Park, Los Angeles, CA, 90089, United States, detlof@aol.com

The Center for Risk and Economic Analysis of Terrorism Events (CREATE) has made several advances in risk analysis in the past few years. These include advances in game theory and dynamic decision analysis. This presentation will summarize these advances.

2 - Estimating Likelihood of Terrorist Attacks by Modeling Terrorist Objectives and Values

Richard John, Associate Professor, University of Southern California, Department of Psychology, MC-1061, University Park, Los Angeles, CA, 90089-1061, United States, richardj@usc.edu, Heather Rosoff

Current methods for terrorism risk assessment focus on target vulnerability, terrorist capability, and attack consequence, largely ignoring terrorist motivations. Analogous to PRA methods that use physical, chemical and biological models to estimate key uncertainties, we represent terrorist motivations with utility models of terrorist objectives and values that include uncertainties in attack outcome and terrorist values (e.g., risk attitude and trade-offs among conflicting objectives).

3 - Risk-Based Multiobjective Resource Allocation for Infrastructure Protection

Don Kleinmuntz, Research Professor, University of Southern California, c/o Strata Decision Technology, 2001 S. 1st Street, Suite 200, Champaign, IL, 61820, United States, dnk@strata-decision.com

A comprehensive decision analysis approach for optimal resource allocation to counterterrorism measures is described. The approach incorporates sophisticated analyses of both risk and consequences of an attack, considering health and safety, economic impact, as well as more qualitative consequences. The approach is demonstrated using data from actual sites in California.

4 - Modeling Mitigation: The Case of Katrina

Carl Southwell, Research Assistant, University of Southern California, University Park, Los Angeles, CA, 90089, United States, southwel@usc.edu

This presentation describes a model to evaluate alternative strategies to rebuild and reconfigure the flood and hurricane protection structures in New Orleans. Using influence diagrams, we consider various reinforcement designs and exceedence and breach probabilities. Several strategies, using both hard (i.e., levees and floodwalls) and soft structures (i.e., wetlands reconstruction), are considered.

■ TA19

Room 319

Agent-Based Modelling of Energy Markets

Sponsor: Energy, Natural Resources & The Environment
Sponsored Session

Chair: Augusto Rupérez Micola, Research Fellow, IMD, Chemin de Bellerive 23, Lausanne, Switzerland, Augusto.RuperezMicola@imd.ch

1 - Learning by Duopoly Agents in Bidding for Day-Ahead Electricity Supply

Fred Murphy, Professor, Temple University, The Fox School of Business, 108 Speakman Hall, 1810 N. 13th Street, Philadlephia, PA, 19122, United States, fmurphy@temple.edu, Steve Kimbrough

Standardly, bids by distinct firms in the day-ahead market for electricity are combined to produce a kinked supply curve. We report results from an agent-based model in which a stochastic demand curve for electricity is given exogenously and in which two agents learn to bid to supply electricity. We report on the design of the model, the behavior of various learning regimes, and the

conditions under which tacit collusion by the bidding agents may be arrived at, sustained, and destroyed.

2 - Spot Pricing and Investment Decisions in an Electricity Market Simulator with Adaptive Agents

Nathanael Miksis, University of Massachusetts, Amherst, 220 ELab, Amherst, MA, 01003, United States, nmiksis@engin.umass.edu, Erin Baker

We report on implementing adaptive agents in an electricity market simulator created by EPRI called STEMS. Investment issues are central to market restructuring efforts globally and STEMS is unique in its ability to handle these decision processes. We first cover experience with simple adaptive agents competing in a pure spot market. Later we explore the ability of adaptive agents without tactical predispositions to develop efficient and successful multi-time-period strategies.

3 - Dynamic Testing of Wholesale Power Market Designs: An Agent-Based Computational Approach

Junjie Sun, Economics PhD Candidate, Iowa State University, Economics Department, 280E Heady Hall, Ames, IA, 50011, United States, jjsun@iastate.edu, Leigh Tesfatsion

In 2003 the U.S. Federal Energy Regulatory Commission proposed the Wholesale Power Market Platform (WPMP) for adoption by all U.S. wholesale power markets. Strong opposition to the WPMP persists among some industry stakeholders due largely to a perceived lack of performance testing. In this study we develop an agent-based computational model of a dynamic wholesale power market organized in accordance with core WPMP features, and we report experimental findings for a dynamic 5-node test case.

4 - Generation Portfolios and Market Power

Augusto Rupérez Micola, Research Fellow, IMD, Chemin de Bellerive 23, Lausanne, Switzerland, Augusto.RuperezMicola@imd.ch, Albert Banal-Estanol

We use an agent-based method to study the relationship between the degree of diversification in the generators' portfolios and their ability to exert market power in capacity-constrained price auctions. We analyse cases in which a generation duopoly own varying amounts of base-load and price-setting capacity, while keeping constant industry concentration and market base-load and price-setting capacities. Our results suggest that portfolio structure is an important determinant of market power.

■ TA20

Room 320

DA Arcade 2

Sponsor: Decision Analysis Society

Sponsored Session

Chair: Robert Bordley, Technical Fellow, General Motors Research, 525 Choice Court, Troy, MI, 48084, United States, robert.bordley@gm.com

1 - Lifetime Portfolio/Spending Decisions with Immediate Life Annuities

Sam Bodily, Professor, Darden School, University of Virginia, 100 Darden Boulevard, Charlottesville, VA, 22901, United States, bodilys@virginia.edu

Investment and spending decisions in later life are optimized using a simulation model of uncertainties in longevity, inflation, and returns of various stock and bond categories. The role of immediate lifetime annuities is highlighted, and the best time to annuitize is studied, along with the effects of consumption risk tolerance, bequest motive, and consumption stability preferences.

2 - A Decision Analytic Approach to Robust Product Design

Robert Bordley, Technical Fellow, General Motors Research, 525 Choice Court, Troy, MI, 48084, United States, robert.bordley@gm.com

Robust detailed engineering design generally employs chance-constrained programming(CCP) since designers consider conventional decision analytic assessment techniques inapplicable. Because of the known inconsistency between CCP and decision analysis, this paper uses target-oriented utility theory to develop a decision analytic approach to robust design which is readily applicable to conventional engineering design problems.

3 - Refining Decision Rules in Influence Diagrams

Barry Cobb, Assistant Professor, Virginia Military Institute, Department of Economics and Business, Lexington, VA, 24450, United States, cobbbr@vmi.edu

Two existing influence diagram (ID) models — discrete ID's and mixtures of truncated exponentials (MTE) ID's — are compared to an extension of MTE ID's. This new model — the continuous decision MTE ID — develops more precise decision strategies for continuous decision variables and marginalizes continuous decision variables from the model by replacing them with deterministic chance nodes.

4 - Some Perspectives on Facing Elicitation Difficulties in Multi-Attribute Decision Analysis

Luis Dias, Assistant Professor, INESCC / FEUC, Rua Antero Quental 199, Coimbra, C, 3000-033, Portugal, lmcdias@fe.uc.pt

This presentation brings a methodological discussion on facing elicitation difficulties regarding preference-related parameters. Robustness analysis is contrasted with sensitivity analysis, and its role is discussed. A compromise is proposed regarding the ideas of heroic approximation, requisite modeling, and rigorous modeling. The proposed methodology consists of using robustness analysis throughout the whole decision process as a tool to guide that process, using DSS such as VIP or IRIS.

■ TA21

Room 321

Intertemporal Choice

Sponsor: Decision Analysis Society

Sponsored Session

Chair: Enrico Diecidue, Assistant Professor, INSEAD, Bd. de Constance, Fontainebleau, 77305, France, enrico.diecidue@insead.edu

1 - Time-Tradeoff Sequences for Quantifying and Visualising the Degree of Time Inconsistency

Han Bleichrodt, Erasmus University, PO Box 1738, Rotterdam, ZH, Netherlands, bleichrodt@bmg.eur.nl, Arthur Attema, Peter Wakker, Kirsten Rohde

We propose time-tradeoff (TTO) sequences as a new tool to measure temporal discounting. TTO sequences make it easy to observe and exactly quantify deviations from constant discounting. They are easy to measure, do not need any assumption about utility, and allow for the empirical discrimination between several hyperbolic discounting models that have been proposed in the literature. Experimental testing of TTO sequences suggests some new directions for theories of intertemporal choice.

2 - When I'm 64: Temporal Referencing and Discount Rates

Shane Frederick, Assistant Professor, Massachusetts Institute of Technology, 38 Memorial Drive, Cambridge, MA, 02139, United States, shanefre@mit.edu

We show that people act more patiently when the future is referenced in terms of ages ("When you are 47") than when referenced by corresponding units of time (e.g. "In 9 years.") We propose that an age reference directs attention away from the intervening time period, and toward other considerations.

3 - Beyond Discounting: The Tradeoff Model of Intertemporal Choice

Daniel Read, Professor, Durham Business School, University of Durham, Durham, DH1 3LB, United Kingdom, daniel.read2@durham.ac.uk, Scholten Marc

We propose a tradeoff model of intertemporal choice that draws on an attribute-based process, in which options are first compared on the attributes of timing and outcome magnitude, the two comparisons are then weighted against one another, and the option favored by this process is chosen. Using elementary principles and few parameters we account for the major anomalies in intertemporal choice. We test the model on several data sets and show that it outperforms existing models.

4 - Decision Making with Delayed Resolution of Uncertainty: Measurement of Anxiety.

Enrico Diecidue, Assistant Professor, INSEAD, Bd. de Constance, Fontainebleau, 77305, France, enrico.diecidue@insead.edu, Mohammed Abdellaoui, Ayse Onculer

In most real decisions a considerable time between the choice and the resolution of uncertainty may occur. Individuals may have preferences between gambles that have the same probability distribution over outcomes if they differ in the timing of resolution of uncertainty. Goal of this paper is to elicit individual probability weighting functions with and without delayed resolution of uncertainty.

■ TA22

Room 322

Military Logistics Research at RAND (Session 2 of 2)

Sponsor: Military Applications

Sponsored Session

Chair: Carol Fan, Operations Researcher, RAND Corporation, 1776 Main Street, Santa Monica, CA, 90407, United States, fan@rand.org

1 - Representing the Allocation of Forces, Fires, and Effects Using Genetic Algorithms

Katherine Comanor, Associate Operations Researcher, RAND, 1776 Main Street, Santa Monica, CA, 90407, United States, comanor@rand.org, Christopher Pernin, Lance Menthe, Louis Moore

This presentation describes a combat planning tool that demonstrates the value of intelligence and its impact on route selection on a battlefield. We use a genetic algorithm to search the vast space of potential maneuver schemes, and we parameterize our results based on intelligence of enemy intent, activity, capability, and location. Additionally, our representation considers perceptions of an enemy's ability to adapt and collect intelligence.

2 - Research Supporting Military Medical Readiness

Adam Resnick, Operations Researcher, RAND, 1776 Main Street, Santa Monica, CA, 90407, United States, resnick@rand.org

The Military Health System has a mission to provide and maintain readiness for the provision of medical support during military operations. We evaluate methods presently employed to determine requirements, and identify alternative ways to determine operational readiness requirements and develop an approach to identify risk.

3 - A Model for Designing Multi-Echelon Inventory Networks with Finite Capacity

Ben Van Roo, Doctoral Candidate, University of Wisconsin - Madison, School of Business, 412 West Johnson Street #9, Madison, WI, 53703, United States, bdvanroo@gmail.com, James Rappold

We propose an approach to model and solve the joint problem of facility location, inventory allocation, and capacity investment when demand is stochastic. The objective of the decision problem is to minimize the total expected costs of (1) Opening repair facilities, (2) Assigning each field service location to an opened facility, (3) Assigning capacity levels to each of the opened facilities, and (4) Determining an inventory allocation among the opened facilities and field service locations.

■ TA23

Room 323

Outsourcing and Offshoring of Services

Cluster: Global Services Sourcing

Invited Session

Chair: Gad Allon, Assistant Professor, Northwestern University, Kellogg School of Management, 2001 Sheridan Road, Evanston, IL, 60208, United States, g-allon@kellogg.northwestern.edu

1 - Outsourcing Service Processes to a Common Service Provider under Price and Time Competition

Gad Allon, Assistant Professor, Northwestern University, Kellogg School of Management, 2001 Sheridan Road, Evanston, IL, 60208, United States, g-allon@kellogg.northwestern.edu, Awi Federgruen

In many industries, firms consider the option of outsourcing a service process associated with the goods or services they bring to the market. Often, competing firms outsource this service process to one or more common service suppliers. When they outsource to a common provider, this gives rise to a service supply chain. We develop analytical models to characterize the benefits and disadvantages of outsourcing in industries in which the retailers compete in terms of prices and waiting time.

2 - Managing Offshore Software Projects: Antecedents of Project Performance and Customer Satisfaction

Sriram Narayanan, narayans@kenan-flagler.unc.edu, Jay Swaminathan, Sridhar Balaswbramanian

We study the antecedents of project performance and customer satisfaction in offshore software projects. We develop a conceptual model and validate our hypotheses using a structural equations model. In particular, we focus on the nature of task and type, duration and size of the software project.

3 - Information Asymmetry and Quality in Service Outsourcing

Justin Ren, Assistant Professor, Boston University School of Management, 595 Commonwealth Avenue, Boston, MA, 02215, United States, ren@bu.edu, Fuqiang Zhang

We consider information asymmetry in a one-outsourcer-one-supplier service outsourcing setting. The supplier sets its capacity level and quality level, and serves the customers of the outsourcer. Moreover, the outsourcer does not have perfect information about the cost structure of the service provider. We compare two classes of optimal contracts under this setting: one that is contingent on the cost information, and the other that is non-contingent.

4 - To Offshore or Not to Offshore: Sourcing and Location of Commonality in Multiplant Networks

Lauren Xiaoyuan Lu, PhD Student, Kellogg School of Management, Northwestern University, MEDS Department, 2001 Sheridan Road, Evanston, IL, 60208, United States, lauren-lu@kellogg.northwestern.edu, Jan Van Mieghem

This paper examines the offshoring decision from a network capacity investment perspective. We analyze two strategic network design questions: (1) Should the common part be produced centrally or in two local facilities? (2) If a centralization strategy is adopted for the common component, which market should the facility be located in? We present a transportation cost threshold that captures costs, revenues, and demand risks, and below which centralization is optimal.

■ TA24

Room 324

Daniel H. Wagner Prize Competition Awards

Cluster: The Daniel H. Wagner Prize for Excellence in Operations Research

Invited Session

Chair: Joe Discenza, President and CEO, SmartCrane LLC, 2 Eaton Street Suite 500, Hampton, VA, 23669, United States, jhdiscenza@smartcrane.com

1 - Daniel H. Wagner Prize Competition Awards

Five finalist teams have been selected for 2006 and these five will be presented in three sessions on Monday and the winning entry announced on Tuesday morning.

■ TA25

Room 325

Applications of OR

Cluster: OR Practice

Invited Session

Chair: Michael Gorman, Associate Professor, University of Dayton, Department of MIS, OM and DSC, 300 College Park, Dayton, OH, 45419-2130, United States, michael.gorman@udayton.edu

1 - Operations Research Helps Reshape Operations Strategy at Standard Register Company

Michael Gorman, Associate Professor, University of Dayton, Department of MIS, OM and DSC, 300 College Park, Dayton, OH, 45419-2130, United States, michael.gorman@udayton.edu

Standard Register Company is facing the strategic challenge of "minimizing the total landed costs" to offer competitive pricing in the highly competitive traditional print market segment. We used a trio of operations research techniques - regression, optimization and simulation - to help SR minimize the cost of production orders across its production-distribution network. We estimate annual savings of over $10 million across SR's major product segments.

2 - NBC-Universal Uses a Novel Qualitative Forecasting Technique to Predict Advertising Demand

Srinivas Bollapragada, Senior Operations Researcher, General Electric Global Research Center, 1 Research Circle, Niskayuna, NY, 12309, bollapragada@research.ge.com

NBC-Universal (NBCU) implemented a novel demand prediction and analysis system to support its $ 5 billion annual upfront market. The system uses an innovative combination of Delphi and grass roots forecasting methods to estimate demand. We embedded the forecasting methodology within a workflow system that automates the demand estimates gathering process and seamlessly integrates into NBCU's existing sales systems. Over 200 sales and finance personnel at NBCU currently use this system.

3 - Route Design for Delivery of Voter Polling Booths in Hamilton County, OH

Michael Fry, Assistant Professor, University of Cincinnati, 532 Lindner Hall, QAOM Department, Cincinnati, OH, 45221-0130, United States, fryml@ucmail.uc.edu, Jeffrey Ohlmann

Starting in Spring 2006, Ohio election sites replaced punch card voting machines with electronic voting machines. In Hamilton County, this change requires the delivery of voting machines to over 500 polling locations over the course of several days. We solve this instance of a vehicle routing problem with time windows (VRPTW) using heuristic search techniques and present empirical

analysis of the sensitivity of the objective function to the time window and delivery day constraints.

4 - Application of Vehicle Routing and Multiperiod Assignment Problem to UAV Planning

Rafael Aleman, Graduate Research Assistant, Wright State University, 207 Russ Center, 3640 Colonel Glen Highway, Dayton, OH, 45435, United States, aleman.2@wright.edu, Xinhui Zhang, Raymond Hill

This project addresses assignment of a set of unmanned aerial vehicles to a set of mobile military targets which follow known trajectories over time. A neighborhood-based metaheuristic is developed to match vehicles and targets over time by decomposing the problem into a multiple depot (MDVRP) and split delivery (SDVRP) vehicle routing problem with mobile customers. Our approach introduces a new variant for the VRP and allows obtaining near optimal solutions in a reasonable computational time.

■ TA26

Room 326

Joint Session DM Invited/DM Sponsored: Data Mining Applications in E-commerce

Cluster: Data Mining and Automated Learning, Data Mining
Invited Session

Chair: Wolfgang Jank, Assistant Professor, University of Maryland, 4322 Van Munching Hall, College Park, MD, 20742, United States, wjank@rhsmith.umd.edu

1 - Learning Bayesian Networks for Managing Inventory of Banner Advertisements

Max Chickering, Mad Scientist, Microsoft Live Labs, Max.Chickering@microsoft.com

Many online publishers sell space for banner advertisements on their web pages. These publishers often give impression guarantees that complicate the delivery system due to the need to manage inventory. I will describe a delivery system that allows targeting of both groups of pages (e.g., sports pages) and information about the people browsing the content (e.g., males from Seattle). The system learns a Bayesian network from web-traffic data to predict inventory of the targetable attributes.

2 - Quantile Modeling for Wallet Estimation

Claudia Perlich, Researcher, IBM T.J. Watson Research Center, 1101 Kitchawan Road, Route 134, Yorktown Heights, NY, 10598, United States, perlich@us.ibm.com

Customer's purchasing power. We formalize the notion of customer wallet and present several new predictive modeling approaches that estimate the unobserved customer wallets in a quantile regression framework. The objective is to estimate a quantile of the conditional distribution of the response, rather than the mean. We survey some of the traditional approaches for quantile modeling and propose adaptations of nearest-neighbor and regression-tree approaches to quantile modeling.

3 - Dynamic Price Forecasts in Online Auction Using Functional Models

Wolfgang Jank, Assistant Professor, University of Maryland, 4322 Van Munching Hall, College Park, MD, 20742, United States, wjank@rhsmith.umd.edu, Galit Shmueli, Shanshan Wang

Online auctions are so plentiful that it is hard to decide which auction to bid on. One step into alleviating this decision is to offer dynamic price predictions. We develop a dynamic model for price using functional data analysis. The model is dynamic in that it operates in the ongoing auction. The use of functional data analysis allows the incorporation of price dynamics such as the price velocity and acceleration. We illustrate our approach on a diverse set of eBay auctions.

■ TA27

Room 327

Technometrics

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: Randy Sitter, Professor, Department of Statistics and Actuarial Science, Simon Fraser University, Burnaby, BC, V5A 1S6, Canada, sitter@stat.sfu.ca

1 - Bayesian Methods for Planning Accelerated Life Tests (ALTs)

William Q. Meeker, Professor, Iowa State University, Department of Statistics, Ames, IA, 50011, United States, wqmeeker@iastate.edu, Yao Zhang

This talk describes Bayesian methods for ALTs based on censored data from a log-location-scale distribution. We use a Bayesian criterion based on estimation precision of a distribution quantile at a specified use condition to find optimum test plans. A large-sample normal approximation provides an useful simplification to this planning problem. We present a numerical example to illustrate the methods and to examine the effects of the prior distribution, censoring, and sample size.

2 - Extreme (X-) Testing with Binary Data and Applications to Reliability Demonstration

Vijayan N. Nair, Professor, University of Michigan, Department of Statistics, Campus Box 1107, Ann Arbor, MI, 48109, United States, vnn@umich.edu, David Mease

Traditional reliability demonstration plans require extremely large sample sizes. One solution to this problem is to test products under extreme conditions so that they are more likely to fail. This presentation develops a general framework for this type of extreme testing with binary data. The effects of testing on sample size and power of reliability demonstration plans are discussed. Several applications are used to illustrate the general usefulness of the approach.

■ TA28

Room 328

Optimal DOE in Computer Science and Bioinformatics

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: Theodore Allen, Associate Professor, Ohio State University, 1971 Neil Avenue, 210 Baker Systems, Columbus, OH, 43221, United States, prodec@ameritech.net

1 - Fast Optimal DOE Using Search Engine Technology

Ning Zheng, Graduate Teaching Associate, The Ohio State University, 1971 Neil Avenue, 210 Baker Systems, Columbus, OH, 43210, United States, ningsean@gmail.com, Theodore Allen

Computational speed has limited the criteria that can be used for generation to be fairly irrelevant to objectives, e.g., D-efficiency. However, if designs can be pre-tabulated, google type search engines promise to instantly generate designs from the most relevant criteria imaginable. We explore this and exploitation of continuous design mathematics. Also, we consider benefits for planning experiments for generalized least squares based analysis.

2 - Optimal Design of cDNA Microarray Experiments

Nilgun Ferhatosmanoglu, Doctoral Candidate, The Ohio State University, 1971 Neil Avenue, 210 Baker System, Columbus, OH, 43210, United States, ferhatosmanoglu.2@osu.edu, Theodore Allen

cDNA Microarray experiments are a key tool in efforts to understand the relationships of genes and diseases. We propose a generalization of D-efficiency to address model misspecification and explore its benefits for biologists. Also, we clarify circumstances in which the well known "reference" designs are preferable to "loop" design approaches.

3 - Optimal Design of Experiments for System Identification Applied to Transcriptional Network Modeling

Cenny Taslim, Graduate Administrative Associate, The Ohio State University, 210 Baker Systems, 1971 Neil Avenue, Columbus, OH, 43210, United States, taslim.2@osu.edu, Theodore Allen

An approach based on systems theory and regression was proposed in Science for unraveling genomic transcription network rules. We systematically study this approach and compare it with a proposed method in terms of correct inferences and accuracy of system resilience estimates derived. Also, we suggest avenues for future research.

■ TA29

Room 329

New Directions in Modeling Patient Perspective in Liver Transplantation

Cluster: Joint Cluster Healthcare/ HAS: Healthcare Engineering
Invited Session

Chair: Gorkem Saka, PhD Student, University of Pittsburgh, 1048 Benedum Hall, Pittsburgh, PA, 15261, United States, gos2+@pitt.edu

1 - A New Liver Allocation Mechanism that Increases Patient Autonomy

Gorkem Saka, PhD Student, University of Pittsburgh, 1048 Benedum Hall, Pittsburgh, PA, United States, gos2@pitt.edu, Mark Roberts, Lisa Maillart, Andrew Schaefer

We present a model that gives greater flexibility to liver patients to express their own preferences. A patient with health h is given b(h) points which are to be allocated among L mutually exclusive sets of livers, assuming that b(h) is monotone in factors such as health and waiting time. The primary optimization question is how a patient with given health and preferences should allocate points. We discuss model formulation and several structural properties related to this allocation system.

2 - Robust Dynamic Control of Living-Donor Liver Transplant Timing
David Kaufman, Postdoctoral Associate, Industrial Engineering, University of Pittsburgh, 1048 Benedum Hall, Pittsburgh PA 15261, United States, davidk@engr.pitt.edu, Andrew Schaefer

Markov decision process (MDP) models for timing of living-donor liver transplants require the estimation of underlying transition probabilities from clinical data. Such estimation is a source of ambiguity that is inherent in many medical decision-making problems. We incorporate this ambiguity in a "robust" MDP formulation of the living-donor problem. We discuss choices of conditional measures based on real data for the resulting "inner problem" and implications for optimal control structures.

3 - The Optimal Timing of Liver Transplantation with Risk-Sensitivity Considerations
Atul Bhandari, PhD Candidate, Carnegie Mellon University, 631 Hastings Street, Pittsburgh, PA, 15213, United States, abhandari79@gmail.com, Andrew Schaefer

The only therapy for end-stage liver disease is liver transplantation. Previous research has concentrated on the optimal strategy of risk-neutral patients for transplantation-timing. We extend these results to risk-sensitive patients. We formulate a MDP in which the state is the patient's health. We show sufficient conditions for existence of a structured optimal policy and verify using clinical data. Two identical patients with different risk sensitivity are compared.

4 - Modeling the Patient Perspective on Liver Acceptance using an Explicit Model of the Waiting List
Burhaneddin Sandikci, Graduate Student, University of Pittsburgh, Department of Industrial Engineering, Pittsburgh, PA, 15261, United States, bus2@pitt.edu, Mark Roberts, Andrew Schaefer, Lisa Maillart, Oguzhan Alagoz

End-stage liver disease patients are organized via a "waiting list" to utilize the benefits of transplantation. However, little is known about the effect of knowing the waiting list on the optimum accept/reject decisions. We formulate a Markov decision process model for the liver transplantation problem. The first part of the talk presents appealing results by identifying structural properties of the model and the second part focuses on the results from clinically driven numerical study.

■ TA30

Room 330

Perspectives on Influenza Vaccine Supply Chain

Sponsor: Health Applications Section

Sponsored Session

Chair: Sarang Deo, PhD Candidate, UCLA Anderson School of Management, 110 Westwood Plaza Gold Hall B501, Los Angeles, CA, 90095, United States, sdeo@anderson.ucla.edu

1 - Influenza Vaccine Distribution
Harish Krishnan, Assistant Professor of Operations and Logistics, Sauder School of Business, University of British Columbia, 2053 Main Mall, Vancouver, BC, V6T 1Z2, Canada, Harish.Krishnan@sauder.ubc.ca

Manufacturers invest in distribution systems for flu vaccines, by making it more accessible to patients (e.g., flu vaccine clinics in offices, etc.). We show, counter-intuitively, that firms' investments in accessibility can be socially inefficient. Increasing accessibility benefits patients, but manufacturers invest excessively in this to minimize the risk of stockouts. This makes it difficult to efficiently allocate vaccines during shortages. We study different ways to address this problem.

2 - Stock Positioning in the Flu Vaccine Supply Chain: Issues and Implications
Prashant Yadav, Professor of Supply Chain Management, MIT-Zaragoza Intl Logistics Program, Zaragoza Logistics Center, Avda Gomez Laguna 25, Zaragoza, AR, 50009, Spain, pyadav@zlc.edu.es

We look at the tradeoffs involved in positioning vaccine stock at the physician's practice vs at the distributor. A scheme where pre-ordered stock is maintained at a centralized location for each healthcare provider and is dispacthed upon appointment scheduling is analyzed. The impacts of such a scheme on cold chain breaks and more efficient distribution are modeled.

3 - Optimal Suppy Diversification Under General Supply Risks
Nan Yang, Assistant Professor of Operations Management, Cornell University, 310 Sage Hall, Ithaca, NY, 14853, United States, ny118@columbia.edu, Awi Federgruen

A firm needs to cover uncertain demand for an item by procuring supplies before the sales season from multiple suppliers with random yields. The suppliers differ in yield distributions, costs and capacity levels. The model determines which potential suppliers are to be retained and what size order is to be placed with each. We consider both the problem of minimizing procurement costs subject to a service level constraint and that of minimizing procurement plus inventory and backlogging costs.

4 - Impact of Yield Uncertainty on Cournot Competition: Case of the US Influenza Vaccine Market
Sarang Deo, PhD Candidate, UCLA Anderson School of Management, 110 Westwood Plaza Gold Hall B501, Los Angeles, CA, 90095, United States, sdeo@anderson.ucla.edu, Charles Corbett

Current economic theory predicts that a market characterized by Cournot competition post-entry will experience excess entry and oversupply. However, we show that presence of yield uncertainty in the production process can result in less entry and production than is socially optimal. Using parameter values that approximately represent the US influenza vaccine market, we show that our model offers one potential explanation for the high degree of concentration and undersupply recently observed.

■ TA31

Room 331

Financial Engineering: Methods and Applications

Cluster: Financial Engineering and Risk Management

Invited Session

Chair: Vadim Linetsky, Professor, Northwestern University, IEMS, 2145 Sheridan Road, Evanston, IL, 60202, United States, linetsky@iems.northwestern.edu

1 - State Processes and their Role in Design and Implementation of Financial Models
Dmitry Kramkov, Professor, Carnegie Mellon University, 5000 Forbes Avenue, Pittsburgh, PA, 15217, United States, kramkov@andrew.cmu.edu

We evaluate on state processes and their role in design and implementation of financial models. The concrete topics will include 1) The classification of financial models on "identical" from the point of view of implementation. 2) Pricing of path dependent derivatives 3) Choices of easily implementable multi-factor models.

2 - Liquidity Risk in Dynamic Portfolio Optimization
John R. Birge, Professor, University of Chicago, Graduate School of Business, 5807 S. Woodlawn Avenue, Chicago, IL, 60637, United States, john.birge@chicagogsb.edu

Liquidity poses a challenge for dynamic portfolio optimization due to potential non-convexities and state complexity, caused for example by vesting periods, varying lock-out restrictions, and advance-notice requirements. Ignoring liquidity concerns, especially no-trade constraints, can also lead to substantial sub-optimality. This talk considers the nature of the solution differences from liquidity risks and approximations of the state and value function that allow for efficient computation.

3 - Exotic Options Pricing in Levy Process Models with a Hilbert Transform Approach
Liming Feng, Assistant Professor, University of Illinois at Urbana-Champaign, 117 Transportation Buliding MC-238, 104 S. Mathews Avenue, Urbana, IL, 61801, United States, feng@iems.northwestern.edu, Vadim Linetsky

We present a new approach to price discretely monitored exotic options in Levy process models. The method involves a sequential evaluation of Hilbert transforms. A discrete approximation with exponentially decaying errors is developed based on Whittaker's cardinal series for functions analytic in a strip.

4 - Time Changed Markov Processes in Credit Risk Modeling
Vadim Linetsky, Professor, Northwestern University, IEMS, 2145 Sheridan Road, Evanston, IL, 60202, United States, linetsky@iems.northwestern.edu

We present a rich class of analytically tractable models for the defaultable stock price that may include diffusion, jumps, stochastic volatility, and jump to default. The construction is based on time changing Markov processes with known spectral expansions of the transition semigroup.

■ TA32

Room 332

Topics in Project Management

Cluster: Project Management

Invited Session

Chair: Richard Wendell, Professor, University of Pittsburgh, Katz Graduate School of Business, Pittsburgh, PA, 15260, United States, wendell@katz.pitt.edu

1 - Project Planning with Uncertain Activity Durations

Jonathan Bard, Professor, The University of Texas, 1 University Station C2200, Mechanical Engineering, Austin, TX, 78712, United States, jbard@mail.utexas.edu, Guidong Zhu, Gang Yu

This talk discusses the problem of setting target finish times (due dates) for project activities with random durations. Using two-stage integer linear stochastic programming, target times are determined in the first stage followed by the development of a detailed project schedule in the second stage. The objective is to balance (1) The cost of project completion as a function of activity target times with (2) The expected penalty incurred by deviating from the specified values.

2 - Portfolio Selection with Probabilistic Objective Values Using Multiobjective Evolutionary Algorithms

Paul Salasznyk, PhD Candidate, Rensselaer Polytechnic Institute, 110th Street, CII 5107, Troy, NY, 12180, United States, salasp@rpi.edu, William Wallace

Many organizations have been making efforts to analyze a large set of project proposals in order to choose project portfolios which maximize the performance, meet resource constraints and minimize risk. Multiobjective evolutionary algorithms (MOEA) are well suited for solving optimization problems involving the several, often conflicting objectives in the R&D project portfolio selection problem. We apply this solution method to a problem with probabilistic, interdependent objective values.

3 - Payment Scheduling for a Project with Resource Constraints and Two Clients

Joseph Szmerekovsky, Assistant Professor, North Dakota State University, Putnam Hall, PO Box 5137, Fargo, ND, 58105-5137, United States, joseph.szmerekovsky@ndsu.nodak.edu

The case of a project contractor with two clients is considered. A mathematical programming formulation for the irregular starting time costs problem with resource constraints is presented. The problem is solved to determine how the contractor allocates resources across the two clients' projects. In particular, the effect of the payment schedule chosen by each client is investigated.

■ TA33

Room 333

Modeling Airline Customer Behavior

Sponsor: Aviation Applications

Sponsored Session

Chair: Laurie Garrow, Assistant Professor, School of Civil and Environmental Engineering, Georgia Institute of Technology, 790 Atlantic Drive, NW, Atlanta, GA, 30332, United States, laurie.garrow@ce.gatech.edu

1 - Incorporating the Time of Day Component in Airline Passenger Demand Models

Joan Walker, Boston University, 675 Commonwealth Avenue, Boston, MA, 02215, United States, joanw@bu.edu

An essential element of demand modeling in the airline industry is the representation of time-of-day demand. The objective of this work is to develop airline passenger demand models that explicitly capture the time of day behavioral dimension and are appropriately sensitive to scheduling adjustments. Two key aspects of the behavior are modeled: the preferred time of day for travel for a given individual on a particular trip and the impact of these preferences on itinerary choices.

2 - An Internet Based Pricing and Booking Tool

David Post, CEO, SigmaZen, Bommersheimerweg 31, Bad Homburg, HE, 61348, Germany, david.post@sigmazen.biz

This presentation introduces a pricing and booking tool that airlines are using for the disposal of distressed inventory. The tool is targeted at time-flexible airline travellers and outsources the product specification to the customer. The tool generates attractive incremental revenues but an even greater benefit may be the creation of a rich data set of revealed customer preference data. This is generated from the high numbers of customer interactions as well as the results of the online questionnaire offered to purchasers. Furthermore, this data set may be used to develop sophisticated pricing algorithms.

3 - Air-Passenger Travel Time Demand

Gregory Coldren, President, Coldren Choice Consulting Ltd., 123 South Adams Street, Rockville, MD, 20850, United States, gregorycoldren@yahoo.com, Frank Koppelman

This talk examines air-travel itinerary share models focusing on time-of-day demand. The models hypothesize that itinerary choice is based on a traveler's effort to minimize schedule delay. Functions are estimated to represent passenger departure time preferences. The models differentiate between outbound vs. inbound passengers and between early vs. late schedule delay. Departure time-of-day preference patterns across the different days of the week, service offerings and distances are compared.

4 - Analysis of Exchange and Refund Behavior for U.S. Airlines

Laurie Garrow, Assistant Professor, School of Civil and Environmental Engineering, Georgia Institute of Technology, 790 Atlantic Drive, NW, Atlanta, GA, 30332, United States, laurie.garrow@ce.gatech.edu, Roger Parker, Dan Iliescu

We analyze airline passengers' exchange and refund behavior for multiple airlines using 2004 ticketing data from the Airline Reporting Corporation. Hazard models are used to analyze the probability a ticket will be exchanged and refunded and the timing of the event. Multiple markets allow exploration of differences in leisure and business segments and differences in competitive market structure.

■ TA34

Room 334

Models and Methods for Road Pricing: II

Sponsor: Transportation Science & Logistics

Sponsored Session

Chair: Siriphong Lawphongpanich, Associate Professor, Industrial and Systems Engineering, University of Florida, PO Box 11-6595, Gainesville, FL, 32611, United States, lawphong@ise.ufl.edu

1 - Existence of Nonnegative Pareto-Improving Tolls

Siriphong Lawphongpanich, Associate Professor, Industrial and Systems Engineering, University of Florida, PO Box 11-6595, Gainesville, FL, 32611, United States, lawphong@ise.ufl.edu, Yafeng Yin

In this talk, we consider nonnegative Pareto-improving toll vectors that improve the social benefit without making anyone worse off. Although such tolls are more likely to be accepted by the general public, they may not exist in all cases. Our focus is on establishing existence conditions when the travel demands are either fixed or elastic.

2 - Road Pricing and Regulation on a Large Mixed-Ownership Network

Lei Zhang, Assistant Professor, Civil, Construction, and Environmental Engineering, Oregon State University, 220 Owen Hall, Corvallis, OR, 97331, United States, lei.zhang@oregonstate.edu

Stimulated by the revived interest in private roads, this paper develops a model to study the economic impact of mixed ownership structures in a large-scale network. Constrained by travel demand patterns and road supply costs, public and private road authorities adopt pricing and investment strategies to achieve their welfare and profit objectives respectively. Potential regulatory needs and strategies are also identified and their effectiveness analyzed.

3 - Internalizing Emission Externality on Road Networks

Yafeng Yin, Assistant Professor, University of Florida, 365 Weil Hall, Box 116580, Gainesville, FL, 32611, United States, yafeng@ce.ufl.edu, Siriphong Lawphongpanich

This paper addresses issues relevant to internalizing traffic emission externality on road networks. We show that the first-best congestion pricing schemes do not necessarily lead to less emissions, and then prove there always exists a nonnegative charging scheme that induces a flow distribution with minimum emissions. We provide a bound on the percent reduction in emissions achievable by any charging scheme, and then offer methods for computing charges that alleviate congestion and emissions.

■ TA35

Room 335

Dynamic Traffic Network Modeling Advances II

Sponsor: Transportation Science & Logistics

Sponsored Session

Chair: S. Travis Waller, Assistant Professor, University of Texas at Austin, 1 University Station C1761, Austin, TX, 78705, United States, stw@mail.utexas.edu

1 - Calibration and Validation of the Anisotropic Mesoscopic Simulation (AMS) Model

Yi-Chang Chiu, Assistant Professor, University of Arizona, PO Box 210072, Tucson, AZ, 85721, United States, chiu@utep.edu, Houbing Song

The Anisotropic mesoscopic Simulation (AMS) model is a mesoscopic traffic simulation approach that is based on directional influence of car-following mechanism. This talk gives an overview of the model with the focus on the calibration and validation procedure and results of the AMS model using the NGSIM data.

2 - A Shipper-Carrier Dynamic Freight Assignment Model Using a Variational Inequality Approach

Bhuwan Agrawal, Department of Civil and Environmental Engineering. Northwestern University, b-agrawal@northwestern.edu

Abstract not available at this time

3 - An Inner Approximation Algorithm for the Discrete Time Varying User Equilibrium Problem

Athanasios Ziliaskopoulos, Department of Mechanical and Industrial Engineering, University of Thessaly, Volos, 38334, Greece, ziliasko@yahoo.com

Traffic assignment models usually assume a convex relationship of link travel time with flow. This paper argues that this is contradictory to what is observed on actual street networks, where the same flow conditions can be observed under at least two states of traffic: a congested state with high link travel time and an un-congested one with lower travel time. A 2-link example network is solved using a Greenshields type density based link performance function and is used to explain elementary concepts. Finally, some thoughts on potential formulations are discussed that are consistent with traffic flow models without, however, making an effort to propose a tractable one.

■ TA36

Room 336

Urban Transportation Planning Models VI: Dynamical Systems Approaches to Modeling Traffic Dynamics

Sponsor: Transportation Science & Logistics

Sponsored Session

Chair: Fan Yang, ESRI, Inc., 380 New York Street, Redlands, CA, 92373, United States, fyang@esri.com

Co-Chair: Wen-Long Jin, Associate Professor, University of Science and Technology of China, Department of Automation, PO Box 4, Hefei, AH, 230027, China, wljin@ustc.edu.cn

1 - A Dynamical System Model of Dynamic Traffic Assignment Problem

Wen-Long Jin, Associate Professor, University of Science and Technology of China, Department of Automation, PO Box 4, Hefei, AH, 230027, China, wljin@ustc.edu.cn

We introduce a dynamical system model of dynamic traffic assignment problem, in which the aggregate route choice behavior is governed by O-D First-In-First-Out violation among different paths, and traffic dynamics is modeled with kinematic wave models of network vehicular traffic. The equilibria of the new dynamical system can be user equilibria or so-called partial user equilibria. A numerical solution method is developed to find dynamic user equilibria.

2 - A Unifying Framework on Day-to-Day Traffic Dynamics

Fan Yang, ESRI, Inc., 380 New York Street, Redlands, CA, 92373, United States, fyang@esri.com, Bin Ran

This study proposed a unifying framework to model drivers' day-to-day route choice behavior, especially under the condition that drivers can only access limited information and exhibit incomplete rationality. The behavior rules are given such that the day-to-day traffic flow may converge to user equilibrium, stochastic equilibrium, system optimal and bounded user equilibrium.

■ TA37

Room 337

Data Confidentiality and Disclosure Limitation I

Sponsor: Information Systems Society

Sponsored Session

Chair: Krish Muralidhar, Professor, University of Kentucky, School of Management, Lexington, KY, 40506-0034, United States, krishm@uky.edu

1 - Anonymous Data Collection Protocols with Participation Constraints

Robert Garfinkel, Professor, University of Connecticut, School of Business, Storrs, CT, 06029, United States, Rob.Garfinkel@business.uconn.edu, Ram Gopal, Rajeev Kumar

We develop flexible, cryptography-based anonymous data collection protocols that can collect data from individuals without the use of a trusted third party. The first achieves full anonymity with communication only among the individual responders. The second achieves the same goal with the addition of an untrusted server. We also propose schemes that allow an individual to query other's confidential data in a distributed environment before deciding whether to participate.

2 - Preserving Privacy When Sharing Distributed Transactional Data

Jing Hao, PhD Student, The University of Texas at Dallas, School of Management, 2601 N. Floyd Road, SM 33, PO Box 830688, Richardson, TX, 75083, United States, jhao@utdallas.edu, Syam Menon, Sumit Sarkar

When data to be shared across organizations is stored in a distributed manner by the data owner, the owner must consider hiding sensitive patterns not only in the consolidated database but also within each component of the distributed database. We present an integer programming formulation for minimizing data distortion while hiding sensitive patterns, along with illustrative examples. A heuristic procedure is also presented to address problems that cannot be solved to optimality.

3 - Data Masking for Privacy-Preserving Estimation - Some Results

Rathindra Sarathy, Professor, Oklahoma State University, Spears School of Business, Stillwater, OK, 74078, United States, sarathy@okstate.edu, Mohammad Al-Ahmadi, Krish Muralidhar

We present results of an approach based on conditional expectations for Privacy Preserving Data Estimation. The approach uses machine-based learning to obtain the relationships among confidential and non-confidential variables in the form of conditional expectations and applies existing methods of data perturbation and data shuffling to optimize data security while providing data utility. The approach can be applied even when the realationships are non-monotonic, under certain conditions.

■ TA38

Room 338

Disaster/Accident Management

Contributed Session

Chair: Zhuoxiu Zhang, Mississippi State University, PO Box 9542, Mississippi State, MS, 39762, United States, zz52@msstate.edu

1 - Statistical Analysis of Accidents on ETC Lane

Toshiharu Hasegawa, Professor, Nanzan University, 27 Seirei-cho, Seto, 489-0863, Japan, thasegaw@it.nanzan-u.ac.jp, Yasuharu Shibata, Shin-ichi Matsuda, Takaji Kitamura

Number of Electronic Toll Collection (ETC) system users in Japanese toll roads is steadily increasing. At the same time, number of accidents on ETC lanes is increasing. This paper deals with the statistical analyses of accidents related with ETC systems of a urban toll expressway. Correlations between the factors are derived to propose policies to reduce ETC system related accidents.

2 - Queuing Systems with Multiple Types of Failure

Ozgecan Uluscu, PhD Student, Rutgers, The State University of New Jersey, 96 Frelinghuysen Road, CoRE Building, Room 201, Piscataway, NJ, 08854, United States, ozgecanu@gmail.com, Tayfur Altiok

We consider queuing systems with multiple types of failure, motivated by the vessel traffic in the Istanbul Strait. We studied average vessel waiting times in cases with one class of vessels subject to multiple types of class-independent interruptions, as well as with priority classes and multiple types of class-dependent interruptions.

3 - Feasibility of Employing Operations Research for Optimizing Hurricane Evacuation Strategies

Fengxiang Qiao, Assistant Professor, Texas Southern University, Department of Transportation, TSU, 3100 Cleburne Street, Houston, TX, 77004, United States, qiao_fg@tsu.edu, Lei Yu

This research identifies the feasibility of using novel and pioneering Operations Research methodologies for the optimization of evacuation strategies under Hurricane within dense urban areas. The key is to spot new models and approaches that can meet the various demands and be easily implemented in practice. This is a network reliability problem which is extendable to the optimization of evacuation strategies under terrorists' attacks, chemical leakage, seismic occurrences, and so on.

4 - Optimal Routing in Disaster Response
Zhuoxiu Zhang, Mississippi State University, PO Box 9542, Mississippi State, MS, 39762, United States, zz52@msstate.edu, Burak Eksioglu, Ismail Capar, Mingzhou Jin

A linear programming model is developed to minimize disruption of freight flow and passenger movement in the event of a disaster. The model tries to optimally route vehicles with communication devices while capturing the routing behaviors of other vehicles. Because of the nonlinear relationship between the speed and traffic density, the LP model is solved iteratively by updating the parameters based on duel prices.

■ TA39

Ballroom B

Logistics I

Contributed Session

Chair: Mengfei Yu, PhD Candidate, RSM Erasmus University, RoomT10-46, Burg. Oudlaan 50, PO Box 1738, Rotterdam, 3000DR, Netherlands, myu@rsm.nl

1 - Design of Robust Topologies for Logistics Networks
Maarten Hendriks, PhD student, Eindhoven University of Technology, Den Dolech 2, PO Box 513, Eindhoven, NB, 5600 MB, Netherlands, m.p.m.hendriks@tue.nl, Dieter Armbruster, Jan Tijmen Udding, Erjen Lefeber, Koos Rooda

We consider the distribution of goods from manufacturers to customers by a logistics provider, who cannot control the stochastic supplies and demands, but may store goods in warehouses. He has to determine which links to use and how much to ship through them to minimize costs and meet demands. We propose a method to find a cost-effective topology, which is only sensitive to the means of supply and demand distributions. A cost-effective topology can thus be constructed when the means are known.

2 - Logistics and Economic Development. The Aguascalientes Case
Jaime Escalera, External Relations Director, Univ Politecnica de Aguascalientes, Prol Mahatma Gandhi Km 2, San Francisco del Arenal, Aguascalientes, AG, 20280, Mexico, jaime.escalera@upa.edu.mx

Quantitative economic analysis as well as comparison of Aguascalientes to other logistics points or shipping centers in Mexico, and the US; we examine AGS in a broader regional context to identify issues and challenges shared with neighboring states, and identify opportunities for inter-state collaboration; an initiative between USC and UPA to understand regional economic development in an international context.

3 - An Applied Logistics Decision Support System
Tan Miller, Senior Director, PCH Logistics, Pfizer, Inc., 201 Tabor Road, Morris Plains, NJ, 07950, United States, tan.miller@pfizer.com

We review the development and implementation of a DSS designed to guide the daily inventory deployment activities of a large-scale consumer distribution networks. We focus on how a well-constructed DSS can effectively augment the planning capabilities of ERP and WMS systems.

4 - Yard Allocation for a Container Port
Loo Hay Lee, Associate Professor, National University of Singapore, 10 Kent Ridge Crescent, Singapore, 119260, Singapore, iseleelh@nus.edu.sg, Yongbin Han, Kok Choon Tan, Ek Peng Chew

In this talk, we will study the yard storage allocation problem of a busy transshipment hub. Generally, the reshuffling of containers and the traffic congestion are two main challenges in the problem. To address the issues, we use the consignment strategy, the high-low workload and the vicinity matrix concept. By considering these new concepts and other actual constraints imposed by the port operator, we solve the problem by developing a mixed integer programming model.

5 - Performance Approximation and Design of Pick-and-Pass Order Picking Systems
Mengfei Yu, PhD Candidate, RSM Erasmus University, Room T10-46, Burg. Oudlaan 50, PO Box 1738, Rotterdam, 3000DR, Netherlands, myu@rsm.nl, René de Koster

We discuss an approximation method based on queueing theories to analyze pick-and-pass order picking systems. The objective is to provide an instrument for obtaining rapid estimation of the performance of the order picking system. This method can be used to evaluate the effects of the storage methods in pick stations, the number of order pickers in pick stations, the size of stations, the arrival process of customer orders, and the impact of batching and splitting orders on system performance.

■ TA40

Room 401

Tutorial: Unifying Facility Restricted Location and Layout Theory

Sponsor: Location Analysis

Sponsored Session

Chair: Rakesh Nagi, Professor, Department of Industrial & Systems Engineering, 438 Bell Hall, University at Buffalo (SUNY), Buffalo, NY, 14260, United States, nagi@buffalo.edu

1 - Tutorial: Unifying Facility Restricted Location and Layout Theory
Rakesh Nagi, Professor, Department of Industrial & Systems Engineering, 438 Bell Hall, University at Buffalo (SUNY), Buffalo, NY, 14260, United States, nagi@buffalo.edu, Rajan Batta

This tutorial aims at synthesizing a common theory base in the context of facilities location and facilities layout. The dichotomy has arisen due to the "point" or "area" treatment of the new facility. Participants will gain an appreciation of the common theory for location and layout problems, and how these results can help advance each field or bring them closer. It is suitable for students and researchers alike. We will draw upon research results of two NSF awards and associated papers.

■ TA41

Room 402

Queueing: Old Problems and New Techniques

Sponsor: Applied Probability

Sponsored Session

Chair: Alan Scheller-Wolf, Associate Professor, Tepper School of Business, Carnegie Mellon University, Pittsburgh, PA, 15213, United States, awolf@andrew.cmu.edu

1 - Pressure-Based Decentralized Resource Allocation in Stream Processing Systems
Cathy Xia, Research Staff Member, IBM, 19 Skyline Drive, Hawthorne, NY, 10532, United States, cathyx@us.ibm.com, Li Zhang, Zhen Liu

Distributed stream processing architecture has emerged as an appealing solution to coping with the analysis of stream data from dispersed sources. A fundamental problem in such distributed systems is how to best utilize available resources to achieve the optimal overall system performance. Queueing network models are well suited to model such stream processing systems. We present pressure-based decentralized solutions for the dynamic resource allocation problem in the above setting.

2 - Dynamic Pricing for On Demand Bandwidth Services
Robert Hampshire, PhD Candidate, Princeton University, Princeton, NJ, 08544, United States, rhampshi@Princeton.EDU

Motivated by a bandwidth leasing service, we consider a loss system model with a finite amount of bandwidth. Viewing demand as a function of the service price and time, we construct a dynamic pricing policy that maximizes profit while satisfying the quality of service constraints of the customers. Optimal control theory and calculus of variations are employed to develop the congestion pricing policy. This is joint work with Prof. W.A. Massey of Princeton and Qiong Wang of Lucent Technologies.

3 - Fundamental Characteristics of Queues with Fluctuating Load
Varun Gupta, Doctoral Student, Computer Science Department, Carnegie Mellon University, Pittsburgh, PA, 15213, United States, varun@cs.cmu.edu, Mor Harchol-Balter, Alan Scheller-Wolf, Uri Yechiali

Systems with fluctuating arrival or service rates are very common, but are still not well understood analytically, even for an M/M/1 system. For example, does increasing the rate of fluctuation cause the mean response time to increase or decrease? Is it even monotonic? How do the performance experienced by users arriving into "high load" periods and "low load" periods compare? Are there stochastic relations between these? In this work, we provide the first answers to such fundamental questions.

4 - Moment Relations Between Single Server and Multi-Server Queues

Alan Scheller-Wolf, Associate Professor, Tepper School of Business, Carnegie Mellon University, Pittsburgh, PA, 15213, United States, awolf@andrew.cmu.edu, Rein Vesilo

Generalizing techniques of Foss and Korshunov, we relate the delay-moment behavior of FIFO multiserver queues to the delay-moment behavior of sets of independent FIFO single server queues. This provides (i) alternate derivations of known sufficient conditions for stationary multiserver delay moments; (ii) more general necessary conditions, and; (iii) a structural interpretation underlying these moment conditions. As such we provide intuition about why multi-server queues behave as they do.

■ TA42

Room 403

Job-Shop Scheduling

Cluster: Scheduling

Invited Session

Chair: Jeffrey B. Sidney, Professor, University of Ottawa, 136 Jean-Jacques-Lussier, Ottawa, ON, K1N 6N5, Canada, jbsidney@hotmail.com

1 - Scheduling Divide-and-Conquer Graphs on Parallel Processors

Wieslaw Kubiak, Professor, Memorial University, St. John's, NL, A1B 3X5, Canada, wkubiak@mun.ca

The problem of scheduling a set of UET tasks subject to precedence constraints on identical parallel processors is NP-hard in the strong sense. However, polynomial time algorithms exist for some classes of precedence constraints graphs. We consider a class of divide-and-conquer graphs that naturally model the execution of divide-and-conquer algorithms. We prove that the HLF strategy minimizes makespan for this class.

2 - Lead-Time Estimation with Minimum Batch Sizes

Susan Slotnick, Associate Professor, Cleveland State University, 2121 Euclid Avenue, BU 542, Cleveland, OH, 44115, United States, slotnick@alltel.net

This model estimates lead-times for a manufacturing system in which the bottleneck process requires a minimum batch size. Customer delivery promise dates take into account processing time, queueing time and time for arrival of the requisite volume to complete the minimum batch size requirement. This research is motivated by the scheduling process of an integrated steel mill.

3 - Job Shop Scheduling with Uncertain Job Processing Time and Limited Distribution Information

Jinfeng Yue, Associate Professor, Middle Tennessee State University, Department of Management and Marketing, Murfreesboro, TN, 37132, United States, jyue@mtsu.edu, Amy (Yu) Xia

We consider a job scheduling with finite set of jobs in multi-machine job shop. Assume that each job follows given chain of operations. The processing time for each job in each machine is uncertain with unknown distribution, but known limited distribution information. To minimize the total long due date penalty and lateness penalty, our procedure and heuristic process provide the robust decision of job processing sequences and due date assignment for each job under consideration.

4 - Minimizing Earliness, Tardiness and Due Date Costs on Uniform Parallel Machines with Identical Jobs

Jeffrey B. Sidney, Professor, University of Ottawa, 136 Jean-Jacques-Lussier, Ottawa, ON, K1N 6N5, Canada, jbsidney@hotmail.com, Inna G. Drobouchevitch

We consider the problem of sequencing n identical jobs with a common due date on m uniform parallel machines. The objective is to jointly determine an optimal value of the due date and an optimal allocation of jobs to machines to minimize a total penalty function, which is a function of earliness, tardiness and due-date values. The main result is an efficient polynomial algorithm that solves the problem to optimality.

■ TA43

Room 404

Multi Criteria Supply Chain Optimization

Cluster: Multi-Criteria Decision Making

Invited Session

Chair: Ravi Ravindran, Professor, The Pennsylvania State University, Department of Industrial Engineering, 310 Leonhard, University Park, PA, 16802, United States, aravi@psu.edu

1 - A General Framework for Enterprise Level Distributed Decision Making

Datta Kulkarni, General Motors Corporation, Manufacturing Systems Research Lab, 30500 Mound Road, Warren, MI, 48090, United States, datta.kulkarni@gm.com, Jeffrey Tew, Edward Hanawalt

We propose a general framework for an enterprise level business decision model involving multiple stakeholders. The model enables trade offs through revenue and risk contributions. The revenue contribution is evaluated through cost structure analysis using Net Present Value. The risk contribution is evaluated employing the Analytical Hierarchy Process. The structured decision framework allows the multiple stakeholders to negotiate effectively to drive optimal enterprise level business decisions.

2 - Increasing Revenue and Reducing Waiting Times, Applications at the Indiana University Medical Group

John Norris, Doctoral Candidate, Purdue University, Krannert School of Management, 403 W. State Street, West Lafayette, IN, 47907-2056, United States, norrisjb@purdue.edu, Herb Moskowitz, Suresh Chand, Deanna Willis

An outpatient clinic concerned with patient waiting times and physician completion times tries to increase capacity utilization and thus revenue. However, factory physics concepts explain how times increase exponentially with higher utilization levels, thus posing challenges for the clinic. We show how improvements at an outpatient clinic can simultaneously achieve higher capacity utilization levels and shorten patient waiting times while allowing physicians to complete their schedule earlier

3 - A Multi-Criteria Collaborative Optimization Algorithm for Supply Chains with Multiple Decision Maker

Atul Rangarajan, Department of Industrial & Manufacturing Engineering, Pennsylvania State University, 310 Leonhard Building, University Park, PA, 16802, United States, aur114@psu.edu

We present a multi-criteria (MC), multiple decision maker decentralized supply chain (SC) inventory model with an arborescent SC network. The criteria are average inventory capital and number of orders per year. We prove that the MC SC inventory problem may result in a dominated solution under the decentralized structure. A collaborative and interactive optimization algorithm is presented that guides firms to a compromise solution that is individually and SC efficient.

4 - Multi-Criteria Optimization Models for Supply Risk Management

Tao Yang, Graduate Student, Industrial Engineering, Penn State University, 176 Larkspur Lane, State College, PA, 16803, United States, tuy100@psu.edu

Although the importance of risk management in supply chain is widely recognized, the research and application are quite limited due to the lack of quantitative tools. Risks can bring significant impacts to buyers. However, risk management cost money, time, etc. Therefore, tradeoffs have to be made. This paper introduces a method to quantify supply risks at first. Then, two multi-criteria optimization models for supply risk management at strategic and operational levels are proposed.

■ TA44

Room 405

Panel Discussion: The Academic Job Search

Cluster: Job Placement Committee

Invited Session

Chair: David Kim, Associate Prof., Oregaon State University, 121 Covell, Corvallis OR 97330, United States, david.kim@orst.edu

1 - Panel Discussion: Academic Job Search

Moderator: David Kim, Associate Prof., Oregon State University, 121 Covell, Carvallis OR 97330, United States, david.kim@orst.edu. Panelists: Lawrence Seiford, Richard Barr, Hemant Bhargava, H. Alan Love

The panel will discuss the academic interview process and do's and don'ts associated with the job search. In addition to comments by current and former search chairs, time will be provided for questions and answers.

■ TA45

Room 406

Tutorial: Linear Equations, Inequalities, Linear Programs (LP), and a New Efficient Algorithm

Cluster: Tutorials

Invited Session

1 - Linear Equations, Inequalities, Linear Programs (LP), and a New Efficient Algorithm

Katta G. Murty, Professor, Department of Industrial and Operations Engineering, 2773 IOE Building, 1205 Beal Avenue, University of Michigan, Ann Arbor, MI, 48109-2117, United States, murty@umich.edu

LP (linear programming) is the 20th century extension of the classical subject linear algebra to solve systems of linear inequalities. In this talk we briefly review the history of the development of algorithms for linear equations, inequalities, and LPs. Then we review existing algorithms used for LPs, all of which depend on matrix inversion operations. We then discuss a new descent method that has the potential for solving LPs without matrix inversions.

■ TA46

Room 407

Joint Pricing and Production Planning in Supply Chains

Cluster: Supply Chain and Operations Engineering

Invited Session

Chair: Christopher Tang, Professor, Anderson School, University of California - Los Angeles, 110 Westwood Plaza, Los Angeles, CA, 90095, United States, chris.tang@anderson.ucla.edu

1 - Price and Service Competition with Transshipments

Maqbool Dada, Professor, Krannert School of Management, Purdue University, West Lafayette, IN, 47907, United States, dada@mgmt.purdue.edu, Kwan Wee

Two newsvendors agree to pool inventory via transhipments at the end of the season but compete for customers on price and service during the season. The potential equilibria are fully characterized. Moreover conditions under which there is exactly one equilibrium are identified.

2 - The Implications of Customer Purchasing Behavior and In-store Display Formats

Rui Yin, PhD Candidate, UCLA Anderson School, 110 Westwood Plaza, Suite B512, Los Angeles, CA, 90095, United States, ryin@anderson.ucla.edu, Christopher Tang

Consider a retailer announces both the regular price and the post-season clearance price at the beginning of the selling season. Throughout the season, customers arrive in accord with a Poisson process. We analyze the impact of two types of customer purchasing behavior (myopic or strategic) and two common in-store display formats (display all items or display items one by one) on the retailer's optimal expected profit and optimal order quantity.

3 - Product Design in a Price-Setting Newsvendor's Decentralized Supply Chain

Qin Geng, Graduate Student, University of Illinois at Urbana-Champaign, 350 Wohlers Hall, 1206 S. 6th Street, Champaign, IL, 61820, United States, qingeng@uiuc.edu, Nicholas Petruzzi

We explore product design and pricing issues in a supply chain characterized by uncertainty by developing and analyzing a model to investigate the following: How does demand randomness affect the optimal decisions and profits in a decentralized system? How do these decisions and profits compare to the optimal centralized decisions, and how does that comparison depend on demand randomness? How do the answers to the above questions depend on which decision maker designs the product?

4 - The Value of Postponement: Market Drivers and Input Commonality

Nils Rudi, Associate Professor, INSEAD, Boulevard de Constance, Fontainebleau, 77305, France, nils.rudi@insead.edu, David Pyke, Jiri Chod

We examine a make-to-order production system assuming an arbitrary bill of material (BOM), price-sensitive demands and secondary market for components. We challenge the commonly accepted insight that the value of postponement increases in demand variability and decreases in demand correlation, showing how these effects depend on commonalities in the BOM.

■ TA47

Room 408

Operations Support Applications in the Automotive Industry

Cluster: Supply Chain and Operations Engineering

Invited Session

Chair: Mark Everson, Technical Leader, Ford Research and Advanced Engineering, RIC Building, MD # 2122, 2101 Village Road, Dearborn, MI, 48124, United States, meverson@ford.com

Co-Chair: Erica Klampfl, Infotronics & Systems Analytics Department, Ford Motor Company, RIC Building, MD #2122, 2101 Village Road, Dearborn, MI, 48124, United States, eklampfl@ford.com

1 - Interactive Line Balancing and Workcell Layout in an Automotive Assembly Environment

Erica Klampfl, Infotronics & Systems Analytics Department, Ford Motor Company, RIC Building, MD #2122, 2101 Village Road, Dearborn, MI, 48124, United States, eklampfl@ford.com, Oleg Gusikhin

Mixed-model assembly lines enable building different vehicles using the same equipment and facility: this creates significant challenges regarding assembly line planning and balancing. Existing methods for line balancing assume that the time required to complete a set of tasks is independent of the cell assignment and layout. We present a method for interactive line balancing and workcell layout, so that non-value added operations (e.g. walking & waiting) and workload variations are minimized.

2 - A New Modeling Approach for Scheduling Stamping Operations

Ada Barlatt, PhD Student, University of Michigan, Industrial & Operations Engineering, 1205 Beal Avenue, Ann Arbor, MI, 48109, United States, abarlatt@umich.edu, Oleg Gusikhin, Yakov Fradkin, Amy Cohn

We consider the challenging problem of scheduling products in an automotive stamping plant. We present a formulation based on "complex variable definitions" in which each variable represents the activity for a full shift on a given press line. We discuss how this removes significant complexity from the model, how to address the potentially very large number of variables, and how this approach might be extended to address planning problems across a broader segment of the automotive supply chain.

3 - Optimizing Tooling Investments Across Internal and External Organizational Boundaries

Blake Johnson, Consulting Professor, Stanford University, 12881 Via Grimaldi, Del Mar, CA, 92014, United States, blakej@stanford.edu

Most automotive components have custom specifications that necessitate investments in custom tooling. Because tool lead times are significant, OEM planning groups coordinate with suppliers to guide their tooling decisions that define capacity, price and liability for OEM procurement groups. Differences in information and incentives between these three parties create biases that impact performance, but which may be addressed with appropriately structured contingent performance commitments.

4 - Determining the Value of Manufacturing Flexibility for a Multi-Plant System

Mark Everson, Technical Leader, Ford Research and Advanced Engineering, RIC Building, MD # 2122, 2101 Village Road, Dearborn, MI, 48124, United States, meverson@ford.com, David A. Ostrowski, Charu Chandra, Janis Grabis

Obtaining the value of manufacturing flexibility for a multi-product manufacturer like an automotive company is a problem that has many facets. Important issues include: consumer demand uncertainty characterization, the product-specific level of flexibility of assembly plants, and capacity in the supply base. This talk will give results of a study of an assembly plant system with several different levels of flexibility.

■ TA48

Room 409

Inventory and Production Strategies

Sponsor: Manufacturing & Service Operations Management
Sponsored Session

Chair: Fernando Bernstein, Associate Professor, Duke University, PO Box 90120, Durham, NC, 27708, United States, fernando@duke.edu

1 - Provably Near-Optimal Balancing Policies for Stochastic Inventory Control Models with Lost-Sales

Retsef Levi, Assistant Professor, Massachusetts Institute of Technology, Sloan School of Management, BDG E53-389, 30 Wadsworth Street, Cambridge, MA, 02139, United States, retsef@mit.edu, Ganesh Janakiraman, Mahesh Nagarajan

We address the single-item, single-location periodic-review stochastic inventory problem with lost-sales. Except for the case with no lead time, little is known about the structure of optimal policies and computing good policies has been a challenge even with independent demands. We show how to find "dual-balancing" policies whose expected cost is at most twice that of the optimal policy. The worst-case analysis is fundamentally different from models with backlogged demands.

2 - Strategies for Bundling Durable Products with Contingent Services or Consumable Products

Sinan Erzurumlu, Doctoral Student, University of Texas at Austin, McCombs School of Business, Austin, TX, 78712, United States, Sinan.Erzurumlu@phd.mccombs.utexas.edu, Stephen Gilbert

We investigate the issue of whether and how a durable goods monopolist should bundle his product with contingent services or consumable products depending upon on the costs of production and distribution and the competitiveness of the industry for the contingent products. Our analysis identifies conditions under which the durable goods monopolist should bundle the two products, sell them separately, or exit the market for the contingent products.

3 - Supply Streams

Jeannette Song, Professor, Duke University, Fuqua School of Business, 1 Towerview Drive, Durham, NC, 27708, United States, jssong@duke.edu, Paul H. Zipkin

A supply stream is a continuous version of a supply chain. It is like a series inventory system, but stock can be held at any point along a continuum, not just at discrete stages. We develop two such models, one with Poisson demand and the other with Brownian-motion demand. For both models we develop tractable computational methods. We also find closed-form solutions for special cases.

4 - Managing Operational Risks in Contract Manufacturing

Fernando Bernstein, Associate Professor, Duke University, PO Box 90120, Durham, NC, 27708, United States, fernando@duke.edu

To mitigate the risks associated with demand variability and supply variability, firms employ a variety of hedging strategies, e.g., resource flexibility, component commonality, supplier diversification, etc. We investigate the impact of outsourcing production to a contract manufacturer on the implementation of these hedging practices.

■ TA49

Room 410

Extending Product Useful Life Through Services and Remanufacturing

Cluster: Closed-Loop Supply Chains and Reverse Logistics
Invited Session

Chair: Sarah Ryan, Iowa State University, 2019 Black Engineering Bldg., Ames, IA, 50011-2164, United States, smryan@iastate.edu

1 - Systems and Methodology for Environmental Compliance

Pitipong Veerakamolmal, IBM Corporation, 125 Pleasant Street, #125, Brookline, MA, 02446, United States, pitipong@us.ibm.com

Electronics enterprises are facing mounting pressure to create "green" supply chains. Specifically, all OEMs selling products in the European Union most conform to the RoHS directive. This directive applies even if the product being sold is manufactured elsewhere. This presentation discusses a comprehensive solution through which manufacturers can meet the directive's mandates.

2 - Adjusting Remanufacturing Capacity Using Sales and Return Information

Suphalat Chittamvanich, Iowa State University, 2019 Black Engineering, Ames, IA, 50011-2164, United States, suphalat@iastate.edu, Sarah Ryan

Remanufacturing capacity may be adjusted as sales and returns vary over time. Using properties of K-concave functions,we prove the optimality of a simple expansion and contraction policy,where the threshold values and target levels depend on the number of items sold but not yet returned. The effects on the capacity policy of different patterns of product sales, non-stationary revenue from processing the returns and levels of variability in the return distribution are found in numerical studies.

3 - A Retailer-Driven Reverse Logistics Model

Jie Li, Operations Research Analyst, Iowa State University, Black Engineering 2019, Ames, IA, 50011, United States, jieli@iastate.edu, Jo Min

We study a closed-loop retailer-driven reverse logistics model with product remanufacturing. The retailer in the supply chain acts as the Stackelberg leader and the used product returning is market-driven. We study the cases of the retailer vs. a third-party acting as the collecting agent. The pricing and resulting profits, the degrees of remanufacturing, and the policy implications for the model are explored analytically and numerically.

4 - Investments in Remanufacturibility: A Supply Chain Perspective

Sasidhar Malladi, Iowa State University, 1400 Gateway Hills Park Drive, 802, Ames, IA, 50014, United States, sasi@iastate.edu, Jo Min

We consider a producer who sells both newly manufactured and remanufactured products to a service provider, who in turn utilizes them to meet her, own customers' demand. Furthermore, the manufacturer has the option to invest in technology so as to increase the degree of remanufacturability, the fraction of products that are remanufactured. We investigate how the optimal degrees of remanufacturability, prices and profits vary with respect to channel power as well as the product life.

■ TA50

Room 411

OM Applications of Approximate Dynamic Programming

Sponsor: Manufacturing & Service Operations Management
Sponsored Session

Chair: Dan Adelman, Professor of Operations Management, University of Chicago, Graduate School of Business, 5807 South Woodlawn Avenue, Chicago, IL, 60637, United States, dan.adelman@gsb.uchicago.edu

1 - A Fully Polynomial Time Approximation Scheme for Single-Item Stochastic Lot-Sizing Problems

Diego Klabjan, Associate Professor, University of Illinois at Urbana-Champaign, 1206 West Green Street, Urbana, IL, 61801, United States, klabjan@mit.edu, Nir Halman, David Simchi-Levi, James Orlin, M. Mostagir

The single-item stochastic lot-sizing problem is to find an inventory replenishment policy in the presence of a stochastic demand under periodic review and finite time horizon. In this paper we prove that this problem is intractable and therefore we provide an approximation algorithm. To the best of our knowledge, this is the first work that develops a fully polynomial time approximation scheme for this problem.

2 - Dynamic Multi-Priority Patient Scheduling with Uncertain Demand

Jonathan Patrick, PhD, University of British Columbia, 1215 Duthie Avenue, Burnaby, BC, V5A 2R5, Canada, jonathan.patrick@sauder.ubc.ca, Martin L. Puterman, Maurice Queyranne

We present a method for scheduling multi-priority patients to a diagnostic facility in a public health setting. Rather than maximize revenue, the resource manager seeks to allocate capacity so that waiting time targets are met. Our research involves modeling the scheduling process as an MDP and applying approximate dynamic programming methods. We present the optimal linear approximation for two cost structures as well as the resulting booking policy for achieving the waiting time targets.

3 - Using Lagrangian Relaxation to Compute Capacity-Dependent Bid-Prices in Network Revenue Management

Huseyin Topaloglu, Assistant Professor, Cornell University, 223 Rhodes Hall, Ithaca, NY, 14853, United States, huseyin@orie.cornell.edu

We propose a method to compute capacity-dependent bid-prices in the network revenue management problem. Our method relaxes certain constraints that link the decisions for different flight legs by associating Lagrange multipliers with them. When compared with the so-called deterministic linear program, our method provides a provably tighter upper bound on the optimal objective value.

4 - Approximate Dynamic Programming for Generalized Joint Replenishment

Dan Adelman, Professor of Operations Management, University of Chicago, Graduate School of Business, 5807 South Woodlawn Avenue, Chicago, IL, 60637, United States, dan.adelman@gsb.uchicago.edu, Diego Klabjan

We provide an approximate dynamic programming approach to solving the generalized joint replenishment problem to within any desired optimality tolerance, using ridge functions.

■ TA51

Room 412

Planning for and Responding to Hurricanes

Cluster: Planning for and Responding to Disasters

Invited Session

Chair: Eva Regnier, Assistant Professor, Naval Postgraduate School, Defense Resources Management Institute, 699 Dyer Road, Monterey, CA, 93943, United States, eregnier@nps.edu

1 - A Stochastic Model for Hurricane Preparedness and Response

Richard C. Larson, Professor, Massachusetts Institute of Technology, Engineering Systems Division, E40-231b, Cambridge, MA, 02139, United States, rclarson@mit.edu, Michael Metzger

With an approaching hurricane, government decision makers face a set of action timing decisions: supply pre-positioning, mobilization and evacuation. The location, time and intensity of the hurricane at landfall are random variables governed by nature. We develop a stochastic dynamic program incorporating economic, social, and logistical impacts of alternative sequential decisions.

2 - Tropical Cyclone Predictability and the Decision Space for Hurricane Preparation

Eva Regnier, Assistant Professor, Naval Postgraduate School, Defense Resources Management Institute, 699 Dyer Road, Monterey, CA, 93943, United States, eregnier@nps.edu

Hurricane preparation decisions force a difficult trade-off between risks to life and high false alarm rates. This work quantifies tropical cyclone predictability, and the relationship between forecast accuracy and decision-critical lead times, focusing on geographic differences, and highlights the climatological contribution to New Orleans's distinction as the most hurricane-vulnerable location in the U.S.

3 - Hurricane Preparedness and Response: How Can All Sectors Support a National Plan?

Chuck Gregg, Hurricane and Earthquake Program Manager, DHS-FEMA Region 6, 800 North Loop 288, Denton, TX, 76205, United States, Chuck.Gregg@dhs.gov

A FEMA hurricane program manager explains what federal, state and local organizations are doing to improve hurricane preparedness and response. He also describes how these systems can benefit from new methods and technologies for everything from evacuation decision making to shelter plans. He also provides an update about national catastrophe planning and the DHS National Response Plan.

4 - Mitigation and Disaster Insurance for Catastrophic Risks: Dealing with the New Era

Erwann O. Michel-Kerjan, Managing Director, Center for Risk Management and Decision Processes, OPIM Department - The Wharton School, University of Pennsylvania, Jon Huntsman Hall, 5th Floor, Room 556, 3730 Walnut Street, Philadelphia, PA, 19104-6340, erwannmk@Wharton.upenn.edu, Howard Kunreuther

What is the best way for the nation to recover from large-scale disasters? To address this question we analyze the central role that insurance plays and the limits to insurability of these events by the private sector alone. Focusing on 5 states (California, Florida, New York, South Carolina and Texas), we examine a set of alternative disaster insurance and mitigation programs. This analysis provides a broad range of interested parties with a better understanding of who will pay what after the next extreme event.

■ TA52

Room 413

Revenue Management in Railroads

Sponsor: Revenue Management & Pricing

Sponsored Session

Chair: Luce Brotcorne, Associate Professor, LAMIH-ROI, University of Valenciennes, Le Mont Houy, Valenciennes Cedex 9, F 59313, France, luce.brotcorne@univ-valenciennes.fr

1 - Commercial Cartography of Trains and Yield Managment

Mariane Riss, SNCF - Direction de l'Innovation et de la Recherche, 45 rue de Londres, Paris Cedex 08, F 75379, France, mariane.riss@sncf.fr

In order to optimize the revenue of each SNCF's TGV we perform a cartography of TGV based on their historical datas of reservations, which keep the temporal aspect of customer's demand. Then we forcast the appartenance of a TGV to a group via others datas known before the train's departure.

2 - A New Generation of Revenue Optimization Tools for the Railway Industry

Jean-Philippe Côté, ExPretio, 905 Michèle Bohec, Suite 210 A, Blainville, QC, J7C 5J6, Canada, jean-philippe.cote@expretio.com, Alexandre Schoeb, Gilles Savard, Mariane Riss, Nicolas Robbe

Some railway operators have, over the last decade, adopted Revenue Optimization (RO strategies borrowed from the airline industry. There are, however, many structural factors that render classical RO approaches less appropriate in a railway context. We present a new framework based on choice modeling and bilevel programming that can tackle the RO problems faced by this industry. We show that this approach address many of the new challenges for the carriers.

3 - Revenue Management of Auto Train at Amtrak

Soheil Sidbari, Assistant Professor, Charlton College of Business, University of Massachusetts, 285 Old Westport Road, North Dartmouth, MA, 02747, United States, ssibdari@umassd.edu, Kyle Lin, Sriram Chellappan

This study involves working with Amtrak, the national railroad passenger corporation, to develop a revenue management model. The RM department provides the sales data of Auto Train, a service that allows passengers to bring their vehicles on the train. We analyze the demand structure from sales data and build a mathematical model to describe the sales process for Auto Train. We further develop an algorithm to calculate the optimal pricing strategy that yields the maximum revenue.

4 - Integrated Operations Planning and Revenue Management for Rail Freight

Gilles Savard, Ecole Polytechnique de Montréal, CP 6079 Succursale Centre Ville, Montréal, QC, H3C3A7, Canada, gilles.savard@polymtl.ca, Jean-François Cordeau, Benoit Crevier

Profit maximization relies heavily on the integration of logistics activities with an improved management of the revenues. The operational policies chosen by the carrier have also an important impact on freight transit time. To achieve this integration, we propose operational and tactical bilevel mathematical models. Solution approaches will be discussed.

■ TA53

Room 414

Multi-Item Inventory Management

Contributed Session

Chair: Shao-ju Lee, Professor, National Dong-Hwa University, Department of Business Management, 1, Sec.2, Da-Hsueh Road, Shoufang, Hualien, 97401, Taiwan, slee@mail.ndhu.edu.tw

1 - Optimal Ordering Policies for a Multi-Product Stochastic Inventory System with Joint Setup Costs

Haolin Feng, Purdue University, West Lafayette, IN, 47907, United States, fengh@purdue.edu, Kumar Muthuraman, Vinayak Deshpande

We consider a continuously monitored multi-product inventory system subject to a correlated demand process. The objective is to minimize the expected discounted cost in the presence of fixed plus proportional ordering costs with major and minor setups and convex storage/shortage costs. We present a moving boundary approach to obtain optimal ordering policies.

2 - The Assortment Problem: A Survey

David Pentico, Duquesne University, School of Business, Pittsburgh, PA, 15282-0180, United States, pentico@duq.edu

The assortment problem involves determining which of a given set of sizes of some product to stock if the demands for an unstocked size can be filled by using a larger stocked size with a substitution cost. We will review the papers published over the past 50 years, classifying them with respect to their differing assumptions about the structure of the problem and discussing how what they present differs from the work of others.

3 - Dynamic Safety Stock Management for Multiple High-Valued Inventories

Shao-ju Lee, Professor, National Dong-Hwa University, Department of Business Management, 1, Sec.2, Da-Hsueh Road, Shoufang, Hualien, 97401, Taiwan, slee@mail.ndhu.edu.tw

This research addresses the issues related to the safety stock level determination for high-tech industry with multiple inventory items. With high carrying costs, volitile demand patterns, significant obsolescence costs, and different life cycles, inventory management of these items require timely and frequent safety stocks adjustments. The study employes simulation to examine various scenarios for determining the appropriate safety stock levels.

4 - Analysis for Base-Stock Levels in Multi-Echelon Inventory Systems with Intermediary Product Demand

Suman Niranjan, Research Assistant, Wright state University, 249 Russ Center, Industrial & Human Factors Engineering, Dayton OH 45431, United States, niranjan.2@wright.edu, Frank Ciarallo

The system considered here is a capacitated three-echelon assembly system with an intermediate, external product demand in one of the upper echelons. We develop a system of equations to describe the inventory dynamics and determine optimal base stock levels for the components, intermediate and final product based on a required customer service level at each stage. A simulation based inventory optimization approach is employed to determine the optimal base stock levels.

5 - A Supplier Selection-Order Allocation Problem with Stochastic Demands

Xiaobo Zhao, Professor, Tsinghua University, Department of Industrial Engineering, Tsinghua University, Beijing, 100084, China, xbzhao@tsinghua.edu.cn, Lei Zhao, Jianhua Jiang

We consider a supplier selection-order allocation problem with stochastic demand for finite horizon. It is formulated as a stochastic dynamic programming problem. An algorithm is developed to obtain an optimal solution of the problem, with analysis of its computational complexity. Numerical resuts are provided with some managerial insights.

■ TA54

Room 415

Managing Supply Systems with Stochastic Leadtimes: Role of Information, Emergency Orders and Fast Deliveries

Cluster: Operations and Marketing for Emerging Markets

Invited Session

Chair: Panos Kouvelis, Professor, Washington University in St. Louis, Olin School of Business, One Brookings Drive, Campus Box 1133, St. Louis, MO, 63130-4899, United States, kouvelis@wustl.edu

1 - Push or Pull? Auctioning Supply Contracts

Cuihong Li, Assistant Professor, University of Connecticut, 2100 Hillside Road, Unit 1041, Storrs, CT, 06269, United States, Cuihong.Li@business.uconn.edu, Alan Scheller-Wolf

For a buyer that faces uncertain demand and purchases from competing suppliers, both the price and inventory risk allocation are important considerations. Based on a news vendor model, we study the auction mechanism in which suppliers bid a single price, with or without a quantity committed by the buyer. That is, the buyer auctions a push or pull contract. We chracterize the environments in which a push or pull contract auction is preferred.

2 - On the Value of Lead-Time Information and Managerial Strategies in Managing Uncertain Supply

Panos Kouvelis, Professor, Washington University in St. Louis, Olin School of Business, One Brookings Drive, Campus Box 1133, St. Louis, MO, 63130-4899, United States, kouvelis@wustl.edu, Jian Li

Conventionally in the literature and practice, the strategy of Safety Lead-time (SL) is used to deal with lead-time uncertainty, ignoring future available information on the delivery status and other possible resources for emergency response. In this paper, we study the alternative strategies of Strategic Inventory (SI) and Dynamic Emergency Response (DER) employing future available information.

3 - Lead-Time Information and The Role of Expediting in Managing Supply Systems with Uncertain Lead-Time

Sammi Tang, PhD Student, Washington University in St. Louis, Olin School of Business, St. Louis, MO, 63130, United States, tangy@wustl.edu, Panos Kouvelis

We study how the lead time information and the existence of an expediting service can help improve inventory management in supply systems with stochastic lead-times. A retailer places a regular order from a supplier. After the order is released, it is possible to expedite part or all of the original order when it passes through some intermediate point so that the expedited product will be delivered in a shorter time.

4 - Flexible Backup Supply and The Management of Leadtime Uncertainty

Jian Li, Assistant Professor, Department of Management and Marketing, Northeastern Illinois University, 5500 North St. Louis Avenue, Chicago, IL, 60625, United States, j-li3@neiu.edu, Panos Kouvelis

Facing lead-time uncertainty, the retailer conventionally places an order at a chosen time ahead to meet future demand. In this paper we study the potential use of a flexible backup supplier in a sole role, as an emergency resource in response to the lead-time information, or in a dual role, as a regular supplier that is assigned to meet part of the original demand interval and as an emergency response to lead-time information.

■ TA55

Room 416

AI Approaches for Business Problems

Sponsor: Artificial Intelligence

Sponsored Session

Chair: Anurag Agarwal, Assistant Professor, Department of Decision and Information Sciences, University of Florida, College of Business Administration, Gainesville, FL, 32611-7169, United States, aagarwal@ufl.edu

1 - Genetic Algorithms for Multiple Equipment Multiple Cover Facility Location-Allocation Problem

Vaidyanathan Jayaraman, Associate Professor, University of Miami, Coral Gables, FL, 33124, vaidy@miami.edu, Anurag Agarwal, Rajesh Srivastava

The Multiple Equipment Multiple Cover Facility Location-Allocation (MEMCOLA)Problem attempts to minimize the amount of demand not covered within the maximal-service distance of an equipment or facility. The model considers multiple types of equipment such as primary/secondary, main/backup or general/specialty. Due to the NP-Hard nature of the problem, optimality is difficult to obtain. We formulate the model and propose some genetic algorithms for this problem.

2 - A Neurogenetic Approach for Resource-Constrained Project Scheduling

Anurag Agarwal, Assistant Professor, Department of Decision and Information Sciences, University of Florida, College of Business Administration, Gainesville, FL, 32611-7169, United States, aagarwal@ufl.edu, Selcuk Colak, Selcuk Erenguc

The Neurogenetic approach is a hybrid of genetic algorithms (GA) and the neural-network (NN) approach. We propose this approach for solving the resource-constrained project scheduling problem. GA search provides good diversification, while NN provides good intensification or local search to improve the solution quality.

3 - Using GA and GRASP to Maximize Network Value of Customers

Hong Guo, PhD Student, University of Florida, Decision & Information Sciences Department, Stuzin Hall 355, University of Florida, Gainesville, FL, 32611, United States, guohong@ufl.edu

Customers' network value maximization problem in viral marketing is a newly emerged NP-hard problem. The increased availability of customer data offers the opportunity to formulate the problem. Using genetic algorithm (GA) and greedy randomized adaptive search procedure (GRASP), this paper finds approximate solutions to network value maximization problems. Computational results comparing different subroutines are based on both randomly generated networks and real large-scale customer network.

4 - Scheduling On-Line Advertisements Using Neural Network / Genetic Algorithm Based Metaheuristics

Jason Deane, Assistant Professor, Virginia Tech, Pamplin Hall, Blacksburg, VA, 24060, United States, jason.k.deane@cba.ufl.edu, Anurag Agarwal

On-line advertising is a very robust industry experiencing revenue growth in 12 of the last 13 quarters. One of the most challenging problems faced by industry participants is the ad scheduling problem. We introduce three new versions of this problem and test several heuristic and metaheuristic solution techniques.

Tuesday, 10:00am - 11:30am

■ TB01

Room 301

Control and Optimization of Networks

Sponsor: Optimization/ Network and Combinatorial Optimization
Sponsored Session

Chair: Steven Low, California Institute of Technology, Pasadena, CA, 91106, United States, slow@caltech.edu

Co-Chair: Mung Chiang, Assistant Professor, Princeton University, B328 Engineering Quad, Olden Street, Princeton, NJ, 08544, United States, chiangm@princeton.edu

1 - FAST Copper: Optimizing Fiber/DSL Broadband Access
Mung Chiang, Assistant Professor, Princeton University, B328 Engineering Quad, Olden Street, Princeton, NJ, 08544, United States, chiangm@princeton.edu

FAST Copper is a joint project by Princeton (Mung Chiang), Stanford(John Cioffi), and Fraser Research Labs (Alexander Fraser). It aims at providing the next revolution in wired broadband access networks through a hybrid fiber-to-the-curb and DSL last mile architecture. A main component is the joint and dynamic optimization of resources in Frequency, Amplitude, Space, and Time. This talk will overview this project, with a focus on interesting optimization problem formulations.

2 - Multi-Objective Network Protocols
Ashish Goel, Stanford University, Terman 311, Stanford, CA, 94305, United States, ashishg@stanford.edu, Sung-Woo Cho

Different variants of the congestion control protocol TCP maximize different utility functions. But could there be a single protocol that is good for all reasonable utility functions? We first present a centralized algorithm that is an O(log n) approximation, simultaneously, for all "canonical" utility functions. Then we present a TCP-like protocol which achieves the same bounds. Our protocol requires per-flow state at routers; whether this is necessary is an intriguing open problem.

3 - Modelling Peer-to-Peer File Dissemination
Mortada Mehyar, Caltech, 256-80 Caltech, Pasadena, CA, 91106, United States, morr@caltech.edu, Wei-Hsin Gu, Lachlan Andrew, Steven Low

We investigate a model for peer-to-peer file sharing. The goal is to distribute a file from a server to multiple peers. Each peer has limited upload capacity and can upload previously downloaded pieces to other peers. We examine the finish times of peers under different transmission strategies. Pareto optimality, min-max finish time, and optimal average finish time of the model are studied. We believe the model provides insights into practical peer-to-peer systems such as Bittorrent.

4 - Distributed Scheduling Algorithms with Contant-Time Overhead
Xiaojun Lin, Assistant Professor, Purdue University, School of Electrical and Computer Engineering, 465 Northwestern Avenue, West Lafayette, IN, 47907-2035, United States, linx@ecn.purdue.edu, Shahzada Rasool

Recently there have been interests in developing distributed scheduling algorithms for ad hoc wireless networks that can achieve provable capacity regions. Most of these algorithms require computation time that increases with the size of the network. In this paper, we propose a class of distributed scheduling algorithms that achieve comparable capacity regions, and that are constant-time, i.e., the time needed for computing a schedule is independent of the network size.

■ TB02

Room 302

Joint Session Open-Source/ICS: Easier to Use: Open-Source Software

Cluster: Open-Source Software: Open Source, Open Standards, Open Data, INFORMS Computing Society
Invited Session

Chair: Robin Lougee-Heimer, Research Staff Member, IBM TJ Watson Research Center, 1101 Kitchawan Road, Yorktown Heights, NY, 10598, United States, robinlh@us.ibm.com

1 - Source Code Not Required: Using the COIN Binaries
Kipp Martin, Professor, University of Chicago, 5807 South Woodlawn, Chicago, IL, 60637, United States, kipp.martin@chicagogsb.edu, Ted Ralphs, JP Fasano

COIN-OR provides open-source software for the operations research community. However, many users may wish to take advantage of COIN-OR without downloading and compiling source code. There is a COIN-OR project that provides compiled libraries and executables for several key COIN-OR projects. These binaries are available for the Windows, Linux, and Mac OS X platforms. We describe the available binaries and illustrate how users can link to them and use them for solving optimization problems.

2 - CoinMP: Simple C-API Windows DLL implementation of CLP, CBC, and CGL
Bjarni Kristjansson, Maximal Software, 2111 Wilson Boulevard #700, Bjarni@maximalsoftware.com

The COIN Open Source Initiative has become very popular in the recent years. To make life easier for users that simply want to solve models and not compile C++ applications, we have developed standard C-API Windows DLL CoinMP.DLL that implements most of the functionality of CLP, CBC, and CGL.

3 - Automated Tuning of Solver Parameters
Mustafa Baz, University of Pittsburgh, 5837 Hobart Street Apt. #2, Pittsburgh, PA, United States, mub3@pitt.edu

We present automated tuning algorithms and implementations which determine good parameter settings for particular instances for MIP solvers. We compare several approaches using ideas from software testing and machine learning. Some of the ideas we use are pairwise testing, decision trees, and artificial neural networks. Our code is available under an open source license.

■ TB03

Room 303

MINLP Theory & Algorithms

Sponsor: Optimization/ Global Optimization
Sponsored Session

Chair: Kevin Furman, ExxonMobil, 1545 Route 22 East, Annandale, NJ, 08801, United States, kevin.c.furman@exxonmobil.com

1 - A Multi-Processor Approach for Outer Approximation
Marcel Hunting, Paragon Decision Technology, Julianastraat 30, Haarlem, 2012 ES, Netherlands, Marcel.Hunting@aimms.com

We have extended the Outer Approximation algorithm in AIMMS such that for any intermediate solution found during the solution process of the master MIP problem the corresponding NLP subproblem will be solved at the same time on another processor. Moreover, multiple NLP solvers can be used to solve the same NLP subproblem to increase the possibility of finding good solutions.

2 - AMIGO: A New Solver for Mixed Integer Nonlinear Optimization
Zsolt Ugray, Assistant Professor, Business Information Systems Department, USU, 3515 Old Main Hill, Logan, UT, 84321, United States, Zsolt.Ugray@usu.edu, János D. Pintér

We introduce AMIGO, an Advanced Mixed Integer Global Optimizer. AMIGO incorporates the LGO (Lipschitz Global Optimizer) solver suite for continuous global/local optimization. We present the algorithmic framework with illustrative numerical results.

3 - FilMINT: A Linearizations-Based Solver for Mixed Integer Nonlinear Programs
Kumar Abhishek, Graduate Student, Lehigh University, Mohler Lab, 200 W. Packer Avenue, Bethlehem, PA, 18015, United States, kua3@lehigh.edu, Sven Leyffer, Jeff Linderoth

We describe a solver for mixed integer nonlinear programs that implements a linearization-based algorithm in a branch-and-cut framework. We use the advanced features of an existing MILP framework and show how to use it to add and manage the linearizations. The solver uses MINTO for solving the MILP, and Filter-SQP, an active set solver, for solving the nonlinear programs. Detailed computational experiments are presented, highlighting the framework's effectiveness.

■ TB04

Room 304

Integer Programming

Sponsor: Optimization/ Integer Programming
Sponsored Session

Chair: Lisa Miller, Assistant Professor, University of Minnesota, 111 Church Street SE, 1100 Mechanical Engineering, Minneapolis, MN, 55113, United States, lmiller@me.umn.edu

1 - Using Strong Formulation to Derive Bounds on Big Bucket Production Planning Problems
Kerem Akartunali, University of Wisconsin, Madison, WI, United States, kerema@cae.wisc.edu, Andrew Miller

We review various methods for generating lower bounds for multi-level, multi-item capacitated lot-sizing problems in which items compete for capacity on a number of given machines. Our research suggests that simple MIP heuristics are, for most problems, as effective as any other methods for generating strong lower bounds. It also shows where research effort in the future needs to be focused if the needed significant progress in generating stronger bounds for these problems is to be made.

2 - Hypergraphic Structures for Solving Hard Mixed Integer Programming Instances

Eva Lee, Associate Professor, School of Industrial and Systems Engineering, Georgia Institute of Technology, Atlanta, GA, 30332, evakylee@isye.gatech.edu, Siddhartha Maheshwary

We continue our report on hypegraphic facial structures and its application in solving hard mixed integer programming instances arising from marketshare, and cancer treatment applications. The talk will first present recent theoretical results, next it will focus on the separation routines and parallel implementation of an efficient branch-and-cut environment. Computational results of real instances will be presented.

3 - Continuous and Discontinuous Extreme Inequalities for Infinite Group Problem

Santanu Dey, School of Industrial Engineering, Purdue University, West Lafayette, IN, 47907, United States, sdey@purdue.edu, Yanjun Li, Lisa Miller, Jean-Philippe Richard

We develop new tools to prove that inequalities are extreme for infinite group problems. These are used to show that integer infinite group problems have discontinuous extreme inequalities, giving insight into unusual types of cuts that may be computationally important. We present connections between finite and infinite group problems and give results about converging sequence of extreme inequalities. Finally, we prove that extreme inequalities for mixed integer programs are always continuous.

4 - A New Approach to Lifting General Integer Variables

Todd Easton, Assistant Professor, Kansas State University, 237 Durland, Manhattan, KS, 66503, United States, teaston@ksu.edu, Talia Gutierrez

Lifting integer variables is a widely used technique to create strong cutting planes for integer programs. In 1976 Wolsey introduced a technique to lift general integer variables. The technique solves u-l integer programs where u and l are the lower and upper bounds of the lifted variable. This talk presents a method to lift integer variables by solving a single integer program. Some computational results will also be presented.

■ TB05

Room 305

Supply Chain Models and Design

Contributed Session

Chair: Nivesh Kumar, Analyst, Lehman Brothers, Winchester Building, Off High Street, Hiranandani, Mumbai, 400076, India, nivesh.kr@gmail.com

1 - Modeling the Supply Chain Configuration Problem under Resource Constraints

Haitao Li, Assistant Professor, Troy University, Business School, Montgomery, AL, 36103, United States, hli@troy.edu, Keith Womer

We consider the supply chain configuration problem (SCCP) under resource constraints. We present a new modeling framework based on the multi-mode resource-constrained project scheduling (MRCPSP) for configuring the supply chain subject to explicit resource constraints. Our model is also able to handle additional practical considerations such as quality level requirements and general temporal constraints which are often encompassed in the real world.

2 - An Novel Approach for Build-to-Order Supply Chain Design

Tarek Shaalan, Doctoral Candidate, University of Central Florida, Department of Industrial Engineering and Management Systems, 4000 Central Florida Boulevard, Orlando, FL, 32816, United States, tshaalan@mail.ucf.edu, Christopher D. Geiger

Build-to-order supply chains (BOSCs) have recently received increasing attention due to the shifting focus of manufacturing companies from mass production to mass customization. This shift has generated a growing need for efficient approaches for BOSC design. We propose an approach that simultaneously considers five performance measures at three stages of the BOSC. Preliminary experiments show that the proposed approach yields BOSC configurations with near-optimal performance.

3 - On the Profitability of Remanufactured Products

Yue Jin, University of Massachusetts, 160 Governors Drive, Amherst, 01003, United States, yuej@acad.umass.edu, Ana Muriel

We investigate the profitability of remanufactured products for a monopoly firm in a single period setting. We characterize a threshold for the remanufacturing cost and focus on analyzing its dependence on the consumer profile. We identify when it is customer segmentation and not price differences that drive the remanufacturing decision.

4- Laboratory for the Simulation of Logistic Processes: Framework of Learning and Innovation

Maria Jesus Saenz, Academic Director, Zaragoza Logistics Center, Gomez Laguna 25, Zaragoza 50009, Spain, mjsaenz@zlc.edu.es

The application of simulation techniques is presented as the driving force of learning and innovation of organizations inserted in their Supply Chains, by means of the emulation of its processes and the following interaction with these structures. The main objective is the learning that the members of these organizations gain from the experience that this interaction provides, as well as determine its weaknesses and how to optimize these.

5 - Model Predictive Control Framework for Inventory Management in Multi-echelon networks

Nivesh Kumar, Analyst, Lehman Brothers, Winchester Building, Off High Street, Hiranandani, Mumbai, 400076, India, nivesh.kr@gmail.com, Prakash G. Awate

An optimization framework involving simultaneous perturbation stochastic approximation is extended to an acyclic network as a way for optimally specifying parameters of model predictive control based decision policies for inventory management in multi-echelon systems. The use of SPSA technique serves to enhance the performance and functionality of this class of decision algorithm and is illustrated on an acyclic network involving limited capacity and demand uncertainty.

■ TB06

Room 306

Metaheuristics in Logistics and Transportation

Sponsor: INFORMS Computing Society/Heuristic Search

Sponsored Session

Chair: Claudio Cunha, Associate Professor, University of Sao Paulo, Av. Prof. Almeida Prado, Trav.2, n,83, Sao Paulo, SP, 05508-970, Brazil, cbcunha@usp.br

1 - Integrated Package and Trailer Routing in Freight Transportation

Shankara Kuppa, University of Michigan, 1205 Beal Avenue, Ann Arbor MI, United States, skuppa@umich.edu, Dushyant Sharma

In planning package and trailer routing, the freight transport industry has to satisfy a number of operational and quality-of-service constraints. We propose an integrated integer LP formulation that captures the non-linearity of the objective and additional constraints. We also suggest exact and heuristic approaches to solve the problem based on neighborhood search techniques for local improvement. We present computational results on realistic data.

2 - A Fitness Landscape Analysis of the Capacitated Vehicle Routing Problem

Jean-Paul Watson, Sandia National Laboratories, PO Box 5800, MS 1110, Albuquerque, NM, 87185-1110, United States, jwatson@sandia.gov

Despite the existence of innumerable metaheuristics for the Capacitated Vehicle Routing Problem (CVRP), almost nothing is known about the structure of the underlying fitness landscape. We explore the CVRP fitness landscape, and use the insight gained to provide formal insight into the underlying reasons for the superior performance of state-of-the-art CVRP metaheuristics, specifically emphasizing tabu search procedures.

3 - New Developments in the Computerized Routing of Meter Readers Over Street Networks

Bruce Golden, University of Maryland, R.H. Smith School of Business, College Park, MD, 20742, United States, bgolden@rhsmith.umd.edu, Edward Wasil, Robert Shuttleworth

Recent advances in utility meter reading technology necessitate similar advances in routing techniques. For a given geographic region, the problem is to construct novel ways of building highly efficient, optimized routes. We propose and implement an optimization-based approach that reduces the duration and cost of a set of routes.

4 - Very Large-Scale Neighborhood Search for the K-Constraint Multiple Knapsack Problem

Claudio Cunha, Associate Professor, University of Sao Paulo, Av. Prof. Almeida Prado, Trav.2, n,83, Sao Paulo, SP, 05508-970, Brazil, cbcunha@usp.br, Ravindra Ahuja

The K-Constraint Multiple Knapsack Problem (K-MKP) is a generalization of the multiple knapsack problem. In K-MKP, each item has K types of weights and each knapsack has K types of capacity. We describe very large-scale neighborhood search (VLSN) algorithms to solve K-MKP, including an approach that consists of randomly perturbing the current solution in order to efficiently produce a set of simultaneous non-profitable. Computational results are also presented.

■ TB07

Room 307

Application of Iterative Methods in Interior-Point Methods

Sponsor: INFORMS Computing Society/Optimization: Computational Optimization and Software

Sponsored Session

Chair: Zhifeng Li, Financial Engineer, Fannie Mae, 3900 Wisconsin Avenue, Washington, DC, 20016, United States, zack_z_li@fanniemae.com

1 - Parallel Constraint Preconditioners for Solving KKT Systems.
Dmitry Golovashkin, Mathematical Programming Specialist, SAS Institute, Inc., SAS Institute, Inc. R5448, SAS Campus Drive, Cary, NC, 27513, United States, Dmitry.Golovashkin@sas.com

A hybrid approach, merging IC preconditioner and approximate inverse is proposed. Computational results on a set of large multicommodity network flow problems for approximate supernode and maximum spanning tree preconditioners are reported.

2 - An Inexact Primal-Dual Path Following Algorithm for Convex Quadratic SDP
Kim-Chuan Toh, Associate Professor, National University of Singapore, Department of Mathematics, 2 Science Drive 2, Singapore, 117543, Singapore, mattohkc@nus.edu.sg

We propose interior-point (IP) methods for linearly constrained convex quadratic semidefinite programming. At each IP iteration, the search direction is computed from an m+n(n+1)/2 dense augmented system, which only be solved by iterative methods when n ccc 100. We propose three classes of preconditioners for the augmented matrix. The preconditioned matrices have favorable asymptotic spectra under suitable assumptions. Numerical results show that our methods are efficient and robust.

3 - Extending An Interior-Point Algorithm with Higher Order Corrections to Semidefinite Programming
Zhifeng Li, Financial Engineer, Fannie Mae, 3900 Wisconsin Avenue, Washington, DC, 20016, United States, zack_z_li@fanniemae.com, Sanjay Mehrotra

We extend a primal-dual infeasible interior-point algorithm with higher order corrections for linear programming (LP) to Semidefinite Programming (SDP). The resulted algorithm has the capbility to combine higher order corrections generated by different strategies. The search direction of the algorithm can be obtained by solving a small SDP program. We give convergence conditions for the algorithm.

■ TB08

Room 308

IT Capabilities: Generative Mechanisms and Performance Implications

Sponsor: Technology Management

Sponsored Session

Chair: Andrea Masini, Assistant Professor, London Business School, Sussex Place, London, NW1 4SA, United Kingdom, amasini@london.edu

1 - IT Adoption, Business Process Isomorphism and the Development of IT Capabilities
Andrea Masini, Assistant Professor, London Business School, Sussex Place, London, NW1 4SA, United Kingdom, amasini@london.edu

This paper suggests that the generation of IT capabilities produces short-term performance advantages. Yet, in the long run the widespread diffusion of IT-based process templates may reduce performance differences among firms, thereby challenging the value of IT as a source of long-term competitive advantage. The role of environmental moderators in this process is also discussed.

2 - Virtual Knowledge Management: Effective Activities and Performance Impact
Antonino Vaccaro, PhD Candidate, Carnegie Mellon University, IST, 5000 Forbes Avenue, Pittsburgh, PA, United States, vaccaro@andrew.cmu.edu, Ronaldo Parente, Francisco Veloso

This research aims to understand the relation between the usage of virtual knowledge management tools and their impact on firm performance. In particular, we investigate how different organizational and environmental conditions affect ICT - enabled knowledge management practices and how different usage levels affect product innovation, speed to market, as well as financial performance.

3 - Improving Learning Through the Nurture of Open Source Communities
Nile Hatch, Assistant Professor, Marriott School, Brigham Young University, 790 TNRB, Provo, UT, 84602, United States, nile@byu.edu, Monte Shaffer

Innovation in open source software is a product of individual and communal learning. We describe this process as the organic growth of communities of practice. Interaction between members of different levels of the community facilitates continued innovation and progress in the open source project. It also requires a boundary spanner to facilitate interaction between members of adjacent levels.

4 - Configuring Capabilities for Integrated Solutions: Evidence from the IT Sector
Federica Ceci, Universitá di San Marino, via Livenza 17, Montesilvano, Pe, 65016, Italy, fceci@london.edu

In an increasing number of industrial sectors, there is an emerging trend towards the provision of bundled services and products sold together, so-called integrated solution. This trend poses new challenges for manufacturers in terms of capabilities development and configuration. Firms shift their core capabilities to provide services and products previously not included in their offer. Aim of this paper is to understand how firms configure their capabilities to adopt this new kind of offer.

■ TB09

Room 309

Emerging Issues in New Product Development

Cluster: New Product Development

Invited Session

Chair: Juergen Mihm, INSEAD, Boulevard de Constance, Fontainebleau, 77305, France, jurgen.mihm@insead.edu

1 - The Effect of NPD Team Structure on Project Termination Decisions
Stylianos Kavadias, Assistant Professor, Georgia Institute of Technology, 800 West Peachtree Street, Atlanta, GA, 30308, United States, Stylianos.Kavadias@mgt.gatech.edu, Nektarios Oraiopoulos

Numerous cases from the industry have indicated strong escalation phenomena among New Product Development (NPD) teams that led to monumental failures. We study the termination decision by modeling NPD teams as groups of decision makers that may evaluate the incoming information differently and thus result in diverse decisions on whether the project should continue or not. Our results indicate the detrimental effect of high dispersion of information perception among team members.

2 - Hierarchies and Problem Solving Oscillations
Juergen Mihm, INSEAD, Boulevard de Constance, Fontainebleau, 77305, France, jurgen.mihm@insead.edu, Bernardo Huberman, Christoph Loch

The vertical hierarchy is the most common way of coordinating specialized groups and their separate decisions in organizations. The distributed nature of problem solving in NPD leads to oscillations and even instability (failure of design teams to converge to a solution). This talk shows, that such problems solving oscillations arise in large organizations under very general circumstances and that coordination through hierarchies can help to dampen such oscillations and create stability.

3 - Component Modularity, Team Network Structure, and Attention to Technical Interdependences
Manuel Sosa, Professor of Technology and Operations Management, INSEAD, Boulevard de Constance, Fontainebleau, 77305, France, manuel.sosa@insead.edu, Martin Gargiulo, Craig Rowles

We study the determinants of teams¥capability to attend to technical interdependences in complex product development projects. We found that teams¥ communication network structure plays a critical role on the capacity of teams to attend to their interdependences. Yet, its impact is contingent upon the modularity and redesign of product components.

4 - Optimal R&D Portfolios: A Risk Management Perspective
Leonardo Santiago, Federal University of Minas Gerais, Av. Antonio Carlos, 6627, Pampulha. Belo Horizonte, MG., 30270-901, Brazil, lsantiago@ufmg.br, Pirooz Vakili

We consider the problem of optimal R&D project selection and portfolio formation based on a two-stage static model. Strategies for risk management, the influence of the degree of risk aversion of the firm on project selection at each stage, and a comparison with other ranking and selection methods will be discussed.

■ TB10

Room 310

Software Demonstration

Cluster: Software Demonstration

Invited Session

1 - SAS Institute, Inc. - SAS Optimization: What's New, What's Next

Ed Hughes, SAS Institute Inc., SAS Campus Drive, Cary, NC, 27513, ed.hughes@sas.com, Trevor Kearney

We'll demonstrate the current and upcoming features that make SAS the smart choice for optimization. Highlights include: —OPTMODEL's unified linear and nonlinear optimization modeling language, —Integration with SAS data handling and analytics, —Model deployment with spreadsheet and Enterprise Guide interfaces, Additionally, we'll preview the upgraded mixed-integer optimization capabilities in our next release.

2 - SCA Technologies - Predictive Cost Modeling for the Intelligent Enterprise

Narendra Bhat, SCA Technologies, 357 N. Craig Street, Pittsburgh, PA, 15213, narendra.bhat@sca-tech.com

Managers need solutions to facilitate rapid scenario-based evaluations needed to enhance their cost structure and productivity. Should these solutions include Make-Buy, Restructuring, Product Reassignments, Outsourcing, Process Improvements, etc., a modeling tool can be the answer to saving time and money before a decision! View how modeling works!

■ TB11

Room 311

Healthcare Logistics

Contributed Session

Chair: Alejandro Davila, Professor, Universidad Politecnica de Aguascalientes, Av. Prol. Mahatma Gandhi Km. 2, Col. San Francisco del Arenal, Aguascalientes, 20280, Mexico, alejandro.davila@upa.edu.mx

1 - Reduction of Wait Time in the Emergency Department of a Public Hospital

Rodolfo Medina, Head of Department, Universidad Politecnica de Aguascalientes, Prol. Mahatma Gandhi Km. 2, Aguascalientes, Ag, 20280, Mexico, rodolfo.medina@upa.edu.mx, Antonio Vazquez, Juventino Martinez, Gilberto Medina, Francisco Briones

This work is motivated from the growth of patients flow in the emergency room, in a public hospital in Mexico, which increases the wait time to receive medical attention. We characterized the incoming demand of services and forecast the future grow of this demand in order to simulate the availability of services and design a method that provides services in the shortest waiting time.

2 - Optimal Parallelization of Anesthetic Processes in Operating Rooms

Rainer Kolisch, Professor, Technical University Munich, Arcisstrasse 21, Munich, 80333, Germany, rainer.kolisch@wi.tum.de, Robert Heil

We consider m operating rooms (ORs) where in each OR patients undergo a three stage process of induction of anesthesia, surgery and emergence from anesthesia. The makespan of one room can be reduced by assigning two anesthetists. If so, the induction of a patient is done in parallel with the preceding patient's process. We assess the benefit of employing n ccc m anesthetists for m ORs by modeling the problem as stochastic scheduling problem. The latter is solved with a branch-and-bound procedure.

3 - A Condition-Based Production System Approach to the Hospital Emergency Room Services

C. Sung, Texas A&M International University, 5201 University Boulevard, Laredo, TX, 78041, United States, drsung@tamiu.edu

Hospital emergency room (HER) services are critical to the quality of patient care and the efficiency of responding to disasters. Respect to the dynamically changing situations faced by the HER, a condition-based production system approach to the HER services is proposed. The modeling of such a healthcare delivery operation will be presented. The goal is to avoid large scale system congestion due to unreliable resource failures. Case studies and systems simulation results will be discussed.

4 - Repeated Negotiations in Health Care Between Hospitals and Payers

Reidar Hagtvedt, Georgia Institute of Technology, 1055 Tumlin Street, Apt. B, Atlanta, GA, 30318, United States, gtg021n@mail.gatech.edu, Paul Griffin

A dynamic model of the iterated negotiations between hospitals and payers is developed and analyzed that captures the goal of the hospital to provide more services, and the intent of the payers to maximize profits over the long-term. These strategic considerations lead to behavior that appears irrational. The key result is that prices will grow proportionately to the capital stock, and never reach equilibrium.

5 - Integral Maintenance System for Medical Equipment of the Health Institute in Aguascalientes

Alejandro Davila, Professor, Universidad Politecnica de Aguascalientes, Av. Prol. Mahatma Gandhi Km. 2, Col. San francisco del Arenal, Aguascalientes, 20280, Mexico, alejandro.davila@upa.edu.mx, Blanca Iracema Mata Jimenez

To design and implement efficient procedures that will help administrate the maintenance efforts of the medical equipment of the Institute of Health of the State of Aguascalientes. Follow up of all processes should be done through a platform and it should guarantee the reliable operation of the equipment at minimum costs of operation. This platform should also aid the institute's certification efforts in different quality norms and should generate statistical information.

■ TB12

Room 312

Spreadsheets in Practice

Sponsor: Spreadsheet Productivity Research

Sponsored Session

Chair: Janet Wagner, Associate Professor, University of Massachusetts-Boston, MSIS Department, 100 Morrissey Boulevard, Boston, MA, 02125, United States, janet.wagner@umb.edu

1 - Optimizing Barge Assignments at Ingram Barge Company

Larry J. LeBlanc, Professor, Vanderbilt University, Owen Graduate School of Management, 401 21st Avenue South, Nashville, TN, 37203, Larry.LeBlanc@owen.vanderbilt.edu

Ingram Barge Company is the leading carrier on U.S. inland waterways. Barge operations are concentrated on the Mississippi, Ohio, Cumberland, and Tennessee rivers and on the Gulf Intracoastal Waterways. At frequent intervals, Ingram Barge must determine what barges to assign to each of a large number of customers at specified sites and time windows. I describe a linear programming assignment model implemented in Excel to determine the optimal assignment of empty barges to customer demands.

2 - A Spreadsheet Patient Scheduling Model for a Student Health Center

John Kros, Assistant Professor of Decision Science, East Carolina University, 3121 Bate, Greenville, NC, 27858, United States, krosj@ecu.edu, Scott Dellana, Dave West

This work studies the procedures that determine how patient appointments are scheduled at a large university Student Health Center and introduces the concept of overbooking to alleviate the detrimental effects of no show appointments. A spreadsheet simulation model is developed and employed to suggest an efficient overbooking procedure. This spreadsheet model augments the rules that determine when appointments can be made and how those appointments are set.

3 - Not Just for Calculating Fast Anymore: Spreadsheet as Platform

Jeffrey Keisler, Assistant Professor, University of Massachusetts Boston, MSIS Department, 100 Morrissey Boulevard, Boston, MA, 02125, United States, Jeff.Keisler@umb.edu

In default mode, spreadsheets look like balance sheets so we use them for arithmetic, or with add-ins to solve well-structured problems. In fact, spreadsheets are application development platforms, with sophisticated language and interface capabilities, allowing different families of functions to be creatively combined to form complex tools. We propose a regimen for exploring the possibilities and developing expertise in this regard.

■ TB13

Room 313

Strategies for Enhancing the Quality and Quantity of Pedagogical Research in OR/MS

Sponsor: Education (INFORM-ED)

Sponsored Session

Chair: Salwa Ammar, Professor of Managment Science, Le Moyne College, 1419 Salt Springs Road, Syracuse, NY, 13214, United States, Ammar@lemoyne.edu

1 - Strategies for Enhancing the Quality and Quantity of Pedagogical Research in OR/MS: Panel Discussion

Moderator: Salwa Ammar, Professor of Managment Science, Le Moyne College, 1419 Salt Springs Road, Syracuse, NY, 13214, United States, Ammar@lemoyne.edu, Panelists: Stephen Powell, Ronald Wright, Donna Llewellyn, Armann Ingolfsson

Meaningful discussions of scholarly work on teaching and learning are now emerging in a variety of disciplines. The need for this body of knowledge is well

accepted. Much debate is taking place on the appropriate form of credible scholarship, where and how it should be disseminated, as well as what defines its value. The panel in this session will lead a discussion on the status of pedagogical scholarship in OR/MS, reasons for its limited availability and strategies for its advancement.

■ TB14

Room 314

Peer-to-Peer Systems and Applications

Sponsor: e-Business
Sponsored Session

Chair: Kai Fischbach, University of Cologne, Pohligstr. 1, Department of Information Systems, Cologne, NW, 50969, Germany, fischbach@wim.uni-koeln.de

1 - The Lifecycle of Movie Piracy in BitTorrent Networks
Michael Smith, Associate Professor, Carnegie Mellon University, 4800 Forbes Avenue, HBH 2105D, Pittsburgh, PA, 15213, United States, mds@cmu.edu, Ramayya Krishnan

Piracy has become an important concern for the movie industry. This concern is driven by the increase in broadband Internet penetration and the development of networking systems, notably the BitTorrent protocol. In our research we analyze the lifecycle of demand for piracy across movies and across countries. Our analysis helps us to evaluate the degree to which piracy serves as a complement or substitute to legitimate demand, and the optimal movie release strategies across international markets.

2 - Trust Formation in the Usage of Peer-to-Peer (P2P) Sharing Software
Heng Xu, National University of Singapore, 3 Science Drive 2, School of Computing, NUS, Singapore, 117543, Singapore, xuheng@comp.nus.edu.sg, Kai Fischbach

In this paper, we develop and empirically test a usage intention model which includes trust in the vendor of P2P sharing software and perceived risk as two major antecedent beliefs to the usage intention. Several trust antecedents are also identified in the model. Our preliminary results show the support for the model, and offer some important implications for software vendors in P2P sharing industry and regulatory bodies.

3 - The Peer-to-Peer Communication Paradigm and its Influence on the IT Industry
Nicolas C. Liebau, Technische Universität Darmstadt, Merckstrasse 25, Darmstadt, He, 64283, Germany, nicolas.liebau@KOM.tu-darmstadt.de, Oliver Heckmann, Andreas Mauthe, Ralf Steinmetz

Applications following the Peer-to-Peer (P2P) communication paradigm are responsible for over 60% of the Internet traffic volume today. As the example of Skype shows, P2P systems potentially have drastic impact on future markets. In this paper, we discuss the P2P communication paradigm and evaluate its impact on the IT industry and eBusiness companies, on products, markets, and business models using case studies.

■ TB15

Room 315

Auctions and Marketing

Cluster: Auctions and e-Commerce
Invited Session

Chair: Peter Eso, Northwestern University, Kellogg School of Management, 2001 Sheridan Road, Evanston, IL, 60208, United States, eso@kellogg.northwestern.edu

1 - Bidding Strategies In Buyer-Determined Online Reverse Auctions
Sandy Jap, Caldwell Research Fellow, Goizueta Business School, Emory University, Sandy_Jap@bus.emory.edu, Sherry Li

The growing use of business-to-business online reverse auctions has produced a new type of auction, one in which the lowest price bidder is not necessarily guaranteed to be the winner and the buyer has full latitude to select the winner from any of the qualified bidders. What are the strategies of bidders in these types of auctions? We find that in these auctions, bidders do not follow the typical bidding strategy of private value English auctions - to outbid the competition down to one's reservation price - but instead respond to their perceptions of competitors' quality and rely on their known quality variables, such as certifications and past relationships in formulating their bids. Using a hierarchical bounded rationality framework and point-by-point bid data from two industrial reverse auctions, we find that bidders incorporate quality information from competitive bids over the course of the auction; that is, suppliers not only adjust their bids for their own quality-advantage or disadvantage - they also account for opponents' perceived quality differences. We also find that bidders will bid more aggressively as the economic stakes, or number of lots, in an auction increases and that although incumbents tend to bid aggressively, this behavior is moderated by their relationship state with the buyer (i.e., the level of trust, willingness to collaborate, and general relationship trend). Implications for the management of online reverse auctions are discussed.

2 - Competition for Scarce Resources
Peter Eso, Northwestern University, Kellogg School of Management, 2001 Sheridan Road, Evanston, IL, 60208, United States, eso@kellogg.northwestern.edu

We show that if firms have symmetric technologies with decreasing returns to scale and buy inputs in an efficient auction, then their downstream competition becomes asymmetric. One firm will be large and inefficient, while the other firms will be small and profitable. The same is true even as the number of firms goes to infinity. Paradoxically, social welfare may fall as the supply of the valuable and scarce input is increased.

3 - When and How Much to Give: Impact of Donation Percentage on Selling Prices in Charity Auctions
Peter Popkowski Leszczyc, Associate Professor of Marketing, School of Business, University of Alberta, Edmonton AB, T6G 2R6, Canada, ppopkows@ualberta.ca, Michael H. Rothkopf, Leo Wong

We study the effects of percentage of selling price donated, product type, information, and gender on outcomes in charity auctions. Controlled field experiments indicate that auctions with 25% of revenue donated to charity had higher net revenue than non-charity auctions.

■ TB16

Room 316

Robustness in Revenue Management

Cluster: Dynamic Pricing and Forecasting
Invited Session

Chair: Aurelie Thiele, P.C. Rossin Assistant Professor, Lehigh University, 200 W. Packer Avenue, Bethlehem, PA, 18015, United States, aut204@lehigh.edu

1 - Robust Monopoly Pricing: The Case of Regret
Dirk Bergemann, Campbell Professor of Economics, Department of Economics, Yale University, 28 Hillhouse Avenue, New Haven, CT, 06511, United States, dirk.bergemann@yale.edu, Karl Schlag

We consider a robust version of the classic problem of optimal monopoly pricing with incomplete information. The robust version of the problem is distinct in two aspects: the seller minimizes regret rather than maximizes revenue, and the seller only knows that the true distribution of the valuations is in a neighborhood of a given model distribution. We characterize the robust pricing policy as the solution to a minimax problem for small and large neighborhoods.

2 - Robust Optimization in Pricing
Aurelie Thiele, P.C. Rossin Assistant Professor, Lehigh University, 200 W. Packer Avenue, Bethlehem, PA, 18015, United States, aut204@lehigh.edu

We investigate the impact of uncertainty and product substitution in pricing models with capacitated resources, when the underlying probabilities are not known. The approach is based on robust optimization with a novel type of constraint, which bounds the amount of the resource to be used by the uncertain component of the aggregate demand. We establish the existence of reference prices, which play a key role in understanding the impact of randomness, and present computational results.

3 - Robust Stochastic Lot-Sizing Using Historical Data
Miao Song, Massachusetts Institute of Technology, 77 Massachusetts Avenue, Room 1-236E, Cambridge, MA, 02139, United States, msong@mit.edu, Diego Klabjan, David Simchi-Levi

We consider the single-item multi-period periodic review stochastic lot-sizing model. Unlike the traditional setting of a given demand distribution, we assume only historical data and distribution fitting is captured in the model itself. We propose an integrated minimax robust model, and prove that the optimal inventory control policy of this model shares the same structure as the traditional stochastic counterpart.

4 - Network Equilibrium Pricing Under Uncertainty
Fernando Ordonez, Assistant Professor, University of Southern California, 3715 McClintock Avenue, GER-240, Los Angeles, CA, 90089, United States, fordon@usc.edu, Nicolas Stier-Moses

Traffic network models assume that utilities only depend on congestion, however in most applications they also include an uncertain component. We explore the use of tolls for managing traffic on networks and encouraging players to select socially-efficient paths. The solution concept we use is a robust Wardrop equilibrium in which players take into account the uncertainty by solving robust shortest path problems. We study conditions under which socially optimal solutions can be enforced.

■ TB17

Room 317

Pricing in IT Services

Cluster: Dynamic Pricing and Forecasting
Invited Session

Chair: Parijat Dube, IBM Research, 19 Skyline Drive, Hawthorne, NY, 10532, United States, pdube@us.ibm.com

Co-Chair: Cathy Xia, Research Staff Member, IBM, 19 Skyline Drive, Hawthorne, NY, 10532, United States, cathyx@us.ibm.com

1 - Pricing End-to-End QoS Guaranteed Internet Services
Aparna Gupta, Assistant Professor, Rensselaer Polytechnic Institute, 110 8th Street, Troy, NY, 12180, United States, guptaa@rpi.edu, Lingyi Zhang

Risks underlying Quality of Service (QoS) guaranteed services on the Internet cannot be technologically eliminated. We develop appropriate models for end-to-end QoS guaranteed contracts and apply options-pricing based techniques for pricing the risk in these contracts.

2 - Pricing Models for On-Demand Computing
Arun Sundararajan, Professor, New York University (NYU), Leonard N. Stern School of Business, 44 West 4th Street, KMC 8-93, New York, NY, 10012, United States, arun@stern.nyu.edu, Ke-Wei Huang

We model the optimal pricing of on-demand computing taking four critical factors into account: the costs of deploying IT in-house, the business value of this IT, the scale of the provider's infrastructure, and the variable costs of providing on-demand computing. Three distinct pricing models emerge as optimal among all possible pricing functions, which describe when volume discounting, free usage and demand caps should be used to manage demand appropriately and profitably.

3 - Flexible-Discount Pricing for Computing Utilities
Giuseppe Paleologo, IBM Research, Yorktown Heights, NY, 10598, United States, gappy@us.ibm.com

The initial capacity investment decision is critical to the success of a new computing utility offering. The problem of capacity allocation under a linear pricing contract resembles that of a newsvendor problem. I introduce a new pricing schedule which attains full information revelation, and results in the highest possible utilitarian welfare for the system.

4 - An Operational Statistical Approach for Informed Pricing
Justin Azadivar, Graduate Student, University of California, Department of IEOR, University of California, Berkeley, CA, 94720, United States, jazad@uclink.berkeley.edu, George Shanthikumar

In order to price products or services, information must be gathered, often at cost. A complete statistical approach should account for the value of additional information dynamically and in relation to the decision. An Operational Statistical approach is presented to avoid the limitations of both the frequentist estimator approach, which does not generally integrate decision-making, and the subjective Bayesian approach, which requires knowledge that is often unavailable.

5 - Demand Uncertainty and Dynamic Pricing of IT Services
Parijat Dube, IBM Research, 19 Skyline Drive, Hawthorne, NY, 10532, United States, pdube@us.ibm.com, Cathy Xia

We consider the problem of dynamic pricing of IT services as an expected utility maximization problem under demand uncertainty. Demand is characterized using probabilistic models based on service provider's prior beliefs, which are improved along the process. Pricing decisions are then obtained dynamically, where the service provider chooses the measure that minimizes the relative entropy with the true model.

■ TB18

Room 318

Joint Session Counter Terrorism/DAS: Game Theory and Related Methods for Security

Cluster: Counter Terrorism and OR, Decision Analysis Society
Invited Session

Chair: Vicki Bier, Professor, University of Wisconsin-Madison, 1550 Engineering Drive, Room 3158 Engineering Centers Building, Madison, WI, 53706, United States, bier@engr.wisc.edu

1 - Terrorism, Game Theory and Motivation
William D. Rowe Sr., Senior Consultant, Project Performance Corporation, 1760 Old Meadow Road, McLean, VA, 22102, United States, wrowe10@comcast.net

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ame theory addresses strategic approaches when facing rational opponents. Terrorists cannot be considered as rational opponents from an organized society's viewpoint. The value functions for the opponents differ and result in a mismatch of measurement scales. Game theory structures provide a means of organizing the "terrorism game". A simple game structure is presented to illustrate the situation. The missing piece is the motivation of the players, requiring a need to map them.

2 - Balancing Protection from Terrorism and Natural Disasters
Jun Zhuang, University of Wisconsin-Madison, 3155 Engineering Centers Building, 1550 Engineering Drive, Madison, WI, 53706-1572, United States, jzhuang@wisc.edu, Vicki Bier

In this paper, we apply game theory to identify equilibrium strategies for both attacker and defender in a fully endogenous model of resource allocation for countering terrorism and natural disasters. Our results provide insights into optimal defensive strategies in a post-9/11 and post-Katrina world.

3 - Attacker-Defender Games with Partial Information About Defensive Allocations
Nikhil Dighe, Research Assistant, University of Wisconsin, Madison, 1550 Engineering Drive, 3155 Engineering Centers Building, Madison, WI, 53713, United States, nsdighe@wisc.edu, Vicki Bier

We discuss the strategic interactions between a defender and an attacker, who partially observes the defender's resource allocation (in particular, the number of resources defended). In this model, keeping the defensive allocation secret is critical to achieving attacker deterrence cost-effectively. This is a departure from the results of many previous models, in which disclosure of defensive resource allocations is advantageous to the defender.

4 - Static and Dynamic Resource Allocation for Perimeter Security
Matthew Bailey, University of Pittsburgh, Department of Industrial Engineering, Pittsburgh, PA, 15243, United States, mdbailey@engr.pitt.edu, Nan Kong

We present a model to assist in the allocation of resources for perimeter security, while accounting for its impact on dynamic operations. More generally, we introduce a framework for optimally allocating static interdiction devices in a zero-sum, one player controlled stochastic game. We first introduce the general model, then illustrate the technique on a problem of perimeter security, and finish with a computational illustration.

■ TB19

Room 319

Environmental Policy in Product Design and Development

Sponsor: Energy, Natural Resources & The Environment
Sponsored Session

Chair: Jeremy Michalek, Assistant Professor, Carnegie Mellon University, Scaife Hall 323, 5000 Forbes Avenue, Pittsburgh, PA, 15213, United States, jmichalek@cmu.edu

1 - Review of Systems Models Linking Economics and Engineering Design in Automotive Policy Analysis
Steven Skerlos, Assistant Professor, University of Michigan, 2350 Hayward Street, Ann Arbor, MI, 48109, United States, skerlos@umich.edu, Ross Morrow

Determination of optimal greenhouse gas emissions policies for the automotive sector requires systems analysis methods to evaluate policies for their impact on future emissions profiles and costs to society. We review two approaches toward this end - economic equilibrium modeling and technology studies - and highlight the importance of integrating economics and design in determining plausible forecasts of future emissions profiles.

2 - The Impact of Environmental Policy on Profit-Driven Vehicle Design Optimization
Jeremy Michalek, Assistant Professor, Carnegie Mellon University, Scaife Hall 323, 5000 Forbes Avenue, Pittsburgh, PA, 15213, United States, jmichalek@cmu.edu

Environmental policy, consumer preferences, and cost structures of current technology set the parameters that determine which vehicle designs are most profitable in a competitive marketplace. This study models the characteristics of optimal vehicle design under a range of policy incentive scenarios and examines the resulting impact on public and private preferences.

3 - Modeling Distributed Customer Base Behavior under Uncertainty in a Reuse Environment
Vijitashwa Pandey, RA, University of Illinois at Urbana-Champaign, 104 S. Mathews, 117 Transportation Building, Urbana, IL, 61801, United States, vijitashwa@yahoo.com, Deborah Thurston

Efficient environmentally conscious product design requires rigorous understanding of customer preferences with strict conformance to government regulations. We present a methodology for modeling preferences of a widely distributed customer base under uncertainty, in a reuse environment, to ensure that the government, manufacturer and the customers speak the same language.

4 - Interactive Decision Tool to Forecast Impacts of Technological Change in the Passenger Vehicle Fleet

David Gerard, Executive Director, Center for the Study & Improvement of Regulation, Engineering & Public Policy, Carnegie Mellon University, Pittsburgh, PA, 15213, United States, dgerard@andrew.cmu.edu, Paul Fischbeck

This talk will describe an accessible, flexible, interactive tool that allows stakeholders to examine the environmental/health implications of vehicle technologies using: dynamic models that estimate emissions of criteria pollutants; a reduced-form model to estimate ambient air quality in US metropolitan areas; and an assessment of health impacts.

■ TB20

Room 320

Health Care Applications

Sponsor: Decision Analysis Society

Sponsored Session

Chair: Sara Eggers, Carnegie Mellon University, Baker Hall 129, 4800 Forbes Avenue, Pittsburgh, PA, 15213, United States, sara.eggers@alumni.cmu.edu

1 - A Decision-Analytic Approach to Frame Regulatory Decisions Regarding Over-the-Counter Statins

Sara Eggers, Carnegie Mellon University, Baker Hall 129, 4800 Forbes Avenue, Pittsburgh, PA, 15213, United States, sara.eggers@alumni.cmu.edu, Baruch Fischhoff

We present a behavioral-realistic, decision-analytic research framework to assess the impact of Over-the-counter availability of statins on consumers' welfare and aid FDA in making judgments on its acceptability. We first normatively model choices facing consumers. We compare those decisions to a descriptive model integrating existing empirical evidence on actual consumer decision making.

2 - The Impact of Over-the-Counter Availability of Plan B on Teens' Contraceptive Decision

Tamar Krishnamurti, Graduate Student, Carnegie Mellon University, 208 Porter Hall, 5000 Forbes Avenue, Pittsburgh, PA, 15217, United States, tamark@andrew.cmu.edu

In ruling on the over-the-counter status of emergency contraception, the FDA must determine whether adolescents can appropriately self-select & self-medicate. We present an approach to this class of regulatory problems, reflecting analytical and empirical methods grounded in behavioral decision research. We inform this approach with findings from interviews with adolescent females, concerning how their choices about contraception will be affected by FDA's interpretation of drug licensing laws.

3 - Parents' Vaccination Decisions

Julie Downs, Carnegie Mellon University, SDS PH 208, Pittsburgh, PA, 15213, United States, downs@cmu.edu, Wändi Bruine de Bruin, Baruch Fischhoff

Fear of side-effects and beliefs that vaccines are unnecessary may lead parents to opt out of immunization programs. We investigate thirty parents' decisions about vaccinating their children and patterns in seeking further information. The results suggest that even general acceptance of vaccination does not ensure that parents will understand the ongoing debate once they encounter it. Moreover, those who know the least about vaccination are the most vulnerable to getting misleading information.

4 - Evaluating Risk-Benefit Tradeoffs in Seafood Consumption: A Decision-Analytic Approach

Ketra Schmitt, Carnegie Mellon University, 5000 Forbes Avenue, Pittsburgh, PA, 15213, United States, ketra@cmu.edu, Sandra Baird, Mitchell Small, Sara Eggers

Risk-benefit trade-offs inherent in seafood consumption render the standard approach of limiting exposure to a risky substance inappropriate. Evaluating these trade-offs requires that risks and benefits be quantified and incorporated into a multi-endpoint risk-benefit model and integrated into a decision-analytic model to derive optimal fish consumption decisions for different sub-populations.

5 - An Expert Model of Pandemic Influenza Risks

Wandi Bruin de Bruin, Research Scientist, Carnegie Mellon University, Pittsburgh, PA, 15213, United States, wandi@andrew.cmu.edu, Baruch Fischhoff, Larry Brilliant, Denise Caruso

Predicting the potentially looming influenza pandemic requires an exercise in judgment, the expertise for which is distributed over many individuals and disciplines. We developed a model of pandemic influenza, with input from an interdisciplinary group of influenza experts, including estimates for key variables potentially affecting the extent of a pandemic.

■ TB21

Room 321

Behavioral Decision Making

Sponsor: Decision Analysis Society

Sponsored Session

Chair: Manel Baucells, Associate Professor, IESE Business School, Avda. Pearson, 21, Barcelona, Ba, 08034, Spain, mbaucells@iese.edu

1 - A Behavioral Measure of Risk

Philippe Delquié, Associate Professor of Decision Sciences, INSEAD, Boulevard de Constance, Fontainebleau, F-77300, France, philippe.delquie@insead.edu, Alessandra Cillo

We develop a measure of risk based on the behavioral assumption that individuals care about differences among the outcomes of a gamble. This new risk measure includes variance as a special case, among many other forms. It also leads to Rank-Dependent Utility and Disappointment models of choice. We discuss properties of the risk measure.

2 - Can't Wait To Look in the Mirror: The Impact of Experience on the Better-Than-Average Effect

Cade Massey, Assistant Professor of Organizational Behavior, Yale University, School of Management, 135 Prospect Street, New Haven, CT, 06520, United States, cade.massey@yale.edu, David Robinson, Ron Kaniel

Decades of research show that an impossibly large percentage of people believe they are better than average in a wide range of activities. In a study of MBA students, we investigate how experience affects this bias. Matching longitudinal surveys about grades expectations with data on classroom performance, we find that experience actually exacerbates the better-than-average effect. This is due in part to students being more responsive to positive feedback than to negative feedback.

3 - The Equal Tails: A Method to Elicit the Value Function

Antonio Villasis, IESE Business School, Av. Pearson 21, Barcelona, 08034, Spain, avillacis@alumni.unav.es, Manel Baucells

We propose a modification of existing elicitation methods for risk attitudes. It keeps most of the simplicity of classic methods and mitigates the distorting effect of probability weighting. The essence of the method is to ensure that the extreme monetary outcomes of the prospects presented to the subjects are the same. Experimentally, we found smaller degrees of concavity for gains. Our findings are consistent with other methods developed to avoid the distortion of probabilities.

4 - Intertemporal Choice Under Timing Risk: An Experimental Approach

Selcuk Onay, PhD Candidate, INSEAD, Boulevard de Constance, Fontainebleau, 77305, France, selcuk.onay@insead.edu, Ayse Onculer

Timing risk, that is, having more than one possible outcome realization time, is an inherent feature of many intertemporal decisions. In this paper, we take an experimental approach to study individuals' attitudes towards such risks and how this attitude relates to risk and time preferences. In contrast to predictions of the discounted utility models, our results show that individuals are averse to timing risk and that the main driver of this aversion is nothing but probabilistic risk aversion.

■ TB22

Room 322

Research at USMA Addressing Department of Defense Strategic and Operational Needs

Sponsor: Military Applications

Sponsored Session

Chair: Simon Goerger, Assistant Professor & ORCEN Director, Department of Systems Engineering, Building 752 (Mahan Hall), United States Military Academy, West Point, NY, 10996, United States, Simon.Goerger@usma.edu

1 - Using Agent Based Models to Assess Strategies Against Asymmetric Warfare

Niki Goerger, ERDC Research Associate at USMA, Engineer Research and Development Center, Department of Systems Engineering, United States Military Academy, West Point, NY, 10996, United States, Niki.Goerger@usma.edu, Simon Goerger, Gregory Griffin

Asymmetric Warfare threats are often devastating in effect, hard to detect, and difficult to thwart. The asymmetric environment makes detecting and defeating this threat complex and challenging. This presentation explores the feasibility of using agent based models to provide insights into countering this threat in urban environments and stability and support operations. It addresses potential methodologies to establish measures of effectiveness to assess the effectiveness of the tactics used.

2 - Six Sigma and Simulation: A Yin and Yang Approach Towards the Pursuit of Better

Simon Goerger, Assistant Professor & ORCEN Director, Department of Systems Engineering, Building 752 (Mahan Hall), United States Military Academy, West Point, NY, 10996, United States, Simon.Goerger@usma.edu, Ernest Wong

The Chinese constructed Yin-Yang to represent how things work. The black and white energies cause everything to happen. But they aren't completely black and white, and one can't exist without the other. As OR practitioners, we know the goals of six sigma and simulation as being contradictory: six sigma is an exacting optimization tool that aims for reduced defects; simulation is a robust learning instrument that aims to enlighten. I examine how these two tools can work as one towards better.

3 - Predictive Modeling with Geospatial Data

Paul Evangelista, Instructor & Analyst, Operations Research Center of Excellence, Building 752 (Mahan Hall), Department of Systems Engineering, West Point, NY, 10996, United States, Paul.Evangelista@usma.edu

Modeling methods for the prediction of low density events from geospatial data attempts to describe underlying patterns of low density events as a function of geospatial statistics. Predictive models compared include pattern recognition and regression methods such as kernel partial least squares regression, support vector machines, poisson regression, linear regression, and kernel density with spatial preference. This modeling approach has shown promise in predicting crimes and combat events.

4 - Small Arms Weapons Effective Life Cycle Study

Gary Kramlich, Instructor & Analyst, Operations Research Center of Excellence, Building 752 (Mahan Hall), United States Military Academy, West Point, NY, 10996, United States, Gary.Kramlich@usma.edu

As mission essential equipment is utilized under varied conditions, determining if and when complete overhaul of the equipment becomes more difficult. This presentation addresses the questions: can mandatory overhaul of small arms weapons based on new metrics improve overall fleet effectiveness; and can simulations determine if it is more efficient to fix weapons before they break or only after they have defective parts?

■ TB23

Room 323

Best Practices in Sourcing Services

Cluster: Global Services Sourcing

Invited Session

Chair: Elaine Hyder, Systems Scientist, Carnegie Mellon University, 5000 Forbes Avenue, 1311 Wean Hall, Pittsburgh, PA, 15217, United States, ehyder@cs.cmu.edu

1 - E-Sourcing Capability Model for Service Providers (eSCM-SP) v2: An Overview

Elaine Hyder, Systems Scientist, Carnegie Mellon University, 5000 Forbes Avenue, 1311 Wean Hall, Pittsburgh, PA, 15217, United States, ehyder@cs.cmu.edu

Developed by a consortium led by Carnegie Mellon University's Information Technology Services Qualification Center (ITSqc), the eSCM-SP v2 contains best practices to address the critical capabilities needed by IT-enabled sourcing service providers. The purpose of this paper is to provide an overview of this model, including its intent, its audience and scope, and its structure.

2 - Identifying Issues in Sourcing: Informing Development of Best Practices

William Hefley, Associate Teaching Professor & Associate Director, IT Services Qualification Center, Carnegie Mellon University, 5000 Forbes Avenue, Pittsburgh, PA, 15213, United States, hefley@cmu.edu, Jane Siegel, Jeff Perdue

Sourcing has rapidly grown in recent years, but has been fraught with numerous issues. Our research explored these issues and informed development of the eSourcing Capability Model for Client Organizations (eSCM-CL), a set of best practices to address the critical capabilities needed by clients to source IT-enabled services. The purpose of this paper is to provide an understanding of these issues, as well as an overview of this model, its intent, its audience and scope, and its structure.

3 - A Statistical Sampling Methodology for eSCM-SP Assessments

David Northcutt, Senior Technical Staff Member, IBM, Chester, NJ, United States, northcut@us.ibm.com, Mark Paulk

Performing assessments in large complex organizations quickly becomes cost prohibitive if every component must be assessed for each criterion. This paper presents a stratified sampling methodology for the eSourcing Capability Model for Service Providers. The approach significantly reduces the number of components that must be reviewed while maintaining statistical confidence in the result. An analysis of the probabilistic behavior of the methodology and examples of its use are included.

4 - Understanding Statistical Thinking in the eSCM-SP

Mark Paulk, Senior Systems Scientist, Carnegie Mellon University, IT Services Qualification Center, 5000 Forbes Avenue, Pittsburgh, PA, 15213, United States, mcp@cs.cmu.edu, Keith Heston, Elaine Hyder

The eSourcing Capability Model for Service Providers (eSCM-SP) version 2 is a "best practices" framework with explicit requirements for statistical thinking and quantitative management. The purpose of this paper is to identify what was expected by the authors of the Model for a complete implementation of statistical thinking; what the Model explicitly requires; and what has been empirically observed, both good and bad, in service providers implementing the relevant Practices.

■ TB24

Room 324

Industry Applications I

Contributed Session

Chair: Marc Rose, Senior Operations Research, MCR, 600 Maryland Avenue, Suite 700, Washington, DC, 20024, United States, mrose@mcri.com

1 - Advanced Resources Planning at Atlas Copco

Kris Lieckens, Research Assistant, University of Antwerp, Prinsstraat 13, Antwerp, 2000, Belgium, kris.lieckens@ua.ac.be, Nico Vandaele, Wouter Ceulemans, Noël Janssens

Atlas Copco, a company operating in the airpower tools industry, is moving into Advanced Resource Planning. Faced with wave-like behavior of demand and capacity over the planning horizon like seasonality and dynamic availability of resources, they developed a decision support system that is used on the monthly Sales and Operations Planning meetings to analyze their manufacturing performance. The model underneath is based on a queueing network that accounts for various stochastic elements.

2 - Principal Component Analysis Applied to the Thermal Cracking of 1,2-Dichloroethane

Helianildes Ferreira, SENAI-Serviço Nacional de Aprendizagem Industrial, Avenida Luís Tarquínio Pontes, 938, Aracuí, Lauro de Freitas, 42.700-000, Brazil, helih@fieb.org.br, João Pereira, M.F.S. Lopes

The Principal Component Analysis is a Multi-statistical Technique used to speed up the training of the Artificial Neural Nets (ANN). In this article we present the application of this technique to reduce also the complexity of the system involving the thermal cracking of 1,2-dichloroethane. In this article this technique could reduce the dimensionality of the problem from 7(seven) to 3(three), that is, we needed only three variables or combination of the most representative variables of the system to describe the prediction of the conversion of 1,2-dichloroethane in the main reaction. The principal component analysis could represent 99% of the data. We obtained a mean square error in the training of 6,8E-7, however the validation and test errrors were higher.

3 - Applied Stochastic Programming - Models and Computation
Gus Gassmann, Professor, Dalhousie University, School of Business Administration, 6100 University Avenue, Halifax, NS, B3H 3J5, Canada, hgassman@mgmt.dal.ca

This talk gives a review of fifty years of stochastic programming, concentrating especially on applications, models and computation.

4 - Optimal Transmission Tower Spotting using Graph Theory and Preference Relationships between Nodes
John Neiva de Figueiredo, Professor, Federal University of Santa Catarina, EPS/CTC - Trindade Campus, Florianopolis, SC, 88010-970, Brazil, jneiva@deps.ufsc.br, Clovis Gonzaga

No method guaranteed transmission tower spotting optimality as all prior formulations were based on sliding window approaches. We present a model that guarantees spotting transmission line towers at minimum cost. Electromechanical and topographical constraints are described; a model using graph theory is introduced; nodes, arcs, costs, and paths are defined; and the algorithm is presented. We use a shortest-path search method with the novel concept of preference relationships between nodes.

5 - FAA Performance Metrics - Block Time & Predictability
Marc Rose, Senior Operations Research, MCR, 600 Maryland Avenue, Suite 700, Washington, DC, 20024, United States, mrose@mcri.com, Gabriela Rohlck

This paper addresses the development of performance metrics used by the FAA. The discussion will talk about two methods of normalizing data. We then focus on 2 performance metrics. Scheduled Block Time, focusing on modifying the calculation for normalization. Flight predictability, - a very important factor to the airlines. This comes in many flavors (e.g., airborne, block time). This paper will focus on a specific methodology showing the results of "Total Flight Time"=Block+Departure Delay.

■ TB25

Room 325

Joint Session OR Practice/CPMS: Edelman - Reprise of 2006 Edelman Award Finalists

Cluster: OR Practice, The Practice Section of INFORMS
Invited Session

Chair: R. John Milne, IBM, 43 Skunk Hollow Road, Jericho, VT, 05465, United States, jmilne@us.ibm.com

1 - Multi-Product Inventory Routing with a Heterogeneous Fleet of Vessels at Omya Hustadmarmor
Nordli Atle, Associate Professor, Norwegian School of Management, Nydalsveien 37, 0484 Oslo, Oslo, Norway, atle.nordli@bi.no, Stephane Dauzere-Peres

A DSS for maritime inventory routing has been developed and implemented. The system has increased both supply chain predictability and flexibility. Direct savings in production and transportation are estimated to 11 million dollars a year. Investments of 35 million dollars have been avoided due to increased capacity utilization, and oil consumption has been lowered by 12 percent as a result of the project.

2 - PLATO Helps Athens Win Gold
Pericles Loucopoulos, Professor, The University of Manchester, School of Informatics, PO Box 88, Manchester, M60 1QD, United Kingdom, p.loucopoulos@manchester.ac.uk, Kostas Zografos

The Athens 2004 Olympic Games organizing committee commissioned the PLATO project (Process Logistics Advanced Technical Optimization) to bring about a major shift in the way that planning, design, and operation of venues were carried out. We developed a systematic process for planning and designing venue operations by using knowledge modeling and resource-management techniques and tools. We developed a rich library of models that is directly transferable to future organizing committees.

3 - Analytical Models Enable Govt/Industry Policy Makers to Balance Impacts on Aviation Security
Russell Wooten, Department of Homeland Security, Washington, DC, 20528, United States, Russell.Wooten@dhs.gov, Bob Peterson

The United States Commercial Aviation Partnership (USCAP) created a large spreadsheet model using systems dynamics, queueing models, and econometrics to encompass the entire US commercial aviation industry including travelers, airlines, airports, airline suppliers, airport suppliers, government agencies, and travel and tourism entities. The model helps stakeholders understand the high level economic impact of policy and procedure decisions going out as much as 30 years.

■ TB26

Room 326

New Data Mining Techniques for Business Applications

Sponsor: Data Mining
Sponsored Session

Chair: Nick Street, Associate Professor, University of Iowa, S232 Pappajohn Business Building, Iowa City, IA, 52242, United States, nick-street@uiowa.edu

1 - Ranking Evaluation of Regression Models
Claudia Perlich, Researcher, IBM T.J. Watson Research Center, 1101 Kitchawan Road, Route 134, Yorktown Heights, NY, 10598, United States, perlich@us.ibm.com

We suggest the use of ranking-based evaluation for regression tasks. In marketing, ranking is often the ultimate goal in building a regression model. Even when ranking is not the contextually correct performance metrics, our measures still have significant advantages: robustness against extreme outliers in the evaluation set; and interpretability. Our measures correspond closely to non-parametric correlation coefficients used in data analysis and both have interesting graphical representations.

2 - Hierarchical Subset Clustering for Consideration Set Analysis
Ding Yuan, The University of Iowa, S210 PBB, Iowa City, IA, 52246, United States, ding-yuan@uiowa.edu, Nick Street

Consideration sets can be used for market segmentation by grouping customers based on what they considered buying. However, consideration sets are not directly observable in consumer markets. We propose a novel subset clustering algorithm, based on binary clustering and itemset mining, to learn consideration sets from scanner data. In addition to discovering structure in the market, we use clustering to divide the data into homogeneous groups, making for easier choice prediction.

3 - Rank Optimization by an Approximation to WMW Statistic and its Applications
Kaan Ataman, The University of Iowa, S210 John Pappajohn Business Building, Iowa City, IA, 52242-1000, United States, kaan-ataman@uiowa.edu, Nick Street

We present a linear programming formulation for ranking instances in the context of binary classification by an approximation to the Wilcoxon-Mann-Whitney statistic. Then we present and discuss applications of this LP based ranking algorithm in the domains of business and health care.

4 - Mining Consumer Network Data for Targeted Marketing
Shawndra Hill, New York University, 44 W 4th Street, New York, NY, 10012, United States, shill@stern.nyu.edu, Chris Volinsky, Foster Provost

This project analyses networks formed from direct interactions between consumers. The data come from a telecommunication firm's targeted marketing campaign, which form a natural testbed for studying network-based marketing because both direct consumer interactions and product adoption are observable. We show that models built using attributes constructed from the consumer interaction network enable better prediction of product adoption than traditional targeted marketing techniques.

■ TB27

Room 327

Wavelets in Statistical Applications

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: Rajesh Ganesan, Assistant Professor, George Mason University, 4400 University Drive, ST2, MS4A6, Fairfax, VA, 22030, United States, rganesan@gmu.edu

1 - Denoising of Microarray Outputs Using Dual Tree Complex Wavelet Transforms
Tapas K. Das, Professor, Department of Industrial & Management Systems Engineering, University of South Florida, 4202 E. Fowler Avenue, ENB118, Tampa, FL, 33620, United States, das@eng.usf.edu, Chaitra Gopalappa

Microarrays continue to evolve as a powerful tool for assessing the expression levels of genes in DNAs. Noise in microarray data is considered to be a major hindrance to a significant number of impending breakthroughs in medical treatment and drug discovery. We discuss a multiresolution analysis based denoising approach using dual tree complex wavelet transform.

2 - Diffusion Wavelets and Applications
Rajesh Ganesan, Assistant Professor, George Mason University, 4400 University Drive, ST2, MS4A6, Fairfax, VA, 22030, United States, rganesan@gmu.edu, Poornima Balakrishna

This talk presents the concept of diffusion wavelets and some of its applications in function approximation and dimensionality reduction.

■ TB28

Room 328

Quality Control of Multistage Systems

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: Shiyu Zhou, Assistant Professor, University of Wisconsin-Madison, 1513 University Avenue, Madison, WI, 53706, United States, szhou@engr.wisc.edu

1 - Error Equivalence Concept and Multistage Manufacturing Process Control
Qiang Huang, Assistant Professor, University of South Florida, 4202 East Fowler Avenue, ENB 118, Tampa, FL, 33620, United States, huangq@eng.usf.edu, Hui Wang

Error equivalence refers to the engineering phenomenon that different error sources result in identical variation patterns on product features. It presents challenging control issues to multistage manufacturing process. This paper modeled error equivalence by transforming all error sources into equivalent amount of base type error. The error equivalence model was then integrated into the description of variation propagation. The advantages of considering error equivalence were discussed.

2 - Monitoring Process Quality in Multistage Systems
Paul Zantek, University of Maryland, Robert H. Smith School of Business, College Park, MD, 20742, United States, pzantek@rhsmith.umd.edu

We propose a monitoring method for detecting process quality changes in multistage systems. The proposed method can also help identify the source(s) of such changes. The performance of the method is studied, both analytically and numerically, and compared to that of existing methods.

3 - Evaluation of Coordinate Sensor System Reliability Using Monte Carlo Methods
Qingyu Yang, University of Iowa, Department of Mechanical & Industrial Engineering, Iowa City, IA, 52242, United States, qiyang@engineering.uiowa.edu, Yong Chen

The diagnosability information of coordinate sensor systems in multistage manufacturing processes has a matroid structure when sensors in the system fail catastrophically. Evaluating the reliability of coordinate sensor systems is therefore an NP hard problem, which has not been investigated in the literature. In this paper, Monte Carlo methods are applied to evaluate/approximate the coordinate sensor system reliability and their performances are compared.

4 - Mapping Engineering Defined Patterns with Factor Loadings for Variation Source Identification in MMP
Jian Liu, University of Michigan, 1205 Beal Avenue, IOE1710, Ann Arbor, MI, 48109-2117, United States, jliuzz@umich.edu, Jianjun Shi

A new diagnosis methodology is proposed for identifying multiple process faults in multi-stage manufacturing processes (MMP). Engineering knowledge represented as a pattern matrix is employed in directing the rotation of factor loadings, which are extracted from measurement covariance matrix, to estimate the true geometric relationships between process faults and quality variables.

■ TB29

Room 329

Joint Healthcare/Simulation: Simulation in Health Care

Cluster: Joint Cluster Healthcare/ HAS: Healthcare Engineering
Invited Session

Chair: Shane Henderson, Associate Professor, Cornell University, School of ORIE, 230 Rhodes Hall, Ithaca, NY, 14853, United States, sgh9@cornell.edu

1 - Outpatient Clinic Simulation Metamodeling
Mark Isken, Associate Professor of MIS, Oakland University, School of Business Administration, Rochester, MI, 48309, United States, isken@oakland.edu

We describe simulation metamodel development for use in an outpatient capacity planning tool. Issues discussed include comparison of polynomial regression models with nonlinear models containing queuing related basis functions, prediction of performance percentiles and prediction of transient performance measures.

2 - The Impact of Ambulance System Status Management
Armann Ingolfsson, Associate Professor, University of Alberta School of Business, 4-30K Business Building, Edmonton, AB, T6G2R6, Canada, armann.ingolfsson@ualberta.ca

We use discrete event simulation to model an ambulance system that practices system status management (SSM), where ambulances are redeployed dynamically to maintain coverage. We use the model to estimate the impact of SSM on performance, compared to ambulances returning to their home station at the conclusion of every call. Using data from a Canadian city, we estimate that the percentage of high priority calls reached in 9 minutes would drop from 85% to 77% if SSM were no longer used.

3 - Towards Ambulance Relocation via Approximate Dynamic Programming
Mateo Restrepo, PhD Candidate, Center for Applied Math - Cornell University, 657 Rhodes Hall, Ithaca, NY, 14853, United States, mateo@cam.cornell.edu, Huseyin Topaloglu, Shane Henderson

We consider a stylized version of the ambulance relocation problem. The goal is to minimize a function of the response times of all calls arriving within a finite horizon. We focus on obtaining good policies for the relocation of idle ambulances that allow the system to anticipate future calls. After presenting a dynamic programming formulation for this problem, we report on the implementation and experimental performance of approximate dynamic programming algorithms.

■ TB30

Room 330

Returns to Scale Analysis Using DEA for Healthcare Services

Sponsor: Health Applications Section
Sponsored Session

Chair: Liam O'Neill, HMP Department, University of North Texas, Health Science Center, 3500 Camp Bowie Boulevard, Fort Worth, TX, 76107, loneill@hsc.unt.edu

1 - Measuring Nursing Home Performance Using Multiple Objective Data Envelopment Analysis
Ronald Klimberg, Associate Professor, Saint Joseph's University, Haub School of Business, Decision and System Sciences, Philadelphia, PA, 19131, United States, klimberg@mailhost.sju.edu, Daniel Shimshak, Melanie Lenard

Decision-makers must not only concentrate on increasing efficiency by increasing productivity, lowering costs, but also other objectives such as quality. By paying attention to the multiobjective nature of overall performance allows decision-makers to address various tradeoffs between these objectives. The results of applying several DEA models to measure the operational efficiency and quality of a data set of nursing homes will be presented.

2 - Efficiency and Returns to Scale Analysis of Surgical Suites
Timothy Butler, Wayne State University, School of Business Administration, Detroit, MI, 48202, United States, ad4518@wayne.edu, Marc Basson

We use data envelopment analysis to evaluate the efficiency of surgical suites in VA hospitals. We consider returns to scale and propose a methodology for assessing the returns to scale tendencies of strictly inefficient suites.

3 - Tactical Increases in Operating Room Block Time Based on Financial Data and Market Growth Estimates from DEA (Submitted for the 2006 Pierskalla Award)
Liam O'Neill, HMP Department, University of North Texas, Health Science Center, 3500 Camp Bowie Boulevard, Fort Worth, TX, 76107, loneill@hsc.unt.edu, Franklin Dexter

A case study is presented to show how results of DEA are linked to financial analysis for purposes of deciding which surgical specialties should be provided more resources. State discharge abstract databases were used to study how to perform and present DEA using data from federal websites.

■ TB31

Room 331

Financial Engineering: Modelling and Computation

Cluster: Financial Engineering and Risk Management

Invited Session

Chair: Steve Kou, Associate Professor, Industrial Engineering and Operations Research, Columbia University, 312 S.W. Mudd, New York, NY, 10027, United States, sk75@columbia.edu

1 - Portfolio Selection with Robust Estimates of Risk

Victor DeMiguel, Assistant Professor of Decision Sciences, London Business School, London, United Kingdom, avmiguel@london.edu, Francisco Nogales

Markowitz portfolios perform poorly out-of-sample due to estimation error. A robust estimator provides meaningful information even when the sample distribution deviates from normality or has outliers. We show how to compute portfolios that minimize a robust estimate of risk. We give a bound on the sensitivity of these portfolios to changes on asset return distribution. Numerical results show the robust portfolios outperform classical portfolios on simulated and empirical data.

2 - Pricing Asian Options via Laplace Transforms

Ning Cai, Graduate Student, Columbia University, Industrial Engineering & Operations Research, New York, NY, United States, nc2118@columbia.edu, Steve Kou

Previous Laplace inversions for Asian options are complicated and have some stability problems. In this paper we present a new representation so that Laplace transforms can be obtained easily and inverted in a stable way. Furthermore, the method works in a broader setting include both the classical Brownian model and models with jumps.

3 - Two-Dimensional Barrier and Partial Barrier Options

Steve Kou, Associate Professor, Industrial Engineering and Operations Research, Columbia University, 312 S.W. Mudd, New York, NY, 10027, United States, sk75@columbia.edu

In this talk we shall give an overview of two recent papers by Cao and Kou (2006) and Huang and Kou (2006). The first one is on pricing discrete two-dimensional barrier and partial barrier options. The second one on pricing continuous two-dimensional barrier options with jump riks.

4 - Integrating Optimal Annuity Planning with Consumption-Investment Selections in Retirement Planning

Aparna Gupta, Assistant Professor, Rensselaer Polytechnic Institute, 110 8th Street, Troy, NY, 12180, United States, Zhisheng Li

This paper develops a framework which merges annuity purchase decisions with consumption-investment selections in retirement planning. A multi-period wealth evolution model is constructed based on an annuity pricing model, a benefit payment model, and an income model. An optimization problem is formulated with an objective of maximizing life time utility of consumption and wealth.

■ TB32

Room 332

Project Management in Economically Competitive Environments

Cluster: Project Management

Invited Session

Chair: Ted Klastorin, Professor, University of Washington, Seattle, WA, 98195, United States, tedk@u.washington.edu

1 - Incentive Contracts in Project Teams

Murat Bayiz, Information and Operations Management, Marshall School of Business, University of Southern California, Los Angeles, CA, 90089-0809, bayiz@marshall.usc.edu

This study explores optimal linear incentive contracts in projects where activities are outsourced to subcontractors. I assume that activity durations are exponentially distributed, which allows transforming project networks to continuous time Markov chains. I use this structure to calculate optimal contract parameters and study how project network configurations change the optimal incentive contract types in which compensations can be tied to joint or individual performances.

2 - Identifying Cost Effective Project Compression Opportunities When Activity Times are Stochastic

Gary Mitchell, Pamplin School of Business, University of Portland, 5000 N. Willamette Boulevard, Portland, OR, 97203-5798, mitchelg@up.edu, Ted Klastorin

We consider the problem of minimizing expected total costs in a complex project with stochastic task durations when total costs are defined by the sum of direct, indirect, and incentive costs. We develop an effective heuristic algorithm under the assumption that task durations can be modeled by a negative exponential distribution although we later relax this assumption and show that our methodology can be applied to any general distribution. Numerical results illustrate the effectiveness of the algorithm.

3 - Crashing Options in Stochastic Serial Networks

Karolina Glowacka, University of Pittsburgh, Katz Graduate School of Business, 343 Mervis, Pittsburgh, PA, 15260, United States, kaglowacka@katz.pitt.edu, Richard Wendell

In this paper we consider how to optimally exercise crashing options in stochastic project networks. First, for the important special case of serial networks we present theoretical properties as well as solution methods and computational results. Then we examine how these results can be extended to more general networks.

4 - The Impact of Information Leakage on New Product Development in a Duopoly Market

Weiyu Tsai, Assistant Professor, University of Utah, Department of Management, 1645 E. Campus Center Drive, Salt Lake City, UT, 84112, United States, mgtwt@business.utah.edu, Ted Klastorin

We consider the introduction of a new product with a finite life span in a duopoly market. An innovator firm begins developing a new product; after a random time, information about the innovator's product "leaks" to an imitator firm who begins designing a competing product of its own. We model this process as a Stackelberg game and show that an equilibrium solution exists for reasonable product costs, development times, and consumer preferences.

■ TB33

Room 333

Joint Session Aviation App./TSL: Topics in Airline Planning

Sponsor: Aviation Applications, Transportation Science & Logistics

Sponsored Session

Chair: Diego Klabjan, Associate Professor, University of Illinois at Urbana-Champaign, 1206 West Green Street, Urbana, IL, 61801, United States, klabjan@mit.edu

1 - Statistical Modeling Approach to Airline Revenue Management

Sheela Siddappa, PhD Candidate, University of Texas at Arlington, 402 South Cooper Street, #202, Arlington, TX, 76019, United States, ssheela2001@yahoo.com, Dirk Guenther, Jay Rosenberger, Victoria Chen

A revenue management approach based on a Markov decision process is presented. Our approach consists of: (1) An off-line phase that estimates the value function within a realistic state space and (2) An on-line phase that determines the accept/reject policy. In the off-line phase, deterministic and stochastic linear programming solutions provide upper and lower bounds on the value function, and a statistical model is constructed to estimate the upper and lower bounds over the state space.

2 - Schedule Analysis and a Duty Partition Model for Crew Scheduling

Ellis Johnson, Georgia Institute of Technology, 765 Ferst Drive, Atlanta, GA, 30332, United States, ejohnson@isye.isye.gatech.edu, Barry Smith, Chunhua Gao

Two schedule analysis methods are proposed to evaluate the crew friendliness of a schedule and suggest improvements. Based on schedule analysis, a duty partition model is proposed for the crew pairing problem. Duties are defined as decision variables. The duty network incorporates legalities for pairings. It can quickly find reasonably good pairing solutions. Possibilities of extending this model to achieve robust planning and integrated planning with fleet assignment are discussed.

3 - A Computer Experiments Approach for Solving a Two-Stage Airline Fleet Assignment Model

Venkata Pilla, The University of Texas at Arlington, PO BOX 19017, Arlington, TX, United States, pillaprasad@yahoo.com, Jay Rosenberger, Victoria Chen

A statistics-based solution approach for a two-stage stochastic fleet assignment model is presented. In the first stage, crew compatible families are assigned, and in the second stage, after most of the demand has been realized, aircrafts within each family are allocated. Demand uncertainty is represented by various scenarios in the second stage. The solution approach uses design and analysis of computer experiments. This is compared to a traditional Benders' approach.

■ TB34

Room 334

Traffic Network Modeling Advances

Sponsor: Transportation Science & Logistics

Sponsored Session

Chair: Yi-Chang Chiu, Assistant Professor, University of Arizona, PO Box 210072, Tucson, AZ, 85721, United States, chiu@utemp.edu

1 - Dynamic Activity-Travel Networks: A Framework to Model Transportation Demand-Supply Interactions

Gitakrishnan Ramadurai, Renssalaer Polytechnic Institute, Department of Civil and Environmental Engineering, Troy, NY, 12180, United States, ramadg@rpi.edu, Satish Ukkusuri

A new network representation framework, Activity-Travel Networks, is proposed where nodes are activity centers that are joined by travel links. Activities are represented by arcs that originate and terminate in same node. Each individual chooses an activity-travel sequence that maximizes his/her utility. A dynamic equilibrium is reached when all users have identified their "best" activity-travel sequence and any unilateral change results in reduction in one's utility.

2 - An Online Travel Time Prediction System with a Decomposed Network Simulator

Xiaorong Lai, University of Maryland, Department of Civil Engineering, College Park, MD, 20742, United States, xrlai@wam.umd.edu, Pei-Wei Lin, Ying Liu, Gang-Len Chang

This study presents the framework and application of an online travel time prediction system with a decomposed network simulator. The system circumvents the constraints in real-time operations, and develops some effective models for data filtering, mainline volume prediction, ramp volume estimation and online simulation. The field study conducted in the Maryland Eastern Shore region (between Ocean City and Bay Bridge) has indicated the potential of the system for online travel time prediction.

3 - A Real-Time Freeway Travel Time Prediction Approach for Normal and Bottlenecked Traffic Conditions

Yi-Chang Chiu, Assistant Professor, University of Arizona, PO Box 210072, Tucson, AZ, 85721, United States, chiu@utep.edu, Hongsheng Xu

This presentation discusses the methodology for predicting freeway point-to-point travel time under both normal and bottlenecked traffic conditions. The research focuses on the real-time operations of multiple input-output curves at different locations of the freeway segment of interest. This allows the travel time under both the normal and bottlenecked traffic conditions to be reasonably predicted. Empirical testing results are also presented and discussed.

■ TB35

Room 335

Hazard Management and Evacuation III

Sponsor: Transportation Science & Logistics

Sponsored Session

Chair: Elise Miller-Hooks, Associate Professor, University of Maryland, Department of Civil & Environmental Engineering, 1173 Glenn Martin Hall, College Park, MD, 20742, United States, elisemh@umd.edu

1 - Traffic Flow Models and Incident Management

Melike Baykal-Gursoy, Associate Professor, I&SE, Rutgers, The State University of New Jersey, 96 Frelinghuysen Road, Piscataway, NJ, 08854-8018, United States, gursoy@rci.rutgers.edu

We construct queueing and stochastic programming models to address the incident management problem. Various types of incidents might happen depending on their severity. The severity of incidents is assumed to affect system parameters such as the flow rate, the incident duration, or the number of response units required to clear the incident. We present computational experiments to show the validity of these models.

2 - Planning the Pre-Disaster Strengthening of Transportation Networks for Disaster Response

Sibel Salman, Assistant Professor, Koc University, College of Engineering, Sariyer, Istanbul, 34450, Turkey, ssalman@ku.edu.tr, Kannan Viswanath, Srinivas Peeta, Dilek Gunnec

We address an investment problem in which a budget is allocated to strengthen a subset of network links to optimize the objectives of the post-disaster emergency response agencies such as minimizing time to reach affected areas using the surviving transportation network. Application to the city of Istanbul is also discussed.

3 - The Evacuation Problem with Shared Information

Lichun (Lisa) Chen, University of Maryland, Department of Civil & Environmental Engineering, 1173 Glenn Martin Hall, College Park, MD, 20742, United States, lcchen@umd.edu, Elise Miller-Hooks

We present a linear integer programming formulation of the time-dependent evacuation problem with shared information. The formulation includes constraints to preclude two evacuees from being given different directions at the same location and time. The problem is to determine the paths along which to send supply from multiple sources to a single sink such that the total time until all supply reaches the sink is minimized over a given time horizon and shared information constraints are respected. Travel times and capacities may vary with time. Solution techniques are proposed and NP-hardness of the problem is explored.

■ TB36

Room 336

Information and Online Network Routing

Sponsor: Transportation Science & Logistics

Sponsored Session

Chair: S. Travis Waller, Assistant Professor, University of Texas at Austin, 1 University Station C1761, Austin, TX, 78705, United States, stw@mail.utexas.edu

1 - System Optimum Assignment of Wireless-Equipped Assets: Problem Variations and Solution

Natalia Ruiz Juri, natiruizjuri@gmail.com, S. Travis Waller

This work explores the marginal cost of routing wireless-equipped assets into a stochastic network, as a means to analyze and quantify information availability impacts on total system expected cost. Optimization models are proposed for several problem variations, involving different assumptions and objectives. Solution algorithms are developed and tested in a number of example networks. The result analysis provides useful insights about the problem significance and complexity.

2 - The Value of Information and Resources in Online Routing

Michael Wagner, Massachusetts Institute of Technology, 77 Massachusetts Avenue, Cambridge, MA, 02139, United States, mikew@mit.edu, Patrick Jaillet

We investigate the value of information and resources in online routing problems, where the problem instance is revealed incrementally. We derive new competitive ratio bounds for generalized versions of the online TSP(with precedence constraints, capacity constraints and multiple vehicles). We consider resource augmentation, where we give the online algorithm additional resources: faster servers, larger capacities and advanced information.

3 - Reliable Routing with Recourse in Stochastic, Time-Dependent Transportation Networks

Stephen Boyles, sd_boyles@yahoo.com, S. Travis Waller

A methodology and exact algorithm are presented to find an optimal routing policy when a traveler's preferences can be expressed by an arbitrary piecewise polynomial disutility function. This approach allows one to find optimal policies for a variety of attitudes towards risk, including risk-averse or risk-prone user behavior.

■ TB37

Room 337

Data Confidentiality and Disclosure Limitation II

Sponsor: Information Systems Society

Sponsored Session

Chair: Krish Muralidhar, Professor, University of Kentucky, School of Management, Lexington, KY, 40506-0034, United States, krishm@uky.edu

1 - Minimum Discrimination Information (MDI) for Confidentiality Protection in Tabular Data

Lawrence Cox, lgc9@CDC.GOV

Cox et al. (2004) proposed a disclosure limitation method for tabular data that preserves analytical properties of original data—quality-preserving controlled tabular adjustment. Their approach replaces each sensitive cell with a safe value subject to linear constraints to preserve additivity and parameters such as mean, variance and covariance. We have implemented an alternative algorithm using Kullback-Leibler minimum discrimination information (MDI).

2 - Approximation Bounds on Information Loss for Disclosure Limitation Methods.

Sumitra Mukherjee, Professor, Nova Southeastern University, Graduate School of Computer & Information Sciences, 3301 College Avenue, Fort Lauderdale, FL, 33314-9918, United States, sumitra@nova.edu

Disclosure limitation methods modify data released to users to protect the confidentiality of data subjects. Since data modification reduces the utility of released data, the objective is to minimize information loss while ensuring that the risk of disclosure is below an acceptable threshold. This paper demonstrates how guaranteed bounds on information loss may be obtained for existing disclosure limitation methods.

3 - The Myth of Micro-Aggregation
Rathindra Sarathy, Professor, Oklahoma State University, Spears School of Business, Stillwater, OK, 74078, United States, sarathy@okstate.edu, Krish Muralidhar

Micro-aggregation is often proposed as a simple but effective technique for masking numerical confidential data. In this presentation, we compare the performance of micro-aggregation with other procedures for masking numerical data. The results clearly show that, compared to other masking procedures, micro-aggregation generally provides lower data utility and/or higher disclosure risk and must be used with caution.

■ TB38

Room 338

Simulation Applications in Transportation

Contributed Session

Chair: Jose Holguin-Veras, Professor, Rensselaer Polytechnic Institute, 110 8th Street, Room JEC 4030, Troy, NY, 12180, United States, jhv@rpi.edu

1 - Optimal Scheduling of Mixed Speed Trains on a Single Track Line
Steven Harrod, University of Cincinnati, 828 Summerville Drive, Lexington, KY, 40504, United States, harrodss@email.uc.edu

Disputes between different classes of operators are becoming more frequent as rail network congestion increases. A new scheduling model is presented, based on a multicommodity flow and discrete time, that both selects an optimal set of trains and schedules these trains over a time horizon according to a linear value function. The model is validated against analytical capacity measures and a demonstration of mixed speed train scheduling is made with a hypothetical example.

2 - New Approaches for Validating and Evaluating Prediction Accuracy of Microbehavioral Models
Dimitris Poulakidas, Assistant Professor, California State Polytechnic University, Department of Urban and Regional Planning, 3801 W. Temple Avenue, Pomona, CA, 91768, United States, dpoulakidas@csupomona.edu

This paper, introduces microsimulation as a technique for validating the estimates of microbehavioral models when alternative datasets are not available for performing comparisons. Moreover, this research re-examines the "Lift Curve", a technique that was designed for binary choice situations, as a tool for evaluating the prediction accuracy of polychotomous choices, especially when choice sets are of different sizes.

3 - A Microscopic Traffic Flow Model Derived from Multilane Hybrid Theory
Jorge Laval, INRETS/ENTPE, Rue Maurice Audin, Lyon, France, jlaval@gmail.com

This paper presents a multilane microscopic traffic flow model derived from the macroscopic multilane hybrid theory. Lane-changing rates obey Daganzo's incremental transfer principle rather than complex gap-acceptance rules. A relaxation procedure is introduced whenever short non-equilibrium headways take place at the moment of the lane change. The proposed model was validated using high-resolution data on a merge bottleneck where the capacity drop phenomenon was observed.

4 - Variability in Dynamic Routing Problems
Tom Van Woensel, Technische Universiteit Eindhoven, PO Box 513, Pav F5, Eindhoven, 5600 MB, Netherlands, t.v.woensel@tm.tue.nl, Christophe Lecluyse, Herbert Peremans

In routing problems, the variability on travel times can not be ignored in order to carry out a realistic optimization. The approach proposed introduces a travel time distribution based on queueing theory resulting in a stochastic dynamic routing problem. The approach allows for evaluating routes on the travel time risk involved. The models are validated using numerical results based on standard datasets.

5 - The Integrative Freight Market Simulation (IFMS)
Jose Holguin-Veras, Professor, Rensselaer Polytechnic Institute, 110 8th Street, Room JEC 4030, Troy, NY, 12180, United States, jhv@rpi.edu, Ellen Thorsn

The IFMS is a formulation based on spatial price equilibrium and game theory that explicitly considers commercial vehicle trip chains. The IFMS models the behavior of trucking companies and producers and consumer of cargoes assuming a condition of market equilibrium. In this talk, the solution algorithms and future research directions are discussed.

■ TB39

Ballroom B

Great Unsolved Problems In OR - IV

Cluster: Great Unsolved Problems in OR

Invited Session

Chair: Saul I. Gass, Professor, University of Maryland, Robert H. Smith School of Business, College Park, MD, 20742, United States, sgass@rhsmith.umd.edu

1 - The Challenge of OR/MS in Healthcare Delivery
Ronald L. Rardin, Professor, Purdue University, Industrial Engineering, W. Lafayette, IN, 47907-2022, United States, rardin@purdue.edu

Healthcare delivery in the United States is in a crisis of inconsistent and sometimes dismal quality, safety and efficiency, with exploding cost. A major reason for these shortfalls is the lack of sufficient involvement from the operations researchers and management scientists who have done so much to improve the effectiveness of manufacturing and distribution operations. Nothing should be more exciting than a critical national challenge to which the tools of OR/MS are so well adapted.

2 - Great Unsolved Problems in Inventory Theory
Paul H. Zipkin, Professor, Fuqua School of Business, Box 90120, Duke University, Durham, NC, 27708-0120, United States, paul.zipkin@duke.edu

Inventory theory has made great strides in the last half century, but many problems remain unsolved, problems of immense practical and scientific significance. We still lack a good understanding of single-item systems with leadtimes and extra complicating factors, such as lost sales and random yields. As for multi-item systems, we can deal with a few special structures, such as series systems, but others remain beyond our reach. We are just starting to study supply chains with several actors.

3 - Great Unsolved Problems in Revenue Management
Garrett J. van Ryzin, Professor, Graduate School of Business, 412 Uris Hall, Columbia University, New York, NY, 10027, United States, msomeditor@gsb.columbia.edu

Revenue management (RM) requires solving large scale optimization problems stemming from complex consumer behaviors. Both dimensions lead to vexing unsolved problems. On the optimization side, we have stochastic dynamic network management problems for which there is little consensus on one "best" solution method. On the consumer behavior side, open problems include how to measure market response to prices, and what to do when there is little or no market information. Further concerns include model validation and how to include many important factors affecting consumer behavior.

■ TB40

Room 401

Location and Networks

Contributed Session

Chair: Kannan Viswanath, Graduate Assistant, Krannert School of Management, Purdue University, West Lafayette, IN, 47906, United States, viswanak@purdue.edu

1 - Probabilistic Distance Clustering
Cem Iyigun, Rutgers University, RUTCOR, 640 Bartholomew Road, Piscataway, NJ, 08854, United States, iyigun@rbs.rutgers.edu, Adi Ben-Israel

Given clusters, their centers, and the distances of data points from these centers, the probability of cluster membership at any point is assumed to depend on its distances from all centers. We state this assumption as a principle that probability is inversely proportional to distance. The method is based on the above principle, and on the joint distance function, a measure of distance from all cluster centers, that evolves during the iterations, and captures the data in its low contours.

2 - Solving the Minimax Sensor Location Problem for Border Protection
Whitney Conner, Graduate Student, The Pennsylvania State University, 310 Leonhard Building, University Park, PA, 16802, United States, wac129@psu.edu, Tom Cavalier, Enrique Del Castillo

A sensor location problem is investigated with the objective of minimizing the maximum probability of non-detection of an event occurring along a border. A heuristic method is developed to solve this problem when the border is described by a piecewise linear curve. Results are compared with differential evolution methods.

3 - The Bi-Objective Relimin-Relisum Location Problem on a Tree
Jose Santivanez, Assistant Professor, Universidad del Turabo, School of Engineering, Department of Industrial and Management Engineering, PO Box 3030, Gurabo, PR, 00778, Puerto Rico, santivanezj@suagm.edu, Emanuel Melachrinoudis

We locate a facility on a tree network having unreliable edges, according to the relimin-relisum criteria. The relimin objective maximizes the minimum expected number of successful responses to node requests while the relisum objective maximizes the sum of successful responses. An efficient algorithm for finding the non-dominated solution set is developed.

4 - Stochastic Location-Assignment Problems on an Interval
Kannan Viswanath, Graduate Assistant, Krannert School of Management, Purdue University, West Lafayette, IN, 47906, United States, viswanak@purdue.edu, James Ward

This talk addresses a class of location problems in which a given number of servers are to be positioned on an interval to serve a given number of random demands, which is lesser than or equal to the number of servers. The objective of the location problem is to minimize the expected value of the total assignment cost, where the assignment cost for a server-demand pair is the corresponding distance between them.

■ TB41

Room 402

Hybrid Tutorial: Large Deviations for Constrained Diffusions

Sponsor: Applied Probability
Sponsored Session

Chair: John Hasenbein, Associate Professor, University of Texas at Austin, Graduate Program in OR/IE, Department of Mechanical Engineering, Austin, TX, 78712, United States, jhas@mail.utexas.edu

1 - Large Deviations of Reflected Diffusions and Associated Queueing Networks
Kavita Ramanan, Associate Professor, Carnegie Mellon University, 6208 Wean Hall, Department of Mathematical Sciences, Pittsburgh, PA, 15213, United States, kramanan@asdf5.math.cmu.edu

Reflected diffusions in the N-dimensional orthant often arise as diffusion approximations to queueing networks. This talk will provide a brief survey of what is known about the large deviation behaviour of this class of reflected diffusions and describe some connections with the large deviation behaviour of associated queueing networks.

2 - Reflected Brownian Motion in a Quadrant: Tail Behavior of the Stationary Distribution
J. Michael Harrison, Graduate School of Business, Stanford University, Stanford, CA, 94301, United States, harrison_michael@gsb.stanford.edu, John Hasenbein

Let Z be a two-dimensional Brownian motion confined to the non-negative quadrant by oblique reflection at the boundary. Analytic methods are used to derive a simple formula for the asymptotic decay rate of the stationary distribution of Z along each axis, and an interpretation in terms of minimum-energy paths is provided.

■ TB42

Room 403

Scheduling Problems in Service/Industry

Cluster: Scheduling
Invited Session

Chair: Chelliah Sriskandarajah, Professor, The University of Texas at Dallas, School of Management, Richardson, TX, 75080, United States, chelliah@utdallas.edu

1 - Supply Chain Distribution Logistics to Minimize Inventory Holding Cost with Dominant Upstream Partner
U.V Manoj, The University of Texas at Dallas, Richardson, TX, United States, muv031000@utdallas.edu, Chelliah Sriskandarajah, Sushil Gupta

We consider a two stage supply chain with a dominant upstream partner. Finding an optimal schedule to minimize inventory holding cost for the downstream member is NP-Hard. Under this situation, we provide efficient Genetic Algorithm using optimized crossover technique to arrive at near optimal solutions.

2 - Scheduling Support-Times for Satellites with Overlapping Visibilities
Gokcen Arkali, The University of Texas-Dallas, PO Box 830688, 2601 N. Floyd Road, Richardson, TX, 75083-0688, United States, gxa023000@utdallas.edu, Chelliah Sriskandarajah, Milind Dawande

We consider the scheduling of ground-station support-times to low-earth-orbit satellites with overlapping visibilities. A ground-station provides support-time to a satellite to perform a variety of tasks. We propose eight basic scheduling models to study the problem and investigate the computational complexity status of each model.

3 - Robotic Cells with Parallel Machines and Multiple Dual Gripper Robots
Neil Geismar, Assistant Professor, Prairie View A&M University, PO Box 638, Prairie View, TX, United States, ngeismar@yahoo.com, Michael Pinedo, Chelliah Sriskandarajah

We consider different actual implementations of robotic cells with multiple dual gripper robots. We provide schemes to prevent robot collisions, discuss cell layout issues, and find optimal move sequences. Additionally, we use simulation to evaluate sequences for a cell with stochastic processing times.

■ TB43

Room 404

MCDM Applications

Cluster: Multi-Criteria Decision Making
Invited Session

Chair: Abu Masud, Professor, Industrial & Manufacturing Engineering, Wichita State University, 1845 N. Fairmount, 120Q Engineering Building, Wichita, KS, 67260-0035, United States, Abu.Masud@wichita.edu

1 - Multiple Objective Model to the Retail Store Design Using Tabu Search
Alice Smith, Professor and Chair, Department of Industrial & Systems Engineering, Auburn University, 207 Dunstan Hall, Auburn, AL, 36849, United States, aesmith@eng.auburn.edu, Haluk Yapicioglu, Bryan A. Norman

This study presents a multiobjective model for the spatial design of a retail store. The model combines ideas from both the shelf space allocation and the facility layout literature. The model considers the revenue and the adjacency requirements among departments. The revenue aspect consists both of department size and department exposure to the main traffic patterns of the customers. Therefore, the problem includes several objectives along with constraints on the departments and on the aisling.

2 - A New Relative Robust Optimization Approach for Full Factorial Scenario Design of Data Uncertainty
Tiravat Assavapokee, Assistant Professor, Industrial Engineering Department, University of Houston, 206 Engineering Building 2, Houston, TX, 77204-4008, United States, tiravat.assavapokee@mail.uh.edu, Jane Ammons, Matthew Realff

We apply bilevel programming to develop an effective relative robust optimization algorithm for two stage decision making under uncertainty. The first stage is 0-1 MILP and the second stage is LP. Each uncertain parameter can independently take its values from a finite set of real numbers with unknown probability distribution. The algorithm solves the relative robust optimization problem with 1.22×10^{19} scenarios. All results illustrate impressive performance of the proposed algorithm.

3 - Practical Issues in the Analysis of the Solution of Multiple Objective Optimization Problems and DM
Heidi Taboada, Graduate Student, Rutgers University, Department of Industrial Engineering, 96 Frelinghuysen Road, Piscataway, NJ, 08854-8018, United States, heidita@eden.rutgers.edu, David Coit

Some approaches to solve multiple objective optimization problems, produce a large number of Pareto-optimal solutions, from which the Decision Maker must then be able to choose a promising one. This decision making stage involves several challenging issues. The selection of one solution over the others may be quite a difficult problem. The main goal of the current project is to use data mining techniques to efficiently organize and reduce the size of the Pareto-optimal set.

4 - A Multiobjective Power Generation Expansion Model
Jose Ceciliano-Meza, Graduate Student, Industrial & Manufacturing Engineering, Wichita State University, 1845 N. Fairmount, 120 Engineering Building, Wichita, KS, 67260-0035, United States, jlceciliano meza@wichita.edu, Mehmet Bayram Yildirim, Abu Masud

This paper describes a multiobjective model for the power generation expansion planning problem. The model optimizes multiple objectives while giving priorities to renewable generation technologies and having several geographical location alternatives for the generation units. The approach to solve this problem is based on multiobjective linear programming and analytical hierarchy process. A case study from the Mexican Electric Power System is used to illustrate the proposed framework.

■ TB44

Room 405

Applications of MS/OR in Nonprofit Operations and Public Sector

Sponsor: Junior Faculty Interest Group (JFIG)
Sponsored Session

Chair: Feryal Erhun, Assistant Professor, Stanford University, MS&E, Stanford, CA, 94305, United States, ferhun@stanford.edu

1 - Public Policy Application of the Joint Price / Quantity Newsvendor Model: The Influenza Vaccine
Gal Raz, Assistant Professor, Australian Graduate School of Management (AGSM), Australian Graduate School of Management, UNSW, Sydney, NS, Australia, galr@agsm.edu.au

The supplying of a produced good is a game that includes three players, the firm that is supplying the good, the consumers that are buying it and the government that can intervene in the transaction by imposing rules and regulations. We analyze a joint price/ quantity newsvendor model for the Influenza Vaccine market, taking a social planner perspective by maximizing the total social welfare and examine the possible government actions to support this outcome.

2 - Efficient Funding: An Exploratory Look at the Nonprofit Sector
Natalie Privett, Stanford University, 67 Olmsted Road #108, Stanford, CA, 94305, United States, nprivett@stanford.edu, Feryal Erhun

Nonprofit organizations are a critical part of the American society as well as a growing sector of the national economy. In this paper, we model the process of funders (foundations or the government) awarding grants and allocating funds between nonprofit organizations using a contracting perspective. We show that the effectiveness of the funding process and the nonprofit sector overall can be significantly improved by designing efficient contracts.

3 - International Humanitarian Relief Logistics
John Vande Vate, Professor & EMIL Executive Director, Georgia Institute of Technology, ISyE, 765 Ferst Drive, Atlanta, GA, United States, John.VandeVate@isye.gatech.edu, Marco Gutierrez

Humanitarian organizations employ 4 strategies in delivering relief: 1. Instantaneous: established presence in the region 2. Fast: Pre-positioned supplies sped to the victims 3. Framework: Agreements with suppliers to deliver provisions to regional response sites 4. Capacity Building: Build long-term capacity within the community We discuss roles the OR community can play in strengthening and aligning these strategies for greater effectiveness.

4 - Resource and Revenue Management in Nonprofit Operations
Miguel Lobo, Assistant Professor, Duke University, 1 Towerview Drive, Durham, NC, 27708, United States, mlobo@duke.edu, Francis de Véricourt

We describe a two-customer-class model for nonprofit organizations that also engage in for-profit activities. We characterize the solution in a multi-period stochastic setting, where in each period the organization must decide what fraction of its resources to allocate to 'mission-customers' vs. to 'revenue-customers'. We consider the interaction of operational and financial decisions by allowing for banking and for dynamic pricing. We compare the optimal policy with proportional allocation.

■ TB45

Room 406

Tutorial: Aviation Security System Design and Optimization Using Operations Research Modeling and Analysis

Cluster: Tutorials
Invited Session

1 - Aviation Security System Design and Optimization Using Operations Research Modeling and Analysis
Sheldon Jacobson, Professor, University of Illinois, 201 N. Goodwin Avenue, Urbana, IL, 61801, United States, shj@uiuc.edu, John Kobza

This tutorial provides an overview and survey of applying operations modeling and analysis methodologies to address both aviation security tactical and strategic problems. A variety of models are presented that address specific and general aviation security issues. Several of these models have been presented to and used by the Transportation Security Administration (TSA) in developing and refining aviation security system operations. Future directions for aviation security are also discussed.

■ TB46

Room 407

Complex Production Planning Problems

Cluster: Supply Chain and Operations Engineering
Invited Session

Chair: Gilvan Souza, Associate Professor, University of Maryland, Smith School of Business, College Park, MD, 20742, United States, gsouza@rhsmith.umd.edu

1 - Dynamic Real-Time Models for Order Promising
Michael Ball, Professor, Robert H. Smith School of Business, University of Maryland, College Park, MD, 20742, United States, mball@rhsmith.umd.edu, Michael Fu

We develop dynamic, real-time models for making order promising decisions. These models monitor order-promising and factory data and dynamically update key decision parameters, most notably the promised lead time. Policies are based on an MDP model, where certain parameters are set based on the periodic solution of a mixed integer program.

2 - Integrating Production Scheduling with Packing of Finished Orders for Delivery
Zhi-Long Chen, Associate Professor, University of Maryland, Robert H. Smith School of Business, College Park, MD, 20742, United States, ZChen@rhsmith.umd.edu, Guruprasad Pundoor

A set of orders are processed first in a production facility, and then packed in batches for delivery to a customer. We consider the production scheduling and order packing decisions jointly. Solvability of various problems is investigated and solution algorithms are proposed.

3 - Production Planning of Returned Products at Pitney Bowes
Mark Ferguson, Assistant Professor, Georgia Institute of Technology, College of Management, 800 W. Peachtree Street NW, Atlanta, GA, 30308, United States, Mark.Ferguson@mgt.gatech.edu, Gilvan Souza, Daniel Guide

At Pitney Bowes, product returns to their remanufacturing facility are categorized into a finite number of quality categories corresponding to an increasing cost to remanufacture as the quality of the return decreases. We modified their traditional MRP planning system to account for this unique aspect of a remanufacturing environment. This modification resulted in several million dollar savings compared to their old method of scheduling remanufactured products.

4 - Pseudo Order Consideration in Available to Promise (ATP)
Gilvan Souza, Associate Professor, University of Maryland, Smith School of Business, College Park, MD, 20742, United States, gsouza@rhsmith.umd.edu, Michael Ball, Maomao Chen

We present a single - period analytic model for Available-to-Promise (ATP) that incorporates n confirmed customer orders, m pseudo orders, material constraints and production capacity constraints. The decision variables are committed quantities for each order, confirmed and pseudo orders. We show that the optimal solution presents a structure similar to Littlewood's for the pseudo orders.

■ TB47

Room 408

Managing Supply Under Uncertainty

Cluster: Supply Chain and Operations Engineering
Invited Session

Chair: Amar Sapra, Assistant Professor, University of Florida, 303 Weil Hall, PO Box 116595, Gainesville, FL, 32611, United States, sapra@ise.ufl.edu

1 - The Hurricane-Supplies Stocking Problem
Emmett Lodree, Assistant Professor, Auburn University, Industrial and Systems Engineering, 207 Dunstan Hall, Auburn, AL, 36849, United States, elodree@auburn.edu

Several manufacturing facilities, service organizations, and government agencies are involved with responding to needs that arise after a hurricane makes landfall. More specifically, such organizations are responsible for ensuring the availability of critical supplies needed to successfully carry out emergency response operations. This presentation defines the hurricane-supplies stocking problem and identifies unique characteristics that distinguish it from existing inventory models.

2 - Early Commitment Strategies Under Capacity Competition
Ismail Bakal, University of Florida, 303 Weil Hall, PO Box 116595, Gainesville, FL, 32611, United States, ismailsb@ufl.edu, Joseph Geunes

We consider the implications of early-commitment strategies when retailers compete for supplier capacity under demand uncertainty. Specifically, we investigate a supply chain with multiple retailers and a single supplier where one of the retailers is the primary customer of the supplier. We compare the expected supplier and retailer profits under each of these strategies and specify conditions under which the early commitment scheme benefits the supplier and/or the primary retailer.

3 - Incorporating Uncertainty into an Optimal Selection of Suppliers and Ordering Plan
Lei Li, University of Washington, Industrial Engineering, Seattle, WA, 98195, United States, leili@u.washington.edu, Zelda Zabinksy

Supplier selection is an important strategic management decision. Incorporating uncertain demand and supplier capacity into the optimization results in a more robust solution than treating them as deterministic values. A stochastic programming model with recourse and a chance-constrained model are developed to optimize the selection of supplier and ordering plan.

4 - Emergency Sourcing in a Serial System
Amar Sapra, Assistant Professor, University of Florida, 303 Weil Hall, PO Box 116595, Gainesville, FL, 32611, United States, sapra@ise.ufl.edu, Miao Liu

We consider a two-stage serial system in which the supply to the downstream stage from the upstream stage is prone to disruptions. In the event of a disruption, the downstream stage can order directly from an emergency supplier. We analyze this problem to characterize the form of the optimal policy and develop efficient computational procedures.

■ TB48

Room 409

Service Operations with Customer Behavior

Sponsor: Manufacturing & Service Operations Management
Sponsored Session

Chair: Senthil Veeraraghavan, Wharton School, Philadelphia, PA, 19104, senthilv@wharton.upenn.edu

1 - Capacity Rationing in Two-Channel Supply Chain with Herding Externalities
Senthil Veeraraghavan, Wharton School, Philadelphia, PA, 19104, senthilv@wharton.upenn.edu, Laurens Debo

We consider a firm selling a product that has uncertain quality through both direct and indirect channels. Each arriving customer observes private, imperfect information about the quality. A customer arriving at one channel complements his private information about the quality of the product by the inventory levels. We answer (i) How the inventory levels influence the customer purchasing behavior and (ii) How the manufacturer can strategically allocate his production capacity.

2 - Strategic Customer Behavior, Commitment, and Supply Chain Performance
Xuanming Su, Assistant Professor, University of California, Haas School of Business, Berkeley, CA, 94720, United States, xuanming@haas.berkeley.edu, Fuqiang Zhang

Consider a newsvendor facing strategic customers who expect that prices may fall after random demand is realized. In this setting, we derive the optimal pricing and inventory decisions. We then study decentralized supply chains facing strategic customers, and show that contractual mechanisms can serve as commitment devices to improve supply chain performance. Surprisingly, we find that decentralized systems may outperform the centralized benchmark, even under a simple wholesale price contract.

3 - No Soup for You! Intentionally Unsatisfied Demand and Future Production
Reynold Byers, University of California, Irvine, SB 309, The Paul Merage School of Business, Irvine, CA, 92697, United States, RByers@uci.edu, David Huff

Intentional shortages are a surprising practical reality. There are several examples of fashion labels that specifically leave known demand unfilled. We explore the relationship of demand with fulfillment in a two-period setting. We assume that unfulfilled demand in the first period creates a ``buzz" that increases demand in the second period. We model the problem first with deterministic demand and then again incorporating demand variability.

4 - Capacity Decisions in a Food Court Environment
Haiyan Wang, Olin School of Business, Washington University in St. Louis, PhD Campus Box 1133, Saint Louis, MO, 63130, United States, hwang27@wustl.edu, Tava Olsen

We consider two competitive food providers in a food court, where the customer arrival rate usually increases before the peak dinner time and then decreases. Customers have different valuations on the services of the two providers and are time sensitive. We employ a fluid model to analysis the equilibrium service rates of the two providers.

■ TB49

Room 410

Life Cycle Considerations in Closed Loop Supply Chains

Cluster: Closed-Loop Supply Chains and Reverse Logistics
Invited Session

Chair: Harold Krikke, Associate Professor, Tilburg University, Economics, PO Box 90153, Tilburg, 5000LE, Netherlands, Krikke@uvt.nl

1 - Issues Surrounding Engine Recovery and Remanufacturing at an Automobile Manufacturer
Ian M. Langella, Faculty of Economics and Management, University of Magdeburg, Universitaetsplatz 2, Magdeburg, 39106, Germany, ian.langella@ww.uni-magdeburg.de

This talk will present product recovery operations currently in place at an automobile manufacturer. The case will highlight the complexity involved in planning, both from a short-term operational standpoint as well as considering the more broad view over the entire product life cycle of a specific engine. When viewed from this prospective, better product design might allow for more cost effective recovery operations and interesting interactions between economic and environmental goals emerge.

2 - Life Cycle Oriented Design of Capital Goods: The State of the Art in Theory and Practice
Rob Basten, PhD Candidate, Twente University of Technology, PO Box 217, Enschede, 7500AE, Netherlands, R.Basten@utwente.nl, Marco Schutten, Matthieu van der Heijden

Increasingly, customers ask companies to take care of the complete life cycle of a product. This means that companies need techniques to optimize their designs for life cycle cost. A lot of design-for-X paradigms have surfaced for (parts of) the life cycle. We conducted a literature study and thorough case studies with four companies to see which (quantitative) techniques are available and how they are used in practice. We identified weaknesses in the techniques and new research opportunities.

3 - The Energy Substition Effect in Closed Loop Supply Chains of Automotive Types
Harold Krikke, Associate Professor, Tilburg University, Economics, PO Box 90153, Tilburg, 5000LE, Netherlands, Krikke@uvt.nl

This talk will discuss the growing importance of energy in closed loop supply chains (CLSCs) due to rising energy prices. CLSCs can be beneficial from to perspectives : (1) 'Waste' can be used as fuel in industrial processes or power plants thereyby substituting fossil fuels. (2) Recycling and remanufacturing can replace new production thereby substituting part of the forward supply chain. Both have great potential from an energy perspective. We discuss applications in the automotive industry with respect to tyres and present a (simple) model that optimizes the energy balances in closed loop supply chains.

■ TB50

Room 411

Empirical Research in Operations Management

Sponsor: Manufacturing & Service Operations Management
Sponsored Session

Chair: Taylor Randall, Associate Professor, University of Utah, 201 South Presidents Circle, Salt Lake City, UT, 84112, United States, acttr@business.utah.edu

1 - Inventory Performance of Auto Dealerships: The Role of Local Market Conditions
Gerard Cachon, Professor of Operations and Information Management, University of Pennsylvania, 543 JMHH, Philadelphia, PA, 19104, United States, cachon@wharton.upenn.edu, Marcelo Olivares

We collected detailed data on the particular vehicles held by dealerships. The goal of this research is to explain heterogeneity in dealership inventory holdings. Of particular interest is the role of local demographics, competition and brand on the propensity of dealerships to hold inventory.

2 - Estimating the Costs of the Newsvendor: Theory and Application
Christian Terwiesch, Associate Professor, University of Pennsylvania, 548 JMHH, Philadelphia, PA, 19104, United States, terwiesch@wharton.upenn.edu, Marcelo Olivares

Previous research related to the Newsvendor model has taken the mismatch cost parameters as given. Following the tradition of structural estimation models in Econometrics, we assume that the decision maker acts rationally and chooses the optimal decision for a cost function that is un-observable for us as researchers. Based on the observed decision making and a set of co-variates, we use Maximum Likelihood estimation to obtain the cost parameters describing the latent cost function.

3 - Churn and Contagion in Supply Chains: An Empirical Investigation

Jayanth Krishnan, The Wharton School, 3730 Walnut Street, Suite 500, Philadelphia, PA, 19104, United States, jayanth@wharton.upenn.edu, Paul Kleindorfer, Aliza Heching

Suppliers in capacity constrained facilities face two important problems: "churn" and "contagion". Churn refers to significant changes in forecasts (in advance of capacity commit dates), even when the actual forecasted demand distribution has not changed. Forecast contagion happens when forecast churn across customers is positively correlated even when the customers' demands are not correlated. Using proprietary data from a large semiconductor manufacturer, we investigate these phenomena.

4 - Role of Operations in Predicting Future Financial Performance: Empirical Study of Airline Industry

Jim Cannon, University of Utah, 1645 E. Campus Center Drive, Salt Lake City, UT, 84112, United States, jim.cannon@business.utah.edu, Taylor Randall, Christian Terwiesch

Using 32 quarters of data from the airline industry, we examine the critical role that operations play in predicting future firm financial performance. The theory supporting the predictive relationship between financial metrics and future earnings is predicated on critical assumptions regarding the operational performance motivating the financial metrics. Our findings have implications for both operations and financial management who are concerned with maximizing firm value.

■ TB51

Room 412

OR and Disaster Planning

Cluster: Planning for and Responding to Disasters

Invited Session

Chair: Rohit M Lotlikar, IBM India Research Lab, Embassy Golf Links, Block D, 4th Floor, Domlur Intermediate Ring Road, Bangalore, 560034, India, rohitmlo@in.ibm.com

1 - Skills Planning for Resilient Service Delivery

Rohit M Lotlikar, IBM India Research Lab, Embassy Golf Links, Block D, 4th Floor, Domlur Intermediate Ring Road, Bangalore, 560034, India, rohitmlo@in.ibm.com, Anuradha Bhamidipaty, Guruduth Banavar, Anees Shaikh, Prashant Pradhan

In remote delivery of IT services from multiple locations, proper skills planning helps mitigate the impact of non availability of personnel due to a disaster at one location. We propose a model for optimal allocation of skills (job roles) across these locations to meet the guaranteed service availability levels during disasters at least cost. Various operational aspects like critical workloads, skill levels, mobile workers, cross-training, and wage costs are factored into the model.

2 - Fire Engine Relocation Revisited

Peter Kolesar, Columbia University, New York, NY, United States, pjk4@columbia.edu

In 1975 Rand Corporation researchers developed an on-line algorithm for tactical relocation of New York City fire engines when large fires depleted a region of the City of its fire protection. During the 9/11 crisis the algorithm -still used to this day — assisted the FDNY in maintaining adequate fire protection throughout the City. We review the concepts of the algorithm and its implementation history.

■ TB52

Room 413

Choice and Strategic Behavior in Revenue Management

Sponsor: Revenue Management & Pricing

Sponsored Session

Chair: Gustavo Vulcano, Assistant Professor, New York University, 44 West 4th Street, Suite 8-76, New York, NY, 10012, United States, gvulcano@stern.nyu.edu

1 - Revenue Management with Strategic Customers

John Wilson, Professor, Richard Ivey School of Business, University of Western Ontario, 1151 Richmond Street North, London, ON, N6A 3K7, Canada, jwilson@ivey.uwo.ca, Christopher Anderson

We consider a two period revenue management problem where customers may act strategically. Specifically, we allow for the possibility that a customer may decide to defer purchase in the hope that a ticket cheaper than those currently on offer will become available. We also allow for the possibility that some customers will buy a more expensive ticket if the cheaper tickets are not available.

2 - Social Optimality and Duopoly Competition with Real Options

Guillermo Gallego, Chairman, IEOR Department, Columbia University, 500 West 120th Street, New York, NY, 10027, United States, ggallego@ieor.columbia.edu, Ozge Sahin

We consider a two period model with homogeneous customers who know the distribution of their valuations in period 1 and see realizations in period 2. We show that options are socially optimal and provide a range of consumer surplus over which options strictly dominate low-to-high pricing. We also consider a duopoly game between providers with finite capacity that compete by offering call options. We compare and contrast our results with the classical Bertrand-Edgeworth model without options.

3 - On the Choice-Based Linear Programming Model for Network Revenue Management

Qian Liu, Assistant Professor, Department of Industrial Engineering and Logistics Management, Hong Kong University of Science and Tech, Clear Water Bay, Kowloon, Hong Kong, qianliu@ust.hk, Garrett van Ryzin

Based on a customer-choice-based deterministic LP model (CDLP) for network RM proposed recently by Gallego et al., we explore applications of their model. We develop a decomposition heuristic to generate dynamic control policies, which is practically viable and significantly improves on the performance of the static CDLP. We also characterize optimal offer sets using a notion of "efficiency" and show only efficient sets are asymptotically optimal.

4 - Choice-Based Revenue Management: An Empirical Study of Estimation and Optimization

Gustavo Vulcano, Assistant Professor, New York University, 44 West 4th Street, Suite 8-76, New York, NY, 10012, United States, gvulcano@stern.nyu.edu

We consider the demand estimation problem faced by an airline flying an origin—destination market, accounting for customer choice behavior. We developed an statistical estimation algorithm based on maximum likelihood estimation. Modifications to account for unobservable data were developed using a variation of the expectation maximization method. The procedure was tested over data provided by a major commercial U.S. airline, showing promising results.

■ TB53

Room 414

Pricing and Inventory Management

Contributed Session

Chair: Sandra Transchel, University of Mannheim, Department of Logistics, Schloss S233, Mannheim, Germany, sandra.transchel@bwl.uni-mannheim.de

1 - Optimal Pricing and Inventory Setup for Perishable Products Considering the Decay Impact

Yanzhi Li, Department of Management Science, City University of Hong Kong, Tat Chee Avenue, Kowloon, Hong Kong, China, ieyanzhi@ust.hk, Andrew Lim

Joint pricing and inventory control has attracted much attention recently. However, little such literature focuses on perishable product, partially due to the analytical intractability. In this work, we propose a recursive dynamic programming approach. The problem is decomposed and bounding procedures help further reduce the solution space. Some general variants are also studied. Numerical experiments are conducted to show the necessity and the impact of joint decisions for perishable products.

2 - Optimal Decisions in Multi-Period Inventory Problems Under Price Uncertainty

Xiangling Hu, Washington State University, 1630 NE Valley Road W. 304, Pullman, WA, 99163, United States, xhu@wsu.edu, Chuck Munson

This paper presents multi-period inventory models in which a retailer faces uncertain purchasing price and three types of demands: deterministic demand, selling price dependent demand, and stochastic demand, and makes purchasing-order-quantity, purchasing-order-time, and selling-price decisions with the objective of maximizing expected utility.

3 - Order Sizing in Inventory Systems with Resource Constraints and Both Price and Shipping Discounts
John Moussourakis, Rider University, 2083 Lawrenceville Road, Lawrenceville, NJ, 08648, United States, moussourakis@rider.edu, Cengiz Haksever

Determining order quantities is based mostly on a fixed or an independent cycle approach, neither of which always outperforms the other. In this paper, we examine a model that suggests which of the two approaches is most cost-effective in the presence of a number of resource constraints and both price and shipping discounts.

4 - VMI Contracts - Coordinating the Supply Chain While Looking from the Supplier's Perspective
Arvind Sainathan, Student, 60 Crittenden Boulevard, Apt. # 601, Rochester, NY, 14620, United States, sainathana2@simon.rochester.edu, Harry Groenevelt

We study coordination of a supply chain when inventory is managed by the vendor (VMI). Four popular contracts are studied: buy-back, quantity flexibility, quantity discount and sales rebate. Though all four contracts coordinate the supply chain under retailer managed inventory (RMI), only buyback and QD contract in general coordinate under VMI as well. We also propose two new contracts that coordinate under VMI, one of which also coordinates under RMI (provided a well-known assumption holds).

5 - Inventory Management Under Dynamic Quantity Competition
Sandra Transchel, University of Mannheim, Department of Logistics, Schloss S233, Mannheim, Germany, sandra.transchel@bwl.uni-mannheim.de, Stefan Minner

We analyze a joint inventory-marketing model under quantity competition. Two firms compete over an infinite horizon. The strategic behavior of the firms is characterized by the dynamic behavior of an economic order quantity inventory policy and the quantity that is sold on a single market. The sales price is modelled by a price response function of the total quantity. We assume that the firms simultaneously maximize their average profits and we determine open-loop Nash-equilibria.

■ TB54

Room 415

Go to Market Strategies: An Operations, Technology, and Marketing Perspective

Cluster: Operations and Marketing for Emerging Markets
Invited Session

Chair: Elie Ofek, Harvard Business School, Soldiers Field, Boston, United States, eofek@hbs.edu

Co-Chair: Oded Koenigsberg, Columbia University, New York, NY, 10027, United States, ok2018@columbia.edu

1 - Optimal Product Line Design for Consumer Durables: An Integrated Marketing and Design Approach
Lan Luo, Assistant Professor of Marketing, University of Southern California, 3660 Trousdale Parkway, ACC 301F, Los Angeles, CA, 90089, United States, lluo@marshall.usc.edu, Babak Besharati, P.K. Kannan, Shapour Azarm

Historically, product line design was considered as selecting the best K products from a set of N candidate products. However, a subjective prior selection of the N products can result in a suboptimal product line. In particular, the performance of consumer durables can vary across different conditions. We adopt a Genetic Algorithm optimization to identify a set of robust products. Next, a combinatorial optimization is used to construct a product line. Our approach was implemented by a US firm.

2 - Is Using Target Rebates Good for Manufacturers?
Wenqiang Xiao, Columbia Business School, 3022 Broadway, New York, NY, United States, wx2004@columbia.edu, Fangruo Chen

This paper studies target rebates in a manufacturer-retailer model with retailer sales efforts. We show that the manufacturer is better off by offering a single wholesale price contract, rather than a target rebate coupled with a wholesale price contract.

3 - Bricks and Clicks: Managing In-Store Product Assortment and Online Returns
Elie Ofek, Harvard Business School, Soldiers Field, Boston, United States, eofek@hbs.edu, Miklos Sarvary, Ozge Turut

Operating an online arm in addition to physical stores allows retailers to appeal to customers that value the conveniences of online shopping. However, online shopping increases the likelihood of product mismatch. Returning mismatched merchandise is a costly process for firms and consumers. Retailers operating dual channels need to decide how much in-store product assortment to offer, how costly to make product returns, and how to price their merchandise online and offline.

4 - High-Low or Low-High: Product Line Introduction Strategies
Oded Koenigsberg, Columbia University, New York, NY, 10027, United States, ok2018@columbia.edu, Eyal Biyalogorsky, Debu Purohit

Determining the specifications of new products to be introduced into the market is one of the most important and difficult tasks. In cases of sequential introduction a manager has to decide whether to direct the initial efforts towards the introduction of a high end model packed with many features, or toward a lower end model. In this paper we derive the optimal introduction strategies under different market conditions and provide guidelines to managers how they should launch their product line

■ TB55

Room 416

Agents

Sponsor: Artificial Intelligence
Sponsored Session

Chair: Karthik Kannan, Assistant Professor, Purdue University, 403 West State Street, West Lafayette, IN, 47907, United States, kkarthik@purdue.edu

1 - Survival of the Fittest: Firm Evolution During the DotCom Era
Jacquelyn Rees, Purdue University, West Lafayette, IN, 47907, United States, jrees@purdue.edu

Evolutionary models have been used to simulate various organizational processes, such as firm structure, markets, and decision processes. In particular, genetic algorithms, (GAs) have been used a both a model and a metaphor for change over time of such structures. In this research, we fit eCommerce firm data to a specific instance of a GA in order to examine the evolutionary course of firms over the so-called "DotCom" era.

2 - Adaptive Supply Chain Trading
Norman Sadeh, Professor, School of Computer Science, 5000 Forbes Avenue, Pittsburgh, PA, 15213, United States, sadeh@cs.cmu.edu, Michael Benisch, Alberto Sardinha, James Andrews

This paper presents CMieux, Carnegie Mellon University's entry in the 2005 and 2006 Supply Chain Trading Agent Competition. CMieux combines novel techniques for dynamic procurement and bidding with an architecture to tightly coordinate these activities. We present and analyze empirical results based on 200 games involving agents entered by 25 different teams during what can be seen as the most competitive phase of the 2005 tournament as well as more recent results from May 2006.

3 - Botticelli 2006: A TAC SCM Agent
Victor Naroditskiy, Graduate Student, Brown University, Department of Computer Science, Box 1910, Providence, RI, 02912, United States, vnarodit@cs.brown.edu, Amy Greenwald

One of the challenges of the TAC SCM is integration of long-term procurement decisions and short-term selling decisions in the environment where product demand and component supply change all the time. We approximate the game-theoretic problem by an optimization problem. We then solve a tractable approximation to make long-term decisions and a smaller problem to make short-term decisions. This strategy was employed by Brown University's entrant Botticelli, a finalist in 2006 TAC SCM.

Interactive Session
Tuesday, 12:30pm -1:30pm

Ballroom Foyer

Miguel Lejeune, Assistant Professor, Carnegie Mellon University, 5000 Forbes Avenue, Tepper School of Business, Pittsburg PA 15213, United States, mlejeune@andrew.cmu.edu

1 - Supply Chain Contracting: Motivating Competing Suppliers
Hongmin Li, MIT Sloan School of Management, E53-384, 30 Wadsworth Street, Cambridge, MA, 02142, United States, hmli00@yahoo.com

OEM's who want to avoid single sourcing need to motivate competing suppliers effectively. This paper studies optimal history-dependent contracts with multiple suppliers in a dynamic, uncertain, imperfect-information environment. The results provide an optimal contract structure for the OEM and optimal performance and effort paths for the suppliers. We compare money-reward contracts and volume-incentive contracts.

2 - Freight Movement Model Development for the State of Oklahoma
Karthik Ayodhiramanujan, Graduate Research Associate, Oklahoma State University, 322, Engineering North, Stillwater, OK, 74078, United States, venugan@yahoo.com, Manjunath Kamath, Simin Pulat, Ricki Ingalls, Guoquiang Shen

We present a two-tiered approach based on the urban travel demand model to estimate the freight movement for Oklahoma. Tier one includes a regional model that analyzes the freight flow between states to estimate the freight flow in, out and through Oklahoma by mode. Tier two focuses on a state model that analyzes the freight flow within Oklahoma between counties following a similar approach. The integrated model will be a part of a DSS for policy-making and infrastructure planning.

3 - Predicting Engineering and Operations Failure Risks Using a Quantitative Project Model

John Chachere, Ph.D. Student, Stanford University, 1311 Ulloa St., San Francisco, CA, 94116, United States, chachere@stanford.edu

Developers of new products with technical failure risks require quantitative projections of complex interactions among product, organization, process, and context factors. We identify theory-based mechanisms by which engineers' and managers' choices moderate the creation of product flaws that jeopardize downstream success, and quantify the likelihood of these events for a given project, by linking a Virtual Design Team simulation of development to a Probabilistic Risk Analysis of operations.

4 - Developing Reusable Final Examination Timetables

Christine R. Kraft, Clemson University, M303 Martin Hall, Clemson, SC, 29634, United States, cstemm@clemson.edu, James P. Jarvis

Three procedures for creating reusable university final examination timetables are developed and compared. Two of the procedures split the problem into two phases: a clustering phase, utilizing either a hierarchical or a partitioning method, and a sequencing phase. The third procedure employs a multi-criteria quadratic integer program formulation. Results are compared using enrollment data from Clemson University.

5 - The ESP Driving Interface for Music Expression Synthesis: Mapping Strategies for Tempo Smoothness

Jie Liu, University of Southern California, 3715 McClintock Avenue, GER 240, Los Angeles, 90089, United States, jieliu@usc.edu, Alexandre François, Elaine Chew

The Expression Synthesis Project allows non-experts to interactively create expressive renderings of music pieces through a driving interface. In ESP, the road represents the music, and the user controls the tempo and dynamics. We present mapping strategies that guarantee tempo smoothness. Visit the ESP demo and drive Brahms' Hungarian Dances.

6 - Heuristic Methods to Solve Hospital Evacuation Planning Problems

Esengul Tayfur, Clemson University, 110 Freeman Hall, Clemson, SC, 29634, United States, etayfur@clemson.edu, Kevin Taaffe

Hospital evacuation is a difficult process that requires a robust strategy and careful execution. We propose a resource allocation model to address the sheltering, transportation, and staffing needs of the hospital, using a heuristic approach to solve the problem in a reasonable amount of time.

7 - Incorporating Profitability and Risk For The Risk Averse Selective Newsvendor

Kiran Chahar, Graduate Student, Clemson University, Department of Industrial Engineering, 110 Freeman Hall, Clemson, SC, 29634, United States, kchahar@clemson.edu, Kevin Taaffe

Consider a firm that operates in consecutive single selling seasons delivering its products across several markets with unique revenue and uncertain demands. Using simulation, we propose a market selection approach that will minimize the firm's risk of incurring successive losses over these seasons.

8 - How to Effectively implement Six Sigma? Inputs from Social Exchange Theory and Knowledge Management

Anant Deshpande, PhD student, University of texas pan american, 807 North cross lane, Apt#3, Edinburg, TX, 78541, United States, ardeshpande@utpa.edu

Unsuccessful implementation of Six Sigma is evident in literature. Researchers have attributed this to lack of strong theoretical foundations in Six Sigma literature. In addition, researchers have advocated use of other management theories. Accordingly, this paper utilizes the social exchange theory and knowledge management to provide valuable insights to Six Sigma literature. The deduced theoretical framework will provide managers with a better understanding of implementation of Six Sigma.

9 - Benchmarking's Methodology in a Set of Organizations

Guillermina Salut, Departamento de Optimización y Control de la Escuela de Ingeniería Industrial de la Facultad de Ingeniería, Ciencias Exactas y Agrimensura de la Universidad Nacional de Rosario, Avenida Pellegrini 250, Rosario, SF, Argentina, guillesalut@yahoo.com.ar, Marta Liliana Cerrano, Luis Diego Piacenza, Daniela Nora Gomez, José Garrera

Through a Benchmarking method developed by the authors, is obtained a ranking of global efficiency for a group of organizations. This method combines the results of the application of recognized mathematical models and determines which organizations develop best practices.

10 - Maintenance Scheduling with Multi-Skilled Workforce Constraints: Model, Algorithms, and Applications

Hongman Gao, University of Mississippi, School of Business, University of Miss., University, 38677, United States, hgao@bus.olemiss.edu

This research provides an integrated solution for the maintenance-scheduling problem with multi-skilled workforce constraints. First, the craft-combination problem is solved by developing an efficient heuristic algorithm to automatically search for the solution. Second, a novel maintenance-scheduling model is formulated to automatically produce the optimal solution and optimal craft combination. Finally, several heuristics are provided that quickly generate good solutions.

11 - A Quantitative Investigation of Japanese Government Subsidy Policy for Private Universities

Anwar Sanusi, PhD Student, National Graduate Ins. of Policy Studies (GRIPS), Roppongi, Minatoku, Tokyo, Japan, Tokyo, Japan, anwaru@rocketmail.com

This paper aims to investigate the Japanese Government's subsidy policy for private universities by applying a number of quantitative approaches. First, by using the current data on the year 2005, we define the most influential variables in allocating government subsidy. Second, by using data in the two periods of 1975-1979 and 2000-2004, we expose the structural properties of the Government's subsidy policy to measure the "dominance power" of the top-ranking subsidy-recipient.

12 - Line of Sight on Terrain Data

Aysegul Peker, Industrial and Systems Engineering Department, 400 Daniels Hall, Campus Box 7906, North Carolina State University, Raleigh, NC, 27695-7906, United States, aspeker@ncsu.edu, John Lavery, Shu-Cherng Fang

Given a set of terrain data represented by C1 smooth piecewise cubic polynomials, we study a line of sight problem for a point on or above terrain. An efficient procedure based on the interactions of tangent planes is reported.

13 - Optimizing Importance Sampling Parameter for Portfolios of Credit Risky Assets

Huiju Zhang, R. H. Smith School of Business, University of Maryland, College Park, MD, 20742, United States, huizhang@rhsmith.umd.edu, Michael Fu

Accurate assessments of potential losses on a credit portfolio play a key role in the financial management. Monte Carlo simulation with importance sampling is widely applied to determine the loss distribution for a credit portfolio. We cast the selection of importance sampling measure change parameter as a minimization problem, and apply a gradient-based stochastic algorithm and Cross-Entropy method to estimate the optimal measure. Both algorithms converges efficiently to the optimum.

14 - A Dynamic Tool for Aviation Market Analysis

Brendan Hogan, Sr. Simulation Modeling Engineer, MITRE/CAASD & University of Virginia, 7515 Colshire Avenue, McLean, VA, 22102, United States, bhogan@mitre.org

We present a tool for interactive research into the market structure of the National Airspace System. Users can dynamically explore carrier market share, air fares, and passenger routing trends on an airport origin-destination pair basis. Output is presented in the form of custom graphs and map-based displays.

15 - An Empirical Analysis of the Determinants of Product Lock-in in Enterprise Software

Ian Larkin, Ph.D. Candidate, Haas School of Business, University of California, Berkeley, 2220 Piedmont Ave, Berkeley, CA, 94720, United States, larkin@haas.berkeley.edu

This study uses a novel dataset of enterprise software deals to examine issues around product lock-in and switching costs. I do find substantial evidence that lock-in leads to higher prices when customers upgrade their software packages, but that lock-in is specific to products, not vendors. This suggests the movement to broad application suites by vendors may be misguided. I also find that customers with higher IT capabilities are more likely to strategically switch and avoid lock-in.

16 - An Algorithm for Solving Fixed Charge Bi-Criterion Indefinite Quadratic Transportation Problem

Archana Khurana,Lecturer, School of Basic and Applied Sciences, Guru Govind Singh Indraprastha University, Kashmere Gate, Delhi 110006, India, archana_maths@rediffmail.com, S.R. Arora

In the present paper a fixed charge bi-criterion indefinite quadratic transportation problem(QTP) with restriction on the total flow is studied. An algorithm to find the efficient cost-time trade off pairs for the problem is presented.A related fixed charge bi-criterion QTP with restricted flow is formulated and the efficient cost-time trades off pairs to the given problem are shown to be derivable from this related problem. The algorithm is illustrated with the help of a numerical example.

17 - An Ant Based Algorithm for the VRP with Simultaneous Delivery and Pick-up

Bülent Çatay, Sabanci University, FENS, Istanbul, 34956, Turkey, catay@sabanciuniv.edu

Ant Colony Optimization (ACO) algorithm to the NP-hard Vehicle Routing Problem with Simultaneous Delivery and Pick-up (VRPSDP) is proposed. In VRPSDP, commodities are delivered to customers from a single depot utilizing a fleet of identical vehicles and empty packages are collected from the customers and transported back to the depot. The objective is to minimize the total distance traveled. The algorithm provides comparable results to the benchmark problems from the literature.

18 - Collaborative, Multi-Attribute Analysis of Facility Design Decisions

John Chachere, Ph.D. Student, Stanford University, 1311 Ulloa St., San Francisco, CA, 94116, United States, chachere@stanford.edu

Collaborative decisions made during architecture, engineering, and construction projects' feasibility studies implicitly define and dramatically impact quality. Teams of industry professionals and stakeholders need systematic and transparent management science methods to clarify goals, more fully explore options, and develop consensus, thereby ultimately improving project quality. We present the application and results of such methods on the feasibility study for the Stanford Green Dorm project.

19 - Global Optimization in Model-Based Clustering

Jeffrey Heath, University of Maryland, College Park, Mathematics Building, University of Maryland, College Park, MD, 20742, United States, jheath@math.umd.edu, Michael Fu, Wolfgang Jank

The Expectation-Maximization (EM) algorithm is an optimization tool in model-based clustering that produces locally optimal solutions. We introduce four new algorithms based on the Cross-Entropy (CE) method and Model Reference Adaptive Search (MRAS) that produce better global solutions. A challenge is efficiently simulating positive definite matrices. One solution is to apply EM principles, leading to CE-EM and MRAS-EM. We also propose CE-CD and MRAS-CD, which rely on the Cholesky decomposition.

20 - Methodological Frameworks for Multi-Agent Supply Chain Modeling

Ramakrishna Govindu, Wayne State University, 4815 Fourth St., Detroit, MI, 48202, United States, RamGovindu@wayne.edu, Ratna Babu Chinnam

Multi-agent systems offer powerful modeling paradigm for supply chains. We develop three methodological frameworks; focusing on analysis & design, implementation, and "goal-directed" BDI-based rationality; to bridge the gap of "lack of generic methodologies". Through SCOR-based reusable components, developers can quickly configure SC models to simulate dynamics, and study control/coordination issues.

21 - Model-based Decision Support in Open-Ended Problem Domains

Andrew Crapo, Information Scientist, GE Global Research, K-1 5C10A, One Research Circle, Niskayuna, NY, 12309, United States, crapo@research.ge.com

Adaptive Work-Centered User Interface Technology (ACUITy) is an open-source framework and architecture for developing semantically-enabled mixed initiative user interfaces. ACUITy uses ontologies captured in the Web Ontology Language (OWL) to model users, human-computer interaction, and domain-specific problems. It enables users to configure their own work environment and learns their preferences for information content and presentation.

22 - The Use of Simulation in Boat Facility Siting

Edward Baker, Professor, University of Miami, Dept of Management Science, Coral Gables, FL, 33124, United States, ebaker@miami.edu, Maria Villanueva

Boating facility development in the state of Florida requires a Boating Facility Siting Plan. The plan requires an assessment of boating activity as well as manatee sighting and mortality data in the related area. This presentation demonstrates how the ARC/INFO geographic information system may be used to simulate the interaction of these two effects. Data are presented from the recent development of a boating facility in southwest Florida.

Tuesday, 1:30pm - 3:00pm

■ TC01

Room 301

Identifying and Pricing Profitable Keywords for Search-Based Advertising Services

Sponsor: Optimization/ Network and Combinatorial Optimization
Sponsored Session

Chair: Paat Rusmevichientong, Assistant Professor, Cornell University, 221 Rhodes Hall, Ithaca, NY, 14850, United States, paatrus@cornell.edu

1 - Bid Optimization in Online Advertisement Auctions

Omid Etesami, University of California, Berkeley, 2299 Piedmont Avenue, Berkeley, CA, United States, etesami@EECS.Berkeley.EDU, Christian Borgs, Nicole Immorlica, Mohammad Mahdian, Jennifer Chayes, Kamal Jain

We study online keyword advertising auctions among bidders with limited budgets, and propose a bidding heuristic to optimize the utility for each bidder by equalizing its return-on-investment across keywords. We study the equilibrium of a system in which every bidder is using this heuristic, and show that if small random perturbations are added to the first price mechanism, the system provably converges to the market equilibrium.

2 - Truthful Auctions for Pricing Search Keywords

Gagan Aggarwal, Stanford University, Computer Science Department, Stanford, CA, 94305, United States, gagan@cs.stanford.edu, Ashish Goel, Rajeev Motwani

We present a truthful auction for pricing advertising slots on a webpage. The auction ranks the advertisers in decreasing order of their (weighted) bids. By setting the weights appropriately, it captures both the Overture model (advertisers ranked in order of bids) and the Google model (advertisers ranked in order of expected revenue generated). Assuming separable click-through rates, we prove revenue-equivalence between our auction and the non-truthful next-price auctions currently in use.

3 - An Adaptive Algorithm for Selecting Profitable Keywords for Search-Based Advertising Services

Paat Rusmevichientong, Assistant Professor, Cornell University, 221 Rhodes Hall, Ithaca, NY, 14850, United States, paatrus@cornell.edu, David Williamson

Motivated by the challenges of identifying profitable keywords, we formulate a model of keyword selection for search-based advertising. We develop an algorithm that adaptively identifies the set of keywords to bid on based on historical performance. The algorithm prioritizes keywords based on a prefix ordering — sorting of keywords in a descending order of profit-to-cost ratio. We show that the average expected profit generated by the algorithm converges to near-optimal profits.

■ TC02

Room 302

Joint Session Open-Source/ICS: Open-Source Application Programming Interfaces for Optimization I

Cluster: Open-Source Software: Open Source, Open Standards, Open Data, INFORMS Computing Society
Invited Session

Chair: Robert Fourer, Professor, Department of Industrial Engineering & Management Sciences, Northwestern University, 2145 Sheridan Road, Evanston, IL, 60208-3119, United States, 4er@iems.northwestern.edu

1 - The COIN-OR Open Solver Interface: Inside a Portable Solver API

Matt Saltzman, Clemson University, Mathematical Sciences Department, Clemson, SC, 29631, United States, mjs@clemson.edu, Laszlo Ladanyi, Ted Ralphs

The Open Solver Interface of the COIN-OR toolkit implements a set of C++ classes for model instance construction and modification, solver invocation, and solution extraction. The OSI provides a common API architecture for any supported solver and is easily extensible to other solvers. We describe the OSI architecture and several examples of its application and we discus issues relating to extending the OSI to more general classes of problems and solvers.

2 - An Open-Source API for Nonlinear Programming Problems.
Michael E. Henderson, mhender@us.ibm.com

I will describe the current COIN-OR Open-source project NLPAPI, which is a C API (though object-oriented) for defining and solving nonlinear programming problems. At present the project relies on LANCELOT's group partial separable function structure, while allowing also for single-function objective and constraints. Future plans include a more generally structured function, and an OSI interface when the problems defined are linear.

3 - The AMPL/Solver Interface Library
David M. Gay, Principal Member of Technical Staff, Sandia National Laboratories, Mail Stop 0370, PO Box 5800, Albuquerque, NM, 87185-0370, United States, dmgay@sandia.gov

The AMPL/Solver Interface Library (ASL) is perhaps the first general, open-source interface library for linear, mixed-integer, and nonlinear programming. It offers sparse or dense first and second derivatives and, for linear constraints, makes the commonly used column-oriented constraint matrix representation readily available. It also conveys names, complementarity conditions and some logical constraints, and is evolving to provide more constructs for constraint and stochastic programming.

■ TC03

Room 303

Stochastic Global Optimization

Sponsor: Optimization/ Global Optimization
Sponsored Session

Chair: Dushyant Sharma, Assistant Professor, University of Michigan, 1205 Beal Avenue, Ann Arbor, MI, United States, dushyant75@yahoo.com

1 - Stochastic Solver Strategies in LGO
János D. Pintér, President and Research Scientist, Pinter Consulting Services Inc., 129 Glenforest Drive, Halifax, NS, B3M 1J2, Canada, jdpinter@hfx.eastlink.ca

LGO is an integrated model development and solver suite to handle global and local (nonlinear) optimization problems. LGO has been implemented both as a stand-alone (compiler-based) solver, and with links to AIMMS, GAMS, MPL, Maple, Mathematica, and MATLAB. The stochastic sampling strategies embedded in LGO support the numerical solution of (merely) continuous GO models. We review the underlying key properties, and present illustrative examples.

2 - It's a Small World If You Hit-and-Run
Archis Ghate, University of Michigan, IOE Department, 1205 Beal Avenue, Ann Arbor, MI, 48109, United States, archis@umich.edu, Robert Smith

Hit-and-Run is a well-known algorithm for sampling from essentially arbitrary distributions over bounded regions of Rn. We show how a special case of Hit-and-Run generates a Small World network on the fly. This network admits efficient search by a decentralized algorithm. We investigate its implications for global optimization.

3 - Local Search Heuristics for Distance Constrained Spanning Tree Problem
Luis Gouveia, Faculdade de Ciencias da Universidade de Lisboa, DEIO-CIO, Bloco c/2 - Campo Grande, Lisboa, Portugal, legouveia@fc.ul.pt, Ana Paias, Dushyant Sharma

We present a Dynamic Program formulation for the Hop Constrained Spanning Tree Problem. Using the DP formulation we develop very large-scale neighborhood structures for this problem. We provide computational results comparing the neighborhood structures with the basic edge exchange neighborhood structure and the best known solutions.

4 - Functional Annealing for Unconstrained Quadratic Binary Optimization
Dushyant Sharma, Assistant Professor, University of Michigan, 1205 Beal Avenue, Ann Arbor, MI, United States, dushyant75@yahoo.com, Dushyant Sharma

We describe stochastic search algorithms for unconstrained quadratic binary optimization that are based on Functional Annealing. The underlying local improvement algorithms are based on the standard one exchange neighborhood and a neighborhood obtained by exploiting easily solvable restrictions of the problem. Computational tests demonstrate the effectiveness of Functional Annealing for the problem.

■ TC04

Room 304

Integer Programming

Sponsor: Optimization/ Integer Programming
Sponsored Session

Chair: Gabor Pataki, Department of Statistics and Operations Research, University of North Carolina, Chapel Hill, NC, United States, pataki@email.unc.edu

1 - Optimizing Over the Split Closure
Anureet Saxena, PhD Student, Tepper School of Business, 5000 Forbes Avenue, Pittsburgh, PA, United States, anureets@andrew.cmu.edu, Egon Balas

The polyhedron defined by all the split cuts obtainable directly from the LP-relaxation P of a mixed integer program (MIP) is called the split closure of P. In this talk we address the problem of optimizing over the split closure and discuss computational results on a wide range of benchmark instances. It turns out that optimizing over this closure bridges on the average about 4/5 of the integrality gap of pure and mixed integer test instances.

2 - Combinatorial Problems on Power Networks
Daniel Bienstock, Department of IEOR, Columbia University, New York, NY, 10027, United States, dano@ieor.columbia.edu

National-scale blackouts are complex phenomena arising from the interaction of combinatorial features of large-scale networks and the physics of power transmission. In this talk we present continuing work on integer programming and combinatorial problems arising in this context, in particular, the attach problem.

3 - A Computational Study of Column Basis Reduction
Gabor Pataki, Department of Statistics and Operations Research, University of North Carolina, Chapel Hill, NC, United States, pataki@email.unc.edu, Bala Krishnamoorthy

We conduct a detailed computational study of a reformulation method for IPs called column basis reduction (CBR). We consider variants that work in the rangespace and the nullspace; solving feasibility and optimization problems; and various problem classes.

4 - The Mixing-MIR Set with Divisible Capacities
Ismael de Farias, Assistant Professor, SUNY Buffalo, 403 Bell Hall, Buffalo, NY, 14260, United States, defarias@buffalo.edu, Ming Zhao

We extend the Mixing-MIR set of Gunluk and Pochet to include divisible capacities. We give all extreme rays of the convex hull P of the resulting set and an algorithm to give all extreme points. We give a polynomial-time separation algorithm for finding a most violated cut valid for the polar of P, thus establishing the tractability of optimization over P. Finally, we show how to extend our results to the case of two non-divisible capacities.

■ TC05

Room 305

Flexibility, Information and Competition in Supply Chains

Contributed Session

Chair: Joern Meissner, Lecturer, Lancaster University Management School, Department of Management Science, Lancaster, LA, LA1 1YX, United Kingdom, joe@meiss.com

1 - Endogenous Information Acquisition in Supply Chain Management
Kaijie Zhu, Assistant Professor, Department of IELM, Hong Kong University of Science and Technology, Clear Water Bay, Kowloon, Hong Kong, kzhu@ust.hk, Qi Fu

We consider a supply chain in which a supplier sells a product to a retailer during a single season with a random demand. The retailer can acquire costly demand information by hiring experts. By comparing the optimal number of experts to hire with the social optimum, we find decentralization may lead to a higher level of information acquisition. We also examine if several commonly-used contracts can coordinate the supply chain and allow an arbitrary profit allocation between the two parties.

2 - The Flexibility of Supply Contracts and Implications of Pooled Option
Hua Tao, National University of Singapore, NUS Business School, Dean's Office, Singapore, Singapore, taohua@nus.edu.sg, Mabel Chou

We analyze the flexibility of supply chain contracts in view of real options. In a manufacturer-retailer game theoretic framework, uni-product reorder option, return option and multi-products pooled option are examined and priced respectively. Their contributions and implications to the whole supply chain are studied and illustrated.

3 - Competition Under Dynamic Lot Sizing Costs with Capacity Aquisition
Hongyan Li, PhD Candidate, Lancaster University Management School, Department of Management Science, Lancaster, LA, LA1 1YX, United States, h.li7@lancaster.ac.uk, Joern Meissner

We develop a competitive supply chain model which combines the complexity of time-varying demand and cost functions and that of scale economies arising from dynamic lot sizing costs under a capacity restriction. Each firm determines the capacity to be purchased and the optimal replenishing plan throughout the horizon. Based on the capacity demand for the competing firms, a market price is determined for the capacity. We establish the existence of an equilibrium, under mild conditions.

4 - Supply Chain Focus' Dependant Treatment of the Sensitivity of the Point of Product Differentiation
Gangaraju Vanteddu, PhD Candidate, Wayne State University, 4815 Fourth Street, # 1073, Detroit MI 48202, United States, vgraju@wayne.edu, Ratna Babu Chinnam, Kai Yang

Our preliminary results show that the POD is relatively less sensitive with respect to the total cost as the inventory related parameters change across the SC for a given set of responsiveness cost related parameters. Our research also suggests that the POD is relatively more sensitive to the cost added at a particular stage as the responsiveness related parameters change across the SC for a given set of inventory related parameters.

5 - Hybrid Rule-based Scoring Methodologies for Supplier Selection
Cuneyt Altinoz, Assistant Professor, East Carolina University, 31314 Bate Building, College of Businees, ECU, Greenville, 27858, United States, altinozc@ecu.edu

In order to properly represent the intentions of decision makers, it is necessary to go beyond attribute scoring approaches and use rules. However, the scoring approaches have their own advantages, such as ease of understanding and ranking. In this paper, we discuss using a hybrid approach that uses fuzzy rules for requirements and scoring for evaluation. Various scoring and ranking procedures are explored. In addition to the benefits, issues related to using such a system are also discussed.

■ TC06

Room 306

Metaheuristic Use In Transportation Logistics

Sponsor: INFORMS Computing Society/Heuristic Search
Sponsored Session

Chair: Jeff Havlicek, Doctoral Candidate, United States Air Force, 4442 Pinebrook Court, Centerville, OH, 45458, United States, jhavlicek@gmail.com

1 - An Adaptive Tabu Search Heuristic for the LPDPTW with a Theater Distribution Application
Robert Burks, Doctoral Candidate, United States Air Force, 145 Freesia Drive, Dayton, OH, 45431, United States, Robert.Burks@afit.edu, James Moore

This research seeks to blend the PDPTW and LRP areas of research to formulate a location scheduling pickup and delivery problem with time windows to model theater distribution. The research utilizes advanced tabu search techniques, including adaptive tabu search and group theory applications, to develop a heuristic procedure for solving the LPDPTW. Group theory provides the structural foundation that supports adaptive tabu search's efficient search and movement through the solution space.

2 - The Vehicle Routing Problem Applied To Unmanned Combat Aerial Vehicles: A New Variant
Rafael Aleman, Graduate Research Assistant, Wright State University, 207 Russ Center, 3640 Colonel Glen Highway, Dayton, OH, 45435, United States, aleman.2@wright.edu, Xinhui Zhang, Raymond Hill

We investigate the mathematical model and heuristic algorithms to solve the assignment of a set of mobile military targets to a set of unmanned combat aerial vehicles (UCAVs) over time minimizing the total travel distance. We solve this problem as a vehicle routing problem (VRP) using innovative mechanisms and introduce a new variant of the VRP where customers are served at different locations over time. Our approach provides good solutions in a reasonable computational time.

3 - Empirical Study and Problem Generation for Multiplechoice Multidimensional Knapsack Problem
Chaitr Hiremath, Wright State University, 3640 Colonel Glenn Highway, Dayton, OH, 45435, United States, hiremath.2@wright.edu, Raymond Hill

We present an empirical study of legacy and new systematically developed heuristics for the Multiplechoice Multidimensional Knapsack Problem (MMKP). Existing problem sets are used in the study and results compared with a new systematically generated problem set. We report our results as a function of problem constraint and correlation structure.

■ TC07

Room 307

ICS Prize Winner 2005

Sponsor: INFORMS Computing Society
Sponsored Session

Chair: John Chinneck, Professor, Carleton University, Systems & Computer Engineering, Ottawa, ON, K1S 5B6, Canada, chinneck@sce.carleton.ca

1 - Mining Data with Classification Trees, Discrete Optimization Models, and Sammon Maps
Edward Wasil, Professor of Management Science, American University, Kogod School of Business, Washington, DC, 20016, United States, ewasil@american.edu, Bruce Golden, S. Raghavan, Zhiwei Fu, Shreevardhan Lele

Over the last five years, we have developed several new methods that use ideas from statistics, heuristic search, and mathematical programming for solving a variety of data mining problems. First, we describe our innovative methods for constructing classification trees in very large data sets. Second, we focus on discrete optimization models in data visualization. Third, we describe our work on formulating visualization models that are based on adjacency data using Sammon maps.

■ TC08

Room 308

Decision Analysis in Technology Management

Sponsor: Technology Management
Sponsored Session

Chair: Karen Eden, Assistant Professor, Oregon Health & Science University, BICC, Portland, OR, 97239, United States, edenk@ohsu.edu

1 - Practical Technology Forecasting Tools - A Review of Recent Tools and Applications
Tugrul Daim, Portland State University, Portland, OR, 97201, United States, tugrul@etm.pdx.edu

This paper presents a comparative review of recent Technology Forecasting applications. Several new and existing methodologies were introduced into this field in the recent years, providing a wide range of options for researchers and practioners. These methods include bibliometrics, system dynamics and roadmaps. Applications that the paper reviews include optical storage, switches, nano technologies, fuel cells, food safety technologies and interconnect technologies.

2 - Using AHP for Technology Assessment on the Reduction of the Internal Digital Divide in Costa Rica
Audrey Alvear, Portland State University, Portland, OR, 97201, United States, alveara@etm.pdx.edu, Dundar Kocaoglu

This study presents a systematic approach to identify Information and Communication Technologies (ICTs), technology applications and key sectors that most impact the internal digital divide in developing countries. The methodology selected is Analytic Hierarchy Process (AHP). The results of this research suggest that the role of technology in 2010 will be distinctively oriented toward Internet mobility and collaboration in Costa Rica.

3 - HDM Sensitivity Analysis
Hongyi Chen, Portland State University, Oregon, OR, 97201, United States, hongyi_chen123@yahoo.com, Dundar Kocaoglu

Hierarchical Decision Model (HDM) is a widely used model in multi-level criteria decision making. In this paper, an algorithm of sensitivity analysis is developed to determine the allowable ranges within which perturbations can be induced on values at different levels of the hierarchy without changing the original ranking of the decision alternatives, sensitivity coefficient of contribution vectors on different levels of the hierarchy, and the critical criteria for keeping current ranking.

4 - Hierarchical Decision Modeling for Quantifying the Value of Technologies

Nathasit Gerdsri, Mahidol University, Thailand, nathasitg@gmail.com, Dundar Kocaoglu

This presentation describes a quantitative model used for evaluating the impact value of technologies on a company's objective. The hierarchical decision making approach is applied to construct the model. Both quantitative and qualitative aspects of technology evaluation are integrated into the model development process. The impact of technologies on a company's objective is calculated as a composite index called Technology Value.

■ TC09

Room 309

New Product Configurations, Positioning and Portfolios

Cluster: New Product Development

Invited Session

Chair: Janice Carrillo, Assistant Professor, University of Florida, PO Box 117169, Gainesville, Fl, 32611-7169, United States, janice.carrillo@cba.ufl.edu

1 - Optimal Product-Fusion and Offering Decisions of All-in-One Device with N Components

Yuwen Chen, PhD Candidate, University of Florida, 902 SW 7th Avenue, Apt. 8, Gainesville, FL, 32601, United States, yuwen@ufl.edu, Asoo Vakharia, Janice Carrillo

All-in-one products with many functions have proliferated in the markets. However, the impact of the fusion product on product portfolio decisions has not been investigated. When the fusion technology is available to include all component functions, we identify conditions under which a firm should optimally include only a subset of these functions. While a huge number of portfolios are typically considered, we propose an efficient algorithm to sort out the optimal fusion product portfolio.

2 - Product Rollovers and Optimal Pace of Product Introductions

Eylem Koca, University of Maryland, R. H. Smith School of Business, College Park, MD, 20742, United States, ekoca@rhsmith.umd.edu, Cheryl Druehl, Gilvan Souza

We present a framework to find the optimal pace of product introductions in the face of inventory and pricing considerations. We also compare the single and dual roll decision. We present numerical solutions and managerial implications using a fluid approximation model.

3 - Budget Creation and Control for Effective NPD Portfolio Management

Raul Chao, Georgia Institute of Technology, 800 West Peachtree Street, Atlanta, GA, United States, raul.chao@mgt.gatech.edu, Cheryl Gaimon, Stylianos Kavadias

We develop an analytical model to explore how a business unit allocates resources between NPD programs under various incentive systems. Our focus is on incentives that vary autonomy through budget creation and/or budget control. Our results indicate that the optimal allocation of resources between existing product improvement (incremental programs) and new product development (revolutionary programs) can be altered by simple incentive schemes based on budget creation and control.

4 - Competition and Innovation in Technology Markets

Bo Van der Rhee, University of Utah, 1645 E. Campus Center Drive, Salt Lake City, UT, 84112-9349, United States, pmgtbv@business.utah.edu, Glen Schmidt

We developed an analytical model to examine the case where technology based products consist of two attributes, quality and a new feature, which are negatively correlated. Firms compete in a duopoly on these attributes as well as on price and we examine the conditions under which either the high or the low quality firm would introduce the new feature.

■ TC10

Room 310

Software Demonstration

Cluster: Software Demonstration

Invited Session

1 - ILOG, Inc. - Introducing ILOG's Optimization Decision Management System (ODMS)

Greg Glockner, ILOG, Inc., 1080 Linda Vista Avenue, Mountain View, CA, 94043, gglockner@ilog.com

Combining the power of ILOG CPLEX with a complete system for optimization modeling, application development, and business user participation. Learn about ILOG's new Optimization Decision Manager (ODM), enabling the development of interactive CPLEX-based planning and scheduling applications with business participation in the model and application refinement process. Integrated with ILOG's OPL-CPLEX Development System, it allows modelers to effortlessly prototype, refine and deploy applications that provide extensive support for what-if analysis, scenario comparison, controlled relaxation of constraints, and goal programming.

2 - AIMMS by Paragon Decision Technology - AIMMS 3.7: Extended Algorithmic & Graphical Capabilities

Peter Nieuwesteeg, Paragon Decision Technology, 5400 Carillon Point, Kirkland, WA, 98033, p.nieuwesteeg@aimms.com, Gertjan de Lange

Check out the latest AIMMS version 3.7. We will walk you through the basics of AIMMS and demonstrate some of the new features: (1) Integrated GIS support, (2) Brand new Syntax Editor, (3) Stochastic Programming support to create a robust solution under uncertainty without changing the actual structure of a model, (3) Parallel Solver Session support. We will also show important extensions to Multi-Development support, and our successful Pivot Table. Details and a free trial: www.aimms.com/aimms/aimms37.html.

■ TC11

Room 311

Healthcare Operations Management

Contributed Session

Chair: Andrew Ganti, Consulting Manager, GE Healthcare, 300 Winged Terrace Drive, San Ramon, CA, 94582, United States, andy.ganti@med.ge.com

1 - Comparison of Dissimilar Capacities in Hospitals

Sanjeev Bordoloi, College of William & Mary, School of Business, Williamsburg, VA, United States, sbordoloi@hotmail.com

Service capacity is a perishable commodity. Treatment capacity in a health care organization is a vague, hard-to-measure concept. Considering the limited resources in a hospital, it is essential to find the optimal way to admit patients in order to maximize revenue or throughput. This paper aims at exploring operating strategies that can increase overall capacity utilization in a hospital by better matching of supply and demand for services.

2 - Capacity Investment Under Competition: Evidence from U.S. Hospitals

Diwas Kc, Doctoral Candidate, The Wharton School, University Of Pennsylvania, 3730 Walnut Street, Suite 500, Philadelphia, PA, 19104, United States, diwas@wharton.upenn.edu, Christian Terwiesch

We study how competition affects capacity investment decisions amongst service providers facing stochastic demand. Although analytical models in the literature show that competition spurs capacity investment, these results have not been validated empirically. We test these conclusions using cross sectional data from maternity wards in U.S. hospitals.

3 - Optimizing Multiple Objectives for the Surgical Case Scheduling Problem

Brecht Cardoen, Katholieke Universiteit Leuven, Naamsestraat 69, Leuven, 3000, Belgium, Brecht.Cardoen@econ.kuleuven.be, Erik Demeulemeester

Our research aims at developing a surgery schedule that incorporates different types of realistic objectives which are either hospital related (leveling recovery beds) or patient related (priority for children, travel distance) and will be combined into a multiobjective function. Multiple optimization methodologies, based on implicit enumeration of feasible schedules according to instrument, bed and infection constraints, will be evaluated and compared on the level of computational efficiency.

4 - Project Hospital Bed Needs Using Simulation

Andrew Ganti, Consulting Manager, GE Healthcare, 300 Winged Terrace Drive, San Ramon, CA, 94582, United States, andy.ganti@med.ge.com, Anita Ganti

This paper describes projecting hospital beds using simulation to respond to changing community demographic profiles. Details cover methodologies with examples to project physical and staffed patient beds by type of nursing unit based on projected rate of change in key demand ratios and project those ratios based on demographic characteristics, if they are unavailable. The benefits include optimal hospital beds and costs. The participants can take away tips and tools to apply to their hospitals.

■ TC12

Room 312

Research on Spreadsheets

Sponsor: Spreadsheet Productivity Research

Sponsored Session

Chair: Thomas Grossman, Associate Professor of Information & Decision Science, School of Business and Management, University of San Francisco, 2130 Fulton Street, San Francisco, CA, 94117, United States, tagrossman@usfca.edu

1 - Categorising Spreadsheets: A Report on a Pilot Study

Pat Cleary, Senior Lecturer, EuSpRIG (European Spreadsheet Risks Interest Group), University of Wales Institute Cardiff, Cardiff School of Management, Colchester Avenue, Cardiff, CF23 9XR, United Kingdom, PMCleary@uwic.ac.uk, M Madahar

A pilot study has been initiated to examine spreadsheets in use in an administration unit within the University of Wales Institute Cardiff (UWIC). Through this study we hope to develop a frame work for categorising spreadsheets by use, importance and risk. If successful, the framework could prove to be a valuable tool in the management of the risks associated with spreadsheet use. This paper will summarise initial results of the pilot study and discuss their value.

2 - Opportunities for Spreadsheet Research

Thomas Grossman, Associate Professor of Information & Decision Science, School of Business and Management, University of San Francisco, 2130 Fulton Street, San Francisco, CA, 94117, United States, tagrossman@usfca.edu

Author will discuss ongoing and new opportunities for spreadsheet research, and will then lead an audience discussion about ideas and outlets.

3 - Mission Critical Spreadsheets at a Large Urban University: an Update

Janet Wagner, Associate Professor, University of Massachusetts-Boston, MSIS Department, 100 Morrissey Boulevard, Boston, MA, 02125, United States, janet.wagner@umb.edu

In 2003, we reported on a survey of the spreadsheet use across all departments of a large urban institution. Of particular interest in that study was the goal of the then-being-implemented Peoplesoft system to eliminate all "parallel systems" (many of them spreadsheets). We are now in 2006 and Peoplesoft is basically fully implemented at that institution. What was the effect on spreadsheet use?

■ TC13

Room 313

PART 1: "Effective Use of Software in the MS/OR Classroom" - INFORMS Transactions on Education Special Issue

Sponsor: Education (INFORM-ED)

Sponsored Session

Chair: Denise Troxell, Associate Professor, Babson College, Mathematics and Sciences Division, Babson Park, MA, 02481, United States, troxell@babson.edu

1 - Web-Based Simulations for Teaching Queueing, Little's Law, and Inventory Management

Gregory Dobson, dobson@simon.rochester.edu, Robert Shumsky

We describe and make available three web-based simulations that help to teach concepts related to process flow and variability. These programs simulate, (i) A G/G/1 queue, (ii) A single-stage process to demonstrate the long-run validity of Little's Law and (iii) A continuous-time reorder point/reorder quantity inventory system. We offer evidence of how the simulations have helped the students to learn, including documentation from a web-based exercise with the queueing simulator.

2 - Introducing Integer Modeling with Excel Solver to Business Students

Dessislava Pachamanova, Assistant Professor, Babson College, 319 Babson Hall, Babson Park, MA, 02457, United States, dpachamanova@babson.edu

We present a simple example for introducing integer modeling of fixed costs with Excel Solver to business students. The example uses concepts from accounting (assessing distribution channel profitability), and blends them with management science techniques. The effectiveness of the software use is in integrating it successfully into a comprehensive discussion about assumptions, modeling, limitations, software pitfalls, validation, and implications for managerial decision making.

3 - An Electronic Teaching Assistant for Basic Operations Management Methods

Ralph Scheubrein, Freiberg University, Faculty of Business Administration, Lessingstrasse 45, Freiberg, 09596, Germany, ralph@scheubrein.de

Software packages are frequently used to support the teaching of quantitative methods. One didactic approach is to make the students implement the method considered in the lecture on their own. A popular type of software used for this purpose is the spreadsheet. ExcelTutor was designed to help students learn the necessary steps to compute the results of a method using a spreadsheet. ExcelTutor verifies the correctness of the final results and provides feedback on the time needed.

4 - An Interactive Excel VBA Example for Teaching Statistics Concepts

Weiyu Tsai, Assistant Professor, University of Utah, Department of Management, 1645 E. Campus Center Drive, Salt Lake City, UT, 84112, United States, mgtwt@business.utah.edu, Don Wardell

We developed a Visual Basic Application driven Excel spreadsheet that is built around one simple business scenario that allows students to integrate the Central Limit Theorem, interval estimation and hypothesis testing. Moreover, the example demonstrates several useful Excel statistical formulae. The results of an in-class open-book quiz showed that the scores of those using the interactive demo were superior to those exposed to more traditional techniques at the 10% significance level.

■ TC14

Room 314

The Value of RFID Visibility

Sponsor: e-Business

Sponsored Session

Chair: Jun Shu, Assistant Professor, Penn State University, 462 Business Building, University Park, PA, 16802, United States, junshu@psu.edu

1 - Six Sigma Supply Chains with RFID Visibility

Sanjay Sarma, Professor, Massachusetts Institute of Technology, 77 Massachusetts Avenue, Cambridge, MA, United States, sesarma@MIT.EDU

The principles of Statistical Process Control have revolutionized the yields of processes ranging from semiconductor fabrication to automotive assembly. The recent emergence of RFID however enables a new level of process measurement, control and continuous improvement in the Supply Chain. I will present some emerging results on this front and show how tighter performance, measured statistically can significantly enhance finacial metrics like revenues and earnings.

2 - Monitoring Methods and Quality Metric for Sensor Data

Jun Shu, Assistant Professor, Penn State University, 462 Business Building, University Park, PA, 16802, United States, junshu@psu.edu

Real-time sesnor data, in particular, RFID Data, provides new possibilities to improve the quality of business processes. Although quality control is widely used in manufacturing, it is not well defined or widely used in supply chain management. We will propose several generic quality measures based on sensor data and we will describe new methods to monitor these measures.

3 - The Impact of RFID on Stockouts at the Retail Level

Matthew Waller, Associate Professor, University of Arkansas, WCOB 347 University of Arkansas, Fayetteville, AR, 72701, United States, mwaller@walton.uark.edu

Several major retailers have launched RFID initiatives with Wal-Mart leading the way. In an effort to explore the potential business case, Wal-Mart commissioned a study to examine the influence of RFID on out of stocks. Preliminary results presented in this paper suggest that RFID is making a difference: within the test stores, out of stocks were reduced; test stores outperformed control stores; and tagged items outperformed non-tagged items within test stores.

■ TC15

Room 315

New Looks at Auctions

Cluster: Auctions and e-Commerce

Invited Session

Chair: Charles A. Holt, Professor, University of Virginia, Department of Economics, Charlottesville, VA, United States, cah2k@cms.mail.virginia.edu

1 - Risk-Averse Bidding on Name-Your-Own-Price Auctions

Christian Terwiesch, Associate Professor, University of Pennsylvania, 548 JMHH, Philadelphia, PA, 19104, United States, terwiesch@wharton.upenn.edu, Il-Horn Hann, Ali Abbas

We discuss optimal repeat bidding strategies on Name-Your- Own-Price (NYOP) auctions, and the effects of bidders' attitude towards risk on the optimal bidding sequence. Using data from an internet site that allowed bidders to rebid indefinitely, we estimate biddersô risk aversion, change in risk aversion, and transaction costs.

2 - Revenue Equivalence Revisited

Tim Salmon, Associate Professor, Florida State University, Department of Economics, Tallahassee, FL, 32306, United States, tsalmon@fsu.edu, Radosveta Ivanova-Stenzel

The conventional wisdom in the auction design literature is that first price sealed bid auctions tend to make more money while ascending auctions tend to be more efficient. We re-examine these issues in an environment in which bidders are allowed to endogenously choose in which auction format to participate. Our findings are that more bidders choose to enter the ascending auction than the first price sealed bid and this extra entry is enough to make up the revenue difference between the formats. Consequently, we find that both formats raise approximately the same amount of revenue. They also generate efficiency levels and bidder earnings that are roughly equivalent across mechanisms. In expected utility terms though, we find that the expected utility of entering a first price sealed bid auction is greater than entering an ascending for any risk averse bidder suggesting that we are seeing "overentry" into the ascending auctions.

3 - A Model of Multi-Period Forward and Reverse Auctions

Kendra Taylor, Senior Consultant, Booz Allen Hamilton, Suite 2100, 230 Peachtree Street NW, Atlanta, GA, 30303, United States, taylor_kendra@bah.com

We compare the expected value to suppliers and buyers when each participates in a sequential auction as bidder, auction-initiator, or alternates between both roles in a new auction design simulating seasonal markets. We find the alternating design is a viable compromise in disagreements on holding a forward or reverse auction.

4 - Combinatorial Auctioneering

Charles A. Holt, Professor, University of Virginia, Department of Economics, Charlottesville, VA, United States, cah2k@cms.mail.virginia.edu, Paul J. Healy, Christoph Brunner, Jacob Goeree

This paper reports laboratory tests of combinatorial auction formats that have been proposed as alternatives to the FCC's simultaneous multi-round procedure. Package bidding formats generally improve performance. In environments where collusion is likely, it is effectively broken by a two-stage Anglo-Dutch auction (a combinatorial clock followed by sealed bids).

■ TC16

Room 316

New Directions in Dynamic Pricing and Revenue Management

Cluster: Dynamic Pricing and Forecasting

Invited Session

Chair: Ozge Sahin, University of Michigan, Ross School of Business, os2003@columbia.edu

1 - Optimal Purchasing Behavior of Strategic Customers Facing Dynamic Pricing Policies

Soulaymane Kachani, Professor, Columbia University (IEOR Department), S.W. Mudd Building Room 334, New York, NY, United States, kachani@ieor.columbia.edu, Attakrit Asvanunt

We consider a strategic customer who wishes to purchase a plane ticket when the airline prices according to the model of Gallego and van Ryzin (Management Science, 1994), or the airline uses the EMSR method for seat allocation. We establish that the optimal purchasing policy is a threshold price policy for both pricing rules, and a threshold time policy for the first pricing rule. We perform numerical analyses to study the effectiveness of the policy under forecasting errors and mispricing.

2 - Finite Horizon Dynamic Pricing of Perishable Assets under Competition

Ming Hu, Columbia University, 500 West 120th Street, IEOR Department, New York, NY, 10027, United States, mh2252@columbia.edu, Guillermo Gallego

We consider a finite-horizon, multi-player, non-cooperative, continuous-time, stochastic dynamic game of pricing perishable inventories and provide sufficient conditions for the existence and uniqueness of open-loop Nash equilibria of the corresponding differential game. We show that fixed-pricing heuristics suggested by the open-loop Nash equilibria work well in the stochastic game in the sense that such equilibria are asymptotically (relative) epsilon Nash equilibria for the stochastic game.

3 - Revenue Management with Costly Price Adjustments

Sabri Celik, Columbia University, sc2190@columbia.edu, Alp Muharremoglu, Sergei Savin

We study the problem of dynamic pricing of inventories in the presence of price adjustment costs. In many retail settings, changing the price involves extra costs, be it through the re-labeling of inventories or advertising the price change to customers. We formulate the problem as a finite horizon dynamic program and describe structural properties of the optimal policy. We introduce several fluid-based heuristics and establish their asymptotic optimality.

■ TC17

Room 317

Simulation-Optimization

Sponsor: Simulation

Sponsored Session

Chair: Raghu Pasupathy, Assistant Professor, Virginia Tech, 221 Durham Hall, Blacksburg, VA, 24061, United States, pasupath@vt.edu

1 - Using Non-I.I.D. Sampling Methods in Stochastic Optimization

Tito Homem-de-Mello, Associate Professor, Industrial Engineering & Management Sciences, Northwestern University, Evanston, IL, 60208, United States, tito@northwestern.edu

We discuss the use of non-i.i.d. sampling methods when solving stochastic optimization problems by sample average approximations. Our focus is on rates of convergence of approximating optimal solutions and optimal values to their true counterparts. We show that, in some cases, these methods methods can be much more efficient than standard Monte Carlo. We also discuss some techniques to implement these methods in practice. We present numerical results illustrating the discussed ideas.

2 - Monte Carlo Methods for Assessing Solution Quality in Stochastic Programs

David Morton, Associate Professor, The University of Texas at Austin, Graduate Program in Operations Research, 1 University Station, C2200, Austin, TX, 78712-0292, United States, morton@mail.utexas.edu, Amit Partani, Guzin Bayraksan

Determining whether a solution is of high quality (optimal or near optimal) is a fundamental question in optimization theory and algorithms. We discuss Monte Carlo sampling-based procedures for assessing solution quality in stochastic programs. Here, quality is defined via the optimality gap and our procedures' output is a one-sided confidence interval on this gap.

3 - On the Implementation of Interior Point Decomposition Algorithms for TS Stochastic Conic Programs

Sanjay Mehrotra, Professor, Northwestern University, 2145 Sheridan Road, Evanston, IL, 60601, mehrotra@iems.northwestern.edu, Gokhan Ozevin

We present a practical primal interior decomposition algorithm for two-stage stochastic programming problems. This uses a sampling based preprocessing heuristic to generate a starting point; a starting barrier parameter; a method for step-length calculation without performing line searches; and a method for adaptive addition of scenarios over the course of the algorithm while generating scenarios using quasi-Monte-Carlo sampling. Results show significant savings for certain class of problems.

4 - Stochastic Gradient Estimation Using a Single Design Point

Jamie Wieland, Purdue University, School of Industrial Engineering, 315 N. Grant Street, West Lafayette, IN, 47907-2023, United States, jwieland@purdue.edu, Bruce Schmeiser

Using concepts arising in control variates, we propose estimating gradients using Monte Carlo data from a single design point. Our goal is to create a statistically efficient estimator that is easy to implement, with no analysis within the simulation oracle and no unknown algorithm parameters. We compare an early version to finite differences and simultaneous perturbation.

■ TC18

Room 318

Dynamic Social Network Models in Counterterrorism

Cluster: Counter Terrorism and OR

Invited Session

Chair: David Banks, Professor, Duke University, ISDS Box 90251, Duke University, Durham, NC, 27708, United States, banks@stat.duke.edu

1 - Latent Space Mixture Models of Dynamic Graphs and Networks

Edo Airoldi, Carnegie Mellon University, School of Computer Science, 5000 Forbes Avenue, Pittsburgh, PA, 15213, United States, eairoldi+@cs.cmu.edu, Eric Xing

Statistical models often inform the analysis of networks of scientific interest (Fienberg et al. 1985; Wasserman & Pattison 1996; Watts & Strogatz 1998; Kossinets & Watts 2006). We introduce a hierarchical model of "network evolution" that combines mixed membership (Airoldi et al. 2006) and a latent space (Hoff et al. 2002) for learning dynamic connectivity patterns among nodes. We develop a fast, approximate posterior inference algorithm, and analyze Enron's email communication network.

2 - Modeling Terrorist Groups as Dynamic Networks

Kathleen Carley, Professor, Carnegie Mellon University, CASOS, Carnegie Mellon University, Pittsburgh, PA, 15213, United States, kathleen.carley@cs.cmu.edu

Terrorist networks are often difficult to reason about, manage and destabilize. In part, this is because they are a complex adaptive system. And in part, it is because the data available is often problematic. Multi-agent simulations in which the actors operate within a socio-cultural space defined by a series of interlinked networks can be used to reason about terrorist networks and evaluate possible courses of action. Such models are often referred to as dynamic network analysis models.

3 - Testing and Validating Agent Models for Networks

David Banks, Professor, Duke University, ISDS Box 90251, Duke University, Durham, NC, 27708, United States, banks@stat.duke.edu

Dynamic network models are important for genetics, social science, disease tracking, and counterterrorism. The traditional school in this area has emphasized formal mathematical models, but many researchers find agent-based models to be more useful. The main problem for both approaches is goodness-of-fit testing. This talk discusses the goodness-of-fit issue and describes solution strategies.

■ TC19

Room 319

Oligopoly Expansion, Market Model with Network, Conjectured Price-Response, Pumping Scheduling

Sponsor: Energy, Natural Resources & The Environment

Sponsored Session

Chair: Efraim Centeno, Professor, Universidad Pontificia Comillas, Alberto Aguilera 23, Madrid, 28015, Spain, Efraim.Centeno@iit.icai.upcomillas.es

1 - ESPAM: An Oligopolistic, Generation Expansion Model Which Incorporates Carbon Emissions Trading

Pedro Linares, Professor, Universidad Pontificia Comillas, Alberto Aguilera 23, Madrid, 28015, Spain, Pedro.Linares@iit.icai.upcomillas.es, Luis Lapiedra, Mariano Ventosa, F. Javier Santos

The model combines detailed system operation and the modeling of the economic market equilibrium and a formulation for the resolution of the emissions permit and tradeable green certificates market equilibriums. It is formulated as a LCP which allows solving simultaneously the optimization problem for each firm considering all the markets. It has been implemented in GAMS and applied to the Spanish system.

2 - Optimization Models for Electricity Markets Planning with Network Constraints

Begoña Vitoriano, Professor, Universidad Pontificia Comillas, Alberto Aguilera 23, Madrid, 28015, Spain, BVitoriano@iit.icai.upcomillas.es, Julian Barquin, Felix Fernandez-Menendez

Medium-term planning involves an equilibrium computation. We develop an optimization model taking into account constraints that represent technical constraints and inter-period operation features (water management, start-up and shut-down of thermal units). If network capacity must be considered, several methods can be defined, leading to different equilibria. Three optimization models are presented: market splitting, capacity auctions and a hybrid one. They have been applied to a real-size case.

3 - Cost-Based Conjectured Price-Response Determination in Electricity Markets

Efraim Centeno, Professor, Universidad Pontificia Comillas, Alberto Aguilera 23, Madrid, 28015, Spain, Efraim.Centeno@iit.icai.upcomillas.es, Julian Barquin, Juan J. Sanchez, Ignacio Hoyos

Electricity markets behavior in a medium-term scope is often represented using a conjectural-variation focusing. In this framework, agents response is represented with fixed parameters that can be obtained from past market analysis. Different approaches can be used to determine these values under these conditions, but when market structure changes, other methods must be used to establish the future value of conjectured variations. Some alternatives will be presented and discussed.

4 - Pumping Scheduling in Object Oriented Simulation of Hydroelectric Power Systems

Jesús M. Latorre, Universidad Pontificia Comillas, Alberto Aguilera 23, Madrid, 28015, Spain, Jesus.Latorre@iit.icai.upcomillas.es, Andres Ramos, Santiago Cerisola

The simulation model, based on the OOP paradigm, uses a fixed time step of one day, and adapts the management decisions obtained from a longer scope model to a daily use. It can model generating and pumping units and canals. We propose a three pass algorithm in order to reduce spillages to a minimum. This algorithm determines the hydro production of every reservoir including pumping scheduling decisions, to reach this objective. Numerical results from a real basin from Spain are presented.

■ TC20

Room 320

DA Arcade 3

Sponsor: Decision Analysis Society

Sponsored Session

Chair: Lev Virine, Schlumberger, 600, 322-11 Avenue SW, Calgary, AB, Canada, lvirine@slb.com

1 - A Multi-Criteria Decision Support System for R&D Project Selection and Portfolio Optimization

Susan Palocsay, Professor, James Madison University, Computer Information Systems & Management Science Department, Harrisonburg, VA, 22807, United States, palocssw@jmu.edu, Anne Henriksen

To determine the optimal R&D portfolio, decision makers must consider positive interdependencies between projects such as the capability to share resources, research results, intellectual capital or investment costs. We have developed Popt, an Excel Solver/VBA DSS that uses goal programming to obtain a portfolio with the optimal combination of project merit and value and maximum portfolio synergy while meeting cost and strategy objectives.

2 - Decision Analysis in the Oil and Gas Industry: From Exploration to Development and Production

Lev Virine, Schlumberger, 600, 322-11 Avenue SW, Calgary, AB, Canada, lvirine@slb.com

Strategic decision-making in the oil and gas industry involves a comprehensive analysis of uncertainties starting from exploration and propagated to field development and production. The decision and risk analysis workflow implemented by Schlumberger includes analysis of uncertainties at various stages of geophysical and geological exploration, reservoir simulation using multiple scenarios, and decision analysis based on economic evaluation of reserves with uncertainties.

3 - Selecting Operational Improvements for European Air Traffic Management

Yael Grushka-Cockayne, London Business School, Regents Park, London, UK, NW106DP, United Kingdom, ygrushka.phd2003@london.edu, Zeger Degraeve, Bert De Reyck

We develop a multi-stakeholder, multi-objective decision model for Eurocontrol, the European Air Traffic Management organization, in efforts to cope with forecasted increase in traffic, while maintaining safety and protecting the environment. We frame this strategic multicriteria problem and develop a method for eliciting stakeholders' preferences across a variety of criteria, combining qualitative and quantitative assessments, to determine a recommended set of system enhancements.

4 - Risk Neutrality and Ordered Vector Spaces

Matthew Sobel, Professor, Department of Operations, Case Weatherhead School of Management, 10900 Euclid Avenue, Cleveland, OH, 44106-7235, United States, Matthew.Sobel@case.edu, James Alexander

A result clarifies when preferences over time and risk correspond to discounting without risk neutrality. Axioms on weak ordering, continuity, non-triviality, and decomposition imply that a utility function f[u()] has f linear if and only if the

converse of decomposition is valid. Since the axioms imply the existence of discount factors and the linearity of an intra-period utility function, preferences support discounting without risk neutrality only if the converse of decomposition is false.

■ TC21

Room 321

Panel Discussion: NSF

Sponsor: Decision Analysis Society
Sponsored Session

Chair: Ali Abbas, Assistant Professor, College of Engineering, University of Illinois-Urbana Champaign, 104 S. Mathews Avenue, Urbana, IL, 61822, United States, aliabbas@uiuc.edu

1 - Panel Discussion: NSF

Moderator: Ali Abbas, Assistant Professor, College of Engineering, University of Illinois-Urbana Champaign, 104 S. Mathews Avenue, Urbana, IL, 61822, United States, aliabbas@uiuc.edu, Panelists: Jacqueline Meszaros, Stephen Nash, Matthew Realff, George Hazelrigg

This session includes presentations by several program directors at NSF on visions for decision analysis related funding. Matthew Realff will talk about the Service Enterprise Engineering program, Jacqueline Meszaros about Decision Risk and Management Science, Stephen Nash on the Operations Research program and George Hazelrigg on Decision-Based Design. Talks will be followed by Q&A.

■ TC22

Room 322

Dynamic Decision Networks Assisting Future Combat Systems

Sponsor: Military Applications
Sponsored Session

Chair: Charles Sulewski, United States Military Academy, Thayer Hall, West Point, NY, 10996, United States, chuck.sulewski@us.army.mil

1 - Modeling Decisions in a New and Complex Environment

Todd Retchless, United States Military Academy, West Point, NY, 10996, United States, todd.retchless@usma.edu, Jerry Kobylski, Dan Maxwell

Battlefield commanders have a plethora of information available that comes from many sources. Given this overabundance of information, the commander's dilemma will be to find optimal decisions throughout mission duration. We will discuss our current work with Dynamic Decision Networks (DDNs). DDNs are very efficient decision making tools for complex problems and thus are a good alternative for military decision makers. We will present a short background of DDNs and the organization of our research. We will also highlight the value model that we have used in all of our models.

2 - To Do or Not To Do - That is the Decision to be Modeled

Kerry Moores, Assistant Professor, United States Military Academy, 646 Swift Road, Thayer Hall, West Point, NY, 10996, United States, kerry.moores@usma.edu, Heather Stevenson, Jong Chung

We will present several Dynamic Decision Networks (DDNs). DDNS are ideal for decision makers faced with multiple uncertain variables, conflicting objectives, and many opportunities to collect information. Our DDNs model routine decisions that will be made by leaders who will operate FCS platforms to include the Infantry Carrier Vehicle and the non line of sight (NLOS) weapon system, and who will maintain equipment under the Future Warrior concept. All of the developed models are scenario driven and are not based on any classified information pertaining to the new platforms.

3 - A Crystal Box Process Used to Validate Dynamic Decision Networks: How Agent-Based Simulations Help.

Charles Sulewski, United States Military Academy, Thayer Hall, West Point, NY, 10996, United States, chuck.sulewski@us.army.mil, Jerry Kobylski

A new decision tool called Dynamic Decision Networks (DDNs) can help future battlefield leaders make good decisions given information overload. DDNs provide good approximations to Dynamic Programming for simple decisions. The Crystal Box Process invites other disciplines to examine the DDN. This presentation will show a DDN model that was first constructed by domain experts, and then how an agent-based simulation provided insight to simplify the DDN in support of the Future Combat Systems.

4 - Modeling Dynamic Information Flow and Processing from Sensors to Commanders

Darryl Ahner, US Army, PO Box 8695, Monterey, CA, 93943, United States, darryl.ahner@us.army.mil

The Dynamic Model of Situated Cognition is a cognition model that puts the complex human-machine interaction on the battlefield into a conceptual framework. This framework lacks a mathematical rigor that models the processing and feedback processes in a capacity constrained system. This research develops a dynamic mathematical model and solution approach for representing dynamic information flow and processing from sensors to commanders within this Dynamic Model of Situated Cognition framework.

■ TC23

Room 323

Non-U.S. Perspectives and Cultural Issues in Services Offshoring

Cluster: Global Services Sourcing
Invited Session

Chair: Richard Metters, Associate Professor, Emory University, 1300 Clifton Road, Atlanta, GA, 30322, United States, Richard_Metters@bus.emory.edu

1 - An Uncertain Future: Offshore Outsourcing from the Manager's Perspective

Christopher Clott, Associate Professor, Graham School of Management, Saint Xavier University, 3700 W. 103rd Street, Chicago, IL, United States, clott@sxu.edu

The purpose of this study is to examine through interviews of project managers of firms in the U.S. the degree of environmental scanning of offshore outsourcing and its effects upon the internal workings of the firm. It is suggested that project managers entrusted with implementing offshoring arrangements to achieve short term cost reduction goals are unaware that it will involve potential far reaching long term effects including changing attitudes and behaviors in a disaggregated workplace.

2 - Towards a Para-Economic Model of Global Outsourcing of White Collar Services

Nir Kshetri, Assistant Professor, University of North Carolina at Greensboro, Bryan School of Business, Greensboro, NC, United States, nbkshetr@uncg.edu

Based on studies of BPO firms in India, this paper integrates theories from multiple sources to propose a "para-economic" model of global outsourcing of white-collar services. Conceptual frames dealing with international trade in services as well as frameworks for e-commerce based on business process outsourcing (BPO) are integrated in this paper.

3 - Who's On the Line? Indian Call Center Agents Pose as Americans for U.S.-Outsourced Firms

Winifred Poster, poster@uiuc.edu

Indian agents in international call centers often pose as Americans, sometimes deceptively, while talking on the phone to U.S. customers. Through ethnographic case studies of three Indian call centers, and interviews with 80 call center agents, CEOs, and industry officials, I ask why this "national identity management" has arisen as an organizational strategy, and what the implications are for the actors involved in terms of varying benefits and costs.

4 - A Case Study of National Culture and Services Offshoring

Richard Metters, Associate Professor, Emory University, 1300 Clifton Road, Atlanta, GA, 30322, United States, Richard_Metters@bus.emory.edu

National culture is frequently cited by both academics and practitioners as being the most important concern in pursuing offshore operations. Here, a particular U.S. service process offshored to Barbados and the Dominican Republic is reviewed. The research question centers on how national culture affects operational implementation.

■ TC24

Room 324

Game Theory I

Contributed Session

Chair: Alper Murat, Assistant Professor, Wayne State University, 4815 Fourth Street, Detroit, MI, 48202, United States, alper@eng.wayne.edu

1 - Distributed Decision-Making: A Model for Hierarchical Decision Networks

Christian Wernz, PhD Candidate, University of Massachusetts-Amherst, 160 Govenors Drive, Amherst, 01003, United States, cwernz@ecs.umass.edu, Abhijit Deshmukh

This paper studies a specific case of hierarchical interaction with two decision-making agents, which are interdependent and affect each other by their actions. We model the multi-level decision dynamics, develop a tool for graphical visualization based on Multi-Agent Influence Diagrams and analyze the agent interaction using game theory. We motivate our model and analysis with a manufacturing management application.

2 - Price Cap Regulation and Investment Decisions in Oligopoly

Nicos Savva, Research Associate, University of Cambridge, CERF, Judge Business School, Trumpigton Road, Cambridge, CB2 1AG, United Kingdom, n.savva@jbs.cam.ac.uk

We study the effect of price regulation on investment decisions in the context of a Real Options model of investment under uncertainty. We allow for oligopolistic competition and time-to-build. For a range of parameters we find three locally stationary investment strategies. We explain this result and we use our model to draw useful conclusions for effective and robust regulation of such industries.

3 - Financial Networks and Transportation Network Equilibria

Zugang Liu, University of Massachusetts- Amherst, Isenberg School of Management, Amherst, MA, 01003, United States, zugang@acad.umass.edu, Anna Nagurney

We consider two classes of network problems: financial networks and transportation network equilibrium problems. We prove that the former problem can be reformulated as the latter through a properly constructed supernetwork. This equivalence allows one to transfer the methodological tools for transportation networks to the financial network domain. This connection provides a novel interpretation of the financial network equilibrium conditions in terms of path flows and a direct existence result.

4 - Learning to Price Airline Seats Under Competition

Andrew Collins, PhD Student, School of Management, University of Southampton, Highfield, Southampton, SO17 1BJ, United Kingdom, a.j.collins@soton.ac.uk

Game Theory has been applied to pricing models within an economic theory context. These models tend to be simple due to the complexity of solving them (i.e. finding the equilibrium). We use a ëreinforcement learning' model to derive a solution, relying on computing power not mathematical complexity. Using stochastic games we explore how the competing airlines might price their tickets in the days before departure. We intend to show the usefulness of this approach within a practical context.

5 - A New Reservation Contract For Capacity Management In High-Tech Industries

Alper Murat, Assistant Professor, Wayne State University, 4815 4th Street, Detroit, MI, 48202, United States, amurat@wayne.edu, Ibrahim Dogan, Ratna Babu Chinnam

In this paper we analyze a capacity reservation problem in high-tech environments with a manufacturer and a retailer. Two recent studies (Jin and Wu 2006, Erkoc and Wu 2005) proposed deductible reservation contracts that seek a coordinated solution. However, their solutions are not stable when manufacturer is the leader. We instead consider a Stackelberg game under a modified reservation contract and show that there is a better coordinating solution for the manufacturer.

■ TC25

Room 325

Joint Session OR Practice/CPMS: Edelman - Reprise of 2006 Edelman Award Finalists (continued)

Cluster: OR Practice, The Practice Section of INFORMS

Invited Session

Chair: R. John Milne, IBM, 43 Skunk Hollow Road, Jericho, VT, 05465, United States, jmilne@us.ibm.com

1 - Supporting Travelocity's Transition to Travel Retailer and Economic Turn-Around

Barry Smith, Sabre Holdings, 3150 Sabre Drive, Southlake, TX, 76092, United States, Barry.Smith@sabre-holdings.com

In 2002, Travelocity experienced revenue and share loss due to competition and a changing business environment. Travelocity and Sabre collaborated to improve performance through modeling of customer behavior, supplier agreements and product pricing. Since then, these models have contributed over $54 million to Travelocity earnings, at a current rate of $43 million per year.

2 - Quantitative Risk Assessment of Animal Antibiotics at the Animal Health Institute

Tony Cox, President, Cox Associates, 503 Franklin Street, Denver, CO, 80218, United States, tcoxdenver@aol.com

The Animal Health Institute (AHI) recently applied OR to quantify impacts on human health from continued use of animal antibiotics. Unexpectedly, quantitative models showed miniscule risks to human health, but significant potential health benefits from reduced animal and human illnesses. These new models and methods let industry and regulatory decision-makers quantify and compare human health impacts of alternative animal antibiotic uses, to better protect human and animal health.

■ TC26

Room 326

Joint Session DM Invited/DM Sponsored: Applications of Automated Learning to Customer Relationship Management

Cluster: Data Mining and Automated Learning, Data Mining

Invited Session

Chair: Baohong Sun, Asscciate Professor, Carnegie Mellon University, 5000 Forbes Avenue, Pittsburgh, PA, 15213, United States, bsun@andrew.cmu.edu

1 - Empirical Investigation of Service Allocation Decisions with Out-Sourced Centers

Baohong Sun, Asscciate Professor, Carnegie Mellon University, 5000 Forbes Avenue, Pittsburgh, PA, 15213, United States, bsun@andrew.cmu.edu, Shibo Li

Firms view call centers as preferred channels to manage customer relationship (CRM). We treat service duration as a measurement of operating cost and a determinant of customer retention. We propose a framework that allows the firm to learn about heterogeneous customers and make optimal allocation decisions that best match customer preference for service duration. Applying the framework to a call history data, we demonstrate that marketing effectiveness can be improved in a cost efficient way.

2 - Strategies for Learning about Customers in CRM

Anand Bodapati, Assistant Professor of Marketing, The Anderson School, UCLA, 110 Westwood Plaza, B520, Los Angeles, CA, 90095, United States, bodapati@ucla.edu

Learning about customers is central to CRM. In very many situations, the ability of the firm to learn is low and learning rates are generally slow. We consider classes of problems where learning can be super-efficient in the sense that learning rates exceed the usually expected Cramer-Rao bounds. We discuss managerial contexts in which such classes of problems are encountered. Furthermore, we present optimal design strategies that accelerate learning in such contexts.

3 - Ant Swarm Reinforcement Learning for Formulating Online Promotion Strategies

P.K. Kannan, Harvey Sanders Associate Professor of Marketing, Director, Center for Excellence in Service, Robert H. Smith School of Business, 3461 Van Munching Hall, University of Maryland, College Park, MD, 20742, United States, PKannan@rhsmith.umd.edu, Tuck Siong Chung

Online environments are characterized by dynamic preferences and response patterns that have to be learned and tracked over time in order to formulate appropriate strategies. We propose a reinforcement learning approach based on the model of ant swarms in the online promotion context and examine the tension between "exploring and "exploiting?

■ TC27

Room 327

Joint Session QSR/ Health Applications: Quality and Statistical Decision-Making in Healthcare Applications III

Sponsor: Quality, Statistics and Reliability, Health Applications Section

Sponsored Session

Chair: Jing Li, Research Assistant, Department of Industrial and Operations Engineering, University of Michigan, 1205 Beal Avenue, Ann Arbor, MI, 48109, United States, jinglz@engin.umich.edu

Co-Chair: Julie Simmons Ivy, Assistant Professor, University of Michigan, 701 Tappan Street, Ann Arbor, MI, 48109, United States, jsimmons@bus.umich.edu

Co-Chair: Nicoleta Serban, Assistant Professor, ISyE, Georgia Institute of Technology, 755 Ferst Drive NE, Atlanta, GA, 30332, nserban@isye.gatech.edu

1 - Hierarchical State Space Model for Short Microarray Time Course Experiments

Ming Yuan, myuan@isye.gatech.edu

Four common tasks in microarray time course experiments are hypothesis testing, pattern recognition, trajectory formation and network/pathway reconstruction. In this work, we propose a hierarchical model integrated with Hidden Markov Model (HMM) structure and auto-regression (AR) to model the temporal gene expression profile on both expression level and state level so that all these tasks can be addressed in a unified framework. We illustrate the method on a vaccacine study.

2 - Performance of the Minimum Data Set (MDS-2.0) to Predict Risk of Falling in Nursing Home Residents

Jenya Antonova, University of Wisconsin-Madison, 1175 WARF Building, 610 Walnut Street, Madison, WI, 53726, United States, Jenya_Antonova@chsra.wisc.edu, David Zimmerman

Falling is a common widespread problem that can cause severe injury in the elderly. We developed and tested a model using data from the Minimum Data Set to identify factors that predict the probability of falling in nursing home residents. Results are reported.

3 - Improving Emergency Department Operations Using a Simulation-Based Decision Support System

David Sinreich, Technion Israel Institute of Technology, Faculty of Industrial Engineering, Haifa, 32000, Israel, sinreich@ie.technion.ac.il, Ola Jabali

This study combines a dedicated simulation tool with an optimization model to improve ED patient flow. First the ED bottleneck is identified using the ED simulation, next the optimization model develops an efficient schedule. Since analytical models can't capture all the intricate interrelations between the ED components, the simulation tool is used to analyze the suggested schedule and asses the ED's operational parameters. This process is repeated until certain operational goals are reached.

■ TC28

Room 328

Sensor Systems I

Sponsor: Quality, Statistics and Reliability

Sponsored Session

Chair: Yu Ding, Assistant Professor, Texas A&M University, College Station, TX, 77843, United States, yuding@iemail.tamu.edu

1 - Wireless Vibration Sensor Array for Monitoring Chemical Mechanical Planarization (CMP) Process

Satish Bukkapatnam, Associate Professor, School of Industrial Engineering & Management, Oklahoma State University, 322 EN, Stillwater, OK, 74078, United States, bsatish@okstate.edu, Ranga Komanduri, Soundar R. T. Kumara

The semiconductor industry uses CMP to realize smooth (Ra ~1nm) and flat surfaces for VLSI device fabrication. Complex dynamics underlying the CMP process is a major impediment to effective quality monitoring. It is shown that the signal features, extracted from a novel wireless vibration sensor array, that capture the underlying nonlinear stochastic dynamics provide ccc 10% improvement in the tracking of CMP material removal rates compared to the use of conventional features.

2 - Dynamic Voltage Scaling for Power-Limited Systems with Hard and Soft Real-Time Tasks

Christos Cassandras, Professor, Boston University, 15 St. Mary's Street, Brookline, MA, 02446, United States, cgc@bu.edu, Shixin Zhuang

Many applications require scheduling of hard and soft real-time tasks on systems with a finite energy budget. We study voltage scaling as a dynamic optimization problem whose objective is to minimize energy consumption by dynamically allocating resources subject to real-time constraints. An efficient algorithm is developed through sample path analysis requiring no nonlinear programming problem solver. Simulation illustrates the performance improvements under different policies.

3 - Robust Calibration for Localization in Wireless Sensor Networks

Jung Jin Cho, Texas A&M University, Industrial and Systems Engineering, TAMU3131, College Station, TX, United States, jjcho@tamu.edu, Yu Ding, Yong Chen, Jiong Tang

This paper presents a robust estimation procedure for determining between-node distances in a wireless sensor network, known as the calibration problem in sensor localization. The problem is modeled by a structured linear regression. We suggest using a robust regression estimator but need to revise it to account for the structural information. We will demonstrate that the sensor cluster pattern in a network determines the structure and will thus affect the system robustness for calibration.

4 - Features Selection via the Minimization of Misclassification Probabilities of Discriminant Functions

Rene Villalobos, Associate Professor, Arizona State University, Department of Industrial Engineering, Tempe, AZ, 85287, United States, rene.villalobos@asu.edu, Hugo Garcia

In this presentation we discuss a novel approach for feature and sensor selection. This approach uses a normal approximation of the exact misclassification probabilities from linear and quadratic discriminant functions as a way to identify the subset of features/sensors that render the lowest misclassification rate. Our approach differs from other methods in two ways: the selection is based on the minimization of the probability of error and it is designed to optimize these particular functions.

■ TC29

Room 329

Operations Research to Inform Healthcare Policymakers

Cluster: Joint Cluster Healthcare/ HAS: Healthcare Engineering

Invited Session

Chair: Daniel Faissol, PhD Student, Georgia Institute of Technology, School of ISyE, Atlanta, GA, 30332, United States, dfaissol@isye.gatech.edu

Co-Chair: Julie Swann, Assistant Professor, Georgia Institute of Technology, Industrial and Systems Engineering, Atlanta, GA, 30332, United States, julie.swann@isye.gatech.edu

1 - Optimal Mix of Screening and Contact Tracing for Endemic Diseases (Submitted for the 2006 Pierskalla Award)

Margaret Brandeau, Professor, Stanford University, Management Science and Engineering, Stanford, CA, United States, brandeau@stanford.edu, Benjamin Armbruster

Screening and contact tracing are two common means of controlling infectious diseases. We present a mathematical model that determines the cheapest mix of screening and contact tracing necessary to achieve a desired endemic disease prevalence or to identify a specified number of cases. We present theoretical results and discuss their practical implications.

2 - A Bernoulli Process Model of HIV Transmission in MSM (Submitted for the 2006 Pierskalla Award)

Daniel Faissol, PhD Student, Georgia Institute of Technology, School of ISyE, Atlanta, GA, 30332, United States, dfaissol@isye.gatech.edu, Julie Swann, Paul Griffin, Thomas Gift

Bathhouses and sex clubs were frequently implicated during the original HIV epidemic. Their role in HIV transmission is again a cause of concern as HIV incidence is back on the rise. We present an extension of the Bernoulli Process Model of HIV transmission to study the role that bathhouses and sex clubs play in the epidemic. We use data from the 1997 Urban Men's Health Study as parameters for the model and discuss the effects of various policies regarding bathhouses.

3 - "Costs?" of Equity in HIV Prevention
Anke Richter, Associate Professor, DRMI, Naval Postgraduate School, 699 Dyer Road, Building 234, Monterey, CA, 93943, United States, arichter@nps.edu

The debate about equity considerations in HIV prevention models focuses on proportionality. However, equity considerations can be incorporated as a variety of constraints or even as part of the objective function. As constraints they can be compared on the basis of lost infections averted. As parts of the objective function, the debate turns to the goal of a resource allocation. Inherent in this debate are the consequences of errors in the model, especially for the underserved populations.

4 - The Cost and Effectiveness Analysis of a Behavioral HIV Risk Reduction Intervention
Sada Soorapanth, Assistant Professor, San Francisco State University, San Francisco, CA, 94132, sada@sfsu.edu, Stephanie Sansom, Stephen Chick

We assessed the cost and effectiveness of a behavioral HIV intervention in reducing the risk of transmission from HIV-infected persons to their sexual partners using a Monte-Carlo simulation. Data from a Prevention Case Management (PCM) program were applied to changes in risk behaviors (proportion of unprotected sexual contacts and number of sex partners). We explored impact of the duration of partnerships and of behavioral changes on the transmission reduction estimates.

■ TC30

Room 330

Healthcare Resource Allocation

Sponsor: Health Applications Section

Sponsored Session

Chair: Adelina Gnanlet, PhD Candidate, University of North Carolina at Chapel Hill, CB#3490 McColl Building, Kenan-Flagler Business School, Chapel Hill, NC, 27599, United States, adelina@unc.edu

1 - Sequential and Simultaneous Decision Making under Dual Resource Flexibilities
Adelina Gnanlet, PhD Candidate, University of North Carolina at Chapel Hill, CB#3490 McColl Building, Kenan-Flagler Business School, Chapel Hill, NC, 27599, United States, adelina@unc.edu, Wendell Gilland

We model simultaneous and sequential decision making for capacity and staffing decisions in two hospital units. We use four flexibility configurations to model downward substitution of bedspaces (capacity) and cross-training (flexibility) of nursing staff. We use two-stage stochastic programming to minimize costs, and assess the impact of configurations and cost parameters on decision variables and performance.

2 - A Mathematical Model for Advanced Access Scheduling in Healthcare Systems
Ramakrishnan Sundaram, Student, Florida International University, EC 3155, 10555 W. Flagler Street, Miami, FL, 33199, United States, rsund001@fiu.edu, Ronald Giachetti

This research addresses the problem of poor access to healthcare identified by the Institute of Medicine, as a major problem in US healthcare. To address this problem we present a mathematical model for Advanced Access Scheduling in Healthcare Systems. The decision is how many appointments to leave open versus advanced booking. The model considers two important health outcomes of access to care and continuity of care and is analyzed for single physician and multiple physician offices.

3 - Forecasting Outpatient Visits to More Effectively Allocate Clinical Resources
Stephen De Lurgio, Professor, Henry Bloch School of Business, University of Missouri, Kansas City, MO, 64110, United States, delurgios@umkc.edu, Arthur Williams, Brian Denton, Rosa Cabanela, Sandra Bruggeman

A system is developed to forecast outpatient visits for 26 divisions of the Mayo Clinic. Univariate, multivariate, and combining methods are found to perform best for 15.4%, 42.3%, and 42.3% of the divisions respectively. Also discussed are improved personnel schedules using a priori determination of division-specific best methods.

4 - Resource Management Problems in Hospital Emergency Response
Mohsen Jafari, Professor, Rutgers University, Department of Industrial & Systems Engineering, 96 Frelinghuysen Road, CoRE Building, Room 201, Piscataway, NJ, 08854, United States, Jafari@rci.rutgers.edu, Davood Golmohammadi, Kian Seyed

Here we focus on the problem of human resource management for hospital emergency response. Both emergency evacuation and surge capacity are considered. For evacuation, the objective is to maximize the number of patients evacuated within allowable time windows, and minimize the overall evacuation time. For surge capacity, the objective is to maximize the number of patients admitted, while minimizing the response time. We discuss our findings from simulations of real life scenarios. Scheduling alternatives and the corresponding performance measures are also presented.

■ TC31

Room 331

Quantitative and Computational Problems in Finance

Cluster: Financial Engineering and Risk Management

Invited Session

Chair: Shi-Jie Deng, Associate Professor, Georgia Institute of Technology, 765 Ferst Drive, Atlanta, GA, 30332, United States, deng@isye.gatech.edu

1 - On Optimal VWAP and Exponential Liquidation Strategies
Youxun Shen, Quant Strategist, Lehman Brothers, 745 7th Avenue, 2nd Floor, New York, NY, 10019, United States, youxun.shen@lehman.com, Amit Manwani

We focus on optimal liquidation for VWAP and exponential strategies. Despite the nonconvex nature we were able to derive globally optimal solutions. In the special yet important and popular case of a square root market impact function, we prove that at the optimal point, execution risk should equal transaction cost which coincides with commonly held trader intuition. Moreover, our numerical experiments indicate that the exponential efficient frontier dominates the VWAP efficient frontier.

2 - Economics of Herd Behavior: Local Conformity, Global Diversity and Punctuated Equilibrium Effect
Steve Kou, Associate Professor, Industrial Engineering and Operations Research, Columbia University, 312 S.W. Mudd, New York, NY, 10027, United States, sk75@columbia.edu, Nan Chen

In this paper we propose a simple, analytically tractable, stochastic model to incorporate local conformity, global diversity and punctuated equilibrium effect in a rigorous way. In doing so, the model provides a better understanding of the economics of herd behavior by characterazing precise meanings of the above three features. In addition, we discuss differences between the current stochastic model and some popular deterministic approximations.

3 - Option Pricing by Fast Convolution Transform
Shi-Jie Deng, Associate Professor, Georgia Institute of Technology, 765 Ferst Drive, Atlanta, GA, 30332, United States, deng@isye.gatech.edu, Jingfang Huang, Yuanqing LI

Financial option pricing problems often boils down to the computation of the probability density function convoluting with given distributions using N discretized points. We propose a scheme which approximates the probability density function utilizing the Fourier series expansion and sums of the double exponential distributions. A recursive relation is derived for each term which reduces the total amount of computational work from $O(N^2)$ to the asymptotically optimal O(N).

■ TC32

Room 332

Optimizing the Supply Chain

Contributed Session

Chair: Ching-Yu Chen, Rutgers, The State University of New Jersey, 180 University Avenue, Newark, NJ, 07102, United States, amychen0624@yahoo.com

1 - Bounds and Heuristics for Optimal Policy of Serial Supply Chains with Regular and Expedited Shipping
Sean Zhou, The Chinese University of Hong Kong, Shatin, N.T., Hong Kong, zhousean@gmail.com, Xiuli Chao

We consider an N-stage serial inventory system with stationary demand. There are two transportation modes between stages: the regular and expedited shippings. The optimal inventory policy for this system is known to be echelon base-stock policy. To identify the key determinants of the optimal policy, we develop simple newsvendor lower and upper bounds for the optimal control parameters, as well as a simple near optimal heuristic. Extensive numerical results show that the heuristic performs well.

2 - A Multi-Item Newsvendor Problem with Preseason Production and Capacitated Reactive Production
James Flynn, Professor, Cleveland State University, 2121 Euclid Avenue, BU 539, Cleveland, OH, 44115, United States, j.flynn@csuohio.edu, Chia-Shin Chung, Omer Kirca

Not producing during the selling season lead to suboptimal profits. We develop a two-stage, multi-item model for improving production through reactive production, i.e., selling season production employing a firm's internal capacity. Production occurs in an uncapacitated preseason stage and a capacitated reactive

stage. Reactive capacities are pre-allocated to each item in the preseason stage. All demands occur in the reactive stage. Reactive production occurs with full knowledge of demands.

3 - Information Update and Inventory Decsions
Houshang Darabi, Associate Professor, University of Illinois-Chicago, 842 W. Taylor Street, Chicago, IL, 60607, United States, hdarabi@uic.edu, Andreas Schaller, Francesca Schuler, Lusine Baghdasaryan

We consider an inventory system that has a choice of receiving up-to-date information or using old information to make order decisions. Two questions are to be answered: whether to ask for new information and how much to order. Receiving up-to-date information has its own cost but such information could improve the order decisions. We develop a mathematical model that formulates the cost trade-off between update and order decisions. We provide algorithms to find the optimal solution.

4 - Partially Observed Inventory Control with Backlog
Ruixia Shi, Student, University of Texas at Dallas, School of Management, SM30, 2601 N. Floyd Road, Richardson, TX, 75080, United States, rxs048100@utdallas.edu, Suresh Sethi, Metin Cakanyildirim, Alain Bensoussan

In most cases of inventory control, the actual inventory level may not always be observed. Only when the inventory level drops below zero, special effort will be taken to make it be completely known. We study such a problem where the inventory manager decides the order quantity using partial information. All the unmet demand is backordered. We obtain that there exists an optimal policy under partial information if the periodic cost is bounded and the discount factor is sufficiently small.

5 - The Impact of Negative Stock Levels in General Supply Chains
Ching-Yu Chen, Rutgers, The State University of New Jersey, 180 University Avenue, Newark, NJ, 07102, United States, amychen0624@yahoo.com, Yao Zhao

The objective of this research is to exam the role of negative base stock levels in general supply chains with the aim of minimizing total cost subjective to a given service rate. Unsatisfied demands are fully backlogged. We show when negative stock levels can be beneficial and how much the benefits can be.

■ TC33

Room 333

Robustness in Aviation Planning

Sponsor: Aviation Applications
Sponsored Session

Chair: Amy Cohn, Assistant Professor, University of Michigan, 2797 IOE Building, 1205 Beal Avenue, Ann Arbor, MI, 48109, United States, amycohn@umich.edu

1 - Assessing Delay Propagation in Airline Plans
Shervin AhmadBeygi, University of Michigan, 1205 Beal Avenue, Ann Arbor, MI, United States, shervin@umich.edu, Peter Belobaba, Amy Cohn

Airline delays have many causes — air traffic control, mechanical problems, weather. But many delays are also caused by the propagation of earlier delays. A single flight delay can cause several subsequent delays, as future flights await the aircraft, cockpit crew, cabin crew, and connecting passengers. We present an approach for analyzing and comparing the potential propagation of different airline plans.

2 - Airline Schedule Planning in a Dynamic Scheduling Context
Cynthia Barnhart, Professor, Massachusetts Institute of Technology, 77 Massachusetts Avenue, 1-235, Cambridge, MA, United States, cbarnhart@mit.edu, Cynthia Barnhart

Airlines are moving toward a dynamic scheduling paradigm where elements of the original schedule are re-optimized in the booking process as final demand situation evolves. We present models to design an original schedule with a greater degree of flexibility that facilitates future re-optimizations. The goal is to improve schedule robustness toward demand variability. Experiments are conducted using data from a major US airline to demonstrate the effectiveness of our models.

3 - Improving Schedule Design Through A Priori Evaluation of Robustness and Reliability
John-Paul Clarke, Associate Professor, Georgia Institute of Technology, School of Aerospace Engineering, 270 Ferst Drive, Atlanta, GA, 30332, United States, john-paul.clarke@ae.gatech.edu, Terran Melconian

Schedule reliability is a concern for all airlines. However, there are few tools to evaluate schedule robustness and reliability a priori. We describe such a tool and illustrate through various examples how MEANS can be used to evaluate schedule robustness and reliability, and thereby improve schedule design.

4 - Demand Based Robust Aircraft Routing
Sergey Shebalov, Senior Programmer Analyst, United Airlines, 1360 S. Elmhurst, #202, Mount Prospect, IL, 60056, United States, Sergey.Shebalov@united.com, Diego Klabjan

Recently, the problem of adjusting capacities late in the booking process to better match observed passenger demand acquired a lot of attention. We address this problem by developing robust aircraft routes, which maximize the number of aircraft swapping opportunities from crew-compatible fleets. We can interpret our approach as providing robustness with respect to passenger demand.

■ TC34

Room 334

Maritime Transportation and Port Logistics

Sponsor: Transportation Science & Logistics
Sponsored Session

Chair: Anne Goodchild, Assistant Professor, University of Washington, Civil and Environmental Engineering, Box 352700, 121E More Hall, Seattle, WA, 98195-2700, United States, annegood@u.washington.edu

1 - Cooperative Time Window Generation for Containers Delivery/Pick-Up
Hossein Jula, Assistant Professor, Pennsylvania State University-Harrisburg, W-256 Olmsted Building, 777 Harrisburg Pike, Middletown, PA, 17057-4898, United States, hjula@psu.edu, Anastasios Chassiakos, Petros Ioannou

Recently, a few container terminals at the Los Angeles/Long Beach complex port have implemented an appointment window system to manage the flow of trucks in and out of the terminals. In this paper, we propose a structure and develop an algorithm to generate cooperative time windows between container terminals and carrier companies. The appointment system is modeled analytically and an optimization technique is proposed. Simulation experiments are used to evaluate the efficiency of the algorithm.

2 - Simultaneous Berth and Quay Crane Scheduling for Container Ports
Alan Erera, Assistant Professor, Georgia Institute of Technology, 765 Ferst Drive, NW, Atlanta, GA, 30332, United States, alan.erera@isye.gatech.edu, Aykagan Ak

This study concentrates on simultaneously scheduling the most critical resources in a container terminal, berths and quay cranes, since the duration of a vessel occupying a berth directly depends on the number of cranes allocated to the vessel. Using heuristic methods, we attempt to determine berthing positions and berthing times of vessels as well as the assignment of quay cranes to bays of the vessels to minimize total required service time.

3 - Developing Measures of North American Container Ports Productivity: Using DEA and FDH Approaches
Evangelos Kaisar, University of Maryland, 1173 Glen L. Martin Hall, College Park, MD, 20742, United States, kaisar@wam.umd.edu, Ali Haghani, Somchai Pathomsiri

Measuring port productivity is an interesting issue, especially if an automated system across ports is required. Amongst other methods, the efficiency of port production can potentially be analyzed by Data Envelopment Analysis (DEA) or by the Free Disposal Hull (FDH) model. This paper aims to evaluate the efficiency of major North American ports using DEA and FDH models. The results show that the above two techniques lead to different conclusions.

4 - Comparison of Asian and American Terminal Operations
Anne Goodchild, Assistant Professor, University of Washington, Civil and Environmental Engineering, Box 352700, 121E More Hall, Seattle, WA, 98195-2700, United States, annegood@u.washington.edu

We present the results of a study comparing a variety of productivity measures for US and Asian marine terminals. Models are developed for several key metrics and compared to empirical data with surprising results. Through this analysis we challenge some assumptions regarding the reasons for productivity differences at US and Asian marine terminals and suggest some alternative explanations.

■ TC35

Room 335

Auctions and Pricing in Air and Land Transportation

Sponsor: Transportation Science & Logistics

Sponsored Session

Chair: Gultekin Kuyzu, PhD Candidate, ISyE, Georgia Institute of Technology, 765 Ferst Drive NW, Atlanta, GA, 30332, United States, gkuyzu@isye.gatech.edu

1 - Optimal Front-End Fare Discounts in Airline Corporate Contracts

Murat Erkoc, merkoc@miami.edu, Julian Pachon

We propose a nonlinear programming model to design optimal corporate contracts for airlines stipulating front-end discounts for all nets, which are defined by combination of routes, cabin types, and fare classes. The airline's profit is modeled using a multinomial logit function that captures the client's choice behavior in a competitive market. We investigate the impact of price elasticity, demand, and competition on optimal discounting policies.

2 - Pricing in Freight Transportation

Huseyin Topaloglu, Assistant Professor, Cornell University, 223 Rhodes Hall, Ithaca, NY, 14853, United States, huseyin@orie.cornell.edu, Warren B. Powell

We present a model to jointly make the pricing and vehicle allocation decisions for fleet management systems. We obtain stochastic gradients of the objective function with respect to the prices and use this information to search for a good set of prices.

3 - Pricing in Dynamic Vehicle Routing Problems in an Auction Setting

Hani Mahmassani, University of Maryland, 3128 J. H. Kim Building, College Park, MD, 20742, United States, masmah@umd.edu, Patrick Jaillet, Miguel Figliozzi

We formulate a pricing problem in the context of a dynamic vehicle routing environment. We discuss some properties of this problem. In addition, we present and analyze extensive numerical results of carriers bidding in an electronic marketplace.

4 - Bidding Algorithms for Simultaneous Transportation Procurement/Auctions

Gultekin Kuyzu, PhD Candidate, ISyE, Georgia Institute of Technology, 765 Ferst Drive NW, Atlanta, GA, 30332, United States, gkuyzu@isye.gatech.edu, Özlem Ergun, Martin Savelsbergh

We explore bidding strategies for a carrier in multiple simultaneous single-lane auctions. The challenge is that the operating cost of the carrier depends on the synergy between the set of lanes the carrier wins, which is not known until the end of the auction. The emphasis is on modeling the strategic bidding behavior of competitors. We model a problem with the objective of maximizing the carrier's expected profit.

■ TC36

Room 336

Transportation Network Optimization

Sponsor: Transportation Science & Logistics

Sponsored Session

Chair: Elise Miller-Hooks, Associate Professor, University of Maryland, Department of Civil & Environmental Engineering, 1173 Glenn Martin Hall, College Park, MD, 20742, United States, elisemh@umd.edu

1 - A Multi-Carrier, Intermodal (IM) Freight Train-Scheduling Problem

April Kuo, University of Maryland, aprilkuo@umd.edu, Elise Miller-Hooks

We formulate a multi-carrier, IM train-scheduling problem in a network with multiple O-D pairs as an IP with multiple objectives. A technique is proposed based on network optimization theory to determine the timetable for the IM network. This technique will be illustrated on a network representation of a corridor in Europe.

2 - A Common Modeling Framework for Transportation and Production Planning Systems with Congestion

Georgios Kalafatas, Purdue University, 550 Stadium Mall Drive, West Lafayette, IN, United States, gkalafat@purdue.edu, Srinivas Peeta, Reha Uzsoy

The cell transmission model and the material requirements planning are compared. Both have an exact graph structure for propagating flow (vehicles or SKUs) under capacity and congestion constraints. The modeling units (cell or facility) differentiate the spatio-temporal analysis. Common concepts, like the existence of a state variable, are highly indicative of the potential of a common modeling framework for transportation and production planning.

3 - An Online Search and Rescue Algorithm

David Fajardo, Graduate Research Assistant, University of Texas-Austin, Center for Transportation Research, 3208 Red River Street, Suite 200, Austin, TX, 78705, United States, davidf@mail.utexas.edu, S. Travis Waller

We develop an optimal routing strategy for a search and rescue problem with a limited number of units which possess the ability for wireless communication. The location and number of individuals are represented via probability distributions at each node. Problem variants, properties and search heuristics will be discussed.

4 - An Extension of Labeling Techniques for Finding Shortest Path Trees

Athanasios Ziliaskopoulos, Department of Mechanical and Industrial Engineering, University of Thessaly, Volos, 38334, Greece, ziliasko@yahoo.com

Label setting techniques are all based on Dijkstra's approach of always scanning the node with the least label. While this condition is sufficient to guarantee that the solution will be found scanning each node exactly once, it is not necessary. In this paper, we propose less restrictive conditions that allow the scanning of a node that does not have the minimum label, yet still maintaining sufficiency in scanning each node exactly once. Several implementation ideas of the new conditions are discussed. One label setting and one flexible hybrid approach that combines label setting and label correcting properties are implemented. The computational complexity of the hybrid algorithm is shown to be better than that of label correcting algorithms. Moreover, four additional shortest path algorithms—among the fastest reported in the literature—are coded and tested, so that objective comparisons can be made.

■ TC37

Room 337

Data Management for Process and Decision Analysis

Sponsor: Information Systems Society

Sponsored Session

Chair: Ram Gopal, Professor, University of Connecticut, School of Business, Storrs, CT, 06269, United States, ram.gopal@business.uconn.edu

1 - Active Learning for Decision-Making

Maytal Saar-Tsechansky, Assistant Professor, Department of Information, Risk, and Operations Management, McCombs School of Business, University of Texas-Austin, Austin, TX, 78712, United States, maytal@mccombs.utexas.edu, Foster Provost

As businesses strive to cater to the preferences of individual consumers, they often employ predictive models to customize their targeting decisions. However building accurate models to support decisions requires information about consumers' preferences that often is costly to acquire. We develop a new approach for information acquisition that targets decision-making specifically. Empirical evaluations demonstrate that the method significantly improves targeting decisions.

2 - Privacy Protection of Microdata with Individual Identifiers

Steven Thompson, Assistant Professor, University of Richmond, 1 Gateway Drive, Richmond, VA, 23173, United States, sthomps3@richmond.edu, Robert Garfinkel, Ram Gopal

The ability to disseminate individually identifiable microdata is important in areas such as health care and national security to ensure public health and safety. We develop a technique that enables the release of individually identifiable microdata in a manner that maximizes the utility of the released data while providing protection of confidential data. Computational results show that the method is practical and that useful data can be released even when the level of risk in the data is high.

3 - Formulating the Data Flow Perspective for Business Process Management

Xiaoyun Sun, University of Arizona, Eller College of Management, Tucson, AZ, United States, xiaoyun@u.arizona.edu, Jay Nunamaker, J. Leon Zhao, Olivia Sheng

Given a syntactically correct process sequence, errors can still occur during workflow execution due to incorrect data flow specifications. However, there are no formal methodologies are available for systematically discovering data flow errors in a workflow model. In this paper, we provide a data flow perspective for detecting data flow anomalies such as missing data, redundant data, and potential data conflicts.

■ TC38

Room 338

Traffic Management

Contributed Session

Chair: Soyoung Ahn, Portland State University, 1231 NE Martin Luther King Jr. Boulevard, #430, Portland, OR, 97232, United States, sahn@pdx.edu

1 - Better Trip Reliability via Link Pricing and Traffic Management: A Side-Constrained Traffic Assignment

George List, Department Head & Professor, North Carolina State University, Department of Civil, Construction, & Environmental Engineering, 208 Mann, 2501 Stinson Drive, Campus Mail 7908, Raleigh, NC, 27695, United States, gflist@ncsu.edu, Xuesong Zhou

This talk presents a path-based non-additive traffic assignment model to simultaneously examine three essential route choice criteria, namely travel cost, travel time and travel time reliability. A practically useful traffic assignment model with side constraints is introduced to achieve multiple traffic management goals through link pricing and network design strategies.

2 - Complementarity Approach to Real Life Traffic Equilibrium

Shahab Toobaie, Planning and Analysis Principal, Amtrak, 60 Massachusetts Avenue NE, 4E327, Washington, DC, 20002, United States, toobais@amtrak.com, Hedayat Aashtiani

We have considered a complementarity formulation to solve a large-scale static traffic equilibrium. A real-life network of 7157 O D pairs and 1516 links has been formulated as a nonlinear complementarity problem and has been solved via decomposition and linearization techniques. The solution of the approach has been compared to that of the conventional Bechman's formulation. The complementarity formulation has also been extended to solve the network with multi-variate travel-time cost functions.

3 - Computational Experience in Solving Dynamic Traffic Assignment Problem

Dung-Ying Lin, Graduate Student, University of Texas at Austin, 1 University Station C1761, Austin, TX, 78705, United States, dylin@mail.utexas.edu, S. Travis Waller, Ampol Karoonsoontawong

Solving Dynamic traffic assignment (DTA) problem efficiently is one of the key challenges in the deployment of DTA on real world networks. We propose an analytical approach to address this issue and obtain computationally tractable solutions. Numerical experiments are performed and some insights are presented.

4 - Estimating Link Performance Function Parameters in Traffic Assignment Models

Jon Fricker, Professor of Civil Engineering, Purdue University, 550 Stadium Mall Drive, West Lafayette, IN, 47907-2051, United States, fricker@purdue.edu, Wolfgang Brueggemann

The traffic assignment step of the standard 4-step travel demand model normally uses the FHWA congestion function, with parameters a=0.15 and b=4.0. However, not all link types should have congestion functions with the same shape. This paper describes how the best set of parameter values for each road class can be estimated. The complex and sensitive nature of the objective function, and the solution methods that were tried before a satisfactory method was found, are described in the paper.

5 - How Merging and Diverging Traffic Impact Freeway Traffic Oscillations

Soyoung Ahn, Portland State University, 1231 NE Martin Luther King Jr. Boulevard, #430, Portland, OR, 97232, United States, sahn@pdx.edu, Michael Cassidy, Jorge Laval

Traffic oscillations are stop-and-go driving motions that arise in queued traffic. We present a theory whereby merging traffic from a fully queued on-ramp reduces oscillation amplitudes. An analogous theory is offered for describing the effects of diverging traffic near off-ramps. We furnish empirical evidence in support of the proposed theory.

■ TC39

Ballroom B

Great Unsolved Problems in OR - V: Paper Presentation and Panel

Cluster: Great Unsolved Problems in OR

Invited Session

Chair: Saul I. Gass, Professor, University of Maryland, Robert H. Smith School of Business, College Park, MD, 20742, United States, sgass@rhsmith.umd.edu

1 - Panel: Resolution of Great Unsolved Problems in OR

Moderator; Saul I. Gass, Professor, University of Maryland, Robert H. Smith School of Business, College Park, MD, 20742, United States, sgass@rhsmith.umd.edu, Panelists: Harvey Greenberg, George Nemhauser, Heiner Müller-Merbach, Arjang Assad

This session will bring together some of the speakers in the previous Great Unsolved Problems in OR (GUPOR) sessions. Issues raised by the GUPORS speakers will be open for further discussion by the panelists and the audience.

■ TC40

Room 401

Facilities Planning & Design

Contributed Session

Chair: Raghavendran Sivaraman, Doctoral Student, Massachusetts Institute of Technology, Operations Research Center, 77 Massachusetts Avenue, Cambridge, MA, 02139, United States, rags@mit.edu

1 - A GIS-Based Multi-Agent Simulation Framework for Facility Network Evaluation

Ming Xie, Staff R&D Engineer, IBM China Research Laboratory, Building 19 Zhongguancun Software Park, Beijing, BJ, China, xieming@cn.ibm.com, Xinxin Bai, Wenjun Yin, Jin Dong

Facility network evaluation is a key problem in network optimization. A direct way to solve this problem is to adopt multi-agent simulation. By combining Geographical Information System (GIS), we identify key aspects of customer behavior when customers are interacting with facilities in a real geographical environment, and build corresponding behavior models. Then we introduce a GIS-based multi-agent simulation framework and build an implementation software system.

2 - Retail Store Layout Design with Stochastic Product Demand

Ahmet Botsali, PhD Student, Department of Industrial and Systems Engineering, Texas A&M University, College Station, TX, 77840, United States, reha@neo.tamu.edu, Georgia-Ann Klutke, Brett Peters

In this study, we analyze retail store layout design problem. We first compare two well-known layout types, aisle-based and serpentine layout designs. Later, we focus on serpentine layout design and derive analytical expressions for expected customer travel distance and impulse purchase revenue. Our results show that customer travel distance and impulse purchase revenue are highly influenced by number of shortcuts and product location strategies under different product demand settings.

3 - Capacity Expansion in Hybrid Telecommunication Networks

Raghavendran Sivaraman, Doctoral Student, Massachusetts Institute of Technology, Operations Research Center, 77 Massachusetts Avenue, Cambridge, MA, 02139, United States, rags@mit.edu, Thomas Magnanti

Most current long-distance telecommunication networks are hybrids between traditional Time Division Multiplexing (TDM) and more recent VoIP technologies. We consider computing an optimal capacity expansion plan in the TDM sub-network of a hybrid network. We provide approximation algorithms with constant performance guarantees for this problem. These algorithms can be extended to include such practical constraints as link capacities and surviving single link failures.

■ TC41

Room 402

Heavy Traffic Analysis of Stochastic Processing Networks

Sponsor: Applied Probability

Sponsored Session

Chair: Baris Ata, Assistant Professor, Kellogg School of Management, Northwestern University, 2001 Sheridan Road, Evanston, IL, 60208, United States, b-ata@kellogg.northwestern.edu

1 - Maximum Pressure Policies for Stochastic Processing Networks with Multiple Bottlenecks

Wuqin Lin, Northwestern University, MEDS Department, Kellogg, 2001 Sheridan Road, Evanston, IL, 60208, United States, wuqin-lin@kellogg.northwestern.edu, Baris Ata, Jim Dai

A class of open processing networks operating under the maximum pressure policy is considered in the heavy traffic regime. We prove that the diffusion-scaled queue length process for network with several bottleneck resources converges to a Semimartingale Reflecting Brownian Motion (SRBM) living in a convex cone. We also establish a state space collapse result that the queue length process can be lifted from a lower dimensional workload process, which is also an SRBM living in a convex cone.

2 - State Space Collapse in Many-Server Diffusion Limits of Parallel Server Systems

Tolga Tezcan, Assistant Professor, Industrial and Enterprise Systems Engineering, University of Illinois at Urbana-Champaign, 117 Transportation Building, 104 S. Mathews Avenue, Urbana, IL, 61801, United States, ttezcan@isye.gatech.edu, Jim Dai

We consider parallel server systems with many servers. We extend the state space collapse framework of Bramson to show that a class of state space collapse results in the Halfin-Whitt many server diffusion limits of a parallel server system hold if the hydrodynamic limits of the same system satisfy certain conditions. In this talk, we focus on the applications of our results and establish state space collapse results conjectured in the literature.

3 - Asymptotically Optimal Admission Control of a Queue with Impatient Customers

Amy Ward, University of Southern California, Marshall School of Business, Los Angeles, CA, 90089, United States, amy@isye.gatech.edu, Sunil Kumar

We consider a GI/GI/1 queue with impatient customers in heavy traffic. We use the solution of an approximating singular diffusion control problem to construct an admission control policy for the queue. The approximating control problem does not admit a so-called pathwise solution. Hence the resulting admission control policy depends on second moment data. We prove asymptotic optimality of the constructed policy using weak-convergence methods.

4 - Dynamic Leadtime Quotation Under General Customer Utilities

Tava Olsen, Associate Professor, Washington University in St. Louis, 1 Brookings Drive, St. Louis, MO, 63130, United States, olsen@wustl.edu, Baris Ata

We consider a make-to-order system where customers have explicit utility functions for leadtimes. Customers are dynamically quoted leadtimes; if the benefits of service do not exceed customers' disutility for waiting then they leave. We examine strategies for leadtime quotation under a variety of assumptions on the shape of the leadtime utility by appealing to approximations in the large-capacity asymptotic regime.

■ TC42

Room 403

Emerging Areas in Scheduling

Cluster: Scheduling

Invited Session

Chair: Jay Sethuraman, Associate Professor, Columbia University, 338 Mudd, IEOR Department, 500 West 120th Street, New York, NY, 10027, United States, jay@ieor.columbia.edu

1 - PBS: Priority Based Blind Scheduling

Vishal Misra, Associate Professor, Columbia University, Computer Science, Electrical Engineering, New York, NY, United States, misra@cs.columbia.edu, Dan Rubenstein, Hanhua Feng

A novel CPU scheduling policy is designed and implemented. It is a configurable policy in the sense that a tunable parameter is provided to change its behavior. With different settings of the parameter, this policy can emulate the first-come first-serve, the processor sharing, or the feedback policies, as well as arbitrarily different levels of their mixtures. This policy is implemented in the Linux kernel as a replacement of the default scheduler, and it's performance analyzed with different workloads and benchmarks. The scheduler's superior performance under different workloads indicate its promise as a configurable replacement for a wide variety of schedulers.

2 - Adversarial Network Analysis

Matthew Andrews, Bell Laboratories, Lucent Technologies, 700 Mountain Avenue, Murray Hill, NJ, 07974-0636, andrews@research.bell-labs.com

In this talk we study communication networks under worst-case adversarial assumptions on input traffic, topology and network behavior. We focus on how the resulting networking performance differs from that which arises under average-case stochastic assumptions.

3 - Optimal Seamless Self-Assembly of Files in Linear Networks

Andreas Constantinides, Columbia University, EE Department, New York, NY, United States, acc40@columbia.edu, E. G. Coffman, Jr.

A file F is sited at one end of a path, in which each node may act as a client for F, and may cache subsets of F. In the seamless, self-assembly (SSA) paradigm, all clients issue requests simultaneously, each starts to receive segments of F immediately, and continues to receive them until F is fully downloaded. We exhibit a distributed protocol that assigns segments of F to caches in such a way that, no matter which nodes are chosen as clients, SSA is realized with a minimum total cache size.

4 - The Least Core Value of Schedule Planning Games

Nelson Uhan, Massachusetts Institute of Technology, Operations Research Center, 77 Massachusetts Avenue, E40-130, Cambridge, MA, 02139, United States, uhan@mit.edu, Andreas Schulz

A schedule planning game is a cooperative game where the cost to a coalition is the minimum sum of weighted completion times of their jobs on one machine. The least core value of a cooperative game is the minimum penalty for defection that encourages all agents to cooperate. We show that computing the least core value of schedule planning games is NP-hard, and provide a fully polynomial time approximation scheme. In addition, we extend the analysis to cooperative games with supermodular costs.

■ TC43

Room 404

Interactive Multi-Criteria Optimization

Cluster: Multi-Criteria Decision Making

Invited Session

Chair: Jyrki Wallenius, Professor, Helsinki School of Economics, Runeberginkatu 22-24, Helsinki, FI, 00100, Finland, Jyrki.Wallenius@hse.fi

1 - An Interactive Evolutionary Approach Based on Convex Preference Cones to Multiobjective Optimization

John Fowler, Professor of Industrial Engineering, Arizona State University, PO Box 87-5906, Tempe, AZ, 85287-5906, United States, John.Fowler@asu.edu, Jon Marquis, Jyrki Wallenius, Esma Gel, Pekka Korhonen, Murat Köksalan

We present an interactive evolutionary algorithm for multiobjective combinatorial optimization problems. The algorithm seeks to find the solution most preferred by the decision maker (DM). The fitness of a solution reflects preference information elicited from the DM and is based on a partial order obtained from pairwise preference comparisons of solutions and implied preferences based on preference cones. We describe test results for randomly generated multidimensional knapsack problems.

2 - On Solving Large-Scale Multiple Criteria Evaluation Problems

Pekka Korhonen, Professor, Helsinki School of Economics, Runeberginkatu 22-24, Helsinki, 00100, Finland, Pekka.Korhonen@hse.fi, Jyri Ruutu

We deal with multiple criteria evaluation problems having few criteria and a huge number (ccc 500 000) of alternatives. The approach, originally developed by Korhonen (1988) and further by Korhonen and Karaivanova (1999), is interactive and uses a reference direction as a tool for obtaining preference information from a decision maker. We present numerical results concerning the performance of the algorithm. In addition, we propose some ideas to further improve its performance.

3 - A DEA-Based Approach for Sorting Alternatives

Murat Köksalan, Professor, Middle East Technical University, Industrial Engineering, Ankara, 06531, Turkey, koksalan@ie.metu.edu.tr, Ceren Tuncer

We consider the sorting problem of classifying alternatives defined by multiple criteria into different preference classes. As the number of classes increase, the sorting problem approaches a ranking problem. We develop a DEA-based approach using weight restrictions on inputs and outputs. To determine the class of an alternative, we consider how the efficiency score of an alternative changes as we remove the alternatives affecting its efficiency score.

4 - An Excel Add-In For Solving Linear and Nonlinear Optimization Problems With Multiple Objectives

Patrick Mackin, Associate Professor, Black Hills State University, 1200 University, Spearfish, SD, 57779, United States, patrickmackin@rap.midco.net, Asim Roy, Jyrki Wallenius

Single objective linear and nonlinear optimization problems can be solved within a spreadsheet system like Excel. However, many decision problems have multiple, conflicting objectives and there are no user-friendly commercial systems available to solve them. In this paper we present an add-in for Excel for solving this class of problems. The system is an implementation of an interactive method that we developed that is based on a Q/A session with the user that asks relatively simple questions.

■ TC44

Room 405

Joint Session JFIG/ED: An Interactive Panel/Audience Discussion: Planning, Designing, and Preparing to Teach a New Course

Sponsor: Junior Faculty Interest Group (JFIG), Educatoin (INFORM-ED)

Sponsored Session

Chair: James Cochran, Louisiana Tech University, College of Administration & Business, PO Box 10318, Ruston, LA, 71055, United States, jcochran@cab.latech.edu

1 - An Interactive Panel/Audience Discussion: Planning, Designing, and Preparing to Teach a New Course

Moderator: James Cochran, Louisiana Tech University, College of Administration & Business, PO Box 10318, Ruston, LA, 71055, United States, jcochran@cab.latech.edu, Panelists: Mark Lewis, Mary Beth Kurz, Jill Hardin

We discuss our experiences organizing and preparing to teach courses at all levels-introductory undergraduate through advanced graduate. Topics may include designing a course to accomplish pedagogical goals, deciding on the scope of a course, selecting a text/support material, choosing methods for assessing student performance, etc. Most of the session will be devoted to contributions and questions from the audience (who will be encouraged to participate and contribute throughout the session!).

■ TC45

Room 406

Tutorial: Game Theory in Supply Chain Analysis

Cluster: Tutorials

Invited Session

1 - Game Theory in Supply Chain Analysis

Gerard Cachon, Professor of Operations and Information Management, University of Pennsylvania, 543 JMHH, Philadelphia, PA, 19104, United States, cachon@wharton.upenn.edu, Serguei Netessine

Game theory has become an essential tool in the analysis of supply chains with multipleagents, often with conflicting objectives. We discuss both non-cooperative and cooperative game theory in static and dynamic settings and outline game-theoretic concepts that have potential for future applications. We demonstrate the existence and uniqueness of equilibrium in non-cooperative games. A newsvendor game is employed throughout as an illustrative example.

■ TC46

Room 407

Supply Chain Operations Planning

Cluster: Supply Chain and Operations Engineering

Invited Session

Chair: Joseph Geunes, Associate Professor, University of Florida, 303 Weil Hall, PO Box 116595, Gainesville, FL, 32611, United States, geunes@ise.ufl.edu

1 - Supply Chain Design with Market Assignments Under Uncertainty

Yasemin Merzifonluoglu, Visiting Assistant Professor, Florida International University, 10555 W. Flagler Street, EC 3122, Miami, FL, 33174, United States, merzify@fiu.edu, Joseph Geunes, H. Edwin Romeijn

Given a set of supply sources and a set of uncertain demands, we model the assignment of demands to supply points in order to minimize expected supply cost. These problems have broad application in supply chain planning across multiple facilities. We employ a Branch and Price approach with associated pricing problems that take the form of "Stochastic Knapsack" problems. We discuss a numerical study that validates the performance of the Branch and Price algorithm.

2 - A Model for Category Management with Vendor-Specific Product Portfolios

Matt Drake, Assistant Professor, Duquesne University, A.J. Palumbo School of Business, Donahue Graduate School of Business, Pittsburgh, PA, 15282, United States, matt.drake@comcast.net, Julie Swann

Some retail firms are allowing suppliers to choose the assortment of products to stock in their stores in addition to the stocking levels. This practice can have significant implications when there is limited shelf space and vendor competition. We present such a model in which vendors producing multiple substitutable products stock their own allocated space. We develop mechanisms to align the economic incentives in this environment and consider the implications of this strategy for consumers.

3 - Optimal Policy for a Periodic Review Inventory System with Expediting

Chiwon Kim, PhD Student, Massachusetts Institute of Technology, 262 Belmont Street #2, Watertown, MA, 02472, United States, chiwon@mit.edu, David Simchi-Levi, Diego Klabjan

We study the single item periodic review inventory model with deterministic lead time and optional expediting. Under a certain expediting cost structure, we prove optimality of serialized base stock policy. The serialized base stock policy is simple, reasonable, and easily implementable. On the other hand, if the expediting cost does not have this structure, it is shown that the optimal decisions are functions of system state variables, and the corresponding optimal policy is no longer simple.

4 - Joint Pricing and Inventory/Production (EOQ) Decisions Across Products in a Supply Chain

Annie Niu, University of Alberta, School of Business, Edmonton, AB, Canada, rniu@ualberta.ca, Xuan Zhao, Ignacio Castillo

We consider joint pricing and inventory/production decision problems with both complementary and substitute products in a two-stage supply chain. Demand for each product is deterministic but sensitive to the retail prices of all products. We analyze each member's pricing and inventory/production problem and found that equilibrium exists under certain conditions. The problem is also considered under VMI. We provide numerical examples that develop insights for product line and category management.

■ TC47

Room 408

Supply Chain Optimization II

Cluster: Supply Chain and Operations Engineering

Invited Session

Chair: H. Edwin Romeijn, Associate Professor, University of Florida, ISE Department, 303 Weil Hall, PO Box 116595, Gainesville, FL, 32611-6595, United States, romeijn@ise.ufl.edu

1 - Solution Methods for the Generalized Assignment Problem with Flexible Jobs

Chase Rainwater, Research Assistant, Industrial and Systems Engineering Department - University of Florida, 450 Weil Hall, Gainesville, FL, 32611-6595, United States, crainwa@ufl.edu, Joseph Geunes, H. Edwin Romeijn

We consider a profit-maximizing version of the generalized assignment problem with flexible job requirements. That is, there is a range of acceptable requirement levels for each candidate assignment and the chosen level affects the job revenue in a linear way. We consider an exact branch-and-price algorithm approach and propose a greedy heuristic that we analyze under a probabilistic model.

2 - Distribution Center Location and Inventory Allocation under Explicit Transportation Costs

Sila Cetinkaya, Associate Professor, Texas A&M University, Industrial and Systems Engineering, College Station TX 77843, United States, sila@tamu.edu, Burcu B. Keskin, Halit Uster

We consider a single-supplier that serves multiple retailers in geographically dispersed locations. In order to benefit from economies of scale in transportation, the supplier is interested in operating a central distribution center. We develop analytical models for quantifying the impact of the location of the central distribution center on inventory allocation and payoffs of all the parties under explicit transportation costs.

3 - Impact of Consumer Returns on Supply Chain Coordination
Ana Muriel, Associate Professor, University of Massachusetts Amherst, 160 Governors Drive, Amherst, MA, 01003, United States, muriel@ecs.umass.edu, Rocio Ruiz Benitez

We consider a two-echelon supply chain with a single manufacturer and a single retailer that faces stochastic and/or price-dependent demand in a single period. Both retailer and manufacturer incur costs associated with consumer returns. We show that higher profits and better coordination can be achieved when the players acting in a decentralized fashion do not consider any information about consumer returns as they make their pricing and ordering decisions.

4 - Stochastic Demand Assignment Problems with Facility Capacities
Kevin Taaffe, Assistant Professor, Clemson University, 110 Freeman Hall, Clemson, SC, 29634, United States, taaffe@CLEMSON.EDU, H. Edwin Romeijn, Joseph Geunes

We study a class of assignment problems in which a supplier utilizes a set of distinct facilities to satisfy the demands of different customers or markets. Our model simultaneously assigns customers to each facility and determines the best utilization of resources at each facility. While resources (or capacity) can be dynamically assigned, the supplier may be restricted in the allowable capacity at each facility. We propose a Lagrangian relaxation and branch-and-price solution approach.

■ TC48

Room 409

Managing Service Capacity and Quality

Sponsor: Manufacturing & Service Operations Management
Sponsored Session

Chair: Robert Shumsky, Associate Professor, Tuck School, Dartmouth College, 100 Tuck Hall, Hanover, NH, 03755, United States, robert.shumsky@dartmouth.edu

1 - Service Quality in US Hospitals: Endogeneity and Variability
Justin Ren, Assistant Professor, Boston University School of Management, 595 Commonwealth Avenue, Boston, MA, 02215, United States, ren@bu.edu, Xin Wang

We study the relation between hospitals' patient volume and the associated operations service quality among US hospitals. We focus on both the mean and the variance measure of service quality, and use a structural model to control for the endogeneity between the patient case volume and the service quality of hospitals. We answer the following questions: (1) Is larger patient volume causing, or caused by, better operations quality? And (2) Are larger hospitals really better than smaller ones?

2 - Quality and Price Competition for Screening Services
Evrim Didem Gunes, Assistant Professor, Koc University, Rumeli Feneri Yolu, Sariyer, Istanbul, 34450, Turkey, egunes@ku.edu.tr, Stephen Chick, Luk N. Van Wassenhove

We examine the effect of market organization for screening for early disease detection on the quality and price of that service. Two providers offer screening and treatment services, and decide on the quality and the price of screening service. The equilibrium is characterized. A sensitivity analysis describes the effect of disease characteristics, such as prevalence, progress rate, and the service cost characteristics on the quality and price levels under competition.

3 - Demand and Supply Management in Services and Manufacturing Supply Chains
Turgut Aykin, ac2 Solutions, 935 Route 34, Suite 3A, Matawan, NJ, 07747, United States, taykin@ac2solutions.com

In this talk, we present a framework for demand and supply management in services and manufacturing supply chains. Challenges faced in demand and supply management in services supply chains are discussed together with a number of new approaches for forecasting and resource optimization. We also present new approaches for demand and supply management in CTO/BTO/ATO type manufacturing supply chains when products do not have fixed bills of materials.

4 - Intra-Day Updating of Call Center Agent Schedules Based on Variable Arrival Rates
Vijay Mehrotra, Assistant Professor, San Francisco State University, Department of Decision Sciences, COB, 1600 Holloway Avenue, San Francisco, CA, 94132, United States, drvijay@sfsu.edu

In this paper, we define a framework for updating call center agent schedules on an intra-day basis, a practice that is carried out (usually in an unstructured way) in 75% of call centers. The key contribtion of this paper is accounting for arrival rate variability in both the initial schedule creation and in schedule updating.

■ TC49

Room 410

The Impact of Regulation in Closed-Loop Supply Chains

Cluster: Closed-Loop Supply Chains and Reverse Logistics
Invited Session

Chair: Beril Toktay, Associate Professor, College of Management, Georgia Institute of Technology, 800 West Peachtree Street, NW, Atlanta, GA, 30308, United States, Beril.Toktay@mgt.gatech.edu

1 - A Model for Operations Planning with Life-Cycle Environmental Considerations
Ravi Subramanian, Assistant Professor, College of Management, Georgia Tech, 800 West Peachtree Street NW, Atlanta, GA, 30332, United States, ravi.subramanian@mgt.gatech.edu, Brian Talbot, Sudheer Gupta

Taking the life-cycle view, we treat tradeoffs to the manufacturer as a result of environmental regulation starting with product design, through production, to the end of the product's economic life. We formulate and solve a non-linear programming model of the multi-period multi-product manufacturing and remanufacturing problem with environmental considerations. Through a rich model that incorporates regulatory constraints, we evaluate optimal decisions within a spectrum of compliance options.

2 - Efficient Take-Back Regulation: Economy and the Environment
Atalay Atasu, INSEAD, Boulevard de Constance, Fontainebleau, 77300, France, atalay.atasu@insead.edu, Luk N. Van Wassenhove, Miklos Sarvary

The new environmental regulations such as European WEEE require accountability for the take-back and proper treatment of used products by the manufacturers. In this paper, we investigate the efficiency conditions for such regulations, identify the problems and provide suggestions for both the social planner and the manufacturers. We discuss the issues of target selection, the impacts of competition, consumer education and cost/benefit ratios on the efficiency of the regulation.

3 - Outsourcing Remanufacturing Operations: Cost Benefits or Potential Competition?
Eda Kemahlioglu-Ziya, Kenan-Flagler Business School, University of North Carolina, CB # 3490, Chapel Hill, NC, 27599, United States, Eda_KemahliogluZiya@unc.edu, Gokce Esenduran, Jay Swaminathan

We consider an OEM manufacturing a product, 100% of which must be recollected at the end of its life cycle due to legislature. The product can be refurbished and resold in the market; however the OEM does not have remanufacturing capabilities. The OEM can either dispose of the cores at cost or sell them to a third-party manufacturer, who becomes their competitor in the market. We are interested in analyzing whether the cost benefits of selling the cores outweigh the loss to competition.

■ TC50

Room 411

Economics of Queues and Service Differentiation

Sponsor: Manufacturing & Service Operations Management
Sponsored Session

Chair: Costis Maglaras, Associate Professor, Columbia University, Graduate School of Business, 409 Uris Hall, 3022 Broadway, New York, NY, 10027, United States, c.maglaras@gsb.columbia.edu

Co-Chair: Assaf Zeevi, Associate Professor, Columbia Business School, 3022 Broadway, New York, NY, 10027, United States, assaf@gsb.columbia.edu

1 - Investment and Market Structure in Industries with Congestion
Gabriel Y. Weintraub, Stanford University, Management Science and Engineering Department, Terman Engineering Center, 3rd Floor, Stanford, CA, 94305, United States, gweintra@stanford.edu, Ramesh Johari, Benjamin Van Roy

We analyze investment and market structure in service industries with congestion effects. Firms compete by choosing prices and investments that mitigate congestion. We develop game theoretic models to analyze whether competition between profit-maximizing firms leads to efficient outcomes in different scenarios. Our model and results provide a framework through which a range of service industries can be studied, offering guidance for policy analysis.

2 - Near Optimal Design of Price and Delay Differentiation
Assaf Zeevi, Associate Professor, Columbia Business School, 3022 Broadway, New York, NY, 10027, United States, assaf@gsb.columbia.edu, Costis Maglaras

A service provider offers substitutable products to a segmented market comprised of customers with heterogenous preferences. The ``products" are differentiated based on price and delay. How many such products to offer and how to design them are some of the questions addressed in this talk.

3 - Implications of Estimation in a Competitive Environment
Omar Besbes, PhD Student, Columbia Business School, 3022 Broadway, New York, NY, 10027, United States, ob2105@columbia.edu, Assaf Zeevi

We consider a competitive market where firms do not have perfect knowledge of the demand model parameters, and these are estimated from market research. We study the resulting game and illustrate some of the consequences on the firms' decisions and performance, as well as on the properties of the equilibrium points.

4 - Operations with Subscribers
Ramandeep Randhawa, Stanford University, 518 Memorial Way, Stanford, CA, United States, randhawa_ramandeep@gsb.stanford.edu, Sunil Kumar

We study a monopolistic firm that offers reusable products to price and quality-of-service sensitive customers. We study the alternatives of offering either a subscription option or a pay-per-use option. In a large market setting under an exponential demand assumption we show that the subscription option is more profitable for the firm. A numerical study suggests that this assumption is not essential. Moreover the social welfare and consumer surplus can also be higher in the subscription option.

■ TC51

Room 412

Panel Discussion: Humanitarian Supply Chain Management

Cluster: Planning for and Responding to Disasters

Invited Session

Chair: Luk N. Van Wassenhove, Professor, INSEAD, INSEAD Technology Management, Boulevard de Constance, Fontainebleau Cedex, ID, 77305, France, luk.van-wassenhove@insead.edu

1 - Panel on Humanitarian Supply Chain Management
Moderator: Luk N. Van Wassenhove, Professor, INSEAD, INSEAD Technology Management, Boulevard de Constance, Fontainebleau Cedex, ID, 77305, France, luk.van-wassenhove@insead.edu, Panelists: Jo van Nunen, Laura Kopczak, Jarrod Goentzel, Eric Johnson, Hau L. Lee

This panel will discuss research priorities in humanitarian supply chain management based on interviews with humanitarian logisticians and our own work on humanitarian disaster preparedness and response.

■ TC52

Room 413

Revenue Management and Pricing in Operations

Sponsor: Revenue Management & Pricing

Sponsored Session

Chair: Philipp Afeche, University of Chicago GSB, 5807 South Woodlawn Avenue, Chicago, IL, 60637, United States, philipp.afeche@chicagogsb.edu

Co-Chair: Achal Bassamboo, a-bassamboo@northwestern.edu

1 - Cross-Selling in Call Centers with Heterogeneous Customers
Mor Armony, Assistant Professor of Operations Management, Leonard N. Stern School of Business, New York University, 44 West 4th Street #8-62, New York, NY, 10012, United States, marmony@stern.nyu.edu, Costis Maglaras, Itay Gurvich

Cross-selling is becoming an increasingly prevalent practice in call centers. This paper considers a call center with cross-selling capabilities that serves heterogeneous customers. It studies the operational decisions of staffing, call routing, and cross-selling under varying levels of customer segmentation. It derives near-optimal policies, and characterizes the impact of increased customer segmentation on the structure of these policies and the center's profitability.

2 - Dynamic Pricing with Options
Guillermo Gallego, Professor, Industrial Engineering and Operations Research, Columbia University, New York, NY, United States, gmg2@columbia.edu, Ozge Sahin

We present a finite capacity, finite horizon perishable inventory model in discrete time where costumer classes with different willingness to pay distributions arrive sequentially and update their valuations until the end of the horizon. We use Dynamic Programming to compute incentive compatible call options for each customer class to maximize expected revenues and compare revenues with options to revenues under a low-to-high pricing strategy.

3 - Communicating Price Changes
Garrett van Ryzin, Columbia University, URis Hall, New York NY 10027, United States, giv1@columbia.edu, Wei Ke

We look at a model of dynamic pricing with reference price effects in which a firm making a price change decides whether or no to broadcast the information. Broadcasting the change attracts customers but lowers the perceiped reference price for the product. We study this tradeoff.

4 - Response Time and Revenue Mangement under Competition and Customer Choice
Philipp Afeche, University of Chicago GSB, 5807 South Woodlawn Avenue, Chicago, IL, 60637, United States, philipp.afeche@chicagogsb.edu

Consider the problem of two providers who compete for heterogeneous and time-sensitive customers with private information about their preferences. How should they design price-delay menus and schedule their resources? We characterize the price-delay equilibria and discuss how they depend on capacity levels, competition, and the value of market segmentation.

■ TC53

Room 414

Supply Chain Sourcing Decisions

Contributed Session

Chair: Ismail Capar, Research Assistant, Mississippi State University, PO Box 9542, MS State, MS, 39762, United States, ic21@msstate.edu

1 - Make or Buy with Production-Driven Cost Reductions
Wenjing Shen, University of Michigan, 701 Tappan Street, Ann Arbor, MI, 48105, United States, wenjings@bus.umich.edu, Roman Kapuscinski, Izak Duenyas

Outsourcing is often driven by potential for cost reductions. However, many cost comparisons ignore the fact that costs can be reduced over time and that some of the reductions are driven by production process. We consider a game in which costs can only be reduced when production exceeds a certain minimum quantity. Strategic consequences are described.

2 - Contracting Capacity Portfolio between a Capacity Provider and a Capacity Marketer
Houcai Shen, Professor, Nanjing University, Engineering and Management School, Nanjing, China, hcshen@nju.edu.cn, Zhan Pang, Youyi Feng

Motivated with the fast development of business to business exchanges, we consider a problem of contracting capacity portfolios between a capacity provider (e.g. freight carrier) and a capacity marketer (intermediary or 3PL) in a contract market. The dynamic pricing strategy of players are studied respectively. We also study the contracting behaviors of the players. Finally, we study the acquisition decisions of the players with benchmark of the integrating system.

3 - Price Matching Guarantees Based on Availability
Arcan Nalca, McGill University, 1001 Sherbrooke West, Montreal, QC, H3A 1G5, Canada, arcan.nalca@mcgill.ca, Tamer Boyaci, Saibal Ray

Price matching guarantees (PM) are offers to match competitor's price for identical merchandise. PMs are widely seen in retail industry as a signal of low price to consumers. Unlike the past literature, retailers verify the availability of in competitors' store before matching the price (PM based on availability, PMA). We investigate a static duopoly game to understand the differences of PMA and PM with respect to competition. The effect of in-store availability on competition is also analyzed.

4 - Life-Time Buy Decisions with Multiple Products and Multiple Parts

James Bradley, Associate Professor, The College of William & Mary, 118C Tyler Hall, Mason School of Business, Williamsburg, VA, 23187-8795, United States, james.bradley@mason.wm.edu, Hector Guerrero

"Life-cycle mismatch" occurs when component life cycles are shorter than the life cycles of products in which they are used. "Life-time buys" are one response to component obsolescence where a quantity of components is purchased for the remaining product life. We extend prior work, which focuses on one product with one obsolete part, by providing closed-form solutions and approximations for (1) One product with multiple obsolete components and (2) Many products that share an obsolete component.

5 - A Decision Rule in a Two-Stage Supply Chain with Alternative Supply Sources

Ismail Capar, Research Assistant, Mississippi State University, PO Box 9542, MS State, MS, 39762, United States, ic21@msstate.edu, Burak Eksioglu

A two-stage supply chain with two distribution centers (DCs) and a set of retailers is analyzed. Each member of the chain uses a (Q, R) policy, and each DC is able to serve all retailers, but with different transportation cost structures. The retailers are identical and face independent demand. A decision rule which compares the expected cost of two alternatives for the above supply chain is proposed. Four different ordering policies are compared with respect to total cost and service level.

■ TC54

Room 415

Inventory Decisions with Marketing Considerations

Cluster: Operations and Marketing for Emerging Markets

Invited Session

Chair: Ding Qing, Assistant Professor, Singapore Management University, Lee Kong Chian School of Business, Singapore, 178899, Singapore, dingqing@smu.edu.sg

1 - Managing Demand under Inventory Uncertainty

Shaoxuan Liu, University of California, Irvine, The Paul Merage School of Business, Irvine, CA, United States, sliu02@merage.uci.edu, Rick So, Fuqiang Zhang

We develop a mathematical model to analyze the impact of inventory uncertainty on the optimal marketing and inventory decisions. Our results provide useful information for evaluating the potential benefits of adopting RFID technology to improve inventory tracking accuracy under different operating environments.

2 - The Revenue Driven Newsvendor under Information Asymmetries

Adam Zhu, Assistant Professor of Operations Management, Singapore Management University, Lee Kong Chian School of Business, Singapore, adamzhu@smu.edu.sg, Zhengping Wu

We consider the impact of advertisement revenue on the newsvendor's inventory decision. The newsvendor also has to appropriately decide how much to charge advertisers without knowing their marginal benefit from the advertisement. We discuss managerial insights obtained from our model.

3 - Maximizing Throughput of Assembly Lines with Workers Cross-Trained Across Work Stations

Yun Fong Lim, Assistant Professor, Singapore Management University, Lee Kong Chian School of Business, Singapore, yflim@smu.edu.sg, Kum Khiong Yang

We find policies to maximize the throughput of an assembly line with workers cross-trained across discrete work stations. In most of the circumstances the system generates higher throughput when workers are sequenced from slowest to fastest, although a significant portion of work distributions favors the reverse ordering. Furthermore, a team of partially cross-trained workers may outperform a totally cross-trained team.

4 - Dynamic Pricing for Hotel Yield Management of Multiple-Day Stay

Ding Qing, Assistant Professor, Singapore Management University, Lee Kong Chian School of Business, Singapore, 178899, Singapore, dingqing@smu.edu.sg, Kum Khiong Yang

We study an application of yield management to the hotel industry of multiple-day stay. The problem is formulated as a stochastic programming model. We develop a dynamic pricing system with demand reshaping and capacity rationing. The policy is almost-optimal and the updated information is revealed in real time. The mechanism is applicable in both spot and online system.

■ TC55

Room 416

Artificial Intelligence

Contributed Session

Chair: Cliff Ragsdale, Bank of America Professor, Virginia Polytechnic Institute and State University, 1007 Pamplin Hall, Blacksburg, VA, 24061, United States, cragsdal@vt.edu

1 - Building Meta-Search Engines with SVMs

Enes Eryarsoy, Assistant Professor, Sabanci University, Orhanli -Tuzla, Istanbul, 34, 34956, Turkey, enes@sabanciuniv.edu, Praveen Pathak

Information retrieval (IR) systems involve different matching and ranking functions that are used to rank documents in a document collection. Several ranking methods have been proposed in the IR literature. These methods are combined by meta-search techniques via filtering, aggregating, and blending the results. In this study we focus on combining different ranking functions with a machine learning technique, Support Vector Machines.

2 - Domain Described Support Vector Classifier For Multi-Classification Problems

Daewon Lee, Pohang University of Science and Technology, POSTECH, San 31 Hyoja-dong, Pohang, 790-784, South Korea, Pohang, South Korea, woosuhan@postech.ac.kr, Jaewook Lee

A novel classifier for multi-classification problems is proposed. The proposed classifier, based on the Bayesian optimal decision theory, tries to model the decision boundaries via the posterior probability distributions constructed from support vector domain description rather than to model them via the optimal hyperplanes constructed from 2-class support vector machines. Experimental results show that the proposed method is more accurate and efficient for multi-classification problems.

3 - Neural Network and Finite Differences in the Thermal Cracking of 1,2-Dichloroethane

Helianildes Ferreira, SENAI-Serviço Nacional de Aprendizagem Industrial, Avenida Luís Tarquínio Pontes, 938, Aracuí, Lauro de Freitas, 42.700-000, Brazil, helih@fieb.org.br, João Pereira, Maria Lopes

The present work simulated the behavior of the process that occurs in the coil of an industrial furnace for thermal cracking of 1,2-dichloroethane through the conventional and non-conventional simulation. In the non-conventional simulation of the process was used the methodology of Artificial Neural Networkss (ANN). The ANN's are particularly useful in applications of processes control where higher processing velocities are necessary in order to achieve the control objectives.

4 - A Strong Texas Hold'em Poker Player via Automated Abstraction and Real-time Equilibrium Computation

Andrew Gilpin, Carnegie Mellon University, 5000 Forbes Avenue, Pittsburgh, PA, 15213, United States, gilpin@cs.cmu.edu, Tuomas Sandholm

We present GS2, our Texas Hold'em poker player which employs automated abstraction and real-time equilibrium approximation to tackle enormous state spaces. We introduce an abstraction algorithm based on clustering and integer programming. We present a method for estimating leaf payoffs for truncated games, allowing equilibrium-finding algorithms to consider the entire game tree. Our player, which incorporates very little domain knowledge, is competitive with leading poker-playing programs.

5 - Fashioning Fair Foursome For The Fairways

Cliff Ragsdale, Bank of America Professor, Virginia Polytechnic Institute and State University, 1007 Pamplin Hall, Blacksburg, VA, 24061, United States, cragsdal@vt.edu, Kevin Scheibe

We present a spreadsheet-based model for creating evenly matched foursomes for a multi-round golf-tournament for university benefactors. The modeling paradigm conveniently allows for a variety of side constriants on pairings. A genetic algorithm is applied to determine optimal foursomes.

Tuesday, 4:30pm - 6:00pm

■ TD01

Room 301

Graph-Theoretic Approximation Algorithms

Sponsor: Optimization/ Network and Combinatorial Optimization
Sponsored Session

Chair: R Ravi, Tepper School of Business, CMU, 5000 Forbes Avenue, Pittsburgh, PA, 15213, United States, ravi@cmu.edu

1 - Delegate and Conquer: An LP-Based Approximation Algorithm for Minimum Degree MSTs

Mohit Singh, Tepper School of Business, Carnegie Mellon University, 5000 Forbes Avenue, Pittsburgh, PA, 15213, United States, mohits@andrew.cmu.edu, R Ravi

In this paper, we study the minimum degree MST problem: Given an edge weighted graph G, the objective is to find an MST T such that the maximum degree of any node in T is minimized. We obtain an algorithm which returns an MST of maximum degree at most OPT+k where OPT is the maximum degree of an optimal MST and k is the distinct number of costs in any MST. Our techniques involve a stronger lower bound given by a LP relaxation to the problem and strengthening of the known graph theoretic results.

2 - Approximation Algorithms for Two-Stage Stochastic and Robust Combinatorial Optimization Problems

Vineet Goyal, PhD Student, Tepper School of Business, Carnegie Mellon University, 5000 Forbes Avenue, Pittsburgh, PA, 15213, United States, vgoyal@andrew.cmu.edu

We consider two stage combinatorial optimization problems where the goal is to construct a partial first stage solution knowing the possible second stage scenarios and complete it in the second stage after one of the scenarios realizes s.t. the expected (worst case) cost is minimized. In particular, we consider min-cut problem on an undirected graph in this model (a root vertex is given but the terminal is uncertain) and give approximation algorithms to minimize the expected and worst case costs

3 - Minimum Vehicle Routing with a Common Deadline

Viswanath Nagarajan, Tepper School of Business, Carnegie Mellon University, 5000 Forbes Avenue, Pittsburgh, PA, 15213, United States, viswanat@andrew.cmu.edu, R Ravi

We study the following vehicle routing problem: given n vertices in a metric space, a specified depot vertex r, and a length bound D, find a minimum cardinality set of r-paths that covers all vertices, such that each path has length at most D. We consider a linear relaxation for this problem that can be solved approximately. The integrality gap of this relaxation is shown to be upper bounded by a constant in tree metrics and by min{log n, log D} in general.

4 - Line of Sight Networks

Alan Frieze, Professor, Carnegie Mellon University, 5000 Forbes Avenue, Pittsburgh, PA, 15213, United States, af1p@andrew.cmu.edu, R Ravi, Warren Debany, Jon Kleinberg

We study a new class of random graph which model communication within an environment with regularly spaced obstacles.

■ TD02

Room 302

Joint Session Open-Source/ICS: Open Source in Teaching

Cluster: Open-Source Software: Open Source, Open Standards, Open Data, INFORMS Computing Society
Invited Session

Chair: John Chinneck, Professor, Carleton University, Systems & Computer Engineering, Ottawa, ON, K1S 5B6, Canada, chinneck@sce.carleton.ca

1 - Open Source Texts and Teaching Materials

John Chinneck, Professor, Carleton University, Systems & Computer Engineering, Ottawa, ON, K1S 5B6, Canada, chinneck@sce.carleton.ca

A variety of freely-available textbooks, examples, assignment questions and other teaching materials are now easily found on the web. What advantages and disadvantages do these have over standard teaching materials? Should anyone be free to alter the content on an open source textbook as is done in a wiki? This talk will explore such questions in relation to the author's experience with an online textbook.

2 - Use of Open Source Software in Teaching Computer Programming to OR/IE Students

Suleyman Karabuk, Assistant Professor, University of Oklahoma, School of Industrial Engineering, 200 West Boyd, Room 124, Norman, OK, 73019, United States, karabuk@ou.edu

This talk includes an account of the author's personal experience in teaching a graduate level computer programming course with an OR/IE flavor. The course, including the management software, is based on open source programming languages, software tools and libraries. The author will share his experiences and his answers to the questions of why open source and how it helps to teach OR/IE.

3 - The Benefits and Problems of Using Open Source Software in the Classroom

J. Brian Adams, Assistant Professor of Computer Science, Franklin & Marshall College, Department of Mathematics, PO Box 3003, Lancaster, PA, 17604-3003, brian.adams@fandm.edu

In teaching OR, we must often make a decision on what software to use in the classroom. Many commercial packages are available, but they come with both a financial and an intellectual cost. An alternative is to teach the course using Open Source software. In this paper, we present the experience of using several different Open Source software packages in the classroom. This discussion includes the potential benefits as well as some of the problems that may result from their use.

4 - Using Java Applets to Teach Linear Programming

Robert Vanderbei, Professor, Princeton University, ORFE, Princeton, NJ, 08544, United States, rvdb@princeton.edu

Associated with my book "Linear Programming", which is freely available online in pdf format, there are several Java applets. These applets illustrate several variants of the simplex method, the network simplex method, and interior point methods. Some are designed to illustrate and others are intended as online exercises. I will demonstrate several of these applets and illustrate how they are integrated with the online version of the textbook.

■ TD03

Room 303

Engineering Applications in Global Optimization

Sponsor: Optimization/ Global Optimization
Sponsored Session

Chair: Jitamitra Desai, University of Arizona, 1127 E. James E. Rogers Way, 111, Tucson, AZ, 85721, United States, jdesai@sie.arizona.edu

1 - A Novel Clustering Approach and Prediction of Optimal Number of Clusters: Global Optimum Search

Christodoulos Floudas, Professor, Princeton University, Department of Chemical Engineering, Princeton, NJ, 08544, United States, floudas@titan.princeton.edu, Meng Tan

Cluster analysis of genome-wide expression data from DNA microarray hybridization studies is a useful tool for identifying biologically relevant gene groupings. In this study, we describe a novel clustering algorithm framework based on a variant of the Generalized Benders Decom-position, which includes a procedure to determine the optimal number of clusters to be used. We apply our algorithm to experimental DNA microarray data and compare with some commonly-used clustering algorithms.

2 - A Massively Parallel Version of the DIRECT Algorithm

Layne Watson, Professor, Departments of Computer Science and Mathematics, Virginia Polytechnic Institute & State University, Blacksburg, VA, 24061, United States, ltw@cs.vt.edu, Ana-Maria Visan, Pengyuan Wang, Clifford Shaffer, John Tyson

The deterministic direct search algorithm DIRECT of D. Jones has proven surprisingly practical, especially when coupled with a local pattern search algorithm such as MADS by Audet and Dennis. Massively parallel implementations of these algorithms, necessary for realistic problems, are highly nontrivial. This talk will summarize the parallel DIRECT and MADS algorithms, place them in the context of global optimization, and describe recent applications in MDO and systems biology.

3 - NET and sim Expression in Drosophila

Leo Lopes, Assistant Professor, University of Arizona, 1127 E. James E. Rogers Way, Room 111, Tucson, AZ, 85721, United States, leo@sie.arizona.edu, Jay Konieczka, Parker Antin

We present NET: the Network Elucidation Template, a framework for optimization procedures that find the complete structure of a network which is only partially observable. NET combines several methodologies to solve problems whose neighborhood strucutres are complex and whose objective evaluation is expensive. We illustrate NET with an implementation for finding the cell signaling network responsible for producing a line of cells in which the sim gene is expressed in Drosophila embryos.

4 - A Global Optimization Algorithm for Reliable Network Design
Jitamitra Desai, University of Arizona, 1127 E. James E. Rogers Way, 111, Tucson, AZ, 85721, United States, jdesai@sie.arizona.edu

We consider the problem of designing reliable networks that satisfy typical network constraints by allocating resources to mitigate the arc failure probabilities so as to minimize the total cost of network design and resource allocation. The resulting model formulation turns out to be a nonconvex mixed-integer 0-1 program for which a globally convergent branch-and-bound procedure is designed. Computational results are reported for a hypothetical case and related extensions are also presented.

■ TD04

Room 304

Cutting Planes in Integer Programmming

Sponsor: Optimization/ Integer Programming
Sponsored Session

Chair: Simge Kucukyavuz, Assistant Professor, University of Arizona, Systems and Industrial Engineering, Tucson, AZ, 85721, United States, simge@sie.arizona.edu

1 - Conic Mixed-Integer Programming Cuts
Alper Atamturk, Associate Professor, University of California at Berkeley, 4141 Etcheverry Hall, Berkeley, CA, 94720, United States, atamturk@ieor.berkeley.edu, Vishnu Narayanan

We present valid inequalities for conic mixed-integer programming for cutting off infeasible points of its continuous relaxation. We discuss aggregation and lifting techniques in this context.

2 - A Study of Stochastic Capacitated Lot-Sizing Problem
Yongpei Guan, Assistant Professor, The University of Oklahoma, 202 West Boyd Street, Room 124, Norman, OK, 73019, United States, Yongpei.Guan-1@ou.edu

This talk addresses a single-item stochastic capacitated lot-sizing problem. It can be verified that this problem is easily to be solved for two period case. For multiple period case, we investigate the performance of current developed valid inequalities for general stochastic integer programming for this problem. The final branch-and-cut algorithm shows the effectiveness of our approach.

3 - A Branch and Cut Algorithm for Finding the Minimum Distance of a Linear Code
Ahmet B. Keha, Assistant Professor, Department of Industrial Engineering, Arizona State University, PO Box 875906, Tempe, AZ, 85287-5906, United States, ahmet.keha@asu.edu

In this talk we introduce an integer programming formulation for the problem of finding the minimum distance of a linear code. We study the polyhedral structure of the single constraint relaxation of this integer programming formulation. We next show how we can use the strong inequalities found as our cuts in a branch and cut algorithm. We finally present some computational experiments that shows the effectiveness of our cuts.

■ TD05

Room 305

Operations Management in Supply Chains

Contributed Session

Chair: John R. Birge, Professor, University of Chicago, Graduate School of Business, 5807 S. Woodlawn Avenue, Chicago, IL, 60637, United States, john.birge@chicagogsb.edu

1 - Dynamic Pricing When Consumers Are Strategic
Chunyang Tong, Marshall School of Business, University of Southern California, Los Angeles, CA, United States, Chunyant@marshall.usc.edu, Sriram Dasu

We study the dynamic pricing policy when single-unit demand buyers are strategic at timing their purchase for perishable product. We also provide extensive computational experiment to show that value increase between posted pricing and contingency pricing scheme and suboptimality due to limited number of price changes by numerical studies.

2 - Dynamic Pipeline Management - Exploiting a Moving Decoupling Point
Bart MacCarthy, Professor of Operations Management, University of Nottingham, Business School, Jubilee Campus, Nottingham, NG7 2RD, United Kingdom, bart.maccarthy@nottingham.ac.uk

An open planning pipeline that allows changes to product specifications and dynamic allocation to customers, potentially increases flexibility in responding to customer demand. The approach results in a moving decoupling point and is very relevant to high variety situations where customer specifications need to be matched to some degree. Simulation results are presented from the automotive sector where the Virtual-Build-to-Order concept has emerged to exploit open pipeline planning.

3 - Rescheduling Production in a Multiplant Environment
Bharatendu Srivastava, Associate Professor, Marquette University, PO Box 1881, Department of Management, Milwaukee, WI, 53201-1881, United States, bharat.srivastava@marquette.edu

In today's global supply chains, it is essential that firms fully exploit their production capabilities. We address a specific problem related to managing the production in a multiplant global environment. Because of the dynamic nature of the system, the initial production assignment at various facilities may not remain optimal over time. In this paper, we look at practical approaches to rebalancing the production load at various manufacturing sites.

4 - Uncertainty, Technology, and Market Effects on Production, Inventory, and Financing Decisions
John R. Birge, Professor, University of Chicago, Graduate School of Business, 5807 S. Woodlawn Avenue, Chicago, IL, 60637, United States, john.birge@chicagogsb.edu

OM models generally focus on relationships among input parameters in the form of costs, revenues, and demand uncertainty to determine outputs such as capacity, production, and inventory decisions. Economic models, on the other hand, often focus on the relationships between observable outputs and financial criteria such as market values and capital structure ratios. This talk will discuss models that attempt to merge these approaches in more integrated views of the firm.

■ TD06

Room 306

Rich Vehicle Routing Problems

Sponsor: INFORMS Computing Society/Heuristic Search
Sponsored Session

Chair: Arne Løkketangen, Professor, Molde University College, Britveien 2, Molde, 6411, Norway, Arne.Lokketangen@hiMolde.no

1 - Vehicle Routing for a Just-In-Time Production System
Jeffrey Ohlmann, Assistant Professor, University of Iowa, S372 Pappajohn Business Building, Iowa City, IA, 52242- 199, United States, jeffrey-ohlmann@uiowa.edu, Michael Fry, Barrett Thomas

We consider the problem of routing a fleet of vehicles to make pickups from a network of suppliers in a lean production system. The pursuit of low work-in-process inventory and production smoothing throughout the system introduces complicating side constraints creating a vehicle routing problem with time windows and split deliveries. We present a heuristic approach and compare results obtained via common frequency routing to those obtained via general frequency routing.

2 - Collection of Animals for Slaughter - Adding Inventory Constraints to a VRP
Johan Oppen, PhD Student, Molde University College, PO Box 2110, Molde, 6402, Norway, johan.oppen@himolde.no, Arne Løkketangen

We present a problem that deals with collection of animals for slaughter. The problem is taken from the Norwegian meat industry, and may be viewed as a rich Vehicle Routing Problem extended with constraints regarding inventory and planned production at the slaughterhouse. Solution methods and computational results are presented.

3 - Using Scenario Trees and Progressive Hedging for Stochastic Inventory Routing Problems
Lars Magnus Hvattum, Molde University College, Britveien 2, Molde, 6411, Norway, lars.m.hvattum@himolde.no, Arne Løkketangen, Gilbert Laporte

In the Inventory Routing Problem (IRP) the goal is to coordinate inventory replenishment and transportation in order to minimize costs. We look at Stochastic IRPs, where the customers have stochastic demands, and where the overall problem being formulated as a discounted, infinite-horizon Markov Decision Process. Here we focus on applying the Progressive Hedging Algorithm as a heuristic for solving finite scenario trees that are used to approximate the Markov Decision Process.

4 - Transportation of Milk to Dairies Using Trailers
Arne Lokketangen, Professor, Molde University College, Britveien 2, Molde, 6411, Norway, Arne.Lokketangen@hiMolde.no, Arild Hoff

We address the problem of transportation of milk from farmers to dairies in rural Norway. Due to accessibility restrictions, the hangers are prohibited from entering the farms, and must be parked at designated spots. Milk is then collected by the main vehicle and then pumped to the trailer. We report from tests on real-world instances.

■ TD07

Room 307

Black Box Optimization

Sponsor: INFORMS Computing Society/Optimization: Computational Optimization and Software

Sponsored Session

Chair: Nick Sahinidis, Department of Chemical and Biomolecular Engineering, University of Illinois Urbana-Champaign, Urbana, IL, United States, nikos@uiuc.edu

1 - Quantitative Object Reconstruction Using X-Ray Tomography and Mixed Variable Optimization

Mark Abramson, Air Force Institute of Technology, 2950 Hobson Way, AFIT/ENC, Building 641, Wright-Patterson AFB, OH, 45432, United States, Mark.Abramson@afit.edu, John Dennis, Thomas Asaki, Rachael Pingel, Kevin O'Reilly

A new approach for quantitatively reconstructing objects from x-ray tomography radiograph data is introduced. A mixed variable programming (MVP) problem is formulated, in which the decision variables are the number and types of materials and the thicknesses of each layer. The objective is to minimize the difference between the data and an Abel transform model of the configuration. Numerical results, using the mixed variable pattern search algorithm are presented for several test configurations.

2 - Artificial Intelligence and Algorithms to Optimize Expensive Black-Box Functions

Deng Huang, Pacific Northwest National Laboratory, PO Box 999, MS-K6-08, Richland, WA, 99352, United States, deng.huang@pnl.gov, Rogene Eichler West, Theodore Allen

When the objective function is black-boxed and expensive, we analyze all available data points before the next move. Also we utilize low-fidelity data to reduce evaluation cost. These strategies mimic human actions in scientific discovery. Two methods are illustrated: Multiple Fidelity Sequential Kriging Optimization (MFSKO) and Hierarchical Bayesian Optimization Algorithm (hBOA). Application examples include radiation detector design and material discovery.

3 - Constrained Optimization of Computer Experiments Using an Expected Improvement Criterion

Brian Williams, Los Alamos National Laboratory, brianw@lanl.gov, Thomas Santner, William Notz, Jeffrey Lehman

In a computer experiment, deterministic responses are computed according to an experimental design of input settings. We introduce a sequential design for computer experiments where the goal is to find an input setting optimizing one output subject to a constraint determined by a second output. The idea of the methods is to compute the posterior expected "improvement" over the current optimum for each untested site; the design selects the next site to maximize the expected improvement.

4 - The DIRECT Global Optimization Algorithm with Nonlinear Equality Constraints

Don Jones, Technical Fellow, General Motors, 1970 Golfview Drive #209, Troy, MI, 48084, United States, don.jones@gm.com

DIRECT is a low-dimensional global optimization algorithm that does not require derivatives and, most importantly, has no tuning parameters controlling the balance between local and global search. These features make it quite robust. Previously versions of DIRECT handled simple bound constraints, nonlinear inequality constraints, and integrality constraints (integer variables). This talk explains how DIRECT can be further extended to handle strict nonlinear equality constraints.

■ TD08

Room 308

Panel Discussion: ETMERC - Engineering and Technology Management Education and Research Council

Sponsor: Technology Management

Sponsored Session

Chair: Dundar Kocaoglu, Professor, Portland State University, PICMET, Portland, OR, 97207, United States, kocaoglu@etm.pdx.edu

1 - Panel DIscussion: ETMERC - Engineering and Technology Management Education and Research Council

Moderator: Antonie de Klerk, President ETMERC, University of Pretoria, Pretoria, South Africa, amklerk@eng.up.ac.za, Panelists: Tinus Pretorius, Anthony Bailett, John Aje, William Flanner

ETMERC (Engineering and Technology Management Education & Research Council) addresses educational and research issues common to all educational institutions in this field. Activities include conducting benchmark studies, developing curriculum guidelines, establishing quality criteria, defining research agenda among others. ETMERC will be explained and activities described; an open discussion will be held on strategic issues, future directions and members' pro-active roles in defining the field.

■ TD09

Room 309

Product Development II

Contributed Session

Chair: Walter Correia, 1, Universidade Federal de Pernambuco, venida dos Reitores, CTG - Bloco Adminis, Rua Visconde de Jequitinhonha 1846/604, Recife, PE, 51021190, Brazil, ergonomia@terra.com.br

1 - Licensing Contract Design for R&D Projects: Single-Phase versus Multi-Phase Contracts

Pascale Crama, London Business School, Regent's Park, London, UK, NW1 4SA, United Kingdom, pcrama@london.edu, Zeger Degraeve, Bert De Reyck

We design licensing contracts for multi-stage R&D projects, when the licensor does not know the licensee's valuation and cannot enforce the licensee's effort level. The staged nature of R&D projects creates two decisions: the number of stages in the contract and the timing of the licensing. Additional project stages create real options, increasing the licensor's value from the contract. The licensor's timing decision depends on his risk-aversion as well as the characteristics of the licensee.

2 - New Product Development (NPD) Tools: Contingencies and Project Performance.

Debasish Mallick, Assistant Professor, Department of Decision Sciences, College of Business, University of St. Thomas, 1000 LaSalle Avenue # SCH 435, Minneapolis, MN, 55403-2005, United States, dnmallick@stthomas.edu, Roger Schroeder

Although new product development (NPD) process tools, such as CAD, PDM, QFD etc., are becoming increasingly popular, users often report mixed results. Using a cross industry survey of 189 new product development projects across six countries, we explore the effects of various environmental and project specific factors on the application of these tools and project performance.

3 - The Impact of the Developer Community on Software Development Performance

Jorge Adrian Colazo, University of Western Ontario, 1151 Richmond St. North, London, Canada, jcolazo@uwo.ca

This empirical study using data from online open source software repositories shows how contributions from non-core developers affect development performance. The effects of contributed bug reports, patches, and new feature requests on software quality and developer productivity are analyzed.

4 - A Field Study About Usability and Accidents with Products of Consumption: A Real Analisys in Recife

Walter Correia, 1, Universidade Federal de Pernambuco, venida dos Reitores, CTG - Bloco Adminis, Rua Visconde de Jequitinhonha 1846/604, Recife, PE, 51021190, Brazil, ergonomia@terra.com.br, Denise de Medeiros

This article shows a study done with users in Recife/Brazil, where it had been studied the behavior of a sample of users regarding usability of consumption products through the application of questionnaires and interviews. It was still applied with such users a questionnaire of SUS - System Usability Scale, with the objective of verifying the users' opinion regarding usability of the products that caused some kind of accident.

■ TD10

Room 310

Software Demonstration

Cluster: Software Demonstration

Invited Session

1 - Responsive Learning Technologies, Inc. - Online Games for Operations Courses

Sam Wood, Responsive Learning Technologies, 4546 El Camino Real, #243, Los Altos, CA, 94022, wood@responsive.net

See a demonstration of online games that are used in operations management courses and supply chain management courses in more than 100 undergraduate and MBA-level programs to teach topics like capacity management, lead time management, inventory control, and supply chain design and logistics.

2 - AMPL Optimization LLC - New Solver Support in the AMPL Modeling Language
Robert Fourer, AMPL Optimization LLC, 900 Sierra Place SE, Albuquerque, NM, 87108-3379, 4er@ampl.com, David Gay

Using a variety of examples, this presentation will survey the AMPL modeling language's support for new linear and integer optimization features in CPLEX 10 and nonlinear optimization features in KNITRO 5. Of particular interest are CPLEX's direct handling of certain logical implications and KNITRO's recognition of complementarity conditions as constraints.

■ TD11

Room 311

Healthcare Resource Management

Contributed Session

Chair: George Konstantinow, OR-Analysis.com, 142 La Vista Grande, Santa Barbara, CA, 93103, United States, george.konstantinow@or-analysis.com

1 - Alert & Response Framework for Social Disaster
Wei Ding, IBM China Research Lab, Zhongguancun Software Park, Beijing, BJ, China, dingw@cn.ibm.com, Chunhua Tian, Rongzeng Cao

The alert and response framework for social disaster with detailed algorithms are proposed in this paper. Based on history event records, the key causes and rules are analyzed for proactive outbreak detection. According to critical paths identified by complex network analysis, reservation network and inventory policy are designed with long-term saving mode and short-term response mode. A case study about SARS illustrates the application of such framework.

2 - Supply Optimization at a Public Health System in Central Mexico
Arturo Cordova, Full Time Professor, Unv Politecnica de Aguascalientes, Prol Mahatma Gandhi Km 2, San Francisco del Arenal, Aguascalientes, 20280, Mexico, arturo.cordova@upa.edu.mx

Lack of efficiency and disorganization in warehouses create obstacles in the operation of medications and treatment material supplying at the clinics, hospitlals drugstores of a public health system in a central Mexico state. An empirical research allows us to identify errors at distribution centers, as well as the effect of those errors on the pharmaceutical availability, patient atention and inventory investment.

3 - Comparing Performance in Static Versus Dynamic Deployment EMS Systems
Jeff Goldberg, Associate Dean of Academic Affairs, College of Engineering, 200 Engineering, Tucson, AZ, 85721, United States, jgoldberg@arizona.edu, Rashid Al-Jalahema

In the design of emergency vehicle systems, one can use a fixed deployment design where each vehicle has a home base, or one can use a dynamic deployment design where the set of bases depends on the current state of the system and vehicles are re-deployed to different bases. We discuss models for estimating expected coverage performance in both designs and provide a case study based on data from Peel Region, Canada.

4 - Multiobjective Optimization in Resource Management for Healthcare Providers
George Konstantinow, OR-Analysis.com, 142 La Vista Grande, Santa Barbara, CA, 93103, United States, george.konstantinow@or-analysis.com, John Denning

Resources - physicians, facilities, and equipment - for healthcare services are typically allocated independently according to the specific procedures they support (surgical, ER, nursing, etc.). We present multiobjective optimization methods for medical resource identification and allocation and demonstrate how these optimize service delivery for healthcare providers by cost and value.

■ TD12

Room 312

Beyond Spreadsheets

Sponsor: Spreadsheet Productivity Research

Sponsored Session

Chair: Dennis Moritz, Advantage for Analysts LLC, 2 Harrison Street, 6th Floor, San Francisco, CA, 94105, dennis.moritz@advantageforanalysts.com

1 - A Case for a New Financial Modeling Metaphor
Dennis Moritz, Advantage for Analysts LLC, 2 Harrison Street, 6th Floor, San Francisco, CA, 94105, dennis.moritz@advantageforanalysts.com

The evolution of spreadsheet technology has been paralleled by an increasing complexity of modeling needs. We propose that the modeling and execution of sophisticated financial structures require a new modeling metaphor. We outline and provide examples of a new metaphor and the advanced analytics needed to support contemporary financial decisions.

■ TD13

Room 313

PART 2: "Effective Use of Software in the MS/OR Classroom" - INFORMS Transactions on Education Special Issue

Sponsor: Education (INFORM-ED)

Sponsored Session

Chair: Denise Troxell, Associate Professor, Babson College, Mathematics and Sciences Division, Babson Park, MA, 02481, United States, troxell@babson.edu

1 - Integrating MS/OR Modeling into an ERP Course
Dale Flowers, Associate Professor, Weatherhead School of Management, Case Western Reserve University, 10900 Euclid Avenue, Cleveland, OH, 44106, United States, dale.flowers@case.edu

In this paper, I describe a graduate course in Enterprise Resource Planning (ERP) systems that utilizes a set of MS/OR case studies, where all the cases are from the same company. The cases range from detailed and operational issues such as the BOM explosion to more strategic issues such as hierarchical production planning and distribution network design. They reveal the integration between different modules of an ERP system, and are facilitated via the use of the STORM software package.

2 - Business School Management Science Courses Should Teach Spreadsheet Engineering
Thomas Grossman, Associate Professor of Information & Decision Science, School of Business and Management, University of San Francisco, 2130 Fulton Street, San Francisco, CA, 94117, United States, tagrossman@usfca.edu

This paper seeks to help faculty deliver spreadsheet engineering abilities to improve student access to spreadsheet management science, and increase student satisfaction. Business students who rely on spreadsheets can use management science only to the extent that they can build a spreadsheet model of an unstructured business situation. Spreadsheets are a rapid development computer programming language that requires spreadsheet engineering principles.

3 - Developing Interactive Tutorials to Support the Teaching of Spreadsheet Modeling Skills
Kala Seal, Professor, Loyola Marymount University, One LMU Drive, Los Angeles, CA, 90045, United States, kseal@lmu.edu, Linda Leon, Zbigniew Przasnyski

McCarthy's 4MAT model shows active experimentation to be a large part of learning for all types of learners. We use 4MAT as the theoretical underpinning to develop, and field test, interactive tutorials using current screen capture software to support the teaching of spreadsheet modeling in OR/MS. Individual faculty can now design and create such support modules in a reasonable amount of time. We discuss implementation issues, benefits and limitations of this approach.

4 - Creating Individualized Data Sets for Student Exercises Using Microsoft Excel and Visual Basic
Don Wardell, Associate Professor, University of Utah, Department of Management, 1645 E. Campus Center Drive, Salt Lake City, UT, 84112, United States, mgtdgw@business.utah.edu, Weiyu Tsai

We describe an approach that utilizes Excel macros to help instructors to enhance and assess their students' learning. We begin by explaining a specific macro, Data Generator, which mainly helps statistics instructors to create assignment questions where data sets used in the questions are randomly generated according to the instructor's instructions. We then describe a more general approach. We also provide a suggested procedure to help instructors grade the students' answers automatically.

■ TD14

Room 314

Supply Chain Execution and Optimization

Sponsor: e-Business

Sponsored Session

Chair: Chien-Yu Chen, Assistant Professor, George Mason University, 4400 University Drive, Fairfax, VA, 22030, United States, cchen8@gmu.edu

Co-Chair: Zhenying Zhao, Intel Corporation, 5000 W. Chandler Boulevard, Chandler, AZ, United States, zhenying.zhao@intel.com

1 - Dealing with Multi-Objectives in Optimization-Based Master Production Scheduling(MPS)

Zhenying Zhao, Intel Corporation, 5000 W. Chandler Boulevard, Chandler, AZ, United States, zhenying.zhao@intel.com

Optimization-based MPS outperforms traditional heuristic approaches due to its capability to consider complex constraints and solution optimality. In this paper, a stochastic mixed integer programming (MIP) model is presented for a generic multi-plant MPS problem. Two major issues regarding MPS are discussed: 1) Handling demand uncertainty with scenario-based stochastic programming formulation; 2) Dealing with multiple objectives with sequential solve execution.

2 - Supply and Demand Synchronization in Assemble-to-Order Supply Chains

Markus Ettl, IBM Research, PO Box 218, Yorktown Heights, NY, 10598, United States, msettl@us.ibm.com, Karthik Sourirajan, Pu Huang

In this paper we propose a novel availability management process called Available-to-Sell (ATS) that incorporates demand shaping and profitable demand response to drive better supply chain efficiency through improved synchronization of supply and demand. We develop an analytical optimization model to assess how the proposed availability management system affects supply chain performance and apply the model in a server computer manufacturing environment.

3 - Pre-Allocating Multi-Component Available-to-Promise Quantities Using a Stochastic Programming Model

Chien-Yu Chen, Assistant Professor, George Mason University, 4400 University Drive, Fairfax, VA, 22030, United States, cchen8@gmu.edu

To support real-time order promising, an available-to-promise (ATP) system allocates available assemble-to-order (ATO) components before knowing actual customer orders. Assuming discrete distributions of future demands, we pre-allocate multiple ATO components into distinct time-product buckets by using a stochastic linear programming (SLP) model. The two-stage SLP model is solved with L-shaped decomposition method. The SLP solution is tested against simulated continuous demand distributions.

■ TD15

Room 315

Panel Discussion: What Should We Teach Students About Auctions?

Cluster: Auctions and e-Commerce

Invited Session

Chair: Michael H. Rothkopf, Professor, Rutgers, The State University of New Jersey, 640 Bartholomew Road, Piscataway, NJ, 08854, United States, rothkopf@rutcor.rutgers.edu

1 - Panel Discussion: What Should We Teach Students about Auctions?

Moderator: Michael H. Rothkopf, Professor, Rutgers, The State University of New Jersey, 640 Bartholomew Road, Piscataway, NJ, 08854, United States, rothkopf@rutcor.rutgers.edu, Panelists: Charles A. Holt, Karla Hoffman, Sandy Jap, Tuomas Sandholm, Charles W. Smith

Different disciplines have different ways of thinking about auctions, and real auctions don't always oblige by fitting completely into any of these particular ways of thinking. This presents a challenge for course content decisions. What's a poor professor to do?

■ TD16

Room 316

Selected Topics in Revenue Management

Cluster: Dynamic Pricing and Forecasting

Invited Session

Chair: Catalina Stefanescu, Assistant Professor of Decision Sciences, London Business School, Regent's Park, London, NW1 4SA, United Kingdom, CStefanescu@london.edu

1 - Acquisition Pricing with Future Repricing

Robert Phillips, Nomis Solutions, robert.phillips@nomissolutions.com

We consider setting the initial price of a fixed term service contract in the case in which future re-pricing is an option. Re-pricing may occur on a periodic basis or at the discretion of the seller. Examples of this setting include many service contracts, magazine subscriptions, bank deposits, credit lines and loans. We present a specific application to the case of credit lines.

2 - Multi-Flight Demand Untruncation with Recapture

Richard Ratliff, Sabre Holdings, Richard.Ratliff@sabre-holdings.com

We discuss a new method for demand untruncation using origin-destination booking activity across multiple flights in a market. This approach involves choice models which estimate market-class group demand across flights. We give closed-form solutions for estimating flight spill and recapture, unique to the specific pattern of flight closures and bookings. Computational experience with this methodology shows considerable promise in reducing forecast errors.

3 - An Adaptive Algorithm for Multiple-Fare-Class Capacity Control Problems

W. Tim Huh, Assistant Professor, Columbia University, 500 W. 120th Street, MC4704, New York, NY, 10028, United States, th2113@columbia.edu, Paat Rusmevichientong

We study a single-resource capacity control problem where demands for several fare classes arrive sequentially and are independent of one another. The manager does not know the demand distributions explicitly, but instead has access to historical data. We consider repeated sales of a fixed capacity and develop an adaptive algorithm that determines protection levels over time based on historical sales data.

4 - Competition in Network Revenue Management

Nishant Mishra, London Business School, London, United Kingdom, nmishra.phd2003@london.edu, Victor DeMiguel

We consider a model for oligopolistic competition in network revenue management. For such a system, we show the existence and uniqueness of equilibrium under certain conditions. We also perform numerical experiments and show how competition will affect revenue management practices in comparison to the case of a monopoly making centralized decisions.

■ TD17

Room 317

Joint Session SIM/QRS: Statistical Methods in Quality Control and Simulation I

Sponsor: Simulation, Quality, Statistics and Reliability

Sponsored Session

Chair: Seong-Hee Kim, Assistant Professor, Georgia Institute of Technology, 765 Ferst Drive, NW, Atlanta, GA, United States, skim@isye.gatech.edu

1 - Spatial Design Strategies for Fitting Forward-Inverse Metamodels

Russell Barton, Professor, Penn State University, Smeal College of Business, University Park, PA, 16802, United States, rbarton@psu.edu

In simulation, metamodels approximate the simulation input-output function. When there are multiple measures of performance, the same set of data used to fit the (forward) metamodels may be used to construct approximations for inverse functions. These inverse maps are often useful for product or process design. We show the performance of some strategies for constructing spatial experiment designs for fitting forward and inverse metamodels.

2 - Distribution-Free SPC Methods for Monitoring Variability

Seong-Hee Kim, Assistant Professor, Georgia Institute of Technology, 765 Ferst Drive, NW, Atlanta, GA, United States, skim@isye.gatech.edu

We consider the problem of monitoring variability of autocorrelated processes. This paper combines variance estimation techniques from simulation literature with two statistical process control charts from statistical process control (SPC) literature. The proposed SPC methods do not require any assumptions on the distribution of the underlying process and determine the control limits analytically.

3 - Comparison of Measures for Identifying Dispersion Effects in Replicated Factorial Experiments

Bruce Ankenman, Associate Professor, Northwestern University, Industrial Engineering and Management Sciences, 2145 Sheridan Road, Box 3119, Evanston, IL, 60208, United States, ankenman@northwestern.edu, Angela Dean, Cheryl Dingus

It is well accepted that variance is seldom constant in simulation experiments. In this talk, several measures of dispersion are compared for identifying the effects of various factors on the dispersion of a response using factorial experiments. We compare the power curves for several measures and make recommendations for practitioners for cases of normal and non-normal responses.

4 - A Hybrid Method for Simulation Factor Screening

Hong Wan, Assistant Professor, School of Industrial Engineering, Purdue University, 315 N. Grant Street, West Lafayette, IN, 47907, United States, hwan@purdue.edu

Controlled Sequential Bifurcation (CSB) and Controlled Sequential Factorial Design (CSFD) are two new screening methods for simulations. Both methods control the Type I Error and power of the screening results. The scenarios at which each method is most efficient are complementary. This paper proposes a two-stage hybrid approach to combine CSB and CSFD. The new method usually has the same error control as CSB and CSFD and are more efficient than either component method.

■ TD18

Room 318

Terrorism: Society and Energy Issues

Cluster: Counter Terrorism and OR

Invited Session

Chair: Sheldon Jacobson, Professor, University of Illinois, 201 N. Goodwin Avenue, Urbana, IL, 61801, United States, shj@uiuc.edu

1 - Algorithms for Network Interdiction Under Suboptimal Enemy Behavior

J. Cole Smith, Associate Professor, University of Florida, ISE Department, 303 Weil Hall, Gainesville, FL, 32611-6595, United States, cole@ise.ufl.edu, Churlzu Lim

We examine the problem of fortifying networks to defend against enemy attacks. The enemy can destroy any portion of any arc, yielding a two-level program with an integer first-stage and a bilinear second-stage problem. We also discuss and provide algorithms for the case of suboptimal enemy behavior.

2 - Interdicting Nuclear Smugglers and Priorities

David Morton, Associate Professor, The University of Texas at Austin, Graduate Program in Operations Research, 1 University Station, C2200, Austin, TX, 78712-0292, United States, morton@mail.utexas.edu, Feng Pan

We describe an interdiction model for locating sensors that detect nuclear material. We model a nuclear material smuggler who selects a path to maximize the probability of avoiding detection. An interdictor installs sensors to minimize that maximum probability. We discuss how to form an optimal priority list of candidate sensor sites.

3 - The Economic Impact of Obesity on Automobile Fuel

Laura McLay, Virginia Commonwealth University, PO Box 843083, 1001 West Main Street, Richmond, VA, 23284, United States, mclay@illinoisalumni.org, Sheldon Jacobson

Obesity is a major public health problem in the United States. One socio-economic implication of obesity is that it reduces automobile fuel economy. This research quantifies the amount of additional fuel consumed (annually) in the United States by automobiles that is attributable to higher average passenger weights, during the period from 1960 to 2002. The results indicate that approximately 938 million gallons of fuel are consumed annually as a result of obesity when measured from 1960.

■ TD19

Room 319

Algorithms for Electricity Market Models: Dynamics and Uncertainty

Sponsor: Energy, Natural Resources & The Environment

Sponsored Session

Chair: Uday Shanbhag, Assistant Professor, Department of Industrial and Enterprise Systems Engineering, University of Illnois, Urbana-Champaign, Urbana, 61801, United States, udaybag@uiuc.edu

1 - Supply Function Dynamics, Equilibrium, and Local Stability Analysis in Electricity Markets

Lin Xu, Graduate Research Assistant, University of Texas at Austin, Austin, TX, United States, linxu@mail.utexas.edu, Ross Baldick

A typical electricity market uses supply function competition. We consider whether update dynamics lead to an SFE when participants begin with supply functions that are in the neighborhood of the SFE. As observed by Baldick and Hogan, the space of supply functions is not a Banach space, so that standard local stability analysis results do not hold. Following Hogan and Baldick, we truncate the infinite dimensional supply function space and apply stability analysis.

2 - Methods for MPEC Planning Problems in Energy

Steve Gabriel, Assistant Professor, Department of Civil & Environmental Engineering, University of Maryland, 1143 Martin Hall, College Park, MD, 20742, United States, sgabriel@umd.edu, Antonio Conejo, Yohan Shim, Raquel Garcia-Bertrand

Certain energy planning can be considered as mathematical programs with equilibrium constraints (MPEC). Consider electric power markets where upper-level variables choose which generators operate in a given time period to satisfy desirable properties (e.g., minimum profit conditions). The lower-level variables relate to the production levels of the active generators, the loads and locational prices of the network. We examine new Benders-like methods for solving these difficult problems.

3 - Conjectured Supply Function Equilibria Under Uncertainty

Andrew Liu, Johns Hopkins University, Whiting School of Engineering, Baltimore, MD, United States, lliu@jhu.edu, Uday Shanbhag

We employ the Conjectured Supply Function approach to model a two-period stochastic game in which players compete in supply functions in the first period and make generation (recourse) decisions in the second-period. The resulting problem may be formulated as a stochastic complementarity problem. A scalable algorithm for solving such a problem is suggested and its convergence properties are discussed briefly. Finally, some results from a small electrical network are reported.

4 - Electricity Market Models: Addressing Uncertainty

Uday Shanbhag, Assistant Professor, Department of Industrial and Enterprise Systems Engineering, University of Illnois, Urbana-Champaign, Urbana, 61801, United States, udaybag@uiuc.edu

Several models of competitive behavior in electricity markets are considered in an uncertain setting. In each case, decomposition and sampling-based algorithms are suggested, accompanied by convergence results and computational experience.

■ TD20

Room 320

Risk Analysis in Decision Analysis

Contributed Session

Chair: Kamonkan Laksana, ISE Department, Lehigh University, 200 West Packer Avenue, Bethlehem, PA, 18015, United States, kal5@lehigh.edu

1 - Comparative Assessment of Multi-Criteria Decision Analysis Tools for Contaminated Site Management

F. Kyle Satterstrom, Cambridge Environmental, 58 Charles Street, Cambridge, MA, 02141, United States, Satterstrom@Cambridgeenvironmental.com, Boris Yatsalo, Igor Linkov, Aleksander Tkachuk, Jongbum Kim, Greg Kiker

Three different multi-criteria decision analysis (MCDA) methods were applied in two case studies involving contaminated sediment management problems encountered in the New York/New Jersey Harbor and the Cocheco Superfund Site in New Hampshire. Our analysis shows that the three different tools point to similar management solutions, no matter which tool is applied. MCDA tools and approaches were constructively used to elicit the strengths and weaknesses of each method when solving the problem.

2 - Deriving Rational Beliefs from Irrational Behavior

Aurelien Baillon, GRID (ENSAM - CNRS), Maison de la Recherche de l'ESTP, 30, avenue du Président Wilson, CACHAN, 94230, France, baillon@grid.ensam.estp.fr, Mohammed Abdellaoui, Peter Wakker

The paper reports the results of an experiment that elicits Bayesian beliefs from non-Bayesian choices. It uses these beliefs to study attitudes toward ambiguity. The elicitation method is based on subdividing the state space using the Ramsey-de Finetti "exchangeability". A subjective probability distribution is then deduced from this partition of the state space into equally-likely events and the attitude toward uncertainty is studied through the willingness to bet on those normalized events.

3 - Preference Reversals for Information Bundles
Onur Bakir, Postdoctoral Research Associate, Center for Risk and Economic Analysis of Terrorism Events, 3710 McClintock Avenue, RTH 314, Los Angeles, CA, United States, nbakir@usc.edu

It is well documented in decision analysis literature that ranking of information bundles using expected utility increase of information and buying price of information do not always agree. In this study, a simple lottery where the decision maker has multiple actions is considered. We analyze the conditions under which both approaches to evaluate information yield identical ranking between two information structures and provide counterexamples to cases where they don't.

4 - Determining the Optimal Level of Filtering Spam Mails
Richard Cho, Assistant Professor, University of New Brunswick, Faculty of Business, PO Box 5050, Saint John NB E2L 4L5, Canada, rcho@unbsj.ca, Dongmin Kim,

Many organizations offer their users the spam filter which screens the possible spam mails - unsolicited promotional mails. However, the spam filter often captures regular emails as spam mail, causing all sorts of trouble. This research compares the perceptual costs of deleting spam mails and of recovering regular mails from the spam filter and suggests the optimal spam-filtering level, under the assumption that the spam filter can change the level of spam screening.

5 - Designing Menus of Extended Warranty Contracts
Kamonkan Laksana, ISE Department, Lehigh University, 200 West Packer Avenue, Bethlehem, PA, 18015, United States, kal5@lehigh.edu, Joseph Hartman

The objective is to design a menu of EW contracts, differing in stipulations and prices for a population defined by risk characteristics. We design a menu of EW contracts which differ according length, age limits, ability to defer or renew, and prices with integer programming. Dynamic Programming is utilized to determine optimal customer policies and prices as input to the model. The results show that a menu of EWs can significantly improve profits when compared to offering a single EW.

■ TD21

Room 321

Best of Decision Analysis Affinity Group

Sponsor: Decision Analysis Society

Sponsored Session

Chair: Kazuo Ezawa, PhD, R&D Decision Analysis, Daiichi Sankyo Pharma Development, 399 Thornall Street, Edison, NJ, 08837, United States, kezawa@daiichisankyo-us.com

1 - Overview of the 2006 DAAG Conference in Baltimore, Maryland
Jack Kloeber, Director, J&J Pharma Group Portfolio Management, 700 Route 202 South, Raritan, NJ, 08869, jkloeber@prdus.jnj.com

Each year the Decision Analysis Affinity Group organizes a 2-3 day conference for practitioners of Decision Analysis. This year's venue was the beautiful Inner Harbor of Baltimore. The program was of high quality and was well attended, with over 80 participants from more than 25 companies. I will describe the DAAG charter and hit some of the highlights of the conference content, where all the presentations were focused on solving real decision analysis problems in these companies, including governmental and not-for-profit organizations.

2 - Tradeoffs in Portfolio Management System Design
Phil Beccue, Baxter BioScience, Phil_Beccue@Baxter.com, Chris Dalton

R&D portfolio management is about tradeoffs — how do we select the set of projects that best meets our objectives given the constraints on our resources. Crafting a portfolio management system also involves tradeoffs. We discuss how Baxter BioScience made difficult tradeoffs in designing and implementing its new portfolio management system, and how other objectives might lead to different choices.

3 - Valuing Information Plans versus Discrete Information - Setting Management Expectations to Lower Information Costs
Ellen M. Coopersmith, Decision Frameworks, Inc., ellen@decisionframeworks.com

Those of us who make the effort to value information often do so comparing discrete information choices - do we want to run a long or short test or a small versus a large pilot? This often results in the comparison of less reliable, but less expensive information to more reliable, more expensive information - and leads to the acquisition of the most reliable and expensive information source, which can be justified for the cost. However, with better understanding of how to utilize the results of the reliability of information estimate and value-of-information approach, teams can evaluate and recommend more cost effective INFORMATION PLANS. This means teams recommending, and managers funding, information plans - rather than the most reliable information, which can be justified, pre-acquisition. Information plan approval often involves immediate funding for less information, and secondary funding for more information, contingent on interpretation results of the initial information in the plan. This case study reviews how information is valued, the role of the reliability of interpretation estimate in information valuation, and the use of the results of that estimate to determine when additional information might be valuable. Moreover, it underscores that it is often not a matter of acquiring one information source or another, but under what interpretations will additional, sequential information be valuable. In this example, we consider a short versus a long test and look at the reliability, cost and value of each, and compare that to the expected cost and value of a well-designed testing plan. More importantly, the presentation will end with a conversation on how to facilitate the "information plan" funding conversation with management - clearly recognizing that some aspects of this approach are unconventional in many organizations across a gambit of industries.

4 - Introducing Decision Analysis Techniques to the Vaccine Research Center (VRC, NIAID, NIH)
Ajoy Chakrabarti, Director, Vaccine Product Development, Contractor/MSD, Inc., Vaccine Research Center (VRC), NIAID, NIH Building 40, Room 2512, 40 Convent Drive, Bethesda, MD, 20892, chakrabartia@mail.nih.gov

Selective implementation of decision analysis approaches has helped structure VRC clinical development plans. I will use a vaccine development plan as a case study to compare & contrast public versus private sector (pharmaceutical company) uses of decision analysis to improve vaccine/drug development.

■ TD22

Room 322

Optimizing the Air Force Academy

Sponsor: Military Applications

Sponsored Session

Chair: Andrew Armacost, Associate Professor of OR, US Air Force Academy, 2354 Fairchild Drive, Suite 6J100, USAFA, CO, 80840, United States, Andy.Armacost@usafa.af.mil

1 - Initial Career Selection Process for Air Force Officers
James Lowe, Professor, 2354 Fairchild Drive, USAF Academy, CO, 80840, Jim.Lowe@usafa.af.mil, Andrew Armacost

The USAF Academy annually commissions 1,000 men/women into the AF. The process of matching cadets to careers involved data collection, a review panel, and time-consuming matching of cadets to jobs. In 2000, we began to improve the process. The intial phase occurred over a 2-year period, full-scale use happened for the next 2 years. In 2004, the academy committed resources to integrate our models into its database. In 2006, we integrated our system with the ROTC process and provide results.

2 - Optimizing Common-Period Exam Scheduling at the U.S. Air Force Academy
Steven Clark, Instructor, 2354 Fairchild Drive, USAF Academy, CO, 80840, Steven.Clark@usafa.af.mil, Andrew Armacost

Exams for most core-curriculum courses at the Academy are scheduled during a common exam period. To avoid over-scheduling cadets, the Registrar's office used a greedy heuristic to de-conflict the academic departments and determine a schedule. We present an improvement to this approach that uses a mixed-integer optimization formulation to minimize schedule conflicts and meet department preferences. The model was successfully incorporated into the Academy's scheduling system in the Fall of '04.

3 - Final Exam Scheduling at the US Air Force Academy
Christopher Nielsen, 2354 Fairchild Drive, U.S. Air Force Academy, CO, 80840, United States, christopher.nielsen@usafa.af.mil, Andrew Armacost

Each semester, the AF Academy registrar must generate final exam schedules for 4000 students. The current greedy scheduling algorithm is frequently unable to find feasible schedules for every cadet. We formulate the problem as a mixed-integer program. We present computational results, offer alternate formulations to enhance tractability, and discuss integration into our campus information system.

4 - Scheduling Summer Programs at the AF Academy via Integer Programming
Andrew Armacost, Associate Professor of OR, US Air Force Academy, 2354 Fairchild Drive, Suite 6J100, USAFA, CO, 80840, United States, Andy.Armacost@usafa.af.mil, Johnathon Dulin

Each of the 4000 cadets at the AF Academy must be scheduled for multiple programs over their nine-week summer period. We develop and solve a binary integer program to generate a workable solution. This model, now being integrated into the campus-wide information system, dramatically reduces the number of unscheduled cadets. It also provides the human scheduler insight into how program enrollment levels affect schedule feasibility.

■ TD23

Room 323

Global Sourcing: Trends, Decisions and Strategies

Cluster: Global Services Sourcing

Invited Session

Chair: Aleksandra Mojsilovic, Research Staff Member, IBM Research, Room 31-215, Route 134, 1101 Kitchawan Road, Yorktown Heights, NY, 10598, United States, aleksand@us.ibm.com

1 - Contracting and Performance Outcomes in Software Development Outsourcing: A Field Study

Sandra Slaughter, Associate Professor of Information Systems, Tepper School of Business, Carnegie Mellon University, Tech & Frew Streets, Pittsburgh, PA, 15213, United States, sandras@andrew.cmu.edu, Donald Harter, Soon Ang

This study traces the complete chain of effects of ex ante contractual conditions and ex post performance outcomes of three types of contracts in software development outsourcing: time and materials, fixed price, and a hybrid contract. We examine archival data collected on the quality, budget and schedule performance of software development contracts completed by a service provider for a major client. Our findings suggest that different contract types maximize different performance outcomes.

2 - The Impact of Emerging Technology on Global Sourcing

Howard Sachar, Director, SO Innovation, Americas, IBM Global Services, 17 Skyline Drive, Hawthorne, NY, 10532, United States, hsachar@us.ibm.com

As the costs associated with operational and maintenance functions dominate IT budgets, these functions are becoming the target of emerging technologies. Increasing research and entrepreneurial focus is directed to the high economic value of replacing support labor with technology. Over the next five to ten years, service technologies will alter the IT landscape, changing the quantity and quality of resources demanded. This talk will discuss these trends and projections.

3 - Avoiding Pitfalls When Outsourcing Commodity IT Services

Cynthia Beath, Department of Information, Risk and Operations Management, McCombs School of Business, CBA 5.202, University of Texas at Austin, Austin, TX, 78712-1175, United States, Cynthia.Beath@mccombs.utexas.edu

Outsourcing commodity IT services has proven to be problematic for both buyers and vendors. This presentation argues that successful buyers and vendors 1) Identify commodity services differently; 2) Find a partner with overlapping interests; and 3) Take actions throughout the process to ensure both parties achieve long-term benefits.

■ TD24

Room 324

Contracts

Contributed Session

Chair: Jun-Yeon Lee, University of Houston-Victoria, 603 Lornmead Drive, Houston, TX, 77024, United States, leej@uhv.edu

1 - Middlemen in Supply Chain Contracts

Yulan Wang, Fuqua School of Business, 1 Towerview Drive, Duke University, Durham, NC, 27708, United States, yw4@duke.edu, Paul H. Zipkin

The paper investigates a moral hazard problem in the context of a buy-back contract for a decentralized two-stage supplier-retailer chain. Here, the retailer's purchasing agent and the supplier's sales agent play middleman roles. We study impacts of such agents' behavior on supply chain performance under both the supplier-as-leader and retailer-as-leader settings. The results may help explain some recent instances of accounting fraud.

2 - Designing Supply Contracts for an Innovative Durable Product: Issues of Commitment and Coordination

Xiuli(Sophia) He, Doctoral Candidate, The University of Texas at Austin, 1632 W 6th Street, Apt #P, Austin, TX, 78703, United States, xiuli.he@phd.mccombs.utexas.edu, Genaro Gutierrez

We study the dynamic interactions in a decentralized channel, composed of a manufacturer and a retailer, to launch an innovative durable product (IDP). The manufacturer maximizes the life cycle profits from the IDP while the retailer may be committed or uncommitted. We show that the manufacturer and retailer may have conflicts in the preferences of retailer's commitment choice. We use slotting allowances and revenue sharing contract to fully coordinate both types of retailers.

3 - Previous-Order-Based Quantity Discount Contracts in a Stochastic, Two-Period Inventory Model

Jun-Yeon Lee, University of Houston-Victoria, 603 Lornmead Drive, Houston, TX, 77024, United States, leej@uhv.edu

We examine previous-order-based quantity discount contracts between a manufacturer and a retailer in a stochastic, two-period inventory model. The manufacturer gives the retailer a price discount on purchases in excess of the previous order quantity or a price discount for all units if the retailer orders more than the previous order quantity. We characterize the retailer's optimal inventory policy. Our computational study provides several managerial insights.

4 - Uncovering the Myths of Supply Chain Collaboration

Kenneth Saban, Associate Professor, Duquesne University, 806 Rockwell Hall, Pittsburgh, PA, 15282, United States, saban@duq.edu

Collaboration is being promoted as a "Silver Bullet" to maximizing supply chain performance. Yet, current studies show that supply chain collaboration is rarely achieved. Using case study methodology, this poster session will underscore many of the "core competencies" to supply chain collaboration.

■ TD25

Room 325

Management of Technology I

Contributed Session

Chair: Dong-Ju Yi, PhD Candidate, Techno-Economics & Policy Program at Seoul National University, 37-415 Seoul National University, Silim 9 Dong Gwan-Ak Gu, Seoul, South Korea, chrisken@bcline.com

1 - A Conceptual Analysis of M-Technology as a Medium Towards E-Governance Society in Emerging Countries

Nihat Kasap, Assistant Professor, Sabanci University, Orhanli - Tuzla, Istanbul, 34, 34956, Turkey, nihatk@sabanciuniv.edu, Ronan Jouan De Kervenoael, Enes Eryarsoy

This paper shows how mobile phone technology can influence the development of e-governance in emerging countries. We evaluate the conditions under which consumers really engage with m-services. We argue that the lower cost of m-infrastructure is more appropriate than the Internet-based structure that prevents large part of the population access to ICT. However, m-technology should not be separated from the Internet but be integrated allowing emerging country to leap frog the technological cycle.

2 - Evaluation of Turkey Vision 2023 Technology Foresight Project

Orhan Dursun, Tubitak, Kosuyolu Cad Baris Mah No 48, TUSSÝDE Gebze, Kocaeli, 41, Turkey, orhan_dursun@yahoo.com, Baris Çarikci

The purpose of the national foresight is to define a "continuous and progressed""national strategy" by bringing the developments in the Sci &Tech to an appropriate form to the social and economics needs of the country with cooperation among gov.-industry-society. The aim of this study is to evaluate the Vision 2023 Technology Foresight Project, the first national TF study in Turkey, and to advance a proposal to following studies by analysing the strengths and the weaknesses in its all facets.

3 - International Organization for Standardization (ISO): Its Role in Globalizing Product Improvement

Daniel Owunwanne, Assistant Professor, Howard University, 2600 6th Street, NW, Washington, DC, United States, dowunwanne@Howard.edu, Mohammad Quasem

ISO plays a vital role in the quality of any product globally. It serves as a high standard and a benchmark across the globe. Open System Interconnection (OSI), as an ISO standard for worldwide communications defines a networking framework for implementing protocols in seven layers. It was conceived to allow interoperability across different platforms. In this study, we will examine the impact of ISO productivity in general, especially its effect in under developed countries.

4 - Extending Project Time-Cost Analysis by Removing Precedence Relationships and Task Streaming

Bruce Pollack-Johnson, Professor of Mathematical Sciences, Villanova University, Department of Mathematical Sciences, 800 Lancaster Avenue, Villanova, PA, 19085, United States, bruce.pollack-johnson@villanova.edu, Matthew Liberatore

We propose the addition of two related approaches to expedite a project: increasing the parallel processing of tasks by completely removing precedence relationships, or streaming tasks by fractionally removing precedence relationships. We present a quadratic mixed integer programming approach for reducing project completion time that considers crashing as well as the removal and modification of precedence relationships.

5 - Restructuring Selection Criteria for Public Subsidy Program
Dong-Ju Yi, PhD Candidate, Techno-Economics & Policy Program at Seoul National University, 37-415 Seoul National University, Silim 9 Dong Gwan-Ak Gu, Seoul, South Korea, chrisken@bcline.com, Jongwook Jeong, Jeong-Dong Lee

So far, public subsidy fund has not been being monitored well and allocated efficiently on the perspective of the tax expenditure. This is owes to lack of well-developed selection criteria on the government support system. The aim of this paper is to shed some light on selection criteria for public subsidy program.

■ TD26

Room 326

Data Mining Applications

Sponsor: Data Mining
Sponsored Session

Chair: Teresa Wu, Assistant Professor, Arizona State University, Industrial Engineering Department, Tempe, AZ, 85287, United States, teresa.wu@asu.edu

1 - On Intelligent Outsourcing Resource Selection
Dan Zhu, Iowa State University, 3226 Gerdin Business Building, Ames, IA, United States, dzhu@iastate.edu

Resource selection is one of the most important steps in outsourcing decision making processes. This paper considers a data intensive selection problem in outsourcing software development projects. We analyze the properties of the resource selection problem and propose some criteria for automatic resource selection model. A simple-minded model, a traditional rough set model, and a generalized rough set (GRS) model are introduced and the advantages and disadvantages of each model are compared.

2 - Optimization for Data Reduction
Sigurdur Olafsson, Assistant Professor, Iowa State University, Department of Industrial and Manufacturing Systems Engineering, Ames, IA, 50011, United States, olafsson@iastate.edu, Shuning Wu

Data reduction is critical to most data mining projects. Selecting relevant variables, often referred to as feature or attribute selection, is well known, and in the last few years instance selection has begun to receive more attention. In this talk we discuss attribute and instance selection from an optimization perspective. We show how both problems can be formulated as combinatorial optimization problems and discuss possible solution methods.

3 - Adaptive Web Presence and Evolution Through Web Usage Mining
Xueping Li, Assistant Professor, University of Tennessee, Knoxville, Xueping.Li@utk.edu, Laigang Song

This paper considers establishing adaptive web presence and evolution through web mining. It presents a workload characterization study for Internet web servers. Several workload invariants are identified which are deemed important since they potentially reveal the universal truth for all web servers. These regularities and patterns shed light on how to design a better Web and enhance its performance.

4 - Rough Set Based Approach to Clustering Categorical Data Using Rough Set Theory
Teresa Wu, Assistant Professor, Arizona State University, Industrial Engineering Department, Tempe, AZ, 85287, United States, teresa.wu@asu.edu

This research proposes a new algorithm for clustering categorical data, termed Min-Min-Roughness, based on the Rough Set Theory, which has the ability to handle the uncertainty in the clustering process. Soybean and Zoo data sets are used to compare MMR with the results from fuzzy set based algorithms. In addition, a larger dataset, Mushroom, is used to compare MMR with Squeezer, K-modes, LCBCDC, ROCK and a traditional hierarchical algorithm.

■ TD27

Room 327

Reliability Optimization 2

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: David Coit, Associate Professor, Rutgers University, Industrial & Systems Engineering, Piscataway, NJ, 08844, United States, coit@rutgers.edu

1 - Solving the Redundancy Allocation Problem to Maximize System Reliability Using Column Generation
David Coit, Associate Professor, Rutgers University, 96 Frelinghuysen Road, Piscataway, NJ, 08854, United States, coit@rci.rutgers.edu, Leila Zia

The redundancy allocation problem is a well-known problem to maximize system reliability by selecting components and redundancy levels. In this formulation, a custom column generation algorithm is developed and applied to the problem. It has superior features compared to existing mathematical programming approaches to the problem.

2 - Structured Maintenance Policies on Interior Sample Paths
Lisa Maillart, Assistant Professor, University of Pittsburgh, lisa.maillart@case.edu, Ludmila Zheltova

We examine the problem of adaptively scheduling perfect observations and preventive replacements for a multi-state, Markovian deterioration system with silent failures such that total expected discounted cost is minimized. We contribute to the existing literature which models this problem as a partially observed Markov decision process by extending the at-most-four-region structure of the optimal policy to non-extreme sample paths.

3 - Probabilistic Solution Discovery Heuristic for Multistate Series-Parallel Systems
Jose Emmanuel Ramirez-Marquez, Assistant Professor, Stevens Institute of Technology, Castle Point on Hudson, Hoboken, NJ, 07030, United States, jmarquez@stevens.edu

This research illustrates solution discovery heuristics for the problem of resource allocation for the optimization of network performance. Network problems are prevalent in every area of technology. Currently, solution approaches for network performance optimization are restricted to traditional operations research approaches or highly involved heuristics. The algorithms are expected to have a broad range of applicability such as: Financial, Manufacturing and Network Reliability.

4 - Planning of Accelerated Degradation Tests for Robust Design of Manufacturing Quality Parameters
Jye-Chyi (JC) Lu, Professor, Georgia Institute of Technology, Ferst Drive, Atlanta, GA, 30022, United States, jclu@isye.gatech.edu, Lingyan Ruan

Typical experimental designs for accelerated degradation tests (ADTs) assume that products are from the same manufacturing condition. This talk proposes a framework of designing ADTs for selecting manufacturing conditions that lead to longest product percentile lifetime, minimized variance of lifetime estimates and also least sensitivity of environmental noise factors creating variation of product reliability.

■ TD28

Room 328

Design and Analysis of Experiments

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: James Delaney, Visiting Assistant Professor, Carnegie Mellon University, Department of Statistics, Baker/Porter Hall 132B, Pittsburgh, PA, 15213-3890, United States, jdelaney@stat.cmu.edu

1 - Evolutionary Designs for Robust Parameter Design Experimentation
Eduardo Santiago, The Pennsylvania State University, 350 Leonhard Building, University Park, PA, 16802, United States, eus146@psu.edu, Enrique Del Castillo

In Robust Parameter Design, Crossed Array and Mixed Resolution designs have been suggested as alternative ways to perform experimentation. However, different constraints make some of these designs inadequate. We present the application of an evolutionary strategy (CMA-ES) to produce optimal designs in terms of D and G optimality. The methodology presented allows the user to produce new experimental designs according to specific needs in number of runs, model and design space.

2 - Analysis of Optimization Experiments
James Delaney, Visiting Assistant Professor, Carnegie Mellon University, Department of Statistics, Baker/Porter Hall 132B, Pittsburgh, PA, 15213-3890, United States, jdelaney@stat.cmu.edu, Roshan Vengazhiyil

Not uncommon are designed experiments with the primary purpose being to determine optimal settings for all of the factors in some prescribed set. Here we distinguish between the two concepts of statistical significance and practical significance. We perform estimation via a Bayesian data analysis methodology that has been detailed in the recent literature. But then propose an alternative to the usual next step in determining optimal factor settings.

3 - Nested Space-Filling Designs for Multiple Experiments with Different Levels of Accuracy

Zhiguang Qian, Assistant Professor, Department of Statistics at the University of Wisconsin-Madison, 1220 Medical Sciences Center, Madison, WI, 53706, United States, zhiguang@stat.wisc.edu, Jeff C. F. Wu, Boxin Tang

Construction of designs for multiple experiments with different levels of accuracy is a new issue because traditional methods deal almost exclusively with a single experiment. In this paper we propose a method for constructing nested space-filling designs for this type of multiple experiments. The construction is aided by use of Galois field and orthogonal arrays. Multiple design sets generated by the proposed method are guaranteed to possess some space-filling property.

4 - Contour Estimation from Complex Computer Codes Using Sequential Design

Pritam Ranjan, Simon Fraser University, 8888 University Drive, Burnaby, BC, V5A1S6, Canada, pritamr@cs.sfu.ca, Derek Bingham, George Michailidis

In many engineering applications, one is interested in identifying the values of the inputs in computer experiments that leads to a response above a pre-specified threshold or, in a region of interest. In this talk we introduce statistical methodology that identifies the desired contour(s) in the input space. Application includes estimation of highest posterior density (HPD) region.

■ TD29

Room 329

Combinatorial Optimization in Medicine & Healthcare

Cluster: Joint Cluster Healthcare/ HAS: Healthcare Engineering
Invited Session

Chair: Allen Holder, Trinity University Mathematics, One Trinity Place, San Antonio, United States, aholder@trinity.edu

1 - Simulation-Based Optimization Approach for Maximizing Liver Allocation Efficiency

Nan Kong, Assistant Professor, Industrial and Management Systems Engineering, University of South Florida, ENC 2505, Tampa, FL, 33620, United States, kong@eng.usf.edu

Liver allocation efficiency is greatly affected by how matched patients are ranked on the waiting list, which is determined by the allocation policy. We develop a simulation model of the waiting list with input of patient prioritization. We focus on one aspect of the prioritization: the clustering of allocation service areas. Since our ultimate goal is to find the optimal policy, we integrate simulation and optimization to ease computational burden and incorporate allocation modeling realism.

2 - Using Vector Quantization & the P-Median Problem in Radiotherapy

Allen Holder, Trinity University Mathematics, One Trinity Place, San Antonio, United States, aholder@trinity.edu, Gino Lim, Josh Reese

We show that the discrete versions of quantization design and the P-median problem are the same. We use this connection to heuristically solve a combinatorial problem in radiotherapy design.

■ TD30

Room 330

Decision Models in Healthcare

Sponsor: Health Applications Section
Sponsored Session

Chair: Julie Simmons Ivy, Assistant Professor, University of Michigan, 701 Tappan Street, Ann Arbor, MI, 48109, United States, jsimmons@bus.umich.edu

1 - An Integer Programming Model for Breast Cancer Treatment Scheduling

Illya Hicks, Associate Professor, Texas A&M University, Industrial and Systems Engineering MS 3131, Zachry Engineering Center, College Station, TX, 77843-3131, United States, ivhicks@tamu.edu, Elif Kolotoglu, Kathleen Diehl

Tamoxifen and several types of Aromatase Inhibitors (AI) have been used for the prevention and adjuvant treatment of breast cancer. However, there is currently conflicting evidence and several unanswered questions regarding which inhibitor is most effective for use in post menopausal patients. In this study, our aim is to design effective 5-year drug treatment plans considering Tamoxifen and AIs for postmenopausal women with breast cancer using integer programming techniques.

2 - Childbirth and Pelvic Floor Dysfunction: An Integrated Decision Analysis

Sejal Patel, University of Michigan, L4000 Women's Hospital, 1500 E. Medical Center Drive, Ann Arbor MI 48109-0276, United States, sejalnp@umich.edu, John DeLancey, Dee Fenner, Julie Ivy, Divya Patel, Scott Ransom, Xiao Xu

We present a decision model for comparing elective cesarean section and planned vaginal delivery, while considering long-term complications including pelvic floor dysfunction. Published data on costs and probabilities of maternal and infant outcomes were used to model cost-effectiveness. Our findings should inform the current debate surrounding elective cesarean section.

3 - Scheduling Adjuvant Endocrine Therapy for Breast Cancer

Sera Kahruman, Texas A&M University, College Station, TX, United States, sera@neo.tamu.edu, Sergiy Butenko

Tamoxifen and Aromatase Inhibitors(AIs) are the endocrine therapy agents used for breast cancer. Although the trial data comparing AIs with tamoxifen show superior efficacy of AIs, the optimal treatment plan is not known yet. Given the patient information, our aim is to design an effective treatment plan, which minimizes risk of recurrence, increases survival chances and keeps side effects within some tolerable limits, by using regression analysis and several mathematical models.

4 - Delivering Preventive Mental Healthcare Services - A Service Engineering Perspective

Vittal Prabhu, Associate Professor, Penn State University, 348 Leonhard Building, University Park, PA, 16802, United States, prabhu@engr.psu.edu, Vamsi Salaka, Meg Small, Celene Domitrovich

This talk presents our recent experience in delivering preventive mental healthcare services in K12 schools in Harrisburg and Baltimore. Service engineering issues we cover include process modeling to characterize the capacity and cost of implementation; program implementation and evaluation for overall effectiveness; technology for providing access to information in real-time. We illustrate similarities between such preventive healthcare processes and manufacturing quality processes.

■ TD31

Room 331

Financial Engineering

Contributed Session

Chair: Mike Ludkovski, Assistant Professor of Mathematics, University of Michigan, East Hall, 530 Church Street, Ann Arbor, MI, 48109, United States, mludkov@umich.edu

1 - Evaluation of Firm's Loss Due to Incomplete Information in Real Investment Decision

Michi Nishihara, Kyoto University, Yoshidahonmachi, Sakyo-ku, Kyoto, 6068175, Japan, michi@amp.i.kyoto-u.ac.jp, Masao Fukushima

We investigate the effect of incomplete information in a model where a start-up pioneers a new market but will eventually be expelled from the market by a large firm's subsequent entry. We evaluate the start-up's loss due to incomplete information about the large firm's behaviour. We clarify conditions under which the start-up needs more information about the large firm. The proposed method of evaluating the loss could also be applied to other real options models involving several firms.

2 - Liquidity Saving Algorithm for Real-Time Gross Settlement System

Chunhua Tian, Staff R&D Engineer, IBM China Research Lab, Zhongguancun Software Park, Beijing, BJ, China, chtian@cn.ibm.com, Wei Ding, Rongzeng Cao, Shun Jiang

A pattern based liquidity saving approach is proposed for real-time gross settlement system in this paper. According to the Herfindahl index of the payment matrix, payment scenarios are divided into 3 patterns: uniformly distributed, biased towards high liquidity participants, biased towards low liquidity participant. Then the algorithms of entry deposition and queuing dissolution for each pattern are proposed. The effectiveness of such approaches is illustrated through a simulation experiment.

3 - Computing Option Bounds Using Generalized Moment Problems

Chanaka Edirisinghe, Professor, University of Tennessee, SMC-610, College of Business, Knoxville, TN, 37996, United States, chanaka@utk.edu

Pricing contingent claims is addressed using discrete-time multi-period scenario trees. The problem is shown to be a certain generalized moment problem at each state node, which is bounded via a simplicial DP algorithm. It is shown why arbitrage-free multi-period (state price) scenario trees are easier to generate as proportional transactions costs increase.

4 - Partial Hedging Using Malliavin Calculus
Lan Ma Nygren, Assistant Professor, Rider University, 2083 Lawrenceville Road, Lawrenceville, NJ, 08648, United States, lnygren@rider.edu, Peter Lanker

We consider the problem of partial hedging of derivative risk when the investor's attitude towards the shortfall is captured by a general convex loss function. A close form formula for the optimal terminal wealth is obtained using the duality approach. The explicit representations of the optimal partial hedging strategies are developed using the Malliavin calculus approach. Examples are worked out for a European call option and a standard lookback put option.

5 - Indifference Pricing of Annuities Under Stochastic Hazard and Interest Rates
Mike Ludkovski, Assistant Professor of Mathematics, University of Michigan, East Hall, 530 Church Street, Ann Arbor, MI, 48109, United States, mludkov@umich.edu, Virginia R. Young

We study indifference pricing of mortality contingent claims in a fully stochastic model. We assume both stochastic interest rates and stochastic hazard rates governing the population mortality. We begin with a continuous-time model where we derive the linear pdes satisfied by the indifference prices under exponential utility. We then also provide a more flexible discrete-time analogue that is illustrated with a numerical example.

■ TD32

Room 332

Supply Chain Optimization I

Contributed Session

Chair: Maher Lahmar, University of Houston, E209 Engineering Building 2, Houston, TX, 77204, United States, mlahmar@uh.edu

1 - Workload Balancing Through Subcontracting: Applications of Fourier Analysis and Goal Programming
Bogdan Bichescu, University of Tennessee, 329 Stokely Management Center, 916 Volunteer Boulevard, Knoxville, TN, 37996, United States, bichesbc@email.uc.edu, Michael Fry, George Polak

We propose a novel approach to workload balancing for a company facing nonstationary demand and having little ability to hold inventory. We use Fourier analysis and Walsh basis functions to decompose an input workload profile into a portfolio of contracts to achieve a desired constant workload. We also develop mathematical programs to make the portfolio more realistic by placing constraints on the available contracts. Numerical analysis based on a data set from a power company is performed.

2 - Bilinear Reduction Based Algorithms for Solving Network Flow Problems with Concave Cost Functions
Artyom Nahapetyan, University of Florida, Department of Industrial and Systems Engineering, 303 Weil Hall, PO Box 116595, Gainesville, FL, 32611-6595, United States, artyom@ufl.edu, Panos Pardalos

We consider concave piecewise linear network flow problems, where the mathematical formulation involves binary variables and belongs to MIP. We propose a bilinear reduction of the problem and prove that a global solution of the reduction problem is a solution of the initial linear mixed integer formulation. Based on the theoretical results, we propose a heuristic algorithm to solve the problem. In addition, we extend the result and adapt the algorithm to solve fixed charge network flow problems.

3 - Capacity and Price Setting with Customer Location and Waiting Effects
Mike Pangburn, Assistant Professor, University of Oregon, 488 Lillis Building, Eugene, OR, 97408, United States, pangburn@uoregon.edu, Effie Stavrulaki

We consider a firm serving two distinct customer segments from a distribution facility. These customers may be heterogenous not only relative to their reservation prices for the firm's product or service, but also in their time sensitivity. Orders from customers arrive according to a Poisson process, and are served on a first-come firstserved basis. We examine the monopolist firm's optimal pricing and capacity-setting policies, to maximize the net profits from both segments.

4 - Optimal Control Policies for Production/Inventory Systems with Exchange Transactions
Maher Lahmar, University of Houston, E209 Engineering Building 2, Houston, TX, 77204, United States, mlahmar@uh.edu, Nilesh Kulkarni

High-volume systematic transshipments of substitutable products, aka as exchanges, are common in petro-chemical industries. We consider a centralized two-location make-to-stock system with exchanges where demand changes with market status. We model the system as an infinite horizon discounted MDP with modulated demand. We characterize the optimal production and inventory policies and investigate the value of market information and exchange transshipments, and their impact on service levels.

■ TD33

Room 333

Estimation of Airport Capacity I

Sponsor: Aviation Applications

Sponsored Session

Chair: Peter Kuzminski, The MITRE Corporation, MS: N590, 7515 Colshire Drive, McLean, VA, 22102, United States, petekuz@mitre.org

1 - Network Flow Based Stochastic Programming Formulations for Capacity Planning at Airport Terminals
Senay Solak, School of Industrial and Systems Engineering, Georgia Institute of Technology, 765 Ferst Drive, Atlanta, GA, 30332, United States, ssolak@isye.gatech.edu, John-Paul Clarke, Ellis Johnson

We develop functions to approximate maximum delays in passageways and processing stations at airport terminals during peak demand periods, and use these delay functions to propose stochastic programming formulations based on a network representation of the whole airport terminal. Solutions of the proposed models provide optimal capacity requirements for each area in an airport terminal during the initial building phase, as well as the optimal expansion policy under stochastic future demand.

2 - A Discrete-Time Simulation Model for the Airport Capacity/Delay Analysis
Hojong Baik, Virginia Polytechnic Institute and State University, 301 Patton Hall, Blacksburg, VA, 24060, United States, hbaik@vt.edu, Antonio Trani

We introduce a new simulation model, named VTASIM, developed for the analysis of airfield operations. Unique features of VTASIM are: 1) It is a discrete-time simulation model; 2) It can capture the communication activities between pilots and controllers; 3) To find efficient taxiing paths between gates and runway exits, the time-dependent shortest path algorithm is implemented, and 4) For runway operations, two types of aircraft sequencing (i.e., FCFS and optimized) methods are applied.

3 - Airport Capacity and Delay Assessment for RJ Fleet Upgauging Options
Alexander Klein, George Mason University, Fairfax, VA, United States, aklein1@gmu.edu, Jianfeng Wang

Using New York LaGuardia (LGA) as example, we analyze upgauging when a proportion of RJ fleet is replaced by larger aircraft. This affects airport capacity in terms of terminal airspace, runway, taxiway system, and gate capacity. We show that moderate upgauging does not lead to increased delays. At the same time, while aircraft such as B757 and larger carry more passengers, they affect airport capacity and their use needs to be balanced.

■ TD34

Room 334

Hazard Management and Evacuation IV

Sponsor: Transportation Science & Logistics

Sponsored Session

Chair: Ann Campbell, Associate Professor, Department of Management Sciences, University of Iowa, Iowa City, IA, 52242, United States, ann-campbell@uiowa.edu

1 - Routing of Public Transit Vehicles in Urban Emergency Evacuation
Fatemeh Sayyady, Mississippi State University, 350 McCain Engineering Building, Mississippi State, MS, 39762, United States, fs131@msstate.edu, Sandra Duni Eksioglu

We developed an off-line dynamic public transit routing plan to pick up and deliver evacuees to the safety. We formulated the problem as a network flow problem. In the planning stage, we generated a number of dissimilar paths between every origin-destination pair based on the current urban infrastructure. Given the impact of the disaster on the current infrastructure and given the public response time, we identified routes for transit vehicles to minimize the total evacuation time.

2 - Multistage Recovery of Transportation Networks
P.R. Raghavender, University of California-Davis, Civil and Environmental Engineering, Davis, CA, 95616, United States, ragpalavadi@ucdavis.edu, Yueyue Fan

Recovery of transportation networks has traditionally been modeled as a single stage problem. Here we will propose a multistage network recovery procedure that identifies the optimal sequence of recovery to maximize the total societal benefits accrued during the recovery period. This model offers higher flexibility in terms of incorporating various uncertainties into the decision making process.

3 - D4S2 - Dynamic Discrete Disaster Decision Simulation System
Bopaya Bidanda, Ernest Roth Professor & Chairman, Industrial Engineering, University of Pittsburgh, 1048 Benedum Hall, Pittsburgh, PA, 15261, United States, Bidanda@engr.pitt.edu, Matthew Kelley, Shengnan Wu, Carey Balaban, Larry Shuman, Ken Sochats

Computer simulations are useful for planning improved responses to large-scale, complex disasters, which, due to their magnitude and multiple contingencies, are impractical to study in physical role-playing simulations. D4S2 integrates agent-based simulation, geographic information systems and discrete event simulation in a decision support tool for designing emergency response protocols.

4 - Routing for Relief Efforts
Ann Campbell, Associate Professor, Department of Management Sciences, University of Iowa, Iowa City, IA, 52242, United States, ann-campbell@uiowa.edu, Dieter Vandenbussche, William Hermann

The routing problems inspired by disaster relief require new methodologies. We focus on alternative objective functions including minimizing the maximum arrival time and minimizing the average arrival time. We bound the worst case performance of optimal VRP solutions with respect to these new variants. We also present solution approaches for these two variants and use these in computational experiments to evaluate average cost/service tradeoffs.

■ TD35

Room 335

Distribution Problems in Facility Logistics II

Sponsor: Transportation Science & Logistics

Sponsored Session

Chair: Russell Meller, University of Arkansas, Department of Industrial Engineering, Fayetteville, AR, 72701, United States, rmeller@uark.edu

1 - Comparing Transportation Systems for Inter-Terminal Transport at the Maasvlakte Container Terminals
Rommert Dekker, Erasmus University Rotterdam, School of Economics, Rotterdam, Netherlands, rdekker@few.eur.nl, Mark B. Duinkerken, Stef T.G.L Kurstjen, Nico Dellaert, Jaap A Ottjes

A comparison between Multi-Trailers, Automated Guided Vehicles and Automated Lifting Vehicles used for inter terminal transport is given. The evaluation is based on the number of containers arriving too late at their destination versus the amount of equipment needed in this respect. The analysis gives insight into the importance of the different characteristics of the transport systems and their interaction with the handling equipment.

2 - Order Batching and Throughput Models Considering Picker Congestion
Rakesh Nagi, Professor, Department of Industrial & Systems Engineering, 438 Bell Hall, University at Buffalo (SUNY), Buffalo, NY, 14260, United States, nagi@buffalo.edu, Rajan Batta, Melih Temel

We consider the order batching problem and picker assignment problem in distribution facilities. We formulate an objective that considers total travel, picking and picker blocking time and formulate the order batching problem to minimize this objective.

3 - The Aisle Design Problem for Unit-Load Warehouses
Kevin Gue, Associate Professor, Auburn University, Department of Industrial & Systems Engineering, Auburn, AL, 36849, United States, kevin.gue@auburn.edu, Russell Meller

We introduce and build models for the aisle design problem for unit-load warehouses, where the challenge is to construct picking and cross aisles in a way that minimizes expected retrieval time. Our results include a simple warehouse design that promises a 20 percent reduction in expected labor cost for warehouses of reasonable size.

4 - Is Taller Always Better? Configuring a Storage Area for Person-on-Board Order Picking
Russell Meller, University of Arkansas, Department of Industrial Engineering, Fayetteville, AR, 72701, United States, rmeller@uark.edu, Pratik Parikh

The conventional assumption in configuring a storage area for person-on-board order picking is that taller is always better since taller systems increase storage density. Increasing storage density also reduces the length of the pick tour in the order picking area. So what could be wrong with this assumption? We present the answer to that question by developing an analytical model of this design problem and show that taller is not always better.

■ TD36

Room 336

Urban Transportation Planning Models VII: Network Equilibrium

Sponsor: Transportation Science & Logistics

Sponsored Session

Chair: Lei Zhang, Assistant Professor, Civil, Construction, and Environmental Engineering, Oregon State University, 220 Owen Hall, Corvallis, OR, 97331, United States, lei.zhang@oregonstate.edu

1 - Method of Successive Weighted Averages for Stochastic User Equilibrium
Xiao-Zheng He, University of Minnesota, hexxx069@tc.umn.edu, Henry Liu, Bingsheng He

SUE models are slow to converge because the auxiliary flow pattern generated at each iteration of the Method of Successive Averages (MSA) contributes equally to the final solution. We introduce the method of successive weighted averages (MSWA). Computation results show the convergence speedup factor is in a manner of magnitude.

2 - Box-Constrained Inverse Variational Inequality and its Application in Toll Pricing
Henry Liu, Assistant Professor, University of Minnesota, Department of Civil Engineering, 500 Pillsbury Drive SE, Minneapolis, MN, 55123, United States, henryliu@umn.edu, Xiao-Zheng He, Bingsheng He

Traffic management authority often wants to adjust toll prices so as to maintain a high level of service for paying drivers,. We formulate such problems as an inverse variational inequality with box-constraints for the lower and upper limits of volume/capacity ratios of toll links. We illustrate with a computational example.

3 - A Behavioral User Equilibrium Principle for Traffic Assignment: Theory and Model
Lei Zhang, Assistant Professor, Civil, Construction, and Environmental Engineering, Oregon State University, 220 Owen Hall, Corvallis, OR, 97331, United States, lei.zhang@oregonstate.edu

Wardrop's user equilibrium principle assumes perfect spatial knowledge and utility maximization behavior. In reality, users' route choice decisions are achieved through adaptive route search processes and involve spatial leaning. We address the important behavioral question of how individuals actually search for routes and achieve Behavioral User Equilibrium (BUE).

4 - The Development of a Spatially and Temporally Scalable Dynamic Traffic Assignment Model
Yi-Chang Chiu, Assistant Professor, University of Arizona, PO Box 210072, Tucson, AZ, 85721, United States, chiu@utep.edu, Jorge A. Villalobos, Pitu Mirchandani

We present the theoretical development and implementation of a spatially and temporally scalable DTA (STS-DTA) model. The STS-DTA model utilizes a cluster-computing methodology that enables flexible scaling of the network. The Anisotropic Mesoscopic Simulation (AMS) model provides temporal scalability in traffic simulation resolution. Model semantics and research issues are discussed.

■ TD37

Room 337

Evaluating Strategies for the e-Commerce Channel

Sponsor: Information Systems Society

Sponsored Session

Chair: Gilbert Karuga, Assistant Professor, University of Kansas, 1300 Sunnyside Avenue, Lawrence, KS, 66045, United States, gkaruga@ku.edu

1 - Evolution of Bidders' Willingness to Pay in Sequential Auctions
Gilbert Karuga, Assistant Professor, University of Kansas, 1300 Sunnyside Avenue, Lawrence, KS, 66045, United States, gkaruga@ku.edu, Paulo Goes, Arvind Tripathi

We investigate how bidders in online sequential auctions learn from available information, form and update their willingness to pay. We analyze the learning and bidding strategies of the bidders as well as the effect of auction design on bidders' willingness-to-pay in sequential auctions. We show that bidders' willingness to pay in sequential auctions is driven by previous auction participation experience, past auction outcomes, and auction design parameters.

2 - Analysis and Insights of Marketing Through Blogs
Mohammad Rahman, The University of Kansas, 345 Summerfield, Lawrence, United States, rahman@ku.edu, Gilbert Karuga, Paulo Goes

Firms are realizing that including promotional messages in the blog content may be an effective way to market their products, in addition to banner ads on blogsites. Can firms buy out blogger support? Will bloggers mislead their audiences in response to sponsorship offers? Should blog readers continue to believe bloggers, even amidst uncertainty or deception? We model promotional blogging within a game-theoretic framework to answer these questions.

3 - Reactivity Models to Analyze Online Auction Dynamics
Wager Miera, Universidade Federal de Minas Gerais, Av. Antônio Carlos 6627 - Prédio do ICEx, Minas Gerais, Brazil, meira@dcc.ufmg.br, Paulo Goes, Adriana Pereira

We introduce the concept of reactivity to analyze the dynamic behavior of online auction participants. We then develop two constructs to assess reactivity levels: the entropy of the auction and the outbid-by graph. Advanced techniques for time series and graph mining are discussed to detect dynamic behavior patterns.

■ TD38

Room 338

Transportation Logistics

Contributed Session

Chair: Hozumi Morohosi, Professor, National Graduate Institute for Policy Studies, 7-22-1, Roppongi, Minatoku, Tokyo, 106-8677, Japan, morohosi@grips.ac.jp

1 - An Integer Linear Programming for Container Stowage Problem
Feng Li, IBM China Research Lab, Diamond Building, ZGC Software Park, Beijing, China, flicn@hotmail.com, Chunhua Tian, Rongzeng Cao, Wei Ding

So far most stowage planning only considers the stowage of single type containers and often neglects vessel stability. Here a 0-1 linear programming model is proposed. The objective is to maximize space utilization while minimize the operation cost from upload and download of different types containers at each port of a multi-port journey, with vessel stability, industry regulations and customized rules as the constraints. The efficiency of the proposed heuristic algorithm is illustrated.

2 - Analysis of Container Carriers Networks Through Simulation
Aldo McLean, University of Louisville, J.B. Speed Building, IE Department, Louisville, KY, 40292, United States, a0mcle01@netmail.louisville.edu, William E. Biles, Gerald W. Evans

Increasing demands for containerized services have resulted in the development of container carrier networks which are large, complex transportation systems. The current research focuses on the analysis of container carrier networks by evaluating the operation of the fleet and transshipment process of intermodal containers. Simulation and optimization models are integrated to evaluate and generate sets of alternative scenarios that could suggest improvements to the operation of the system.

3 - Shipper Procurement Planning with Freight Guarantees for Seasonally-Varying Demand
Zhou Xu, Graduating Student, Department of IELM, Hong Kong University of Science and Technology, Clear Water Bay, Kwoloon, Hong Kong, xuzhou@ust.hk, Andrew Lim, Brian Rodrigues

This paper studies a transportation procurement problem with a seasonal capacity ratio policy, faced in a global manufacturer for freight sourcings. The policy smooths load allocations for carriers among various seasons, but creates hardness for the shipper to optimize its allocations. We have proposed a few methods to obtain tight upper and lower bounds for the optimums. A linear programming relaxation based method has performed the best, and been integrated in a software delivered in industry.

4 - Evaluating the Importance of Links in Road Network System by Path Counting Methods
Hozumi Morohosi, Professor, National Graduate Institute for Policy Studies, 7-22-1, Roppongi, Minatoku, Tokyo, 106-8677, Japan, morohosi@grips.ac.jp, Brian Gozun, Tatsuo Oyama

We apply Path Counting Methods (PCM) for evaluating the importance of road segments in Tokyo and Manila. The results show that PCM effectively detects crucial edges in road network system. Then we develop PCM to stochastic network for the sake of evaluating the stability of the network. The stability of two cities road network is computed numerically. The feature of each city network is shown by our method.

5 - Transportation Problems Involving Trailers and Tractors
Yune T. Han, Student, POSTECH, San31, Hyoja-Dong, Nam-Gu, Pohang, 790-784, South Korea, bluerain@postech.ac.kr, Soo Y. Chang, Jongho Park, Diego Klabjan

We consider an interesting transportation problem where trailers and tractors are involved in moving material. We identified a class of combinatorial problems for minimizing the number of tractors and trailers required to accommodate the transportation needs. We show that the problem is NP-hard and discuss complexities of several useful variants of the problems. We also propose and analyze efficient heuristics for the problem.

■ TD39

Ballroom B

Logistics II

Contributed Session

Chair: Susan Laird, Operations Research Analyst, Naval Air Systems Command, 47060 McLeod Road, Building 447, Room 100A, Patuxent River, MD, 20670, United States, susan.laird@navy.mil

1 - A Lagrangian Heuristic for Vehicle Rescheduling Problems with a Trip Cancellation Strategy
Jing-Quan Li, University of Arizona, 3426 E. 2nd Street, Tucson, AZ, 85716, United States, jingquan@email.arizona.edu, Pitu Mirchandani, Denis Borenstein

When a vehicle breaks down on a scheduled trip, one or more vehicles need to be rescheduled to serve that trip and other unfinished trips. We define the vehicle rescheduling problem (VRSP) for which the objective is to minimize the sum of operating costs, delay costs, schedule disruption costs, and trip cancellation costs. This study formulates an optimization model and shows that VRSP is NP-hard. An insertion-based Lagrangian heuristic is developed to obtain a good solution.

2 - Optimizing the Retrieval of Containers from a Bay
Tonguç Ünlüyurt, Assistant Professor, Sabanç University, Orhanlỳ, Tuzla, Istanbul, 34956, Turkey, tonguc@sabanciuniv.edu, Cenk Ayd'n

In this study, the retrieval of containers from a bay in a fixed sequence is discussed. Algorithms are developed to minimize the number of rehandles combined with the total distance traveled by the crane. The performance of the heuristics are compared among themselves and the optimal solution (for smaller size problems) obtained by a branch and bound algorithm. It is demonstrated that doing a cleaning up session before actually retrieving the container may lead to more efficient solutions.

3 - Freight Mode Choice in Combined Transportation Based on Genetic Algorithm
Zhuqing He, School of Management, Xi'an Jiaotong University, 28# Xianning Westroad, Xi'an, Sh, 710049, China, hzq@mail.xjtu.edu.cn, Linyan Sun

Freight mode choice is a key problem in combined transportation, but there are seldom papers based on quantitative analysis. The purpose of this paper is to outline a methodology to analyze the method of mode choice in combined transportation. An integral program model is established to choose freight mode in logistics corridor and Genetic algorithm is applied to solve this problem in this paper. An example indicates that the method is efficient in practice.

4 - Path Relinking for the Vehicle Routing Problem
Sin C. Ho, The Chinese University of Hong Kong, Shatin, New Territories, Hong Kong, Hong Kong, scho@se.cuhk.edu.hk, Michel Gendreau

This paper describes a tabu search heuristic (TS) with path relinking (PR) for the vehicle routing problem (VRP). TS is a local search method that explores the solution space more thoroughly than other local search based methods by overcoming local optima. PR is a method to integrate intensification and diversification in the search. It explores paths that connect previously found elite solutions. Computational results show that TS with PR is superior to pure TS on the VRP.

5 - Retooling the Navy's Capability for Aviation Maintenance and Logistics Modeling and Simulation
Susan Laird, Operations Research Analyst, Naval Air Systems Command, 47060 McLeod Road, Building 447, Room 100A, Patuxent River, MD, 20670, United States, susan.laird@navy.mil, Robert Brown

The operation of aircraft from ships offers many OR challenges. Critical is the depiction of aviation maintenance at sea. The Navy has a 40-year history using simulation for this task. Changes to processes, manpower, ship design, and aircraft have changed the OR requirements. This paper will address efforts to modernize the Navy's aviation maintenance simulation capability. The retooling scope ranges from the creation of data processing tools to operational analysis simulations

■ TD40

Room 401

Facility Location

Contributed Session

Chair: Minghua Zhu, IBM China Research Laboratory, Building 19 Zhongguancun Software Park, Beijing, BJ, China, zhumingh@cn.ibm.com

1 - Facility Location and Allocation Based on Clusters of Customers

Kurtulus Baris Oner, PhD Candidate, Technical University of Eindhoven, Faculteit Technologie Management, OPAC Group Paviljoen E14, Eindhoven, 5600, Netherlands, K.B.Oner@tm.tue.nl, Necati Aras, I. Kuban Altinel

A facility location and allocation problem in which facilities provide multiple services is introduced. Customer demand for services varies and it is assumed that the variation depends on locations of customers. The main objective is extracting m customer clusters and locating a customized facility for each cluster. A MINLP model is formulated and small artificial instances are solved by GAMS. A simulated annealing algorithm is also developed for solution of large problems.

2 - Optimal Sensor Location for Path Detection

Alixandra Demers, Graduate Student, North Carolina State University, Department of Civil, Construction, & Environmental Engineering, 208 Mann, 2501 Stinson Drive, Campus 7908, Raleigh, NC, 27695, United States, ademers@unity.ncsu.edu, George List

Observing travel is dependent on what is being transported, mode, instrumentation available, and network utilized. Therefore, as the flexibility, instrumentation, and fee for service is increased, observing the paths taken increases. An opportunity exists to increase observability as the quality of networks improves. This paper reviews instrumentation and inference methodologies available and presents a research plan for optimally locating various types of sensors throughout a road network.

3 - A Business Potential Tree Based Mechanism for Facility Location

Minghua Zhu, IBM China Research Laboratory, Building 19 Zhongguancun Software Park, Beijing, BJ, China, zhumingh@cn.ibm.com, Bin Zhang, Wenjun Yin, Jin Dong

Facility Location is the problem of deciding where and which format of new facilities to open on the presence of existing facilities. Traditional approaches are difficult to reach the optimal results. In this paper, a business potential tree based mechanism for facility location is presented. It includes three steps: business tree building, coverage matrix calculation and greedy heuristic search. Moreover, one GIS-based software workbench is also introduced.

■ TD41

Room 402

Stochastic Networks: Algorithms and Analysis

Sponsor: Applied Probability

Sponsored Session

Chair: Devavrat Shah, Assistant Professor, Massachusetts Institute of Technology, 32-D670, 77 Massachusetts Avenue, Cambridge, MA, 02139, United States, devavrat@mit.edu

1 - File Swarming Systems

Milan Vojnovic, Researcher, Microsoft Research, Cambridge, United Kingdom, milanv@microsoft.com

With some peer-to-peer file sharing applications, a data file is disseminated to users by users exchanging file pieces towards downloading the entire file (e.g. BitTorrent in the Internet). Our primary focus is on user file download time and robustness to rare pieces. We ask and provide some answers to the question: How do simple random replication strategies perform? We will also point to some piece replication strategies aiming for data streaming.

2 - Continuum Models for Broadcasting Over Sensor Networks

Sanjay Shakkottai, Assistant Professor, The University of Texas of Austin, ECE Department, Austin, TX, 78712, United States, shakkott@ece.utexas.edu, Sundar Subramanian, Ari Arapostathis

We study the role of geographic information and state information (i.e. memory of previous messages or transmissions) in reducing the redundant transmissions while broadcasting over a large-scale sensor network. We show that the absence of geographic/state information leads to broadcasting strategies that require an exponential number of transmissions, whereas networks with very little geographic or state information require only a polynomial number of transmissons.

3 - Traffic Engineering vs. Source Routing: Inefficiency and Paradoxes

Ramesh Johari, Assistant Professor, Stanford University, Terman Engineering Center 319, Stanford, CA, 94305, United States, rjohari@stanford.edu, Asuman Ozdaglar, Daron Acemoglu

Most large-scale communication networks, such as the Internet, consist of interconnected administrative domains. In this talk we will study the interaction between source (or selfish) routing across domains, and intradomain optimization by service providers. We will discuss the efficiency of the resulting outcome, as well as some paradoxes that can result from the interaction of traffic engineering and source routing.

4 - Achieving Capacity in Finite-Buffer Wireless Networks

Peter Momcilovic, Assistant Professor, University of Michigan, 1301 Beal Avenue, 4211 EECS, Ann Arbor, 48109, United States, petar@eecs.umich.edu, Predrag Jelenkovic, Mark Squillante

We study the existence of protocols that can achieve the capacity limit in a large, growing wireless network with the fixed buffer space in each node. The goal is to maximize the network throughput in the presence of packet losses caused by limited buffer space. We establish that the network cannot operate at its capacity limit with a finite buffer in each node. However, somewhat unexpectedly, we construct a protocol that obtains just a slightly smaller throughput even with very small buffers.

■ TD42

Room 403

Supply Chain Scheduling and Optimization

Cluster: Scheduling

Invited Session

Chair: Lei Lei, Rutgers, The State University of New Jersey, 180 University Avenue, Newark, NJ, 07102, United States, llei@andromeda.rutgers.edu

1 - Solving Difficult Extended Enterprise Scheduling Problems

Leyuan Shi, Professor, University of Wisconsin-Madison, 1513 University Avenue, Madison, WI, 53706, United States, leyuan@engr.wisc.edu, Yunpeng Pan

Real-life scheduling problems in an extended industrial enterprise are far more complex than classical models, due to the presence of complicating constraints. We propose a Nested Partitions framework to aptly deal with such constraints and provide efficient solutions to those problems. An example is presented to illustrate our idea.

2 - Production Control with Stochastic Processing Times and Random Demand

Vladimir Krasik, Stern School of Business, New York University, 44 West 4th Street, New York, NY, United States, vkrasik@stern.nyu.edu, Peter Lanker, Michael Pinedo

In this paper we consider the dynamic single class production control problem of a single make-to-stock production facility with random production times and demand. For the three cases of underlying demand and production time processes - deterministic, exponential and Brownian we compute total average cost, obtain optimal policies and make comparisons.

3 - Coordinated Dynamic Control of Marketing and Production

Jian Yang, Assistant Professor, New Jersey Institute of Technology, Department of Industrial Engineering, Newark, NJ, 07102, United States, yang@adm.njit.edu, Xiaolong Zhang

We study the dynamic profit maximization problem for a firm who exercises control on both marketing and production. The firm's marketing effort impacts the demand it faces, and the current-period demand in turn affects future demands in a subdued fashion. We find characterizations of optimal control policies.

4 - Solving the Coastal Gasoline Inventory-Distribution Problem

W. Art Chaovalitwongse, Assistant Professor, Rutgers University, 96 Frelinghuysen Road, Piscataway, NJ, 08854, United States, wchaoval@rci.rutgers.edu, Lei Lei, Su Gao, Wen Chen

We study the problem of integrated planning and scheduling of the production, inventory, and coastal distribution operations involving capacitated vessels. Given that the loading and unloading setup times are port-dependent, we analyze the properties the problem and propose a sequential optimization algorithm to solve it.

■ TD43

Room 404

Multiple Criteria Approaches to Wireless Network Applications

Cluster: Multi-Criteria Decision Making
Invited Session

Chair: Behnam Malakooti, Professor, Case Western Reserve University, 10900 Euclid Avenue, Olin 611, Cleveland, OH, 44106, United States, bxm4@po.cwru.edu

1 - Intelligent Delay Prediction for MANET Routing
Zhihao Guo, PhD Candidate, Case Western Reserve University, 10900 Euclid Avenue, Olin 613, Cleveland, OH, 44106, United States, zhihao.guo@case.edu, Behnam Malakooti

In this paper, we present a delay prediction mechanism using artificial neural network techniques. By incorporating our delay prediction mechanism into any proactive MANET routing protocols, we expect to realize better routing information exchange efficiency, more accurate routing decision making, and more balanced bandwidth utilization. Our prediction approach can similarly be applied to other routing metrics (e.g., residual energy) to support multi-criteria routing.

2 - Space Network Scenarios for Intelligent Internet Protocol
Hyun Kim, PhD Student, Case Western Reserve University, 10900 Euclid Avenue, Olin 613, Cleveland, 44106, United States, hsk5@case.edu, Behnam Malakooti

The space networks differ significantly from the terrestrial networks. We have developed Intelligent Internet Protocol (IIP) to accommodate constraints posed by the space networks. In order to demonstrate the effectiveness and applicability of the IIP six functionalities, we develop a comprehensive scenario for each of surface and orbital networks that closely resemble actual space operations. Using these scenarios, we demonstrate the implementation and applications of IIP.

3 - Multiple Criteria Clustering and Routing for Heterogeneous Networks
Siva Tanguturi, Graduate Student, Case Western Reserve University, 10900 Euclid Avenue, Cleveland, OH, 44106, United States, skt8@case.edu, Hyun Kim, Behnam Malakooti

We develop a novel hybrid, highly scalable and robust routing protocol for heterogeneous networks that considers multiple criteria such as energy, delay, and error-rate to satisfy application requirements such as delay and energy efficient, and reliable routes. To organize the network hierarchically, we present an autonomous and distributed clustering algorithm that considers multiple criteria such as node mobility, rate of neighbor change to achieve maximum cluster stability and load balancing.

4 - Multiple Criteria Broadcasting for Wireless Networks
Brian Barritt, Graduate Student, Case Western Reserve University, 10900 Euclid Avenue, Cleveland, OH, 44106, United States, barritt@gmail.com, Hyun Kim, Behnam Malakooti, Shahdi Malakooti

In a MANET, simple broadcast schemes flood the network with broadcast storms, and more complex broadcast schemes adapt poorly to changing network conditions. As a solution, we propose Multiple-Criteria Broadcasting (MCB) where the source of a broadcast assigns the importance to broadcast objectives. Network nodes use this policy to intelligently relay broadcast messages. Using ns2 simulation, we demonstrate that MCB offers a more efficient and flexible approach to MANET broadcasting.

■ TD44

Room 405

Analytic Hierarchy Process

Contributed Session

Chair: Yuji Sato, Professor, Mie Chukyo University, 1846 Kubo, Matsusaka, 515-8511, Japan, ysatoh@mie-chukyo-u.ac.jp

1 - Analytic Hierarchy Process Decision Model for Health Institution Selection: User Perception
Astrid Oddershede, Academic, Universidad de Santiago de Chile, Industrial Engineering Department, Santiago, Chile, aoddersh@lauca.usach.cl, Rolando Carrasco

A decision model is developed to examine patient criteria and its implication. The challenge is improving quality of service. Measuring quality in health care systems involves competing goals: satisfying citizen necessities and proportionate appropriate resources for health professionals. Since service not always meet patient expectations, a case study using Analytic Hierarchy Process (AHP) is pursued to derive a framework to assist in evaluating quantitative and qualitative factors

2 - A Decision Model for Warehouse Outsourcing
Amirhosein Norouzi, North Carolina State University, Department of Operations Research, 710 Chappel Drive, Apt. D, Raleigh, NC, 27606, United States, anorouz@ncsu.edu, Arsalan Paleshi

An ever-increasing trend in firms is to exploit outsourcing for functions deemed to be outside the company's core competence, but warehouse outsourcing has not been considered scientifically so far. Given the multi-attribute nature of warehouse outsourcing decision, this paper argues the factors should be considered for outsourcing decisions and proposes a decision model, which uses AHP method to help users in the outsourcing problems. Finally, this model is applied in an automobile company.

3 - Comparison Between the Feeling Thermometer and the Analytic Hierarchy Process in Questionnaire Design
Yuji Sato, Professor, Mie Chukyo University, 1846 Kubo, Matsusaka, 515-8511, Japan, ysatoh@mie-chukyo-u.ac.jp

In this paper, we evaluate the effectiveness of the Feeling Thermometer (FT) with that of the Analytic Hierarchy Process (AHP) in designing survey questionnaire. Specifically, we compared the answers to two types of questions on a particular issue, each formatted in a different way, one using the FT and the other using the AHP.

■ TD45

Room 406

Tutorial: Planning for Disruptions in Supply Chain Networks

Cluster: Tutorials
Invited Session

1 - Planning for Disruptions in Supply Chain Networks
Lawrence Snyder, Assistant Professor, Department of Industrial & Systems Engineering, Lehigh University, 200 West Packer Avenue, Bethlehem, PA, 18015, United States, larry.snyder@lehigh.edu, Richard Church, Paola Scaparra, Mark Daskin

We present a broad range of models for designing supply chains that are resilient to disruptions. We categorize these models by the status of the existing network (a network may be designed from scratch, or an existing network may be modified to prevent disruptions at some facilities), then by the underlying optimization model (facility location or network design), and finally by the risk measure (expected cost or worst-case cost). We conclude with suggested directions for future research.

■ TD46

Room 407

Supply Chain Collaboration Issues

Cluster: Supply Chain and Operations Engineering
Invited Session

Chair: Jeannette Song, Professor, Duke University, Fuqua School of Business, 1 Towerview Drive, Durham, NC, 27708, United States, jssong@duke.edu

1 - Coalition Formation among Component Suppliers in Decentralized Assembly Systems
Shuya Yin, Assistant Professor, University of California, Irvine, Paul Merage School of Business, Irvine, CA, 92697, United States, syin@merage.uci.edu

This paper studies coalition formation among component suppliers in decentralized assembly systems. The stability analysis of coalition structures indicates that coalitions of a very small number of suppliers are often emerging in equilibrium, and that the grand coalition of all suppliers is never stable when the number of suppliers is relatively large. We show that the assembler would always benefit if coalitions are formed among its suppliers.

2 - A Multi-Retailer Decentralized Distribution System with Updated Demand Information
Ulas Ozen, PhD candidate, Technische Universiteit Eindhoven, Department of Technology Management, Eindhoven, MB, Netherlands, u.ozen@tm.tue.nl, Greys Sosic

We consider a distribution system that consists of a manufacturer, a warehouse, and n retailers who face stochastic demand. The retailers can update their demand forecasts while their orders are shipped to the warehouse. We analyze three cases (non-cooperating retailers, cooperating retailers, and manufacturer's resale of returned items), and we investigate the impact that each of these models has on the retailers and the manufacturer. Afterwards, we focus on coordination of the supply chain.

3 - Allocation Problem Revisited
Nesim Erkip, Bilkent University, Department of Industrial Engineering, Ankara, 06800, Turkey, nesim@bilkent.edu.tr

We consider a multi-echelon distribution system with one warehouse and n-retailers. The allocation assumption as described by Eppen and Schrage (1981) is an approximation that has been widely used in subsequent studies. We propose a minimum-order-quantity policy for the ordering problem that will increase the probability that the allocation assumption is not be violated.

4 - Outsourcing Structures and Information Flow in a Three Tier Supply Chain
Jeannette Song, Professor, Duke University, Fuqua School of Business, 1 Towerview Drive, Durham, NC, 27708, United States, jssong@duke.edu, Pengfei Guo, Yulan Wang

We consider a supply chain consisting of an OEM, a contract manufacturer and a supplier. We examine the effectiveness of three outsourcing structures currently implemented by top-tier OEMs. We characterize each party's optimal decision and the intermediary party's information distortion behavior under each structure. We then compare each party's profit across three outsourcing structures and identify who benefits and when.

■ TD47

Room 408

Leveraging Operations to Improve Supply Chain Performance

Cluster: Supply Chain and Operations Engineering
Invited Session

Chair: Srinagesh Gavirneni, Assistant Professor of Operations Management, Johnson Graduate School of Management, Cornell University, 310 Sage Hall, Ithaca, NY, 14853, United States, sg337@johnson.cornell.edu

1 - Provably Near-Optimal Approximation Algorithms for Capacity Expansion Problems
Van Anh Truong, Cornell University, 288 Rhodes Hall, Cornell University, Ithaca, NY, 14853, United States, vat3@cornell.edu, Robin Roundy

We present the first multi-dimensional balancing algorithms for capacity expansion problems with correlated and non-stationary demands. Our approach is computationally efficient for large numbers of machines and products, and guaranteed to have cost no worse than 2 times optimal. We depart from traditional considerations of clusters, or groups of machines purchased together, by introducing a novel quasi-separable resolution scheme for decomposing the cost to the system by machine types.

2 - Dynamic Production and Inventory Transshipment Policies for a Two-Location Make-to-Stock System
Jennifer Ryan, Assistant Professor, University of Notre Dame, Mendoza College of Business, Department of Management, Notre Dame, IN, 46556, United States, jryan8@nd.edu, Hui Zhao, Vinayak Deshpande

We study inventory transshipment in a two-location make-to-stock system with exponential production times. Transshipments may be triggered by both demand arrivals and production completions, i.e., transshipment is used to achieve production flexibility and to fill emergency demands. We prove the structure of the optimal production and demand filling policies. Finally, we develop easy-to-implement heuristics which work very well for a range of cost parameters.

3 - Integrated Scheduling of Production and Outbound Distribution in a Supply Chain
Zhi-Long Chen, Associate Professor, University of Maryland, Robert H. Smith School of Business, College Park, MD, 20742, United States, ZChen@rhsmith.umd.edu

In many applications of time-sensitive products, finished orders are delivered to customers shortly after the production. Consequently, there is little finished product inventory in the supply chain such that production and outbound distribution are closely linked and must be scheduled jointly. Research on integrated scheduling of production and outbound distribution is relatively recent, but growing rapidly. We will provide an overview of the latest developments in this area.

4 - Scheduled Ordering in Decentralized Distribution Supply Chains
Gongtao (Lucy) Chen, Cornell University, 401 Sage Hall, Ithaca, NY, 14853, United States, gc84@cornell.edu, Srinagesh Gavirneni

We analyze two different scheduled ordering polices in a supply chain with one supplier providing a single product to multiple retailers facing identical stochastic demands. Both the cases with and without information sharing among the supply chain are considered. We develop the conditions under which those scheduled ordering policies will reduce the total supply chain cost. We also compare the performances of the two scheduled ordering polices.

■ TD48

Room 409

Customer Behavior in Operations Management

Sponsor: Manufacturing & Service Operations Management
Sponsored Session

Chair: Xuanming Su, Assistant Professor, University of California, Haas School of Business, Berkeley, CA, 94720, United States, xuanming@haas.berkeley.edu

1 - Persistency Model and Its Applications in Discrete Choice Modeling
Karthik Natarajan, National University of Singapore, Department of Mathematics, Singapore, Singapore, matkbn@nus.edu.sg, Song Miao, Chung-Piaw Teo

Given a discrete optimization problem, with random objective coefficients, we are interested in evaluating the expected optimal objective value and the probability that the decision variable takes a particular value. This is called the persistency problem for a discrete optimization problem under uncertain objective. In this talk, we show that a subclass of this problem can be solved in polynomial time. Our results extends the results of Meilijson and Nadas (JAP 1979) to general integer programs (with more than two values) using marginal distributions or marginal moment information. We discuss applications of the model in discrete choice models and integer knapsack.

2 - Channel Coordination and Incentives for Variety
Garrett van Ryzin,Columbia University, Uris Hall, New York NY 10027, United States, gjv1@columbia.edu, Wei Ke

We look at a simple stylized model of multiple manufactures who sell differentiated products through a single retailer. Both pricing and product positioning decisions are modeled. We look at how various trading relationships affect the incentives for creating appropriate product variety and the resulting impact on channel coordination.

3 - Simple Models of Discrete Choice and Their Performance in Bandit Experiments
George Knox, Doctoral Candidate, Wharton School, 3730 Walnut Street, 700 JMHH, Philadelphia, PA, 19103, United States, gknox@wharton.upenn.edu, Rachel Croson, Noah Gans

Recent operations management papers model customers as solving multi-armed bandit problems, positing that consumers use a particular heuristic when choosing among suppliers. These papers then analyze the resulting competition among suppliers and mathematically characterize the equilibrium actions. In this paper, we empirically investigate how well these choice rules match actual performance as people solve two-armed Bernoulli bandit problems.

4 - Behavioral Decision Making and Inventory Models
Xuanming Su, Assistant Professor, University of California, Haas School of Business, Berkeley, CA, 94720, United States, xuanming@haas.berkeley.edu

Recent experimental findings have highlighted several anomalies in inventory models: decision makers do not behave as normative theory predicts. We propose a descriptive framework of decision biases and investigate its implications in traditional inventory models.

■ TD49

Room 410

Closed-Loop Supply Chain Marketing and Strategic Issues

Cluster: Closed-Loop Supply Chains and Reverse Logistics
Invited Session

Chair: Daniel Guide, Penn State University, 509 Business Administration Building, University Park, PA, 16802, United States, dguide@psu.edu

1 - Organizing Remanufacturing Operations: A Transaction Cost Perspective
Pinar Martin, PhD Student, SDA Bocconi, Operations and Technology, Management Dept, Milan, Italy, pinarmartin@gmail.com, Daniel Guide

This study uses the transaction cost economics approach to build an analytical framework to understand the organizational choices for remanufacturing processes. A conceptual model is developed to test the relationships between the transactional attributes and vertical integration decisions in product recovery and to identify the strategic implications of these governance forms.

2 - Remanufacturing as a Marketing Strategy
Atalay Atasu, INSEAD, Boulevard de Constance, Fontainebleau, 77300, France, atalay.atasu@insead.edu, Miklos Sarvary, Luk N. Van Wassenhove

The profitability of remanufacturing systems for different cost, technology and logistics structures has been extensively investigated in the literature. We provide an alternative and somewhat complementary approach that considers further issues such as the existence of green segments, OEM competition and product life cycle effects. We show that profitability of a remanufacturing system strongly depends on these issues as well as their interactions.

3 - The Potential for Cannibalization of New Product Sales by Remanufactured Products
Kate Li, Doctoral Student, Penn State University, 419A Business Building, University Park, PA, 16802, United States, jzl120@psu.edu, Daniel Guide

We discuss the potential problem of cannibalization of new product sales by remanufactured products. Previous literature usually assumes perfect substitutability between new and remanufactured products, or no substitution. We present the results from an experimental study that explores the willingness to pay for remanufactured and new products for a class of consumer products.

4 - Setting the Maximum Return Time for Commercial Returns in B2C Situations
Simme Douwe Flapper, Technische Universiteit Eindhoven, Den Dolech 2, Eindhoven, Netherlands, s.d.p.flapper@tm.tue.nl

Commercial returns are an important selling tool in B2C situations, where the allowed return time is an important parameter to be set. In practice many different times are used. After having given insight in a number of important issues related to a maximum return time for B2C commercial returns, a mathematical model to support the decision is given. Some results are presented and discussed. Topics for further research are indicated.

■ TD50

Room 411

Retail Operations

Sponsor: Manufacturing & Service Operations Management
Sponsored Session

Chair: Vishal Gaur, Assistant Professor, Leonard N. Stern School of Business, New York University, 44 West 4th Street, 8-72, New York, NY, 10012, United States, vgaur@stern.nyu.edu

1 - Empirical Results on Drivers of Retail Sales and Customer Satisfaction
Jayanth Krishnan, The Wharton School, 3730 Walnut Street, Suite 500, Philadelphia, PA, 19104, United States, jayanth@wharton.upenn.edu, Serguei Netessine, Marshall Fisher, Nicole deHoratius

We discuss results of analysis conducted with a retailer using data from 500 stores over 29 months in which we identify factors that explain 80% of the variation in sales and 94% of the variation in customer satisfaction. We to use these models to identify changes estimated to increase sales by 5-10%.

2 - Assortment Localization
Ramnath Vaidyanathan, PhD Student, The Wharton School, 500 Jon M Huntsman Hall, 3730, Walnut Street, Philadelphia, PA, 19104, United States, ramnathv@wharton.upenn.edu, Marshall Fisher

Most retailers would like to vary their assortments by store, but lack an appropriate methodology. We describe an algorithm for analyzing sales history to determine store specific assortments that maximize a given profit function. We discuss application of this algorithm with several retailers.

3 - Effect of Demand Endogeneity on Firm Level Sales Forecasts
Saravanan Kesavan, Doctoral Candidate, Harvard Business School, Soldiers Field Road, Morgan Hall, 428B, Boston, MA, 02163, United States, skesavan@hbs.edu, Vishal Gaur, Ananth Raman

Firm level sales forecasting is an important activity for retailers. Retailers trade-off mark-ups, inventory and sales in their day-to-day operations. I explore the simultaneity of mark-up, aggregate inventory and sales in past decisions to forecast firm level sales. I use publicly-available financial data to econometrically estimate the simultaneous equations model and test its predictive power.

4 - The Geography of Retail Inventory
Richard Lai, Harvard Business School, Gallatin Hall, Boston, MA, 02163, United States, rlai@hbs.edu

How different are retailers' inventory levels around the world? I test various forms of "global determinism:" are levels constant across countries, converging, or at least co-integrating? The tests use a novel dataset covering 4,100 retailers in 23 countries. I find evidence to reject all the three forms of global determinism. Instead, I report evidence consistent with an alternative hypothesis - "local contingency" - in which country effects are significant.

5 - Modeling Handling Operations in Retail Stores: An Empirical Analysis
Tom Van Woensel, Technische Universiteit Eindhoven, PO Box 513, Pav F5, Eindhoven, 5600 MB, Netherlands, t.v.woensel@tm.tue.nl, Alina Curseu, Jan Fransoo, Karel van Donselaar, Rob Broekmeulen

We present an empirical study of the shelf-stacking process in retail stores to investigate the main factors affecting the execution time. We examine the complete process at the level of individual sub-activities and derive a simple prediction model, on the basis of the number of case packs and consumer units. The model is tested and validated using real-life data from two European retailers.

■ TD51

Room 412

Joint Session Planning & Responding/Counter Terrorism: Planning for and Responding to Biological or Chemical Terrorist Attacks

Cluster: Planning for and Responding to Disasters, Counter Terrorism and OR
Invited Session

Chair: Fernando Ordonez, Assistant Professor, University of Southern California, 3715 McClintock Avenue, GER-240, Los Angeles, CA, 90089, United States, fordon@usc.edu

1 - Modeling the Logistics of Response to Anthrax Bioterrorism (Submitted for the 2006 Pierskalla Award)
Margaret Brandeau, Professor, Stanford University, Management Science and Engineering, Stanford, CA, United States, brandeau@stanford.edu, Greg Zaric, Dena Bravata, Douglas Owens

A bioterrorism attack with an agent such as anthrax will require rapid deployment of medical and pharmaceutical supplies to affected areas and exposed individuals. How much capacity should be built into each element of the bioterrorism response supply chain? We present a model to evaluate the costs and benefits of various strategies for pre-attack stockpiling and post-attack distribution and dispensing of medical and pharmaceutical supplies, as well as the benefits of rapid attack detection.

2 - Reliability Based Design Optimization for Critical Infrastructure Protection Decision Support
Mark McDonald, Los Alamos National Laboratory, PO Box 1663, Los Alamos, NM, 87545, United States, mark.p.mcdonald@vanderbilt.edu, David Izraelevitz, Dennis R. Powell, John Ambrosiano

The methods of reliability based design optimization (RBDO) are widely used in design applications in many engineering fields. However, RBDO can be applied to problems in policy decision making under uncertainty. In this paper, RBDO methods are adapted to optimize local public health responses under uncertainty to a pandemic influenza outbreak. Using existing models of infrastructures to simulate system responses, the method can be applied to other problems in critical infrastructure protection.

3 - Disbursement of Medical Supplies for Biological Emergencies
Fernando Ordonez, Assistant Professor, University of Southern California, 3715 McClintock Avenue, GER-240, Los Angeles, CA, 90089, United States, fordon@usc.edu, Hongzhong Jia, Maged Dessouky, Zhihong Shen

A response to biological emergencies considers the delivery of federal push packages of medical supplies to meet the surge in demand. We investigate how to efficiently disburse these supplies from a local site to points of dispensing, where the population receives treatment. We separate the problem into a facility location and routing problems that incorporate the uncertainty present in emergencies and show the benefits of this formulation on an example of a mass vaccination in LA County.

4 - Biological and Chemical Terrorism Risk Analysis
Terry O'Sullivan, Postdoctoral Research Associate, University of Southern California, CREATE Center, RTH 314, Los Angeles, CA, 90089-2902, United States, osulliv@usc.edu

Biological & chemical terrorist agents are unique, modern catastrophic threats facing Western societies. This presentation frames related policy and research problems for risk assessment, and discusses the overall structure of existing & planned preparation & response to biological and chemical terror. It concludes by outlining ongoing bioterrorism cost-benefit modeling projects at USC, such as analyzing the BioWatch detection program & the Cities Readiness Initiative SNS response pilot.

■ TD52

Room 413

Dynamic Pricing and Optimization

Sponsor: Revenue Management & Pricing

Sponsored Session

Chair: Dan Adelman, Professor of Operations Management, University of Chicago, Graduate School of Business, 5807 South Woodlawn Avenue, Chicago, IL, 60637, United States, dan.adelman@gsb.uchicago.edu

1 - An Approximate DP approach to Network RM: Separable Approximations

Vivek Farias, Graduate Student, Electrical Engineering, Stanford University, 274 Packard Electrical Engineering, Stanford, CA, 94305, United States, vivekf@stanford.edu, Benjamin Van Roy

We explore the use of separable approximations to the value function in the computation of dynamic bid prices for network RM problems. Our approximation is computed via the solution of a single LP at the start of the sales season. Bid prices computed via this technique consistently generate between 1-6% higher revenues than bid prices computed via the re-solution of the standard bid price LP at each time step as well as bid prices computed via an affine approximation to the value function.

2 - Revenue Management of Perishable Products Under Competition

Benny Mantin, Sauder School Business, University of British Columbia, 2053 Main Mall, Vancouver, BC, V6T 2C1, Canada, benny.mantin@sauder.ubc.ca, Daniel Granot, Frieda Granot

We study a multi-period no-replenishment model of competition between retailers. Consumers return to the same retailer with probability P and purchase an identical good once price is below their valuations. We find that prices decline exponentially as long as P is not too close to 1, consumers' surplus is maximized when they zigzag between retailers, and changing monopoly to duopoly dramatically affects prices, while further intensifying competition to oligopoly marginally affects prices.

3 - Markov Perfect Industry Dynamics with Many Firms

Gabriel Y. Weintraub, Stanford University, Management Science and Engineering Department, Terman Engineering Center, 3rd Floor, Stanford, CA, 94305, United States, gweintra@stanford.edu, C. Lanier Benkard, Benjamin Van Roy

We propose an approximation method that dramatically reduces the computational complexity of solving dynamic models of imperfect competition. We provide conditions for which our method closely approximates an equilibrium for large markets. We develop bounds that can assess accuracy for any given applied problem. Experiments show how our method greatly expands the set of economic problems that can be analyzed. As an example we consider a model of price competition with investments in quality.

4 - An Approximate Dynamic Programming Approach to Network Revenue Management with Customer Choice

Dan Zhang, University of Chicago, 5807 S. Woodlawn Avenue, Chicago, IL, 60637, United States, dan.zhang@ChicagoGSB.edu, Dan Adelman

We consider a network revenue management problem where customers choose among open fare products according to some pre-specified choice model. We approximate the dynamic programming value function with an affine function of the state vector, and show how to solve the resulting linear program using column generation.

■ TD53

Room 414

Supply Chain Production Decisions

Contributed Session

Chair: Annie Niu, University of Alberta, School of Business, Edmonton, AB, Canada, rniu@ualberta.ca

1 - Distributed Modeling of Long-Term Production Scheduling in Multisite, Multiproduct Enterprise Systems

Israel Owusu, Carnegie Mellon University, 5000 Forbes Avenue, DH 4201, Pittsburgh, PA, 15213, United States, iowusu@andrew.cmu.edu, Steinar Hauan

An agent based optimization approach is applied to enterprise optimization problems consisting of demand allocation and scheduling. The allocation problem is solved iteratively using agents with embedded heuristic and stochastic strategies to gerenate objectives for the scheduling subproblems. The multiagent solution approach is implemented within a distributed computing environment and illustrated using both synthetic problems and examples from literature on production scheduling.

2 - IPA Derivatives for Make-to-Stock Production-Inventory Systems under the (R, r) Policy

Yihong Fan, PhD Candidate, Rutgers University, 180 University Avenue, Newark, NJ, 07102, United States, yihong_fan@yahoo.com

We consider a class of single-stage, single-product systems with backorders, driven by random demand, and subject to a continuous-review (R, r) policy. A model from this class is formulated as a Stochastic Fluid Model (SFM). We apply Infinitesimal Perturbation Analysis (IPA) to the sample-path time averages of the inventory level and backorders level with respect to the stock-up-to level R and reorder point r.

3 - Replenishment Decisions Under Quantity Discounts and Explicit Transportation Considerations

Aysegul Toptal, Assistant Professor, Bilkent University, Department of Industrial Engineering, Bilkent, Ankara, 06800, Turkey, toptal@bilkent.edu.tr

Quantity discounts are extensively used for coordinating the supply chain. In this study, we consider a coordinated system where the vendor offers quantity discounts to the multiple buyers under the existence of transportation costs and capacities. We examine the structural properties of the underlying inventory replenishment problem.

4 - Vender Selection under an Uncertain Demand and Price Discount Environment

Guoqing Zhang, Associate Professor, University of Windsor, 401 Sunset Avenue, Windsor ON N9B 3P4, Canada, gzhang@uwindsor.ca, Liping Ma

We present a mixed integer nonlinear programming approach to determine vender selection and optimal capacity for a manufacturer, which produces multiple products and faces uncertain demands. The vendors provide volume discount schemes and have capacity limits. A GAMS-based solution approach is developed to solve the complex problem. Numerical results and sensitive analysis are discussed.

5 - Flexibility via Production and Upgrade Decisions in a Make-to-Stock System

Bora Kolfal, Northwestern University, 2145 Sheridan Road C210, Evanston, IL, 60208, United States, b-kolfal@northwestern.edu, Mark van Oyen, Seyed Iravani

We consider a firm producing two products in a make-to-stock system. Stochastically arriving orders for a lower quality product may be upgraded and satisfied by the higher quality product. We provide insights into the flexibility created by the joint optimal production and upgrade policies in a dynamic setting.

■ TD54

Room 415

Supply Chain Applications

Cluster: Operations and Marketing for Emerging Markets

Invited Session

Chair: Yehuda Bassok, Professor, University of Southern California, Marshall School of Business, Los Angeles, CA, 90089, United States, bassok@marshall.usc.edu

1 - The Use and Abuse of the Negotiation Process with an Application to a Supply Chain

Krishnan Anand, Assistant Professor, Operations and Information Management, The Wharton School, 3730 Walnut Street, Suite 500, Philadelphia, PA, 19104, United States, anandk@wharton.upenn.edu, Maurice Schweitzer, Pnina Feldman

We study Negotiations from a process perspective, using an analytical model, with a focus on (i) The abuse of the negotiations process leading to its potential breakdown, (ii) Ways of forestalling abuse, and (iii) Policy implications. We experimentally test our findings. Finally, we apply these ideas to a supply chain context.

2 - Inventory Policies for Capacitated Systems with Multiple Products

Senthil Veeraraghavan, Wharton School, Philadelphia, PA, 19104, senthilv@wharton.upenn.edu, Mahesh Nagarajan, Ganesh Janakiraman

We study a production-inventory model in which multiple products are produced using a common production resource with finite capacity. The system is reviewed periodically and the demands for the products are random. Costs are linear and excess demand is backordered. We examine optimal and near-optimal policies (ordering & allocation policies) for long run average cost performance measure.

3 - Achieving Benefit of Variety with Limited Shelf Space

Nan Xia, University of Southern California, Marshall School of Business, Los Angeles, CA, 90089, United States, Nan.Xia.2008@marshall.usc.edu, Yehuda Bassok

Some retail stores have to provide low variety due to limited shelf spaces. When competing with regular retailers who provide a large variety, they may use temporal variety (change the displayed variant over time) and low price to attract customers. Our research investigates the cost and benefit of the temporal variety strategy and shows that under certain conditions, retailers using this strategy might be more profitable than the regular retailers using spatial variety strategies.

■ TD55

Room 416

Production & Scheduling II

Contributed Session

Chair: Tadeusz Sawik, Professor, AGH University of Science & Technology, Al. Mickiewicza 30, Krakow, 30059, Poland, ghsawik@cyf-kr.edu.pl

1 - A Stochastic Production Planning Model with Load-Dependent Lead Times

German Riano, Assistant Professor, Universidad de los Andes, COPA - Centro de Opt. y Prob. Aplicada, Departamento de Ingeniería Industrial, Bogota, DC, Colombia, griano@uniandes.edu.co, Steve Hackman, Richard Serfozo

We describe a production planning model that explicitly models stochastic load-dependent lead times. The model is developed in three steps. First, we develop an accurate yet simple approximation to estimate the transient WIP and cycle time distributions in a production network. Next, we show how to include this approximation in a linear program (LP). Finally, we obtain a convergent solution via a sequence of LPs and approximation steps.

2 - Models of the Transient Behaviour of Production Units to Optimize the Aggregate Material Flow

Hubert Missbauer, Professor, University of Innsbruck, Department of Information Systems, Production and Logistics Management, Innsbruck, Austria, hubert.missbauer@uibk.ac.at

The purpose of this lecture is twofold: First, it aims at providing a link between order release mechanisms based on the workload control concept on the one hand and models for aggregate order release planning on the other hand. Secondly, it highlights the limitations of the models of the latter category and presents a direction for improvement by integrating models of the transient behaviour of queueing networks into aggregate order release planning models.

3 - Multiproduct Dynamic Lot Sizing with Work in Process and Congestion

Sangwook Hwang, PhD Candidate, Purdue University, Grissom Hall, West Lafayette, IN, 47907-2023, United States, hwang15@purdue.edu, Reha Uzsoy

Most existing lot sizing models focus on the tradeoff between setup costs and holding costs. In contrast, we present a lot sizing model that explicitly captures the effects of congestion, eliminating the need to estimate setup costs. Simulation experiments indicate that the proposed model provides plans with significantly lower WIP and lead time than existing models

4 - Supply Chain Operations Planning with Load-Dependent Lead Times

Baris Selcuk, Doctoral Candidate, Technische Universiteit Eindhoven, Department of Technology Management, Eindhoven, Netherlands, b.selcuk@tm.tue.nl, Ton de Kok, Jan Fransoo

We consider a multi-period, multi-item order release planning problem. Time-phased order releases are decomposed from capacity loading decisions. Lead times are updated according to the workload status and anticipated production requirements. Simulation experiments indicate that, together with the concept of clearing, updating the lead times provides flexibility under fluctuating demand and generate less costly solutions, but increases the nervousness in the planning system.

5 - A Mip Based Reactive Scheduling with Service Level Constraints in Make-to-Order Manufacturing

Tadeusz Sawik, Professor, AGH University of Science & Technology, Al. Mickiewicza 30, Krakow, 30059, Poland, ghsawik@cyf-kr.edu.pl

New reactive scheduling algorithms based on MIP models are proposed for a dynamic, make-to-order manufacturing environment. The objective is to update production schedule subject to service level constraints, whenever customer orders are modified. Results of computational tests modeled after a real-world rescheduling in electronics industry are reported.

Wednesday, 8:00am - 9:30am

■ WA01

Room 301

Reputation and Ranking Systems

Sponsor: Optimization/ Network and Combinatorial Optimization
Sponsored Session

Chair: Eric Friedman and Ashish Goel, Cornell and Stanford, ORIE and MSandE, Ithaca, NY, 14850, United States, friedman@orie.cornell.edu

1 - Game-Theoretic Aspects of Designing Hyperlink Structures
Nicole Immorlica, Microsoft Research, One Microsoft Way, Redmond, WA, 98052, United States, nickle@microsoft.com

We study the problem of designing the hyperlink structure of a website to maximize the revenue generated by a random walk on the website. We ask if each webpage is controlled by an autonomous agent, is it possible to give all coalitions incentive to cooperate and build the optimal hyperlink design? We show that the optimal design is in the core of the transferable utility game. For non-transferable utilities, we show the core is non-empty but can be highly inefficient.

2 - Strategic Manipulation of Internet Opinion Forums: Implications for Consumers and Firms
Chrysanthos Dellarocas, R. H. Smith School of Business, University of Maryland, 4341 Van Munching Hall, College Park, MD, 20742, United States, cdell@rhsmith.umd.edu

Firms whose products are being discussed in online forums are tempted to manipulate consumer perceptions by posting anonymous messages that praise their products. This paper analyzes the impact of such behavior on firm profits and consumer surplus. Contrary to intuition, we show that strategic firm manipulation can sometimes help consumers better assess the true qualities of competing products and, thus, improves the information value of online forums to consumers.

3 - Incentive-Based Ranking Mechanisms
Ashish Goel, Terman 311, Stanford University, Stanford, CA, United States, agoel@cs.stanford.edu, Ashish Goel

We consider ranking/recommendation systems based on user feedback. We make a case for sharing with users the revenue generated by such systems. Our main contribution is a mechanism which rewards useful feedback and is resistant to selfish/malicious behavior (eg. click spam). The mechanisms are designed to reward discovery of high quality entities. Misclassified pages represent an arbitrage opportunity for the discerning user. The mechanisms are simple enough for use with existing technology.

4 - On the Efficiency of Ranking Methods
Eric Friedman, Associate Professor, ORIE Cornell, Ithaca, NY, 14850, ejf27@cornell.edu

We analyze the effectiveness of various ranking systems from a statistical perspective. We consider a class of random graphs in which nodes are more likely to link to higher "quality" nodes which are themselves more selective. We show that both pagerank and indegree are significantly suboptimal and thus there is significant room for improvement. Of independent interest, we prove new results about the distribution of pageranks on random graphs with bounded expected degree.

■ WA02

Room 302

Joint Session Open-Source/ICS: Open-Source Application Programming Interfaces for Optimization II

Cluster: Open-Source Software: Open Source, Open Standards, Open Data, INFORMS Computing Society
Invited Session

Chair: Robert Fourer, Professor, Department of Industrial Engineering & Management Sciences, Northwestern University, 2145 Sheridan Road, Evanston, IL, 60208-3119, United States, 4er@iems.northwestern.edu

1 - The OSInstance Application Programming Interface for Optimization Problem Instances
Robert Fourer, Professor, Department of Industrial Engineering & Management Sciences, Northwestern University, 2145 Sheridan Road, Evanston, IL, 60208-3119, United States, 4er@iems.northwestern.edu, Kipp Martin, Jun Ma

As a complement to our proposal for OSiL, a new XML-based representation for optimization problem instances, we propose OSInstance, an in-memory representation. An open-source library provides application programming interfaces for reading and writing OSiL and OSInstance and for converting between them. This arrangement allows the two standards to be defined by a single design, yet offers diverse "get" methods for extracting data from OSInstance objects in a variety of convenient ways.

2 - Convergence of Optimization Instance Languages in XML with Solver API's
Bjarni Kristjansson, Maximal Software, 2111 Wilson Boulevard #700, Bjarni@maximalsoftware.com

In recent years there has been lot of activity in the development standard languages of optimization instances through XML (OptML, OSiL). In this presentation we will explore various design issues and the benefits of possible convergence with published API's for optimization solvers and how they relate to each other.

3 - Using the Optimization Services hookup Language (OShL) to Invoke Remote Optimization Services
Jun Ma, Postdoctoral Fellow, Northwestern University, Department of Industrial Engineering & Management Sciences, 2145 Sheridan Road, Evanston, IL, 60208-3119, United States, maj@northwestern.edu, Robert Fourer, Kipp Martin

We describe an open-source, platform and language independent API that implements OShL, a universal framework for hosting and invoking optimization software as services. OShL makes use of Web service standards to facilitate synchronous ("solve") and asynchronous ("send") optimization via the Internet. OShL has built-in features to maintain states ("getJobID") between subsequent service invocations, and to remotely "knock", "kill", and "retrieve" optimization jobs from the services.

■ WA03

Room 303

Large Scale Optimization Models and Solution Approaches in Health Applications

Sponsor: Optimization/ Global Optimization
Sponsored Session

Chair: Gino Lim, Assistant Professor, University of Houston, 4800 Calhoun Road, E211, Engineering Building 2, Houston, TX, 77204, United States, ginolim@uh.edu

1 - Optimizing Beam Sequence for IMRT planning
Gino Lim, Assistant Professor, University of Houston, 4800 Calhoun Road, E211, Engineering Building 2, Houston, TX, 77204, United States, ginolim@uh.edu

We consider a Beam Sequencing Problem (BSP) for IMRT planning. Given a fluence map, we aim to decompose the non-homogeneous beam intensity map into several (finite) number of beam shapes such that each beam will have a uniform intensity. It is known that solving BSP is NP-hard. We reformulate this problem as an optimization problem to minimize the final error between the fluence map and the results from the decomposition. We believe that this approach is much more practical for practioners.

2 - Probability Modeling for Heuristics to Beam Selection in Radiotherapy
Allen Holder, Trinity University Mathematics, One Trinity Place, San Antonio, United States, aholder@trinity.edu, Evan O'Dea

Selecting optimal beams in the design of radiotherapy treatments often requires values (probabilities) to be assigned to angles. We show that a balanced solution provides a suitable distribution and characterize when this distribution correctly estimates zero probabilities.

3 - Robust Optimization for Intensity Modulated Radiation Therapy (IMRT) Treatment Planning
Yuriy Zinchenko, AdvOL, CAS, McMaster University, 1280 Main Street W, ITB 221, Hamilton, ON, L8S 4K1, Canada, yzinchen@optserv.cas.mcmaster.ca, Millie Chu, Michael Sharpe, Shane Henderson

We propose a robust formulation for IMRT fluence map optimization problem that allows to incorporate the inheritent geometric uncertainties into the model. This approach has the potential to find treatment plans that are more adept at sparing healthy tissue while maintaining the prescribed dose to the target as compared to traditional models. Several strategies to reduce the computational burden associated with solvimg this problem are discussed.

4 - Optimal Design of Regions for Liver Transplantation: A Stochastic Programming Approach

Mehmet Demirci, University of Pittsburgh, 1048 Benedum Hall, Pittsburgh, PA, United States, mcd21@pitt.edu, Brady Hunsaker, Mark Roberts, Andrew Schaefer

Currently the in the U.S., a harvested liver is offered hierarchically, first within the local area, then regionally and finally nationwide. We consider the problem of optimizing the design of regions for liver transplantation across the U.S. We employ a two-stage stochastic programming approach where the scenarios give snapshots of the waiting list and a pricing problem generates promising regions. We adopt a branch-and-price framework and present preliminary computational results.

■ WA04

Room 304

Scheduling Applications I

Contributed Session

Chair: Ai Jun Zhang, Operations Analyst, Wells Fargo, 11601 N. Black Canyon Highway, Phoenix, AZ, 85029, United States, AiJun.Zhang@wellsfargo.com

1 - Stability and Scheduling of Cambridge Ring Queueing Network

Balaji Sampath, Graduate Research Assistant, The University of Texas at Austin, 3501 Speedway #103, Austin, TX, 78705, United States, balajis@mail.utexas.edu, John Hasenbein

This paper analyzes the stability of the Cambridge Ring Queueing network and discusses the scheduling of a few special cases of the network to optimize average work in progress (WIP). We also present simulation results of the performance of this network with respect to average WIP under different policies.

2 - Total Flow Time Minimization for a Flow Shop with Synchronous Transfers

Banu Soylu, Research Assistant, Middle East Technical University, Cankaya, Ankara, 06531, Turkey, bsoylu@metu.edu.tr

In this study, a flow shop sequencing problem with synchronous transfers is considered. Our objective is to minimize the total flow time. We assume that the speed of the transfer mechanism is adjusted by the end of each unit completion; i.e. cycle. We present a branch and bound algorithm. The algorithm returns optimal solutions to moderate-sized problems with reasonable solution times. For larger sized instances, the upper bounding procedures can be used to approximate the optimal solution.

3 - An Auction System for Scheduling Employees

Melanie De Grano, Penn State University, 310 Leonhard Building, State College, PA, 16802, United States, mxd265@psu.edu

This research illustrates a scheduling process in which employees can bid on preferred shifts in an auction format. Bids are used as input to an assignment model which allocates any remaining vacant shifts. The resulting schedule satisfies coverage and accommodates as many preferences as possible. Nurse scheduling is used for demonstration.

4 - Optimizing Capacity Planning in Real World

Ai Jun Zhang, Operations Analyst, Wells Fargo, 11601 N. Black Canyon Highway, Phoenix, AZ, 85029, United States, AiJun.Zhang@wellsfargo.com, Hung-Nan Chen, Charles Reichenbach

We model and achieve optimal staffing considering not only demands, employee categories, and cost but also learning curve, attrition and business practice. The non-linearity from the model complicates the derived solution; we are challenged by the non-smoothing results obtained from the optimization. We will demonstrate how a Dynamical Variable Grouping algorithm is developed for solving this problem and how a smooth, realistic and optimized capacity planning solution is obtained.

■ WA05

Room 305

Coordination and Outsourcing of Supply Chain Processes

Contributed Session

Chair: Katariina Kemppainen, Assistant Professor, RSM Erasmus University, Burg. Oudlaan 50, 3062 PA, Rotterdam, Netherlands, kkemppainen@rsm.nl

1 - Channel Coordination in Increasing Price Environments

Guoren Zhang, PhD Candidate, Richard Ivey School of Business, 1151 Richmond Street North, London, ON, N6A3K7, Canada, gzhang@ivey.uwo.ca, Ai Xingzheng

This paper examines two policies that are used to coordinate supply chain channels in increasing price environments: Midlife Returns (M) and End-of-Life Returns (E). We show that the combination of two policies can achieve coordination. We give out a group of detailed coordination mechanisms.

2 - Outsourcing Design Works to Contract Manufacturers

Jun Shan, PhD Candidate, Hong Kong University of Science and Technology, A408A, UA, HKUST, Clear Water Bay, Kowloon, Hong Kong, jshan@ust.hk

We study a brand-name company that outsources the production of a product to a contract manufacturer. The brand-name company has two alternatives: He can either conduct product design by himself, or let the manufacturer take over the design work (if the latter is capable of doing so). We compare the channel performance across the two alternatives and identify conditions under which a win-win situation can be achieved by letting contract manufacturers taking over product designs.

3 - Lean Thinking in Semiconductor Manufacturing

Peng Qu, Senior Industrial Engineer, AMD, 5204 E Ben White Boulevard, MS 563, Austin, TX, 78741, United States, peng.qu@amd.com, Shekar Krishnaswamy

In Semiconductor Manufacturing,lots take months to be processed in front-end fabs and one week for assembly and test respectively.Within this period,the value-added time is only a few days while lots spend most of remaining times on waiting. High non-value-added time results in high production inventory and costs,which may be reduced by bringing in lean manufacturing concepts. This presentation reviews the general assumptions/challenges of implementing lean concepts in Semiconductor Manufacturing.

4 - Coordinated Customer Order Management

Katariina Kemppainen, Assistant Professor, RSM Erasmus University, Burg. Oudlaan 50, 3062 PA, Rotterdam, Netherlands, kkemppainen@rsm.nl, Ari P.J. Vepsalainen

As a result of specialization and outsourcing, manufacturing firms are increasingly challenged to design efficient methods for coordinating inter-organizational processes. This paper analyzes the power of dispatching rules in the customer order management. Computational results and real-life examples will be discussed.

■ WA06

Room 306

Heuristic Techniques

Sponsor: INFORMS Computing Society/Heuristic Search

Sponsored Session

Chair: Alan McKendall, Associate Professor, West Virginia University, 325A Mineral Resource Building, Morgantown, WV, 26506, United States, Alan.McKendall@mail.wvu.edu

1 - Solution Techniques for a Crane Sequencing Problem

Jin Shang, Quality Planning Corportation, 388 Market Street, Suite 750, San Francisco, CA, 94111, United States, jshang19@gmail.com, Alan McKendall

In the areas of power plant maintenance, it is essential to develop efficient techniques for relocating resources to new locations such that the cost is minimized. In this paper, it is defined as the crane sequencing problem (CSP). It is closely related to some variants of the traveling salesman problem. The CSP is a unique problem with many applications and is computationally intractable. In this paper, a mathematical model and hybrid ant systems are developed to solve CSPs.

2 - The General Machine Layout Problem

Juan Jaramillo, West Virginia University, PO Box 6070, Morgantown, WV, 26506, United States, jrjarami@rocketmail.com, Alan McKendall

The general machine layout problem (GMALP) is the assignment of machines to locations while simultaneously assigning parts flows between machines, such as total system profits are maximized. The GMALP can be represented as a combination of the quadratic assignment problem (QAP) and the maximum profits multicommodity flow problem (MPMFP). Since the GMALP is closely related to the QAP, it is computationally intractable.

3 - IMBOSH: IMprovement BOundary Search Heuristic for Solving Unequal Area Plant Layout Problem

Artak Hakobyan, West Virginia University, 1056 Van Voorhis Road, Apt. K 418, Morgantown, WV, 26505, United States, artakhak@yahoo.com, Alan McKendall

In this paper promising techniques are presented to solve the Facility Layout Problem with unequal area departments. The deficiency of most methods used to solve the discrete representation of the unequal area FLP is that the departments in the solution may have irregular shapes, and the computational time may increase considerably when considering smaller grid sizes. However, the heuristics presented in this paper solve the discrete model without these deficiencies.

■ WA07

Room 307

Global Optimization: Software and Applications

Sponsor: INFORMS Computing Society/Optimization: Computational Optimization and Software

Sponsored Session

Chair: János D. Pintér, President and Research Scientist, Pinter Consulting Services Inc., 129 Glenforest Drive, Halifax, NS, B3M 1J2, Canada, jdpinter@hfx.eastlink.ca

1 - Using Global Optimization, Physics and Information Theory in Image Analysis

Larry Deschaine, Engineering Physicist, SAIC / Chalmers University, 272 Parker Road, Edgefield, SC, 29824, United States, Larry.M.Deschaine@alum.mit.edu, Melissa McKay, János D. Pintér, Seth Blanchard, Frank Francone

This work extends subsurface exploration techniques in geological work by incorporating algorithms and techniques from Information Theory, Physics Based Modeling, Signal Processing/Filtering, Medical Imaging, Machine Learning, Cognitive Modeling and Global Optimization. The result is a method to optimaly define subsurface objects such as plumes and unexploded ordnance.

2 - Global Optimization with Maple: An Introduction with Illustrative Examples

János D. Pintér, President and Research Scientist, Pinter Consulting Services Inc., 129 Glenforest Drive, Halifax, NS, B3M 1J2, Canada, jdpinter@hfx.eastlink.ca

The objective of this talk - based on our electronic book - is to present Maple as an integrated modeling and optimization environment. Within this broad context, the emphasis is placed on solving GO models, using the Global Optimization Toolbox. We highlight the key features of the e-book, and present 'live' numerical examples.

3 - Numerical Results Using AMIGO (A Mixed Integer Global Optimizer)

Zsolt Ugray, Assistant Professor, Business Information Systems Department, USU, 3515 Old Main Hill, Logan, UT, 84321, United States, Zsolt.Ugray@usu.edu, János D. Pintér

We present some preliminary results for solving mixed integer global optimization problems using AMIGO (A Mixed Integer Global Optimizer).

4 - Circle Packing Problems: Numerical Results and Applications

Ignacio Castillo, Wilfrid Laurier University, School of Business and Economics, Waterloo, ON, Canada, icastillo@wlu.ca, Frank Kampas, János D. Pintér

A circle packing is an optimized arrangement of N arbitrary sized circles inside a given container (e.g., a rectangle or a circle) such that no two circles overlap. We present several circle packing problems, review their practical applications, and some strategies for their solution. We also provide illustrative numerical examples using (our) global optimization software.

■ WA08

Room 308

Building Regional Innovation Systems Through Entrepreneurship: Beyond Market Incentives

Sponsor: Technology Management

Sponsored Session

Chair: Robert Lowe, Carnegie Mellon University, 5000 Forbes Avenue, Pittsburgh, PA, 15222, United States, roblowe@cmu.edu

1 - Are Environmental Technologies Unique?: University Inventions and Tech Adoption

Matt Hamilton, PhD Student, Carnegie Mellon University, Pittsburgh, PA, 15213, United States, mhamilto@andrew.cmu.edu, Robert Lowe

Academics and practitioners have expressed concerns that environmental technologies struggle to transition from laboratory to commercial adoption. The open question in this line of research is: are barriers to adoption attributable to environmental technologies specifically or indicative of a broader set of technologies. We study disclosure and commercialization of environmental technologies developed at universities to explore this critical question.

2 - Government Regulation of Entrepreneurs

Steven Michael, Schoen Faculty Fellow and Associate Professor of Business Administration, University of Illinois at Urbana-Champaign, Urbana-Champaign, IL, 61801, United States, smichael@uiuc.edu, Candace Martinez

Little empirical research has been carried out to shed light on the relationship between the informal norms of a society (its culture) and the formal rules and regulations that structure the economic lives of its citizens (regulation). This study examines the effects of culture on regulation of entrepreneurs for starting new businesses in 51 countries. Culture does affect regulation of entrepreneurs in ways consistent with existing theory. Implications for theory and practice are discussed.

3 - Public Innovation and Commercial Entrepreneurship in Nascent Software Markets

Jon Eckhardt, Assistant Professor, University of Wisconsin-Madison, Madison, WI, 53706, United States, jeckhard@wisc.edu

This paper empirically examines in a sample of over one million transactions if the effect innovations have on a focal commercial product depends on whether innovators pursue financial incentives or not. I predict that innovations that are shared by individuals who are not guided by market incentives will increase the sales of commercial products. Conversely, due to competition products created for commercial purposes will decrease the sale of other commercial producers.

4 - Offshoring of Technology and Local Innovation Dynamics

Brian Fifarek, PhD Student, Carnegie Mellon University, Pittsburgh, PA, 15213, United States, bfifarek@andrew.cmu.edu

Current research maintains that firm-level offshoring practices are beneficial to firms and national economies, but little is known about the long-term effect of offshoring on home economy innovation, especially at a regional or local level. We look at the rare earths industry to understand how offshoring practices have adverse effects on innovation at the regional and national levels.

■ WA09

Room 309

Business Applications I

Contributed Session

Chair: Augusto Rupérez Micola, Research Fellow, IMD, Chemin de Bellerive 23, Lausanne, Switzerland, Augusto.RuperezMicola@imd.ch

1 - Capital Investment of Wafer Foundry Industry: The Cases of TSMC and UMI

Kun-Jung Hsu, Assistant Professor, Leader University, No. 188 An-Chung Rd. Sec. 5, Tainan, 709, Taiwan, hsu@mail.leader.edu.tw, Chi-Wen He

Wafer foundry industry is the kind of high capital-intensive. But how the industry decides the ongoing capital investment? The paper uses profit opportunities and capital stock of the company as two major variables to explain the capital investment of TSMC and UMI. After examining the G-Q test, we find the market value of the company respect to the residual of the model exhibits hetereskedasticity. Accordingly the results of GLSE, the investment behavior of the two companies were discussed.

2 - Deploying Virtuality in Organization Studies: A Moment of Reflection

Pracheta Mukherjee, Mukherjee Associates, 20 West Cooper Street, Slippery Rock, PA, 16057, United States, pracheta@aol.com

The metaphor of virtuality is widely used in describing organizational phenomena. At least, eight different uses were identified in print. Sadly, a few of these applications or metaphors have no coherent link to the original optical phenomenon from which they draw their inspiration.

3 - Optimal Forward Buys of Commodities with Increasing Price Uncertainty

Andrew Manikas, PhD Candidate, Georgia Institute of Technology, 800 West Peachtree Street, College of Management, Atlanta, GA, 30332, United States, andrew.manikas@mgt.gatech.edu, Yih-Long Chang, Mark Ferguson

Commodity prices often fluctuate significantly so firms often practice forward buying (buying for future demand) when prices are low. We provide models to determine the optimal number of future periods to purchase for at each ordering opportunity to minimizes total expected costs given the increasing uncertainty of future prices.

4 - Demand Forecasting - Case Study from the DVD Industry

Namit Mehta, Consultant, Infosys Technologies Limited, 9400 Wade Boulevard, Apt. # 1022, Frisco, TX, 75035, United States, namitmehta@gmail.com

Demand Forecasting and Operations Planning within the DVD market has the capability to make or break the Home Entertainmemt Divisions of the Hollywood studios. The need to build scientific forecasting processes for a new release of a DVD in the retail market and its implications are discussed. Implications of moving from a number forecast to a distribution based forecast are discussed.

5 - Toeholds as Real Options: An Empirical Approach
Augusto Rupérez Micola, IMD, Chemin de Bellerive 23, Lausanne, Switzerland, augusto.ruperezmicola@imd.com, Didier Cossin

We study partial acquisitions as a stepping stone ("toehold") in a full acquisition. Our main theoretical resting point is adverse selection: When target assets are specialised, information on their prices could be unavailable to the buyer. Small acquisitions could be a way of alleviating this problem.

■ WA11

Room 311

Medical Appointment Scheduling

Contributed Session

Chair: Linda LaGanga, Director of Quality Systems, Mental Health Center of Denver, 4141 East Dickenson Place, Denver, CO, 80222, United States, laganga@colorado.edu

1 - Efficient Short Term Allocation of Patients to Floors of a Hospital During Demand Surges
Matthew Dean, University of Connecticut, 2100 Hillside Road, Unit 1041, Storrs, CT, 06269, United States, matthew.dean@business.uconn.edu, Robert Garfinkel, Manuel Nunez, Steven Thompson

Many hospitals face the problem of insufficient capacity to meet demand for inpatient beds, especially during demand surges. As a result, large delays occur between the admission of a patient and his arrival to a floor causing degraded patient care and lost revenue. One solution is to proactively transfer patients between floors in anticipation of demand. To solve this allocation problem, an optimization-based decision support system was developed and implemented at a local community hospital.

2 - Strategic Medical Scheduling: Evaluation of an Out-of-Office Scheduling System
Chris Duckworth, University of Tennessee, 451 Lager Drive, Maryville, TN, 37801, United States, cduckwor@utk.edu

A medical practice's schedule of patients can be separated into two separate queues, an out-of-office scheduled queue and an in-office queue. Dynamics affecting the out-of-office waiting portion of a single physician medical clinic are presented and discussed. A series of analytically stochastic classification-based scheduling systems are developed utilizing class dependent social utility functions to define a patient's ability to wait out-of-office.

3 - Scheduling Patients Elective Surgeries Using a Revenue Management Approach
Alia Stanciu, PhD Candidate, University of Pittsburgh, 343 Mervis Hall, Pittsburgh, PA, 15260, United States, alstanciu@katz.pitt.edu, Luis Vargas

We present implementations of revenue management concepts and models for scheduling patients requesting elective procedures. Surgical units within a hospital should recognize the necessity of functioning as profit centers, and so, a segmentation mechanism based on patients' insurance type will be considered in allocating operating room times to various procedures.

4 - A New Formulation of Service Level for Overbooking Appointment Schedules
Linda LaGanga, Director of Quality Systems, Mental Health Center of Denver, 4141 East Dickenson Place, Denver, CO, 80222, United States, laganga@colorado.edu

We extend airline service level modeling to time-driven appointment scheduling to support decision-makers in efficiently evaluating the operational impact of overbooking on clinic overtime. Our dynamic branch and fathom model finds the maximum booking level that does not exceed a desired probability of overtime. This allows clinic managers to efficiently predict the impact of appointment overbooking policies on clinical providers.

■ WA12

Room 312

Enterprise-Wide Optimization: Petroleum & Energy Industries

Cluster: Enterprise-Wide Optimization in the Process Industry

Invited Session

Chair: Kevin Furman, ExxonMobil, 1545 Route 22 East, Annandale, NJ, 08801, United States, kevin.c.furman@exxonmobil.com

1 - Optimization of Recipe for and Scheduling of Gasoline Blending and Distribution
Jie Li, National University of Singapore, Singapore, 117576, Singapore, g0304872@nus.edu.sg, Iftekhar Karimi, Rajagopalan Srinivasan

In this paper, we develop a more efficient formulation for simultaneous treatment of recipe, blending, scheduling, and distribution in contrast to previous works that have considered only parts of these and a new algorithm to solve the nonlinearity arising from the variable property indices of the input materials to the bending unit. Several examples are provided to illustrate the effectiveness of our formulation and algorithm.

2 - Global Optimization for Scheduling Refinery Crude Oil Operations
Ramkumar Karuppiah, Graduate Student, Department of Chemical Engineering, Doherty Hall, Carnegie Mellon University, 5000 Forbes Avenue, Pittsburgh, PA, 15213, United States, rkaruppi@andrew.cmu.edu, Kevin Furman, Ignacio Grossmann

We present an Outer-Approximation algorithm to obtain the global optimum of a nonconvex Mixed Integer Nonlinear Programming model for the scheduling of crude oil movement at the front-end of a petroleum refinery. A spatial decomposition of the network is performed to enhance the computational efficiency of the algorithm.

3 - Upstream Supply Chain Planning in Natural Gas Systems: A Real World Case Study
Ajay Selot, Massachusetts Institute of Technology, 66-365, 77 Massachusetts Avenue, Cambridge, MA, 02139, United States, selot@mit.edu, Paul Barton

We present a short term planning framework for upstream natural gas supply chain operations using the Sarawak Gas Production System in Malaysia as a case study. Operation of the system is governed by complex contracts evolved over years. These are a challenge to model and require the use of binary variables. Moreover the infrastructure model is nonconvex. The overall program is a nonconvex MINLP and is solved with a global branch-and-reduce algorithm with customized heuristics.

4 - Incorporation of Emerging Technologies for Environmentally Conscious Energy Production Systems
Metin Turkay, Assistant Professor, Koc University, Rumelifeneri Yolu, Istanbul, 34450, Turkey, mturkay@ku.edu.tr

Industrial systems require energy for production, therefore the supply of energy is as important as the supply of any other raw material. It became a requirement to incorporate new technologies due to stricter environmental reglations in energy systems. In this talk, environmentally friendly technologies will be evaluated and an optimization model that considers some emerging technologies that are applicable in the short-term will be presented.

■ WA13

Room 313

Teaching Operations Research in a Liberal Arts Setting

Sponsor: Education (INFORM-ED)

Sponsored Session

Chair: Christopher J Zappe, Interim Dean of Arts and Sciences, Bucknell University, 113 Marts Hall, Lewisburg, PA, 17837, United States, zappe@bucknell.edu

1 - Teaching Operations Research in a Liberal Arts Setting
Christopher J Zappe, Interim Dean of Arts and Sciences, Bucknell University, 113 Marts Hall, Lewisburg, PA, 17837, United States, zappe@bucknell.edu

In this session we will consider the opportunities and challenges of teaching operations research to predominantly undergraduate students at a liberal arts institution. Specifically, we consider how learning OR can enhance undergraduate liberal arts students' quantitative literacy as a critical component of their general education. Upon providing some background material, the presenter will facilitate a discussion of some critical issues facing those who teach OR in a liberal arts setting.

■ WA14

Room 314

E-Business/Commerce I

Contributed Session

Chair: Yongma Moon, The Pennsylvania State University, 710 S. Atherton Street #512, State College, PA, 16801, United States, yongma@psu.edu

1 - Category Management and Internet Retailing
Adam Fleischhacker, Rutgers University, 73 Castle Rock Road, Lake Hopatcong, NJ, 07849, United States, adam_fleischhacker@yahoo.com, Mahesh Kumar

Given that online stores are typically organized by product category, this research investigates Internet retailing from a category perspective. By leveraging the increasing body of offline category management research, theoretical predictions of the key drivers of online category performance are surmised. These predictions are empirically tested and results are presented to provide insights into effective category management practices on the Internet.

2 - Comparing Comparison Shopping Sites
Jan Edman, Assistant Professor, Penn State University, 120 Ridge View Drive, Dunmore, PA, 18512, United States, jme22@psu.edu

Comparison shopping sites collect information about product offerings from retailers and present this information on their own sites. At a time of growth of E-commerce and growing use of comparison shopping sites, comparisons between the leading sites are of particular interest. This paper compares prices and number of listed retailers on six leading sites in three years. The paper also compares, with an experiment, consumer selections of retailers across four different designs of leading sites.

3 - Interaction Between Different Supplier Types in B2B Spot Markets
Hila Etzion, Assistant Professor of Business Information Technology, University of Michigan, Stephen M. Ross School of Business, 701 Tappan Street, Ann Arbor, MI, 48109, United States, etzionh@bus.umich.edu, Edieal Pinker

We model a spot market in a make-to-stock industry with two types of suppliers: a Type 1 supplier faces stochastic contracted demand and has access to the spot market for liquidating surplus, while a Type 2 supplier produces only for the spot market. We find the production quantity equilibrium when the market consists of one supplier of each type and determine which supplier benefits more from the existence of the spot market and from an increase in spot market's demand.

4 - Revenue Management and Investment for the Internet Channel: Real Option Approach
Yongma Moon, The Pennsylvania State University, 710 S. Atherton Street #512, State College, PA, 16801, United States, yongma@psu.edu, Tao Yao

With the rapid development of the Internet, manufacturers have been interested in constructing the direct internet selling channel. We study the investment decision to construct the Internet channel based on a real option approach to quantify the managerial flexibility under uncertainty. Our study shows paradoxical result and double marginalization in revenue for the dual channel. We use the Monte Carlo simulation to derive our solution.

■ WA15

Room 315

Auctions and Computer Science

Cluster: Auctions and e-Commerce
Invited Session

Chair: Kevin Leyton-Brown, University of British Columbia, 2366 Main Mall, Vancouver, BC, V6T 1Z4, Canada, kevinlb@cs.ubc.ca

1 - Informational Limitations of Ascending Combinatorial Auctions
Liad Blumrosen, Microsoft Research, Silicon Valley, blumrosen@gmail.com, Noam Nisan

We study the inherent limitations of natural widely-used classes of ascending combinatorial auctions. Specifically, we show that ascending combinatorial auctions that do not use both bundle (non-linear) prices and personalized (non-anonymous) prices can not achieve social efficiency with general bidder valuations. This casts doubt on the performance that can be achieved using the simpler auctions suggested in the literature, and justifies the added complexity in the auctions suggested by Parkes and Ungar (2000) and Ausubel and Milgrom (2002). Our impossibility results are very robust in several senses: they hold for any price update system, pattern of interaction with agents, or payment determination rule. They do not depend on strategic aspects of the bidders, on computational limitations or on communication limitations. Finally, we show that the loss of efficiency is severe and that only a diminishing fraction of the social welfare may be captured.

2 - Combinatorial Agency
Moshe Babaioff, University of California, Berkeley, Michal Feldman, Noam Nisan

The field of Algorithmic Mechanism Design handles the issue of private information held by different "selfish" parties in computational settings. This paper deals with a complementary problem: handling the "hidden actions" that are performed by the different parties. Our focus is on cases where {\em complex combinations} of the actions influence the outcome. We present formal models for this setting, suggest and embark on an analysis of some basic issues, but leave many questions open.

3 - Bidding Agents for Online Auctions with Hidden Bids
Kevin Leyton-Brown, University of British Columbia, 2366 Main Mall, Vancouver, BC, V6T 1Z4, Canada, kevinlb@cs.ubc.ca, Albert Xin Jiang

When the valuation distributions of bidders in online auctions are not known ex ante, machine learning techniques can be used to approximate them from historical data. It is a characteristic feature of such auctions, however, that information about some bidders' valuations is systematically concealed. This occurs in the sense that some bidders may fail to bid at all because the asking price exceeds their valuations, and also in the sense that a high bidder may not be compelled to reveal her valuation. Ignoring these "hidden bids" can introduce bias into the estimation of valuation distributions. To overcome this problem, we propose an EM-based algorithm, which we validate experimentally using agents that react to their environments both decision-theoretically and game-theoretically, and using both synthetic and real-world (eBay) datasets. We show that our approach estimates bidders' valuation distributions and the distribution over the true number of bidders significantly more accurately than more straightforward density estimation techniques.

■ WA16

Room 316

Forecasting: Issues, Models, and Challenges

Cluster: Dynamic Pricing and Forecasting
Invited Session

Chair: Edward Kambour, Director of Science and Research, PROS Revenue Management, 3100 Main Street, Suite 900, Houston, TX, 77002, United States, ekambour@prosrm.com

1 - Measuring Forecast Precision in RM Applications, or "How Do I Know This Stuff is Working?"
Edward Kambour, Director of Science and Research, PROS Revenue Management, 3100 Main Street, Suite 900, Houston, TX, 77002, United States, ekambour@prosrm.com

It is clearly important to deliver quality forecasts. However, in practice the process of measuring forecast effectiveness tends to be problematic, even though to the lay person it seems simple: just compare the forecasts to actual observations. In this presentation we will examine methods and metrics, and also touch on the pitfalls associated with the commonly used "common sense" approaches.

2 - Forecast Accuracy Monitoring & Control Process: Call Center Applications
Viroj Buraparate, Manager, Hewlett Packard Company, 20555 SH 249, Houston, TX, 77070, United States, Viroj.Buraparate@hp.com, Kristofer Johnson, David Olsen

The authors discuss how to integrate the call centers operations' requirements into the forecasting process. By applying quality control techniques, the new forecasts can be statistically adjusted to react to the dynamics of the in-bound call volumes and operations' constraints. Methodology and examples will be given.

3 - DARMA: Interpreting the Results of a Regression
Evan Brott, Scientist, PROS Revenue Management, 3100 Main Street #900, Houston, TX, 77002, United States, ebrott@prosrm.com

Driver Apportionment for Regression Model Analytics (DARMA), a novel method for visualizing and analyzing the results of a regression, is presented. Each covariate is represented as causing a specific deviation from a filtered response; shifts in this response over time can then be attributed to sources other than the analyzed covariates. Examples and applications using real datasets are provided.

■ WA17

Room 317

Shipping, Maritime, and Supply Chain Logistics

Contributed Session

Chair: John Liu, Department of Logistics, Hong Kong Polytechnic University, Lgtjliu@polyu.edu.hk

1 - Efficiency Analysis of Global Container Ports with Time-Variant Individual Production Frontiers
Jia Yan, Hong Kong Polytechnic University, Lgtjiay@polyu.edu.hk, Xinyu Sun, Tsz Leung Yip

With the ever-increasing role of seaports in global supply chain, port efficiency has become one of the most critical indicators of global and regional economies. In assessing the production efficiency of global container ports, there are two well-noted intriguing points of complication, that is, operator-dependent heterogeneity and time-variant productivity. While effective methods of production efficiency analysis to address these two points are still seriously lacking. In this paper, we develop MC/MC based econometric models and algorithms for port efficiency analysis, using time-variant heterogeneous production frontiers. We report initial results of our ongoing empirical study of global container port efficiency, by applying the methods and algorithms we are developing on the database of over 150 terminals/operators.

2 - Law Enforcement at Sea by Port State Control
Kevin Li, Hong Kong Polytechnic University, Lgtkxli@polyu.edu.hk, Haisha Zheng

After the events of September 11th 2001, shipping as the one of next potential targets gets more and more attention on security. One of the effective and efficient measures against terrorism and strengthen safety of shipping seems to be PSC inspection systems. The higher and higher inspection rates are adopted by PSC authorities and now it has caused some issues since the inspection-related initiatives not only involve immediate costs but also slow down international trade and put up inventory costs and ultimately prices, moreover even the United State as the richest country in the world can afford the financial burden to realized 100% inspection. This research focuses on an inspection rate set by a PSC authority under different resource limitation. We investigate the relationship between a PSC authority and ship-operators. A generic game model of a decision-making mechanism used by a PSC authority is formulated by adopting the theory of Stackelberg theory. After specify the generic model, four inferences are obtained. We also show some real PSC inspection systems to reveal these results.

3 - Simulation Framework for Inter-Port Competition in the South China
Meifeng Luo, Hong Kong Polytechnic University, Lgtmluo@polyu.edu.hk, Tsz Leung Yip

Hong Kong port has been the world leading container port over the past 20 years. However, with the recently fast port development in Chinese Mainland, it is now facing strong competition from the new, low cost ports in South China. The rapidly changing environment offers researchers opportunities to disclose the mechanisms of inter-port competition. This paper first introduces the port development and competition in the South China. It includes recent international trade, national and regional port-related policies, and response of private investors. A spatial simulation framework will be introduced next, which takes into account shipper preferences, transportation facility development and strategic responses by existing ports. A discrete choice model to estimate shippers' spatial preference and experimental settings in the port simulation laboratory for hypothesis testing will also be discussed.

4 - Instability of Dynamic Inventory and P&I Insurance Reserve Systems
Jia Yan, Hong Kong Polytechnic University, Lgtjiay@polyu.edu.hk, John Liu

Motivated by the notorious volatility in insurance reserves of marine P&I (protection and indemnity) and the bullwhip effect in supply chain, we study in this paper the instability of a dynamic inventory system, with the understanding that the same transition dynamics are associated with insurance reserve and supply management. We report that instability in inventory transition alone can cause the bullwhip effect in a dynamic inventory system that is normally considered as free of the bullwhip effect. Based on stability analysis of difference equations, we obtained two important findings: 1) A one-time change in the fixed-point steady state will affect all the future inventory planning, such that the optimal order-up-to level will start to oscillate and diverge. The inventory system is therefore prone to the bullwhip effect, and thus explains volatility problems in insurance as well as in supply chain. 2) Inventory/insurance refunds can stabilize the system.

5 - A Tactical Planning Model for Liner Shipping Companies: Joint Management of Container Flow and Ship Deployment
Xinxin Liu, Heng-Qing Ye, Xue-Ming Yuan

This paper addresses two practical problems from a liner shipping company, i.e., the container flow management problem and the ship deployment problem at the tactical planning level. The joint optimization model, as well as a sequential model, are formulated to solve the problems. Our results show the company should implement the joint optimization model at the tactical planning level to improve the shipping capacity utilization rather than the sequential model used in the current practice. Repositioning of empty containers is also considered jointly with the loaded container flow at the tactical planning level. Some important managerial insights into the operational and business processes are gained.

■ WA18

Room 318

Modeling Systems

Contributed Session

Chair: Mieko Moki, Fujitsu Research Institute, New Pier Takeshiba South Tower, 16-1, Kaigan 1-Chome, Minato-ku, Tokyo, 105-0022, Japan, moki@jp.fujitsu.com

1 - New Approach to Management Accounting for Process Industries with Mathematical Programming
Tomoaki Miyazaki, Senior Research Fellow, Fujitsu Research Institute, New Pier Takeshiba South Tower, 16-1, Kaigan 1-Chome, Minato-ku, Tokyo, 105-0022, Japan, t.miyazaki@jp.fujitsu.com, Susumu Ikenoue, Mieko Moki

Strategic use of IT spread by extension of SCM. Especially, by wonderful progress of computer, the mathematical programming technique has greatly contributed to SCM realization. This paper describes the new approach using the mathematical programming technique which supports management accounting of process industries. We will show the availability using visual modeling and simulation tool.

2 - New Paradigm of the Profit-and-Loss Planning and Simulation for Process Industries
Susumu Ikenoue, President, Ike Ltd., 5-33-4, Otsuka, Bunkyo, Tokyo, Japan, susumu.ikenouye@nifty.ne.jp, Tomoaki Miyazaki, Mieko Moki

To cope with economical environmental change and to keep enterprise profits, on demand decision-making become to be more difficult and to be done more promptly. In process industry, LP based profit management function will be very strong tool for the people who has responsibility of enterprise-wide profit control. From practical point of view, the structure of this tool should be designed for daily work for ordinary persons.

3 - Preprocessing DEA
Francisco Lopez, University of Texas-El Paso, 500 W. University Avenue, El Paso, TX, United States, fjlopez@utep.edu, Jose Dula

We compile, analyze, implement, and compare different preprocessing procedures for identifying efficient and inefficient DMUs in DEA. We treat the problem as a special application of procedures from the more general problem of classifying boundary and interior elements of finitely generated polyhedral sets. Contributions to DEA emerge from these adaptations . A new preprocessor is introduced based on the rotation of hyperplanes.

4 - The Future of Network-Based Modeling and Forecasting in the Transportation Industry
Anna Engelsone, MergeGlobal, Inc, 1010 N. Glebe Road, Suite 420, Arlington VA, United States, aengelsone@mergeglobal.com

Poor data availability and complexity of transportation networks are common obstacles to creating detailed network simulation models for the air freight industry. Our model incorporates network generation based on airline schedules, demand distribution based on data synthesis and optimization, and a forecasting engine. We will demonstrate how our model has aided our clients in making important strategic decisions and discuss extensions to sea freight and other industries.

5 - Visual Modeling and Simulation Tool for Process Industries
Mieko Moki, Fujitsu Research Institute, New Pier Takeshiba South Tower, 16-1, Kaigan 1-Chome, Minato-ku, Tokyo, 105-0022, Japan, moki@jp.fujitsu.com, Tomoaki Miyazaki, Susumu Ikenoue

This paper describes the visual modeling tool for process industries which offers easy and quick planning environment and supports management accounting. In this tool, defining Process flow and Table data generate automatically LP-format data. And, for management accounting, this tool decomposes the total cost which is result of optimization into the production cost i.e., resource cost, utility cost, operation cost for every product.

■ WA19

Room 319

Optimization Under Uncertainty in an Electric Power System

Sponsor: Energy, Natural Resources & The Environment
Sponsored Session

Chair: Mainak Mazumdar, Professor, University of Pittsburgh, 1048 Benedum Hall, Pittsburgh, PA, 15206, United States, mmazumd@engr.pitt.edu

1 - Optimal Buying and Selling Strategies for a Power Retailer
Antonio J. Conejo, Professor, Univ. Castilla - La Mancha, Campus Universitario s/n, Ciudad Real, Spain, Antonio.Conejo@uclm.es, Jose M. Arroyo, Miguel Carrion

An electricity retailer faces two sources of uncertainty. While buying electricity, it must cope with uncertain pool prices or sign forward contracts. While selling electricity, it should handle the fact that customers might choose a different retailer if the selling price is not competitive. We propose a risk-constrained stochastic programming framework to decide which forward contract the retailer should sign and at which price it must sell electricity so that its expected profit is maximized.

2 - Effects of Market-Based Uncertainty on Optimal Flows of Fuels and Power in the U.S.
Yan Wang, Research Assistant, Iowa State University, 2019 Black Engineering, Ames, IA, 50011-2164, United States, yanwang@iastate.edu, Sarah Ryan

A generalized network flow model of the U.S. electric energy system reveals ideal movements of coal, natural gas and electric power. We introduce uncertainties in fuel prices and market demands for electric power and use stochastic programming to learn how energy flows would be affected if the national energy system were planned optimally under these uncertainties.

3 - Sources of Uncertainty for the Locational Marginal Prices of Electricity
Lizhi Wang, University of Pittsburgh, 1048 Benedum Hall, Pittsburgh, PA, 15261, United States, liw18@pitt.edu, Mainak Mazumdar

The probability distributions of the LMP's depend mainly on the following factors: load uncertainty, generator and transmission line outages and congestion, and strategic gaming. We examine the contribution of each factor in determining these distributions.

4 - Long Run Power Sector Response to CO2 Allowance Allocation Methods
Ming-Che Hu, PhD Student, Johns Hopkins University, 313 Ames Hall, 3400 N. Charles Street, Baltimore, MD, 21218, United States, mchu@jhu.edu, J.-S. Pang, Jinye Zhao, Yihsu Chen

By basing the allocation of CO2 emissions allowance on investment decisions, carbon trading systems (including the EU) risk distorting investments. A long run capacity equilibrium problem is formulated subject to allocation rules, and is analyzed for existence of solutions. Simulations show a potential for large distortions.

■ WA20

Room 320

Risk Assessment in Decision Analysis

Contributed Session

Chair: Ayse Kocabiyikoglu, Assistant Professor, Bilkent University, Department of Business Administration, Bilkent, Ankara, 06800, Turkey, aysekoca@bilkent.edu.tr

1 - A New Way Estimating Project Volatility in Real Options
Hyun Jin Han, Auburn University, 306 Dunstan Hall, Auburn University, AL, 36849, United States, hanhyun@auburn.edu, Chan S. Park

In real options analysis, one of the critical parameters in determining the option value is the volatility of the underlying asset. Even though several methods have been suggested in the literature, each method has its own weakness to serve as a general technique to various real options environment. In this presentation we first review various existing methods for estimating the volatility and suggest a new way to estimate the project volatility by adapting the Free Cash Flow (FCF) concept.

2 - Assessing the Value of Information in Supply Chain Decisions
Kimberly Thompson, Associate Professor, MIT Sloan School of Management, 50 Memorial Drive, E53-339, Cambridge, MA, 02142, United States, kmt@mit.edu

Efficiently managing supply chains requires understanding the system and optimizing performance based on trade-offs of multiple (often competing) objectives. For example, managers seek to minimize cost while maximizing resiliency in the context of an uncertain future. This paper explores the application of decision analytic tools and perspectives to supply chain management and demonstrates the utility of considering the many possible futures dynamically.

3 - Evaluating Real Options for Mitigating Risk in Government R&D Acquisitions
Jeremy Eckhause, Research Fellow, LMI, 2000 Corporate Ridge, McLean, VA, 22102, United States, jeckhause@lmi.org, Danny Hughes

Government acquisitions requiring R&D efforts are fraught with uncertainty. The risks are often mitigated by employing a multi-stage competition, with multiple vendors funded initially, until a single successful vendor is selected. While decision-makers recognize they are using a real option approach, analytical tools are often unavailable to evaluate optimal decisions. We present a stochastic integer programming approach for obtaining optimal strategies for generic, hypothetical acquisitions.

4 - Heuristic Methods as a Tool to Improve Management Decision Making
Mahmood Ridha, Assistant Professor, Philadelphia University, Jordan-Amman PO Box 1, Amman, 19392, Jordan, mahbedir@yahoo.com

This research aims to explore and analyze how heuristic methods can give better support for managers compared with some of mathematical models. It will give examples of some heuristic methods applyed to solve production planning problems.

5 - Managerial Motivation Dynamics and Incentives
Ayse Kocabiyikoglu, Assistant Professor, Bilkent University, Department of Business Administration, Bilkent, Ankara, 06800, Turkey, aysekoca@bilkent.edu.tr, Ioana Popescu

We investigate drivers of managerial motivation by focusing on an agent's optimal effort decision in trading off compensation utility with effort cost. We identify the relevant motivational drivers underlying the agent's utility and compensation plan. We characterize properties of the agent's preferences for performance lotteries (such as risk aversion) that trigger systematic motivational patterns with respect to a variety of factors, such as agent's past performance and market factors.

■ WA21

Room 321

Risk Management

Sponsor: Decision Analysis Society

Sponsored Session

Chair: Jayavel Sounderpandian, Professor, University of Wisconsin-Parkside, Department of Business, 900 Wood Road, Kenosha, WI, 53144, United States, sounderp@uwp.edu

1 - Extending Medical Preference Models to Include Lifetime Goals
Gordon Hazen, Professor, Northwestern University, IEMS Department, Evanston, IL, 60208, United States, hazen@iems.northwestern.edu

QALYs in medical decision analysis capture ongoing goals with impact proportional to lifetime, like mobility or comfort. Extrinsic goals, like finishing a key project or seeing a child's graduation, are independent of lifetime. We give a wider QALY model that includes both goal types. This allows one to decline trading lifetime for health quality when remaining lifetime is short; and to refuse time with poor health quality after important life milestones - behaviors forbidden by the QALY model.

2 - Exploring the Risk Preferences Towards the Pure and Speculative Risks
Clare Chua, Associate Professor, Ryerson University, 350 Victoria Street, Toronto, ON, M5B2K3, Canada, cchua@ryerson.ca

It has been assumed that the individual is risk averse when it comes to decision making. However, the falsity of such an assumption had been demonstrated time and again. How do we account for this apparent inconsistency? This is a study to understand how people react to different types of risk. We will use the Prospect theory to predict the risk behavior under the scenario of speculative risk and pure risk.

3 - Balancing Risk and Return in R&D Portfolios
Jeffrey Keisler, Assistant Professor, University of Massachusetts Boston, MSIS Department, 100 Morrissey Boulevard, Boston, MA, 02125, United States, Jeff.Keisler@umb.edu

Portfolio decision analysts often chart expected value against probability of success and then intuitively select a balanced mix of attractive projects. A mean-variance rule could, under some conditions, provide a stronger basis for balancing the portfolio.

4 - Risk Sharing through Coalition Formation in Multiple Ruin Game Environments
Jayavel Sounderpandian, Professor, University of Wisconsin-Parkside, Department of Business, 900 Wood Road, Kenosha, WI, 53144, United States, sounderp@uwp.edu

The starting point for this paper is the basic ruin game for which Demoivre gave the solution. Suppose there are two pairs of players playing two independent ruin games. It is possible that a player in one pair forms a coalition with a player in the other pair so as to reduce the risk of ruin for both of them. The paper analyzes such risk sharing possibilities among different combinations of players, and looks for stable coalitions. The results can be extended to more pairs of players.

■ WA22

Room 322

Joint Session MAS/ED: Social Network Analytics: Methods and Applications

Sponsor: Military Applications, Education (INFORM-ED)
Sponsored Session

Chair: Mary Helander, IBM Research, TJ Watson Research Center, 1101 Kitchawan Road, Yorktown Heights, NY, 10598, United States, helandm@us.ibm.com

1 - Using Social Networks to Evaluate University-High School Partnerships
Donna Llewellyn, Georgia Institute of Technology, 225 North Avenue, Tech Tower Suite 4, Atlanta, GA, United States, donna.llewellyn@cetl.gatech.edu

Social Network theory is applied to the process of evaluating the evolution of a program that partners a university with neighboring high schools. Measures such as graph density, connectedness, cut sets, and other classical graph theory constructs translate into social network tools that are used to analyze partnerships and to make policy decisions about how to best institutionalize these programs.

2 - Managing Collaboration in Knowledge-Intensive Environment
Fang Liu, Northwestern University, 2145 Sheridan Road C210, Evanston, IL, United States, f-liu@northwestern.edu, Seyed Iravani, Wally Hopp

Collaboration is critical in knowledge-intensive environments for promoting efficiency and creativity. Dynamics of collaboration depend on social connections among agents. In this paper, we develop models to investigate mechanisms of collaborations and the impact of social networks. We draw insights into managerial policies by comparing agent-based behavior with a centralized management strategy.

3 - Importance Measures for Social Network Links
Mary Helander, IBM Research, TJ Watson Research Center, 1101 Kitchawan Road, Yorktown Heights, NY, 10598, United States, helandm@us.ibm.com, Kate Ehrlich, Sarah McAllister

In this paper, we consider the mathematical importance of individual links in a social network. Relative to various network-level metrics, we mathematically define importance measurements for arbitrary links. We consider these measurements relative to the problem of identifying best (or worst) links to remove (or add) to a social network, and we discuss the implications for what we call "robust" and "frail" social networks.

4 - An Interpersonal Influence Representation in Social Network Flow Modeling
Jonathan Hamill, USAF/AFIT, 2950 Hobson Way, WPAFB, OH, 45434, United States, thehamills@yahoo.com, James Chrissis, Robert Mills, Richard Deckro

Methods to measure the strength of interpersonal ties among individuals in a social network as well as a means to mathematically characterize source-dependent influence are presented. These techniques lend themselves to use of classic network flow formulations, to include a new centrality measure based upon generalized network flows.

■ WA23

Room 323

Risks and Gains of Offshore Outsourcing

Cluster: Global Services Sourcing
Invited Session

Chair: Praveen Pathak, Assistant Professor, University of Florida, 362 Stuzin Hall, PO Box 117169, Gainesville, FL, 32611, United States, Praveen@ufl.edu

Co-Chair: Ravi Aron, Assistant Professor, The Wharton School, 545 Jon M. Huntsman Hall, 3730 Walnut Street, Philadelphia, PA, 19104, United States, raviaron@wharton.upenn.edu

1 - Effective Strategies For Internal Outsourcing and Offshoring of Business Services
Andrea Masini, Assistant Professor, London Business School, Sussex Place, London, NW1 4SA, United Kingdom, amasini@london.edu, Zeynep Aksin

The growing pressure to reduce costs induces organizations to undertake shared services initiatives. This paper builds upon the "structure-environment" perspective to uncover configurations of Shared Services organizations and to explain why some of these configurations exhibit superior results. The conceptual model proposed suggests that the effectiveness of a shared services project depends on the degree of fit between the characteristics of the environment in and the capabilities developed.

2 - Multi-Shore Sourcing of Judgment and Expertise-Intensive Services: Evidence From Field Research
Ravi Aron, Assistant Professor, The Wharton School, 545 Jon M. Huntsman Hall, 3730 Walnut Street, Philadelphia, PA, 19104, United States, raviaron@wharton.upenn.edu, Annapurna Valluri, Lyle Ungar

Based on panel data collected from providers of multi-shore research and show that providers (firms) that use deep-linked inter-organizational information systems are able to migrate their buyers away from costly synchronous channels of communication (telephone, in-person) towards asynchronous channels that are less costly and over a period of time, more effective. Finally, we also study the factors that are best predictors of what makes ad-hoc sourcers convert to contractual sourcing.

3 - Offshore Outsourcing of Services: A Model of the Extended Organizational Form and Survey Findings
Ying Liu, The Wharton School, University of Pennsylvania, 3730 Walnut Street, Suite 500, Philadelphia, PA, 19104, United States, yliu@wharton.upenn.edu, Ravi Aron

We provide a game-theoretical model of the Extended Organizational Forms (EOF) when the buyer firm outsources processes to a provider with the attendant problems of moral hazard. Constructing all functional forms based on our survey of Business Process Outsourcing contracts in several labor regimes (including the US, UK, Singapore, Mauritius and India), we derive the Subgame-Perfect Nash Equilibrium solutions and comment on the welfare implications of the EOF.

4 - Multi-Shore Sourcing of Services: Impact of Technology on Sourcing Outcomes
Annapurna Valluri, Wharton School, University of Pennsylvania, Suite 500 Jon M. Huntsman Hall, Philadelphia, PA, 19104, United States, avalluri@wharton.upenn.edu

In this paper we use computational methods to investigate how firms allocate production of services between different wage regimes and service characteristics, namely, in-house, onshore, offshore and automated utility. Our model was motivated by a survey we conducted with executives at different Fortune 500 companies. We also study the impact of different service characteristics on the allocation of production across the different wage regimes.

■ WA24

Room 324

Supply Chain Coordination

Contributed Session

Chair: Puneet Prakash Mathur, Doctoral Student, Indian Institute of Management Bangalore, Bannerghatta Road, Bangalore, 560076, India, puneetp03@iimb.ernet.in

1 - A Supply Chain Model with Direct and Retail Channels
Aussadavut Dumrongsiri, Information Systems and Operations Management, University of Washington, Mkz 370, UW Business School, Box 35320, Seattle, WA, 98195-3200, United States, adumrong@u.washington.edu, Ming Fan, Apurva Jain, Kamran Moinzadeh

We study a dual channel supply chain where a manufacturer sells to a retailer and consumers. mfr. decides direct channel price and retailer decides price and quantity. The difference in costs of 2 channels and demand variability determine the existence of equilibrium. Under a centralized setting, adding a direct channel will increase the overall profit. The dual channel is preferred by mfr. when the retailer cost is high and wholesale price, consumer valuation and demand variability are low.

2 - Chaos in the Supply Chain
Christopher Rump, Assistant Professor, Bowling Green State University, Applied Statistics & Operations Research, Bowling Green, OH, 43403, United States, cmrump@cba.bgsu.edu, Anju Bhatt

We develop game-theoretic models of the interactions between agents in either competitive or cooperative (with alliances) supply chains. We examine the nonlinear dynamics of these interactions, focusing on the stability or possible chaotic instability of the equilibrium solutions in such environments. A computer simulation demonstrates the applicability of the results.

3 - A Supply Chain Network Dynamic Equilibrium Model
Cheng-Chang Lin, Professor, National Cheng Kung University, 1 University Road, Tainan, 701, Taiwan, cclin@mail.ncku.edu.tw, Terry Friesz, I-Chen Wu

Under the oligopolistic market, each firm is to unilaterally determine its dynamic prices and operating plans to gain its optimal profit over the planning horizon. The price does not reach an instant steady state due to time delay. We apply the optimal control theory to design a mathematical model to explore the price, flows and inventory trajectories over time. We propose a diagonalization decomposition algorithm, and analyze the economic implications on how firm reacts on price signals.

4 - Suppliers' Pricing Game and Manufacturer's Sourcing Strategy Under Stochastic Reliability
Chengbin Zhu, PhD Candidate, Virginia Tech, 250 Durham Hall, Blacksburg, VA, 24061-0118, United States, cbzhu@vt.edu, Ann Chan

We consider single period, multi-suppliers, single manufacturer system. The manufacturer sells the final products to the market with stochastic demand at a given price. The components for manufacturing the product are provided by the suppliers with stochastic reliability. Different component request and sourcing strategy are analyzed. We study the model in different operation mechanism: suppliers' coordination and suppliers' competition.

5 - Supply Chain Contracts with Two-Way Penalties
Puneet Prakash Mathur, Doctoral Student, Indian Institute of Management Bangalore, Bannerghatta Road, Bangalore, 560076, India, puneetp03@iimb.ernet.in, Janat Shah

Various SC contracts show different coordination characteristics under forced and voluntary compliance regimes. Non-enforceability of quantity makes forced compliance an unrealistic assumption, whereas voluntary compliance is too conservative assumption. We propose price compliance regime where the price for non-compliance on quantity is enforceable on parties in form of penalties. We model two-echelon SC under price compliance regime and analyze impact of contract parameters on SC coordination.

■ WA25

Room 325

Management of Technology II

Contributed Session

Chair: Nilesh Saraf, Assistant Professor, Simon Fraser University, 8888 University Drive WMC 3323, Burnaby, BC, Canada, nsaraf@sfu.ca

1 - Disruption Lies in the Eye of the Beholder: Differential Effects of Technological Disruption
Raja Roy, Assistant Professor, Tulane University, 605 Goldring Woldenberg Hall, 7 McAlister Drive, New Orleans, LA, 70118, United States, rroy@tulane.edu

I investigate technological changes in the global industrial robotics industry and suggest that "ability" of the firms play an important role in explaining firm failure during technological disruption. I suggest that whether a change is disruptive or sustaining depends on the overlap of a firm's technological capabilities with those that are needed to meet the demands of the market conditions.

2 - Structural Equation Model for the Evaluation of National Funding on R&D Project in Consideration with MBNQA Criteria
So Young Sohn, Professor, Yonsei University, Department of Industrial Engineering, Seoul, South Korea, sohns@yonsei.ac.kr, Yong Gyu Joo

Financial support on the R&D in Science & Technology for SMEs at the governmental level plays a crucial role on the improvement of the national competitiveness. In this paper, we propose a structural equation model (SEM) to evaluate the performance of KOSEF funding program in terms of three aspects: output, outcome and impact under given funding input, R&D environment of a recipient company, and external evaluation programs of funding organization.

3 - Research and Development Planning: Selecting and Scheduling Projects with Heuristic Methods
Kevin Gormley, The MITRE Corporation, 7515 Colshire Drive, M/S N370, McLean, VA, 22102, United States, kgormley@mitre.org, William Scherer

A multi-period technology roadmap of R&D projects with end technology goals is modeled as a Markov Decision Process. A dynamic program solves for the best initial portfolio of projects with anticipation of future project funding. Due to the "curse of dimensionality," states grow rapidly with problem size. Objective value and computation time performance are explored for three solution methods: state aggregation, decomposition into sub-problems, and a greedy expected utility heuristic.

4 - 'Shapeshifting' Gambits: Entrepreneurs' Industry Action - Evidence From Technology Standards Writing
Mike Provance, Doctoral Student, University of Maryland, 372 N Street SW, Washington, DC, 20024, United States, mprovanc@rhsmith.umd.edu

Entrepreneurs face decisions to allocate resources to industry actions such as involvement in technology standard setting early in their life cycles with profound implications for growth. Some entrepreneurs choose to shape their strategies to fit with the standards they are involved in writing. Others attempt to dominate standards writing in order to shift standards towards their strategies. When do entrepreneurs choose one path over the other? How does performance vary with this choice?

5 - Cross-Platform Mobility of IT Vendors: A Real Options Approach
Nilesh Saraf, Assistant Professor, Simon Fraser University, 8888 University Drive WMC 3323, Burnaby, BC, Canada, nsaraf@sfu.ca, Jing Li

We present a real-options model of IT application vendors considering adoption of new, emerging platforms. In the model, we consider the ratio of future compatibility cost relative to the current cost. We present the simulation results and discuss implications for both, application vendors and IT platform sponsors.

■ WA26

Room 326

Applications of Data Mining in Exploratory Research

Sponsor: INFORMS Computing Society/Data Mining

Sponsored Session

Chair: Uzma Raja, University of Alabama, Box 870226, Tuscaloosa, AL, 35487-0226, United States, URaja@cba.ua.edu

1 - Building Predictive Models from Medical Records
Mike Hardin, Professor of Statistics, University of Alabama, Box 870226, Department of ISM, Tuscaloosa, AL, 35487, United States, mhardin@cba.ua.edu, Tyler Keenum, Jerry Oglesby, Timothy Day, Josh Hamilton, Tara Mitchell

The preliminary results of a project between the University of Alabama, the University of Alabama at Birmingham, and the SAS Institute are presented. This project examined text mining applied to medical records. The data were clinical notes; particularly, notes from pathology, radiology and discharge summaries. Using this data, we constructed a start list using the medication list from RxNorm and SNOMED CT(r). We then developed several predictive models.

2 - Underlying Themes in the Supply Chain Management Literature: An Initial Investigation
Jeremy Brann, PhD Candidate, Texas A&M University, 4217 TAMU, College Station, TX, 77843, United States, jbrann@mays.tamu.edu, Antonio Arreola-Risa

Supply Chain Management has varied definitions. As such, the extant literature is topically diverse with widespread target audiences. This paper utilizes text mining to attempt to uncover a set of major underlying themes within the Supply Chain Management literature. These themes are subsequently used to develop a framework for identifying areas within the literature that need further research.

3 - A Model for Open Source Project Performance Using Data Mining and Text Mining
Uzma Raja, University of Alabama, Box 870226, Tuscaloosa, AL, 35487-0226, United States, URaja@cba.ua.edu, Marietta Tretter

A model for identifying the factors that affect the performance of Open Source Software (OSS) projects was developed using Data Mining and Text Mining. The OSS project data from Source Forge repository was used to develop test and validate the model. The model was improved using new variables created by using Text Mining techniques.

■ WA27

Room 327

Data Mining/Statistical Modeling and Process Monitoring

Sponsor: Quality, Statistics and Reliability

Sponsored Session

Chair: Myong K. Jeong, Assistant Professor, University of Tennessee, 311 East Stadium Hall, Knoxville, TN, 37996, United States, mjeong@utk.edu

1 - Improved Detection of Out-of-Control Conditions in Multivariate Process Control
Amit Mitra, Associate Dean, Auburn University, Office of Dean, College of Business, Auburn, AL, 368495240, United States, mitra@business.auburn.edu

Process monitoring involving multiple variables using control charts has traditionally used a distance measure in the form of a T-squared chart. The measure has usually been based on process output variables. In this paper, we consider two categories of input variables that may impact the output variables; process regulatory variables and the uncontrollable noise factors.

2 - Kernel-Based Biomass Monitoring Based on NIR Spectroscopy in Forest Products Manufacturing Industry

Hyun-Woo Cho, Research Associate, University of Tennessee, 309 East Stadium Hall, Knoxville, TN, 37996, United States, hwcho@postech.ac.kr, Myong K. Jeong

Near infrared (NIR) spectroscopy has been used for the characterization of different forms of biomass. This work presents the kernel-based approaches combined with a signal filtering technique for biomass monitoring.

3 - A New Generalized Linear Model for Estimating Electric Power System Reliability

Seth Guikema, Texas A&M University, Department of Civil Engineering, 3136 TAMU, College Station, TX, 77843, United States, sguikema@civil.tamu.edu, Jeremy Coffelt

This talk presents a new GLM model based on the Conway-Maxwell-Poisson probability density function. It demonstrates the use of this model for estimating the impacts of tree trimming on electric power system reliability. The results from the new model are compared to the results from more standard models such as the Poisson and Negative Binomial GLMs.

4 - Feedforward Control of Multistation Assembly Processes Using Reconfigurable Fixtures

Luis E. Izquierdo, Graduate Research Assistant, University of Michigan, Mechanical Engineering, Ann Arbor, MI, 48109, United States, leiv@umich.edu, Jianjun Shi, S. Jack Hu

The use of feedforward control in multistation manufacturing systems has emerged as a promissory method to reduce product variation. Using process adjustment to compensate deviations in a part-by-part basis, final product quality can be significantly improved. This talk addresses the problem of designing a feedforward control strategy that considers: deviations estimation (from in-line measurements), process/parts constraints and variation propagation on determining the optimal control action.

■ WA28

Room 328

Data Mining for Process Control

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: Hang Zhang, PhD Student, Department of Industrial & Systems Engineering, Rutgers University, Piscataway, NJ, 08854, United States, zhangh@eden.rutgers.edu

1 - Data Mining and Causal Discovery for Process Control in Manufacturing Hot Rolling Processes

Jing Li, Research Assistant, Department of Industrial and Operations Engineering, University of Michigan, 1205 Beal Avenue, Ann Arbor, MI, 48109, United States, jinglz@engin.umich.edu, Ran Jin, Jianjun Shi

Massive data are collected in manufacturing hot rolling processes, which contain rich information on process and product quality conditions. In this study, data mining tools are used to analyze the data and discover the causal relationships for process control and root cause diagnosis.

2 - Identifying Outliers and Monitoring Process Profile Data

Hang Zhang, PhD Student, Department of Industrial & Systems Engineering, Rutgers University, Piscataway, NJ, 08854, United States, zhangh@eden.rutgers.edu, Susan Albin

We propose a new method to identify outliers in a dataset that consists of profiles, that is, functions that characterize a product or process. The method can be used to remove out-of-control profiles in a baseline dataset or for monitoring purposes. We demonstrate the method on simulated and real application data.

3 - Statistical Modeling of Marketing Contact Effects

Dingxi Qiu, PhD Candidate, Northwestern University, 2145 Sheridan Road, Room C-217, Evanston, IL, 60208, United States, d-qiu@northwestern.edu, Edward Malthouse, Ajit Tamhane

This study attempts to quantify the effect of a marketing contact on the future customer purchase behavior. While the direct effect is usually easy to compute; the indirect effect is hard to model. We analyze the marginal effect of an additional marketing contact based on the contact and transaction history in the database so that the on-line advertisers can dynamically determine whether to serve an individual prospect the commercial or not.

■ WA29

Room 329

Patient Scheduling and Flow

Cluster: Joint Cluster Healthcare/ HAS: Healthcare Engineering
Invited Session

Chair: Mark Lawley, Associate Professor, Purdue University, 315 North Grant Street, West Lafayette, IN, 47906, United States, malawley@purdue.edu

1 - A Stochastic Overbooking Model for Outpatient Clinical Scheduling with No-Shows

Kumar Muthuraman, Assistant Professor, Purdue University, 315 North Grant Street, West Lafayette, IN, 47906, United States, kumar@purdue.edu, Mark Lawley

We formulate a stochastic overbooking model and develop an appointment scheduling policy for outpatient clinics. Each calling patient has a no-show probability, and overbooking is used to compensate for patient no-shows. The scheduling objective captures patient waiting time, staff overtime, and patient revenue. We derive conditions under which the objective evolution is unimodal and we investigate the behavior of the scheduling policy under a variety of conditions.

2 - Blueprint for Effective Patient Flow

Renata Kopach, Doctoral Student and Graduate Researcher, Purdue University, 315 North Grant, West Lafayette, IN, 47906, United States, rkopach@purdue.edu, Narayanan Varadarajan, Imran Hasan

Patient flow impacts the delivery of care and a hospital's budget. The two primary factors impeding flow are the lack of real-time communication and inefficient bed assignment. In an effort to smooth patient flow 'state transparency' technology can be employed. Using trace data from this technology we seek to recreate representative patient care paths. Our objective is to develop a tool capable anticipating how the patient load will tend to change in the near future given the current flow.

3 - Focused Factories versus Service-Plexes: Comparison of U.S. Hospital Operations

Diwas Kc, Doctoral Candidate, The Wharton School, University of Pennsylvania, 3730 Walnut Street, Suite 500, Philadelphia, PA, 19104, United States, diwas@wharton.upenn.edu, Christian Terwiesch

In this paper, we use operational metrics such as patient length of stay, quality of care, service levels, charges, capacity investments and utilization rates to compare cardiac specialty hospitals, which focus on a limited number of cardiac procedures, with general hospitals. To deal with selection bias, we stratify patients based on their pre-operative levels of risk.

4 - A Configurable Framework for Open Access Scheduling in Outpatient Clinics

Po-Ching DeLaurentis, Doctoral Student and Graduate Researcher, Purdue University, 315 North Grant, West Lafayette, IN, 47907, United States, chenp@purdue.edu, Kumar Muthuraman, Renata Kopach, Mark Lawley, Leyla Ozsen, Ronald L. Rardin, Xiuli (Shelly) Qu, Hong Wan

Open access scheduling has become a prevailing practice in outpatient clinics because it is believed to provide better access to care, better quality of care and ultimately optimize the use of urgent care and hospital resources. However, implementations have failed at many sites. Therefore, we propose a configurable framework of rough cut tools for open access scheduling design which can make open access scheduling effective and adaptable to a variety of outpatient settings.

■ WA30

Room 330

Marketing I

Contributed Session

Chair: Tomoaki Tabata, Assistant Professor, Tokyo Fuji University, Shimoochiai 1-7-7, Shinjuku, Tokyo, 1618556, Japan, tabata@fuji.ac.jp

1 - Customer Portfolio Optimization

Tuba Pinar Yildirim, PhD Student, University Of Pittsburgh, 1048 Benedum Hall, Pittsburgh, PA, 15261, United States, tubapinar@gmail.com

Portfolio optimization has been used by investors as a major practical field of finance. Models to structure optimal portfolio have been successfully applied to areas other than finance, like marketing. In this study, we are investigating the strategic fit of portfolio selection models to customer selection models and derive the optimal customer portfolio, the group of highest return customers at a preset level of risk.

2 - Optimal Product Line Pricing for Two Customer Segments
Govind Daruka, PhD Student, University of Illinois at Urbana-Champaign, 406 TB, 104 S. Mathews Street, Urbana, IL, 61801, United States, daruka@uiuc.edu, Udatta Palekar

We consider the pricing problem for a product line with two customer segments. Customers can be grouped into segments based on the maximum acceptable price and the lowest product features acceptable, which is proportional to the cost of the item. Demand for an item is dependent on the price differential between the item and the next item with higher cost. Our mathematical analysis provides important insights to a retailer for assortment planning and pricing of a product line.

3 - Optimizing Product Assortment Under Customer-Driven Demand Substitution
Sibel Salman, Assistant Professor, Koc University, College of Engineering, Sariyer, Istanbul, 34450, Turkey, ssalman@ku.edu.tr, Eda Yucel, Metin Turkay, Fikri Karaesmen

The problem of product assortment and inventory planning under customer-driven demand substitution is analyzed. A stochastic programming model that maximizes expected revenue under uncertain demand with substitution is provided and compared with several other approaches in the literature with different consumer choice and demand substitution models.

4 - Pricing for Health Food Product
Tomoaki Tabata, Assistant Professor, Tokyo Fuji University, Shimoochiai 1-7-7, Shinjuku, Tokyo, 1618556, Japan, tabata@fuji.ac.jp, Takashi NAMATAME, Makoto Goto, Piyapong Chariyavilaskul

It is widely known that health food can help reduce risk for some diseases, result in lower expected value of medical expense or any cost occurred from illness. Therefore, consumers gain some benefit from health food products. We developed the model to evaluate the monetary benefit from health food product by financial engineering approach. Useful information can be obtained for product value evaluation process and also customer perception based pricing process.

■ WA31

Room 331

Portfolio Optimization in Finance-Risk Management

Contributed Session

Chair: Thomas Yeung, Assistant Professor, Department of Automation and Production, Ecole des Mines de Nantes, France, tyeung@uark.edu

1 - An Optimal Policy for the Funding of Warranty Reserves
Cigdem Gurgur, Professor, Colorado School of Mines, 1500 Illinois Street, Golden, CO, 80401, United States, cgurgur@mines.edu

Many companies create a reserve fund to cover future liabilities arising from product warranties. We use probabilistic dynamic programming with infinite horizon to determine the optimal warranty reserve policy a along two lines: 1) The amount of cash additions or subtractions at the beginning of each period; (2) The amount to contribute to the reserve after each sale. We also discuss extension of our model to multi-product case.

2 - Optimal Investment (via Dynamic Programming) Using Leveraged Assets
Sham Kakade, Assistant Professor, Toyota Technological Institute, 1427 E. 60th Street, Chicago, IL, 60637, United States, sham@tti-c.org, Dean Foster

We study the problem of investing for retirement, focusing on the risk/return tradeoff, using financial instruments which leverage. Such schemes include margin buying and financial options/futures. The core decisions are how much to save/spend and whether to work or not. Via dynamic programming techniques, we characterize many aspects of the optimal policy and we estimate optimal values. Calibrating ourmodel with historical data, we find that the optimal strategy is highly leveraged.

3 - A Learning Real Options Framework Applied to Capacity Expansion
Luke Miller, Assistant Professor, Fort Lewis College, 1000 Rim Drive, Durango, CO, 81301, United States, miller_l@fortlewis.edu

This paper studies the impact of learning on a multi-staged investment scenario and quantifies information acquisition by merging statistical decision theory with the real options framework. Using real data provided by a firm in the aerospace maintenance, repair, and overhaul industry, the methodology is used to guide a multi-phased irreversible investment decision involving process design and capacity planning.

4 - Control and Management of Financial Risks: A Quantitative Approach
Danilo Abril, Politecnico Grancolombiano, Calle 57 No. 3-00 Este, Bogotá, BO, Colombia, danabril@poligran.edu.co, Rodrigo Caliz, Jesus Velásquez

In this paper a generic stochastic optimization model for Colombian insurance enterprises including cVaR (Conditional Value at Risk) issues is presented. This model is the first quantitative approach that takes into account Enterprise Risk Management (ERM) as well as Asset and Liability Management (ALM) concepts to design new regulations including international standards for management and control of financial risks in Colombia.

5 - A Real Options Approach to Venture Capitalist Investment Decisions
Thomas Yeung, Assistant Professor, Department of Automation and Production, Ecole des Mines de Nantes, France, tyeung@uark.edu, Richard Cassady

Contingent claims analysis and options pricing theory are incorporated into stochastic optimization models for investment project capital budgeting under uncertainty. We formulate, design solution procedures for, and analyze the behavior of two optimization models. One is a capital budgeting optimization model to determine the optimal portfolio of options to purchase, and the other is a multi-period optimization model to determine which options to implement for each decision-making period.

■ WA32

Room 332

Risk and Supply Chain Management

Contributed Session

Chair: Seong Hyun Nam, Associate Professor, University of North Dakota, PO Box 8377, Grand Forks, ND, 58202, United States, seong_nam@und.edu

1 - The Risk-Averse Newsvendor Problem with Coherent Risk Measures
Sungyong Choi, Rutgers University, 101 Bleeker Street #52, Newark, NJ, 07102, United States, sungyong@pegasus.rutgers.edu, Andrzej Ruszczynski

We shall consider the classical newsvendor problem, best in the risk-averse setting. Then, we shall use modern mean-risk models and coherent risk measures to derive the optimal policy of the risk-averse newsvendor. Next, we shall apply these results to derive risk-averse inventory policies when the demand is uncertain. The theoretical considerations will be accompanied by a simulation study and statistical analysis of the results.

2 - Optimal Operating Policies for a Multinational Company under Varying Market Economics
Shu-Chen Chang, Department of Business Administration, National Formosa University, 64 Wen-Hua Road, Huwei, Yunlin 632, Taiwan, shu-chen@nfu.edu.tw, Cheng-Ying Yang

While being different from other research methods which assume that both the market price of products and the exchange rate are static, our approach is based on two assumptions: (1) The market price of products is not static and mainly depends on individual market's demand; and (2) The exchange rate is dynamic and defined by a stochastic probability distribution function. Then, this paper develops and evaluates a mathematical programming model for the multi-national corporation operations.

3 - Load Dependent Lead Times in Tactical Production Planning
David Woodruff, Professor, University of California - Davis, Graduate School of Management, 155 AOB 4, Davis, CA, 95616, United States, dlwoodruff@ucdavis.edu, Julia Pahl, Stefan Voss

There have been only a few papers that describe models at the aggregate planning level that recognize the relationship between the planned utilization of capacity and lead times. In this paper we provide an in-depth discussion of the state-of-the art in this literature, with particular attention to those models that are appropriate at the aggregate planning level.

4 - Integrating Forest Bucking and Transportation
Satyaveer Chauhan, Bordeaux Business School, Domain de Raba - 680, cours de la Libération, 33405 Talence Cedex, France, satyaveer.chauhan@bordeaux-bs.edu, Luc LeBel, Sophie D'Amours, Jean-Marc Frayret

We consider timber supply chain in which the contractor wants to produce as much products as possible from the forest while minimizing production and transportation costs. Production cost which includes harvesting and bucking of trees, depends upon the variety of products produced in the forest while transportation cost depends upon the volume of the product and distance. A solution approach based on decomposition approaches and heuristic is developed and tested on the randomly generated data.

5 - Optimal Dynanic Pricing and Ordering Policy Under Supplier's Uncertain Environment

Seong Hyun Nam, Associate Professor, University of North Dakota, PO Box 8377, Grand Forks, ND, 58202, United States, seong_nam@und.edu, Hisash Kurata

This paper presents a model for analyzing the impact of joint decision policies on optimal pricing and order size over a given time interval in a system consisting of a supplier and buyers. The joint decision policies characterized by the unit selling price that reflect the supplier's uncertain environmental factors and order size under uncertain demand. We apply the stochastic optimal control to find strategic optimal decision for buyer's.

■ WA33

Room 333

Estimation of Airport Capacity II

Sponsor: Aviation Applications

Sponsored Session

Chair: Gregory Coldren, President, Coldren Choice Consulting Ltd., 123 South Adams Street, Rockville, MD, 20850, United States, gregorycoldren@yahoo.com

1 - Estimating Runway Capacity with Simulation

John Barrer, The MITRE Corporation, 7515 Colshire Drive, N370, McLean, VA, 22102, United States, jbarrer@mitre.org

This paper describes a simulation technique for estimating the capacity and delay of a runway system. The process is unique in that the simulation code itself is controlled by a standardized set of parameters whose format remains the same for all airports in the world. This greatly reduces the time required to simulate an airport's runway system. The modeling technique is in use and has been successful for a wide range of airport operations.

2 - Airport Capacity: Aggregate vs. Disaggregate Modeling

Jasenka Rakas, University of California at Berkeley, NEXTOR, 107B McLaughlin Hall, Berkeley, CA, 94720, United States, jrakas@berkeley.edu, Yu Zhang

We develop a comprehensive methodology for assessing airport performance and establishing airport efficiency metrics for runway and airport utilization using PDARS. We focus on the estimates of landing time intervals (LTIs) for each consecutive pair of aircraft for each runway and then aggregate micro aircraft-landing data to runway level, airport-configuration level and airport level for five major airports in the U.S. We discus the advantages of disaggregate airport capacity modeling.

3 - Transient States and Dynamics of Airport Runway Configurations

Jasenka Rakas, University of California at Berkeley, NEXTOR, 107B McLaughlin Hall, Berkeley, CA, 94720, United States, jrakas@berkeley.edu, Yu Zhang

This study explores a dynamic behavior of an airport system by investigating changes in airport primary runway configurations and their intermediate transitions. We analyze the duration and operational performance of each runway configuration and its transition to a subsequent configuration by using a semi-Markov process. The results can be useful in predicting airport states and the expected airport performance and used in tactical decisions to avoid capacity congestion and expected delays.

■ WA34

Room 334

Modeling and Analysis of Intra and Inter-Plant Logistical Problems

Sponsor: Transportation Science & Logistics

Sponsored Session

Chair: Sunderesh Heragu, Department of Industrial Engineering, J.B. Speed School of Engineering, University of Louisville, Louisville, KY, 40292, United States, s.heragu@louisville.edu

1 - Design of Multistage Pull Control Systems

Ronald Askin, Professor, Arizona State University, Department of Industrial Engineering, Tempe, AZ, 85287-5906, United States, Ron.Askin@asu.edu, Shravan Krishnan

A model is presented to guide the partitioning of multistage, multiproduct, stochastic, dynamic production systems into a series of control sections. Pull control is used to release jobs and coordinate between sections. Push control is used within sections in that released jobs flow without requiring additional authorizations. Flow time and inventory cost are minimized subject to service level constraints.

2 - Designing Supply Networks and Facilities with Robust Order-to-Delivery Capability

Benoit Montreuil, Professor, Laval University, CIRRELT, Pav. P. Prince, Office 2533, Québec, QC, G1K 7P4, Canada, benoit.montreuil@centor.ulaval.ca, Alain Martel, Marc Paquet

We present an optimization methodology for the design of supply networks and facilities operating in an assemble-to-order or make-to-order context, having the robust capability to deliver products to geographically distributed customers within a to-be-specified offer in each market segment, combining an order-to-delivery time and a service level, given that daily demand is stochastic and dependent on the offer.

3 - Bucket Brigade Dynamics for Discrete Tasks

Bryan A. Norman, PhD, University of Pittsburgh, 1033 Benedum Hall, Pittsburgh, PA, 15261, United States, banorman@pitt.edu, Natasa Vidic

We study throughput of a bucket brigade when tasks are discrete, production rates are worker/task dependent and workers are idle if blocked. We compare the bucket brigade line throughput with the throughput from a fixed assignment line and define conditions for which bucket brigades are more effective. We substantiate our proofs with numerical examples.

4 - Semi-Open Queuing Network Applications in Logistics

Sunderesh Heragu, Department of Industrial Engineering, J.B. Speed School of Engineering, University of Louisville, Louisville, KY, 40292, United States, s.heragu@louisville.edu, Jing Jia

In this paper, we illustrate applications for semi-open queuing network models in manufacturing and logistics. We solve some special cases of this model exactly using analytical matrix genometric methods and develop heuristic solution methods for others.

■ WA35

Room 335

Urban Transportation Planning Models VIII: Trip Distribution and Assignment

Sponsor: Transportation Science & Logistics

Sponsored Session

Chair: James Moore, Professor and Chair, Epstein Department of Industrial & Systems Engineering, University of Southern California, GER 240; MC 0193, Los Angeles, CA, 90089, United States, jmoore@usc.edu

1 - A Comprehensive Approach for Estimating Freeway Time-Dependent O-D Demands

Pei-Wei Lin, Assistant Professor, University of Missouri at Kansas City, Department of Civil Engineering, Kansas City, MO, 64110, United States, linp@umkc.edu, Gang-Len Chang

We propose a comprehensive approach for estimating time-dependent origin-destination (O-D) distributions for a freeway corridor. The approach accounts for missing ramp traffic flows, an unavailable initial O-D set, and measurement errors. Numerical experimental results based on Maryland's I-95 freeway corridor reveal the robustness and effectiveness of the proposed approach.

2 - Determination of the Optimal Placement of Point Detectors on Virginia's Freeways

Praveen Edara, Research Scientist, Virginia Transportation Research Council, 530 Edgemont Road, Charlottesville, VA, 22903, United States, Praveen.Edara@VDOT.Virginia.gov, Brian Smith, Jianhua Guo, Cathy McGhee

A decision support tool to identify the best locations of a finite set of point detectors on a freeway corridor is developed in this research. The objective function, minimization of the travel time estimation error, is formulated as a combinatorial optimization program and solved for a good solution using metaheuristics.

3 - Traffic Assignment with Paired Alternative Segments

David Boyce, Department of Civil and Environmental Engineering, Northwestern University, 2149 Grey Avenue, Evanston, IL, 60201, d-boyce@northwestern.edu, Hillel Bar-Gera

Preliminary computational results for large-scale networks are presented for a new traffic assignment algorithm that maintains consistency among paired alternative route segments across all OD pairs. Consistency means route flow proportions on alternative subroutes are equal across OD pairs, which is a behavioral interpretation of the entropy maximizing route flows.

4 - Modeling the Effect of Traffic Congestion on Commuter Path Choices
Justin Yates, Department of Industrial and Systems Engineering, State University of New York at Buffalo, 415 Lawrence D. Bell Hall, Buffalo, NY, 14260-2050, jtyates@buffalo.edu, Mingzhe Li, Rajan Batta

The standard approach for modeling commuters is to assume that O-D travel is based on criteria like shortest time, number of turns, and number of intersections. We show a convergence scheme accounting for congestion effects on shared links. Computational examples are based on a sample road network in Northridge, California.

■ WA36

Room 336

Analysis for Defense Transformation II

Sponsor: Military Applications

Sponsored Session

Chair: Greg Parlier, Gregory.h.parlier@saic.com

1 - Developing Capabilities-Based Battle Command Training Centers for the Future Force
Simon Goerger, Assistant Professor & ORCEN Director, Department of Systems Engineering, Building 752 (Mahan Hall), United States Military Academy, West Point, NY, 10996, United States, Simon.Goerger@usma.edu, Gregory Boylan

Training the Army's future digital force has precipitated the need to assess the ability of current training facilities to meet the needs of the transforming force. Of interest are the Battle Command Training Centers (BCTCs) and their abilities to support the Army's training needs for this future force. This presentation addresses the systems engineering process used to determine essential requirements and the resulting model designed to validate the capabilities of prototype BCTC facilities.

2 - Transforming Army Logistics: A Supply Chain Approach
Greg Parlier, Gregory.h.parlier@saic.com

Fully engaged in the Golobal War on Terrorism, the US Army is also committed to a comprehensive and ambitious "Transformation" endeavor. This presentation summarizes a three-phase project, combining elements of classical inventory theory and large-scale supply chain management concepts with several innovative approaches, culminating in an "analytical architecture" to guide Logistics Tranformation for the US Army.

3 - Discerning Patterns of Aircraft Usage and Spare Parts Demands
George Kuhn, Senior Research Fellow, LMI, 2000 Corporate Ridge, McLean, VA, 22102, United States, gkuhn@lmi.org

Report on research exploring whether patterns of aircraft (helicopter) usage and spare parts demands may be better described in order to support better forecasts. Progress toward greater differentiation among usage and spares behaviors, and away from traditional approaches relying on highly aggregated views, will be discussed.

4 - Enhancing Army Aviation Readiness
Stan Horowitz, shorowitz@ida.org, Daniel Levine, Christopher Hanks

This work examines two topics related to improving the readiness of Army helicopters. The first addresses the efficacy of special helicopter maintenance programs that are more extensive than normal depot overhaul. They will be evaluated in terms of how much mission capable rates improved. The second topic compares spares packages designed by several methodologies. Statistical analysis will attempt to show which approach is likely to yield the highest readiness.

■ WA37

Room 337

Supply Chain Management II

Contributed Session

Chair: Anna Nagurney, John F. Smith Memorial Professor of Operations Management, University of Massachusetts, Isenberg School of Management, Amherst, MA, 01003, United States, nagurney@gbfin.umass.edu

1 - Elements of VMI Systems
Sami Sarpola, Researcher, Helsinki School of Economics, PO Box 1210, FIN-00101 Helsinki, Helsinki, Finland, sami.sarpola@hse.fi, Katri Karjalainen, Sanna Laukkanen

Vendor Managed Inventory (VMI) systems have gained prominence during the last decade and a wide variety of them can be identified from the practice. To enable their evaluation and comparison six elements ñ inventory location, distribution model, inventory level monitoring and demand visibility, role of information systems, replenishment decision, and inventory ownership ñ are defined and combined to form a framework for the evaluation of VMI systems.

2 - Performance Analysis of Acyclic Supply Chains
Yao Zhao, Rutgers, The State University of New Jersey, 180 University Avenue, Newark, NJ, 07102, United States, yaozhao@andromeda.rutgers.edu

We analyze acyclic supply chains under the full backorder assumption. We present some unique system properties which lead to complexity reduction in network toplogy. Various supply systems, inventory policies and demand processes are considered.

3 - An Optimal Soft Order Revision Policy for a Vendor Facing Atypical Demand and Supply Uncertainty
Pundarikaksha Baruah, Student, Wayne State University, 4815 4th Street, Detroit, MI, 48201, United States, baruah@wayne.edu, Ratna Babu Chinnam

Atypical demands are highly volatile and unsuitable for regular forecasting. In such cases, vendors utilize market signals to do demand forecast updating. We determine an optimal soft order revision policy for a vendor facing atypical demand and supply uncertainty in a single selling season. The decision variables are soft orders and final firm order quantity to be transmitted to the supplier. We also demonstrate the value of supplier sharing order inventory information with the vendor.

4 - Financial Engineering of the Integration of Global Supply Chain Networks and Social Networks
Tina Wakolbinger, University of Massachusetts, Amherst, 121 H Brittany Manor Drive, Amherst, MA, 01002, United States, wakolbinger@som.umass.edu, Jose M. Cruz, Anna Nagurney

In this paper, we focus on the financial engineering of integrated global supply chain and social networks. Through a multilevel, dynamic supernetwork framework consisting of the global supply chain network with electronic commerce and the social network, we capture the multicriteria decision-making behavior of the various decision-makers (manufacturers, retailers, and consumers), which includes the maximization of profit, the maximization of relationship values, and the minimization of risk.

5 - Dynamic Electric Power Supply Chains and Traffic Networks as Evolutionary Variational Inequalities
Anna Nagurney, University of Massachusetts, Isenberg School of Management, Amherst, MA, United States, zugang_liu@yahoo.com, Monica-Gabriel Cojocaru, Zugang Liu, Patrizia Daniele

We develop an electric power supply chain network equilibrium model and establish the supernetwork equivalence between the model and a transportation network model. This equivalence yields a new interpretation of electric power network equilibria in path flows. We exploit this equivalence to propose a dynamic electric power network model using an evolutionary variational inequality (EVI) formulation. Numerical examples are solved using the unification of EVI and projected dynamical systems.

■ WA38

Room 338

Transportation Problems in Urban Planning

Contributed Session

Chair: Ozlem Yanmaz-Tuzel, Rutgers University, 623 Bowser Road, Piscataway, NJ, 08854, United States, yanmaz@rci.rutgers.edu

1 - Industrial Impact of a Suburban Transport System in Central Mexico
Juan Enrique Sandoval, Program Director, Univ Politecnica de Aguascalientes, Prol Mahatma Gandhi Km 2, San Francisco del Arenal, Aguascalientes, AG, 20280, Mexico, juan.sandoval@upa.edu.mx

This project evaluates economic implications of light suburban system in the Aguascalientes Region in central Mexico, using a model that includes routing variables, industrial costs, return over investment, timing and savings. We propose a method to grade how attractive will this system be in terms of investment.

2 - An Analysis of Improving Transit Accessibility in the In-city Village in China
Zhaoqiong Qin, Assistant Professor, Embry-Riddle Aeronautical University, College of Business, 600 S. Clyde Morris Boulevard, Datona Beach, FL, 32114, United States, qina50@erau.edu, Zheng Yang

The in-city village is special in the urbanization in China, which affected the implementation of city function and changed the city transit structure. In this paper, based on the characteristics in the in-city village in China, we proposed a model and methodology to improve the transit accessibility for the in-city village.

3 - An Approach to Solve Mixed Integer Linear Programming Formulations with Big-M Constraints

Archana Khurana, Lecturer, School of Basic and Applied Sciences, Guru Govind Singh Indraprastha University, Kashmere Gate, Delhi 110006, India, archana_maths@rediffmail.com, Iftekhar Karimi, Arul Sundaramoorthy

This paper addresses the impact of first level Reformulation Linearization Technique (RLT) and Reduced Reformulation Linearization Technique (RRLT) on Mixed Integer Linear Programs (MILP) with big-M constraints. Our approach has less number of variables and constraints and it is computationally more efficient than the existing approach. We solve a variety of problems such as flow-shop, job-shop and strip packing to illustrate the performance of the modified RLT and RRLT.

4 - Modeling of Commuters' Day-to-Day Learning Behavior: An Application to NJ Time-of-Day Pricing Program

Ozlem Yanmaz-Tuzel, Rutgers University, 623 Bowser Road, Piscataway, NJ, 08854, United States, yanmaz@rci.rutgers.edu, Kaan Ozbay

Stochastic Learning Automata (SLA) is used to model commuters' day-to-day learning behavior. Stochastic nature of the system and heterogeneity among users are considered by combining Bayesian Learning approach with the SLA.The proposed model aims to capture the commuters' departure-time choice learning behavior both under undisturbed and disturbed network conditions and to investigate responses to toll, travel-time, departure/arrival time restrictions while selecting their departure-times.

■ WA39

Ballroom B

Education and Discrete Optimization

Contributed Session

Chair: Torsten Reiners, University of Hamburg, Von-Melle-Park 5, Institut für Wirtschaftsinformatik, Hamburg, Germany, reiners@econ.uni-hamburg.de

1 - New Turnpike Theorems for Knapsack Problems

Ping Heidi Huang, Purdue University, Krannert School of Management, West Lafayette, IN, 47907, United States, huang74@mgmt.purdue.edu, Thomas Morin

New and improved turnpike theorems for the knapsack problem are developed. Number-theoretic concepts are used to prove some of our results and several of our theorems subsume known results as special cases. A number of numerical examples are also given.

2 - A Statistical Heuristic for Designing Access Telecommunications Networks

Gnana Anandalingam, Professor, University of Maryland, Smith School of Business, Van Munching Hall 4365, College Park, MD, 20742, United States, ganand@rhsmith.umd.edu

We provide a heuristic based on statistical clustering for designing access telecommunications networks. The proposed heuristic combines iterative partitioning with a minimum spanning tree heuristic. We obtain very good results when applying our method to a real design problem that was part of a consulting project. We also compare our heuristic to a number of well-known methods for designing access networks, and show it is superior in both speed of computation and closeness to optimality.

3 - Boundary Critique: A Tool for Promoting Pratical Reason in OR/MS Projects

Luis Arturo Pinzon, Professor, Universidad de los Andes, Cra 1 Este No.18 A-10 Of. W506 UNIANDES, Calle 19A No.1-37 Este Of.W506 UNIANDES, Bogota, Colombia, lpinzon@uniandes.edu.co

Boundary critique is a critical systems thinking concept that OR/MS practitioners may use for executing or facilitating work in their research or consultancy projects. We illustrate the use of the boundary critique in a specific research project. Boundary critique may help to establish links between practical and instrumental in OR/MS projects given that OR/MS approaches have proved particularly strong and well-founded in the realm of instrumental reason.

4 - Adaptive Learning Paths to Support the OR-Education

Torsten Reiners, University of Hamburg, Von-Melle-Park 5, Institut für Wirtschaftsinformatik, Hamburg, Germany, reiners@econ.uni-hamburg.de

We developed an approach called configurable adaptation including the concept of individualized and adaptive learning paths. That is, for a course with algorithmic experiments, results are stored in a general content pool to be dynamically included in (individual) learning scenarios. Furthermore, courses are made personal by including results from previous course units and, therewith, increasing the motivation for off-line learning.

■ WA40

Room 401

Logistics/Transportation Issues in Facility Location

Contributed Session

Chair: Vladimir Marianov, Pontificia Universidad Católica de Chile, Department of Electrical Engineering, Vicuna Mackenna 4860, Santiago, RM, 782-0436, Chile, marianov@ing.puc.cl

1 - Genetic Algorithms for a Network Design Problem with Lead Time and Safety Stock Considerations

Karthik Sourirajan, Research Staff Member, IBM TJ Watson Research Center, 1101 Kitchawan Road, Yorktown Heights, NY, 10598, United States, ksourira@us.ibm.com, Reha Uzsoy, Leyla Ozsen

We consider a production facility that replenishes a single product at retailers. The objective is to locate DCs such that the sum of the facility location, pipeline inventory and safety stock costs is minimized. We model the relationship between the flows in the network, lead times and safety stock levels. We examine the use of genetic algorithms to solve the model and found a novel chromosome representation that combines binary vectors with random keys to give a favorable solution quality.

2 - An Inventory-Location Model with Stochastic Capacity Constraints, Solved with Valid Inequalities

Pablo A. Miranda, Universidad Andres Bello, Sazie 2320, Piso 2, Santiago, 837-0149, Chile, pamiranda@unab.cl

We present a joint location-distribution-inventory model for a three layered supply chain, and an efficient heuristic solution approach. A firm must design a minimum cost system to supply commodities to a set of spatially distributed retailers, enforcing capacity constraints stochastically at each installed DC. The solution approach is based on Lagrangian Relaxation, improved with valid inequalities. These constraints represent the convex hull of demand mean and variance, faced by each DC.

3 - Multiple-Vehicle Routing Problem with Fixed Distribution and Optional Recollection

Gabriel Gutiérrez, PhD Student, Pontificia Universidad Católica de Chile, Department of Electrical Engineering, Vicuña Mackenna 4860, Macul, Santiago, 6904411, Chile, gegutier@ing.puc.cl, Vladimir Marianov

A model is proposed and solved for the multiple-vehicle routing problem with fixed distribution and optional recollection. The transportation cost is minimized and the revenue generated for attending recollection customers is maximized. The model can be applied to distribution systems in which customers and suppliers are visited, but suppliers are visited only they generate revenues. A branch and cut procedure is used to solve this problem, and computer experiences is provided.

4 - The Capacitated Hierarchical Path Problem

Macarena Donoso, PhD Student, Pontificia Universidad Católica de Chile, Department of Electrical Engineering, Vicuña Mackenna 4860, Macul, Santiago, 6904411, Chile, macarena.donoso@udp.cl, Vladimir Marianov

We formulate and solve the Capacitated Hierarchical Path Problem for a two-level distribution system. A path is built between two points of the network, and potential delivery routes that reach the clients start at each node of the path. We minimize the distribution cost of the system,considering the costs of the main path and the delivery routes. Applications are newspaper and courier distribution system. An integer programming formulation and computational experience are presented.

5 - Location of a Maximal Coverage - Minimum Cost or a Maximum Traffic - Minimal Cost Path on a Network

Vladimir Marianov, Pontificia Universidad Católica de Chile, Department of Electrical Engineering, Vicuña Mackenna 4860, Santiago, RM, 782-0436, Chile, marianov@ing.puc.cl, Gabriel Gutiérrez, Macarena Donoso, Carlos Obreque

A model is proposed and solved for locating a path on a network. The cost of the path is minimized (or constrained), while maximizing either coverage or traffic captured between pairs of nodes that are close to the path. Applications are metro or bus lines in a city, or telecommunications backbones. Reduced multicommodity formulations are offered, and computational experience presented.

■ WA41

Room 402

Performance Bounds for Queueing Networks and Related MDPs

Sponsor: Applied Probability

Sponsored Session

Chair: Mike Veatch, Department of Mathematics, Gordon College, 255 Grapevine Road, Wenham, MA, 01984, United States, mike.veatch@gordon.edu

1 - Performance Bounds and State-Relevance Weights for Approximate Linear Programming

Daniela Pucci de Farias, pucci@mit.edu, Theophane Weber, David Jeria

The linear programming approach to approximate dynamic programming returns a solution that depends on the objective function coefficients, a result which contrasts with the case of LP for exact dynamic programming. In the general case of linear combination of features approximating the cost-to-go function, we prove the existence of objective coefficients ensuring an a priori bound on the quality of the resulting policy, in terms of the power of the approximation architecture.

2 - Dynamic Programming for the Crossbar Switch

Ciamac Moallemi, Graduate Student, Stanford University, Department of Electrical Engineering, Packard 274, Stanford, CA, 94305, United States, ciamac@stanford.edu, Sunil Kumar, Benjamin Van Roy

There are a number of heuristics based on generalized maximum-weight matching for scheduling in the crossbar switch. We interpret them in terms of dynamic programming; in particular, each heuristic can be viewed as a greedy policy with respect to an approximation of the value function. We apply an approximate dynamic programming algorithm to generate alternative approximations. We compare behavior and performance of resulting scheduling policies to those of the heuristics.

3 - Throughput Bounds for Closed Queueing Networks via Differential Cost Function Approximation

James R. Morrison, Assistant Professor of Electrical Engineering, Central Michigan University, Department of Engineering and Technology, ET 147, Mount Pleasant, MI, 48859, United States, morri1j@cmich.edu

We develop linear programming throughput bounds for Markov chain models of closed queueing networks operating under affine index control policies. The approach employs surrogates for the differential cost function in an inequality relaxation of the average cost equation. The surrogates considered include piecewise quadratics on polyhedral regions of the state space. Our throughput bounds are tighter than those of some previous approaches and require less computation than exact solution.

4 - Average Cost Bounds for Open Queueing Networks Via LPs

Mike Veatch, Department of Mathematics, Gordon College, 255 Grapevine Road, Wenham, MA, 01984, United States, mike.veatch@gordon.edu

The approximate LP method establishes lower bounds on optimal average cost of queueing network control problems. Numerical results are presented on the tightness of the bound when various value function approximations are used and the rate of convergence as the size of the LP increases. Comparisons with other LP bound are made using duals.

■ WA42

Room 403

Scheduling and Network Optimization

Cluster: Scheduling

Invited Session

Chair: Xiangtong Qi, Assistant Professor, Hong Kong University of Science and Technology, Clear Water Bay, Kowloon, HK, Hong Kong, ieemqi@ust.hk

1 - Equipment and Staff Scheduling Under Disruptions - An Application in USPS Mail Processing Facilities

Xinhui Zhang, Assistant Professor, Wright State University, 207 Russ Center, 3640 Colonel Glen Highway, Dayton, OH, 45435, United States, xinhui.zhang@wright.edu, Arvindkumar Chakravarthy

We address an equipment and staff scheduling problem under disruptions such as demand variation and staff absenteeism that arises in USPS mail processing facilities. The problem is modeled as an integer program, consists of lot sizing, shifting scheduling and overtime management modules, integrates seamless with other research studies. Results suggest financial saving in the tens of millions of dollars annually could be achieved when the model is implemented nationwide for USPS.

2 - Minimizing Class-Based Completion Time Variance in Single Machine Systems

Xueping Li, Assistant Professor, University of Tennessee, Knoxville, Xueping.Li@utk.edu, Yuerong Chen

This paper considers the problem of scheduling a set of simultaneously available jobs on one machine. The jobs come from several different classes of source. The problem is to determine a schedule to minimize the class-based completion time variance (CB-CTV) in which both earliness and tardiness are penalized. We prove that a CB-CTV problem can be transformed into a series of CTV problems and propose an algorithm to achieve differentiated mean completion time for different class of jobs.

3 - Online Network Synthesis

Donglei Du, Associate Professor, University of New Brunswick, PO Box 4400, Fredericton, NB, E3B 5A3, Canada, ddu@unb.ca, Santosh Kabadi

We consider on-line network synthesis problems. We distinguish between two on-line versions of the problem depending on whether the entire set of sites is known a prior or not. For the first version where the entire set of site is unknown, we present a best possible algorithm along with a matching lower bound. For the second version where the entire set of sites is known a priori, we present a best possible algorithm for nbbb=11.

4 - Scheduling with Outsourcing

Xiangtong Qi, Assistant Professor, Hong Kong University of Science and Technology, Clear Water Bay, Kowloon, HK, Hong Kong, ieemqi@ust.hk, Huimin Wang

We consider a production scheduling problem where both in-house production and outsourcing can be used. For a given set of jobs, the problem is to determine which jobs to be processed by in-house production, and which by outsourcing. Job transportation has to be considered when the production schedule is to be made. We present algorithms for different objective functions, and discuss managerial issues for implementation.

■ WA43

Room 404

Multi Criteria Mathematical Programming

Cluster: Multi-Criteria Decision Making

Invited Session

Chair: Ravi Ravindran, Professor, The Pennsylvania State University, Department of Industrial Engineering, 310 Leonhard, University Park, PA, 16802, United States, aravi@psu.edu

1 - Automatic Target Adjustment for Goal Programming Problems

Glenn Kuriger, University of Oklahoma, 100 East Boyd, SEC, Suite R-208, Norman, OK, 73019, United States, kuriger@ou.edu, Hank Grant

An Automatic Target Adjustment (ATA) technique was developed that uses simulation optimization to automatically adjust the target levels of goal programming simulation optimization problems. The target levels were adjusted to ensure that the top two goals were satisfied and that all the goals were satisfied. The best target levels for each case were then selected and the goal programming simulation optimization problems were re-solved at these new target levels.

2 - Multi-Criteria Optimization of the Component-Based Software Systems

Soundar R. T. Kumara, Distinguished Professor, The Pennsylvania State University, 363 Leonhard Building, University Park, PA, 16802, United States, skumara@psu.edu, Seokcheon Lee

We consider a software system whose behavior can be controlled by resource allocation and algorithm selection. A problem is decomposed into root tasks and those tasks are propagated through a task flow structure. The service provided is to produce a global solution, an aggregate of partial solutions. The QoS depends on the quality of solution and the time for generating the solution. We provide a methodology to identify the decision sets that give non-dominated quality of services.

3 - A Stochastic Multi Criteria Model for Joint Inventory-Transportation Policies in Supply Chains

Ajay Natarajan, PhD Student, Penn State University, 445 Waupelani Drive, E 5, State College, PA, 16801, United States, azn110@psu.edu

This presentation deals with finding inventory policies for each company in a Single Warehouse Multi Retailer system under stochastic demand and stochastic lead times when transportation costs are considered. Each company follows a continuos review policy. Excess demand faced by the retailers and the warehouse is treated as lost sales. Service level constraint is treated as an independent criterion. The methodology is explained with the help of an example problem.

4 - Optimization Model for Outsourcing
Vijay Wadhwa, Student, Penn State University, 310 Leonhard Building, University Park, PA, 16802, United States, vuw100@psu.edu

We model and solve the vendor selection problem in two steps. In first step cluster analysis is used to pre-classify the vendors as favorable or unfavorable. Detailed quantitative data is collected on favorable vendors. In second step multi-objective techniques are used to solve the supplier selection problem, with price, lead-time and quality as the three conflicting objective.

■ WA44

Room 405

Combinatorics

Contributed Session

Chair: Bala Krishnamoorthy, Washington State University, 103 Neill Hall, PO Box 643113, Pullman, WA, 99164-3113, United States, kbala@wsu.edu

1 - Combinatorial Problems Related to Order Consolidation
June-Ho Chang, Student, POSTECH, SAN 31, Hyo-Ja Dong, Nam Gu, Pohang, 790-784, South Korea, junho@postech.ac.kr, Soo Y. Chang

The minimum batch cover problem for order consolidation is the problem of covering all orders with the minimum number of batches with a fixed capacity. Each batch may be composed of the whole or parts of multiple orders with similar characteristics. We prove that the problem is SNP-hard and develop an optimal algorithm to solve an important sub-class of problem.

2 - Two-Stage Stochastic Winner Determination Problem for Truckload Transportation Procurement with Shipment Uncertainty
Zhong Ma, PhD Student, University of Toronto, 5 King's College Road, Toronto, ON, M5S 3G8, Canada, zhongma@mie.utoronto.ca, Roy H. Kwon, Chi-Guhn Lee

A shipper wishes to procure truckload transportation services from third party carriers by combinatorial auctions. Generally, the auctioneer (shipper) announces expected shipment volumes on lanes for bid and solves a winner determination problem (WDP) to allocate the lanes, and tenders shipments during daily execution when the shipments realize. However, the realized shipments might be quite different, and the auctioneer may not find the best solution to move realized shipments. We propose a two-stage stochastic model for the WDP to hedge the shipper's risk and prove it is guaranteed to achieve at least the same allocation as the current models provided.

3 - P Equals NP: Linear Programming Formulation of the Quadratic Assignment Problem
Moustapha Diaby, Associate Professor, University of Connecticut, 2100 Hillside Road, Storrs, CT, 06269-1041, United States, moustapha.diaby@business.uconn.edu

In this talk, we will present a first linear programming formulation of the Quadratic Assignment Problem (QAP). The proposed linear program is a network flow-based model with $O(n^9)$ variables and $O(n^7)$ constraints, where n is the number of assignments. Hence, it provides for the solution of the QAP in polynomial-time. Computational testing and results will be discussed.

4 - Adaptive Knapsack Problem with Stochastic Rewards
Taylan Ilhan, Northwestern University, 2145 Sheridan Road C210, Evanston, IL, 60208, United States, t-ilhan@northwestern.edu, Mark Daskin, Seyed Iravani

We study an adaptive knapsack problem, in which items with random rewards are inserted sequentially into a knapsack. We seek a policy to maximize the probability of reaching a predetermined target level while not violating the capacity constraint. We analyze the optimal policy and develop optimal and heuristic policies.

5 - An Integer Programming Model for Protein Sequencing using Mass Spectrometry
Bala Krishnamoorthy, Washington State University, 103 Neill Hall, PO Box 643113, Pullman, WA, 99164-3113, United States, kbala@wsu.edu, John Chuba

We present recent progress made using an IP model in the identification of amino acid sequence given the masses of a protein and several of its (overlapping) fragments. After finding the composition (counts of each of twenty amino acids) and the ion-type of fragments (b or y), the sequence order is obtained using an efficient enumeration algorithm. Compared to standard dynamic programming models, we add many more constraints, resulting in a major reduction in the number of possible solutions.

■ WA45

Room 406

Tutorial: Approximate Dynamic Programming for Large-Scale Resource Allocation

Cluster: Tutorials

Invited Session

1 - Approximate Dynamic Programming for High-dimensional Applications
Warren B. Powell, Department of Operations Research and Financial Engineering, Princeton University, Princeton, NJ, 08544, powell@princeton.edu, Huseyin Topaloglu

We show how dynamic programming and math programming can be merged to solve very high-dimensional applications under the umbrella of approximate dynamic programming. Using a form of Bellman's equation constructed around the post-decision state variable, we obtain simple, scalable algorithms that have been applied to large scale, industrial applications. The techniques are illustrated using applications from transportation, supply chain management, financial portfolios and blood management.

■ WA46

Room 407

Supply Chain Flexibility

Cluster: Supply Chain and Operations Engineering

Invited Session

Chair: Douglas Morrice, Professor, The University of Texas at Austin, IROM Department, McCombs School of Business, 1 University Station B6500, Austin, TX, 78712-0212, United States, Douglas.Morrice@mccombs.utexas.edu

1 - Inventory System Structure: Transshipment vs. Allocation
Uday Rao, Professor, College of Business, University of Cincinnati, Cincinnati, OH, 45221, United States, uday.rao@uc.edu, David Rogers, Claudia Rosales

We compare four inventory systems structures respectively with the following options: Only Allocation, Only Transshipment, Both, and Neither. We identify the effects of problem parameters such as mean and variability of demand, replenishment lead time, and differences between retailers on the relative performance of the four systems.

2 - The Value of Risk Pooling: Impacts of Order Quantity and Economic Parameters
Jun Zhang, Assistant Professor, Tulane University, A. B. Freeman School of Business, New Orleans, LA, 70123, United States, jzhang4@tulane.edu

We study the effects of the inventory level and economic parameters on the value of risk pooling. Our analysis demonstrates that for a given inventory level risk pooling achieves the maximum value when the inventory level is the demand mean. When the inventory level is set to maximize the expected profit, the value of risk pooling increases with both the underage cost and the overage cost; consequently, the value of the critical ratio is NOT an effective indicator for the value of risk pooling.

3 - Outsourcing of Warranty Contracts
Wei Huang, SAS, wei.huang@sas.com, Vidyadhar Kulkarni, Jay Swaminathan

Firms are outsourcing their business processes in order to gain greater flexibility in their supply chains. In this paper, we study a firm that is outsourcing its warranty services to vendors. We provide insights on alternative leadership, competition and contract settings.

4 - Managing Backlog and Capacity Flexibility in an Assemble-to-Order Production Environment
Douglas Morrice, Professor, The University of Texas at Austin, IROM Department, McCombs School of Business, 1 University Station B6500, Austin, TX, 78712-0212, United States, Douglas.Morrice@mccombs.utexas.edu, Fehmi Tanrisever, David Morton

We consider a multi-period planning problem in an assemble-to-order production environment in which multiple product families can be produced on multiple production lines. Given the demand distribution, assignment decisions are made in the first period. In subsequent periods as demand is realized it is allocated to production lines in order to minimze backlog.

■ WA47

Room 408

Optimization Methods in Production Planning and Scheduling

Cluster: Supply Chain and Operations Engineering
Invited Session

Chair: Andrew Miller, Assistant Professor, University of Wisconsin-Madison, 1513 University Avenue, Madison, WI, United States, amiller@engr.wisc.edu

1 - Lot-Sizing with Minimum Order Quantity
Diego Klabjan, Associate Professor, University of Illinois at Urbana-Champaign, 1206 West Green Street, Urbana, IL, 61801, United States, klabjan@mit.edu

We study the deterministic lot-sizing problem under the assumption that in each time period either no order is placed or at least a certain given amount is ordered. We present two polynomially solvable cases and we develop a fully polynomial time approximation scheme.

2 - A Polynomial Time Algorithm for the Stochastic Uncapacitated Lot-Sizing Problem
Yongpei Guan, Assistant Professor, The University of Oklahoma, 202 West Boyd Street, Room 124, Norman, OK, 73019, United States, Yongpei.Guan-1@ou.edu, Andrew Miller

We analyze a path property of an optimal solution for the stochastic uncapacitated lot-sizing problem (SULS) and develop a backward recursion that shows the value function is piecewise linear and right-continuous. We use these properties to derive a polynomial time algorithm for the problem. Then, we show that the value function for the SULS problem without set-up cost is continuous, piecewise linear and convex and therefore, a more efficient algorithm is developed for this special case.

3 - Submodular Inequalities for Capacitated Lot Sizing with Backlogging
Alper Atamturk, Associate Professor, University of California at Berkeley, 4141 Etcheverry Hall, Berkeley, CA, 94720, United States, atamturk@ieor.berkeley.edu, Laurence Wolsey

We describe an efficient computation of submodular valid inequalities for the capacitated lot-sizing problem with backlogging. We compare the inequalities with other related ones and show how to lift them sequence independently.

■ WA48

Room 409

Operations Management in Commodity Markets

Sponsor: Manufacturing & Service Operations Management
Sponsored Session

Chair: Nicola Secomandi, Assistant Professor, Carnegie Mellon University, Tepper School of Business, 5000 Forbes Avenue, Pittsburgh, PA, 15213, United States, ns7@andrew.cmu.edu

1 - Supply Management in Proportional Product Markets
Paul Kleindorfer, Professor, INSEAD, Boulevard de Constance, Fontainebleau, 77305, France, kleindorfer@wharton.upenn.edu, Onur Boyabatli

In several supply chains (fed-cattle, soybean, petrochemicals), where there are spot markets for inputs, one unit of input is processed to produce proportional amounts of multiple-outputs. Building on previous work on options-based approaches to supply chain coordination, this research investigates the implications of the proportional product model on the supply management, in particular optimal mix of long-term and short-term (spot) contracting decisions.

2 - Role of Commodity Markets in the Procurement and Distribution of Gasoline
Goel Ankur, University of Texas-Austin, CBA 5.202 IROM Department, Austin, TX, 78712, United States, goel@mail.utexas.edu, Genaro Gutierrez

We incorporate the information on commodity market equilibrium in modeling procurement and distribution of gasoline under the framework of one-warehouse multi-retailer. Commodity can be procured through forward and spot contracts. In this research, we seek to understand how the term structure of the futures price at the market equilibrium can be used to obtain better procurement and distribution policies in order to enhance the efficiency of supply chains under centralized decision making.

3 - Valuation of LNG Supply Chains
Xiaofeng Wang, PhD Candidate, Carnegie Mellon University, Tepper School of Business, Pittsburgh, PA, United States, xiaofenw@andrew.cmu.edu, Nicola Secomandi, Alan Scheller-Wolf, Sunder Kekre, Christine Parlour

This talk illustrates a model to value liquefied natural gas (LNG) supply chains consisting of natural gas liquefaction, LNG shipping, storage and re-gasification, and natural gas sale into the wholesale market at the prevailing spot market price. We model this price using a mean reverting model with seasonality. We use a closed queuing network to represent LNG shipping. We then use a finite-horizon dynamic program to make price and inventory dependent sales and storage decisions.

■ WA49

Room 410

Game-Theoretic Models in Closed-Loop Supply Chains and Reverse Logistics

Cluster: Closed-Loop Supply Chains and Reverse Logistics
Invited Session

Chair: Fuminori Toyasaki, Postdoctoral Research Fellow, McGill University, Faculty of Management, 1001 Sherbrooke Street West, Montreal, H3A 1G5, Canada, fuminori.toyasaki@mcgill.ca

1 - Operational Impacts of Monopolistic and Competitive WEEE Collection Schemes
Fuminori Toyasaki, Postdoctoral Research Fellow, McGill University, Faculty of Management, 1001 Sherbrooke Street West, Montreal, H3A 1G5, Canada, fuminori.toyasaki@mcgill.ca, Vedat Verter, Tamer Boyaci

This research investigates the operational efficiency of a monopolistic and a competitive collection system for WEEE from the perspective of EEE manufacturers and consumers. We assume that EEE manufacturers compete with each other strategically in a Bertrand oligopoly form. We assume that in the both systems the behavior of the EEE manufacturers and collection schemes can be represented by a leader-follower game.

■ WA50

Room 411

Optimization Techniques I

Contributed Session

Chair: Deniz Kasap, Researcher, TUBITAK-TUSSIDE, Baris Mah. Kosuyolu Cad. No:48 PK.14, Gebze, Kocaeli, 41401, Turkey, dkasap@tusside.gov.tr

1 - A Column Generation Algorithm for the Split Delivery Vehicle Routing Problem
Mingzhou Jin, Assistant Professor, Mississippi State University, PO Box 9542, Mississippi State, MS, 39762, United States, mjin@ise.msstate.edu

A column generation approach is developed to solve the Split Delivery Vehicle Routing Problem (SDVRP) by using the minimal number of routes required. Besides the routes, the columns also include delivery amount information. A limited-search-with-bound (LSB) algorithm is developed to efficiently solve the pricing sub-problem. The numerical experiments show that the algorithm yields solutions better than the best-known solutions in the literature with regards to lower bounds and upper bounds.

2 - A Minimax Theorem with Applications to Machine Learning, Signal Processing, and Finance
Seung-Jean Kim, Consulting Assistant Professor, Information Systems Laboratory, Department of Electrical Engineering, Stanford University, 223 Packard, 350 Serra Mall, Palo Alto, CA, 94305, United States, sjkim@stanford.edu, Stephen Boyd

We consider a zero-sum game associated with a special type of Rayleigh quotient, which arises in several applications. We give a nonstandard minimax theorem for this game, and describe an efficient method for computing the saddle point, based on convex optimization. We describe applications in machine learning, signal processing, and finance.

3 - An Improved Cut and Reduce Algorithm for Reverse Convex Optimization
Khosrow Moshirvaziri, Professor, California State University, 1250 Bellflowe Boulevard, Long Beach, CA, 90840-8506, United States, moshir@csulb.edu, Mahyar A. Amouzegar

In this paper we derive a variation of an earlier cutting plane algorithm for the solution of linear reverse convex programs. The new method uses fewer iterations than the original algorithm and early computationally results on a set of test problems have been promising.

4 - On Solving a Dual Problem in Generalized Linear Fractional Programs
Kuang-Yao Wu, Associate Professor, Department of Business Management, National United University, No. 1 Lien-Da, Kung-ching Li, Miaoli, 360, Taiwan, kywu@nuu.edu.tw

This paper addresses the dual problem of minimizing the maximum of a finite number of linear ratios over a polytope. The dual is of the parametric optimization in which a parametric basic solution is defined by a system of parametric linear equalities. A simplex-type algorithm is proposed for exploring basic solutions iteratively, until the optimal point is reached. The dual approach appears to be highly adaptive to solve the primal fractional problem with a considerable number of linear ratios.

5 - Profits Maximization for Intermediaries in Telecom Networks Considering QoS and Capacity Constraints
Nihat Kasap, Assistant Professor, Sabanci University, Orhanli - Tuzla, Istanbul, 34, 34956, Turkey, nihatk@sabanciuniv.edu, Burcin Bozkaya

In this study, an optimization model is proposed to maximize the revenue of the intermediary providing video conferencing service to alternative demanding customers. The model also handles resource management of an intermediary by considering that the available capacity of the operator is only distributed for the video conferencing service users.

■ WA51

Room 412

Aviation Applications

Contributed Session

Chair: Frederic Ferchaud, EUROCONTROL EC, Centre de Bois des Bordes BP15, Bretigny Sur Orge, 91222, France, fredferchaud@gmail.com

1 - Air Traffic Flow Management: An Adaptable Robust Approach
Constantine Caramanis, Assistant Professor, The University of Texas at Austin, ECE, 1 University Station, C0803, Austin, TX, 78712-0240, United States, cmcaram@ece.utexas.edu, Dimitris Bertsimas

We consider the global problem of scheduling ground delays, air delays, and dynamic route selection, subject to take off, landing, and sector capacity constraints. We take an Adaptable Robust Optimization approach, using Finite Adaptability to build a schedule that is robust to dynamically changing weather conditions, while controlling the degree of conservativeness. We test our framework on multi-sector, multi-airplane problems, demonstrating the advantages of finite adaptability.

2 - Productivity of U.S. Airports with Consideration of Undesirable Outputs
Somchai Pathomsiri, University of Maryland, 4309 Rowalt Drive #201, College Park, MD, 20740, United States, egspt@mahidol.ac.th, Ali Haghani, Robert J. Windle, Martin Dresner

Airport operation does create some undesirable outputs such as delays, noise, pollution and accident. Previous studies largely ignore these outputs when assessing airport productivity. This research considers delays and reassesses productivity of 56 major U.S. airports using a panel data during 2000 - 2003. The directional output distance function is used to analyze technical efficiency of airport operation. Comparisons of results between with and without consideration of delays are presented.

3 - Aviation Safety Oversight Aided by Decision Analysis
Larry Berk, Operations Research Analyst, The Volpe Center, U.S. DOT, RTV-5B/DTS-67, 55 Broadway, Cambridge, MA, 02142, United States, berkl@volpe.dot.gov, James Hallock

This talk describes grassroots research to introduce decision analysis to the FAA Aviation Safety organization (AVS), then structure and solve a multiple criteria decision problem with prototype software given a specific context; generating optimal airline surveillance plans for teams of AVS inspectors.

4 - Aircraft Delay and Throughput in ATFM Slot Allocation
Frederic Ferchaud, EUROCONTROL EC, Centre de Bois des Bordes BP15, Bretigny Sur Orge, 91222, France, fredferchaud@gmail.com, Alexandre D'Aspremont

We present an approach for optimizing aircraft slot allocation and air traffic flow planning in the presence of uncertainty. We use Chernoff Bounds to solve the problem of optimally allocating buffer slots to maximize throughput while satisfying capacity constraints with a given confidence level. We also study the trade-off between total throughput and slot reallocation time (or aircraft delay).

■ WA52

Room 413

Bilevel Programming and Revenue Management

Sponsor: Revenue Management & Pricing

Sponsored Session

Chair: Patrice Marcotte, Professor, University of Montreal, CP 6128, Succ. Centre-Ville, Montreal, QC, H3C3J7, Canada, marcotte@iro.umontreal.Ca

Co-Chair: Gilles Savard, Ecole Polytechnique de Montréal, CP 6079 Succursale Centre Ville, Montréal, QC, H3C3A7, Canada, gilles.savard@polymtl.ca

1 - A Tabu Search Heuristic for a Pricing Problem on a Network
Luce Brotcorne, Associate Professor, LAMIH-ROI, University of Valenciennes, Le Mont Houy, Valenciennes Cedex 9, F 59313, France, luce.brotcorne@univ-valenciennes.fr, Fabien Cirinei

We consider a bilevel pricing problem where a company (a leader) strives to maximize its revenue raised from tariffs imposed on a set of arcs while taking into account the cost minimizing behaviour of the customers. We propose a tabu search algorithm based on the characterization of feasible followers solutions as a set of paths. To assess the efficiency of the method, a comparison with previously proposed heuristics is made on instances solved to optimality.

2 - Global and Local Approaches to a Logit-Based Pricing Problem
Patrice Marcotte, Professor, University of Montreal, CP 6128, Succ. Centre-Ville, Montreal, QC, H3C3J7, Canada, marcotte@iro.umontreal.Ca, François Gilbert

The logit route choice model allows one to model commuter behavior in a network both realistically and in a computationally affordable way. We consider a network toll-setting problem based on a bilevel programming framework where the reaction of the commuters is modelized with a logit model. Observations will be made concerning the general features of the revenue function and a parallel with the deterministic toll setting problem established.

3 - Choice Models and Simultaneous Pricing-Inventory Control
Gilles Savard, Ecole Polytechnique de Montréal, CP 6079 Succursale Centre Ville, Montréal, QC, H3C3A7, Canada, gilles.savard@polymtl.ca, Jean-Philippe Côté, Alexandre Schoeb

The aim of this presentation is to present a unified framework that integrates simultaneously the inventory and pricing sub-problems faced by airlines and high-speed rail companies. The framework is based on the bilevel programming paradigm where the behavior of passengers is implicitly considered with the use of choice models. According to the selected choice models, algorithmic issues will be discussed. Numerical results on real life instances will be presented.

■ WA53

Room 414

Supply Chain III

Contributed Session

Chair: Karthik Ayodhiramanujan, Graduate Research Associate, Oklahoma State University, 322 Engineering North, Stillwater, OK, 74078, United States, karthik.ayodhiramanujan@okstate.edu

1 - The Effects of Paperless MIR in a Supply Chain
Shilei Yang, Washington State University, Department of Management & Operations, Pullman, WA, 99164, United States, yangstone@wsu.edu, Bintong Chen

Mail-in rebate has become a popular price discrimination device by providing discounts to the end customers. However, due to the hassles of paperwork, customers are getting frustrated and have no incentives to buy the product even with MIR. Now, some manufacturers provide online systems that allow customers to claim their rebates much easier. We show that as long as the actual redemption rate is lower than the perceived redemption probability, the paperless MIR can always benefit manufacturers.

2 - Success Factors in Strategic Supplier Alliances: A Decade Later
Loay Sehwail, Oklahoma State University, PO Box 406, Stillwater, OK, 74076, United States, loay.sehwail@okstate.edu, Ricki Ingalls

Supply chain alliances received considerable attention in the academic and business press. In light of the advances in information technology, the authors examine how time affected the factors attributed to the success of supply chain strategic alliances by re-testing the model developed by Monczka et al. (1998). The authors then compare their findings with the results of the study conducted a decade ago.

3 - Who Should Take Over Operations in a Supply Chain? The Effect of Efforts and Specificity
Santiago Kraiselburd, Executive Director, Zaragoza Logistics Center, Avda. Gómez Laguna, 25 1(tm) Planta, Zaragoza, 50009, Spain, skraiselburd@zlc.edu.es

When is having no previous contract better than having one, if ever? When should a manufacturer/retailer take over part (or all) of the other party's operation, instead of considering just a contract? This paper attempts to respond to these questions in the context of a supply chain under a single period scenario where both the manufacturer and the retailer can exert uncontractible effort that may or may not be specific to the relationship.

4 - Dynamics of Supplier Innovation
Arash Azadegan, PhD Student, Arizona State University, WP Carey School, Tempe, AZ, 85287, United States, arash.azadegan@asu.edu, Kevin Dooley

The Dynamics of innovation model has a user/manufacturer perspective. We view the innovation cycle from supplier's perspective. Questions on supplier innovation include: Whether supplier innovation shows a different pattern than manufacturers' and whether supplier innovation is driven by different forces at different phases of the cycle. The paper suggests that supplier innovations are mainly performed at the start and end of the innovation cycle and justified using resource based view.

5 - An Integrated Framework for Warehouse Performance Analysis
Karthik Ayodhiramanujan, Graduate Research Associate, Oklahoma State University, 322 Engineering North, Stillwater, OK, 74078, United States, karthik.ayodhiramanujan@okstate.edu, Manjunath Kamath

Performance evaluation models of warehouse operations have focused on individual subsystems such as AS/RS systems. We discuss the development of analytical models that consider all key operations from receiving to shipping including material transport, storage/retrieval and cross-docking operations. Such models are useful at the tactical planning stage, and our approach builds on recent research in queueing and production-inventory networks.

■ WA55

Room 416

Production & Scheduling III

Contributed Session

Chair: Thom Hodgson, James T. Ryan Professor, North Carolina State University, Fitts ISE Department, Raleigh, NC, 27695, United States, hodgson@ncsu.edu

1 - Controlling Stochasticity in the Execution of Production Plans
Karl Kempf, Intel Fellow, Intel Corporation, Decision Technologies, Chandler, AZ, 85226, United States, karl.g.kempf@intel.com, Kirk Smith, Gary Godding

Production planning matches supply and demand both containing various elements of stochasticity. A standard mechanism for addressing this situation is the inclusion of safety stocks in the plan. We have been exploring the application of real time feed forward feedback control to the execution of production plans as an additional mechanism for managing stochasticity. We will present results from both simulation and actual practice for a multi-echelon multi-product semiconductor production system.

2 - Integrating Production Planning and Safety Stock Determination
Reha Uzsoy, Professor, Purdue University, 315 N. Grant Street, West Lafayette, IN, 47907, United States, uzsoy@ecn.purdue.edu, Ashwin Ravindran

We consider the problem of integrating production planning and safety stock determination using clearing functions to represent the capacity of a production resource. We present a linear programming model with chance constraints, and show that this model provides comparable service levels to existing models while holding significantly less inventory.

3 - Supply Chain Planning in a Foundry and Services Environment
Stuart Smith, IBM Systems and Technology Group, 1000 River Road, Essex Junction, VT, 05452, United States, stuarts1@us.ibm.com, Chih-Hui Chang, Chi-Tai Wang

Traditionally, products are planned via Make To Order (MTO) or Make To Stock (MTS). This talk describes how IBM Systems and Technology Group models the planning of products which have complimentary demands - that is demands which share both MTO and MTS aspects. This is handled through the integration of two linear programming models.

4 - The Value of Shared Information in a Multi-Plant Manufacturing Network
Thom Hodgson, James T. Ryan Professor, North Carolina State University, Fitts ISE Department, Raleigh, NC, 27695, United States, hodgson@ncsu.edu, Kristin Thoney, A. S. Peker, S. Nayak, Russell King

We address the value of shared information in a multi-plant network with scheduled inter-plant transportation, with detailed scheduling of facilities and transportation. A finite capacity multi-plant scheduling system is used in a simulated multi-plant manufacturing environment and is partially disabled when individual plants in the network do not share information, forcing it to operate in local mode. System performance is studied in terms of inventory cost and due date performance.

Wednesday, 10:00am - 11:30am

■ WB01

Room 301

Algorithms, Games, and Computation

Sponsor: Optimization/ Network and Combinatorial Optimization

Sponsored Session

Chair: Mohammad Mahdian, Microsoft Research, One Microsoft Way, Redmond, WA, 98052, United States, mahdian@gmail.com

1 - Steiner Tree Mechanisms and Prize Collection
Mukund Sundararajan, mukunds@stanford.edu, Tim Roughgarden

A cost-sharing mechanism is a strategyproof protocol that collects bids from a set of players, selects a subset of the players to receive a service (incurring a subset-dependent cost), and determines prices that recover the cost of the constructed solution. We show that previously proposed steiner tree mechanisms, which were not designed with social efficiency in mind, approximate a measure of social efficiency that is reminiscent of well studied prize-collecting objectives.

2 - Adwords Allocation Problem with Unreliable Estimates
Hamid Nazerzadeh, Stanford University, Stanford, CA, 94305, United States, hamidnz@stanford.edu, Amin Saberi, Mohammad Mahdian

Search engines such as Google, Yahoo!, or MSN use auction mechanism for allocating the advertisement space. In this work, our objective is to find an algorithm that uses given estimates of the frequencies of the queries to find a near-optimal allocation, while maintaining a good worst-case performance when the given estimates are inaccurate. In order to evaluate our algorithm, we present a bi-criteria framework, which also can be extended to design and analysis of other online algorithms.

3 - To Fill or Not to Fill: The Gas Station Problem
Azarakhsh Malekian, Graduate Student, University of Maryland, Room #1103, A.V. Williams Building, College Park, MD, 20742, United States, malekian@cs.umd.edu, Samir Khuller, Julian Mestre

In this work, we study some generalization of shortest paths and TSP. We consider a more general model that incorporates the actual cost in terms of gas prices and also tank capacity of the vehicle. The objective is to find the cheapest route to go from s to t, or the cheapest tour visiting a given set of locations. For the first problem, we develop a polynomial time algorithm. For most other versions, the problem is NP-complete and we develop approximation algorithms for them.

4 - Mechanism Design via Machine Learning
Maria-Florina Balcan, Carnegie Mellon University, Department of Computer Science, 5000 Forbes Avenue, Pittsburgh, PA, 15213-3891, United States, ninamf@cs.cmu.edu, Avrim Blum, Yishay Mansour, Jason Hartline

We use techniques from sample-complexity in machine learning theory to reduce problems of incentive-compatible mechanism design to standard algorithmic questions, for a broad class of revenue-maximizing pricing problems. We apply our generic reductions to the problem of auctioning a digital good, to the attribute auction problem which (includes a wide variety of discriminatory pricing problems), and to the problem of item-pricing in unlimited-supply combinatorial auctions.

■ WB03

Room 303

Sphere Packing

Sponsor: Optimization/ Global Optimization
Sponsored Session

Chair: Nick Sahinidis, Department of Chemical and Biomolecular Engineering, University of Illinois Urbana-Champaign, Urbana, IL, United States, nikos@uiuc.edu

1 - Circle Packing: A New Approach Based on Research Space Discretization
Raffaele Cerulli, Associate Professor, University of Salerno, Via Ponte Don Melillo, Fisciano, SA, 84084, Italy, raffaele@unisa.it, Carmine Cerrone, Monica Gentili

The circle packing problem consists in finding a minimum diameter circle containing circles with diameter varying from 1 up to n. We present an efficient combinatorial heuristic algorithm based on the discretization of the search space that results to be competitive with the existing resolution approaches.

2 - Sphere Packings Using Global Optimization Software
János D. Pintér, President and Research Scientist, Pinter Consulting Services Inc., 129 Glenforest Drive, Halifax, NS, B3M 1J2, Canada, jdpinter@hfx.eastlink.ca, Frank Kampas

We discuss non-overlapping packings of uniform and non-uniform size spheres into containers. The generic objective is to provide "tightest possible" packings: this leads to context-dependent model forms. We present model variants and illustrative numerical results, using MathOptimizer Professional (MOP). MOP is our Mathematica package with an easy-to-use interface to the LGO global/local optimization solver suite.

3 - Heuristic and Exact Algorithms for Packing Discs in a Minimal Container Circle
Wei Xie, Graduate Student, Department of Chemical & Biomolecular, University of Illinois at Urbana-Champaign, 600 S. Mathews Avenue, Urbana, IL, 61801, United States, wxie@uiuc.edu, Nick Sahinidis

We address the problem of packing n discs of given radii in a way that minimizes the radius of a container circle. We present several greedy heuristics as well as branch-and-bound-based global optimization algorithms for this problem. Extensive computational results are presented for problems with up to 50 discs.

■ WB05

Room 305

Machine Scheduling Problems

Contributed Session

Chair: Maria Vlasiou, Research Engineer, Georgia Institute of Technology, ISyE, 765 Ferst Drive, Atlanta, GA, 30332-0205, United States, vlasiou@eurandom.tue.nl

1 - Approximation Methods for the Standard Deviation of Flow Times in the G/G/s Queue
Xiaofeng Zhao, PhD Candidate, University of Tennessee, Department of Statistics, Operations, and Management Science, Knoxville, TN, 37916, United States, xzhao1@utk.edu, Kenneth Gilbert

In this research, we provide an approximation for the standard deviation of the time in system for a general multi-server queue with infinite waiting capacity (G/G/s). The approximation requires only the mean and standard deviation of the inter-arrival and service time distributions, and the number of servers. This approximate is simple enough to be implemented in manual or spreadsheet calculations, but in comparisons to Monte Carlo simulations has proven to give good approximations.

2 - Minimizing Total Flow Time on a Single Flexible Machine
Ibrahim Karakayali, Research Assistant, University of Florida, 303 Weil Hall, PO Box 116595, Gainesville, FL, 32611, United States, ibrahimk@ufl.edu, Meral Azizoglu

In this study, we address a job sequencing and tool switching problem arising in flexible manufacturing systems. We consider the single machine problem of minimizing the total flow time. We prove that the problem is NP-hard in the strong sense and show that the tool switching problem is polynomially solvable for a given sequence. We propose a branch-and-bound algorithm whose efficiency is improved by precedence relations and several lower and upper techniques.

3 - Minimizing Regular Performance Measures for Unrelated Parallel Machine Scheduling Problems
Yangkuei Lin, Arizona State University, PO Box 87590, Tempe, AZ, 85287, United States, yangkuei.lin@asu.edu, Michele Pfund, John Fowler

In this research, several heuristics and a Genetic Algorithm (GA) for scheduling unrelated parallel machine problems to minimize the makespan, total weighted completion time, and total weighted tardiness when each objective is considered individually are proposed. Computational results show that the proposed heuristics outperform the best existing heuristics from the literature for these objectives.

4 - Minimizing Total Earliness and Tardiness on a Single Machine
Rym M'Hallah, Associate Professor, Department of Statistics and Operations Research - Kuwait University, PO Box 5969, Safat 13060, Kuwait, mhallah@kuc01.kuniv.edu.kw

This paper proposes an approach that schedules jobs with different processing times and distinct due dates on a single machine with no inserted idle time as to minimize the sum of total earliness and tardiness. Computational results show that large problems can be solved efficiently.

5 - On Queues with Service and Interarrival Times Depending on Waiting Times
Maria Vlasiou, Research Engineer, Georgia Institute of Technology, ISyE, 765 Ferst Drive, Atlanta, GA, 30332-0205, United States, vlasiou@eurandom.tue.nl, Onno Boxma

We study a non-monotone Lindley-type recursion, which represents the waiting time in a FCFS queue in which the service times and interarrival times depend linearly on the waiting times. The model reduces either to Lindley's equation for the waiting time in G/G/1 or to the waiting time of the server in an alternating service model. We derive the waiting-time distribution when the interarrival time is either generally or exponentially distributed and the service time is either PH or deterministic.

■ WB06

Room 306

Metaheuristics for Data Mining Problems

Sponsor: INFORMS Computing Society/Heuristic Search
Sponsored Session

Chair: Belén Melián, University of La Laguna, Dpto. E.I.O. y Computación, La Laguna, Spain, mbmelian@ull.es

1 - Multiobjective Clustering with Metaheuristic Technology
Manuel Laguna, Professor, University of Colorado, Leeds School of Business, 419 UCB, Boulder, CO, 80309, United States, laguna@colorado.edu, Rafael Marti, Julian Molina, Rafael Caballero

We develop a metaheuristic procedure for multiobjective clustering problems. Our goal is to find good approximations of the efficient frontier and provide a means for improving decision making in multiple areas of application and in particular those related to marketing. Clustering using multiple criteria and/or multiple data sources has received limited attention in the literature. Our procedure is general and tackles several problems classes within this area of combinatorial data analysis.

2 - Hybridizing Reactive Tabu Search with Simulated Annealing
Stefan Voss, Chair and Director of the Institute of Information Systems within the Faculty of Economics and Business Administration, University of Hamburg, IWI, Von-Melle-Park 5, Hamburg, HG, 20146, Germany, stefan.voss@uni-hamburg.de, Andreas Fink

Reactive Tabu Search aims at the automatic adaptation of the tabu list length. The idea is to increase the tabu list length when the tabu memory indicates that the search is revisiting formerly traversed solutions. Once too many repetitions are encountered an escape meachanism coonstituting a random walk is an essential part of the method. We propose to replace this random walk by a controlled simulated annealing. Excellent results are presented for various combinatorial optimization problems.

3 - Analysis of New Variable Selection Methods for Logistic Regression Models
Joaquin Pacheco, University of Burgos, Plaza Infanta Elena s/n, BURGOS, BU, Spain, jpacheco@ubu.es, Silvia Casado, Laura Nuñez

New methods to select variables for Logistic Regression are proposed. The aim is to find a smaller subset that built a good classification. Reducing dimensionality has advantages: less costs, better understanding and efficiency and efficacy. The problem consists in finding a subset of original variables that yields the greatest percentage of hits in Logistic Regression. A series of techniques based on metaheuristic strategies is proposed. They obtain better results than traditional methods.

4 - Feature Subset Selection as a Bi-Objective Optimization Problem
Belén Melián, University of La Laguna, Dpto. E.I.O. y Computación, La Laguna, Spain, mbmelian@ull.es, Marcos Moreno, Miguel García, Jose Moreno-Perez

In feature subset selection applied to supervised classification, given a set of labelled instances, a model is induced with a subset of features to classify new non-classified instances. In this work we use a scatter search metaheuristic to solve the feature subset selection problem, in which both the classification error and the features subset size have to be minimized.

■ WB07

Room 307

Cyberinfrastructure and Integer Programming

Sponsor: INFORMS Computing Society/Optimization: Computational Optimization and Software

Sponsored Session

Chair: Jeff Linderoth, Assistant Professor, Lehigh University, 200 W. Packer Avenue, Bethlehem, PA, 18015, United States, jtl3@Lehigh.EDU

1 - Using Cyberinfrastructure Tools to Solve Bicriteria Integer Programs
Ted Ralphs, Lehigh University, 200 West Packer Avenue, Bethlehem, PA, United States, tkr2@lehigh.edu

We discuss solution of several classes of difficult bicriteria integer programming problems on the computational grid using a parallel algorithm based on the weighted Chebyshev norm scalarization. The talk will focus on the cyberinfrastructure tools used, the challenges faced in parallelizing the algorithm, and the use of advanced methodology to improve soluton times.

2 - Solving Difficult Mixed-Integer Programming Problems Using GAMS and Condor
Michael Ferris, Professor, University of Wisconsin-Madison, 1210 W. Dayton Street, Madison, WI, 53706, United States, ferris@cs.wisc.edu, Michael Bussieck

GAMS is a commercial modeling system for mathematical programming problems. Condor is a resource manager that delivers huge amounts of computing cycles from large collections of distributively owned computing resources. We describe new modeling features of GAMS and recent solver enhancements that allow us to harness the computational resources of Condor for solving difficult mixed-integer programs. We report on the solution of the MIPLIB problems timtab2, roll3000, a1c1s1 and swath.

3 - Distributed Decision-Making Methods for Collaborative Logistics Optimization
Andrew Miller, Assistant Professor, University of Wisconsin-Madison, 1513 University Avenue, Madison, WI, United States, amiller@engr.wisc.edu, Sricharan Poundarikapuram, Dharmaraj Veeramani, Rao Panchalavarapu

We develop distributed decision-making methods that can provide optimal solutions during collaborative planning in logistics networks without disclosing significant private local information of the participating corporations (the players). We have tested our ideas by implementing them on a practical data sets from the logistics industry, and our implementation may point the way to how practically to use cyberinfrastructure to make practical decisions in collaboration.

4 - On Implementing a Parallel Integer Solver Using Optimization Services
Sanjay Mehrotra, Professor, Northwestern University, 2145 Sheridan Road, Evanston, IL, 60601, mehrotra@iems.northwestern.edu, Jun Ma, Huanyuan Sheng

We will present a framework for implementing a parallel integer solver using optimization services and standard instances. Depending on the progress computational results will be presented describing the viability of this approach for implementing parallel solvers for solving difficult integer programs within the IMPACT solver package.

■ WB08

Room 308

RFID in Supply Chain and Services Management

Sponsor: Technology Management

Sponsored Session

Chair: Chris Forman, Assistant Professor, Information Systems, Carnegie Mellon University, Tepper School of Business, 5000 Forbes Avenue, Pittsburgh, PA, 15213, United States, cforman@andrew.cmu.edu

1 - The Value to the Customer of RFID: A Taxonomy of RFID-Enhanced Service
Gregory Heim, Assistant Professor, Wallace E. Carroll School of Management, Boston College, 140 Commonwealth Avenue, Chestnut Hill, MA, 02467, United States, heimgr@bc.edu, William Wentworth

It is essential today for managers to determine the strategic implications posed by RFID. To the best of our knowledge, prior research has not analyzed how customer value will be provided via RFID, or what aspects of value customers might gain from RFID applications. We examine the customer value proposition of RFID within physical service environments. We develop a taxonomy of RFID applications in services, and use the taxonomy to examine survey data on value across the RFID application types.

2 - Inventory Management with Differential Pricing and RFID
Diego Klabjan, Associate Professor, University of Illinois at Urbana-Champaign, 1206 West Green Street, Urbana, IL, 61801, United States, klabjan@mit.edu

We study the inventory control problem of a single item, which is priced differently based on the added value. Radio frequency identification is an enabling technology for several new applications of this concept. We give results with respect to standard base-stock and (s,S) policies.

3 - RFID Adoption and Implementation in Supply Chains
Reyes Pedro, Assistant Professor, Hankamer School of Business, Baylor University, One Bear Place #98006, Waco, TX, 76798-8006, United States, pedro_reyes@baylor.edu

Like many other technologies of the past few decades, RFID technology in supply chain operations promises a variety of performance benefits and a powerful competitive weapon. While the ROI has been widely debated, we present findings based on secondary data collected on multiple international cases along with twelve field study interviews of RFID implementation in order to provide insights, identify implementation challenges, and highlight lessons learned.

4 - Assessing the Impact of RFID on Return Center Logistics
Nishtha Langer, PhD Candidate, Tepper School of Business, Carnegie Mellon University, 5000 Forbes Avenue, Posner #357, Pittsburgh, PA, 15213, United States, nishtha@cmu.edu, Chris Forman, Alan Scheller-Wolf, Sunder Kekre

RFID technology is being widely embraced in the supply chain, but there is a debate about its business value. To ascertain the real benefits of RFID, we conduct a field study with a third party logistics company that deployed RFID at one of its outbound logistics operations. After controlling for product, process and customer mix, we find that RFID not only provides operational benefits through improvements in productivity and process quality, but also moderates transaction costs.

■ WB09

Room 309

Sustainable Development

Contributed Session

Chair: Ibrahim Dogan, Wayne State University, 4815 4th Street, Detroit, MI, 48202, United States, dogan@wayne.edu

1 - Using Emission Functions in Mathematical Programming Models for Sustainable Urban Transportation
S. Ilker Birbil, Associate Professor, Sabanci University, Orhanli-Tuzla, Istanbul, 34956, Turkey, sibirbil@sabanciuniv.edu, Ahmet Esat Hizir

There seems to be a lack of mathematical programming approaches to sustainable urban transportation problems. To demonstrate the possible applications of mathematical programming within sustainable urban transportation, we analyze emission functions in terms of traffic flow and incorporate these functions into toll pricing models. The proposed models are solved by a state-of-the-art solver. Our presentation ends with a discussion of solution effort as well as the interpretation of the results.

2 - A Real Options Approach to Value Sustainable Product Manufacturing

Bilsel Ragip Ufuk, The Pennsylvania State University, 215 W. Fairmount Avenue #514, State College, PA, 16801, United States, rub150@psu.edu, Harriett Nembhard, Tao Yao

We propose an analytical method to value environmental sustainability under uncertainty. Specifically, we use a discrete time model combining lattice analysis and simulation to determine the value of switching between ordinary and green product manufacturing. We will consider four different sources of uncertainty; due to price, output rate, variable costs and technological improvements. A numerical example will be presented to discuss application aspects.

3 - Creating a Marketplace for Development Projects: Combinatorial Auctions and Post-Conflict Aid

J.D. Lecy, Student, Maxwell School of Public Affairs, 200 Eggers Hall, Syracuse University, Syracuse, NY, 13244, United States, jdlecy@maxwell.syr.edu

Post-conflict aid enables more growth than other kinds of aid, but the mechanisms of allocation have yet to be studied. We present a framework for analyzing the effects of post-conflict aid, and a fully-implemented decision support system that allows donors to choose bundles of project contracts that optimize social benefit.

4 - Modeling Closed-Loop Supply Chains Using Dynamic Bayesian Networks

Ibrahim Dogan, Wayne State University, 4815 4th Street, Detroit, MI, 48202, United States, dogan@wayne.edu, Ratna Babu Chinnam

This study models a two-stage supply chain where a supplier remanufactures products under information asymmetry. We employ novel Dynamic Bayesian Networks (DBNs) to improve supplier's visibility for product returns as well as market demand and in turn improve supplier's operations. Our results show that, with this approach, supplier is able to estimate supply chain states more accurately.

■ WB11

Room 311

Medical Decision Making

Contributed Session

Chair: George Miller, Altarum Institute, PO Box 134001, Ann Arbor, MI, 48113-4001, United States, george.miller@altarum.org

1 - Technology Integration in Healthcare Organizations: Self Selection and Performance Implications

Asoke Dey, PhD Candidate, University of Minnesota, 321 19th Avenue South, Room 3-150, Minneapolis, MN, 55455, United States, adey@csom.umn.edu, Kingshuk Sinha

Though application of information technologies in healthcare firms has direct positive impacts on patient safety and business-process reengineering, inappropriate choice of technologies and lack of integration across these technologies have left much to be desired. This study develops a conceptual understanding of how firms select the multiple technologies, what factors are important for this selection, and how it affects the performance of these firms. We test empirically with healthcare data.

2 - Probabilistic Models for Analyzing the Effect of Data Quality on Clinical Decision Support Systems

Sharique Hasan, Graduate Student, Carnegie Mellon University, 5000 Forbes Avenue, Pittsburgh, PA, 15213, United States, shasan@andrew.cmu.edu, Rema Padman

Clinical decision support systems have been advocated to improve patient safety by delivering guidance at the point-of-care. Recent literature shows, however, that these systems may also facilitate medical error. One class of errors may result from poor patient data quality. To analyze this problem we develop a mathematical model of system accuracy as a function of data quality. The methodology employs probabilistic graphical models to represent data, errors, and data use.

3 - Information Visualization and Meeting Physician Information Needs for Risk and Compliance Assessment

Christopher Harle, Carnegie Mellon University, Heinz School, 5000 Forbes Avenue, Pittsburgh, PA, 15213, United States, charle@cmu.edu, Rema Padman

Electronic patient data is increasingly available to physicians. This trend is likely to continue with policy makers urging widespread adoption of EHRs. This presents an opportunity to provide physicians with critical information to improve decision making at the point of care. We establish physician information needs for assessing diabetes risk and guideline compliance. We then develop and evaluate multidimensional information visualization models for delivery of those needs.

4 - Information-Based Medicine Integrated with RFID Technology in a Health Evaluation Center

Hsueh-Ming Wang, Assistant Professor, Chang Gung University, 259 Wen Hua 1st Road, Kwei Shan, Tao Yuan, 333, Taiwan, steve@mail.cgu.edu.tw

This paper studies on a RFID prototype system that is integrated with mobile healthcare of health-section supply chain in a health evaluation center. The aims are to (i) Keep track of the locations of patients in the health evaluation processes, (ii) Provide greater visibility of the operations data, and (iii) Improve the control processes. The case study illustrates the advantages of using an RFID system, particularly its support of M-healthcare activities in the health evaluation center.

5 - Cost-Effectiveness of Disease Management: Modeling to Infer Long-term Results from a Clinical Trial

George Miller, Altarum Institute, PO Box 134001, Ann Arbor, MI, 48113-4001, United States, george.miller@altarum.org

We use a Markov chain model to extend the results of an 18-month clinical trial of disease management for congestive heart failure (CHF) patients. Our results suggest that disease management of CHF patients can be cost-effective if patients remain in the program for life and the effects observed in the trial continue in the long run. But accurate estimation of both the clinical and financial benefits requires an ability to project costs and effectiveness for the lifetime of the patients.

■ WB12

Room 312

Enterprise-Wide Optimization: Process Industry Supply Chain

Cluster: Enterprise-Wide Optimization in the Process Industry

Invited Session

Chair: Iftekhar Karimi, Professor, Department of Chemical & Biomolecular Engineering, National University of Singapore, 4 Engineering Drive 4, Singapore, 117576, Singapore, cheiak@nus.edu.sg

1 - A Generalized Model for Supply Chain Redesign and Asset Management

Pavan Kumar Naraharisetti, Institute of Chemical & Engineering Sciences, 1 Pesek Road, Jurong Island, Singapore, 627833, Singapore, pavan_kumar@ices.a-star.edu.sg, Iftekhar Karimi, Rajagopalan Srinivasan

Organizations manage assets such as production & inventory holding facilities, raw materials, technological know-how and financial resources (capital from loans & bonds). Assets also include contracts to hedge the risk from uncertainties in material production and distribution. Optimal asset management (AM) involves investing and disinvesting in assets, leading to supply chain redesign (SCR), such that the NPV of the shareholder value is maximized. We present here a novel MILP model for SCR&AM.

2 - Merging Process Operations and Financial Analysis to Enhance the Supply Chain Management

Luis Puigjaner, Professor, Spain, luis.puigjaner@upc.edu, Gonzalo Guillén-Gosálbez, José Miguel La"nez

This work proposes a general framework for the design and retrofit of chemical supply chains which relies on the development of holistic models which merge process operations as well as financial variables and constraints. A mathematical formulation which utilizes mixed integer modeling techniques is derived and its advantages are highlighted through a case study in which a comparison with the traditional myopic approach, which neglects the financial side of the problem, is carried out.

3 - Distributed Modeling of Long-Term Production Scheduling in Multisite, Multiproduct Enterprise System

Steinar Hauan, Professor, Carnegie Mellon University, Department of Chemical Engineering, Pittsburgh, PA, United States, steinhau@andrew.cmu.edu, Israel B Owusu

An agent based optimization approach is applied to enterprise optimization problems consisting of demand allocation and scheduling. The allocation problem is solved iteratively using agents with embedded heuristic and stochastic strategies to gerenate objectives for the scheduling subproblems. We implement the approach in a distributed computing environment and show multi-product literature example that has been expanded to cover multiple plants with different internal cost structures.

4 - Strategic Sourcing Based on Contract Selection
Jie Li, National University of Singapore, Singapore, 117576, Singapore, g0304872@nus.edu.sg, Mukta Bansal, Iftekhar Karimi, Rajagopalan Srinivasan

Selecting contracts for raw material purchases is an important problem, as raw material costs are significant for many companies and contracts allow risk sharing in the presence of uncertainties. However, contracts come with different terms & conditions, hence selection is a non-trivial problem. We consider the optimal selection of raw material contracts using a mathematical programming approach. We also treat procurement planning horizon as a potential decision.

■ WB13

Room 313

Teaching Problem Formulation

Sponsor: Education (INFORM-ED)

Sponsored Session

Chair: Stephen Powell, Professor, Tuck School of Business, Dartmouth College, Hanover, NH, 03755, United States, Stephen.G.Powell@Dartmouth.EDU

1 - Teaching Problem Formulation
Stephen Powell, Professor, Tuck School of Business, Dartmouth College, Hanover, NH, 03755, United States, Stephen.G.Powell@Dartmouth.EDU, Thomas Willemain

While formulating ill-structured problems is the biggest challenge in modeling, little is known about how to teach this skill. We have studied both expert and student modelers to uncover the heuristics used by experts and the dysfunctional behaviors of students. We will report on our research and explore its implications for teaching.

■ WB14

Room 314

Auctions

Contributed Session

Chair: Barin Nag, Professor, Towson University, Department of Management, Towson, MD, 21252, United States, bnag@towson.edu

1 - Auction-Based Network Problem with Delayed Item Augmentation
Judy Doupu Geng, PhD Candidate, University of Toronto, 5 King's College Road, Toronto, ON, M5S 3G8, Canada, judygeng@mie.utoronto.ca, Roy H. Kwon

We consider an combinatorial auction based network problem with delayed item augmentation in which auctioneer gradually introduces items to bidders rather than put all items for sales at once. We prove the efficiency of this mechanism in terms of auctioneer's revenue and number of allocated bidders. Numerical results show that CA with delayed item augmentation outperforms CA of offering all times to bidder once.

2 - Welfare Maximization in Congestion Games
Liad Blumrosen, Microsoft Research, Silicon Valley, Mountain View, CA, United States, liad@cs.huji.ac.il, Shahar Dobzinski

Congestion games are non-cooperative games where the utility of a player from using a certain resource depends on the total number of players that are using the same resource. This paper studies centralized solutions for congestion games. We analyze the computational complexity of the welfare-maximization problem, and provide novel incentive-compatible mechanisms, approximation algorithms and lower bounds. We also characterize useful connections to combinatorial auctions.

3 - Modeling Agent-Based Auctions in Two Dimensions
Barin Nag, Professor, Towson University, Department of Management, Towson, MD, 21252, United States, bnag@towson.edu, Sungchul Hong, Dongqing Yao

In an agent-based auction environment, we consider matching buyer bids and seller offers in the two dimensions of quantity and price. The decision is a trade-off between the cost of accepting a part quantity versus carrying over the trade to the next period. Cooperation is permitted in matching quantities.

■ WB15

Room 315

The Economic Theory of Auctions I

Cluster: Auctions and e-Commerce

Invited Session

Chair: Felix Brandt, University of Munich, Oettingenstrasse 67, Munich, 80538, Germany, felix.brandt@gmail.com

1 - Asymmetric Auctions with Resale
Isa Hafalir, Vijay Krishna

We study first- and second-price auctions in which, after the auction, the winner may resell the object to the other bidder. When bidders take resale possibilities into account, the first-price auction has a unique monotone equilibrium. The revenue from a first-price auction with resale exceeds that from a second-price auction.

2 - Reducing Costly Information Acquisition in Auctions
Kate Larson, University of Waterloo, Computer Science Department, klarson@cs.uwaterloo.ca

Most auction research assumes that potential bidders have private information about their willingness to pay for an item. In reality, bidders often have to go through a costly information-gathering process in order to learn their valuations. Recent attempts at modeling this phenomena has brought to light complex strategic behavior arising from information-gathering, and has shown that traditional approaches to auction and mechanism design are not able to overcome it.

3 - Internet Advertising and the Generalized Second Price Auction: Selling Billions of Dollars Worth of Keywords
Michael Ostrovsky, Stanford University, Ostrovsky@gsb.stanford.edu, Benjamin Edelman, Michael Schwarz

We investigate the "generalized second price" auction (GSP), a new mechanism which is used by search engines to sell online advertising that most Internet users encounter daily. GSP is tailored to its unique environment, and neither the mechanism nor the environment have previously been studied in the mechanism design literature. Although GSP looks similar to the Vickrey-Clarke-Groves (VCG) mechanism, its properties are very different. In particular, unlike the VCG mechanism, GSP generally does not have an equilibrium in dominant strategies, and truth-telling is not an equilibrium of GSP. To analyze the properties of GSP in a dynamic environment, we describe the generalized English auction that corresponds to the GSP and show that it has a unique equilibrium. This is an ex post equilibrium that results in the same payo.s to all players as the dominant strategy equilibrium of VCG.

4 - Spiteful Bidding in Sealed-Bid Auctions
Felix Brandt, University of Munich, Oettingenstrasse 67, Munich, 80538, Germany, felix.brandt@gmail.com, Yoav Shoham, Tuomas Sandholm

We derive Bayes Nash equilibria in 1st-price and 2nd-price sealed-bid auctions for agents who maximize the weighted difference of their own profit and their competitors' profit. It turns out that revenue equivalence only holds for auctions in which all agents are either self-interested or completely malicious.

■ WB16

Room 316

Topics in Pricing

Cluster: Dynamic Pricing and Forecasting

Invited Session

Chair: Darius Walczak, Senior Scientist, PROS RM, 3100 Main Street, Suite 900, Houston, TX, 77002, United States, dwalczak@prospricing.com

1 - Risk-Sensitive Strategies for Revenue Management Problems
Joern Meissner, Lecturer, Lancaster University Management School, Department of Management Science, Lancaster, LA, LA1 1YX, United Kingdom, joe@meiss.com

Revenue Management systems rely on the quality of forecasts, in particular if premium demand shows mainly close to the end of the planning horizon. We develop risk-sensitive strategies for the situation where some information is known about the quality of past forecasts.

2 - Dynamic Pricing with Online Learning and Strategic Consumers
Mikhail Nediak, Assistant Professor, School of Business, Queen's University, 143 Union Street, Kingston, ON, K7L 3N6, Canada, mnediak@business.queensu.ca, Yuri Levin, Tanya Levin, Jeffrey McGill

We study the problem of dynamic pricing when consumers are strategic and have unknown preferences. The company learns demand through successive observations (online) and incorporates it in pricing decisions. We formulate the consumer choice model as a stochastic dynamic game and study its structural properties. Learning is integrated via an aggregating algorithm. We study the effects of strategic nature of consumers on the pricing policy of the company, and report numerical experience.

3 - Dynamic Pricing Under Competition
Michael Li, Associate Professor, Nanyang Technological University, Nanyang Business School, Nanyang Avenue, Singapore, 639798, Singapore, ZFLI@ntu.edu.sg

In this paper, we will introduce a simple dynamic pricing model what incorporates the presence of competition.

■ WB17

Room 317

Simulation of Service Chains and Health Care Systems

Contributed Session

Chair: David Hoffman, University of Alaska Anchorage, PO Box 111829, Anchorage, AK, 99511, United States, dhoffman@alaska.net

1 - A System Dynamics Model for Service Pricing

J.J. Jeng, Research Staff Member, IBM, 1101 Kitchawan Road, Route 134, Yorktown Heights, NY, 10598, United States, jjjeng@us.ibm.com, Lianjun An

We propose a service pricing model in which the causality relationships among service metrics are captured via System Dynamic Model. We will demonstrated how to leverage SD modeling capabilities to help decision makers to make good pricing decisions. Weighting combination among pricing schemes would change as time progresses to achieve optimal profit margin. Focus shifting on pricing reflects balance change among market sharing, profit taking and customer satisfaction in the different stage.

2 - Simulation-Based Process Improvement at a Free Outpatient Clinic

Edward Padula, University of Pittsburgh, College of Business Administration, Pittsburgh, PA, 15260, United States, egp3@pitt.edu, Jonathan Petruch, Scott Shearer, Karolina Glowacka

In this work, we consider operations of a free outpatient clinic. We use simulation together with data mining techniques for patient categorization to evaluate multiple scheduling procedures and patient routing through the system. Based on our study we propose the configuration that best satisfies multiple performance criteria identified by the clinic.

3 - Impact of Variability in Arrivals and Service on Finite Waiting Lines

David Bandy, University of Wisconsin Oshkosh, College of Business, Oshkosh, WI, 54901, United States, bandy@uwosh.edu

Variability in waiting line processes with room for waiting for a limited number of entities is investigated. The impact of variability in both the arrival of entities and in service operations are evaluated with respect to three primary measures of performance: 1) Average flow rate through the process; 2) Average number of entities in the process; and 3) Average flow time for the entities. The analysis is based on Little's Law, which can be used to improve waiting line processes.

4 - A Predictive Model for H.I.V. Transmission

Jorge Diaz, Resident Agent, T.M. of Greater San Juan, Inc., PO Box #9300239, San Juan, PR, 00928, Puerto Rico, jdiaz_castro@hotmail.com

We propose an isomorphism between maps and graphs. For any given map, there is one representative graph. We consider for each nation an index of incidence, an index of prevalence, the birth rate, the mortality rate, the immigration rate and the emigration rate. By making calculations over a standard time period, we predict future indeces of incidence and of prevalence for a given disease. We chose H.I.V. because it has a large data set, and large indeces of prevalence and incidence.

5 - Assessing Project Risk by Using Simulation

David Hoffman, University of Alaska Anchorage, PO Box 111829, Anchorage, AK, 99511, United States, dhoffman@alaska.net, Jang Ra

Simulating project risk demonstrates the unique complexities found in project plans. Examples are simulated to show the effects of project task variances on estimates for completing a project. Merely applying PERT and CPM simplifies how project activities times, costs and dependencies interact, especially where there are near critical paths. Project Management simulation with Extend allows for mixed distributions, rework, feed-forward effects and the assessment of the "knock-on" effect.

■ WB18

Room 318

Marketing II

Contributed Session

Chair: Sourav Ray, Assistant Professor, McMaster University, DeGroote School of Business, 1280 Main Street West, Hamilton, ON, L8S-4M4, Canada, sray@mcmaster.ca

1 - On Using Factor Analysis in Market Segmentation

Chaim Ehrman, Professor, Loyola University, 820 N. Michigan Avenue, Chicago, IL, 60611, United States, cehrman@luc.edu

Trans America Cable, Harvard Business Case # 9-583-150 deals with selling cable to residents in Southern Alabama. The data base that is provided can be used to run a Regression Model to identify which variables are significant to predict likelihood of purchase. If we use Factor analysis and then use the factor scores to identify likelihood of purchase, we get very different results. We show how Factor Analysis is the preferred way to go.

2 - Application of Product Life Cycle Model in Generational Sales Forecasting

Jian Yang, Director, Analytics Engineering, Rapt, Inc., 625 Second Street, San Francisco, CA, 94107, United States, jimmy.yang@rapt.com

Product life cycle model plays an important role in forecasting sales for generational products. Many different models have been proposed for product life cycles, both as a single generation and as successive generations. In this paper, we examine different types of product life cycles and generational patterns, apply different models to sales forecasting for both the existing generation and the new generation, and compare their results in terms of accuracy and stability.

3 - Customer Lifetime Duration and Discounted Expected Transactions: A Discrete-Time Based Data Analysis

Chao Wang, London Business School, Regent's Park, London, NW1 4SA, United Kingdom, cwang.phd2004@london.edu, Ilaria Dalla Pozza

This study implements a stochastic model to estimate the lifetime duration and discounted expected transaction with standard discrete-time based transaction data, and identifies the exchange and demographic factors that have significant contributions in the explanation of the variance in customer lifetime duration and discounted expected transactions. Several important managerial implications are discussed to offer some insights for marketing managers and decision makers.

4 - Product-Launch Strategies in Fast-Changing, Technology-Intensive Industries

Ying Li, Assistant Professor, Texas A&M University, Mays School of Business, College Station, TX, United States, yli@mays.tamu.edu, Yanhong Jin

Firms utilize different launch strategies according to their own characteristics and market structures. For example, Apple replaces its current generation product as soon as the new product is technologically ready, while Dell is known for efficiently producing the current-generation products and avoiding R&D cost on new technologies. We model the launch time by incorporating launch costs and market structures. Preliminary results provide some insights into different product-launch strategies.

5 - Transshipment and Product Assortment Decisions in Distribution Channels

Sourav Ray, Assistant Professor, McMaster University, DeGroote School of Business, 1280 Main Street West, Hamilton, ON, L8S-4M4, Canada, sray@mcmaster.ca, Mohamed Mahaboob

A retailer facing an inventory shortage could transship products from another with excess stock. In principle, a proactive transshipment contract can benefit the channel by reducing the overall inventory costs. However, transshipment possibility may also fundamentally impact the variety of products carried by the channel. In this paper, we attempt to explore how transshipment might affect the channel's incentives to invest in the assortment of products.

■ WB19

Room 319

Capacity and Transmission Expansions in Restructured Markets

Sponsor: Energy, Natural Resources & The Environment

Sponsored Session

Chair: Jorge Valenzuela, Associate Professor, Auburn University, 211 Dunstan Hall, Auburn, AL, 36849, United States, jvalenz@eng.auburn.edu

1 - Transmission Expansion Planning under Uncertainty in Restructured Markets

Chan Park, Professor, Auburn University, 201 Dunstan Hall, Auburn, AL, 36849, United States, park@eng.auburn.edu, Sevin Sozer, Jorge Valenzuela

In restructured markets, consideration of the economic impacts of congestion costs for transmission expansion planning is essential. The proposed transmission expansion planning approach for restructured markets considers uncertainty in power markets and minimizes the costs of investment and congestion, simultaneously. A numerical example will be used to illustrate the results.

2 - A Sustainable Capacity Expansion Model in Competitive Power Markets
Chung-Li Tseng, Associate Professor, University of Missouri-Rolla, Department of Engineering Management, Rolla, MO, 65409, United States, chungli@umr.edu

This paper addresses the capacity expansion process of generation and transmission under competition. A planning model is proposed for the Regional Transmission Organization, from a long-term and system-wide perspective, to achieve sustainable capacity expansion. The development cycle of the power market is formulated mathematically as a dynamic system. Sustainable equilibrium of the capacity expansion process will be defined and obtained through some numerical examples.

3 - A Numerical Comparison of Equilibria for Single Period and Multi-Period Games
Tapas K. Das, Professor, Department of Industrial & Management Systems Engineering, University of South Florida, 4202 E. Fowler Avenue, ENB118, Tampa, FL, 33620, United States, das@eng.usf.edu, Vishnu Nanduri, Cihan Babayigit

A majority of the oligopolistic energy market models focus on obtaining equilibria for single period (one shot) games with constant demand. We develop a multi-period model capable of incorporating stochastic demand variations, and a simulation & learning based solution approach. A multi period equilibrium solution is developed for a sample network for which a single period game solution is available in literature. The solutions are compared for various numerical scenarios.

4 - Transmission Congestion and Competition on Power Generation Expansion
Pinar Kaymaz, Graduate Student, Auburn University, 207 Dunstan Hall, Auburn, AL, 36849, United States, kaymapi@auburn.edu, Jorge Valenzuela, Chan Park

Generation expansion planning involves decisions on location and capacity of new generation, which may lead to add or relieve congestion in transmission lines and to increase or reduce competition in deregulated markets. In this paper, the interaction between competition and transmission congestion on power generation expansion is studied. Results from a 5-bus power network and the IEEE 24-Bus system are presented and discussed.

■ WB20

Room 320

Solution Techniques I in Decision Analysis

Contributed Session

Chair: Toshikazu Aiyama, Tokyo Metropolitan University, tyaiyamajp@yahoo.co.jp

1 - On the Mathematical Foundations of Decision Theory
Jonathan Barzilai, Dalhousie University, PO Box 1000, Halifax, Canada, barzilai@dal.ca

The purpose of measurement is to enable the operations of addition and multiplication (such as m(3)=m(1)+m(2) and m(2)=5m(1) on a fixed mass scale). The applicability of such expressions in the case of a fixed utility scale was taken for granted by von Neumann and Morgenstern in their development of utility theory. We show that these operations are not applicable in the case of utility scale values or to any scale values that are based on the models of the classical theory of measurement.

2 - A New Constrained Multiple Response Surface Method Based on Necessary Conditions and Assumptions
Alicia Wilson, University of Central Florida, 10624 Sandridge Court, Orlando, FL, 32817, United States, awilson4195@cfl.rr.com, Robert Armacost

There are many advantages to utilizing a constrained methodology when evaluating multiple objectives. The necessary conditions and assumptions for constrained multiple response surface methods will be presented and contrasted to those required for combined methods. A new constrained multiple response surface method is proposed that improves decision-maker trade-offs among the multiple responses. Results will be compared to existing constrained methods.

3 - Developing a Tool for Justification of Advanced Technology
Sharon Ordoobadi, Professor, University of Massachusetts at Dartmouth, 285 Old Westport Road, N. Dartmouth, MA, 02747, United States, sordoobadi@umassd.edu

A model is developed to help decision makers with their investments regarding advanced technologies. The purpose is to complement the already existing evaluation techniques by adding intangible costs of adopting new technologies. The intangible costs (risks) of investing in a new technology are identified and a methodology is developed for evaluation of these costs.

4 - Dynamic Data Driven Decision Field Theory Extension (D4FTE)
Seungho Lee, The University of Arizona, 4513 E. Bellevue Street #9, Tucson, AZ, 85712, United States, mountlee@email.arizona.edu, Young-Jun Son

Decision Field Theory has been widely used for the cognitive decision making tasks. In this paper, we enhance it with dynamic update of the value matrix (evaluations of alternatives) using Bayesian Belief Networks. We also investigate the effect of dynamic update during the decision deliberation. The proposed model is validated against both the traditional Decision Field Theory as well as real human behaviors in the laboratory experiments. Initial results look quite promising.

5 - Population Equilibrium Methods for Medical Decision Making
Min Huang, Northwestern University, 2145 Sheridan Road, C210, Evanston, IL, 60208, United States, huangmin@northwestern.edu, Gordon Hazen

In Markov models of healthcare interventions, cohort methods are widely employed in cost-effectiveness analysis to calculate population QALYs and costs. However it is also useful to determine equilibrium population levels before and after an intervention and examine outcomes at the equilibrium level. We derive equilibrium distributions using population Markov models, present equilibrium measures to evaluate healthcare interventions and show how they differ from traditional cohort measures.

■ WB21

Room 321

E-Business/Commerce II

Contributed Session

Chair: Daewon Sun, Assistant Professor, University of Notre Dame, 366 Mendoza CoB, Notre Dame, IN, 46556, United States, dsun@nd.edu

1 - Petri Net Analysis of RosettaNet Protocol Enabled Supply Chains
Andrew Feller, Research Associate, Intel Corporation & Arizona State University, 1201 E. Sea Breeze Drive, Gilbert, AZ, 85234, United States, andrew.feller@asu.edu

Templates for Petri Net translation of RosettaNet protocols exchanging business messages between trading partners generate P/T Nets that are analyzed to provide structural validation and performance simulation of the protocol's behavior under varying network and business process failure rates. Analysis includes RNIF provisions for retries, timeout and failure processing using exception-signal and notification-of-failure mechanisms with performance curves guiding improved protocol reliability.

2 - The Role of Customer Experience in Online Financial Service
Xin Ding, PhD Candidate, University of Utah, 1645 E. Campus Center Drive, Salt Lake City, UT, 84112, United States, pmgtxd@business.utah.edu

This study explores the relationships between service experience and customer satisfaction and loyalty. A model is proposed and tested within the context of online financial service. Results of this study indicate that while information and system quality affect customer satisfaction, the relationship is strongly mediated by customers' overall experience on the service site.

3 - Cross-Platform Mobility of Information Technology Vendors: A Real Options Analysis
Jing Li, Assistant Professor, Simon Fraser University, 8888 University Drive, Burnaby, BC, Canada, jingli@sfu.ca, Nilesh Saraf

We present a real-options model of IT application vendors considering adoption of new, emerging platforms. In the model, we consider the ratio of future compatibility cost relative to the current cost. We present the simulation results and discuss implications for both, application vendors and IT platform sponsors.

4 - Improving Web-Catalog Design for Easy Product Search
Manuel Nunez, Assistant Professor, University of Connecticut, 2100 Hillside Road Unit 1041, Storrs, CT, 06269-1041, United States, mnunez@business.uconn.edu, Robert Chiang

Building intuitive websites is important for online businesses. We incorporate browsing patterns to design a web catalog, and propose a two-stage optimization procedure to reduce click-count and page cluttering. Our analysis reveals that an optimized catalog is robust against shifts in browsing behavior and that simplistic interfaces are preferred.

5 - The Role of Stockless Operations in Electronic Retailing
Daewon Sun, Assistant Professor, University of Notre Dame, 366 Mendoza CoB, Notre Dame, IN, 46556, United States, dsun@nd.edu, Jennifer Ryan

Due to the proliferation of electronic commerce and the development of Internet technologies, many firms have considered new pricing-inventory models. In this paper, we study the role of stockless operations in online retailing by considering duopoly competition in which two retailers compete to maximize profit by jointly optimizing their pricing and inventory decisions. In our model, the retailers are allowed to choose either an in-stock policy or stockless operations with a discounted price.

■ WB22

Room 322

Naval Applications

Sponsor: Military Applications

Sponsored Session

Chair: Robert Taft, Lead Scientist, NSWCDD, PO Box 1497, Dahlgren, VA, 22448, United States, robert.l.taft@navy.mil

1 - Rapid Re-Planning of a Launch Schedule

Thomas Turner, Scientist, NSWCDD, Code B32, 17320 Dahlgren Road, Dahlgren, VA, 22448, United States, Thomas.G.Turner@navy.mil

The planned firing schedule of cruise missiles from a platform is often perturbed at the last minute to accommodate over-water routing constraints and coordinated fires desires. The issues involved in rapidly re-planning the firing schedule are examined and an integer programming formulation to solve the problem is proposed.

2 - Estimation of Marine Rifle Squad Load Weight

Christopher Zaffram, Operations Research Analyst, MCCDC, 3300 Russell Road, Quantico, VA, 22134, United States, ZafframCD@mccdc.usmsc.mil

To clearly state requirements for transport, an accurate definition of the combat loaded Marine is needed. We discuss estimates calculated using weight data from Marine forces conducting combat and peacekeeping operations in OPERATION ENDURING FREEDOM and OPERATION IRAQI FREEDOM in Afghanistan and Iraq during the spring and summer of 2004. We also discuss a tool developed for determining individual and group squad member weight for any billet combination.

3 - Finding Three Good Alternatives in a Multi-Criteria Decision Problem

Robert Taft, Lead Scientist, NSWCDD, PO Box 1497, Dahlgren, VA, 22448, United States, robert.l.taft@navy.mil

The Pareto Boundary Explorer (ParBoX) is an architecture and implementation using mathematical programming, expert systems, and statistical discrimination to nominate a handful of significantly different non-dominated solutions to multi-criteria decision problems. Problems examined include notional theater level planning for cruise missile strikes and selecting a college semester schedule.

■ WB23

Room 323

Panel Discussion: Managing Global Human Resources

Cluster: Global Services Sourcing

Invited Session

Chair: Yael Ravin, Program Director, IBM, TJ Watson Research Center, 19 Skyline Drvie, Hawthorne, NY, 10542, United States, ravin@us.ibm.com

1 - China's Evolving Talent Pool: A Strategic Perspective

Cong Cao, Senior Research Associate, Levin Institute, Cong.Cao@suny.edu

In 2005, China graduated over 800,000 engineers from its universities. Spending on science and technology is increasing at a faster rate than overall economic growth. Many of the world's most innovative companies have established R&D centers to develop new products and services for global markets and the Chinese domestic market. Once considered one of the more backward developing countries, today China stands at becoming one of the world's major economic and technological forces. Underlying these transitions is the emergence of a large, increasingly well educated talent pool. Building upon significant investments to modernize and upgrade the country's higher education system and R&D infrastructure, China hopes to harness its major resource - people - to close the technological gap between itself and the West. The launch of a new Medium-to-Long Term Plan for Science and Technology in 2006 further reflects this commitment to bring China into a leadership position in the 21st century. At the heart of the debate about whether China's potential can be realized, lie a number of issues related to the quantity/quality of China's scientific and technical workforce. Will China have sufficient talent to compete with the US and other leading technological nations? How will demographic trends in China affect the supply of college age candidates for university enrollment? What has been the impact of Chinese scientists and engineers who have been trained abroad and have returned to China? And, what factors in the changing complexion of the Chinese economy will affect the supply and demand for high-end talent?

2 - Offshore Operations: Strategic Positioning to Address Skill Gaps

Jeanette Harrison, Vice President, American Express Learning Network, American Express, 777 American Expressway, MS 05-01-4, Fort Lauderdale, FL, 33337, United States, jeanette.k.harrison@aexp.com

Skills gap, industry growth and technological advances have in part driven companies to develop off shore operations. Offshore centers provide enormous opportunity but require careful planning and cultural awareness in order to obtain benefit from the world's labor pool. This paper will address the cross cultural issues attendant to offshore operations.

3 - Global Resourcing: Today's Reality and Tomorrow's Challenges

Kellar Nevill, Vice President, Global Delivery BTO HR, IBM, 11 Brook Hollow Lane, Trophy Club, TX, United States, knevill@us.ibm.com

Global resourcing has become prevalent in the services industry. If it can be digitized, it can be offshored. In this session we will discuss today's issues that effect this practice and tomorrow's challenges that are inevitable as the practice grows. How you hire, train, retain and enable qualified human capital.

4 - Strategic Expertise and Leadership Development in the "BRIC" Countries

Rahul Singhal, IBM, rsinghal@us.ibm.com

This presentation will discuss macro trends in the development of talent and leadership that IBM has observed in the "BRIC" countries (Brazil, Russia, India, China), and describe challenges these workforces pose for managers. Potential actions as they relate to delivering business strategy will be discussed as well.

■ WB24

Room 324

Supply Chain Competition and Coordination

Contributed Session

Chair: Goel Ankur, University of Texas-Austin, CBA 5.202 IROM Department, Austin, TX, 78712, United States, goel@mail.utexas.edu

1 - Coordinating a Constrained Channel

Navid Sabbaghi, Massachusetts Institute of Technology, 77 Massachusetts Avenue, Room 32D-712, Cambridge, MA, 02139, United States, sabbaghi@mit.edu, John Tsitsiklis, Yossi Sheffi

Linear wholesale-price contracts are considered incapable of coordinating a newsvendor's procurement decision for a 1 supplier/1 newsvendor supply channel. Consequently, more complex contracts have been studied. We show that when a newsvendor is capacity-constrained there is a set of wholesale prices that coordinate his ordering decision. We prove this for multiple-supplier channels, assuming independent demand for each product. We analyze both negotiation and equilibrium settings.

2 - Coordinating Serial Supply Chains under Different Information Regimes: Batch vs. Periodic Ordering

Kevin Shang, Fuqua School of Business, Duke University, Durham, NC, United States, khshang@duke.edu, Sean Zhou

Coordination mechanisms for batch ordering models have been studied extensively in the literature. In this talk, we present exact and heuristic coordination mechanisms for periodic ordering models under local and echelon information regimes. We discuss implementation issues and system performance for batch ordering and periodic ordering models.

3 - Joint Inventory and Pricing Decisions in a Consignment Channel with Competing Suppliers

Dengfeng Zhang, The University of Iowa, S210 PBB, Iowa City, IA, 52242, United States, dengfeng-zhang@uiowa.edu, Renato de Matta

We consider a supply chain with two suppliers of substitutable products on consignment to a single retailer. The retailer (Stakelberg leader) sets the revenue share, while the suppliers (followers) decide on the product prices and inventory levels. We develop equilibrium model solutions to investigate how channel decisions and changes in exogenous parameters affect channel profits. Other channel settings such as exclusive retailer channel and wholesale channel are also explored and compared.

4 - Supply Chain Coordination with Generalized Forced Quantity Incentives

Yuanjie He, Assistant Professor, California State Polytechnic University, 3801 W. Temple Avenue, Pomona, CA, 91768, United States, he@csupomona.edu, Hassan Halati

This paper examines the use of generalized forced quantity incentive to coordinate inventory decisions in a decentralized supply chain. We first consider the finite horizon, periodic review inventory model with fixed costs and prove that for an independent retailer, a generalized (s, S) policy is optimal. We investigate the performance of a two-stage decentralized supply chain and show that under this generalized forced quantity incentive, the optimal strategy results in centralized profit.

5 - Using Market Information to Coordinate Distribution of a Commodity in a Decentralized System.
Goel Ankur, University of Texas-Austin, CBA 5.202 IROM Department, Austin, TX, 78712, United States, goel@mail.utexas.edu, Genaro Gutierrez

We model the distribution of a commodity in a decentralized two-echelon multi-period framework. Cost of commodity procurement is determined by spot and forward markets. Procurement of the commodity, and value adding activities are performed at the higher echelon and then it is shipped to fulfill orders of the lower/retailer echelon. We propose channel coordination mechanisms using functions of market prices as a coordinating lever. We examine symmetric and asymmetric information scenarios.

■ WB25

Room 325

Innovation/Entrepreneurship

Contributed Session

Chair: David Güemes-Castorena, Professor & Researcher, Tec of Monterrey, Av. Eugenio Garza Sada 2501 Sur, Col. Tecnológico, Monterrey, NL, 64898, Mexico, guemes@itesm.mx

1 - The Theory of Entrepreneurial Policy Alignment: A Newer Institutional Economics
Keenan Yoho, Associate Researcher, The RAND Corporation, 1776 Main Street, Santa Monica, CA, 90401-3208, United States, kdyoho@gmail.com, Solon Simmons

A Theory of Entrepreneurial Policy Alignment is proposed. Central to the theory is the concept of the policy as the strategic lever of entrepreneurial action. Analysis of policy draws attention to the Schumpeterian dynamics of competing supply chains operating in environments far from equilibrium, and can be seen as a movement through transaction cost economics. Application of the theory in a supply chain setting is discussed.

2 - Strategic Operations Alignment for Global Entrepreneurs
Yasemin Aksoy, Associate Professor, Tulane University, A.B. Freeman School of Business, New Orleans, LA, 70118, United States, professor@stropa.com

New start-ups are in a unique position to employ operations research tools as they align their operations strategy with their global operations. I believe there is a strong need for offering courses that will help entrepreneurs to make the right decisions at the early stages of their business. This presentation offers a framework and a course design to that end.

3 - The Impact of Peer Ratings and Make Effect on Consumers Willingness to Pay for IT Products
Chin-I Wang, Avio Corporation, 10 Brockton, Irvine, CA, 92620, United States, cwang@aviocorp.com, Yu-Ming Wang

In the absence of perfect information regarding product quality, support and reliability, the make of an IT product may be used by consumers as a proxy. Similarly, the various ratings of a product by consumers are likely to influence the perceived quality and thus value of such product. Using an experimental design, this study assesses the extent of peer ratings and brand effect on consumers' willingness to pay for IT products using laptop PC purchasing decision as a context.

4 - Institutional Semiotics: Meaning and Markets
Roy Suddaby, Pearson Faculty Fellow, School of Business, University of Alberta, 2-32E Business Building, Edmonton, AB, T7Y 1b, Canada, roy.suddaby@ualberta.ca

This paper focuses on the rhetorical and semiotic strategies used by publicly traded companies to communicate to market actors; competitors, regulators, shareholdeers, employees and other market participants. We draw from rhetorical theory, semiotics and neo-institutional theory to demonstrate how organizations use public market disclosure mechanisms to code and deploy rhetorical "signals" simultaneously to multiple audiences.

5 - Innovative Capability and Competitive Intelligent Practices of Medium & Small Companies in Mexico
David Güemes-Castorena, Professor & Researcher, Tec of Monterrey, Av. Eugenio Garza Sada 2501 Sur, Col. Tecnológico, Monterrey, NL, 64898, Mexico, guemes@itesm.mx

This study sheds some light on the technological innovation framework being used by the medium and small Mexican companies by providing with information on their competitive intelligent practices: information culture, management style, knowledge of sources of information, its systematic use, evaluation and analysis, diffusion, and the use to make decisions in the company. The results are contrasted with a self-evaluation of the innovative capability.

■ WB26

Room 326

Data Mining, Knowledge Management and Applications

Sponsor: Data Mining

Sponsored Session

Chair: Bill Tseng, Assistant Professor, Department of Mechanical and Industrial Engineering, The University of Texas at El Paso, 500 West University Avenue, El Paso, TX, 79968, United States, btseng@utep.edu

Co-Chair: Chun-Che Huang, Professor of Information Management, National Chi Nan University, Department of Information Management, Pu-Li, Na-Tau, 545, Taiwan, chuang@im.ncnu.edu.tw

1 - Applying a Hybrid Data Mining Approach in Machining Operation for Surface Quality Assurance
Bill Tseng, Assistant Professor, Department of Mechanical and Industrial Engineering, The University of Texas at El Paso, 500 West University Avenue, El Paso, TX, 79968, United States, btseng@utep.edu, Hansuk Sohn, Chun-Che Huang, Johnny Ho

Little work has been devoted to the development of the automated decision support for machining operation, to support surface roughness quality control when qualitative data is taken into consideration. This presentation demonstrates a data mining based hybrid approach to control surface quality while qualitative data is involved. The approach consists of a novel rough-set algorithm for feature selection and an enhanced binary-class support vector machines (SVMs) method for accurate prediction.

2 - Business Intelligence: Analytical Knowledge Warehousing
Chun-Che Huang, Professor of Information Management, National Chi Nan University, Department of Information Management, Pu-Li, Na-Tau, 545, Taiwan, chuang@im.ncnu.edu.tw, Bill Tseng

In this presentation, an "analytical knowledge warehousing" approach is proposed to apply business intelligence, and solve the knowledge management and diffusion issues for decision-making. The solution approach includes conceptual framework of analytical knowledge, analytical knowledge externalization, design and implementation of analytical knowledge warehouse. The methodology has integrated with multi-dimensional analytical techniques to efficiently search analytical knowledge documents.

3 - E-Quality for Manufacturing (EQM) Integrated with Web-Enabled Production System
Yongjin Kwon, Assistant Professor, Applied Engineering Technology, Drexel University, 3001 Market Street, Suite 100, Philadelphia, PA, 19104, United States, yk73@drexel.edu, Mira Lalovic-Hand

This study investigates the feasibility of integrating internet-based remote quality control using a web based vision system and an assembly robot. The web-based quality control presents an opportunity for many key improvements such as ubiquitous access, monitoring capability, and integration of production equipment into information networks for improved efficiency and product quality within the framework of Concurrent Engineering and Design for Manufacturing.

4 - Advanced Demand Forecasting for Call Centers
Roger R. Gung, VP for Research and Technologies, ac2 Solutions, Inc., 935 Route 34, Suite 3A, Matawan, NJ, 07747, United States, rogergung@ac2solutions.com, Turgut Aykin

Call volume and service time forecasts have been most critical inputs to call center workforce management. Because of the existence of multi-level seasonality and special event days, it is very difficult to accurately forecast these two inputs for intervals, such as 15 and 30-minute intervals or even 1-day. This talk will discuss new methods that significantly improve forecast accuracy despite of being based on traditional statistical models.

■ WB27

Room 327

Recent Advances in Computer Experiments

Sponsor: Quality, Statistics and Reliability

Sponsored Session

Chair: Zhiguang Qian, Assistant Professor, Department of Statistics at the University of Wisconsin-Madison, 1220 Medical Sciences Center, Madison, WI, 53706, United States, zhiguang@stat.wisc.edu

1 - Orthogonal-Maximin Latin Hypercube Designs

Ying Hung, Georgia Institute of Technology, yhung@isye.gatech.edu, Roshan Vengazhiyil

A randomly generated Latin hypercube design (LHD) can be quite structured. There are procedures to find good LHDs by minimizing the pairwise correlations or maximizing the inter-site distances. In this article we have shown that these two criteria need not agree with each other. Therefore, we propose a multi-objective optimization approach to find good LHDs. Several examples are presented to show that the new algorithm is fast and that the optimal designs are good in terms of both criteria.

2 - Blind Kriging

Roshan Vengazhiyil, Assistant Professor, Georgia Institute of Technology, Industrial and Systems Engineering, 755 Ferst Drive, Atlanta, GA, 30332, United States, roshan@isye.gatech.edu, Ying Hung, Agus Sudjianto

Kriging is a useful method for developing meta-models for product design optimization. However, the commonly used kriging predictor has some problems; it is not easy to interpret, not robust to the misspecifications in the correlation parameters, and in some cases may lead to poor predictions. In this article, we propose a modified kriging method that overcomes the foregoing problems. The usefulness of the proposed method is illustrated with several examples.

3 - Gaussian Process Models for Computer Experiments With Qualitative and Quantitative Factors

Zhiguang Qian, Assistant Professor, Department of Statistics at the University of Wisconsin-Madison, 1220 Medical Sciences Center, Madison, WI, 53706, United States, zhiguang@stat.wisc.edu, Jeff C. F. Wu, Huaiqing Wu

Modeling experiments with qualitative and quantitative factors is an important but unsolved issue in computer modeling. Some Gaussian process models that can accomodate both qualitative and quantitative facotors are proposed. A real example for modeling the thermal distribution in a data center is used to illustrate the proposed models.

■ WB28

Room 328

Accelerated Testing and Testing Plans

Sponsor: Quality, Statistics and Reliability

Sponsored Session

Chair: Haitao Liao, Assistant Professor, Wichita State University, Industrial & Manufacturing Engineering, Wichita, KS, 67260, United States, haitao.liao@wichita.edu

1 - HASS or Non-HASS for Printed Circuit Board Manufacturing - How to Breakeven in MTBF vs. Cost

Tongdan Jin, Teradyne, Inc., 300 Riverpark Avenue, MS 3001-14, North Reading, MA, 01864, United States, tongdan.jin@teradyne.com

Electronic products usually exhibit early life profiles. Highly accelerated stress screening (HASS) can help weed out the early failures. However, many practitioners are cautious of HASS, particularly for capital-intensive electronic equipment manufacturers. In this paper a mathematical model is developed to address the benefit in improving MTBF of printed circuit boards vs. the investment in HASS. The model helps reliability engineers achieve the high reliability with a minimum cost.

2 - Effects of Missing Data in Competing Risks on Accelerated Life Testing

Rong Pan, Assistant Professor, Arizona State University, Department of Industrial Engineering, Tempe, AZ, 85287, United States, rong.pan@asu.edu

It is important to consider the change in relative prevalence of the failure modes and the change in the dependence structure as the stress increases. The dependence structure of competing failure modes as their relative dominance change with the increase of the applied stress is studied in this research. Another objective of this research is to evaluate the impact of missing data at high stress levels during accelerated life testing on the extrapolation to normal working conditions.

3 - Optimal Design of Accelerated Testing Plans Considering Maintenance Requirements

Haitao Liao, Assistant Professor, Wichita State University, Industrial & Manufacturing Engineering, Wichita, KS, 67260, United States, haitao.liao@wichita.edu, Murad Hamada

Accelerated life tesing (ALT) is usually conducted to predict the reliability of a product and optimize the maintenance activity. In many cases, however, maintenance requirements have been given in advance by some mandatory regulations. In this paper, the maintenance-oriented optimal design of ALT plans is presented. The goal of this research is to provide a new set of optimal testing plans under a variety of maintenance requirements.

4 - Equivalence of Accelerated Testing Plans

Elsayed Elsayed, Professor, Department of Industrial and System Engineering, Rutgers University, 96 Frelinghuysen Road, Piscataway, NJ, 08854-8018, United States, elsayed@rci.rutgers.edu, Hao Zhang, Haitao Liao

In this presentation we present approaches for assessing the equivalence between two different accelerated test plans. We focus on constant stress plans and the simple step-stress test plans and determine the parameters of each plan that will make the two plans equivalent. The parameters include the stress levels, allocations of test units to the applied stresses and the duration of the test.

■ WB29

Room 329

Constraint Programming

Contributed Session

Chair: John Mittenthal, The University of Alabama, Box 870226, Tuscaloosa, AL, United States, jmittent@cba.ua.edu

1 - Chance-Constrained Semidefinite Programming: A Definition

Yuntao Zhu, Arizona State University, Math Sciences and Applied Computing, Phoenix, AZ, 85069-7100, United States, Yuntao.Zhu@asu.edu, K. A. Ariyawansa

Recently, Ariyawansa and Zhu have defined an extension of semidefinite programs termed {\em stochastic semidefinite programs with recourse} to deal with uncertainty in data defining semidefinite programs. In this talk we introduce an alternative extension of semidefinite programs termed {\em chance-constrained semidefinite programs} for handling uncertainty in data defining semidefinite programs, and indicate an application of chance-constrained semidefinite programs.

2 - Logic-Based Optimization for Interdependent Layered Networks (ILN) Problems

Jing Gong, Rensselaer Polytechnic Institute, CII 8225, 110 8th Street, Troy, NY, 12180, United States, gongj@rpi.edu, Earl Lee, William Wallace, John Mitchell

The paper discusses the application of incorporating constraint programming into mathematical programming for ILN problems. This methodology can be used to model interdependent infrastructures, such as power, telephone, and transportation. A realistic problem of managing disruption to the critical infrastructure systems in the area south of 60th street, Manhattan region of New York is discussed. A restoration model is developed in OPL and solved by ILOG Solver and Hybrid.

3 - Hurricane Evacuation of the Rio Grande Valley of Texas

Robert Webb, University of Texas-Brownsville (Student), 521 Zapata, Rancho Viejo, TX, 78575, United States, robert.b.webb@lmco.com

This presentation will review a Maximal Flow Analysis of the routes of evacuation from the Rio Grande Valley of Texas (Brownsville-Harlingen-McAllen-Edinburg). Additional contraints to the analysis will be: a) Homeland Security (Border Patrol) checkpoints 70 miles beyond the U.S border which will impede flow, and b) Accommodation of Mexican citizens who may no other evacuation route except through the United States which will increase the flow.

4 - The Just-in-Time Assembly Line Balance Problem

John Mittenthal, The University of Alabama, Box 870226, Tuscaloosa, AL, United States, jmittent@cba.ua.edu

This problem, based on the traditional Assembly Line Balancing (ALB) problem, is motivated from manufacturing environments where fabrication and assembly operations are coordinated. Integer and constrained programming models are presented for the JIT-ALB problem. Solution results are presented for a set of publicly available test problems.

■ WB30

Room 330

Optimization Techniques

Contributed Session

Chair: Svyatoslav Trukhanov, Texas A&M University, Industrial and Systems Engineering, College Station, TX, United States, slavik@tamu.edu

1 - Robust Stochastic Games

Erim Kardes, PhD Candidate, University of Southern California, Industrial and Systems Engineering, 1651 S. Wilton Place, Los Angeles, CA, 90019, United States, kardes@usc.edu, Fernando Ordonez

In this paper, two-player non-zero sum, finite state/action, discounted stochastic games with uncertainty in transition probabilities and payoffs are considered, where at least one player adopts a robust optimization approach to data uncertainty. We call such games robust stochastic games. We first prove existence of equilibrium points, and then reformulate this problem as a nonlinear, non-convex problem using duality.

2 - A Comparative Study of Disjunctive Cuts for Two-Stage Stochastic Mixed-Binary Programs

Matthew Tanner, Graduate Student, Texas A&M University, 1703 Langford Street, College Station, TX, 77840, United States, wileytanner@gmail.com, Lewis Ntaimo

Recent results seem to indicate the effectiveness of disjunctive cuts in solving large-scale stochastic mixed-binary programs. In this talk we present a comparative study of the disjunctive decomposition (D2) method of Sen and Higle and the lift-and-project cut method of Caroe. In both methods, the cuts are generated for an individual scenario and then translated so that they are valid for all scenarios. However, Caroe's method generates cuts in a higher dimensional space than the D2 method.

3 - Robust Optimization for Least Squares Estimation

Laura Wynter, Research Scientist, IBM Research, PO Box 218, Yorktown Heights, NY, 10598, United States, lwynter@us.ibm.com, Cathy Xia, Fan Zhang

We analyze an existing method called robust least squares on a parameter estimation problem arising in queueing network inference and show that it is inferior to a different method, which we construct based upon the simplest superefficient estimator.

4 - Stochastic Optimization via Robust Parameter Design

William McDaniel, Marriott International, Marriott Drive, Department 51/954.04, Washington, DC, 20058, United States, bill.mcdaniel@hotmail.com

Optimization via simulation techniques attempt to account for variability through stochastic approximation or random searches. We present a response surface approach incorporating Taguchi robust parameter design principles to determine the optimal answer in the presence of this noise, accounting for both the objective function and the certainty of the answer.

5 - Adaptive Multicut Aggregation in Solving Stochastic Linear Programs with Recourse

Svyatoslav Trukhanov, Texas A&M University, Industrial and Systems Engineering, College Station, TX, United States, slavik@tamu.edu, Lewis Ntaimo, Andrew Schaefer

Outer linearization methods such as the L-shaped method for stochastic linear programs generally apply a single cut on the nonlinear objective at each major iteration, while the multicut version allows for several cuts to be placed at once. The L-shaped tends to have more major iterations than the multicut method. This talk presents an adaptive multicut method that dynamically adjusts the aggregation level of the master program optimality cuts to gain in computation time over the two methods.

■ WB31

Room 331

Portfolio Construction in Finance-Risk Management

Contributed Session

Chair: Kathryn Kaminski, Massachusetts Institute of Technology, ORC E40-149, Cambridge, MA, United States, katykam@mit.edu

1 - Alternative Approaches to Compute Value-at-Risk

Taposhri Ganguly, Research Student, CARISMA, Brunel University, Department of Mathematical Sciences, John Crank Building, Uxbridge, Middlesex, UB8 3PH, United Kingdom, taposhri.ganguly@brunel.ac.uk, Gautam Mitra, Paresh Date

Value-at-risk is a commonly used measure of market risk for a portfolio. In this paper, an algorithm for computing VaR using fractional Fourier transformations (FRFT) is developed. The computation of VaR for non-linear portfolios with non-normal returns is compared using copula/EVT based approach and fractional FFT approach.

2 - Portfolio Construction Using Variance and CVaR

Diana Roman, PhD Student, Brunel University, Kingston Lane, Uxbridge, UB8 3PH, United Kingdom, diana.roman@brunel.ac.uk, Ken Darby-Dowman, Gautam Mitra

We propose a model for portfolio optimisation, in which distributions are described and compared using 3 statistics: mean, variance and CVaR. The purpose is to improve on mean-variance and mean-CVaR efficient distributions. The problem is multi-objective and transformed into a single objective one in which variance is minimised and constraints imposed on mean and CVaR. In case of scenario models, the problem is a quadratic program. The model is tested on real data drawn from the FTSE 100 index.

3 - Portfolio Optimization with Higher Moment Risk Measures

Paul Krokhmal, Assistant Professor, University of Iowa, 2403 SC, Iowa City, IA, 52242, United States, krokhmal@engineering.uiowa.edu

The paper considers modeling of risk-averse preferences in stochastic programming problems using risk measures. By representing risk measures via solutions of specially constructed stochastic programming problems, we introduce a new family of higher-moment coherent risk measures (HMCR). It is demonstrated that the HMCR measures are compatible with utility theory, and can be efficiently used in portfolio optimization, especially by investors with aggressive risk preferences.

4 - Investment in Operational Attributes: System Dynamics Approach to Training Services

Kalyan Pasupathy, University of Missouri, 311 Clark Hall, Columbia, MO, 65211, United States, pasupathyk@missouri.edu

Managers in organizations make operational attribute investment decisions all the time. These decisions have an impact on the bottom-line profits and on the market penetration of the organization. This research develops a dynamic model to evaluate investments made in operational attributes and determine the behavior of customer perceptions, loyalty, profit, market penetration and marginal rate of return over time.

5 - When Do Stop-Loss Rules Stop Losses?

Kathryn Kaminski, Massachusetts Institute of Technology, ORC E40-149, Cambridge, MA, United States, katykam@mit.edu, Andrew Lo

Stopping strategies, policies to close out positions after reaching a certain threshold of losses, are commonly used by retail and institutional investors to manage portfolio risks. However, under certain conditions, stop-loss policies can significantly alter an underlying strategy and thus impact long term portfolio performance. We derive analytical and numerical implications of stop-loss policies on portfolio performance when they are applied to common investment strategies.

■ WB32

Room 332

Supply Chain Management with Disruptions

Contributed Session

Chair: David Heimann, Professor, Management Sciences & Information Systems Department, University of Massachusetts Boston, 100 Morrissey Boulevard, Boston, MA, 02125, United States, david.heimann@umb.edu

1 - Coordinated Sourcing Models for Coping with Disruptions

Amy Zeng, Associate Professor, Worcester Polytechnic Institute, 100 Institute Road, Department of Management, Worcester, MA, 01609, United States, azeng@wpi.edu

In this paper we focus on designing an effective coordinated sourcing model for coping with disruptions that will break down a buying firm's primary supplier. Two models are examined and compared: the first is a single sourcing model with a secondary supplier, and the second is an order-split dual sourcing approach. We report our results on the critical factors affecting the decision, the feasibility of the two models, and the sensitivity of their decision parameters.

2 - Supply Contracts with Weather-Related Recourse

Candi Yano, Professor, University of California at Berkeley, 4141 Etcheverry Hall, Berkeley, CA, 94720-1777, United States, yano@ieor.berkeley.edu, Frank Chen

Demands for many products are highly correlated with weather metrics such a temperature or amount of snowfall. Both retailers and manufacturers are beginning to offer rebates that depend upon weather metrics that are reported by independent third party sources. We analyze contracts with weather-related recourse, focusing on supply chain coordination and division of profits between the parties.

3 - The Benefit of Time-Dependent Ordering Policies Under Cyclic Supply Disruptions

Ying Rong, PhD Student, Department of Industrial & Systems Engineering, Lehigh University, 200 West Packer Avenue, Bethlehem, PA, 18015, United States, yir204@lehigh.edu, Lawrence Snyder, Andrew Ross

We consider ordering policies in a single-stage inventory system with cyclic supply disruptions. We compare a range of policies, some of which are time dependent while others are stationary. We perform an extensive numerical study to identify the value of implementing a time-dependent policy and to determine the added value of implementing more complex policies as opposed to simpler ones. We also investigate the robustness of the time-dependent policies to errors in the supply parameters.

4 - A Closed-Form Approximate Inventory Model with Supply Disruptions & Non-ZIO Reorder Policy

David Heimann, Professor, Management Sciences & Information Systems Department, University of Massachusetts Boston, 100 Morrissey Boulevard, Boston, MA, 02125, United States, david.heimann@umb.edu, Frenck Waage

This paper considers a supply chain problem where the supplier, when receiving the order from the producer, is either capable of shipping the order at once or not, according to a Markov process. We develop an approximating cost function whose minima can be obtained in closed form. The tradeoff between the order quantity q and the reorder point r ≥ 0 (a non-ZIO reorder policy) can therefore be addressed explicitly. Numerical examples based on realistic data are provided.

■ WB33

Room 333

Indicative Trends in the National Airspace System (NAS) Performance

Sponsor: Aviation Applications
Sponsored Session

Chair: Dave Knorr, Manager, Forecasting and Operations Analysis, FAA Air Traffic Organization, AJP-2, 800 Independence Avenue SW, Washington, DC, 20591, United States, dave.knorr@faa.gov

1 - Delay Trend Assessment for Future NAS Using Weather-Impacted Traffic Index

Alexander Klein, George Mason University, Fairfax, VA, United States, aklein1@gmu.edu

Weather-Impacted Traffic Index (WITI) is a useful metric for quantifying inclement weather impact on NAS operations, with Delay as the measure of NAS response. We use WITI for assessing delay trends for future-NAS projections in 2010 and 2015, compared to base year, 2004. Three different traffic samples, each representing a busy weekday in the respective year, are used. We apply an entire convective season's weather to the base day, with day-of-the-week traffic demand fluctuations.

2 - Very Light Jet (VLJ) Operational Impact Analysis

Tony Dziepak, Federal Aviation Administration, Office of Strategy, 800 Independence Avenue SW, Washington, DC, 20591, United States, tony.dziepak@faa.gov

Very light jet (VLJ) operations contribute the greatest uncertainty to the FAA forecast. The impact of this new class of small business jets hinges on two factors: the success or failure of the on-demand air taxi business model, and at what altitude these VLJs will choose to fly. This study explores the impact of VLJ operations on air traffic workload, in the en route phase of flight, for each of these scenarios. Preliminary results indicate more impact for higher altitudes.

3 - Operational Errors and Traffic Levels: A Challenge for NAS Growth

Gerald Shapiro, CNA Corporation, Gerald.CTR.Shapiro@faa.gov

An operational error occurs when separation rules and procedures are not followed due to equipment or human error. Currently, operational errors are rare events; however, our analysis shows that the number operational errors increases faster than the growth in air traffic operations. We examine some implications, and the potential for automated tools to ameliorate the problem.

4 - En Route Trends in the National Airspace System

Antoine Charles, Antoine.Charles@faa.gov

En Route metrics are pivotal to understanding the performance of the NAS (National Airspace System). Critical decisions must be made about capacity and workload, and reliable data is required to support these decisions. We will observe NAS trends, measure changes within the NAS, and identify the driving factors of change. Using the Enhanced Traffic Management System (ETMS), we measure changes in the NAS, as a whole, and proceed to observe changes its components.

■ WB34

Room 334

Urban Transportation Planning Models IX: Fuel Infrastructure

Sponsor: Transportation Science & Logistics
Sponsored Session

Chair: Yueyue Fan, University of California, Davis, yyfan@ucdavis.edu

1 - Optimal Infrastructure for Waste Biomass-Based Hydrogen

Nathan Parker, ncparker@ucdavis.edu, Yueyue Fan

Waste biomass-based hydrogen is an attractive alternative fuel but faces logistical challenges in siting and sizing facilities, and choosing delivery mode to minimize cost. This study uses mixed-integer nonlinear programming to solve for the optimal number, location, and size of conversion facilities as well as hydrogen delivery mode.

2 - Transition Challenges for Alternative Fuel Vehicle and Transportation Systems

Jeroen Struben, Postdoctoral Associate, MIT Sloan School of Management, E53-364A, 30 Wadsworth Street, Cambridge, MA, 02139, United States, jjrs@mit.edu

Successful diffusion of alternative fuel vehicles is complex as it requires the coevolution of the installed base, technology, technology spillovers, driver behavior, and complementary resources. We present a dynamic behavioral model captures these interactions, including spatial coevolution of fueling infrastructure and driver behavior. We discuss critical obstacles to and levers for sustained adoption.

3 - The Hydrogen Infrastructure Transition Model: A State-Filter Dynamic Programming Approach

David Z. Lin, University of California, ITS-Davis, zlin@ucdavis.edu

This research focuses on building an optimal transition model for future hydrogen infrastructure development. Dynamic programming is used to model this large-scale multistage planning problem and a state-filter approach is exploited to reduce the dimensionality of this problem. Policy implications are discussed using a case study in Beijing.

■ WB35

Room 335

Dynamic Routing Problems

Sponsor: Transportation Science & Logistics
Sponsored Session

Chair: Maciek Nowak, mnowak@georgiasouthern.edu

1 - A Dynamic Driver Management Scheme for Less-than-Truckload Carriers

Burak Karacik, bkaracik@isye.gatech.edu, Martin Savelsbergh, Michael Hewitt, Alan Erera

We describe a scheme for the management of linehaul drivers developed for the one of the largest U.S. LTL carriers. The scheduling problems faced by transportation service providers are complicated by time-constrained vehicle operators that can be renewed only after resting. LTL driver scheduling is further complicated by the fact that trucking moves are generally not scheduled. We develop a driver dispatch scheme that combines greedy search with enumeration of time-feasible driver duties.

2 - Solution Approaches for the Probabilistic Traveling Salesman Problem with Deadlines

Barrett Thomas, Assistant Professor, Department of Management Sciences, University of Iowa, 108 John Pappajohn Business Building, Iowa City, IA, 52242, United States, barrett-thomas@uiowa.edu, Ann Campbell

Time definite services are the fastest growing segment of the transportation industry. Yet, little research has explored the impact these time constraints place on delivery problems. This talk describes solution approaches to variants of the probabilistic traveling salesman problem that incorporate deadline constraints. The effects of using approximate cost and probability distributions in local search are discussed, and different neighborhood structures in local search are explored.

3 - Dynamic Routing and Scheduling in Drayage Operations

Guangming Zhang, g-zhang@northwestern.edu, Karen Smilowitz

This research explores modeling and solution techniques for dynamic routing and scheduling problems in drayage operations. In intermodal drayage applications, it is typical that about 60% of task requests are known before the day of operation and the remaining 40% become known over the day.

4 - Pickup and Delivery with Split Loads
Maciek Nowak, mnowak@georgiasouthern.edu, Özlem Ergun, Chip White

Splitting a load such that the delivery of that load may be completed by multiple vehicles results in numerous opportunities for cost reduction. We present an upper bound on this cost reduction. We also discuss the problem characteristics that allow for the most benefit and those market sectors that may find split loads to be most useful.

■ WB36

Room 336

Risk Analysis

Sponsor: Military Applications

Sponsored Session

Chair: Greg Brouillette, Technical Staff Member, Los Alamos National Laboratory, PO Box 1663, MS 603, Los Alamos, NM, 87545, United States, brouillg@lanl.gov

1 - An Architecture for Hybrid Reasoning in Risk Analysis
John Ambrosiano, Technical Staff Member, Los Alamos National Laboratory, PO Box 1663, MS 603, Los Alamos, NM, 87545, United States, ambro@lanl.gov, Randy Roberts

Risk analysis has changed considerably. The complexity of systems under consideration is very high, often requiring simulations to predict consequences. The nature of uncertainty has broadened to include vagueness and ignorance as well as random variation. This often exceeds the traditional scope of probabilistic risk assessment. We present a hybrid architecture for risk assessment able to combine diverse methods like probability, approximate reasoning, and simulation within the same framework.

2 - A Comparison of Various Modeling Approaches for a Network Security Model
Gregory Chavez, PhD Student, Los Alamos National Laboratory, PO Box 1663, MS 603, Los Alamos, NM, 87545, United States, gregchavez@lanl.gov, Brian Key

For a particular event, the risk is a function of the likelihood and the consequences of the outcome. Both the likelihood and the consequences are uncertain quantities; therefore, risk is inherently uncertain. The likelihood and the consequence may be expressed either numerically or linguistically. We determine an aggregate risk result for a network security model using only linguistic values and compare this result to the value of risk determined from only numerical values.

3 - Risk Assessment of GPS Spoofing
Mihaela Quirk, Technical Staff Member, Los Alamos National Laboratory, PO Box 1663, MS 603, Los Alamos, NM, 87545, United States, pal@lanl.gov, Roger Johnston, Jon Warner, Edward Bitzer

Civilian Global Positioning System (GPS) receivers may be subjected to attacks such as blocking, jamming, and spoofing. This paper gives a methodolgy to assess the risk of GPS spoofing. Probabilistic estimation is employed to process historical data on technology development. The data on GPS spoofing is sparse, hence expert elicitation embeded into an approximate reasoning engine is used for risk evaluation.

4 - Managing a Complex System Architecture Through the Use of Knowledge Modeling
Andrew Koehler, Technical Staff Member, Los Alamos National Laboratory, PO Box 1663, MS 603, Los Alamos, NM, 87545, United States, akoehler@lanl.gov, Ben Bigelow, Mihaela Quirk, Thomas Dufresne, Greg Brouillette

As part of preventing WMD attacks on US forces, the DoD and IC are changing how they gather and analyze data. This paper discusses a set of methodological tools and processes being developed to support this technology analysis and forecasting challenge. Focusing on the creation of a flexible technology knowledge base, this paper will also discuss future trade-space and real-time decision support capabilities that may ultimately be linked to this knowledge base.

5 - Using Approximate Reasoning To Evaluate Terrorist Intent
Stephen Eisenhawer, President, Logic Evolved Technologies, Inc., PO Box 1807, Santa Fe, NM, 87504-1861, United States, seisenhawer@logicevolved.com, Terry Bott, Markus Binder, Gary Ackerman

The likelihood that a terrorist group mounts an attack is a function of intent and capability. An approximate reasoning-based (AR) model to evaluate intent is presented. In AR inferences are made with rule bases and variables are linguistic. The model here is a rational choice (RC) representation of terrorist decision-making. We discuss RC in the AR context and present illustrative results. Revisions to include expressive factors such as ideological obsessions are examined.

■ WB37

Room 337

Supply Chain Management for Manufacturing

Contributed Session

Chair: Kumar Satyam, Rensselaer Polytechnic Institute, 110 8th Street, Department of DSES, Troy, NY, 12180, United States, satyak@rpi.edu

1 - Loop Length Trade-Offs in Pull Systems with Product Variety
Ananth Krishnamurthy, Rensselaer Polytechnic Institute, 110 8th Street, Department of DSES, Troy, NY, 12180, United States, krisha@rpi.edu, Kumar Satyam

Node decomposition approaches are developed to evaluate the performance of closed queuing network models of multi-product systems operating under card-based pull control policies. The models are used to examine how the length of the card loops for different products need to be set in order to optimize various performance measures.

2 - Queuing Models for Multi-Product Fabrication/Assembly Systems
Ram Ramakrishnan, Rensselaer Polytechnic Institute, 110 8th Street, Department of DSES, Troy, NY, 12180, United States, ramakr@rpi.edu, Ananth Krishnamurthy

Fabrication/Assembly systems with end assemblies composed of multiple components are considered. Unlike prior research, the fabrication lines supplying the components could be shared or dedicated facilities. The system is modeled as a multi-class closed queuing network with fork/join stations. Parametric decomposition based methods are developed for performance evaluation.

3 - Event Time Models in Supply Chain Scheduling
Omer Benli, California State University, Long Beach, Department of Information Systems, Long Beach, CA, 90840-8506, United States, obenli@csulb.edu

It has long been recognized that scheduling was not a visible problem in many enterprises because other parts of the enterprise have absorbed much of the impact of poor scheduling. This is especially true in current supply chains. In this presentation, after reviewing the current literature in the area, an "event-time" model for supply chain scheduling will be presented. It is based on lot streaming paradigm and makes use of the basic modeling framework of constraint programming.

4 - Surviving the Evolution of a Supply Network
Surya Pathak, Vanderbilt University, 6501 Harding Road, Apt. A-22, Nashville, TN, 37205, United States, surya.pathak@vanderbilt.edu, David Dilts

Supply networks can be conceptualized as complex adaptive systems that constantly evolve over time. Our research investigates factors that appear to affect survivability of individual firms in such networks. Additionally, survivability may significantly affect the eventual supply network topology, so we briefly address the interactions between survivability and topology.

5 - Node Decomposition Based Approaches for Multi-Class Closed Queuing Networks
Kumar Satyam, Rensselaer Polytechnic Institute, 110 8th Street, Department of DSES, Troy, NY, 12180, United States, satyak@rpi.edu, Ananth Krishnamurthy, Manjunath Kamath

Two new approaches for analyzing general multi-class non-product form closed queuing networks are compared. Both approaches are based on node-decomposition techniques and use two-moment approximations for performance measures. The approaches differ in the way in which network characteristics are incorporated into the computation of waiting times at individual stations.

■ WB38

Room 338

Vehicle Routing

Contributed Session

Chair: Malini Natarajarathinam, PhD in Operations Management, University of Alabama, 361 Stadium Drive Box 870226, Tuscaloosa, AL, 35401, United States, mnataraj@cba.ua.edu

1 - A Fast Solution on Time-Dependent Discrete Shortest-Path Problems
Jian Hu, University of Arkansas at Little Rock, System Engineering Department, 2801 S. University Avenue, Little Rock, AR, 72204, United States, jxhu@ualr.edu, Yupo Chan

A solution is proposed for the all-to-one discrete-time fastest path and minimum cost problem in a dynamic network. The algorithm is based on the general Bellman's principle of optimality and applies to the real-valued arc travel times. The complexities of early studies are discussed and the new algorithm has a great improvement theoretically.

2 - Flexibility in Dynamic Vehicle Routing
Thomas Huth, Dipl. Wirt.-Inform., Technical University Braunschweig, Abt-Jerusalem Strasse 4, Braunschweig, Germany, t.huth@tu-bs.de, Dirk C. Mattfeld

In recent years, emphasis has been put on dynamic problems in transportation. We deal with customer orders occurring dynamically overtime. This talk sketches the basic idea of decomposing a pickup and delivery problem. Furthermore we survey methods for solving dynamic transportation problems. Finally, we present a framework for adapting the model to the needs of dynamism including a flexibility term in the objective function. The resulting heuristic will anticipate dynamic events this way.

3 - Stochastic Vehicle Routing to Minimize Unmet Demand
Zhihong Shen, University of Southern California, 3715 McClintock Avenue, GER-240, Los Angeles, CA, United States, shenz@usc.edu, Maged Dessouky, Fernando Ordonez

Most vehicle routing problems (VRPs) are aimed at minimizing the total travel distance. However, in some applications there is such a large demand, tight deadlines, and significant uncertainty that it becomes impossible to service all nodes. For such problems a more appropriate primary objective is to satisfy as much demand as possible. In this work, we propose a Stochastic VRP to minimize unmet demand, present a constructive tabu heuristic and present results in an emergency situation.

4 - The Multiple Vehicle Routing Problem with Stochastic Demands under a Dynamic Approach
Clara Novoa, Assistant Professor, Texas State University, 601 University Drive, Engineering and Technology Department, San Marcos, TX, 78666, United States, cn17@txstate.edu

We develop and compare two rollout-based algorithms for solving the multiple vehicle routing problem with stochastic demands under an approximate dynamic programming approach. The models take ideas from the "cluster-first-route-second" and "route-first-cluster-second" methodologies for solving deterministic VRP. We also compare our solutions to a static or "here-and-now" approach.

5 - The Stochastic Inbound Inventory Routing Problem
Malini Natarajarathinam, PhD in Operations Management, University of Alabama, 361 Stadium Drive Box 870226, Tuscaloosa, AL, 35401, United States, mnataraj@cba.ua.edu, Charles Sox

We consider a situation where parts from different suppliers have to be picked up for an assembly plant. The demand at the assembly plant is stochastic and the trucks have limited capacity. We propose a heuristic that groups suppliers on a route and calculates base stock policies for each part to be picked up. We also quantify the effectiveness of the heuristic with a lower bound.

■ WB39

Ballroom B

Forecasting

Contributed Session

Chair: Baris Tan, Professor, Koc University, Rumelifeneri Yolu, Sariyer, Istanbul, 34450, Turkey, btan@ku.edu.tr

1 - On S-Curves and Tipping Points
Fred Phillips, Professor & Associate Dean, Maastricht School of Management, PO Box 1203, Maastricht, 6201 BE, Netherlands, phillips@msm.nl

Kurzweil and Gladwell describe but do not identify points where a growth curve accelerates and sustains itself. We look for tipping points in three growth models, and resolve some paradoxes in the literature.

2 - Interval Regression Analysis with Piecewise-Linear Underestimation
Chia-Hui Huang, Research Scholar, Department of Industrial and Operations Engineering, University of Michigan, 1205 Beal Avenue, Room 1815, Ann Arbor, MI, 48109-2117, United States, leohuang@umich.edu, Han-Ying Kao

The interval regression model is regarded as the simplest version of possibilistic regression analysis with interval coefficients. Based on an approach proposed by Mangasarian et al., a method for evaluating the interval regression model with piecewise-linear underestimation is presented. For finding an accurate estimate, this study underestimates the nonconvex objective function by a piecewise-linear function and search the global minimum of the underestimator.

3 - Forecasting the Impact of Special Events in Timeseries
Konstantinos Nikolopoulos, Assistant Professor in Decision Sciences, Manchester Business School, Booth Street West, Manchester, M156PB, United Kingdom, kostas.nikolopoulos@mbs.ac.uk

Quantitative methods are very successful for producing baseline forecasts of time series; however fail to forecast neither the timing nor the impact of special events such as promotions or strikes. Forecasters prefer to use their own judgment for adjusting for forthcoming special events, but humans' efficiency in such tasks has been found to be deficient. This study after examining the relative performance of Artificial Neural Networks and Multiple Linear Regression proposes an expert method.

4 - An Estimation Method for Stock-Out Based Substitution Rates by Using Point-of-Sales Data
Baris Tan, Professor, Koc University, Rumelifeneri Yolu, Sariyer, Istanbul, 34450, Turkey, btan@ku.edu.tr, Selcuk Karabati, Omer Cem Ozturk

Empirical studies in retailing suggest that stock-out based substitution rates must be taken into consideration when product-assortment and inventory decisions are given. We present a state-space based method to estimate substitution rates by using point-of-sales data only. We first cluster POS data according to different substitution scenarios and then estimate substitution rates by incorporating the consolidated sales information in a fluid model and solving an optimization problem.

■ WB40

Room 401

Applications

Contributed Session

Chair: Imdat Taymaz, Assistant Professor, Sakarya University, Engineering Faculty, Esentepe Campus, Adapazari/Sakarya, 54187, Turkey, taymaz@sakarya.edu.tr

1 - Developing an Electricity Price Model with Uncertain Demand and Fuel Costs
H. Hakan BALCI, PhD Candidate, Auburn University, 207 Dunstan Hall, Auburn, AL, 36849, United States, balcihh@auburn.edu, Jorge Valenzuela

In this study, we develop a price model with the consideration of uncertain electricity demand and fuel costs. The market is governed by the Cournot model. The price is modeled with a bottom-up approach that it strategic bidding and load elasticity into account.

2 - The Impacts of Compliance Choices under Market-Based Environmental Regulation
James Kroes, Student, Georgia Institute of Technology, 5559 Glenridge Drive NE, Apt. 2405, Atlanta, GA, 30342, United States, james.kroes@mgt.gatech.edu, Ravi Subramanian

We examine the relationship between compliance choices and environmental performance at the generating sites of publicly traded utility firms regulated by the US Acid Rain Program. We then investigate the impact of environmental performance on firms' market valuation. We find evidence of the ability of several compliance options to effectively reduce SO2 emissions. We also find a moderately significant relationship between higher SO2 emissions and higher Tobin's q.

3 - Performance Simulation of a Hybrid Vehicle
Imdat Taymaz, Assistant Professor, Sakarya University, Engineering Faculty, Esentepe Campus, Adapazari/Sakarya, 54187, Turkey, taymaz@sakarya.edu.tr, Kemal Cakir

Conventional vehicles play a big role in city transportation. Hybrid electrical vehicles gain a great importance with their environmental friendship and efficient usage of fuel. In this study, a computer program was created for road simulation of the vehicles. The road simulations show that the mixed hybrid system has high performance and low fuel consumption values then the conventional vehicles.

■ WB41

Room 402

Recent Trends in Make-to-Stock Queue Modelling

Sponsor: Applied Probability

Sponsored Session

Chair: Baris Balcioglu, Department of Mechanical & Industrial Engineering, University of Toronto, 5 King's College Road, Toronto, ON, Canada, baris@mie.utoronto.ca

1 - Optimal Control of Assembly Systems with Multiple Stages and Multiple Demand Classes
Saif Benjaafar, Professor & Director, Division of Indusrial & Systems Engineering, University of Minnesota, 111 Church Sreet SE, Minneapolis, MN, 55419, United States, saif@umn.edu, Mohsen Elhafsi, Weihua Zhou, Chung-Yee Lee

We consider the optimal production and inventory control in a multi-stage assembly system with multiple demand classes. Each assembly stage consists of a production facility with finite production rate. Demand classes differ in their demand rates and their shortage costs. We formulate the problem as a Markov Decision Process (MDP) and characterize the structure of an optimal policy.

2 - The Structure and Sensitivity of Dynamic Pricing and Replenishment Policies in a Production System

Lerzan Ormeci, Koc University, Rumelifeneri Yolu, Sariyer, Istanbul, TR, 34450, Turkey, lormeci@ku.edu.tr, Jean-Philippe Gayon, Isilay Degirmenci, Fikri Karaesmen, Eren Basar Cil

A production system which controls both pricing and replenishment dynamically is modeled as a make-to-stock queue. The potential demand is generated by a Markov-modulated Poisson process, where the actual demand depends on the offered price. We obtain results on the structure of the optimal replenishment and pricing policies. The effects of dynamic and static pricing are compared in a numerical study. The sensitivity of the optimal policies with respect to certain parameters is also explored.

3 - Imperfect Demand Information in Production-Inventory Systems with Multiple Customer Classes

Francis de Vericourt, Associate Professor, Duke University, 1 Towerview Road, Durham, NC, 27708, United States, fdv1@mail.duke.edu, Jean-Philippe Gayon, Saif Benjaarfar

We consider a make-to-stock supplier with limited capacity serving different customer classes, some of which share advance demand information with the supplier by announcing their orders ahead of their due date. The supplier is faced with a joint production control and inventory allocation problem. We formulate the problem as an MDP and characterize the optimal policy. From numerical results, we obtain several insights into the value of advance demand information for both supplier and customers.

4 - Scheduling Policies in the M/G/1 Make-to-Stock Queues

Baris Balcioglu, Department of Mechanical & Industrial Engineering, University of Toronto, 5 King's College Road, Toronto, ON, Canada, baris@mie.utoronto.ca, Nima Sanajian

We exploit the distributional Little's law to obtain the exact numerical solution for the M/G/1 system size distribution. Considering multiple-demand types, we explore the performance of three static scheduling rules, namely, FCFS, non-preemptive and preemptive priority rules. We provide the conditions to see when a make-to-order queue would be the optimal discipline. Finally, we extend our analysis by adjusting a well-known dynamic scheduling policy, i.e. myopic-T, for the M/G/1 queue.

■ WB42

Room 403

Production & Scheduling

Contributed Session

Chair: Priyantha Devapriya, PhD Candidate, Clemson University, 110 Freeman Hall, Department of Industrial Engineering, Clemson, SC, 29634, United States, ddevapr@clemson.edu

1 - Group Identification Techniques to Help Solve the Multipurpose Machines Scheduling Problem

Amit Garg, Case Western Reserve University, 10900 Euclid Avenue, Cleveland, OH, United States, amit.garg2@case.edu, Dale Flowers

We studied a scheduling problem in a multipurpose machine environment with the objective of minimizing make-span. We developed a group identification scheme to exploit the structure of this problem. This group identification scheme improved the efficiency of our optimal branch and bound algorithm under certain conditions. We performed computational experiments to measure the benefits of our group identification scheme.

2 - Impact of Separable Setups and NIQ on Mean Flowtime

Edward Stafford, Professor of Management Science, University of Alabama in Huntsville, College of Administrative Science, Room 355 Administrative Science Building, Huntsville, AL, 35899, United States, staffoef@uah.edu, Fan Tseng

The impact of Separable, Sequence-Independent Setup Times (SSIST) and the NIQ restriction on the mean flowtime performance measure for MxN flowshop problems is examined. Identical problems are solved under four scenarios: (Regular or NIQ)x(SSIST or NSIST). Problem sizes range from MxN = (5x6) to (9x14). Solution time experiences with LINDO and LINGO are reported.

3 - Modelling an Ice Cream Factory for De-Bottlenecking

Bas Bakker, Process & Spuply Chain Design, Unilever Food & Health Research Institute, Olivier van Noortlaan 120, 3133 AT Vlaardingen, Netherlands, bas.bakker@unilever.com, Peter Bongers

The output of Unilevers factory in Hellendoorn, needed to increase by 30%. For this a multi-scheduling model of the factory (equipment and working procedures) has been designed. Using the model, scenario's where evaluated. The most important conclusion was that in the current situation, the requested volumes are not feasible. A number of main modifications have been proposed based on the simulations. As a result, non-operational time reduced to 12% and feasible factory schedules made.

4 - Multi-Level Just-in-Time Scheduling Problem with Workload Smoothing Goal

Mesut Yavuz, Assistant Professor, University of Florida, 1350 N. Poquito Road, Shalimar, FL, 32579, United States, yavuzm@ufl.edu

Two major goals considered in scheduling mixed-model assembly lines under just-in-time principles are (1) Smoothing the workload on each workstation on the assembly line, and (2) Keeping a constant usage rate of all parts fed into the assembly line. In the literature, a few papers are concerned with achieving both of these goals at the same time. However, they ignore the processing time requirements of the parts at the sub-levels. We propose a new model that bridges this.

5 - Multi-Plant Integrated Production and Distribution Scheduling Problem for a Perishable Product

Priyantha Devapriya, PhD Candidate, Clemson University, 110 Freeman Hall, Department of Industrial Engineering, Clemson, SC, 29634, United States, ddevapr@clemson.edu, William G. Ferrell

We solve the fleet selection problem of an integrated production and distribution scheduling problem for a perishable product with multiple plants. A heuristic based on evolutionary algorithms is given 1) To assign each customer to a distinct plant 2) To find out production schedules and efficient routes to minimize the total cost while the total demand is satisfied within a given planning horizon.

■ WB43

Room 404

Multiple Criteria Routing for Business Applications

Cluster: Multi-Criteria Decision Making

Invited Session

Chair: Hyun Kim, Graduate Student, Case Western Reserve University, 10900 Euclid Avenue Olin 611, Cleveland, OH, 44106, United States, hsk5@cwru.edu

1 - A Multiobjective Planner for Intensity Modulated Radiation Treatment Planning of Cancers

Vira Chankong, Professor, Case Western Reserve University, 10900 Euclid Avenue Olin 708, Cleveland, OH, 44106, United States, vira@case.edu

We describe a goal programming based planning system to generate IMRT treatment plans that are robust against patient movement during treatment. The medial line core of an object is used to capture morphological information of each target and OAR. The weight of each voxel is calculated using its distance from the core and is employed into the dose-volume objective functions to steer the local dose distribution. We show the clinical benefits of this planning system dealing with difficult cases.

2 - Multiple Criteria Decision Analysis: Two Business Applications

Gina Beim, Senior Consulting Engineer - Marketing, Pile Dynamics, Inc., 4535 Renaissance Parkway, Cleveland, OH, 44128, United States, gina@pile.com, Moren Levesque

Multiple Criteria Decision Analysis (MCDA) is an Operations Research methodology that help people and organizations make better decisions. It is most valuable in instances where tradeoffs, subjectivity, and accountability exist. We test the feasibility of using MCDA to aid in two business situations with no previous applications of this methodology: selection of a country where to launch a new venture, and selection of business plans to receive funding from a venture capital fund.

3 - DA-MLAR-AXP: Directional Antenna Multi-Path Location Aided Routing with Adjustable X-Mission Power

Sanjaya Gajurel, Graduate Student, Case Western Reserve University, 2463 Overlook Road, Apt #11, Cleveland, OH, 44106, United States, sxg125@case.edu, Hyun Kim, Limin Wang, Behnam Malakooti

This paper presents an adjustable transmission power capability for our Directional Antenna Multi-path Location Aided Routing (DA-MLAR) and provides analysis of energy consumption of fixed and adjustable transmission power modes. Through simulations, we demonstrate that adjustable transmission power capability in DA-MLAR improves its packet delivery ratio by up to thirty percent.

4 - A Multi Attribute Model for Supplier Performance for an Industrial Equipment Manufacturer

Richard J. Titus Jr., Industrial Engineering Department, The Pennsylvania State University, University Park, PA, 16802, rjt186@psu.edu

An empirical study of an industrial equipment manufacturer's supplier quality and delivery performance against select supplier attributes such as quality certifications (ex. ISO9000, etc.), the use of quality techniques (such as Statistical Process Control), financial ratings, product complexity, product differentiation, supplier size, distance between supplier and customer location and financial leverage or purchasing power was performed in order to evaluate the relationship of these key attributes to supplier performance.

■ WB44

Room 405

Networks & Graphs

Contributed Session

Chair: Holly Waisanen, Massachusetts Institute of Technology, 77 Massachusetts Avenue, 32-760D, Cambridge, MA, 02139, United States, waisanh@mit.edu

1 - Local Search in Maximum Flow Network Interdiction

Doug Altner, Graduate Student, Georgia Institute of Technology, 765 Ferst Drive, Atlanta, GA, 30332, United States, daltner@isye.gatech.edu, Nelson Uhan, Özlem Ergun

We investigate the effectiveness of local search for the Maximum Flow Network Interdiction Problem (MFNIP). Our goal is to develop methods that consistently obtain good solutions over a range of interdiction budgets in a timely fashion. Two main kinds of variable-depth neighborhoods are used: neighborhoods based on cut-sets and neighborhoods based on simple arc exchanges. We present implementations, computational results, and discuss generalizations to natural extensions of MFNIP.

2 - Facility Protection Optimization Using Stochastic Network Interdiction

Patrick Hester, Vanderbilt University, 729 William Howard Place, Nashville, TN, 37209, United States, patrick.hester@vanderbilt.edu, Sankaran Mahadevan

This paper develops a methodology to solve facility protection optimization problems for cost and performance objectives using stochastic network interdiction. The method extends current network interdiction capabilities to problems where interruption probability is the parameter of interest, while including timely detection, an improved method of candidate path selection, and comprehensive stochastic consideration. A discussion of the developed method is provided along with a numerical example.

3 - Random Graphs and Restricted Second Order Logic

Kemal Gursoy, Kean University, Willis Hall 305-G, 1000 Morris Avenue, Union, NJ, 07083, United States, kgursoy@kean.edu

One randomly build a graph, where nodes are natural numbers. At each node, the person will flip a coin to connect this node to the other nodes. This probabilistic construct provides a structure to extend the first order logic to the restricted second order logic, which is restricted to the subsets of the universe. An application of this extension would be constrained databases.

4 - Synchronization of Networks for Discrete Complex Systems

Rex Kincaid, Professor, College of William and Mary, Department of Mathematics, Williamsburg, VA, 23185, United States, rrkinc@wm.edu, Michael Holroyd

Synchronization is critical in communication and transportation networks as well as in neuron respiratory systems. The first non-trivial eigenvalue of a network's Laplacian matrix provides a quantifiable measure of synchronizability. The utility of this approach for the design and management of networks where synchronization is desirable (respiration networks), or detrimental to network performance (router networks) is explored. An example is given for a neuron respiratory system.

5 - The Dynamic Pickup and Delivery Problem Under Information Constraints

Holly Waisanen, Massachusetts Institute of Technology, 77 Massachusetts Avenue, 32-760D, Cambridge, MA, 02139, United States, waisanh@mit.edu, Devavrat Shah, Munther Dahleh

In the multi-vehicle Dynamic Pickup-Delivery vehicle routing problem, messages arrive to the system sequentially in time and must be picked up and delivered such that the average delay between arrival and delivery is minimized. We obtain analytical lower bounds on the delay performance under both full and limited information, demonstrating the importance of information to this dynamic multi-vehicle problem. We also provide policies that prove these lower bounds are achievable up to a constant.

■ WB45

Room 406

Tutorial: Multi-Echelon Production/Inventory Systems: Optimal Policies, Heuristics, and Algorithms

Cluster: Tutorials

Invited Session

1 - Multi-Echelon Production/ Inventory Systems: Optimal Policies,Heuristics, and Algorithms

Geert-Jan Van Houtum, Associate Professor, Eindhoven University of Technology, Den Dolech 2, Eindhoven, NB, 5612AZ, Netherlands, g.j.v.houtum@tm.tue.nl

The development of the theory of multi-echelon production/inventory systems started almost 50 years ago. Planning concepts based on this theory are increasingly incorporated into the practice of supply chain management. In this tutorial, we focus on optimal policies and key insights for serial, assembly, and distribution systems. In particular, we demonstrate why generalized forms of basestock policies are optimalfor many systems. We also present applications of multi-echelon theory.

■ WB46

Room 407

Managing Risks and Cost Benefits in Complex Supply Chains

Cluster: Supply Chain and Operations Engineering

Invited Session

Chair: Kathryn Stecke, Professor, University of Texas at Dallas, School of Management — SM30, PO Box 830688, Richardson, TX, 75083-0688, United States, KStecke@utdallas.edu

1 - Evaluating the Performance of Multi-Stage Supply Chains Under Disruptions and Random Customer Demand

Sanjay Kumar, PhD Student, University of Texas at Dallas, School of Management, PO Box 830688, SM30, Richardson, TX, 75083, United States, skumar@utdallas.edu, Fred Glover, Kathryn Stecke, Thomas Schmitt

Uncertain demand and periodic disruptions pose critically important challenges to effective supply chain management. We test the performance of such supply chains under various scenarios relating to costs, expediting, and length of disruptions. The study also employs search routines to find order-up-to quantities that minimize total supply chain costs.

2 - Lead Time and Price Quotation Mode Selection: Uniform or Differentiated?

Xuying Zhao, University of Texas at Dallas, School of Management, Richardson, TX, 75080, United States, kxz024000@utdallas.edu, Ashutosh Prasad, Kathryn Stecke

Firms in make-to-order industries often provide lead time and price quotations to customers. When a firm offers a single lead time and price, it is called uniform quotation mode. The differentiated quotation mode is when a firm offers a menu of lead times and prices for customers to choose from. By modeling, analyzing, and comparing these two quotation modes, we provide guidelines for a manager to choose a suitable mode for his/her firm.

3 - Transshipment Policies of Independent Retailers

Nagihan Comez, PhD Student, University of Texas at Dallas, United States, nagihan@utdallas.edu, Metin Cakanyildirim, Kathryn Stecke

We study a decentralized system of two retailers selling a substitutable product. In case of a stock-out, an item can be transshipped to a stocked-out retailer from the other one. Customers can also move with a demand overflow probability. The model is characterized by two decisions: the transshipment and the initial replenishment decision which is a game. Our work combines pooling and demand substitution in a single model, where retailers use transshipment voluntarily under demand overflow.

■ WB47

Room 408

Models and Algorithms for Complex Inventory Problems

Cluster: Supply Chain and Operations Engineering
Invited Session

Chair: Eda Kemahlioglu-Ziya, Kenan-Flagler Business School, University of North Carolina, CB # 3490, Chapel Hill, NC, 27599, United States, Eda_KemahliogluZiya@unc.edu

1 - A Non-Parametric Approach to Stochastic Inventory Planning with Lost Sales
W. Tim Huh, Assistant Professor, Columbia University, 500 W. 120th Street, MC4704, New York, NY, 10028, United States, th2113@columbia.edu, Paat Rusmevichientong

We study stochastic inventory planning systems with lost sales and censored demand under stationary and non-stationary settings. Contrary to classical inventory theory, we assume that no knowledge of demand is initially available, and lost sales in each period are unobservable. We take a non-parametric approach and propose adaptive inventory policies that generate a sequence of ordering decisions over time.

2 - Approximation Algorithms for the One-Warehouse Multi-Retailer Problem
Retsef Levi, Assistant Professor, Massachusetts Institute of Technology, Sloan School of Management, BDG E53-389, 30 Wadsworth Street, Cambridge, MA, 02139, United States, retsef@mit.edu, Maxim Sviridenko

We consider the classical one-warehouse multi-retailer inventory model with discrete and finite horizon, and with determinitic but time-dependent demands. The problem is known to be NP-Hard. We use modern linear-programming-based approximation techniques to derive approximation algorithms for the problem that have constant worst-case guarantees. That is, for each instance of the problem the solution we produce is guaranteed to be within constant times the optimal cost.

3 - Inventory Management under a Broad Class of Stochastic Leadtimes
Alp Muharremoglu, Columbia Business School, 3022 Broadway, 410 Uris Hall, New York, NY, 10027, United States, alp2101@columbia.edu, Nan Yang

We introduce a quite general class of stochastic leadtime processes for inventory systems. This class includes models from literature (e.g. Kaplan's leadtimes with no order crossing or i.i.d. leadtimes with order crossing) and new situations, such as a model with congestion dependent leadtimes. We provide a method to compute base stock levels. The method finds the optimal levels for single stage systems and near optimal levels for multi-echelon systems.

■ WB48

Room 409

Information and Operations Management

Sponsor: Manufacturing & Service Operations Management
Sponsored Session

Chair: Holly Lutze, Assistant Professor, University of Texas, PO Box 830688, SM 30, Richardson, TX, 75083, United States, hlutze@utdallas.edu

Co-Chair: Ozalp Ozer, Assistant Professor, Stanford University, Management Science and Engineering, Terman Engineering Center, Stanford, CA, 94305, United States, ozalp@stanford.edu

1 - Advance Orders and Market Segmentation in a Multi-Product Supply Chain
Holly Lutze, Assistant Professor, University of Texas, PO Box 830688, SM 30, Richardson, TX, 75083, United States, hlutze@utdallas.edu, Ozalp Ozer

We consider a multi-product manufacturer with multiple retail customers, each placing advance orders with a particular demand lead time. We determine an optimal menu of demand lead times and payments to maximize the manufacturer's benefit from advance orders. By choosing among menu options, retailers segment themselves according to the service level each provides his end customers. We explore how postponement and retailer markets affect this optimal menu and resulting supply chain performance.

2 - Bayesian Inventory Replenishment and Audit Policies When Records Are Inaccurate
Adam Mersereau, Assistant Professor, University of Chicago GSB, Chicago, IL, United States, amersere@chicagogsb.edu

When inventory records do not reliably match physical inventory levels, a retailer may form a Bayesian belief of her inventory position for inventory management purposes. We examine optimal replenishment and audit policies in a lost sales environment based on such a belief, isolating a "learning effect" on replenishment decisions.

3 - Improving Consumers' Product Valuation Under Consumer Search
Olga Perdikaki, Kenan-Flagler Business School, 3490 McColl Building, Chapel Hill, NC, 27599, United States, olga_perdikaki@unc.edu, Jay Swaminathan

Several practices implemented by retailers are aimed towards providing consumers with more information about their offerings in order to increase their valuation. We examine a stylized model with two stores where consumers have an opportunity to learn from one store and buy from another and provide managerial insights on the optimal effort, pricing and profits in a monopoly and duopoly setting.

4 - Periodic Review Inventory with Pilferage/Spoilage
Mariana Olvera-Cravioto, Columbia University, New York, NY, United States, marianao@stanford.edu, Ozalp Ozer, Peter W. Glynn

We consider a single product periodic review inventory with lost sales with unrecorded pilferage and/or spoilage. As a consequence, the actual and the recorded inventory levels might disagree, but managerial decisions, such as ordering products or performing inventory counts, must be made based solely on the recorded inventory level. We present a model which reduces the problem of finding the optimal counting/ordering policy to that of solving a two-dimensional MDP with perfect information.

■ WB50

Room 411

Optimization Techniques II

Contributed Session

Chair: Joon-Yeoul Oh, Assistant Professor, Texas A&M-Kingsville, MSC 184, 700 University Boulevard, Kingsville, TX, 78363, United States, kfjo000@tamuk.edu

1 - Resource-Constrained Shortest Path Sub-Problems on Acyclic Graphs in a Column-Generation Context
Wilbert Wilhelm, Barnes Professor, Texas A&M University, TAMUS 3131, College Station, TX, 77843-3131, United States, wilhelm@tamu.edu, Xiaoyan Zhu

Our three-stage approach comprises stages 1 (preprocessing) and 2 (set up), which are implemented one time, and stage 3 (iterative solution), which is implemented at each column-generation iteration to solve transformed sub-problems, each time with different arc costs. We present preprocessing and setup techniques, worst-case complexity analyses, and computational evaluation.

2 - Dynamic Programming in Models with Both Continuous and Discrete Variables
Christopher Raphael, Associate Professor, Indiana University, 1900 E. 10th Street, Bloomington, IN, 47406, United States, craphael@indiana.edu

We present an extension of dynamic programming to functions involving both discrete and continuous variables. The functions we treat are locally composed and quadratic in the continuous variables, given any configuration of discrete variables. From an analytic point of view, it is unclear if the proposed optimization technique is computationally tractable in general. We demonstrate an application to musical rhythm recognition in which we identify a globally optimal solution.

3 - Searching the Best Fitting Solution for the Location of Mobile Telephone Switching Office
Joon-Yeoul Oh, Assistant Professor, Texas A&M-Kingsville, MSC 184, 700 University Boulevard, Kingsville, TX, 78363, United States, kfjo000@tamuk.edu, Hyunju Oh, Eunjin Lee

The cellular telecommunication network system often encounters capacity inadequacy issues due to the increased subscribers and data traffic. Installing a Mobile Telephone Switching Office (MTSO) is a method to increase the network capacity. Because of the installation cost and call routing, selecting the location of MTSO is critical. Based on the analytical results of the test cases, this paper suggests a method of selecting MTSO location along with the effectiveness of the method.

4 - Complexity of the Inverse Shortest Paths Lengths Problems
Tingting Cui, University of California, Berkeley, 4141 Etcheverry Hall, Berkeley, CA, 94720, United States, tingting@ieor.berkeley.edu, Dorit Hochbaum

The Inverse Shortest Paths Lengths Problem (ISPL) looks for a arc weight assignment to a graph such that the shortest paths lengths between a collection of source-sink pairs equal some prescribed values and the total deviation from the original weight is minimized. We identify polynomial and NP-complete cases for ISPL and provide solution techniques for the general and specially structured problems.

5 - A Flexible Approach to Robust Optimization via Convex Risk Measures
David Brown, Assistant Professor, Duke University, Fuqua School of Business, 1 Towerview Drive, Durham, NC, 27708, United States, dbbrown@duke.edu, Dimitris Bertsimas, Aharon Ben-Tal

We develop a flexible approach to robust optimization based on risk preferences of the decision-maker in which one specifies not only the values of the uncertain parameters for which feasibility should be ensured, but also the degree of feasibility. We apply our approach to a real-world portfolio optimization problem and show promising results that it can yield significant improvements in downside risk protection at little or no expense in expected performance compared to traditional methods.

■ WB51

Room 412

Scheduling in Aviation Applications

Contributed Session

Chair: Federico Trigos, LSOG/BIE Chairman, ITESM Campus Toluca, Eduardo Monroy Cardenas 2000, San Antonio Buenavista, Toluca, Mx, 50110, Mexico, ftrigos@itesm.mx

Co-Chair: Jenny Diaz-Ramirez, I.E. PhD Candidate, ITESM Campus Toluca, Eduardo Monroy Cardenas 2000, Colonia San Antonio Buenavista, Toluca, 50110, Mexico, jenny.diaz@invitados.itesm.mx

1 - Connection Fixing Strategy for Crew Pairing Problems
Curt Hjorring, Carmen Systems, Odinsgatan 9, Göteborg, SE41103, Sweden, curt.hjorring@carmensystems.com, Lennart Bengtsson, Johan Ivarsson

The integrality strategy within the Carmen column generator for the crew pairing problem is based on Ryan-Foster constraint branching. It focuses on finding high quality solutions quickly, rather than finding provably optimal solutions. We present the strategy, including details such as how it interacts with a specialized IP heuristic (paqs) that is run during the whole run.

2 - Grouping and Staffing with Passenger Threat Attributes
Xiaofeng Nie, PhD Candidate, Department of Industrial & Systems Engineering, SUNY at Buffalo, 438 Bell Hall, Buffalo, NY, 14260, United States, xnie2@buffalo.edu, Rajan Batta

We extend the passenger grouping model of Babu etc. to consider both passenger threat attributes and staffing of screeners. Here, several types of passengers with different risky characteristics are considered. A linear program is formulated to determine the assignment of every passenger type and the staffing of each check station.

3 - Dynamic Assignment of Aircraft Services Using Online Flight Information
Rob Broekmeulen, Technische Universiteit Eindhoven, PO Box 513, Pav E10, Eindhoven, 5600 MB, Netherlands, r.a.c.m.broekmeulen@tm.tue.nl, Koray Hakan, Will Bertrand

We develop models and methods to improve the reliability of the ground time management processes. We use a dynamic vehicle routing approach for the aircraft services to respond to changes in arrival times. Experiments, using six weeks data from a major European hub, show that the number of flight delays can be reduced significantly.

4 - Simultaneous Aircraft and Crew Scheduling for Small Airlines
Federico Trigos, LSOG/BIE Chairman, ITESM Campus Toluca, Eduardo Monroy Cardenas 2000, San Antonio Buenavista, Toluca, Mx, 50110, Mexico, ftrigos@itesm.mx, Jenny Diaz-Ramirez

From the practical point of view, this simultaneous approach can be applied to small airlines, where the resulting instances could be still computationally manageable. It is expected to get more adapted solutions with objective values at least as good as the current available ones. This work is inspired on small Mexican Airlines.

■ WB52

Room 413

Pricing in Networks

Sponsor: Revenue Management & Pricing

Sponsored Session

Chair: Johanne Cohen, CNRS, LORIA, 615 rue du Jardin Botanique, Villers les Nancy, 54602, France, Johanne.Cohen@loria.fr

1 - Trunk Reservation Revisited: On Price-Driven Storage Allocation in a Peer-to-Peer Network Federation
Peter Reichl, Key Researcher, Telecommunications Research Center Vienna (ftw.), Donaucitystrasse 1, Vienna, A-1220, Austria, reichl@ftw.at, Barbara Emmert, Sandford Bessler

This paper deals with federations of peer-to-peer networks and proposes a price-driven mechanism for matching available free storage capacity with respective demands. The scheme is based on "trunk reservation" as an optimal capacity allocation strategy for loss networks with two different classes of requests. We compare this approach with two other simple allocation schemes and demonstrate to which extent it is able to provide incentives for the individual domains to cooperate with each other.

2 - Grid Economics: A New Perspective for Yield Management Techniques
Yezekael Hayel, IRISA, Campus Universitaire de Beaulieu, 35042, Rennes, France, yhayel@irisa.fr, Parijat Dube

With the rapid deployment of infrastructure supporting high speed communications, grid services such as grid computing, is becoming a business reality. Several interesting problems in the domain of grid services, including resource allocation, dynamic pricing and capacity planning, find parallelism in other contexts where the use of YM techniques have been successfully employed.

3 - Economically Efficient Capacity Planning for Grid Computing
Jörn Altmann, Professor, School of Information Technology, International University of Bruchsal, Campus 3, Bruchsal, 76646, Germany, jorn.altmann@acm.org, Jun Shu

An open issue about Grid computing is the lack of tools for capacity planning. We present a model for capacity planning that takes into consideration costs of contributions of different providers. This includes pricing of servers, possible congestion charges, and the risk of unavailable resources. The model is expected to provide answers to under what set of constraints fine-grained resource allocation is economically efficient and what kind of strategy to apply for capacity planning.

4 - Transit Prices Negotiation: Repeated Game Approach
Loubna Echabbi, INRIA/LORIA, 615 Rue du Jardin Botanique, Villers Les Nancy, 54602, France, Loubna.Echabbi@loria.fr

We present a game theoretic approach for the transit price negotiation problem in the interdomain routing framework. We analyze the behavior of providers on a specific scenario mainly by considering the simple but not simplistic case of one source and one destination.

■ WB53

Room 414

Quality Issues in Supply Chain Management

Contributed Session

Chair: Xiaowei Zhu, Assistant Professor, West Chester University of Pennsylvania, West Chester, PA, 19383, United States, xiaoweiusa@yahoo.com

1 - Quality Cost-Sharing Contracts and Pricing Strategies
Gary Chao, Northwestern University, 2145 Sheridan Road C223, Evanston, IL, 60208, United States, garychao@iems.northwestern.edu, Seyed Iravani, Canan Savaskan

We evaluate the profitability of quality cost-sharing contracts in the monopoly and duopoly markets where the market share is determined by the product quality and sales price. In addition to optimal quality improvement effort, we obtain optimal sale prices for different contracts and market situations in order to maximize the manufacturer's final profit. Our results suggest that manufacturers, especially with low quality product, should adopt the contract with the selective root cause analysis.

2 - Quality Risk In Outsourcing: An Empirical Study
Aleda Roth, Arizona State University, W.P. Carey School of Business, Main Campus, PO Box 874706, Tempe, AZ, 85287, United States, Aleda.Roth@asu.edu, John Gray, Brian Tomlin

We first present theoretical arguments that explain how manufacturing outsourcing poses a potential quality risk to the buying firm. We then introduce our central hypothesis derived from this theory: contract manufacturers' plants will pose a higher finished-product quality risk than internal plants. Next, we introduce our plant-level measure of quality risk. This measure utilizes multiple years of Food and Drug Administration inspection data. Finally, we present the results of the study.

3 - A Supplier Selection Model with Quality and Capacity Constraints
Abraham Mendoza, Graduate Student, Pennsylvania State University, 310 Leonhard Building, University Park, PA, 16802, United States, aum144@psu.edu, Jose Ventura

This paper presents a new procedure to solve the supplier selection problem. This procedure includes a preliminary ranking method to reduce the number of potential suppliers to a manageable size. Then, a non-linear integer programming model is used to complete the supplier selection process and determine the individual order quantities. The model minimizes procurement and inventory costs under quality and capacity constraints.

4 - Models of Spot Markets and Longer Term Contracts
Anton Kleywegt, Associate Professor, Georgia Institute of Technology, School of Industrial Systems Engineering, Atlanta GA 30332, United States, anton@isye.gatech.edu, Yi He

This work considers a setting in which products can be bought and sold on a spot market or by entering into contracts in advance of demand realization. Various people have studied the interaction between contracts and spot markets. We consider the effect of different market structures, and of spot market participation rates, on the amounts transacted via contracts and on the spot market, and on the surpluses of the sellers and buyers.

5 - Optimum Quality and Pricing in Call Center Operations
Xiaowei Zhu, Assistant Professor, West Chester University of Pennsylvania, West Chester, PA, 19383, United States, xiaoweiusa@yahoo.com, Samar Mukhopadhyay

Outsourcing is fast becoming an important strategy for firms to reduce cost. We use the call center as an example to study optimal outsourcing contracts where the offshore firm has private cost information for quality improvement giving rise to information asymmetry. We use a game theoretic model to derive optimal contracts under both full and asymmetric information. We derive optimal quality strategy and the value of information, and present several managerial insights.

■ WB54

Room 415

Product and Service Development for New Markets

Cluster: Operations and Marketing for Emerging Markets
Invited Session

Chair: Cheryl Druehl, University of Maryland, 4318 Van Munching Hall, College Park, MD, 20742, United States, cdruehl@rhsmith.umd.edu

1 - A Theoretical Framework for Managing the NPD Portfolio: When and How to Use Strategic Buckets
Raul Chao, Georgia Institute of Technology, 800 West Peachtree Street, Atlanta, GA, United States, raul.chao@mgt.gatech.edu, Stylianos Kavadias

Developing the "right" new products is critical to firm success and is often cited as a key competitive dimension. This paper addresses the link between new product development (NPD) portfolio strategy and firm performance. We first develop a general theoretical framework for resource allocation and NPD portfolio strategy. We then apply our framework to analyze a popular practice in NPD portfolio management: the use of strategic buckets.

2 - Why Don't We Live in a Modular World?
Sezer Ulku, Assistant Professor, Georgetown University McDonough School of Business, Washington, DC, 20057, United States, SU8@georgetown.edu, Glen Schmidt

To deal with uncertainty and technological change, the prescription is often to use modular product architectures. However, the evolution of products in the electronics market sometimes tells a different story. For instance, Handspring had conceived a modular platform that would accomomdate new applications through an expansion port. But more recent versions have adopted a more integral architecture that does not allow expansion. We seek to explain anomalies such as this.

3 - Strategies for Encroaching on the Low End of Existing Markets
Cheryl Druehl, University of Maryland, 4318 Van Munching Hall, College Park, MD, 20742, United States, cdruehl@rhsmith.umd.edu, Glen Schmidt

Kodak's early digitals were expensive cameras that appealed to tech-savvy males. Instead, maybe Kodak should have initially pursued cheaper, simpler digitals. We compare and contrast these two possible strategies, developing an analytical framework that relates these strategies to the notions of disruptive innovation, blue oceans, and willingness to cannibalize. We discuss the link between Kodak's encroachment strategy and its operational and marketing capabilities.

■ WB55

Room 416

Scheduling

Contributed Session

Chair: Jun Zhang, PhD Student, Purdue University, School of Industrial Engineering, 315 N. Grant Street, West Lafayette, IN, 47906, United States, zhang28@purdue.edu

1 - Order Acceptance Using Genetic Algorithms
Walter Rom, Cleveland State University, 1860 East 18th Street, Cleveland, OH, 44114, United States, w.rom@csuohio.edu, Susan Slotnick

We solve the joint order-acceptance problem and job-sequencing problem for a firm that has a known pool of potential orders, for which it knows processing time, delivery date, and customer weights. The objective is to maximize profit (revenue minus weighted tardiness). We test a genetic algorithm against previous methods.

2 - Single Machine Scheduling with Preventive Maintenance Activities
Sakine Batun, Research Assistant, Middle East Technical University, Middle East Technical University, Industrial Engineering Department, Ankara, 06531, Turkey, sakine@ie.metu.edu.tr, Meral Azizoglu

This study considers a single machine total flow time problem that is subject to preventive maintenance activities of known starting times and durations. We propose a branch and bound algorithm to find the optimal solution of the problem and show that our algorithm can solve large-sized problem instances in reasonable times.

3 - Production Planning for Tissue-Engineered Biomaterial Manufacturing
Jun Zhang, PhD Student, Purdue University, School of Industrial Engineering, 315 N. Grant Street, West Lafayette, IN, 47906, United States, zhang28@purdue.edu, Yuehwern Yih

Reducing cost of health care is an attactive research topic. Since the pharmaceutical is an important component of health care costs, it has been considered as a potential source of cost reduction. Although many factors contribute to pharmaceutical costs, production operations are significant.This research studies the tissue-engineered biomaterial manufacturing and proposes a model for production planning in order to reduce the operations cost as well as provide high service level.

Wednesday, 1:30pm - 3:00pm

■ WC01

Room 301

Online Optimization

Sponsor: Optimization/ Network and Combinatorial Optimization
Sponsored Session

Chair: Adam Kalai, Assistant Professor, Toyota Technological Institute, Chicago, IL, United States, kalai@tti-c.org

1 - Games, Optimization, and Online Algorithms
Martin Zinkevich, Department of Computing Science, University of Alberta, 2-21 Athabasca Hall, Edmonton, AB, Canada, maz@cs.ualberta.ca

Texas Hold-em is a huge multi-agent, partial information game. While an equilibrium exists, this is not the best strategy against non-equilibrium play. I will present a novel way of finding an approximate equilibrium involving approximately solving a linear program (previously considered intractable) such that "experts" that can be useful against suboptimal strategies can be extracted from the solution.

2 - (Exponentiated) Stochastic Gradient Descent for L1 Constrained Problems
Sham Kakade, Assistant Professor, Toyota Technological Institute, 1427 E. 60th Street, Chicago, IL, 60637, United States, sham@tti-c.org, Eyal Even-Dar, Dean Foster

Convex optimization problems with L1 constraints often underly such tasks as feature selection and obtaining sparse representations. We show the exponentiated gradient algorithm is effective as a stochastic gradient descent algorithm under general convex loss functions when there are many irrelevant dimensions - requiring a number of gradient steps only logarithmic in the number of dimensions. This includes supervised learning problems under the square, hinge, logistic, and absolute loss.

3 - Approximate Online Optimization
Katrina Ligett, PhD Student, Carnegie Mellon University, katrina+@cs.cmu.edu, Sham Kakade, Adam Kalai

We show how to convert nearly any offline approximation algorithm into an online approximation algorithm that can applied to a sequence of optimization problems. In particular, given a polynomial-time offline approximation algorithm with approximation ratio R, we show how to solve the sequential online decision version of the problem in polynomial time, achieving competitive ratio R+eps, for arbitrarily small eps.

4 - Approximation and Online Algorithms for Item Pricing
Avrim Blum, Professor, Carnegie Mellon University, Department of Computer Science, 5000 Forbes Ave, Pittsburgh, PA, 15213-3891, United States, avrim@cs.cmu.edu, Maria-Florina Balcan

We consider the problem of a seller with various goods attempting to set prices to maximize revenue, when customers have valuations over sets of items. Our main result is a simple O(k) approximation for the case of single-minded bidders who

each want at most k items, improving on the O(k^2) bound of Briest and Krysta. We also show how our algorithms can be combined with results of [BH05,KV03] to achieve good performance in the online setting.

■ WC02

Room 302

Game Theory II

Contributed Session

Chair: Nicole Adler, Assistant Professor, School of Business Administration, Hebrew University of Jerusalem, Mount Scopus 91905, Israel, msnic@huji.ac.il

1 - Mixed Strategies in Combinatorial Agency
Moshe Babaioff, University of California Berkeley, School of Information, Berkeley, CA, 94720-4600, United States, moshe@sims.berkeley.edu, Michal Feldman, Noam Nisan

We study a setting where a principal needs to motivate a team of agents whose combination of hidden efforts stochastically determines an outcome. In a companion paper we devise and study a basic ``combinatorial agency" model for this setting, where the principal is restricted to inducing pure Nash equilibria. Here, we show that the principal may possibly gain from inducing mixed equilibria, but this gain can be bounded for some technologies. We also present a sufficient condition for no gain.

2 - Social Learning Dynamics and the Distribution of Information
Ilan Lobel, MIT, Operations Research Center, Cambridge, MA, 02139, United States, lobel@mit.edu, Asuman Ozdaglar, Munther Dahleh, Daron Acemoglu

Present models of social learning either assume all previous actions are observable or assume agents are not fully rational. We provide a new model for social learning in a network of rational agents and characterize the equilibrium behavior of the players given certain information structures. We also characterize the long-term dynamics of play in such networks and we consider the effects of changing the information structure on the learning dynamics.

3 - Continuous Movement in Noniterated Social Dilemmas
Gregory Jones, Faculty Research Fellow, Georgia State University, 2792 Crown Mill, Marietta, GA, 30068, United States, gtjones@gsu.edu, Reidar Hagtvedt

Previous social simulation studies have often relied on computational automata on discrete torii. Continuous movement on a continuous torus provides more realistic opportunities for multiple interactions, unique behaviors, and a qualitatively different approach to equilibrium selection. Here we present a noniterated prisoner's dilemma where cooperation evolves without the adaptive improbability of projection strategies or the demanding cognitive overhead of detection strategies.

4 - Pricing of Over-The-Counter Hedging Contracts for Real Investments
Jianer Zhou, Simon School of Business, University of Rochester, Carol Simon Hall, Rochester, NY, 14627, United States, zhouj2@simon.rochester.edu, Nils Rudi

To offset the risk of his real investment, a firm buys from an issuer a hedging contract with an underlying payoff correlated with the demand uncertainty. The issuer lays off her risk through her financial portfolio or by writing another hedging contract. We characterize the contract pricing mechanism in the framework of Stackelberg game and price equilibrium. We also define two benchmark cases and show that the issuer plays an important role in sharing the risk by numerical experiments.

5 - Knowledge Flows and Modeling Competition Among Multinational Enterprises
Nicole Adler, Assistant Professor, School of Business Administration, Hebrew University of Jerusalem, Mount Scopus 91905, Israel, msnic@huji.ac.il

This research develops a location-allocation, mixed integer linear program that evaluates multi-national enterprises location and control configurations to yield optimal networks, considering R&D, production and marketing facilities, produced in-house and/or outsourced, as well as intra-firm and inter-firm knowledge flows. A second stage game permits price competition for end customers and their effect on the first stage network cost minimization and the overall Nash-Bertrand equilibrium.

■ WC03

Room 303

Discrete Optimization

Contributed Session

Chair: Jonathan Turner, Student, Purdue University, 2353 Yeager Road, Apt. 1, West Lafayette, IN, 47906, United States, jonathan-turner@northwestern.edu

1 - LP-Based Solution Methods for the Asymmetric TSP
Vardges Melkonian, Ohio University, Department of Mathematics, Athens, OH, 45701, United States, vardges@math.ohiou.edu

We consider an LP relaxation for ATSP. We introduce concepts of high-value and high-flow cycles in the basic solutions and show that the existence of this kind of cycles would lead to constant-factor approximation algorithms for ATSP. The existence of high-flow cycles is motivated by computational results and theoretical observations.

2 - Transposition Search for Optimal Graph Embedding
George Popescu, ACM, 5 Wild Rose Road, Westport, CT, 06880, United States, george.popescu@acm.org

Distributed indexing networks are networks defined by a set of connectivity rules on node indices. Construction of distributed indexing networks can be formulated as an optimal graph embedding, with a cost function defined over graph weights. We propose here efficient search algorithms based on the idea of transposing vertex indices. We compare local search and stochastic gradient descent algorithms and provide an asymptotic analysis of their performance.

3 - A Branch-and-Price Algorithm for Optimizing the Share-of-Choice Product Line Design Problem
Xinfang Jocelyn Wang, PhD Student, Department of QAOM, College of Business, University of Cincinnati, 501 Carl H. Lindner Hall, PO Box 210130, Cincinnati, OH, 45221, United States, wangfx@email.uc.edu

In this paper, we focus on solving the share-of-choice product line problem. Previous contributions to this NP-Hard problem include a series of ever improving heuristics. We present a new algorithm that embeds a column generation procedure within branch-and-bound to obtain exact optimal integer solutions. The initial computational results using large simulated dataset demonstrate that the algorithm is capable of identifying provably optimal solutions very quickly.

4 - Branch, Bound, and Remember Algorithms for the Simple Assembly Line Balancing Problem
Edward Sewell, Professor, Southern Illinois University Edwardsville, Department of Math and Statistics, Edwardsville, IL, United States, esewell@siue.edu, Sheldon Jacobson

We present heuristic and exact algorithms for the assembly line balancing problem. They can find and verify the optimal solution for every problem in the combined benchmarks of Hoffman, Talbot, and Scholl in less than one second per problem, on average, including two problems that have remained open for 10 years. The previous best algorithm was reported to solve 245 of the 269 benchmarks. Both algorithms are based on a branch & bound method that uses memory to eliminate redundant subproblems.

5 - Mitigating Shortage and Distribution Costs in Damaged Water Networks
Jonathan Turner, Student, Purdue University, 2353 Yeager Road, Apt. 1, West Lafayette, IN, 47906, United States, jonathan-turner@northwestern.edu, Dulcy Abraham, Mark Lawley, Jean-Philippe Richard, Jianhong Qiao

Intentional attacks and natural disasters may expose or exploit vulnerabilities in public infrastructures. Water networks are very critical infrastructures for which the consequences of a disaster are severe. If a disaster occurs, the right response strategy can minimize water shortage and distribution costs while the network is being repaired. We present a problem formulation and solution methodology will find this strategy quickly.

■ WC06

Room 306

Advances in Heuristic Methods

Sponsor: INFORMS Computing Society/Heuristic Search

Sponsored Session

Chair: Bob Storer, Professor, ISE Department, Mohler Lab 200, Lehigh University, Bethlehem, PA, 18015, United States, rhs2@lehigh.edu

1 - Determining Fueling and Servicing Feasible Locomotive Plans
Ravindra Ahuja, Professor, University of Florida, 303 Weil Hall, Gainesville, FL, 32611, United States, ahuja@ufl.edu, Larry Shughart, James Orlin, Balachandran Vaidyanathan

The locomotive planning problem consists of assigning locomotives to a weekly train schedule so that each train receives sufficient tonnage and horsepower. Several approaches have been proposed in the literature for locomotive planning but none of these approaches produces a fueling and servicing feasible plan. This presentation will describe an integer programming-based heuristic to obtain such a locomotive plan.

2 - Sampled Fictitious Play Heuristics for Discrete Optimization Problems

Marina Epelman, University of Michigan, 1205 Beal Avenue, Ann Arbor, MI, United States, mepelman@umich.edu, Robert Smith, Archis Ghate

Sampled Fictitious Play is a heuristic for solving large-scale discrete optimization problems. We consider both traditional large-scale discrete problems, and problems modeling "complex systems." We describe several versions of the algorithm, discuss their theoretical convergence guarantees, and demonstrate their computational efficiency on various problems, with applications ranging from transportation and operations management, to finite horizon, Markov decision problems.

3 - A Very Large Scale Search Algorithm for General Balancing Problems

Bob Storer, Professor, ISE Department, Mohler Lab 200, Lehigh University, Bethlehem, PA, 18015, United States, rhs2@lehigh.edu

We discuss a Very Large Scale Neighborhood search algorithm for solving a generalized balancing problem. At each iteration an extension of the number partitioning problem is solved. This work extends a previous, quite successful algorithm for the rotor blade balancing problem.

■ WC07

Room 307

Computational Systems for Distributed Optimization

Sponsor: INFORMS Computing Society/Optimization: Computational Optimization and Software

Sponsored Session

Chair: Jun Ma, Postdoctoral Fellow, Northwestern University, Department of Industrial Engineering & Management Sciences, 2145 Sheridan Road, Evanston, IL, 60208-3119, United States, maj@northwestern.edu

1 - Extensions to an Optimization Services Instance Language

Robert Fourer, Professor, Department of Industrial Engineering & Management Sciences, Northwestern University, 2145 Sheridan Road, Evanston, IL, 60208-3119, United States, 4er@iems.northwestern.edu, Jun Ma, Kipp Martin

Optimization problems of interest today go beyond the traditional linear, integer, quadratic, and smooth nonlinear types. A language for problem instances must be extended accordingly. This presentation describes prospective extensions to OSiL, our proposed language standard, in such areas as combinatorial optimization and constraint programming, stochastic programming, and semidefinite and cone programming.

2 - A Result Language (OSrL) and Solver Option Language (OSoL) for Distributed Optimization

Kipp Martin, Professor, University of Chicago, 5807 South Woodlawn, Chicago, IL, 60637, United States, kipp.martin@chicagogsb.edu, Robert Fourer, Jun Ma

We present an XML-based result language (OSrL) and an XML-based solver option language (OSoL) for distributed optimization systems. We also describe associated in-memory objectes OSResult and OSOption that are used in a library to support client-solver communication in a system based on Web Services.

3 - Impact Solver for Optimization Services

Huanyuan Sheng, Northwestern University, Tech C231, 2145 Sheridan Road, Evanston, IL, 60208, United States, h-sheng@northwestern.edu, Sanjay Mehrotra, Jun Ma

We improve our IMPACT solver for broader range of optimization problems. New algorithms are being developed and tested for large scale mixed nonlinear integer problems. Combining with Optimization Services(OS) protocols, we plan to provide a robust solver service for applications of mathematical programming.

4 - An Enterprise Computational System Built on the Optimization Services (OS) Framework and Standards

Jun Ma, Postdoctoral Fellow, Northwestern University, Department of Industrial Engineering & Management Sciences, 2145 Sheridan Road, Evanston, IL, 60208-3119, United States, maj@northwestern.edu

Optimization Services (OS) is a unified framework and a set of open source standards (under the CPL license) for building Comutational and Optimization software both as standalone and over distributed systems. In this talk we present an professional implementation and deployment of large scale enterprise computational system that is based on the OS standards and fit for scheduling computational jobs over both Internet and Intranet.

■ WC08

Room 308

Panel Discussion: Service Industry -The Next Frontier for Technology Management

Sponsor: Technology Management

Sponsored Session

Chair: Tugrul Daim, Portland State University, Portland, OR, 97201, United States, tugrul@etm.pdx.edu

Co-Chair: Paul P. Maglio, IBM Almaden Research Center, Almaden Research Center, 650 Harry Road, San Jose CA 95120, United States, pmaglio@almaden.ibm.com

1 - Panel Discussion: Service Industry -The Next Frontier for Technology Management

Moderator: Daniel Berg, Rensselaer Polytechnic Institute, Troy, NY, 12180, United States, bergd@rpi.edu, Panelists: Dundar Kocaoglu, James C. Spohre, Arnold Reisman

Service industry represents 75% of the U.S. economy today; and its backbone is technology. Yet, while the manufacturing sector has improved impressively through proper application of technology management concepts and methodologies, the service industry has lagged behind manufacturing very badly in that context. This panel will explore the ways technology management can and should be applied to the health, financial, educational, government and other sectors of the service industry.

■ WC09

Room 309

Flexible Manufacturing Systems

Contributed Session

Chair: Larry Stapleton, Assistant Professor, Millikin University, 1184 W. Main Street, Decatur, IL, 62522, United States, lstapleton@millikin.edu

1 - Planning for Manufacturing Flexibility in the Automotive Industry

Jorge Arinez, Senior Research Engineer, General Motors R&D Center, MC 480-106-359, 30500 Mound Road, Warren, MI, 48090, United States, jorge.arinez@gm.com, Stephan Biller

Automotive companies operate in a capital intensive environment where investment decisions are made years in advance of highly uncertain revenue streams. In addition, manufacturing allocation decisions must also be made well before refined product definition and specific market demand knowledge exists. This presentation describes a quantitative approach to evaluate flexibility decisions for a portfolio of manufacturing plants designed to respond to future market uncertainties.

2 - Global Capacity Investment Strategies for Product Variants

Chen Xiang, PhD Candidate, Carnegie Mellon University, Tepper School of Business, 5000 Forbes Avenue, Pittsburgh, PA, 15213, United States, ccx@andrew.cmu.edu, Bahar Biller

We study the optimal capacity investment decision faced by a global firm that has to customize its product to satisfy product regulations in different markets. We derive the structure of the optimal strategy, identify the optimal and investigate the changes in the optimal strategy when the demands are perfectly correlated. We conclude with a case study demonstrating how a manager could use our optimal strategy characterization for making robust investment decisions in global settings.

3 - The Role of Common Product Architecture in Creating Manufacturing Flexibility

B. Joon Park, Assistant Professor, Singapore Management University, 50 Stamford Road, Singapore, Singapore, jpark@smu.edu.sg, Soumen Ghosh

Many firms have now started to adopt the strategy of enhancing manufacturing flexibility by exploiting common design platforms among its products. Using smart product platform design strategies - using common product architecture and standardised manufacturing processes - is to attain higher levels of manufacturing flexibility. In this research, we explore how common product architecture can enhance the effectiveness of manufacturing flexibility.

4 - Implementation Guidelines for Robust Supervisors in Automated Manufacturing

Shengyong Wang, School of Industrial Engineering, Purdue University, 148-11 Arnold Drive, West Lafayette, IN, 47906, United States, wangs@purdue.edu, Mark Lawley, Song Chew

In this research, we seek to propose implementation guidelines for robust supervisors in flexibly automated manufacturing systems with unreliable resources. We first review a number of supervisory controllers that we developed in previous work. A simulation study of performance of the above controllers in systems with various design parameters is conducted. Based upon the results, we propose implementation guidelines for these controllers in systems under various settings.

5 - Flexible Manufacturing System Buffer Optimization Using Simulated Annealing and Genetic Algorithm
Larry Stapleton, Assistant Professor, Millikin University, 1184 W. Main Street, Decatur, IL, 62522, United States, lstapleton@millikin.edu

This study compares two metaheuristic approaches (Simulated Annealing and Genetic Algorithm) and two traditional scheduling approaches (Longest Processing Time and Due Date) in defining which approach minimizes the makespan time and the number of pallets required (Buffer). This study focuses on the scheduling of low rate and bottleneck part types on a 5 station FMS, in an aerospace company. A Lagrangian Relaxation objective function is used.

■ WC11

Room 311

Radiation Therapy Planning

Contributed Session

Chair: Dionne Aleman, University of Florida, 303 Weil Hall, Gainesville, FL, 32605, United States, daleman1@ufl.edu

1 - New Approaches to the Leaf Sequencing Problem in IMRT Treatment Planning
Zeki Caner Taskin, PhD Student, University of Florida, ISE Department, 303 Weil Hall, Gainesville, FL, 32611-6595, United States, taskin@ufl.edu, H. Edwin Romeijn, J. Cole Smith, James F. Dempsey

Intensity modulated radiotherapy (IMRT) is a powerful technique for radiotherapy treatment delivery. We discuss the problem of efficiently delivering a given beam intensity profile using a so-called multi-leaf collimator system. In particular, we need to decompose the intensity profile into a set of beam shapes and associated intensities. We propose new methods to solve this problem under different efficiency criteria and delivery constraints and compare their performance using clinical data.

2 - Incorporating Delivery Efficiency into Radiotherapy Treatment Plan Optimization
Chunhua Men, PhD Student, University of Florida, ISE Department, 303 Weil Hall, Gainesville, FL, 32611-6595, United States, chhmen@ufl.edu, Zeki Caner Taskin, H. Edwin Romeijn, James F. Dempsey

We use an aperture modulation approach to Intensity Modulated Radiotherapy (IMRT) treatment plan optimization. In contrast with traditional approaches, we directly optimize apertures (beam shapes) and their intensities. This allows us to improve the quality of the dose model and thereby the planning process by explicitly accounting for transmission effects as well as a bound on the total beam-on-time. We test our models on clinical data and under different classes of deliverable apertures.

3 - Accounting for Fractionation in Fluence Map Optimization in IMRT
Dionne Aleman, University of Florida, 303 Weil Hall, Gainesville, FL, 32605, United States, daleman1@ufl.edu, H. Edwin Romeijn, James F. Dempsey

The majority of IMRT treatment plans are not delivered in a single session, but rather as several daily treatments (fractions) over an extended period. The current practice of transforming a single FMO solution into fractionated solutions is suboptimal. We formulate and solve a model that simultaneously optimizes one fluence map per prescription dose level by treating each beamlet in each fraction as a variable and incorporating artificial doses to account for previously delivered fractions.

■ WC12

Room 312

Enterprise-Wide Optimization: Robustness and Uncertainty

Cluster: Enterprise-Wide Optimization in the Process Industry

Invited Session

Chair: Ignacio Grossmann, Carnegie Mellon University, Department of Chemical Engineering, Pittsburgh, PA, 15213, United States, grossmann@cmu.edu

1 - Uncertainty in Process Scheduling Using Parametric Programming
Marianthi Ierapetritou, Associate Professor, Department of Chemical and Biochemical Engineering, Rutgers University, Piscataway, NJ, 08854, United States, marianth@soemail.rutgers.edu, Zukui Li

The consideration of uncertainty in process scheduling is of great importance to preserve plant feasibility during operations. We have recently proposed an approach to deal with demand uncertainty based on the ideas of parametric mixed-integer linear programming. In this work we are extended this work to address (a) The issue of infeasibility prior to the implementation of parametric MILP algorithm, and (b) The consideration of uncertainty in prices and processing times.

2 - Medium-Term Planning and Scheduling Under Uncertainty for BP Chemicals
Andrew Schaefer, Assistant Professor, University of Pittsburgh, Department Industrial Engineering, Pittsburgh, PA, 15261, United States, schaefer@ie.pitt.edu, Mehmet Demirci, Gorkem Saka, Anastasia Vaia, Norman F Jerome

We extend BP Chemicals' medium-term operations planning model which represents global production assets, distribution system for some of their chemical businesses and uses forecasts of the future economic environment. Our goal is to develop a multi-stage stochastic integer program through extending their model so it will explicitly account for the uncertainty in forecasts. We present a 2-stage stochastic LP where the operating policy for first month constitutes the first-stage decision variables

3 - Short-Term, Medium-Term, and Reactive Scheduling of an Industrial Batch Plant
Christodoulos Floudas, Professor, Princeton University, Department of Chemical Engineering, Princeton, NJ, 08544, United States, floudas@titan.princeton.edu, Stacy Janak, N. Vormbrock, J. Kallrath

The medium-term production scheduling of a multipurpose, multiproduct industrial batch plant is modeled using a novel continuous-time mathematical formulation first developed. The methodology consists of the decomposition of the whole scheduling period into successive short horizons of a few days. Computational studies on short-term, medium-term and reactive scheduling of a large scale industrial batch plant will be presented.

4 - Quantifying Supply Chain Risks Using Methods from Process Safety
Pavan Kumar Naraharisetti, Institute of Chemical and Engineering Sciences, 1 Pesek Road, Jurong Island, Singapore, Sg, 627833, Singapore, naraharisetti_pavan_kumar@ices.a-star.edu.sg, Rajagopalan Srinivasan, Arief Adhitya, Iftekhar Karimi

Risk and disruption management has become imperative for today's supply chains. Quantifying risks in terms of potential loss of money, time, or material provides a basis for evaluating the efficacy of risk management strategies. To achieve this, we build on well-developed quantitative methods from chemical process risk management and extend them to the supply chain context.

■ WC13

Room 313

Automation for Homework and Exams

Sponsor: Education (INFORM-ED)

Sponsored Session

Chair: Thomas Grossman, Associate Professor of Information & Decision Science, School of Business and Management, University of San Francisco, 2130 Fulton Street, San Francisco, CA, 94117, United States, tagrossman@usfca.edu

1 - Web-Based Homework in Introductory Statistics Courses
Scott Stevens, Professor, Computer Information Systems & Management Science Department, James Madison University, Harrisonburg, VA, 22807, United States, stevensp@jmu.edu, Susan Palocsay

Three online homework systems (ALEKS, PH-Assist, and custom online quizzes) were compared to traditional (textbook) homework assignments for undergraduates taking an introductory statistics course, then student performance on a standardized exam was used to compare these options. Multiple regression analysis results of the factors that were found to be important in student performance will be presented and discussed.

2 - Semi-Automated Grading of Online Exams and Assignments
Armann Ingolfsson, Associate Professor, University of Alberta School of Business, 4-30K Business Building, Edmonton, AB, T6G2R6, Canada, armann.ingolfsson@ualberta.ca

We have given online assignments and exams in several management science courses for about 10 years, using custom-designed web tools. The presentation will focus on semi-automated marking of complicated problems, where students report an array of numerical values, e.g., decision variables for an optimization problem. We will describe a structured way of giving partial credit for such problems, based on consistency, feasibility, and optimality.

■ WC14

Room 314

Cost/Performance Analysis

Contributed Session

Chair: Joost Santos, Research Assistant Professor, University of Virginia, 112 Olsson Hall (400736), Charlottesville, VA, 22901, United States, jrs8e@virginia.edu

1 - Performance of Private Sector Auditors in Public Sector Audit Engagements

Arvind Patel, Associate Professor, University of the South Pacific, School of Accounting and Finance, Faculty of Business and Economics, Suva, LA, Fiji, patel_a@usp.ac.fj, Sharon Wati

The objective of this paper is to examine the difference in the performance of private sector auditors engaged in public sector audits and vice versa. Auditors were required to complete a case study with a series of questions. The results show that private sector auditors performance were significantly less accurate compared to pubic sector auditors in the pubic sector audit task. Similarly, private sector auditors significantly outperformed public auditors in the private sector audit task.

2 - Inoperability Input-Output Model (IIM) with Multiple Expert Distributions

Joost Santos, Research Assistant Professor, University of Virginia, 112 Olsson Hall (400736), Charlottesville, VA, 22901, United States, jrs8e@virginia.edu

The IIM is a tool for analyzing perturbations to a given system and the associated ripple effects. In this paper, the IIM is extended to address perturbations that comprise of multiple expert distributions. The probability densities of ripple effects are generated via Monte Carlo simulation; hence, providing estimates of the mean and extreme values of economic losses and corresponding levels of system inoperability. The method is demonstrated through an oil and gas infrastructure case study.

■ WC15

Room 315

The Economic Theory of Auctions II

Cluster: Auctions and e-Commerce

Invited Session

Chair: Octavian Carare, The University of Texas at Dallas, carare@utdallas.edu

1 - Discriminatory Pricing Schemes in Ascending Auctions with Anonymous Bidders

Nicole Immorlica, Microsoft Research, One Microsoft Way, Redmond, WA, 98052, United States, nickle@microsoft.com, Mohammad Mahdian, K. Talwar, A. Karlin

An auctioneer is selling an unlimited supply of goods to bidders with unit demand through ascending auctions and would like to maximize his profit. We show that discriminatory pricing can not significantly increase the revenue of the seller when bidders are ex-ante identical even if their values are interdependent.

2 - Winner Determination Under Uncertainty

Roy H. Kwon, Assistant Professor, University of Toronto, 5 King's College Road, Toronto, ON, M5S 3G8, Canada, rkwon@mie.utoronto.ca

We consider the winner determination problem under uncertainty for combinatorial auctions. The WD problem under uncertainty is formulated as a multi-stage stochastic integer program. We present both approximation heuristics with worst-case guarantees as well as a novel exact approach based on dual decomposition and column generation.

3 - Monotonicity and Selection of Bidding Equilibria

Vladimir Mares, MARES@WUSTL.EDU

In second price common-value auctions we can identify a continuum of equilibria. This paper identifies conditions under which the set of equilibria is monotone. This allows us to construct selection criteria which identify equilibria for asymmetric cases. The criterion uniquely selects the symmetric equilibrium the symmetric case.

4 - Reserve Prices in Repeated Multi-Unit Auctions: Theory and Estimation

Octavian Carare, The University of Texas at Dallas, carare@utdallas.edu

We estimate the distribution of bidders' valuations for a high-tech product and the sellers' optimal stationary reserve price. A model of search is used to evaluate the effect on bidding of imposing a reserve price. The revenue gain from a reserve price is 25% for a subsample of our auctions.

■ WC16

Room 316

Revenue Management in the IT Industry

Cluster: Dynamic Pricing and Forecasting

Invited Session

Chair: Laura Wynter, Research Scientist, IBM Research, PO Box 218, Yorktown Heights, NY, 10598, United States, lwynter@us.ibm.com

1 - Revenue Management for the e-Service Industry: Price and Service Level Segmentation

Tieming Liu, Assistant Professor, Oklahoma State University, 322 Engineering North, Stillwater, OK, 74078, United States, tieming.liu@okstate.edu, Parijat Dube, Laura Wynter

We study a joint pricing and capacity allocation model for an e-service provider facing multi-type of demands and competitors. We apply the Logit model to describe demand diversions among different service classes and different periods, and we use recent results in queueing theory to approximate the QoS of each service class. Computational analyses are provided to develop insights into the benefits of the yield management model, as well as the impacts of service capacity and demand structure.

2 - Real-Time Yield Management of e-Services

Parijat Dube, IBM Research, 19 Skyline Drive, Hawthorne, NY, 10532, United States, pdube@us.ibm.com, Yezekael Hayel

We propose a framework for real-time yield management of e-services. The framework employs demand forecasting, yield management and customer behavior monitoring modules. The quality of service measure is the expected delay and using queueing theory we model the dependence of the expected delay on the demand, customer choices and providers' capacity. Using numerical examples we show the gain in revenue that can be realised by firms in markets with different buying power of customers.

3 - Offerings and Investment Strategy

Chuck Maniaci, Senior Financial Analyst, IBM Global Technology Services, One Michigan Avenue, Lansing, MI, 48933, United States, cmaniaci@us.ibm.com

We discuss important steps in developing market-based price for IT services. These involve identifying target markets for different types of offerings and then determining customer's willingness-to-pay through market studies. This is then used to construct a market-based price for the offering. We also describe how the on demand pricing structure can provide considerable savings to the customers on their overall IT spending through a case study employing a TCO financial estimate.

■ WC17

Room 317

Simulation II

Contributed Session

Chair: Javier Faulin, Associate Professor, Public University of Navarra, Department Statistics and OR, Campus Arrosadia, Pamplona, NA, 31006, Spain, javier.faulin@unavarra.es

1 - A Framework for the Modeling and Simulation of Post-Merger Workforce Integration Strategy

Terrill Frantz, Carnegie Mellon University, 5000 Forbes Avenue, School of Computer Science, Pittsburgh, PA, 15213, United States, terrill@cs.cmu.edu

This paper develops a framework for modeling and simulating the integration of two distinct organizations transforming from a pre-merger state to a merged organization. The political and operational structures of the pre-merger groups are captured, then an integration strategy is applied in a stochastic process for the qualitative evaluation of the strategy.

2 - A Simulation of IS Security with Variable Attacker Populations

Norman Pendegraft, University of Idaho, College of Business and Economics, Moscow, 83844-3161, United States, norman@uidaho.edu, Mark Rounds

A simulation of the interaction between an information system, its users, and its attackers is presented. The model extends our earlier work to allow the number of attackers to vary over time. The model displays three types of response: value (the key metric) declines over time, increases over time, or oscillates. There are circumstances in which increasing enforcement is a superior policy to increasing perimeter security.

3 - Overlapping Folded Variance Estimators for Stationary Simulation Output

Melike Meterelliyoz, Graduate Research Assistant, Georgia Institute of Technology, 765 Ferst Drive, NW, Atlanta, GA, 30332, United States, mmeterel@isye.gatech.edu, Christos Alexopoulos, Dave Goldsman

We propose a new class of estimators for variance parameter of a steady-state

simulation output process. The estimators are computed by averaging "folded" versions of the standardized time-series corresponding to overlapping batches. We establish the limiting distributions of the proposed estimators as the sample size tends to infinity. The new estimators have almost the same bias but smaller variance than their counterparts. Finally, these estimators can be computed with order-of-sample-size work.

4 - Synthesis and Recognition of Malicious Simulation Inputs
Thomas Willemain, Professor, Rensselaer Polytechnic Institute, 2520 Peters Lane, Niskayuna, Niskayuna, NY, 12309, United States, willet@rpi.edu

Simulation inputs can be designed to serve as probes to detect system vulnerabilities. In an offensive mode, one could discover those portions of the input space that would degrade or destroy enemy systems. In a defensive mode, one would like to be the first to discover vulnerabilities in one's own systems to redesign them to be more robust and/or to be able monitor inputs in real time to recognize and thwart attacks. We illustrate these ideas with simulations of simple queues.

5 - Using Discrete Event Simulation to Develop Academic and Research Projects in the Computer Networking
Javier Faulin, Associate Professor, Public University of Navarra, Department Statistics and OR, Campus Arrosadia, Pamplona, NA, 31006, Spain, javier.faulin@unavarra.es, Joan M. Marques, Norbert Martinez, Angel A. Juan, Alejandro G. Del Valle

This article describes some academic and research experiences, related to the computer network simulation area, that have been developed at the Open University of Catalonia. Firstly, we describe how discrete event simulation can help students to model complex computer networks (including protocols, queuing policies, etc.). Finally, we present a research project where a real network has been simulated with OPNET in order to improve its performance according to the manager specifications.

■ WC18

Room 318

Risk Analysis

Contributed Session

Chair: Manpreet Hora, Richard Ivey School of Business, The University of Western Ontario, 1151 Richmond Street North, London, N6A 3K7, Canada, mhora@ivey.uwo.ca

1 - Study on a Risk of RFID Technique Innovation
Se Kyoung Youm, Dongguk University, 26,3Pil-Dong, Chung-Gu, Seoul, South Korea, skyoum@dongguk.edu, Sung Ku Cho

So many Companies think that all problems are solved and companies can get economic benefit by introducing RFID technology. However it is impossible for RFID technology to introduce to existing system. In this paper, we study on the risk or barrier elements according to the introducing of RFID system. And we define detail activities about that. It minimizes the risk and offer a strategy of gradual migration and the guide line for construction RFID system.

2 - Strategic Risk Management Framework for Long-Term Service Agreements
Aparna Gupta, Assistant Professor, Rensselaer Polytechnic Institute, 110 8th Street, Troy, NY, 12180, United States, guptaa@rpi.edu, Chaipat Lawsirirat

Long-term service agreements provided for high-cost and high-tech equipment are getting increasingly popular, however they expose the provider to multiple sources of risks. We develop a strategic risk management framework for assessment and management of risks from single as well as a portfolio of long-term service agreements from a provider's perspective.

3 - Applying Risk Theory and Optimization to Physical Security Decisions
Greg Graves, LTC, U.S. Military Academy, Department of Mathematical Sciences, 646 Swift Road, West Point, NY, 10996, United States, gregory.graves@us.army.mil

Physical security systems should prevent or mitigate potentially catastrophic consequences. We present a risk theoretic approach to the selection from among alternative configurations of safeguards. The problem of determining a clear preference among alternatives without a unique probability measure on risk events is considered. Through a novel application of linear programming and sensitivity analysis, insights are gained regarding vulnerability and priorities for information acquisition.

4 - Assessing Construction Defect Risks
Tony Cox, President, Cox Associates, 503 Franklin Street, Denver, CO, 80218, United States, tcoxdenver@aol.com

Construction defects in housing developments can take years to become apparent, yet pose hard-to-estimate threats to human safety, quality of life, and real estate property values. We discuss statistical methods and models for using the partial information available from inspections and failure histories to estimate present and probable future defect rates and to optimize inspection and remediation decisions.

5 - Association Between Non-Recurrent Operational Failures and Performance
Manpreet Hora, Richard Ivey School of Business, The University of Western Ontario, 1151 Richmond Street North, London, N6A 3K7, Canada, mhora@ivey.uwo.ca

The risk of operational failures in firms arises from external events or internally from failure of processes, people and systems. This study focuses on the negative consequences of such failures on performance. Specifically, this study examines non-recurrent events like failed or delayed ERP/CRM/SCM implementations. Using an event study methodology, the results show a significant negative association between these failures and financial performance.

■ WC19

Room 319

Economic Models of Distributed Energy Resources

Sponsor: Energy, Natural Resources & The Environment
Sponsored Session

Chair: Chung-Li Tseng, Associate Professor, University of Missouri-Rolla, Department of Engineering Management, Rolla, MO, 65409, United States, chungli@umr.edu

1 - Distributed Generation Benefits Under Various Tariff Structures
Ryan Firestone, Research Assistant, Lawrence Berkeley National Laboratory, 1 Cyclotron Road, MS90R4000, Berkeley, CA, 94720, United States, rmfirestone@lbl.gov, Chris Marnay

The on-site cogeneration of electricity and heat can benefit individual adopters, utility electricity providers, and the greater customer base. However, the benefits are dependent on how the co-generation is dispatched. Economically optimal dispatch, in turn, will depend on both energy prices and tariff structure. This research is a study of the effects of electricity tariff structure on the optimal dispatch of a cogeneration system at an industrial facility in Southern California.

2 - Investing in a Wind Farm Under Electricity Price Uncertainty
Stein-Erik Fleten, Associate Professor, NTNU Norway, IÿT, Alfred Getz v. 3, Trondheim, NO, NO-7491, Norway, stein-erik.fleten@iot.ntnu.no, Per Christian L Torgersrud, Kim Kross¯y, Bernhard Kvaal

A company holding a license to build a wind farm has the right, but not the obligation, to build a certain capacity of wind power. Assuming that long term electricity prices follow a Brownian motion dynamics, with parameters estimated by considering forward prices of the Nordic electricity market, the value of the investment flexibility is estimated. Investment decisions and wind power values are discussed in terms of a case study from a Norwegian energy company.

3 - Valuing a Natural Gas Storage Facility via a Real Options Approach
Youyi Feng, Associate Professor, The Chinese University of Hong Kong, The Department of SEEM, R609, M. W. Mong Engineering Building, Hong Kong, Hong Kong, yyfeng@se.cuhk.edu.hk, Zhan Pang

We consider valuing a storage facility for an independent and risk-neutral natural gas marketer who plans to own or rent the facility for facilitating gas trading in an energy commodity exchange. We optimize the integrated decisions on gas trading and storage operations over a finite or an infinite horizon by switch-curve policies. We assess the capacity investment of a storage and a long-term renting agreement with the storage owner, respectively.

■ WC20

Room 320

Solution Techniques II in Decision Analysis

Contributed Session

Chair: Xiongfei Zhang, National Defense University, Haidian District, Red Hill A3, Beijing, China, zhang.xiong.fei@163.com

1 - Quantifying and Mitigating Splitting Biases in Value Trees
Sarah Jacobi, PhD Candidate, Johns Hopkins University, 313 Ames Hall, 3400 N. Charles Street, Baltimore, MD, 21218, United States, skjacobi@jhu.edu, Ming-Che Hu

Two models are used to estimate and correct splitting biases resulting from value tree weight elicitation. The models assume subjects use the "anchor-and-adjust" heuristic. Using two trees, two weight sets are elicited from electric utility managers. Both models support the hypothesis that splitting biases exist, but they result in different sets of corrected weights. Implications for rankings are analyzed.

2 - Dynamic Pricing and Warranty Policies for Products with Fixed Lifetime
Sherry Z.F. Zhou, Assistant Professor, City University of Hong Kong, 83 Tat Chee Avenue, Kowloontong, Kowloon, Hong Kong, zhefzhou@cityu.edu.hk

Product warranties have been an integral part of production and marketing strategies for a manufacturer to gain market shares and control quality related costs. Effective design of warranty policies is crucial for a manufacturer to succeed in today's competitive world. In our paper, we develop a mathematical model to investigate a policy that jointly considers dynamic pricing and warranty length for a repairable high-tech product over its effective lifetime.

3 - Group Information Seeking Behavior in Emergency Response
David Mendonca, New Jersey Institute of Technology, University Heights, Newark, NJ, 07102, United States, mendonca@njit.edu, Qing Gu

Emergencies require coordination and shared responsibility by response personnel in order to find information and make decisions, often under conditions of risk and time pressure. This paper develops a theory that explains how risk, time pressure, and differential distribution of information influence how groups seek for and process information during emergency response, leading to a model that yields a set of testable propositions for future research.

4 - Product Introduction with Options of Information Acquisition and Market Withdraw
Yongquan Li, Hong Kong University of Science & Technology, IELM, HKUST, Clear Water Bay, Kowloon, yqli@ust.hk, Kaijie Zhu

We consider a company that plans to introduce a new product but faces much uncertainty about the market demand. Because costly forecasts are available from outside experts, to balance the benefit and the cost of acquiring such forecasts, the company needs to determine the number of experts to hire. We analyze and compare two approaches: The company decides the number all at once or hires experts sequentially and makes a decision on whether to hire an additional one.

5 - Research on the Coordination Models of Organizational Decision
Xiongfei Zhang, National Defense University, Haidian District, Red Hill A3, Beijing, China, zhang.xiong.fei@163.com, Shaojun Liu

The integration of decision making is the requirement of the advanced organizational decision, and the coordination of decision making is the direct way to the integration. We investigated the bi-level structure of the organizational system. Based on the information exchange among the two levels and different components in the lower level, we constructed four basic models and one popular transformation of the coordination of organizational decision.

■ WC21

Room 321

Hypergame Theory - Reasoning and Context

Sponsor: Decision Analysis Society
Sponsored Session

Chair: Russell R. Vane III, Senior Researcher, GDAIS, 1400 Key Boulevard, Arlington, VA, 22209, United States, russ.vane@gd-ais.com

1 - Hypergame Normal Form
Russell R. Vane III, Senior Researcher, GDAIS, 1400 Key Boulevard, Arlington, VA, 22209, United States, russ.vane@gd-ais.com

An extension of original hypergame theory is presented in a normal form for recording competitive problem semantics. These semantics include: possible situations and "own" options, surmised contexts of the other players, as well as our beliefs about evidence and expected outcomes. The result is an effectiveness measure, Hypergame Expected Utility (HEU), for all "own" options over uncertainty.

2 - Using Hypergames to Analyze Situations Involving Denial and Deception
Michael Bennett, Principal Analyst, Jasmah Consulting, Inc., VA, United States, cynicalmass@verizon.net

The aim of strategic and tactical deception operations is to distort the target's perceptions of reality in order to influence his actions in a way that benefits the deceiver. Using the Fall of France in World War II as an example, this presentation examines the use of Vane's hypergame approach as a means of modeling situations that involve strategic deception and demonstrates how hypergames can be used both as an aid to deception planning and as a counterdeception tool.

3 - Methodological Issues for Hypergames
Douglas Griffith, Cognitive Scientist, GDAIS, 1400 Key Boulevard, Arlington, VA, 22209, United States, douglas.griffith@gd-ais.com

This presentation provides an overview of common human information processing biases that can adversely affect Hypergame inputs. It provides methodologies for mitigating or eliminating these biases. The techniques vary depending upon the time and resources available. Even with simple techniques, Hypergames provide a useful analytic tool. However, the quality of Hypegame outputs should vary as a function of the quality of the inputs.

4 - The Hyper-Hypergame and Evidence-Based Evaluation
Doug Samuelson, Homeland Security Institute, 8711 Chippendale Court, Annandale, VA, 22003, United States, samuelsondoug@yahoo.com

As models' complexity approaches that of the actual systems of interest, traditional methods of validation are often ineffective or ethically indefensible. These difficulties force us to reconstitute our methods of assessing the quality of models and evidence. Extending hypergame analysis and integrating it with recent advances in philosophy of science help to address such issues.

■ WC22

Room 322

Analysis for Defense Transformation I

Sponsor: Military Applications
Sponsored Session

Chair: Greg Parlier, SAIC, Gregory.h.parlier@saic.com

1 - Recruiter Selection Model and Implementation within the United States Army
John Halstead, Assistant Professor, U.S. Military Academy, Department of Systems Engineering, West Point, NY, 10996, United States, john.halstead@usma.edu

MG Bostick, Commanding General of the U. S. Army Recruiting Command, began a new method of selecting individuals from within the Army for recruiting duty. Previously, the Army assigned successful Non-Commissioned Officers, regardless of inherent sales and marketing skills, into the recruiting force. The new selection model applies statistical learning using NLSI and biographical data to determine the best Non-Commissioned Officers for recruiting duty.

2 - Army Process Optimization Model - Active Enlisted (APROM-AE)
BJ Thornburg, President, MAT Inc., 5 Pritchard Court, Stafford, VA, 22554, United States, ThornBJ@mat-inc.net

The Army Accessions Command (USAAC) was established with to manage soldier accessions from "First Handshake" to "First Unit." USAAC's mandate is to make the process more efficient and effective to field an Army transforming while at war. The APROM-AE models the enlisted accessions process with unique characteristics of each process to optimize enlisted recruiting and initial training. It is designed to enable USAAC to evaluate business policies and practices to improve the accessions system.

3 - Posttraumatic Stress Disorder (PTSD) Treatment Algorithm
Dean Hartley, Principal, Hartley Consulting, 106 Windsong Lane, Oak Ridge, TN, 37830, United States, DSHartley3@comcast.net

PTSD affects both civilians and military personnel and is of concern to the international health community. The International Psychopharmacology Algorithm Project (IPAP) is using OR in creating treatment algorithms for mental disorders, including PTSD. The PTSD algorithm will be described, along with lessons learned about the algorithm creation process.

4 - U.S. Army Deploys Lean Six Sigma
Doug Matty, US Army, 101 Army Pentagon, Suite 5D562, Washington, DC, 20310, United States, douglas.matty@us.army.mil

As part of the U.S. Army's business transformation, Lean Six Sigma is being used as a forcing function to drive increased operational performance and efficiency. This is the largest organizational deployment of analysis-based operational excellence in the history of management science. This presentation will focus on the organizational infrastructure and policy that guides this critical imperative for the success of the Army in accomplishing its missions.

■ WC23

Room 323

Semiconductor Manufacturing

Contributed Session

Chair: Banu Gemici, PhD Candidate, Lehigh University, 200 W. Packer Avenue, Bethlehem, PA, 18015, United States, bag4@lehigh.edu

1 - Throughput Capacity Analysis of AMHS in 300mm Wafer Fabs
Dima Nazzal, Georgia Institute of Technology, 765 Ferst Drive, Atlanta, GA, United States, dnazzal@isye.gatech.edu, Leon McGinnis

We explore analytical models useful in the design of vehicle-based Automated Material Handling Systems to support semiconductor manufacturing. This analysis proposes a computationally effective analytical approach to multi-vehicle AMHS performance modeling. A probabilistic model is developed, based on a description of AMHS operations, and the system is analyzed as an extended Markov chain. The model tracks the operations of vehicles on the loop considering the possibility of vehicle-blocking.

2 - Data-Driven Queueing Models of Semiconductor Manufacturing Systems

Shengwei Ding, Post-Doc, University of California at Berkeley, 4141 Etcheverry Hall, Berkeley, CA, 94720, United States, dingsw@cal.berkeley.edu, George Shanthikumar, Mike Zhang

Classical queueing models built on independence and stationary assumptions have not been accurate in estimating the cycle time in semiconductor manufacturing. Due to the complexity in the production process, the general assumption of the independence between the arrival and the service process is violated. We use real fab data to analyze the correlations between these two processes and their impact on cycle time. We then bring forward a new model to estimate the cycle time more accurately.

3 - Evaluating Lot Allocation Policies in Semiconductor Supply Chains

Yang Sun, PhD Candidate / Research Associate, Department of Industrial Engineering, Arizona State University, PO Box 87-5906, Tempe, AZ, 85287, United States, yang.sun@asu.edu, John Fowler, Dan Shunk

A set of composite-allocation-rule-based procedures is evaluated for the generalized lot allocation problem in semiconductor supply chains in order to improve service quality and to reduce allocation cost. The composite allocation rule is parameterized via a statistical model. The procedures are compared with optimization-based allocation methods as well as elementary heuristics. Computational experimental results are reported to illustrate the quality, cost and robustness of the solutions.

4 - Hidden Efficiency in Vehicle Dispatching for a Semiconductor FAB

Jae-joon Shin, Graduate Student, POSTECH, IME, San 31 Hyoja-Dong, Pohang, 790-784, South Korea, redguy@postech.ac.kr, Sangwon Jeong, Byung-In Kim

Reassignment based vehicle dispatching rules are proposed for a semiconductor FAB, which consists of 18 bays, 468 equipments and uses more than 150 overhead hoist transporters. The rules are designed to reduce the average lead time of load transfer and the variation of lead time. The proposed rules compare much favorably with traditional dispatching rules such as shortest travel distance first rule, in the number of vehicles required, the average lead time, and the variation of the lead time.

5 - RD Project Portfolio Analysis for the Semiconductor Industry

Banu Gemici, PhD Candidate, Lehigh University, 200 W. Packer Avenue, Bethlehem, PA, 18015, United States, bag4@lehigh.edu, Jeffry Moore, Jeff Linderoth, David Wu

We introduce a three-phase, decision support system for a U.S. major semiconductor manufacturer's strategic project selection problem. Key characteristics of our DSS are 1) Qualitative data and foresight of high-level executives are input to portfolio selection problem, 2) A multistage stochastic program is solved to obtain the best portfolio and optimal level of resources for the horizon, and 3) Optimal portfolio is constructed considering risk of the projects.

■ WC24

Room 324

Supply Chain Inventory Management

Contributed Session

Chair: Richard Cho, Assistant Professor, University of New Brunswick, Faculty of Business, PO Box 5050, Saint John, NB, E2L 4L5, Canada, rcho@unbsj.ca

1 - Shelf Space Management Through Retailer-Manufacturer Coordination

Ajay Mishra, Associate Professor, SUNY Binghamton, School of Management, Binghamton, NY, 13902, United States, amishra@binghamton.edu

Shelf space in a store is a scarce resource that a retailer must use well for higher profit and customer satisfaction. Manufacturers market their products aggressively to get more space for their product line. A retailer must assign shelf space to the assortment in a category by balancing the many marketing and operations constraints. We study how a retailer makes room on the shelf for a product while coordinating with a manufacturer.

2 - Retailer Inventory Reporting in Inventory-Replenishment and Allocation Decisions

Xin Zhai, Krannert School of Management, Purdue University, West Lafayette, IN, 47907, United States, xzhai@purdue.edu

We study retailer inventory reporting in a one-warehouse N-retailer distribution system, particularly retailer truth-telling at the times of allocation and system replenishment, under different information scenarios. We compare the incentives of independent retailers attempting to minimize their expected costs with those in a centralized system. We also develop an efficient mechanism to induce retailer to tell the truth so that the system best can be achieved in the decentralized system.

3 - Approximate Dynamic Programming for Optimal Material-Dispatching in Vendor-Managed Inventory Systems

Abhijit Gosavi, Assistant Professor, University at Buffalo, SUNY, 317 Bell Hall, Buffalo, NY, 14260, United States, agosavi@buffalo.edu, Zheng Sui, Li Lin

We develop an approximate dynamic programming approach to solve the problem of dynamically selecting the optimal number trucks in a vendor-managed inventory system. The underlying semi-Markov decision problem, whose transition probabilities are hard to determine, is solved via a reinforcement learning (approximate dynamic programming) algorithm that employs a vanishing discount factor.

4 - Coordination Between a Retailer and a Manufacturer Under the Price-Dependent Demand

Jungkyu Kim, Doctoral Student, Division of Mechanical and Industrial Engineering, Postech, San 31, Hyoja, Pohang, 790-784, South Korea, m819@postech.ac.kr, Yushin Hong

We study pricing and lot-sizing policies between a retailer and a manufacturer. Demand at the retailer is constant over time, but it is decreasing in retail price. A procedure is developed for finding the optimal retail price and lot-sizings for the manufacturer and the retailer.

5 - The Effect of the Inventory Reduction Level on the Supply Chain Profit Under the VMI Contract

Richard Cho, Assistant Professor, University of New Brunswick, Faculty of Business, PO Box 5050, Saint John, NB, E2L 4L5, Canada, rcho@unbsj.ca

The VMI contract changes the inventory strategy for SCM. A big retailer deals with many items and simply uses the VMI to reduce its inventory burden. Thus, the big retailer which plays a buyer's role is not tempted to introduce an ambiguous coordination scheme when it moves to a new VMI system. Instead, the retailer enforces the reduced maximum inventory level to the supplier. This research determines the effect of the enforced reduction of inventory level on the profit of buyer and supplier.

■ WC25

Room 325

Industry Applications II

Contributed Session

Chair: Moshe Rosenwein, Novartis, One Health Plaza, East Hanover, NJ, United States, moshe.rosenwein@novartis.com

1 - Pallet Tracking Method Based on RFID

Hye-Jin Lee, Researcher, ETRI, Postal Technology Research Center, 161 Gajeong-dong, Yuseong-gu, Daejeon, 305-700, South Korea, lhjin@etri.re.kr, Hong-Suk Hu

In this paper, pallet tracking method utilizes patterns and rules about trajectories of the pallet. The trajectories are created by predefined query about RFID data. The patterns are extracted from the trajectories and the rules are applied to the patterns. This method enables efficient and intelligent management of pallet without intervention of manager. Also it reduces false-dispatch and false-arrival since it can monitor real-time state of pallet.

2 - Robust Design Methodology and Applications of Automobile Occupant Restraint System Design

Yan Fu, Technical Expert, Ford Motor Company, 2101 Village Road, MD 2115, RIC-2112, Dearborn, MI, 48124, United States, yfu4@ford.com

With emphasis on product quality and consistency of product performance, variations in modeling, simulation, and manufacturing, need to be considered for product development in the automotive industry. This paper will present an integrated robust design methodology, which takes advantages of design of experiments, variable screening, meta-modeling, and genetic algorithm. A real world case study on occupant restraint system design is used as an example to demonstrate the methodology.

3 - Forecast Support Systems for Intermittent Demand Items

Aris Syntetos, Assistant Professor, University of Salford, Salford Business School, Maxwell Building, Salford, M5 4WT, United Kingdom, a.syntetos@salford.ac.uk, Kostas Nikolopoulos, I John Boylan, Robert Fildes, Paul Goodwin

This study evaluates the forecasting and stock control implications of judgementally (qualitatively) adjusting statistical forecasts. In particular, the case of intermittent demand items is considered, where demand occurs at random with some time periods showing no demand at all. The empirical database used for simulation purposes consists of the demand histories of 138 SKUs.

4 - Applications of Management Science in the Pharmaceutical Industry
Moshe Rosenwein, Novartis, One Health Plaza, East Hanover, NJ, United States, moshe.rosenwein@novartis.com

The pharmaceutical industry spends billion of dollars annually on sales force and marketing promotions. Measurement of each tactic's return on investment is critical to resource allocation decision making. This talk reviews common pharmaceutical marketing and sales business decision problems such as sales force call planning, TV direct-to-consumer (DTC) advertising effectiveness, and physician (customer) segmentation. These problems lend themselves to management science models and methods.

■ WC26

Room 326

Data Mining in RFID Applications

Sponsor: INFORMS Computing Society/Data Mining
Sponsored Session

Chair: Bruno Agard, Assistant Professor, École Polytechnique de Montréal, C.P. 6079, succ. Centre-ville, Montréal, QC, H3C 3A7, Canada, bruno.agard@polymtl.ca

Co-Chair: Martin Trépanier, Department of Mathematical and Industrial Engineering, Polytechnique Montréal, martin.trepanier@polymtl.ca

1 - Mining Weather Influence on Transit Travel Behaviour
Bruno Agard, Assistant Professor, École Polytechnique de Montréal, C.P. 6079, succ. Centre-ville, Montréal, QC, H3C 3A7, Canada, bruno.agard@polymtl.ca, Catherine Morency, Martin Trépanier

The authors propose to link information contained in Smart Card Automated Fare Collection Systems with meteorological data to see if weather influences the use of public transportation. To better understand these impacts, a 10-month period of city bus network data (6 millions boardings) is analyzed using various data mining techniques.

2 - Data Mining Scheduling Data: Identifying Best Practices
Sigurdur Olafsson, Assistant Professor, Iowa State University, Department of Industrial and Manufacturing Systems Engineering, Ames, IA, 50011, United States, olafsson@iastate.edu, Xiaonan Li

To compliment traditional scheduling models, data mining can be used to discover new knowledge directly from production schedules that are created by expert schedulers. However, to achieve the full benefits only the best scheduling practices should be used. In this talk we show how to combine optimization and data mining to identify best practices from which new scheduling knowledge can be discovered.

3 - A Data Mining Methodology for Product Design Support
Rakesh Nagi, Professor, Department of Industrial & Systems Engineering, 438 Bell Hall, University at Buffalo (SUNY), Buffalo, NY, 14260, United States, nagi@buffalo.edu, Carol Romanowski

Product designers often end up "reinventing the wheel" because they cannot find previous work that would aid in designing a new product. These challenges can be met by employing data mining methods on existing documents such as bills of material. We present a manufacturing case study using tree mining, tree union procedures, and constrained XML for information modeling. We also identify new research directions for data mining motivated by engineering design and information technology.

■ WC27

Room 327

Joint Session QRS/Health Applications: Quality and Statistical Decision-Making in Healthcare Applications IV

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: Jing Li, Research Assistant, Department of Industrial and Operations Engineering, University of Michigan, 1205 Beal Avenue, Ann Arbor, MI, 48109, United States, jinglz@engin.umich.edu

Co-Chair: Julie Simmons Ivy, Assistant Professor, University of Michigan, 701 Tappan Street, Ann Arbor, MI, 48109, United States, jsimmons@bus.umich.edu

Co-Chair: Nicoleta Serban, Assistant Professor, ISyE, Georgia Institute of Technology, 755 Ferst Drive NE, Atlanta, GA, 30332, nserban@isye.gatech.edu

1 - Nursing Home Quality Assessment Scorecard
Jenya Antonova, University of Wisconsin-Madison, 1175 WARF Building, 610 Walnut Street, Madison, WI, 53726, United States, Jenya_Antonova@chsra.wisc.edu, David Zimmerman

Quality of care scorecards are increasingly used as part of an overall Balanced Scorecard approach to nursing home performance. The concept of a multi-dimensional nursing home Quality of Care Scorecard is introduced. Illustrative data from several nursing home networks are presented.

2 - Improving Quality of Care and Revenue Management at the Indiana University Medical Group
John Norris, Doctoral Candidate, Purdue University, Krannert School of Management, 403 W. State Street, West Lafayette, IN, 47907-2056, United States, norrisjb@purdue.edu, Herb Moskowitz, Suresh Chand, Deanna Willis

With healthcare costs exceeding 15% of the US economy and rising and unpaid medical bills the leading cause of personal bankruptcy in America, costs are reaching epidemic proportions; yet some facilities are not fully utilized. Scheduling physicians and reserving appointments to meet demand can both improve care by providing care when it is needed and reduce costs by better utilizing existing resources. Historical registration data of demand patterns and simulation models will be discussed.

3 - Reducing Infection Transmission in the ICU: Using a System Level Model
Shreyas Limaye, University of Washington, Industrial Engineering, Box 352650, Seattle, WA, 98116-2650, United States, shreyas@u.washington.edu, Christina Mastrangelo

This study takes a systemic view at the operational level of ICU in order to reduce transmission of Hospital-associated infections. It suggests an integrated methodology that combines cognitive modeling, simulation, risk analysis and generalized linear models to improve the quality of healthcare provided at the Children's Hospital, Seattle.

4 - Machine Maintenance and The Optimal Scheduling of Drug Therapies
Steven Shechter, University of British Columbia, 2053 Main Mall, Vancouver, BC, Canada, steven.shechter@sauder.ubc.ca, Andrew Schaefer, Matthew Bailey

We begin by describing a machine maintenance problem that seeks to extend the lifetime of a system with one vital component and a finite number of iid spares. We then extend the framework to consider a patient faced with a finite number of drug therapies which may not be identically distributed. We discuss structural properties of the problem and a dynamic programming algorithm for finding the optimal sequencing of therapies and time to spend on each therapy.

■ WC28

Room 328

Sensor Systems II

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: Shiyu Zhou, Assistant Professor, University of Wisconsin-Madison, 1513 University Avenue, Madison, WI, 53706, United States, szhou@engr.wisc.edu

1 - Sensor Fault Detection in Presence of Model Specified Manufacturing Process Faults
Shan Li, University of Iowa, Department of Mechanical and Industrial Engineering, Iowa City, IA, 52242, United States, shanli@engineering.uiowa.edu, Yong Chen

This paper proposes a W control chart to detect the sensor mean shift faults in discrete manufacturing processes based on a linear fault-quality model. The sensitivity of the W chart to the occurrence of sensor faults is studied. A parameter called sensitivity preserving ratio (SPR) is used to evaluate the sensitivity of the control chart. In comparison with the control chart directly monitoring the product quality characteristics, our W chart can separate sensor faults from the process faults.

2 - Influence of Sensor Noise in Regression Adjustment Method for Quality Control
Li Zeng, University of Wisconsin-Madison, Department of Industrial and Systems Engineering, 1513 University Avenue, Mechanical Engineering Building, Madison, WI, 53706, United States, lzeng1@wisc.edu, Shiyu Zhou

In the regression adjustment method, one can choose to monitor the residual resulted from the adjustment for all possibly related variables or monitor that from the adjustment for an directly influential subset identified through a model selection procedure. In this paper, it is shown theoretically that when sensor noise is negligible, these two kinds of adjustment are equivalent. Otherwise the first adjustment will lead to higher false alarming rate and lower detection rate.

3 - Route Discovery and Throughput Capacity of Ad Hoc Wireless Networks

Eugene Perevalov, eup2@lehigh.edu, Rick Blum, Xun Chen

Throughput capacity of large ad hoc networks has been shown to scale adversely with the size of network. However the need for the nodes to find or repair routes has not been analyzed in this context. In this paper, we explicitly take route discovery into account and obtain the scaling law for the throughput capacity under general assumptions on the network environment, node behavior, and the quality of route discovery algorithms.

4 - Blind Sequential Identification of Manufacturing Variation Sources

Dan Apley, Associate Professor, Northwestern University, IE/MS, 2145 Sheridan Road, Evanston, IL, 60208, United States, apley@northwestern.edu, Xuemei Shan

Blind source separation is a new tool for identifying and eliminating major sources of variation in multivariate manufacturing processes. One recent algorithm combines different separation criteria to minimize mean square error. We propose a sequential method for separating the sources that achieves better estimation accuracy than the optimal "all-at-once" approach.

■ WC29

Room 329

Continuous Optimization

Contributed Session

Chair: Ronny Luss, Princeton University, Department of Operations Research & Financial Engineering, Engineering Quadrangle, Princeton, NJ, United States, rluss@princeton.edu

1 - An Analytic Center Cutting Surface Method: Complexity and Application

Mohammad Oskoorouchi, Assistant Professor, California State University at San Marcos, 333 Twin Oaks Valley Road, San Marcos, CA, 92081, United States, moskooro@csusm.edu, John Mitchell

We present an analytic center cutting surface algorithm that uses multiple second-order cone cuts. Theoretical issues and applications of this technique are discussed. We discuss the complexity of recovering the analytic center after adding multiple second-order cone cuts, and show that the overall algorithm is fully polynomial. Computational experience with randomly generated problems of moderate to large size are presented and compared with that of SDPT3.

2 - Some Recent Results on Merit Functions for the Second-Order Cone Complementarity Problem

Jein-Shan Chen, Assistant Professor, Department of Mathematics, National Taiwan Normal University, 88 Sec. 4, Ting-Chou Road, Taipei, 11677, Taiwan, jschen@math.ntnu.edu.tw

Like the nonlinear complementarity problem (NCP) and the semidefinite complementarity problem (SDCP), a popular approach to solving the second-order cone complementarity problem (SOCCP) is to reformulate the SOCCP as an unconstrained minimization problem via certain merit functions. In this talk, we will study some merit functions for the SOCCP and their related properties including error bounds and bounded level sets.

3 - A Derivative-Free Trust-Region Method for Engineering Optimization

Rommel Regis, Cornell Theory Center, 626 Rhodes Hall, Cornell University, Ithaca, NY, 14853, United States, rgr6@cornell.edu, Stefan Wild, Christine Shoemaker

We implement a derivative-free trust-region optimization method that utilizes a radial basis function (RBF) interpolation model. We compare the performance of our algorithm to alternative optimization methods on several test problems and on an environmental engineering application.

4 - Matrix Exponential Computations for Semidefinite Programming

Ronny Luss, Princeton University, Department of Operations Research & Financial Engineering, Engineering Quadrangle, Princeton, NJ, United States, rluss@princeton.edu, Alexandre D'Aspremont

We examine a first order method for solving semidefinite programs which arise in relaxing the hard sparsity constraint in sparse PCA. Matrix exponentiation is the most computationally intensive step in the method and, when results do not require machine precision (as is the case here), the common Pade approximation to the exponential may not be the most competitive method. We discuss Pade and two additional approximations - partial eigenvalue decompositions and Pade-Chebyshev approximations.

■ WC30

Room 330

Queueing & Stock Models

Contributed Session

Chair: Kai Huang, Research Associate, University of Arizona, Room 111, 1127 E. North Campus Drive, Tucson, AZ, 85721, United States, kaih@tucson.sie.arizona.edu

1 - Flexible Servers in Non-Markovian Lines with Finite Buffers

Eser Kirkizlar, School of Industrial & Systems Engineering, Georgia Institute of Technology, 765 Ferst Drive, Atlanta, GA, 30332-0205, United States, eser@gatech.edu, Sigrún Andradóttir, Hayriye Ayhan

We study the assignment of flexible servers to stations in tandem lines with finite intermediate buffers and service times that are not necessarily exponentially distributed. We obtain theoretical results for systems with two stations and two or three flexible servers. For bigger systems, we propose several heuristic server assignment policies and show that they yield near optimal performance for different service time distributions.

2 - Sensitivity in Retrial Queues Under QED Scaling

Rui Kang, Lehigh University, 2 Duh Drive, Apt. 224, Bethlehem, PA, 18015, United States, ruk2@lehigh.edu, Andrew Ross

We study sensitivity to distribution changes in multiserver retrial queues under QED (square-root) scaling. We focus on M/M/s+PH-retrials and M/PH/s+M-retrials systems. We find counterintuitive behavior for the blocking probability—it can get better as the retrial distribution increases in variance, for some retrial rates.

3 - Recent Proceedings on the Probabilistic Traveling Salesman Problem

Zehra Akyurt, Graduate Student, University of Maryland, 3116 Gershwin Lane, Silver Spring, MD, 20904, United States, zakyurt@umd.edu

The Probabilistic Traveling Salesman Problem (PTSP) assigns an apriori tour to a finite group of nodes within a bounded region whose occurrences are known only probabilistically beforehand. We show that the a priori tour is asymptotically as reliable as a reoptimization scheme, and we extend previous results to include asymptotic analysis of situations with non-identical node occurrence probabilities.

4 - Stochastic Application in the International Shipping Environment

Wen Chen, PhD Student, Rutgers Business School, 2nd Floor, 617 Central Avenue, Harrison,, NJ, 07029, United States, echodrawing@yahoo.com, Michael Katehakis

The research discusses stochastic application in the international shipping environment. Random demands generates in USA. Companies put their production section in China. The price of products will be decreased with the waiting time of customers because of modern rough business competition. Our research forces on finding the optimal shipping time.

5 - Partially Observable Network Interdiction Problem

Kai Huang, Research Associate, University of Arizona, Room 111, 1127 E. North Campus Drive, Tucson, AZ, 85721, United States, kaih@tucson.sie.arizona.edu, Suvrajeet Sen

We study a network interdiction problem where the attacker does not have the same information as the defender of the network. The attacker has the option to obtain more information at a cost. This problem can be modeled using alternative paradigms, such as multistage stochastic programming and Markov Decision Processes. Comparisons between these approaches are discussed.

■ WC31

Room 331

Finance-Risk Management II

Contributed Session

Chair: Mohamed Wahab Mohamed Ismail, PhD Student, University of Toronto, 5 King's College Road, Toronto, ON, M5S 3G8, Canada, wahab@mie.utoronto.ca

1 - Dynamic Financial Planning for a Household in a Multiperiod Optimization Approach

Norio Hibiki, Associate Professor, Keio University, 3-14-1 Hiyoshi, Kohoku-ku, Yokohama, 223-8522, Japan, hibiki@ae.keio.ac.jp, Katsuya Komoribayashi

Financial planning tools can be used for giving a financial advice for a household. We describe the multiperiod optimization model to determine an optimal set of asset mix, life insurance and fire insurance in conjunction with wage income, survivor's pension, consumption, home buying strategy, and life plan of a household. Some practical examples are solved to illustrate optimal financial plans.

2 - Integrating Optimal Annuity Planning with Consumption-Investment Selections in Retirement Planning

Zhisheng Li, Rensselaer Polytechnic Institute, 110 8th Street, Troy, NY, 12180, United States, liz4@rpi.edu, Aparna Gupta

This paper develops a framework which merges annuity purchase decisions with consumption-investment selections in retirement planning. A multi-period wealth evolution model is constructed based on an annuity pricing model, a benefit payment model, and an income model. An optimization problem is formulated with an objective of maximizing life time utility of consumption and wealth.

3- On Loan-to-Value Ratios of Inventory Financing with Doubly Stochastic Poisson Default Processes

Yixue Li, School of Management, Xi'an Jiaotong University, 1679 Mailbox, Xi'an Jiaotong University, Xi'an, 710049, China, liyixue@mail.xjtu.edu.cn, Gengzhong Feng, Yu Xu, Wenqiang Dai

This paper assumes that the default of the enterprise is exogenous and follows a doubly stochastic poisson process, and then provides a model on the determination of loan-to-value ratios for banks. In this model, some factors, such as risk appetite of banks, frequency of marking to market and maturity time of loan, are considered synthetically, so banks may determine appropriate loan-to-value ratios of particular inventory financing operation to keep the level of taken risk consistent.

4 - Swing Option Valuation in Electricity Market

Mohamed Wahab Mohamed Ismail, PhD Student, University of Toronto, 5 King's College Road, Toronto, ON, M5S 3G8, Canada, wahab@mie.utoronto.ca, Zhijian Yin

The spot electricity market is very volatile. The time series of the daily averaged electricity price are characterized by the seasonality, mean reversion, jumps, and regime-witching process. In this paper, first we develop a lattice approach to model the daily averaged price of electricity with a regime-switching process that utilizes three regimes, which consist of Brownian motions and a mean reverting process. We then present some numerical examples.

■ WC32

Room 332

Supply Chain Risk Management I

Contributed Session

Chair: Laird Burns, Michigan State University, N370 North Business Complex, Broad Graduate School of Business, East Lansing, MI, 48824, United States, burnslai@msu.edu

1 - The Loss-Averse Newsvendor Problem

Charles Wang, Assistant Professor, SUNY at Buffalo, 326 M Jacobs Management Center, Buffalo, NY, 14260, United States, cxwang@buffalo.edu, Scott Webster

This research models manager's decision-making behavior in the single-period newsvendor problem within the Prospect Theory framework. We find that if shortage cost is not negligible, then a loss-averse newsvendor may order more than a risk-neutral newsvendor. We also find that the loss-averse newsvendor's optimal order quantity may increase in wholesale price and decrease in retail price, which can never occur in the risk-neutral newsvendor model.

2 - Measuring Risk in Operational Hedging

Rockey Myall, PhD Student, Lehigh University, 200 West Packer Avenue, Room 354, Bethlehem, PA, 18015, United States, rrm204@lehigh.edu, Aurelie Thiele

We investigate models of operational hedging for a multinational company subject to demand and exchange rate uncertainty. We study how the choice of the risk measure impacts the decision-maker's strategy when the underlying probabilities are available and extend the analysis to the case where the distributions are not known precisely.

3 - Optimal Dynamic Procurement Portfolio with Capacity Options Contracts

Huifen He, Chinese University of Hong Kong, Chiangs Building Room 2703, Hong Kong, Hong Kong, hfhe@se.cuhk.edu.hk, Youyi Feng

This paper studies a multi-period inventory system that replenishes its stock by ordering one-period forwards and if necessary one-period-expiry options contracts. We explore how the inventory system and its supplier under consideration optimize their operations decisions respectively over the planning horizon while the parameters of the options contracts are prespecified. Then, we discuss how the options contracts can be sealed in a mutually agreeable manner.

4 - Multi-Period Risk-Averse Inventory Models: Fast Operational and Slow Financial Reporting Cycles

Lijun Ma, PhD Candidate, Department of Systems Engineering & Engineering Management, The Chinese University of Hong Kong, Hong Kong, Hong Kong, ljma@se.cuhk.edu.hk, Houmin Yan

We study a multi-period risk-averse inventory model with an additive utility function where the inventory decision is faster than the financial reporting cycle. We study the problem under both accrual- and cash-basis accounting schemes. We prove that the optimal inventory policy under accrual-basis accounting is state- dependent base-stock policy. We then show that the complexity of the optimal policy under cash-basis accounting.

5 - Visibility in Demand and Supply Networks: Effects of Risk Propagation on Firm Performance

Laird Burns, Michigan State University, N370 North Business Complex, Broad Graduate School of Business, East Lansing, MI, 48824, United States, burnslai@msu.edu

Visibility in demand and supply networks has important information effects in variance reduction. Research on the role visibility plays in mediating firm performance is limited. This study uses empirical case research and agent based modeling to investigate the effects of risk factors on firm performance within multi-echelon networks, based on modularity and interactive effects from the literature. A framework is developed to build theory on properties of risk propagation in such networks.

■ WC33

Room 333

Airline Industry Applications II

Sponsor: Aviation Applications

Sponsored Session

Chair: Gregory Coldren, President, Coldren Choice Consulting Ltd., 123 South Adams Street, Rockville, MD, 20850, United States, gregorycoldren@yahoo.com

1 - Aircraft Boarding Strategies: A Simulation Study

Massoud Bazargan, bazargam@erau.edu, Victor Cole, Juan Ruiz

This paper simulates the boarding strategies in use today by major airlines. To properly simulate the boarding process, the simulation model accounts for passenger interferences, baggage stowage, and the passenger arrival rate. We applied our simulation model to study the AirTran Boeing 737-700 short haul aircraft. We looked at five major boarding strategies from random to the customary back to front. Our analyses identifies that the arrival rate has an effect on the total boarding time and that the reverse pyramid and window middle aisle were among the efficient boarding strategies.

2 - Equitable Airport Flight Scheduling Using Airline Costs

Maarten Soomer, PhD Student, Vrije Universiteit, Amsterdam, the Netherlands, National Aerospace Laboratory NLR, Amsterdam, Netherlands

Arrival and departure delays have a large impact on airline operations. There is dependency between arriving and departing flights (crew, aircraft and transfers). We introduce a model to tactically schedule flights on an airport. Airlines provide cost functions related to delays and to represent the dependency between their flights. A scaling method for the costs is introduced to ensure equity. Our formulation will assign landing and take-off times to the flights, while taking costs into account.

3 - Solving Airline Scheduling Problems with Benders Decomposition

Yufeng Yao, School of Industrial and Systems Engineering, Georgia Institute of Technology, Atlanta, GA, 30332, Özlem Ergun, Ellis Johnson

One of the major objectives for airline scheduling is to cover all customer demand with minimum operating costs and high utilization of its resources. We propose an integrated model and solution methodology to simultaneously solve the fleet assignment, aircraft routing, and crew scheduling problems. For small size instances, column generation can be used. However, for larger size instances, the Benders decomposition gives more efficient and effective results.

■ WC34

Room 334

Dynamic Traffic Network Modeling Advances I

Sponsor: Transportation Science & Logistics

Sponsored Session

Chair: Georgios Kalafatas, Purdue University, 550 Stadium Mall Drive, West Lafayette, IN, United States, gkalafatas@gmail.com

1 - A Graph Theoretic Version of the Cell Transmission Model: The Single Destination Case

Georgios Kalafatas, Purdue University, 550 Stadium Mall Drive, West Lafayette, IN, United States, gkalafat@purdue.edu, Srinivas Peeta

The cell transmission model (CTM) has been used in the past to develop a linear formulation for the single destination dynamic traffic assignment problem, and show the existence of a minimum cost flow sub-structure. Here, the fundamental equations of the CTM are revisited to develop a complete graph structure. The trade-offs between modeling accuracy and computational benefits are highlighted and key properties like uniqueness are addressed in graph theoretic terms.

2 - A Graph Theoretic Version of the Cell Transmission Model: The Multiple Destination Case

Georgios Kalafatas, Purdue University, 550 Stadium Mall Drive, West Lafayette, IN, United States, gkalafatas@gmail.com, Srinivas Peeta

The existence of a graph theoretic version of the cell transmission model has shown the potential of significant computational benefits for the single destination case. In order to model multiple destinations for different user classes, the FIFO property has to be "strongly" satisfied at the expense of computational complexity. The new formulation corresponds to a mixed-integer multiple destination network design problem.

3 - Traffic Assignment Subjected to Additional User Constraints

Deepak Kumar, dkumar@mail.utexas.edu, S. Travis Waller

This paper studies the traffic assignment problem subjected to additional user constraints. In this problem, the additional constraints imposed by the users are the deadlines for reaching their respective destinations. A simple attempt to solve the problem includes using the time constrained shortest path problem as the subproblem under frank wolfe algorithm. The properties of the problem will be discussed and the preliminary results obtained will be presented.

■ WC35

Room 335

Urban Transportation Planning Models X: Day-to-Day Planning Models

Sponsor: Transportation Science & Logistics

Sponsored Session

Chair: Kaan Ozbay, Associate Professor, Rutgers University, 623 Bowser Road, Piscataway, NJ, 08854, United States, kaan@rci.rutgers.edu

1 - On the Stability of User Equilibria in Static Transportation Networks with Fixed Demand

Wen-Long Jin, Associate Professor, University of Science and Technology of China, Department of Automation, PO Box 4, Hefei, AH, 230027, China, wljin@ustc.edu.cn

The stability of a user equilibrium determines whether it can be realized or sustained in a transportation network. Based on a simple deterministic dynamical system model of the traffic assignment problem, we present a systematic approach to analyzing asymptotic stability and instability of user equilibria in static transportation networks with fixed demand and discuss an example of a non-monotone multiclass traffic assignment problem. The results are consistent with those in the literature.

2 - Modeling of Commuters' Learning Behavior: An Application to NJ Time-of-Day Pricing Program

Kaan Ozbay, Associate Professor, Rutgers University, 623 Bowser Road, Piscataway, NJ, 08854, United States, kaan@rci.rutgers.edu, Ozlem Yanmaz-Tuzel

Stochastic Learning Automata (SLA) is used to model commuters' day-to-day learning behavior. Stochastic nature of the system and heterogeneity among users are considered by combining Bayesian Learning approach with the SLA. The proposed model aims to capture the commuters' departure-time choice learning behavior both under undisturbed and disturbed network conditions and to investigate responses to toll, travel-time, departure/arrival time restrictions while selecting their departure-times.

■ WC36

Room 336

Military Applications I

Contributed Session

Chair: Niki Goerger, ERDC Research Associate at USMA, Engineer Research and Development Center, Department of Systems Engineering, United States Military Academy, West Point, NY, 10996, United States, Niki.Goerger@usma.edu

1 - A Planning and Control Architecture for Multi-Element Defensive Systems

George Mayernik, Manager III Systems Engineering, Raytheon Company, 235 Presidential Way, MS 26/3127, Woburn, MA, 01801-1060, United States, George_E_Mayernik@raytheon.com, Jarrod Kallberg

This paper discusses the applicability of deliberate, reactive, and hybrid planning methodologies commonly used in robotics to planning for military defense systems. Much like modern robots, defense systems must interact with the world in real time and must deal with plans that go awry. Furthermore, both are becoming more complex, flexible, multi-function, and interconnected. In addition to theoretical concepts, example applications are presented for single systems and "systems-of-systems".

2 - BotEC - Back of the Envelope Calculations

William West, Weapon Delivery, Air Force SEEK EAGLE Office, 205 West D Avenue, Suite 348, Eglin AFB, FL, 32542-6865, United States, william.west@eglin.af.mil, Jeff Ward

The Guided Weapon Trajectory Software (GWTS)computes three-degree-of-freedom trajectories for laser-guided weapons. GWTS solves for the collection of weapon launch locations known as the Launch Acceptability Region. GWTS computes expeditiously these LARs. The search algorithm was developed and optimized over nearly a decade of dedicated application for laser guided weapons.

3 - Analysis of the Effects of Information Asymmetry in the Shortest Path Network Interdiction Problem

Halil Bayrak, University of Pittsburgh, 1048 Benedum Hall, Pittsburgh, PA, 15261, United States, hab8@pitt.edu, Matthew Bailey

We consider the shortest path network interdiction problem. We investigate the effects of information asymmetry between the interdictor and the evader. We compare models based on worst-case scenario (symmetric information), best-case scenario (asymmetric information), and a combination of both (asymmetric information with a risk criterion). We show that the interdictor can benefit by including the information asymmetry in the model.

4 - Assessing Situational Awareness in Networks of Cooperating Entities: A Mathematical Approach

Herman Monsuur, Netherlands Defense Academy, PO Box 10.1000, 1780 CA Den Helder, Netherlands, h.monsuur@kim.nl

We assess situational awareness (SA) of nodes in military networks. To study the influence of the network topology, we consider two methods. The first method is in terms of updating information using the network and the second is interpreted as a steady state of information flowing through the network. These network values are combined with given characteristics to obtain SA. We introduce a performance metric that can be used to compare various competing alternative network configurations.

5 - Defining Meaningful Metrics for this New Century - A Condition-Based Maintenance Example

Simon Goerger, Assistant Professor & ORCEN Director, Department of Systems Engineering, Building 752 (Mahan Hall), United States Military Academy, West Point, NY, 10996, United States, Simon.Goerger@usma.edu, Ernest Wong

Metrics play a key role in organizational performance, and good metrics help to drive improvement. Leaders are, thus, concerned about what gets measured. In its infant stages, the CBM paradigm for U.S. Army aviation is resulting in new technologies and processes to improve warfighting capability. CBM intends to improve operational readiness, reduce maintenance down time, and provide cost savings. In order to evaluate CBM's viability, we examine new more meaningful metrics for consideration.

■ WC37

Room 337

Supply Chain Practice I

Contributed Session

Chair: H. Alan Love, Professor, Department of Information & Operations Management, Texas A&M University, 320 Wehner Building, College Station, TX, 77843-4217, United States, alove@tamu.edu

1 - A Fuzzy Decision Support System Design For Supplier Selection in Manufacturing Industries

Nevin Karaarslan, Maltepe University, Maltepe Universitesi Endustri Muh. Bol., Istanbul, Turkey, nevink@maltepe.edu.tr, Hasan Kacamak, Hayrettin Evirgen

The question of "who to buy from?" is simply the supplier selection that every firm faces. Many business decisions, including supplier selection, involve preferences. In edition, in many of there activities, exact information is either not available, or very difficult to get. Fuzzy logic allows computing with imprecise terms and fits well into the goals of the decision. Therefore, a software program implements the concepts in the model and fuzzy logic technique is developed.

2 - Valuing Corporate Social Performance in the Supply Chain

Amrou Awaysheh, Richard Ivey School of Business, University of Western Ontario, 1151 Richmond Street North, London, ON, N6A3K7, Canada, aawaysheh@ivey.ca, Robert Klassen

Research is only beginning to explore how a firm's management systems and relationships with suppliers and customers incorporate social issues - a critical dimension of sustainable development. Social issues are defined to encompass product and process characteristics that affect the quality of life for a wide range of stakeholders: customers, employees (both direct and indirect), and communities. To contribute to this emerging debate, results from an event study are presented.

3 - A Performance Driven Mechanism for Supply Chain Transformation

Changrui Ren, Staff R&D Engineer, IBM China Research Lab, Building 19 Zhongguancun Software Park, 8 Dongbeiwang WestRoad, Haidian District, Beijing, 100094, China, rencr@cn.ibm.com, Hongwei Ding, Wei Wang, Jin Dong

A performance driven mechanism for supply chain transformation is presented, which includes the steps of "measure", "diagnose", and "improve". By leveraging the advantage of industry standard SCOR (Supply Chain Operations Reference) model and performance analysis methods, both qualitative and quantitative approaches are designed to power the whole transformation process. A software workbench, which can support all these transformation efforts, is also introduced.

4 - A SCOR-Based Formulation of the Supply Chain Multi-Objective Optimization Problem

Jaime Mora, Head of the Graduate Program in Industrial Enginnering, ITESM CEM, Carr. Lago de Guadalupe km 3.5, Atizapan, 52926, Mexico, jmora@itesm.mx, Cesar Martinez

As many of today's supply chain inter-functional elements have been studied separately for years and traditional supply chain optimization problems consider either the cost or the time (or both) as the elements to be optimized, there is a need for a formulation that at the same time it includes all the inter-functional elements of the supply chain, it optimizes the attributes that guarantee total customer satisfaction such as flexibility, reliability, and responsiveness.

5 - Entry Effects on Strategic Input Procurement Competition

H. Alan Love, Professor, Department of Information & Operations Management, Texas A&M University, 320 Wehner Building, College Station, TX, 77843-4217, United States, alove@tamu.edu, Diana Burton

Limited production substitution possibilities for strategic inputs often result in concentrated downstream processing. In such environments, a potential entrant into a processing sector will intensify competition for inputs and therefore must consider the impact entry will have on input price. A method is demonstrated whereby strategic input price change and profit impacts of entry can be evaluated before a new downstream processor enters a supply area where processors are already operating.

■ WC38

Room 338

Operations Management I

Contributed Session

Chair: Carlos Oliveira, Oklahoma State University, 322 Engineering North, Stillwater, OK, 74078, United States, coliv@okstate.edu

1 - Analyzing Compound Causes of Bullwhip Effect

Xiaolong Zhang, Assistant Professor of Quantitative Methods, Department of Finance and Quantitative Analysis, Georgia Southern University, College of Business Administration, Statesboro, GA, 30460, United States, xzhang@georgiasouthern.edu, Gerard Burke

This paper investigates compound causes of the bullwhip effect. We consider a distribution system with cross-correlated demand streams. We examine a baseline scenario in which only forecasting causes the bullwhip effect and then introduce other sources including order batching, price variations, and shortage rationing into the problem. The compounded effects are decomposed and their manitudes are examined in relation to the parameters of the model.

2 - Nurse Triage Line: Value of Information and Strategic Implementation Policies

Xiaofang Wang, Tepper School of Business, Carnegie Mellon University, NSH 1502G, Robotics, 5000 Forbes Avenue, Pittsburgh, United States, xiaofanw@cs.cmu.edu, Laurens Debo

Health insurance companies need well-informed consumers. They have invested in some information services such as nurse triage line to support consumers' treatment decisions. Thus motivating consumers to fully use the information service becomes a key question. We develop an analytical model to study this question. We analyze demand patterns of health care services and propose possible solutions for the insurer's profit optimization problem.

3 - Capacity Decision Under Bass-Type Demand Dynamics

Bo Hu, PhD Candidate, The Simon School, University of Rochester, PhD Program, 4th Floor, C.G.Simon Hall, University of Rochester, Rochester, NY, 14627, United States, hub1@simon.rochester.edu, Nils Rudi, Harry Groenevelt

We study a profit-maximizing firm's capacity decision. Demand dynamics exhibit Bass-type diffusion (satisfied demand spreads positive word-of-mouth). The optimal capacity decreases with capacity and capital cost; increases with margin. When anticipating a "weak" competitor, the optimal capacity increases in hope of expelling the competitor from the market, but a "strong" competitor leads to sharing the market and lower capacity.

4 - Employee Turnover Intentions: A Review of Literature, Empirical Studies, and Contributing Factors

Kelly Weeks, Jackson State University, 1300 Lynch Street, Jackson, United States, wally188188@yahoo.com

This exploration contemplates the notion that there are moderating factors that affect employee turnover intentions when analyzing Organizational Citizenship Behavior (OCB). It is this paper's contention that in order to be able to forecast or minimize employee turnover, one must understand all the variables and interactions. So, to that effect, this paper offers the possibility that satisfaction plays a moderating role when viewing turnover intentions in relation to OCB.

5 - Equipment Schedule and Optimization with Backup Capacity Constraints

Carlos Oliveira, Oklahoma State University, 322 Engineering North, Stillwater, OK, 74078, United States, coliv@okstate.edu, William Giffen, Ricki Ingalls

We consider equipment schedule models with backup provisions for operations in the oil industry. A set of machines with different capacities is given. Each machine can be assigned to at most one job in an oil well, and jobs require a set of machines with capacity to handle its demands. Each job requires levels of machine backup. An MIP model is derived and a system of backup levels is determined. Experimental results show the efficiency of the models on real instances of the problem.

■ WC39

Ballroom B

Linear Programming

Contributed Session

Chair: John Butler, Assistant Professor, Ohio State University, 2100 Neil Avenue, Columbus, OH, 43210, United States, butler.267@osu.edu

1 - A Complete Closed-Form Solution to Stochastic Linear Programs with Fixed Constraint Coefficients

Elmor Peterson, Systems Science Consulting, 3717 Williamsborough Court, Raleigh, NC, 27609, United States, elpeterson@alumni.cmu.edu

Given a fixed but arbitrary constraint coefficient matrix A and a meaningful input probability distribution that jointly describes both the other input constraint data b and the objective-function data c and d, explicit formulas are given for the induced output probability distributions that individually describe problem consistency, problem boundedness, and problem optimality.

2 - Constraint Optimal Selection Techniques (COSTs) for a Class of Linear Programming Problems

H.W. Corley, Professor, The University of Texas at Arlington, PO Box 19017, Arlington, TX, 76019, United States, corley@uta.edu, Jay Rosenberger, Tai-Kuan Sung

We present two classes of Constraint Optimal Selection Techniques (COSTs) and develop a new algorithm in each class for solving nonnegative linear programming problems. We describe the geometric interpretation of these new algorithms and give computational results for some large-scale problems.

3 - Infinite Linear Programs

Archis Ghate, University of Michigan, IOE Department, 1205 Beal Avenue, Ann Arbor, MI, 48109, United States, archis@umich.edu, Robert Smith

We provide conditions for existence of extreme point optimal solutions, weak duality, complementary slackness, and absence of a duality gap for the class of countably infinite linear programs. Moreover, we show that a characterization of extreme points through positive "basic" variables can be developed under a strictly positive support condition. We explore the implications for developing a simplex method in the presence and absence of this condition.

4 - Assigning Priests to Parishes in West Texas

John Butler, Assistant Professor, Ohio State University, 2100 Neil Avenue, Columbus, OH, 43210, United States, butler.267@osu.edu, Leon Lasdon, Jim Dyer, Les Maiman

This presentation describes a decision support system to assist short and long term assignment of priests in the Roman Catholic Diocese of San Angelo, Texas. The mixed-integer programming formulation was implemented in GAMS with an Excel interface. This system has been adopted for further studies by the diocese's Chancellor and Priest Personnel Board.

■ WC40

Room 401

Environment, Energy, and Natural Resources

Contributed Session

Chair: Shalini Vajjhala, Fellow, Resources for the Future, 1616 P Street, NW, Washington, DC, 20036, United States, shalini@rff.org

1 - Market Power Mitigation at the Midwest ISO

Peter Whitman, Potomac Economics, 4029 Ridge Top Road, Suite 350, Fairfax, VA, 22030, United States, pwhitman@potomaceconomics.com

Along with the introduction of restructured electricity markets came the increased potential for market abuses. Market monitors, as described in Order 2000, are an import safeguard to maintain efficiency and reduce the exercise of market power. The Midwest ISO has an Independent Market Monitor to identify, report and initiate market power mitigation in accordance with the MISO tariff. We present one aspect of the market power mitigation: the conduct-impact test in the MISO Real Time Market.

2 - New Developments in ISO Power Markets in the United States

Jonathan Jacobs, Managing Consultant, PA Consulting Group, 75 Nova Drive, Piedmont, CA, 94610, United States, jon.jacobs@paconsulting.com, Alasdair Turner, John George

Independent System Operators (ISOs) in the United States have recently begun implementing spot markets that feature combined optimization of energy and reserves, with locational detail. At least one ISO has also implemented a forward auction for operating reserves. We will describe how these markets are being conducted, and how one tests and certifies the details of the software implementations.

3 - R&D Portfolio Investment under Uncertain Carbon Tax

Ekundayo Shittu, Research Assistant, University of Massachusetts, Amherst, MA, 01003, United States, eashittu@engin.umass.edu

Just as environmental damage can be partially or totally irreversible, so is the optimal abatement investment decision a firm makes. In this paper, we explore the profile of a firm's portfolio of energy R&D technology investment under an uncertain carbon tax. We model the uncertain tax as a stochastic jump process with random timing and magnitude. The optimal path of investment decisions in a two-technology portfolio is examined.

4 - Siting Difficulty and Renewable Energy Development

Shalini Vajjhala, Fellow, Resources for the Future, 1616 P Street, NW, Washington, DC, 20036, United States, shalini@rff.org

Renewable energy projects in sensitive, isolated environments face increasing siting constraints. Using GIS and statistical analysis, this research examines the relationships between U.S. wind, solar, and geothermal resources and a constructed measure of state-level transmission line siting difficulty. Results reveal significant interstate variation in resource availability and siting difficulty with policy implications for meeting state Renewable Portfolio Standards and regional energy plans.

■ WC41

Room 402

Queueing Applications in Manufacturing and Services

Sponsor: Applied Probability

Sponsored Session

Chair: Opher Baron, University of Toronto, 105 St. George Street, Toronto, ON, M5S 3E6, Canada, Opher.Baron@Rotman.Utoronto.Ca

1 - Learning and Resource Allocation in Service Networks

Kevin Ross, Assistant Professor, University of California Santa Cruz, 1156 High Street, SOE3, Santa Cruz, CA, 95064, United States, kross@soe.ucsc.edu, Geoffrey Ryder

Service networks such as call centers rely on scheduling people with various skill levels among multiple tasks. Further, their skills evolve as they gain experience in each task. We analyze resource allocation in this environment, where immediate delay and buffer penalties are traded off against long term service capacity. We find that queued jobs should sometimes be served by slower workers when this leads to service rate progress along a typical learning curve.

2 - Dimensioning the Repairman Problem with Spares

Isilay Degirmenci, Duke University, Fuqua School of Business, 1 Towerview Drive, Durham, NC, 27708, United States, it@duke.edu, Otis Jennings, Francis de Véricourt

Consider the repairmen problem with spares consisting of n machines that breakdown, s repairmen and m spare machines. As a function of n, we set a staffing (of repairmen) and stocking (of spares) policy pair. Each element of the policy falls into one of three limiting regime categories: efficiency-driven, quality-driven or quality- and efficiency-driven. For each valid regime combination, we prove many-server limit theorems. Selection of the policy is accomplished through constraint satisfaction or cost minimization.

3 - Staffing to Maximize Revenues with Alternate Service Level Agreements

Joseph Milner, Professor, milner@rotman.utoronto.ca, Opher Baron

We determine the profit maximizing staffing policy for alternate service level agreements for an outsourced call center operating in an environment with uncertain demand and abandonment. In a new heavy traffic regime, we approximate the probability of abandonment and of meeting a service level measured by the percentage of customers served within the acceptable delay. We compare staffing to maximize profits dependent on service failure penalties over alternate time periods and draw conclusions.

4 - Law for the i^{th} Waiting Time in a Busy Period of a G/M/1 Queue

Opher Baron, University of Toronto, 105 St. George Street, Toronto, ON, M5S 3E6, Canada, Opher.Baron@Rotman.Utoronto.Ca

We use induction to derive the distribution of the waiting time of the $i^{\{th\}}$ waiting customer in a busy period for a G/M/1 queue with a first come, first served service. We use the Lindley recursion to relate our result to a conditional distribution of random walk and a one-sided regulated random walk.

■ WC42

Room 403

Scheduling Applications II

Contributed Session

Chair: Ozay Ozaydin, Research Assistant, Dogus University, Acibadem, Zeamet Sokak No: 21, Istanbul, 34722, Turkey, oozaydin@dogus.edu.tr

1 - Two-Machine Flowshop Scheduling Problem with Random Processing Times

Hossein Soroush, Associate Professor, Department of Statistics & Operations Research, Kuwait University, PO Box 5969, Safat, 13060, Kuwait, hsoroush@kuc01.kuniv.edu.kw

The available literatures on the stochastic two-machine flowshop scheduling problem, in which job processing times are random variables, utilize the expected makespan criterion. In this paper, we study a stochastic two-machine flowshop problem with distinctly distributed processing times to determine a schedule that minimizes the expected total completion times of all jobs. In particular, we explore three scenarios of the problem when processing times are normally distributed.

2 - Tabu Search Heuristics for the Group-Scheduling Problems in PCB Manufacturing

Cumhur Gelogullari, Operations Research Analyst, American Airlines, 4333 Amon Carter Boulevard MD 5358, Fort Worth, TX, 76155, United States, Cumhur.Gelogullari@aa.com, Rasaratnam Logendran

We address the multi-machine flowshop group-scheduling problem with carryover sequence-dependent setup times in PCB manufacturing. To minimize the mean flow time of this strongly NP-hard problem efficiently and effectively, we develop different tabu search (TS) algorithms, each consisting of two layers of search. The applicability of the algorithms is demonstrated on an example problem, and the experimental results obtained confirm the high quality of the TS solutions.

3 - Collaborative Vessel Scheduling in Semi-Liner Shipping Operations

Chunxing Fan, Rutgers, The State University of New Jersey, 180 University Avenue, PhD Program, Newark, NJ, 07102, United States, cxfan@andromeda.rutgers.edu, Lei Lei, Maria Boile, Sotirios Theofanis

We mathematically model and empirically investigate the operational performance of vessel schedules under three management policies: the non-collaborative, the slot-sharing, and the total-sharing. Empirical results from over 900 randomly generated test cases under different problem settings are reported. We observed that without partner carriers' willingness to fully share the demand and the resources in a flexible manner, the promise of collaborative planning cannot be fully delivered.

4 - A Crew Scheduling Decision Support Model for a Local Airline

Ozay Ozaydin, Research Assistant, Dogus University, Acibadem, Zeamet Sokak No: 21, Istanbul, 34722, Turkey, oozaydin@dogus.edu.tr, Ilker Topcu

Airline crew scheduling is concerned with finding a minimum cost assignment of flight crews to a given flight schedule while satisfying related restrictions. In this study, a decision model is proposed for creating possible flight series composed of various flight legs covering the flights in schedule and assigning the airline crew to the optimum series among possible ones. The model is utilized for a national airline company.

■ WC43

Room 404

Multicriteria Decision Making I

Contributed Session

Chair: Igor Linkov, Senior Scientist, Cambridge Environmental Inc., 58 Charles Street, Cambridge, MA, 02141, United States, ilinkov@yahoo.com

1 - Multicriteria Decision Making Under Uncertainty and Risk

Sundeep Samson, Graduate Student, Clemson University, O-106 Martin Hall, Box 340975, Clemson, SC, 29634, United States, ssamson@clemson.edu, James Reneke

Decision problems under conditions of uncertainty and risk are challenging. The decomposition methodology to be presented exploits separable stochastic approximations of random fields and the functional representations of risk. This methodology has the potential of resolving complex problems such as multicriteria real portfolio selection and engineering design problems.

2 - Multi-Criteria Decision Support for Public Project Selection

Peter Kelle, Professor, Louisiana State University, ISDS Department, Baton Rouge, LA, 70803, United States, qmkell@lsu.edu, Helmut Schneider

In the selection of public projects several objectives must be considered besides profit maximization. Our methodology can be applied where tens of projects are to be selected out of hundreds or thousands of potential projects and the selection have to be based on difficult to compare multi-criteria objectives. A case study of selecting highway improvement projects demonstrates the decision support process.

3 - Multi-Scenario Multi-Objective Optimization with Applications in Engineering Design

Margaret M. Wiecek, Professor, Clemson University, Department of Mathematical Sciences, O-106 Martin Hall, Box 340975, Clemson, SC, 29634-0975, United States, wmalgor@clemson.edu

A theoretical and methodological framework for handling decision-making problems represented as collections of multi-objective problems is proposed. Two research issues arise in this context: the modeling of decision maker's preferences over a collection of problems and the development of solution approaches to finding a preferred feasible solution for the collection. Findings are illustrated with mathematical examples and case studies from engineering design.

4 - New Preference Models for Decision Problems with Multiple Objectives

Alexander Engau, PhD Candidate, Clemson University, Department of Mathematical Sciences, O-106 Martin Hall, Box 340975, Clemson, SC, 29634-0975, United States, aengau@clemson.edu, Margaret M. Wiecek

The assessment and modeling of preferences are important for both theory and real-life applications of multicriteria decision making. Revealing drawbacks of the classic but static Pareto concept, we use a framework of general preference cones to propose alternative models that allow for changing preferences. Examples of practical relevance are given.

5 - Use of Multi Criteria Decision Analysis (MCDA) to Prioritize Small Arms Technology Gaps

Igor Linkov, Senior Scientist, Cambridge Environmental Inc., 58 Charles Street, Cambridge, MA, 02141, United States, ilinkov@yahoo.com, John Edwards, F. Kyle Satterstrom, George Fenton

This presentation reports MCDA approach and implementation for prioritizing 72 capability gaps identified by Joint Small Arms Capability Analysis. To elicit decision-makers' preferences, a survey was developed and administered to representatives of Army, Navy, Marines, Air Force, SOCOM and Coast Guard. Comparison of the consensus and individual branches' prioritization showed the two to be quite similar, with differences explained by service branches' specific concerns.

■ WC44

Room 405

Use of Optimization in Networks & Graphs

Contributed Session

Chair: Marcus Volz, Department of Electrical & Electronic Engineering, The University of Melbourne, Victoria, 3010, Australia, m.volz@ee.unimelb.edu.au

1 - Integer Programs for Modularity Maximization

Yiming Yao, Lawrence Livermore National Lab, 7000 East Avenue, Livermore, CA, 94550, United States, yyao@llnl.gov, Tracy Hickling, William Hanley

We formulate the problem of finding community structure in graphs as an integer program (IP) that attempts to maximize Newman's modularity. Though the optimal solution to the IP model is possible only for small graphs, it can serve as a verification tool for heuristic algorithms. We present IP solutions on some graphs in the research literature and compare them with results obtained from a well known heuristic algorithm.

2 - Least-Squares Network Flow Algorithm

Seunghyun Kong, PhD Student, Georgia Institute of Technology, 251 10th Street NW, D-305, Atlanta, 30318, United States, konggas@gmail.com, Ellis Johnson, Joel Sokol

When least-squares primal-dual algorithm is applied to network flow problem, there are good properties to enhance the performance of the algorithm. The algorithm is compared to other network flow algorithm citing its advantages and disadvantages. Some ideas to overcome the computational bottleneck and to decrease the number of iterations are also explained. The computational result is compared with CPLEX.

3 - Multi-Depot Multi-Vehicle-Type Vehicle Scheduling Problem: TSN vs. CBN

Cheng-Kang Chen, Associate Professor, National Taiwan University of Science and Technology, No. 43, Sec. 4, Keelung Road, Taipei, Taiwan, ckchen@cs.ntust.edu.tw, Cheng-Huang Hung

Two different formulations, which are time-space network (TSN) and connection-based network (CBN), are constructed and analyzed for the multi-depot multi-vehicle-type vehicle scheduling problem (MDMV-VSP). A key feature differentiating our paper from extant literature is that the task cost is considered to be dependent on the vehicle type assigned to the task. By utilizing the optimization software CPLEX to compare TSN and CBN formulations, several interesting observations are obtained.

4 - Pseudoflow-Push Algorithms for the Maximum Flow Problem
Cenk Caliskan, Assistant Professor, University of Delaware, Department of Business Administration, 211 Alfred Lerner Hall, Newark, DE, 19716, United States, caliskanc@lerner.udel.edu

We introduce a class of pseudoflow-push algorithms for the maximum flow problem with the same worst-case time as their augmenting path counterparts. Pseudoflow-push algorithms differ from augmenting path algorithms in the sense that feasibility is obtained at termination, but they are also similar because flows are pushed on paths. We present the generic pseudoflow-push algorithm, as well as the shortest balancing path and capacity scaling versions of it.

5 - The Gradient-Constrained Fermat-Weber Problem with Applications to Underground Mine Design
Marcus Volz, Department of Electrical & Electronic Engineering, The University of Melbourne, Victoria, 3010, Australia, m.volz@ee.unimelb.edu.au

In this paper we introduce the gradient-constrained Fermat-Weber problem and provide a general method for solving the three-dimensional case. We demonstrate the efficiency of the algorithm using a computer program. We discuss applications of this work to the optimal design of underground mines and present an industry case study.

■ WC45

Room 406

Tutorial: Complementarity-Based Modeling of Electric Power Markets: Transmission Constraints and Market Power

Cluster: Tutorials
Invited Session

1 - Complementarity-Based Modeling of Electric Power Markets: Transmission Constraints and Market Power
Benjamin Hobbs, The Johns Hopkins University, Dept. Geography & Env. Engineering, Baltimore MD, United States, bhobbs@jhu.edu

I discuss the modeling of power market games using this powerful and flexible approach. Such models can represent large systems, including thousands of generators and transmission lines, while accounting for peculiarities of particular market designs. I review models of perfect competition and Cournot competition, and their use in evaluations of market designs, merger proposals, and transmission reinforcements. Multilevel games, represented as MPECs and EPECs, are also discussed.

■ WC47

Room 408

Supply Chain Risk Management II

Contributed Session

Chair: Jack Crumbly, Doctoral Student, Jackson State University, 1711 Melrose Place, Clinton, MS, 39056, United States, jackcrumbly@hotmail.com

1 - Analysis of Supplier's Downside Risk Aversion in a Supply Chain with a Risk Neutral Retailer
Sudarsan Rangan, Student, The University of Alabama, 361 Stadium Drive, Box 870226, Tuscaloosa, AL, 35487, United States, srangan@cba.ua.edu, Charles Sox

Here we consider a supply chain with a downside risk averse supplier and a risk neutral retailer. We analyze the supplier's downside risk in some common supply contracts in vogue. We also try to propose a risk sharing contract to coordinate the channel.

2 - Strategic and Tactical Risks of Supply Chain Disruption
Zigeng Yin, PhD Student, Northwestern University, 2145 Sheridan Road, C231, Evanston, IL, 60208, United States, z-yin@northwestern.edu, Seyed Iravani, Wally Hopp

Disruption of a supply chain due to a supplier problem, political event or natural disaster can result in both short-term tactical costs and long-term strategic consequences. We develop a framework to consider both types of risks and discuss methods for reducing risk exposure. We find that while redundancy policies, using inventory and capacity, can be effective in reducing tactical risk, strategic risk is better addressed via organizational preparation and speed of response in a crisis.

3 - The Impact of Customer Returns on Optimal Pricing and Inventory Policies
Jing Chen, PhD Candidate, Ivey School of Business, the University of Western Ontario, 279G, Windermere Road, London, ON, N6G 2J7, Canada, jchen@ivey.uwo.ca, Peter Bell

We investigate decisions on price and inventory policies for the firm facing selling a product with customer returns that depend on sales volume and/or prices. We derive optimum solutions for single period and multi-period deterministic and dynamic problems and use these results to draw conclusions on how the practice of revenue management is affected by the presence of customer returns.

4 - Input Price Hedging with Futures in Newsvendor Models under Conditional Value-at-Risk Criterion
Ke Huang, Graduate Student, SEEM, The Chinese University of Hong Kong, PGH1, CUHK, Shatin, N.T., Hong Kong, khuang@se.cuhk.edu.hk

In this paper we consider the newsvendor model with demand and input price uncertainty. In addition to make order decision, a risk-averse processor uses futures to hedge the input price uncertainty. For a single selling season, we use the Conditional Value-at-Risk risk measure as well as the tradeoff between the expected revenue and the Conditional Value-at-risk as the optimality criteria of the risk-averse processor.

5 - Organization Structure for Disaster Response: Building Dynamic Capability through Structural Changes
Jack Crumbly, Doctoral Student, Jackson State University, 1711 Melrose Place, Clinton, MS, 39056, United States, jackcrumbly@hotmail.com, Samhita Shah, Rupak Rauniar

The beginning of 2000 has seen catastrophic incidents that have impacted business operations for firms. As firms build and sustain capabilities to implement operations policies for the disaster handling, an approach to incorporate structural changes can lead businesses to turn such environmental threats into opportunities. Drawing from Burgleman (1984), the present study proposes a theoretical matrix to align operational relatedness and strategic importance for its product and services.

■ WC48

Room 409

Price and Lead Time Decisions

Sponsor: Manufacturing & Service Operations Management
Sponsored Session

Chair: Esma Gel, Arizona State University, Department of Industrial Engineering, PO Box 5906, Tempe, AZ, 85287, United States, esma.gel@asu.edu

Co-Chair: Pinar Keskinocak, Associate Professor, ISYE, Georgia Institute of Technology, 765 Ferst Drive, NW, Atlanta, GA, 30332, United States, pinar@isye.gatech.edu

1 - Integrated Production Planning and Pricing with Congestion-Prone Production Resources
Reha Uzsoy, Professor, Purdue University, 315 N. Grant Street, West Lafayette, IN, 47907, United States, uzsoy@ecn.purdue.edu, Abhijit Upasani

We present an integrated production planning and pricing model where demand is determined by both price and lead time, and production resources are subject to congestion. We examine the relationship between lead times, prices and demand characteristics and provide numerical examples comparing the results to those from a fixed lead time model that does not capture the relationship between resource loading and lead times.

2 - Dynamic Pricing and Leadtime Quotation in a Make-to-Order Queue
Costis Maglaras, Associate Professor, Columbia University, Graduate School of Business, 409 Uris Hall, 3022 Broadway, New York, NY, 10027, United States, c.maglaras@gsb.columbia.edu, Sabri Celik

We study a profit maximizing make-to-order manufacturer that offers multiple products to a market of price and delay sensitive users. Our model captures three aspects of interest: 1) The joint use of dynamic pricing and leadtime quotation controls; 2) The ability to expedite orders at a cost; and 3) The interaction of the demand controls with sequencing and expediting decisions that the firm must employ to optimize profits and satisfy the quoted leadtimes.

3 - Value of Considering Service-Sensitive Demand in Customer Acceptance Decisions
Serhan Duran, Graduate Research Assistant, School of Industrial & Systems Engineering, Georgia Institute of Technology, Atlanta, GA, 30332, United States, gtg865i@mail.gatech.edu, Julie Swann, Altan Gulcu, Pinar Keskinocak

We investigate a manufacturer's customer acceptance decisions when past performance in meeting quoted leadtimes affects the future arrivals of customers. We focus on finite capacity under an industry-dictated leadtime. We investigate the conditions under which the optimal accept decision is structured with respect to service level. We compare the manufacturer's profit from the service-savvy policy to one in which a manufacturer is ignorant of the impact of past performance.

4 - Joint Price and Lead-Time Quotation in Make-to-Order Systems
Esma Gel, Arizona State University, Department of Industrial Engineering, PO Box 5906, Tempe, AZ, 85287, United States, esma.gel@asu.edu, Pinar Keskinocak, Ozgun Bekki

We consider the problem of dynamically quoting price and lead-time to arriving customers. The facility operates in a make-to-order mode with a limited buffer area. We formulate the problem as an MDP to maximize the expected total discounted profit and show various characteristics of an optimal policy. We demonstrate the value of price and lead time quotation flexibility through numerical analysis and provide results on a simple heuristic to determine effective quotes.

■ WC50

Room 411

Supply Chain Practice II

Contributed Session

Chair: Hongwei Ding, IBM China Research Lab, Building 19 Zhongguancun Software Park, 8 Dongbeiwang WestRoad, Haidian District, Beijing, 100094, China, dinghw@cn.ibm.com

1 - A Rule-Based Available-to-Promise (ATP) System for MTO/ATO Manufacturing Company
Emin Gundogar, Sakarya University, Sakarya Universitesi Bilgi Islem, D. Bsk., Esentepe Kampusu, Adapazari 54 54187, Turkey, gun@sakarya.edu.tr, Yavuz Burak Canbolat, Baha Guney

Manufacturing companies just want to give their customers reliable quote lead times and delivery dates. But it is a hard process in a firm having various configures of products and final assembly groups. Therefore, the system should make automatically the needed and proper modifications when they are input. In this study, a rule based expert available-to-promise (ATP) system in ERP, which was developed and applied for a MTS/ATO manufacturing company, is presented.

2 - Integrated Statistical Data Modeling and Stochastic Optimization for Dynamic Supply Chain Planning
Viji Krishnamurthy, Product Engineer - Supply Chain Optimization, Philips Lumileds Lighting, 370 West Trimble Road, San Jose, CA, 95131, United States, viji.krishnamurthy@philips.com

This paper develops an approach for supply chain planning of a multistage production-inventory system where each stage is characterized by stochastic process parameters, supply and demand. We solve each stage using a combination of statistical analysis that derives nonlinear regression models, and stochastic optimization that uses decomposition and hybrid heuristic methods. We show an iterative approach for integrating stage optimization modules to derive aggregate planning for the supply chain.

3 - Classification of Quick Response Supply Networks
Nan Wang, Institute for Manufacturing/University of Cambridge, 16 Mill Lane, Cambridge, CB2 1RX, United Kingdom, nw259@cam.ac.uk, Yongjiang Shi

This study investigates response capability as a key competitive advantage to tackle business environmental uncertainty and complexity. We propose a framework grounded from case studies of top international clothing companies. The framework integrates quick response components and processes from the best practices in global operations. It builds upon a synthesis of three types of responses from alternative supply chain configurations.

4 - Integrated Supply Chain Network Optimization and Analysis
Hongwei Ding, IBM China Research Lab, Building 19 Zhongguancun Software Park, 8 Dongbeiwang West Road, Haidian District, Beijing, 100094, China, dinghw@cn.ibm.com, Jin Dong, Wei Wang, Changrui Ren

An integrated workbench for supply chain network optimization and analysis is proposed to facilitate decision-making on sourcing and distribution strategies, transportation volume allocation and service territory assignment. Mixed integer programming, linear programming, heuristics and simulation are employed to enable the workbench, with a graphic interface. The workbench is applied in a hi-tech manufacturing company to help supply chain mangers define their sourcing and assembly strategy.

■ WC51

Room 412

Scheduling/Maintenance in Aviation Applications

Contributed Session

Chair: Gizem Keysan, Georgia Institute of Technology, 58 6th Street NE, Unit 2201, Atlanta, GA, 30308, United States, gkeysan@isye.gatech.edu

1 - Itinerary Design and Airline Scheduling for Small Airlines in Mexico
Federico Trigos, LSOG/BIE Chairman, ITESM Campus Toluca, Eduardo Monroy Cardenas 2000, San Antonio Buenavista, Toluca, Mx, 50110, Mexico, ftrigos@itesm.mx

Most of the research in Airlines has been paid by big companies and therefore those developments have been designed for very big models. We study two of the most important steps in the operations of a single fleet airline. Our model works in an integral form and makes the decision of where to fly and the weekly route of the aircrafts involved. Maintenance and regular operational issues are also taken into consideration. Numerical experimentation is based on real instances.

2 - The Tail Assignment Problem - A Hybrid Column Generation and Constraint Programming Approach
Mattias Grönkvist, Carmen Systems AB, Odinsgatan 9, Göteborg, SE-41103, Sweden, mattias.gronkvist@carmensystems.com, Sami Gabteni

Tail Assignment is the problem of assigning flights to aircraft while satisfying all operational constraints, and optimizing some objective function. We present a hybrid column generation and constraint programming solution approach. This approach can be used to quickly produce solutions for operations management, and also to produce close-to-optimal solutions for long and mid term planning scenarios. We present computational results which illustrate the practical usefulness of the approach.

3 - Scheduled Maintenance Planning for an Air Taxi Service
Gizem Keysan, Georgia Institute of Technology, 58 6th Street NE, Unit 2201, Atlanta, GA, 30308, United States, gkeysan@isye.gatech.edu, Martin Savelsbergh, George Nemhauser, Renan Garcia, Faramroze Engineer

We study a scheduled maintenance planning problem for a per-seat on-demand air transportation service. The aim is to use the maintenance cycle of each jet as efficiently as possible while providing a smooth workflow into the maintenance facility and ensuring the capacity of the facility is never exceeded. We use a look ahead strategy over a rolling time horizon to determine which jets are to be sent to maintenance and the itineraries assigned to each jet in the fleet.

■ WC52

Room 413

Data-Driven Research on Pricing and Revenue Management

Sponsor: Revenue Management & Pricing

Sponsored Session

Chair: Itir Karaesmen, Assistant Professor of Management Science, University of Maryland, Robert H. Smith School of Business, Decision and Information Technologies, College Park, MD, 20742, United States, ikaraes@rhsmith.umd.edu

1 - Predicting Price in Concurrent Online Auctions
Wolfgang Jank, Assistant Professor, University of Maryland, 4322 Van Munching Hall, College Park, MD, 20742, United States, wjank@rhsmith.umd.edu, Galit Shmueli

Several hundred even thousand concurrent auctions for the same or similar item take place on eBay every day. We investigate the question whether concurrency has an effect on an auction's price. We propose a spatio-temporal semiparametric model. The spatial model component accounts for item similarity. The temporal component accounts for correlation in price over time. The flexible semiparametric approach results in high prediction accuracy. We illustrate our model on a set of laptop auctions.

2 - Intertemporal Price Discrimination with Forward-Looking Consumers: The Market for Video-Games
Harikesh Nair, Assistant Professor of Marketing, Stanford University, 518 Memorial Way, Graduate School of Business, Stanford, CA, 94035, United States, Nair_Harikesh@gsb.stanford.edu

We develop a framework to investigate empirically intertemporal price discrimination policies by firms selling durable-good products. Prices in the model are equilibrium outcomes of a game played between strategic forward-looking consumers and firms. We present methods to infer estimates of demand

under such dynamic consumer behavior, and to compute optimal prices. An empirical application to the market for video-games is presented.

3 - Consumer Price Sensitivities Across Categories
Sri Devi Duvvuri, Assistant Professor, Tippie College of Business, University of Iowa, Iowa City, IA, 52242, United States, sri-duvvuri@uiowa.edu, Thomas Gruca

A Hierarchical Bayesian factor analytic approach is used to explore how market structure affects the relationships among consumer price sensitivities for categories that are related - substitutes or complements. The factor structure allows estimation of higher-order factors so complex and managerially important patterns of covariation in price sensitivities can be deduced. The model is empirically tested using scanner panel data.

4 - Integrating Revenue Management Systems with Recommendation Engines: An Application for Sheraton
Senthil Veeraraghavan, Wharton School, Philadelphia, PA, 19104, senthilv@wharton.upenn.edu, Christian Terwiesch

A hotel room is an experience good: the customers do NOT know the product before arriving at the hotel. Sheraton does not know the customer and the purpose of her visit; this makes it difficult to recommend a room. A customer who is interested in exploring a range of options is likely to do so by going to expedia; however, this will make the customer search ACROSS hotels. The study addresses the three shortcomings in the hotel's RM system which has to be coordinated with customer search.

■ WC53

Room 414

Information Sharing in Supply Chain Management

Contributed Session

Chair: William Sawaya, Cornell University, Civil and Environmental Engineering, Hollister Hall, Ithaca, NY, 14853-3501, United States, wjs32@cornell.edu

1 - A Markov Decision Model for Supply Chain Information Sharing
Lauren Davis, Assistant Professor, North Carolina A&T State University, 1601 East Market Street, 404 McNair, Greensboro, NC, 27411, United States, lbdavis@ncat.edu, Russell King, Thom Hodgson

A two-stage serial supply chain, where the retailer shares information with the supplier, is modeled as a Markov Decision Model. A completely observable MDP represents the case when full information sharing occurs. The case of no information sharing is modeled as an MDP with restricted observations. We characterize the structure of the optimal policy with and without information sharing and quantify the cost associated with sharing information.

2 - Effect of Information Sharing on Supply Chain Stability and the Bullwhip Effect
Yanfeng Ouyang, Assistant Professor, University of Illinois at Urbana-Champaign, 205 N. Mathews Avenue, Urbana, IL, 61801, United States, yfouyang@uiuc.edu

This paper analyzes the bullwhip effect in multi-stage supply chains with shared information (i.e., orders and inventories at all stages). The paper (i) Characterizes orders placed at any supplier stage for known and ergodic customer demand processes; and (ii) Derives robust analytical conditions to predict and bound the bullwhip effect, independent of the customer demand. It is shown as a special case that sharing customer demand information reduces but does not eliminate the bullwhip effect.

3 - Retail Promotions: The Value of Information Sharing Up the Supply Chain
John Aloysius, Associate Professor, University of Arkansas, WCOB 204 University of Arkansas, Fayetteville, AR, 72701, United States, aloysius@uark.edu, Travis Tokar, Matthew Waller

Information regarding retail promotions can improve the quality of replenishment decision making. We present four dynamic programs that analyze the optimal replenishment strategies in the 2X2 cases when information regarding the timing and the magnitude of promotions are available/not available in the beer distribution game, a simulated supply chain. We report the results of two controlled experiments in which we manipulate information regarding timing and magnitude of promotions.

4 - Upstream Information Sharing in a Serial Supply Chain with Supplier Random Yields
Hyun-Cheol Choi, Doctoral Student, Indiana University, 2451 E. 10th Street #714, Bloomington, IN, 47408, United States, hyunchoi@indiana.edu, Srinagesh Gavirneni, J. Doug Blocher

We look at the benefits of a supplier sharing its upstream production information with its customers in a two-stage supply chain where the supplier's processes have uncertain yields. Our computational study shows that information is more beneficial when the lead time from the supplier to its customer is short, when the uncertainty in the supplier's yield is high, when customer demand variances are low, and when the stock-out penalty to holding cost ratio is high.

5 - Agent-Based Simulation of Point-of-Sale Information Sharing in a Heterogeneous Distribution Network
William Sawaya, Cornell University, Civil and Environmental Engineering, Hollister Hall, Ithaca, NY, 14853-3501, United States, wjs32@cornell.edu

The impact of sharing point-of-sale data is investigated using an empirically-motivated, agent-based simulation of a distribution network. Each DC faces empirically-based, non-normal, heterogeneous demand and has stochastic and heterogeneous transportation times, each also passes POS data to the manufacturer daily. Findings indicate that even in this setting and with relatively large coefficients of variation, the sharing of point-of-sale information leads to system-wide cost reductions.

■ WC54

Room 415

Strategic Planning

Contributed Session

Chair: Jun Ma, Xi'an Jiaotong University, 28 Xianning Road, Xian, Shaanxi, Xian, Shaanxi, 710049, China, junma@mail.xjtu.edu.cn

1 - First Stage of the Risk Management: Identify Risks
Deniz Kasap, Researcher, TUBITAK-TUSSIDE, Baris Mah. Kosuyolu Cad. No:48 PK.14, Gebze, Kocaeli, 41401, Turkey, dkasap@tusside.gov.tr, Murat Kaymak

Risk identification is the first step in the risk management process. Before risk can be managed, it must be identified. Stating and analyzing these identified risks clearly will lead to more effective decision making in various steps of the projects. In this study, we our goal is to determine basic risks especially in long-term projects.

2 - Signpost Approach to Strategic Decision Support
Ruoyi Zhou, Research Staff Member, IBM Research, Almaden Research Center, 650 Harry Road, San Jose, CA, 95120, United States, ruoyi@us.ibm.com, Ray Strong

We describe a novel signpost-based approach to enterprise contingency planning at the strategic initiative level. A signpost is a recognizable potential future event that signals a change of significance to the enterprise. Our focus will be on techniques for generating high quality signposts.

3 - Reorganization of Global Supply Chains: A Mathematical Framework and Applications
Baptiste Lebreton, Postdoctoral Research Fellow, INSEAD, 19, Boulevard de Constance, Fontainebleau, 77300, France, baptiste.lebreton@insead.edu, Luk N. Van Wassenhove

Global manufacturers often face the issue of closing current capacities while opening new ones in emerging countries. Nevertheless, we observe that the current literature on strategic network planning does not particularly address this issue as the models generally assume a greenfield situation. Therefore, we present a dedicated network planning model whose relevance is illustrated with help of two practical cases studies (chemical industry and consumer goods).

4 - Product Portfolio Strategies: The Case of Multi-Function Products
Asoo Vakharia, Professor, University of Florida, 355D Stuzin Hall, PO Box 117169, Gainesville, FL, 32611, United States, asoov@ufl.edu, Aydin Alptekinoglu, Yuwen Chen

Product portfolio decisions are one of the most strategic commitments made by a firm. Motivated by the proliferation of multi-function products in consumer markets, we investigate product portfolio decisions for a single firm. Notable among industries where multi-function products are making a major impact is consumer electronics (e.g. cell phones and PDAs).

5 - Cognition and Experiential Learning: The Evolution of Organization with Different Tasks
Jun Ma, School of Management, Xi'an Jiaotong University, Xi'an, Shaanxi, Xi'an, 710049, China, majun@mailst.xjtu.edu.cn, Youmin Xi, Hua Zhang

Organizational capabilities research have paid much attention on the routine-based evolution of capabilities but largely ignored the roles played by cognition. We use the OrgAhead model to introduce experiential learning and cognition to the organization capability. We compared the different model's performance and present the proper models for diversely complex tasks.

■ WC55

Room 416

Information Systems

Contributed Session

Chair: Li-Lin Liu, PhD Student, FIU, 9631 Fontainebleau Boulevard, Apt# 515, Miami, FL, 33172, United States, lliu005@gmail.com

1 - A Navigation System Using Mobile Database

Kyounghwan An, ETRI, 161 Gajeong-dong, Yuseong-gu, Daejeon, South Korea, mobileguru@etri.re.kr, Juwan Kim

Currently, a navigation system uses a proprietary file format on an external device like PDA or an embedded device like telematics terminal. However, the system is very difficult to update the stored map incrementally and to combine the navigation service with other services. This paper solves the problems by using mobile database. The suggested mobile database provides additional structures and algorithms to manage map data and network data for vehicle routing.

2 - Exclusive Licensing in Complementary Network Industries

Ravi Mantena, Assistant Professor, University of Rochester, Carol Simon Hall 3-318, PO Box 270100, Rochester, NY, 14627, United States, mantena@simon.rochester.edu, Ramesh Sankaranarayanan, Siva Viswanathan

This study seeks to understand the drivers and consequences of exclusive licensing in network industries, with a specific focus on the video-gaming industry. We derive conditions that lead to regimes of exclusivity and non-exclusivity and examine their implications for the competitive outcomes for console manufacturers and game publishers.

3 - Open Source Business Models

Evangelos Katsamakas, Fordham University/School of Business, 113 West 60th Street, 625A, New York, NY, 10023, United States, katsamakas@fordham.edu

The emergence of open source software movement has driven the creation of new business models in the software industry. This paper provides a classification of these models, and analyzes pricing, profitability and competition. The analysis is based on game-theoretic economic models, and supplemented with simulations.

4 - The Association Between Knowledge Management System, Strategic Orientation, and Firm Performance

Li-Lin Liu, PhD Student, FIU, 9631 Fontainebleau Boulevard, Apt# 515, Miami, FL, 33172, United States, lliu005@gmail.com, Sheng-Ying Tseng

This paper attempts to examine the association between KMS adoption, strategic orientation, level of innovation and firm performance. Hopefully, the findings can provide some new insights into the productivity paradox associated with KMS adopters as well as some significant implications to both IS researchers and practitioners regarding the decisions of KMS investments. A regression method will be employed to conduct the analysis and to test for the ten hypotheses proposed.

Wednesday, 3:30pm - 5:00pm

■ WD01

Room 301

Solution Techniques in Integer Programming

Contributed Session

Chair: Nicolas Sawaya, Carnegie Mellon University, Department of Chemical Engineering, 5000 Forbes Avenue, Pittsburgh, PA, 15213-3890, United States, nws@andrew.cmu.edu

1 - A Dual Decomposition Method for Stochastic Uncapacitated Facility Location Problems

Cheng (Marshal) Wang, University of Toronto, 915-30 Charles Street West, Toronto, M4Y1R5, Canada, cwang@mie.utoronto.ca, Roy H. Kwon

We consider stochastic uncapacitated facility location problem (UFLP) as two and three stochastic linear programs. We develop a dynamic dual decomposition method. Moderate sized deterministic equivalent MIPs couldn't be solved by CPLEX 9.0 MIP solver directly. We consider semi-equivalent MIPs that could be solved by CPLEX to the same integer solutions. The proposed method is found to be effective in numerical experiments and outperforms CPLEX on semi-relaxed versions of the problem.

2 - Implementation Issues of Flow Cover and Flow Path Separation Algorithms in a General MIP-Solver

Philipp Christophel, DS&OR Lab, University of Paderborn, Warburgerstrasse 100, Paderborn, 33098, Germany, christophel@dsor.de, Uwe H. Suhl, Leena Suhl

Although the theory of flow cover cuts is very well studied, a straight forward implementation tends to give results that may be far from an optimum. This talk discusses some changes to the cover finding method and other parts of the algorithm as implemented in MOPS. The second part of the talk deals with the implementation of flow path cuts. These are so far not very well studied and the talk shows alternatives to traditional implementations and evaluates them.

3 - A Metaheuristic Algorithm for the Steiner Problem in Graphs

Minseok Seo, Penn State University, 1400 Martin Street, Apt. 2025, State College, PA, 16803, United States, mxs713@psu.edu, Jose Ventura

The Steiner problem in graphs is concerned with finding the shortest tree containing a subset of nodes, called terminal nodes, in an undirected graph. We propose an ant colony algorithm which was the Takahashi and Matsuyama's heuristic method to generate improved trees iteratively by adjusting edges' pheromone values until an optimal or near-optimal solution is obtained.

4 - A Theoretical and Computational Comparison Between GDP Cuts and Disjunctive Cuts

Nicolas Sawaya, Carnegie Mellon University, Department of Chemical Engineering, 5000 Forbes Avenue, Pittsburgh, PA, 15213-3890, United States, nws@andrew.cmu.edu, Ignacio Grossmann

We report some exciting insights and connections between Disjunctive Programming (Balas) and Generalized Disjunctive Programming (GDP, Raman & Grossmann), emphasizing fundamental understanding of their corresponding cutting planes, specifically the connections that exist between GDP cuts and disjunctive and lift and project cuts. We present a unified framework for this development through Balas' concept of reverse polar, and present examples that demonstrate the efficiency of both methods.

■ WD02

Room 302

Economics

Contributed Session

Chair: Matthew O'Connor, Professor of Finance, Quinnipiac University, 275 Mount Carmel Avenue, Hamden, CT, 06518, United States, matthew.oconnor@quinnipiac.edu

1 - Economic Impact of the Thai Canal on Asean and the World

Nuansri Erbkamol, Assistant Professor, King Mongkut's Institute of Technology North Bangkok, 1518 Pibulsongkram Road, BangSue, Bangkok, 10800, Thailand, erbkamol@kmitnb.ac.th, Satapon Keovimol

The Thai Canal will be like a large stream passing Thailand, connecting the two coasts of Thailand together, creating an economical route and generating a flow of money from countries around the world to Thailand directly, creating jobs, income, a tourism attraction, a business center and a source of industries.

2 - What Will Thailand Benefit from the Thai Canal Project?
Satapon Keovimol, Associate Professor, King Mongkut's Institute of Technology North Bangkok, 1518 Pibulsongkram Road, Bang Sue, Bangkok, 10800, Thailand, keovimol@hotmail.com, Thanakorn Kiatbanlue

If Thailand builds a Thai Canal, it would be a new route for ships that shortens the trips. Thailand will become an important centre for international sea transport, Many nations along the coasts of the Indian and Pacific oceans will have complement advantages with Thailand's advantages, especially tourism.

3 - The Impacts of Complementarity/Substitutability of Goods on Bundling Strategy
Young Sok Bang, Graduate School of Management, KAIST, 207-43, Cheongyangri 2-Dong, Dongdaemun-Gu, Seoul, South Korea, buffett0112@hanmail.net, Jae-Hyeon Ahn, Dong-Joo Lee

We analyze the bundling strategy in the presence of a complementarity or substitutability between goods under different industry structures. We find, contrary to the common perspective that bundling benefits from complementarity of goods, that bundling can be an optimal strategy even under substitutability, and that the competition in the industry increases the firm's incentive of bundling with relatively more complementary goods compared to the monopoly case.

4 - Algorithms for Rationalizability and CURB Sets
Michael Benisch, PhD Student, School of Computer Science, Carnegie Mellon University, 5000 Forbes Avenue, Pittsburgh, PA, 15213, United States, mbenisch@cs.cmu.edu, Tuomas Sandholm, George Davis

The concepts of rationalizability and CURB (Closed Under Rational Behavior) sets have not been studied from a computational perspective. We describe an LP-based polynomial algorithm that finds all strategies that are rationalizable against a mixture over a given set of opponent strategies. We describe a series of polynomial algorithms for finding minimal CURB sets. Finally, we give theoretical showing that finding a Nash equilibrium can be exponential only in the size of the smallest CURB set.

5 - The Question of Tenure: A Dynamic Cost Minimization Model
Matthew O'Connor, Professor of Finance, Quinnipiac University, 275 Mount Carmel Avenue, Hamden, CT, 06518, United States, matthew.oconnor@quinnipiac.edu, Mario Norbis

We develop an N-period dynamic optimization model to explain the rational allocation of tenure and non-tenure track positions subject to a university's course coverage and research output requirements. We find that is optimal for a cost minimizing university to include tenure track positions in the faculty mix.

■ WD03

Room 303

Discrete Optimization via Integer Programming

Contributed Session

Chair: Mohammad S. Sabbagh, Professor, Isfahan University of Technology, University Boulevard, Isfahan, 84154, Iran, sabbagh@cc.iut.ac.ir

1 - Linear Forms of Nonlinear Expressions: New Insights on Old Ideas
Richard Forrester, Assistant Professor, Dickinson College, College and Louther Streets, Carlisle, PA, 17013, United States, forrestr@dickinson.edu, Warren Adams

We examine recent linearization strategies for mixed 0-1 polynomial programs and show how they can be improved and unified through an intepretation of a classical strategy introduced 30 years ago. Furthermore, we show that the classical approach provides more concise forms and theoretically tighter relaxations. Computational experience demonstrating a reduction in both the number of nodes explored and CPU execution times are presented for randomly generated test problems.

2 - A Tour Improvement Algorithm for the Asymmetric Traveling Salesman Problem
Mohammad S. Sabbagh, Professor, Isfahan University of Technology, University Boulevard, Isfahan, 84154, Iran, sabbagh@cc.iut.ac.ir

We use heuristic methods to get, in little time, a good tour for large asymmetric traveling salesman problem (ATSP). Suppose we have a tour. The question now is how this tour can be improved further. This paper presents a heuristic method for improving such a tour by utilizing some necessary conditions of tour optimality that limits the search space to some edges that have the potential to improve the current tour. We coded the method in C++ and improved tours of all ATSP benchmarks problems.

■ WD06

Room 306

Metaheuristic Development Framework (MDF)

Sponsor: INFORMS Computing Society/Heuristic Search

Sponsored Session

Chair: Kamran Fatahi, Lecturer, Amirkabir University of Technology, No. 424, Hafez St., Tehran, TH, Iran, k_fatahi@aut.ac.ir

1 - MDF
Kamran Fatahi, Lecturer and PhD Candidate, Amirkabir University of Technology, No. 424, Hafez Street, Tehran, Iran, k_fatahi@yahoo.com

Combinatorial optimization problems (COP) play great role in academy and industry and in the past thirty years, many metaheuristics which most of them inspired by nature like genetic algorithm, simulated annealing, tabu search, ant colony systems and evolutionary algorithms have been developed to solve them. These algorithms use different methods such as guided strategies for search of solution space and work very good.

2 - Optimization Software Class Libraries - An Update of Research
Stefan Voss, Chair and Director of the Institute of Information Systems within the Faculty of Economics and Business Administration, University of Hamburg, IWI, Von-Melle-Park 5, Hamburg, HG, 20146, Germany, stefan.voss@uni-hamburg.de

Just as metaheuristics provide flexible and extensible methods of solving optimization problems, class libraries provide flexible and extensible building blocks for creating software to implement metaheuristics. We provide an update of research regarding class libraries and frameworks in the metaheuristics domain. This includes a survey of some of the more general metaheuristics class libraries and some examples of specific uses.

3 - Multi-Start Tabu Search and Diversification Strategies for the Quadratic Assignment Problem
Tabitha James, Pamplin College of Business, Business Information Technology, Blacksburg, VA, United States, tajames@vt.edu, Cesar Rego, Fred Glover

We introduce several multi-start tabu search variants and show the benefit of utilizing strategic diversification approaches within the tabu search framework for the QAP. Results on a set of instances from QAPLIB demonstrate the improvement of our TS multi-start variants over the classic tabu search approach widely used for the QAP. We also show that our new procedures are highly competitive with the best recently introduced methods from the literature, including more complex hybrid approaches.

4 - Scheduling English Football Matches Over Holiday Periods
Graham Kendall, University of Nottingham, School of Computer Science & IT, Nottingham, NO, NG9 2JB, United Kingdom, gxk@cs.nott.ac.uk

In English football, each divison holds a double round robin tournaments but the scheduling for one division cannot be done in isolation, due to the constraints between them. Over the Christmas period, every team has to play two matches (one at home and one away), and the distance they travel should be minimised. We present an overview of the problem, the data collection that we have undertaken, our algorithm and the results, which show that it is possible to produce high quality schedules.

■ WD07

Room 307

Tuning, Pre- and Post-Processing in Conic Optimization

Sponsor: INFORMS Computing Society/Optimization: Computational Optimization and Software

Sponsored Session

Chair: Yuriy Zinchenko, AdvOL, CAS, McMaster University, 1280 Main Street W, ITB 221, Hamilton, ON, L8S 4K1, Canada, yzinchen@optserv.cas.mcmaster.ca

1 - On Solving Specially Structured Large SDP's
Bharath Rangarajan, University of Minnesota, Minneapolis, MN, 55455, United States, bharathr@me.umn.edu

The stability conditions for spatially-distributed systems give rise to large semi-definite programs with very special structure. In this presentation, gradient and interior-point algorithms along the lines of a Dantzig-Wolfe method are explored. The gradient techniques, while slower than interior-point methods, have the additional capability of being distributed in computation. The interior-point techniques promise a faster asymptotic convergence and an improvement in overall complexity.

2 - Parameter Tuning and Adaptive Techniques in SeDuMi
Imre Pólik, PhD Student, McMaster University, 1280 Main Street W., Department of Mathematics, Hamilton, ON, L8S 4K1, Canada, poliki@mcmaster.ca, Tamás Terlaky

Most optimization solvers use a set of default parameters. While these values are rarely optimal, most users can not change them. In this talk we present some techniques to remedy this situation. Both offline and online solutions are discussed, involving optimization and learning techniques. The methods will be illustrated with the SeDuMi package.

3 - Projective Preconditioners for Improving the Practical Performance of IPMs for Conic Programming
Alexandre Belloni, MIT, 77 Massachusetts Avenue, Cambridge, MA, 02139, United States, belloni@mit.edu, Robert Freund

The traditional strategy for speeding up the performance of IPMs for conic optimization problems has been to focus on pre-conditioners to try to improve the numerical performance of the equation system solved at each iteration. In contrast, we present a methodology for mapping the entire problem to one that is better behaved in order to actually reduce the number of IPM iterations that are required to solve the problem. We report our latest computational results.

■ WD08

Room 308

Technology Management and Service Industry

Sponsor: Technology Management

Sponsored Session

Chair: Tim Anderson, Department of Engineering & Technology Management, Portland State University, Portland, OR, 97207, United States, tima@etm.pdx.edu

1 - Intellectual Property Rights and the Service Industry
Arnold Reisman, Reisman and Associates, Shaker Heights, OH, 44122, United States, reismana@cs.com

Tradition recognizes manufacturing, public, and services. Thus, service sector subsumes both the knowledge and entertainment industries (K&EI). Each K&EI firm is much more dependent on protection of its intellectual property (IP) rights than are companies or agencies in the other sectors. Because IP protection is an emerging domain, there is no general theory, model, or structure, for this field. Using a taxonomic approach this paper views the broad field of IP protection as a tapestry.

2 - Can Service Industry Learn Technology Management from Manufacturing?
Antonie Jetter, Department of Engineering & Technology Management, Portland State University, Portland, OR, 97207, United States, jettera@cecs.pdx.edu

Many firms in the service industry still lack systematic approaches to technology evaluation and selection, to new product development, and to providing organizational structures that foster innovation. This paper highlights the differences between manufacturing and service industries and discusses which of the technology management approaches currently employed by the most productive and innovative manufacturing firms can be successfully adopted by the service sector.

3 - Exploratory Evaluation of University Technology Transfer Efficiency
Tim Anderson, Department of Engineering & Technology Management, Portland State University, Portland, OR, 97207, United States, tima@etm.pdx.edu, Francois Lavoie, Tugrul Daim

Services represents largest part of the US economy. One great example is IBM that has long been more of a services company than a computer company. Services can be difficult to analyze and outputs may not be tangible products as units may not be easily converted to dollars. Universities are also considered a part of the service economy. They provide education as well as innovations resulting from research. This paper focuses on the service of transferring research results into the other sectors.

4 - Of People, By People, and For People: A Pragmatic View of Business Service Engineering Acceptance
William "Ike" Eisenhauer, Assistant Vice President of Loss Mitigation and Equity Operations, Wells Fargo CCG, ike@techsensei.com

Engineering of business processes, in general, and servicing processes, specifically, are experiencing a resurrection in the United States. This effort, typically done to remain competitive and customer orientated, has brought with it a new exposure to operations research and its tools. This exposure has done a great deal to bring potential optimization and streamlining of labor intensive and costly servicing activities. However, too many times this potential, however justified by "the data" is never reached or even attempted by the business channel. We explore the typical barriers to acceptance of operations research and process engineering efforts in the "real world" and what can be done to overcome them. In addition, some suggested and proven methods are presented to assist and ease the integration of operations research and management science in to the day to day operations of servicing organizations. Examples presented are primarily in the financial services industry, but are applicable to any servicing industry.

■ WD09

Room 309

Manufacturing

Contributed Session

Chair: Fong-Yuen Ding, Department of Industrial and Information Engineering, University of Tennessee, Knoxville, TN, 37996, United States, fding@utk.edu

1 - Grouping of Manufacturers Based on their Manufacturing Goals
Deepak Subedi, Assistant Professor, Marshall University, One John Marshall Drive, CH 423, Huntington, WV, 25705, United States, deepak_subedi@yahoo.com

For manufacturers, cost, quality, flexibility, delivery speed and new product development (NPD)are the major priorities. Cluster analysis was conducted based on the importance manufacturers attach to each of the priorities. They formed two clusters. Cost and quality are important for the first group, while NPD is the priority of the second. First group seeks profit by improving productivity in their plants; the second group emphasizes on growth.

2 - Machinery Asset Monitoring Using Bayesian Networks
Tim Lund, Software Engineer, Quantum Leap Innovations, 3 Innovation Way, Suite 100, Newark, DE, 19711, United States, thl@quantumleap.us

We describe a mechanism to monitor large scale mechanical systems using Bayesian models relating live sensor data to machine state. This enables real-time feedback of probabilities of potential problems, thereby allowing early diagnosis, preventative maintenance, and mean-time-to-failure projections. The system uses existing sensor deployments and middleware collection software. We describe the system architecture and a real-world deployment example in the area of heavy rotating machinery.

3 - Workload-Dependent Capacity Control in Make-to-Order Production
Gergely Mincsovics, Technische Universiteit Eindhoven, PO Box 513, Eindhoven, NB, 5600MB, Netherlands, g.z.mincsovics@tm.tue.nl, Nico Dellaert

We investigate adaptive capacity planning in make-to order situations. We introduce a set of Markov chain models to represent workload-dependent capacity control policies and show two analytical approaches to evaluate the policies' due-date performance, capacity, capacity switching, and lost sales costs. We give a comparison with fixed capacity planning rules.

4 - Process Improvement
Ashima Gupta, Student, NSIT, A-5/B 381 Paschim Vihar, New Delhi, 110063, India, ashima_nsit@yahoo.co.in, Pradeep Khanna, Richa Rastogi

In the current market scenario, as the sale of cars climbs up, the net output capacity of engines (cylinder head, cylinder block, crank, cam etc) has to be increased. The process improvement of crank line to increase the productivity without installing a new line is the aim of our study, conducted in Maruti Udyog Ltd. For that purpose a detailed study of processes was done, cycle time split up evaluated, bottleneck machines found and rectifications incorporated to achieve the target cycle time.

5 - A Heuristic Procedure to Solve the Generalized Car Sequencing Problem
Fong-Yuen Ding, Department of Industrial and Information Engineering, University of Tennessee, Knoxville, TN, 37996, United States, fding@utk.edu, Jingxu He

In sequencing an automobile assembly line, many car options often need to be considered, for example, objectives that consider a fixture pattern, blocking, spacing, and smoothing of options. A heuristic sequencing procedure is developed to obtain an initial sequence constructively, then swap orders and perform resequencing. The procedure was shown to improve initial sequences by swapping and resequencing. Solutions from the heuristic procedure were compared to those from simulated annealing.

■ WD11

Room 311

Novel Applications

Contributed Session

Chair: Mike O'Leary, Associate Professor, Towson University, Department of Mathematics, Towson, MD, 21252, United States, moleary@towson.edu

1 - Scheduling in Cellular Manufacturing

Jose Ribeiro, Professor, University of Sao Paulo, USP CP668 Sao Carlos SP Brazil, Av. T Neves 457 641 Sao Carlos SP Brazil, São Carlos, Brazil, jffr@uol.com.br

A method for scheduling workshop tasks is presented in this article. The method uses a partition of the workshop in manufacturing cells for solving the global problem in a decomposed manner. The scheduling are determined by a heuristic procedure that solves the job shop disjunction while taking into account the release and due dates. The proposed method allows us to efficiently solve some large size examples and works in real time, despite the non-polynomial nature of the problems studied.

2 - Closed Loop Queueing Model for Material Handling Systems

Narasimhan Ravichandran, Professor, Indian Institute of Management, Vastrapur, Ahmedabad, gu, 380015, India, nravi@iimahd.ernet.in

Motivated by a real life application we develop a queueing model to optimise the resources to handle a specified volume of material on a given time period. Given the complex nature of the situation approximate anlytical solutiuon and simulation results are compared. The sensitivity of various parametres in the system on the total resource required is studied. Based on the results a resource allocation policy to improve system parameters is suggested.

3 - Application of Optimization to Value-Based Pricing

Rongzeng Cao, IBM China Research Lab, Zhong Guan Cun Software Park, 19# Building, Beijing, 100094, China, caorongz@cn.ibm.com, Wei Ding, Chunhua Tian

Recently buyers and suppliers of IT services are increasingly moving toward more flexible contract structures built around a value-focused approach based on usage or defined service-level objectives. In this paper, we focus on some analysis and optimization technologies together with some cases used in this new application by optimizing various proportions and configuring a pricing schedule from a set of pricing models such as: fixed fee, performance fee, usage fee, and shared benefit.

4 - An Interpersonal Influence Representation in Social Network Flow Modeling

Jonathan Hamill, USAF/AFIT, 2950 Hobson Way, WPAFB, OH, 45434, United States, thehamills@yahoo.com, James Chrissis, Robert Mills, Richard Deckro

Methods to measure the strength of interpersonal ties among individuals in a social network as well as a means to mathematically characterize source-dependent influence are presented. These techniques lend themselves to use of classic network flow formulations, to include a new centrality measure based upon generalized network flows.

5 - Finding the Optimal Search Area for a Serial Criminal

Mike O'Leary, Associate Professor, Towson University, Department of Mathematics, Towson, MD, 21252, United States, moleary@towson.edu, Melissa Zimmerman, Ruozhen Yao

We describe a new method to find the optimal search area for a serial criminal committing crimes like burglary, arson, and rape. Our method accounts for simple geographic features like jurisdictional boundaries and the presence of bodies of water, and can be extended to account for additional features. This is done by writing the problem as a maximum likelihood estimate problem, and using nonlinear optimization to find the required parameters.

■ WD12

Room 312

Enterprise-Wide Optimization: Process Scheduling

Cluster: Enterprise-Wide Optimization in the Process Industry

Invited Session

Chair: Andrew Bringhurst, IT Associate, Decision Sciences, Air Products and Chemicals, Inc., 7201 Hamilton Boulevard, Decision Sciences, A5238, Allentown, PA, 18195, United States, BRINGHA@airproducts.com

1 - Task Selection, Assignment and Sequencing in Multistage Batch Processes

Christos Maravelias, Assistant Professor, Department of Chemical and Biological Engineering, University of Wisconsin at Madison, 1415 Engineering Drive, Madison, WI, 53706, United States, christos@engr.wisc.edu, Pradeep Prasad

We propose a novel MIP model for the scheduling of multistage batch processes with parallel units of different capacities. The problem is difficult because orders cannot be a priori assigned to batches. Thus, selection, as well as assignment and sequencing decisions are required. To solve large instances we develop an algorithm that lends itself to parallelization.

2 - Optimal Planning and Scheduling for Multiproduct Batch Plants with Parallel Lines

Muge Erdirik Dogan, PhD Student, Carnegie Mellon University, Department of Chemical Engineering, Doherty Hall, Pittsburgh, PA, 15213, United States, muge@cmu.edu, Ignacio Grossmann, John Wassick

An integrated approach is presented for optimal planning and scheduling of batch reactors operating in parallel that involve intermediate storage and sequence dependent changeover times. A continuous time MILP model based on slot time representation is proposed for scheduling, while a tight STN relaxation model where the detailed timing constraints and changeovers are replaced by time balances is proposed for planning.

3 - Easing Rescheduling Complexity for a Bulk Gas Production and Distribution Problem

Wasu Glankwamdee, Lehigh University, 200 W. Packer Avenue, Bethlehem, PA, 18015, United States, wag3@lehigh.edu, Jeff Linderoth, Jierui Shen, Jackie Griffin

This paper demonstrates the impact of different planning models within a large industrial gas company for its production and distribution during the course of a month. We build an optimization model approximating the model in place at the company and a simulation mechanism that allows us to create instances of varying time-granularities. Computational results are given to reveal the best course of action that minimizes the frequency and severity of intra-month schedule adjustments.

4 - Optimal Crane Scheduling

John Hooker, Carnegie Mellon University, Tepper School of Business, Pittsburgh, PA, 15213, United States, john@hooker.tepper.cmu.edu, Ionut Aron, Latife Genc, Iiro Harjunkoski, Marco Fahl

We present an algorithm for scheduling cranes in a factory or mill. The cranes operate on a single track and cannot bypass each other. Each job to be scheduled consists of a sequence of pickup and delivery stops at predetermined locations and a time window. We combine a local search heuristic for assigning jobs to cranes and sequencing them with a dynamic programming algorithm that finds an optimal space-time trajectory for each crane.

■ WD13

Room 313

Innovative Approaches to Bringing Communication into Engineering and Business Undergraduate Courses

Sponsor: Education (INFORM-ED)

Sponsored Session

Chair: Judith Shaul Norback, Director of Workforce & Academic Communication, School of Industrial & Systems Engineering, Georgia Institute of Technology, 765 Ferst Drive, Atlanta, GA, 30332, United States, judith.norback@isye.gatech.edu

1 - Integrating Workforce Communication into an Engineering Introduction to Statistics Course

Judith Shaul Norback, Director of Workforce & Academic Communication, School of Industrial & Systems Engineering, Georgia Institute of Technology, 765 Ferst Drive, Atlanta, GA, 30332, United States, judith.norback@isye.gatech.edu, Nicoleta Serban

More and more employers are expecting engineering graduates to have excellent workforce communication skills. And of course universities have responded to ABET2000 by incorporating more communication skills in their undergraduate curricula. At the Georgia Tech H. Milton Stewart School of Industrial and Systems Engineering, we have identified the needed workforce communication skills by interviewing practicing engineers, supervisors and senior executives in companies employing many engineers. The skills have been integrated through the use of projects into Introduction to Statistics. We will describe the very positive preliminary student feedback and how to implement the process at other universities.

2 - Effective Managerial Presentations of Analytical Work

Thomas Grossman, Associate Professor of Information & Decision Science, School of Business and Management, University of San Francisco, 2130 Fulton Street, San Francisco, CA, 94117, United States, tagrossman@usfca.edu, Judith Shaul Norback

Business students struggle to give effective managerial presentations of analytical work, tending to discuss their model and their spreadsheet rather than the model outputs and resulting business insights. We integrate empirical research (from the

Workforce Communication Program at Georgia Tech's H. Milton Stewart School of Industrial & Systems Engineering) with observations of business student analytical presentations to identify twelve presentation skills that can usefully be taught in the business school management science course. The process of implementing these skills in business and engineering courses at several universities will be described.

3 - Using Science Fiction to Teach Leadership and Communication in an Undergraduate Information Systems Course

Brian Butler, Associate Professor of Business Administration, Katz Graduate School of Business, University of Pittsburgh, 226 Mervis Hall, Pittsburgh, PA, 15260, United States, bbutler@katz.pitt.edu, Michelle M. Butler

Undergraduates often have difficulty understanding the complexity involved with implementing information systems in organizations. Even when they comprehend the technical issues, they often miss the human and organizational issues, and as a result find it difficult to understand the importance of communication and leadership skills in the success of these efforts. Well written science fiction can make the human and social challenges associated with technology more concrete, providing both context and grounding for efforts to incorporate communication and leadership into traditional information systems courses. We will report on experience from a joint Science Fiction/Information Systems course. Consideration will be given to ways in which the readings, discussions, and assignments worked together to increase student understanding of language, audience, and imagination and their role in effective organizational communication and leadership. Particular emphasis will be placed on ways the techniques and materials could be used to supplement more traditionally organized courses in information systems and engineering management.

■ WD14

Room 314

Metaheuristics

Contributed Session

Chair: Funda Samanlioglu, Assistant Professor, North Carolina A&T State University, 1601 East Market Street, 406 McNair, Greensboro, NC, 27411, United States, fsamanli@ncat.edu

1 - C-GRASP Heuristic for Identification of Adverse Drug Reactions

Michael Hirsch, Raytheon, Inc. and University of Florida, 303 Weil Hall, Gainesville, FL, 32611, United States, mjh8787@ufl.edu, Michelle Ragle, Claudio Meneses, Panos Pardalos, Mauricio Resende

Adverse drug reactions (ADRs) are estimated to be one of the leading causes of death in the United States. Many national and international agencies have set up databases of ADR reports for the express purpose of determining these relationships. We formulate the drug-reaction relationship problem in the framework of text categorization. We utilize a new C-GRASP heuristic to recover the relationship. Our approach is applied to cardiovascular-type reactions reported in the ADRAC database.

2 - A Hybrid Metaheuristic Approach For Solving The Course Scheduling Problem

Carlos Osorio Ramirez, Politecnico Grancolombiano, Calle 57 No. 3-00 Este, Bogota, BO, Colombia, caosorio@poligran.edu.co, Danilo Abril

The course scheduling problem of large size, or the timetabling problem, is known to be NP-hard, and as such only combinatorial optimization techniques should obtain an optimal solution. In this paper, we present a metaheuristic hybrid approach based on Local Search, Tabu Search and Genetic Algorithms, applied to the course scheduling process in a colombian higher education institution.

3 - Unrelated Parallel Machines Scheduling with Ready Times and a Total Weighted Tardiness Objective

Dong-Gil Na, Electronics and Telecommunications Research Institute, 161 Gajeong-dong, Yuseong-Gu, Daejeon, 305700, South Korea, dgna@etri.re.kr, Hoon Jung, Dong-Won Kim, Jong Heung Park

This paper addresses the batch scheduling for parallel unrelated machines using search heuristics. The problem accounts for allotting batched work parts to the unrelated parallel machines. The objective is to minimize the total weighted tardiness for the unrelated parallel machine scheduling with ready-times. Two search heuristics are suggested for the problem.

4 - Algorithms for Data Association in Multi-Target Tracking

Dimitri Papageorgiou, The Raytheon Company, 235 Presidential Way, Woburn, MA, 01801, United States, Dimitri_J_Papageorgiou@raytheon.com

Multi-target tracking hinges upon the solution of a data association problem, which can be formulated as a maximum weight independent set problem or as a multi-dimensional assignment problem. We discuss the leading algorithms for these two approaches and compare their performance.

5 - An Interactive Genetic Algorithm with Random-Keys Representation for a Symmetric Multi-Objective TSP

Funda Samanlioglu, Assistant Professor, North Carolina A&T State University, 1601 East Market Street, 406 McNair, Greensboro, NC, 27411, United States, fsamanli@ncat.edu, William G. Ferrell

This research focuses on incorporating user preferences interactively in terms of classification of objective functions into five classes and specification of optional weighting coefficients, bounds, and especially optional upper bounds on "indifference trade-offs" with a hybrid random-key genetic algorithm, in order to find preferred (approximate) (weakly) Pareto optimal solutions to a symmetric multi-objective traveling salesman problem.

■ WD15

Room 315

Auction Theory

Cluster: Auctions and e-Commerce

Invited Session

Chair: Mahesh Nagarajan, Assistant Professor, University of British Columbia, 2053 Main Mall, Vancouver, BC, V6T 1Z2, Canada, Mahesh.Nagarajan@sauder.ubc.ca

1 - Characterizing Optimal Keyword Auctions

Anuj Kumar, Industrial Engineering & Operations Research Department, Columbia University, 500 West 120th Street, New York, NY, 10027, United States, ak2108@columbia.edu, Garud Iyengar

We present a variety of models for keyword auctions used for pricing advertising slots on the search engines (Google Inc., Yahoo! Inc. etc.). First, we present a compact characterization of the set of all deterministic incentive compatible direct mechanisms in a model with slot dependent valuations. Next, we study two interesting cases of this model: slot independent valuation and constant valuations up to a privately known slot and zero thereafter.

2 - Optimality of (s,S) Replenishment Policies for Inventory Systems with Heterogeneous Sales

Ganesh Janakiraman, Assistant Professor, Stern School of Business, New York University, 44 West 4th Street, New York, NY, United States, gjanakir@stern.nyu.edu, W. Tim Huh

A multi-period model of a firm that replenishes inventory periodically and conducts auctions within each period to sell the product was recently studied by Van Ryzin and Vulcano (2004). In the absence of fixed costs for replenishment, they showed that the optimal replenishment policy has the order-up-to structure. With fixed costs, we show that the optimal inventory replenishment policy is of the (s,S) type. We also present extensions to other types of sales channels.

3 - Simplified Bidding and Solution Mechanisms for VCG Combinatorial Auctions

Damian Beil, Assistant Professor, Ross School of Business, University of Michigan, 701 Tappan Street, Ann Arbor, MI, 48109, United States, dbeil@bus.umich.edu, Amitabh Sinha, Amy Cohn

Combinatorial auctions' applicability in practice has been limited by the need for bidders to bid on an exponential number of bundles and for the auctioneer to solve an exponentially large winner-determination problem. We present a new bidding approach to address these challenges for a broad class of VCG combinatorial auctions. In our approach, the bidders' true-cost types are explicitly incorporated within a mathematical program that is used to solve the winner-determination problem.

4 - Vendor Selection Mechanisms

Mahesh Nagarajan, Assistant Professor, University of British Columbia, 2053 Main Mall, Vancouver, BC, V6T 1Z2, Canada, Mahesh.Nagarajan@sauder.ubc.ca

We use a math programming model to characterize the optimal mechanism for a set of adverse selection problems. We characterize using duality, conditions under which auction type mechanisms are either optimal or perform well. We also provide conditions under which certain bargaining games dominate auctions. In this process we use inner approximation techniques to approximate the infinte dimesnional linear program, thereby demonstrating strong convergence properties of auction type mechanisms.

■ WD16

Room 316

Revenue Management & Its Application

Cluster: Dynamic Pricing and Forecasting

Invited Session

Chair: Jian Wang, Vice President, R&D, RainMaker Group, 1000 Holcomb Woods Parkway, Suite 114, Roswell, GA, 30076, United States, JWang@letitrain.com

1 - Market Segmentation in the Car Rental Industry

Darren Arrington, Director, Revenue Management Science, Dollar Thrifty Automotive Group, 5330 E 31st Street, 3W2, Tulsa, OK, 74135, United States, Darren.Arrington@DTAG.Com

Discuss Market segmentation methods and their uses in Demand Forecasting and Pricing Optimization systems.

2 - Dynamic Pricing and Optimal Development Stragegy in Presales Housing Market

Youyi Feng, Associate Professor, The Chinese University of Hong Kong, The Department of SEEM, R609, M. W. Mong Engineering Building, Hong Kong, Hong Kong, yyfeng@se.cuhk.edu.hk, Zhan Pang

We consider a house developer who designs an options contract in a presales (sales-before-completion) housing market. The spot price in the housing market is random and is assumed to be a diffusion process. The demand approaches housing systems as a Poisson stream and the arrival rate is sensitive to the premium and affected by spot price. The premium of each house is dynamically adusted. Finally, we discuss the optimal contract design issue and the optimal capacity investment decison.

3 - An Observation of Optimization Horizon Impact on Apartment RM Pricing

Montgomery Blair, AVP, Archstone-Smith, MBlair@archstonesmith.com, Jian Wang

Optimization horizon is often pre-specified in many applications of revenue management (RM). Different selection of optimization horizons has significant effects on dynamic pricing behaviors. Little theoretical research has been done on how to determine an "optimal" horizon in published literatures. Based on a real apartment RM system, we simulated how rental pricing changed to a wide range of optimization horizon selections, and suggested some criteria to pick the "proper" horizon.

■ WD17

Room 317

Simulation of Supply Chain Systems

Contributed Session

Chair: Brian Neureuther, SUNY Plattsburgh, School of Business, Plattsburgh, NY, United States, sdbrian@isugw.indstate.edu

1 - Web-Based Oil Supply Chain Game

Samik Raychaudhuri, Decisioneering, Inc., 9100 E. Florida Avenue, Apt. 17-207, Denver, CO, 80247, United States, samik@freeshell.org

We present an interactive web-based gaming mode simulation model of a multi-echelon oil supply chain. The top echelon (Refineries) and the bottom echelon (Retail Outlets) are controlled by the computer, and the players take decisions at Storage Points and Depots, trying to minimize total cost. The game also provides ways of simulating different decision strategy (order-supply strategy) combinations. Players physically apart can participate in the simulation through LAN or Internet.

2 - System Dynamics Modeling for Biodiesel Supply Chain Management

Denis Borenstein, Universidade Federal do Rio Grande do Sul, R. Washington Luis 855, Porto Alegre, RS, Brazil, denisb@ea.ufrgs.br, Luciano Ferreira

Supply chain modeling has received an increasing attention from researchers in recent years. However, very few attempts have been made to develop formal models applied to the biodiesel supply chain. This work presents a system dynamics model for the analysis and evaluation of biodiesel supply chains. The model focuses not only on logistical costs, but also on the social impacts related to the location of biodiesel plants.

3 - Agent-Based Computational Framework for a Complex Multi-Product Supply Chain

Partha Priya Datta, Cranfield University School of Management, Wharley End, Cranfield, MK43 0AL, United Kingdom, parthapriya.datta@gmail.com, Peter Allen, Martin Christopher

Traditional mathematical modelling approaches are ineffective in dealing with dynamic complex supply chains. An agent-based computational framework is developed for studying a complex supply chain that provides managerial insights on how to improve operational resilience by drawing on results from multiple scenario simulation.

4 - Port Simulation Using Arena

Marcos Antonio Masnik Ferreira, System Analyst, Central Bank of Brazil, Rua Camoes 175, ap32 Cristo Rei, Curitiba, PR, 80050-290, Brazil, masnik@gmail.com

One of the most challenging obstacles when carrying on a simulation project in a harbor environment is how to implement and simulate the arrival process of trucks and trains. Those arrivals have at same time a stochastic and a deterministic behavior that must be appropriately modeled. In addition, the cargo must be sent prior to the ships arrivals. Nevertheless, the amount of cargo that can be sent, in advance, to the port depends on the available space in the port storage facilities.

5 - Simulating Complexities in Semiconductor Manufacturing

Brian Neureuther, SUNY Plattsburgh, School of Business, Plattsburgh, NY, United States, sdbrian@isugw.indstate.edu

One of the most challenging environments to develop a validated simulation model is in the semiconductor manufacturing process. Numerous simulations have been developed for specific operations within the manufacturing process, but few have been developed for the entire front-end. A simulation model is developed and the complexities involved in the simulation of the semiconductor manufacturing process are discussed.

■ WD18

Room 318

Reliability

Contributed Session

Chair: Md. Rezaul Karim, JSPS Postdoctoral Research Fellow, The University of Electro-Communications, Department of Systems Engineering, 1-5-1 Chofugaoka, Chofu-shi, Tokyo, 182-8585, Japan, mrezakarim@yahoo.com

1 - Cost and Availability as Effectiveness Metrics for Maintained Systems

Geoffrey Okogbaa, University of South Florida, 4202 E. Fowler Avenue, FAO 274, Tampa, FL, 33620, United States, okogbaa@ibl.usf.edu, Sulabh Jain, Wilkistar Otieno

Several maintenance policies have been proposed to minimize systems maintenance cost. However, most of them fail to consider systems in transient state. In the proposed paper, a simulation of a multi-unit transient state system with n economically dependent components is used to evaluate the efficacy of opportunistic and preventive maintenance policies using cost and availability as metrics.

2 - Estimation Methods for Lifetime Data Under Random Right Censoring

Jonathan Bates, Lieutenant, U.S. Coast Guard, 2217 Spring Circle, Cocoa, FL, 32926, United States, jbates@cgcconfidence.uscg.mil

David Reineke completed a study in 1998 that examined estimation methods for data under random right censoring. This study adds to this earlier work by examining the Kaplan-Meier Estimator, Maximum Likelihood Estimator, Földes, Rejtı, and Winter Estimator, Piecewise Exponential Estimator, and the Klein, Lee, and Moeschberger Estimator for levels of censoring above 75%, values of n from 5-100, and various Weibull shape parameters to determine the best performing method for each case.

3 - Nonparametric Degradation Inference from Highly Censored Exceedance Data

Hui Fan, Rensselaer Polytechnic Institute, 110 8th Street, CII 5015, DSES Department, Troy, NY, 12180, United States, fanh2@rpi.edu, Thomas Willemain, Brock Osborn, Pasquale Sullo

We consider the problem of analyzing degradation data censored to reveal only the times at which a performance variable exceeds a threshold. We evaluate the use of traditional nonparametric methods of detecting deterioration by developing power curves for simple models of the deterioration process. We also develop a new test method based on Markov chains and compare it with traditional nonparametric test methods. This work was motivated by study of exhaust gas temperatures in jet engines.

4 - Optimization of Warranty Costs with Different Repair Options

Raja Jayaraman, Graduate Research Assistant, Department of Industrial Engineering, Texas Tech University, PO Box 43061, Lubbock, TX, 79409, United States, r.jayaraman@ttu.edu, Dr. Timothy I Matis

We study warranty policies consisting of Free Replacement (FRW) and Pro-Rata (PRW) policies of systems subject to random breakdowns. The manufacturer can perform different strategies from minimal repair to replacement upon failure, and these strategies will have different cost implications. We derive expressions for expected profit to the manufacturer in a product purchase and long run average profit in the product life cycle under each option employed.

5 - Reliability Analysis of Automobile Component with Covariates During the Warranty Period

Md. Rezaul Karim, JSPS Postdoctoral Research Fellow, The University of Electro-Communications, Department of Systems Engineering, 1-5-1 Chofugaoka, Chofu-shi, Tokyo, 182-8585, Japan, mrezakarim@yahoo.com, Kazuyuki Suzuki

In warranty database, the information on covariates associated with reliability-related factors is unknown for the censored automobiles, which makes it difficult to estimate the reliability as a function of such covariates. This presentation deals with this problem and models the lifetime of automobile component to estimate some quantities of interest that are applicable in assessment of reliability and predicting warranty claims and costs. An example based on real field data is given.

■ WD20

Room 320

Decision Support Systems

Contributed Session

Chair: Ram Pakath, Gatton Endowed Research Professor of DSIS, University of Kentucky, School of Management, 425 C.M. Gatton College of Business, Lexington, KY, 40506, United States, pakath@uky.edu

1 - Distributed Quantitative Proactive Risk Analysis

Salah Benabdallah, Director, Institute of Technology in Communications (ISET'Com), Parc Technologique,El Ghazala, Ariana, 2088, Tunisia, sba@supcom.rnu.tn, Mohamed Hamdi, Noureddine Boudriga, Wafa Jridi

The objective of this paper is to present an approach for transforming the developed mono pro-active RA process into a distributed process which could be used by a team of experts simultaneously. A set of mathematical methods have been used to merge the different experts opinions. In addition a set of experts weights have been introduced to guarantee the best interaction between the team members and consequently the consistency of the RA process.

2 - Agent-Based Simulation Model for Disaster Management Decisions

Shengnan Wu, PhD Candidate, Industrial Engineering, University of Pittsburgh, 1048 Benedum Hall, Pittsburgh, PA, 15261, United States, SHW14@pitt.edu, Carey Balaban, Bopaya Bidanda, Matthew Kelley, Larry Shuman, Ken Sochats

The last few years have revealed the importance and need for intelligent control systems to deal with unanticipated events including disasters. In this paper, the authors describe the general framework for a simulation-based decision support system for disaster management. The built-in simulation model fully applies the multi-agent systems ideas, interfaced with a real-time GIS database, a rule-based decision module which contains standard treatment rules for emergency and a rule optimizer.

3 - A Framework for Branch Internal Optimization

Xinxin Bai, R&D Engineer, IBM China Research Laboratory, Building 19 Zhongguancun Software Park, Beijing, BJ, China, baixx@cn.ibm.com, Wenjun Yin, Ming Xie, Jin Dong

With the rapid change of market environment, optimization of internal resources allocation is rather critical for branches to achieve strategic goals. A branch internal optimization methodology with a series of analysis and optimization models is presented. By multi-dimensional analysis of transaction history, bottlenecks can be mined rapidly; besides, simulation-based optimization can help executives get better understandings on the effects of new resource allocations.

4 - Determining an Optimal Selling Price for a Product in a Bidding Competition

Haleh Valian, PhD Student, Rutgers University, 703 Bevier Road, Piscataway, NJ, 08854, United States, valian@eden.rutgers.edu, Davood Golmohammadi

In this paper, finding an optimal price for selling a product in a bidding competition is discussed. Optimal price is determined by maximizing expected profit, and computed probability of wining the bid as a price function and other bid features. Feature selection techniques are applied for gaining more information. The bid outcome is predicted and the results are compared with the database of bid transaction history of the product. Also some techniques for the classification of patterns such as the Bayes classification model, neural networks, and k nearest-neighbor method are applied.

5 - Adaptive Decision Support Systems: A Critique

Ram Pakath, Gatton Endowed Research Professor of DSIS, University of Kentucky, School of Management, 425 C.M. Gatton College of Business, Lexington, KY, 40506, United States, pakath@uky.edu, Shashank Rao

Attempts at articulating a category of Decision Support Systems (DSS), called Adaptive DSS, date back to the late 80s. These attempts differ in their views of what constitutes "adaptation," the targets of adaptation, and in the means used to achieve adaptation capabilities. We seek to critically examine and contrast these various perspectives with the aid of representative implementations to help better comprehend the paradigm and to help set the stage for further exploration and refinement.

■ WD21

Room 321

DA Arcade 4

Sponsor: Decision Analysis Society

Sponsored Session

Chair: Alessandra Cillo, INSEAD, Boulevard de Constance, Fontainebleau, F-77300, France, Alessandra.CILLO@insead.edu

1 - Applying Multi-Criteria Decision Analysis for Student Admission in the Case of a Magnet High School

Marina Polyashuk, Northeastern Illinois University, 5500 North St. Louis Avenue, Chicago, IL, 60625, United States, M-Polyashuk@neiu.edu

The problem of student admission to a college preparatory high school with selective enrollment is considered as a multiple criteria decision making problem. After formulating the problem, which includes defining decision space and criteria space, setting feasibility constraints and relationships among the criteria, different multi-criteria methods of student selection are discussed.

2 - A Quantitative Measurement of Regret Theory

Alessandra Cillo, INSEAD, Boulevard de Constance, Fontainebleau, F-77300, France, Alessandra.CILLO@insead.edu, Han Bleichrodt, Enrico Diecidue

This paper presents a quantitative measurement of regret theory. Our method is choice-based and requires no assumptions about the shape of functions reflecting utility and regret. The event-splitting effects could not confound our results. Our findings are consistent with the assumptions of regret theory although some deviations are found.

3 - Multi-Attribute Choice with Ordinal Information: A Comparison of Different Decision Rules

Paula Santos, Escola Superior de Tecnologia de Viseu, Departamento de Matemática, ESTV, Campus Politécnico de Viseu, Viseu, 3504-510, Portugal, psarabando@mat.estv.ipv.pt, Luis Dias

In the context of additive multi-attribute aggregation, we consider problems with ordinal information, namely considering a ranking of the scaling coefficients and a ranking of the value of each alternative on each criterion. Monte-Carlo simulation was used to compare how different choice rules compare, aiming also to provide guidelines about how to use these rules. The compared rules include ROC weights, minimum value, maximum loss of value, quasi-dominance and quasi-optimality.

4 - Utility Theory in a Networked Environment of Local Managers

Steven Harper, Research Scientist, National Center for Supercomputing Applications, University of Illinois Urbana-Champaign, 1205 W. Clark Street, Room 1008, Urbana, IL, 61801, United States, srharper@uiuc.edu

This study examined strategic investment alternatives for a networked system of managers producing a common product. Utility analysis, modeling and simulation, and game theory were applied by individual manages in there decision analysis with varied success. Results indicate that when smaller managers make changes there is little effect on the environment, whereas when larger manages make changes, the environment is changed, thus requiring updating of the managers' probability beliefs.

■ WD22

Room 322

Informing Infrastructure Decisions

Sponsor: Military Applications

Sponsored Session

Chair: Patrick Driscoll, Professor, U.S. Military Academy, Department of Systems Engineering, Building 752, Mahan Hall, West Point, NY, 10996, United States, patrick.driscoll@usma.edu

1 - Analytical Framework for Assessing Physical Security Systems

Greg Graves, LTC, U.S. Military Academy, Department of Mathematical Sciences, 646 Swift Road, West Point, NY, 10996, United States, gregory.graves@us.army.mil

Security systems seek to prevent or mitigate potentially catastrophic consequences. We present an analytical framework for the assessment of alternative security systems. The problem of separating preferences among alternatives without a unique probability distribution on reward is considered. Through a novel application of linear programming and sensitivity analysis, insights are gained regarding vulnerability and priorities for information acquisition.

2 - Decision Support Model for Metropolitan Disaster Response Planning

Niki Goerger, ERDC Research Associate at USMA, Engineer Research and Development Center, Department of Systems Engineering, United States Military Academy, West Point, NY, 10996, United States, Niki.Goerger@usma.edu, Patrick Driscoll

Terrorist attacks and natural disasters pose significant threats to metropolitan areas. Their ability to recover quickly is key. Determining how to respond and assess progress after such events offer serious challenges for decision makers. In light of this, we present a problem formulation for decision support for metropolitan emergency disaster response planning. The model is based on critical infrastructure states, interdependencies, and response over time.

3 - Linear Stochastic Systems Model for Counter-Insurgency Strategies

Patrick Driscoll, Professor, U.S. Military Academy, Department of Systems Engineering, Building 752, Mahan Hall, West Point, NY, 10996, United States, patrick.driscoll@usma.edu, Niki Goerger

We introduce a linear dynamic model that uses the evolving effects of system inter-dependencies on state and process conditions to suggests effective alternative counter-insurgency strategies based on stochastic intertemporal effects.

■ WD23

Room 323

Service Industry Applications

Contributed Session

Chair: Divya Tiwari, Student, IIM,Bangalore, FPM office, IIMB, Bannerghatta Road, Bangalore, Ka, 560076, India, divyat00@iimb.ernet.in

1 - Manpower Planning for Call Centers with Learning Curves and Random Shocks

Tom Robbins, Penn State University, 462A Business Building, University Park, PA, 16803, United States, trr147@psu.edu, Terry Harrison

We examine the issue of short and medium term manpower planning for a call center where worker productivity is subject to learning curve productivity improvement. We consider the case where random shocks may impact both demand and productivity such as the operation of a software support desk when a new version of software is rolled out. We examine the types of shock that may occur and investigate approaches for mitigating the operational impact.

2 - Measuring Service Work: An Information Economic Perspective

John H. Lundin, Assistant Professor, San Jose State University, MIS Department BT 250, One Washington Square, San Jose, CA, 95192-0244, United States, lundin_j@cob.sjsu.edu, Paul P. Maglio

We develop a foundation for determining the work done by service providers to create services in three categories of the goods-services continuum: material, process, and information. Work occurs in each category directly, indirectly, and administratively. The metrics to quantify service work combine financial, benefit, worth, and resource measures. This method of measuring work aims to capture the full extent of what is needed to create services in an expanding service organization or economy.

3 - Service Quality Effort and Contract Renewals

Kuo-Ting Hung, Assistant Professor, Suffolk University, 8 Ashburton Place, Boston, MA, 02108, United States, khung@suffolk.edu, Jafar Manar, Hasan Arslan

We model the service relationship between a supplier and its customer over a single period. The customer experiences the service provided by the supplier over the single period and decides either to continue or shift to a competing supplier at the end of the period. We propose a service delivery policy that maximizes the supplier's profit and customer retention.

4 - Resource Planning for Software Service Industry

Divya Tiwari, Student, IIM,Bangalore, FPM office, IIMB, Bannerghatta Road, Bangalore, Ka, 560076, India, divyat00@iimb.ernet.in, Janat Shah, Jishnu Hazra, Shubhabrata Das

Two primary issues with the Software Service Industry are high demand uncertainty and supply crunch leading to resource uncertainty. The attempt is to develop an optimal resourcing policy: "how much to hire, when and what type-lateral vs fresher ratio". Typically freshers require longer lead time for training etc whereas laterals which are "of the shelf" type are scarce hence there is uncertainty about their timely availability. The firm has to strike a balance between these two uncertainties.

■ WD24

Room 324

Supply Chain Optimization II

Contributed Session

Chair: Xuemei Su, University of Wisconsin, Milwaukee, PO Box 742, 53201-0742, Milwaukee WI 53201, United States, xuemeisu@uwm.edu

1 - Supply Chain Coordination Under Multiple Objectives

Chunming Shi, Washington State University, Department of Management and Operations, Pullman, WA, 99164, United States, cshi@mail.wsu.edu

Supply chain coordination has been studied extensively under the objective of expected profit maximization. In this paper, we focus on supply chain coordination where different agents may have different and/or multiple obectives, including the objective of maximzing the probability of achieving some predetermined performance level. We adopt the defintion of coordinating contracts which can lead to Pareto-optimal payoff for each agent in the supply chain.

2 - Capacity Allocation Using Past Sales: Turn-and-Earn in a Product Line

Debu Purohit, Professor, Duke University, Fuqua School of Business, Box 90120, Durham, NC, 27708, United States, purohit@duke.edu, Dinah Vernik

In the short run, if a supplier's capacity and prices are fixed, then a low demand realization leaves the manufacturer with unused capacity, while a high demand realization leaves retailers with limited supply. In this paper we generalize Cachon and Lariviere (1999) by analyzing the case where a manufacturer sells a product line and the demand for the products is interrelated. We find that turn-and-earn across items in a product line leads to higher profits for the manufacturer.

3 - Supply Chain Coordination Contracts with Warranty

Wan-Ting Hu, LeBow College of Business, Drexel University, Academic Building, 2nd Floor, Decision Sciences, Philadelphia, PA, 19104, United States, wh52@drexel.edu, Hande Benson

We consider the wholesale and revenue sharing contracts between one supplier and one retailer, where the supplier offers free replacement warranty to the end customers with warranty length elastic demand. The chain is coordinated if the channel optimal production amount and warranty length are reached while each party maximizes own profit. We show that coordination only occurs if both revenue and warranty cost are shared, with the share of the warranty cost equal to the share of the profit.

4 - Motivating Retail Marketing Effort: Optimal Contract Design

Xuemei Su, University of Wisconsin, Milwaukee, PO Box 742, 53201-0742, Milwaukee, WI, 53201, United States, xuemeisu@uwm.edu, Samar Mukhopadhyay

We study a scenario where the manufacturer relies on the retailer for investing in marketing effort to boost demand. The retailer's cost of marketing is private. To motivate the retailer to provide desired level of marketing effort, the manufacturer offers a menu of contracts, hoping to invoke the "revelation principle" when the retailer accepts a certain contract from that menu. We find both a two part tariff price schedule and a cost plus contract schedule will coordinate the channel.

■ WD25

Room 325

Industry Applications III

Contributed Session

Chair: Renata Maciel, 1, Universidade Federal de Pernambuvo, Rua AcadÍmico Hélio Ramos, s/n, CEP 5074, Recife, PE, 51021190, Brazil, remaciel@hotmail.com

1 - An Analysis on Optimal Operating Conditions at Automatic Delivery Sequencing in Korea

Seong-Joon Lee, Electronics and Telecommunications Research Institute, POB 106, Yuseong-gu, Daejon, 305-600, South Korea, sungjun2@etri.re.kr, Seung-Jin Wang

The purpose of this paper is an attempt to solve the optimal operating conditions from experimental results during the field test period of the delivery sequence sorting machines at Korean postal service.

2 - An Estimation of Management Excellence Criterion Weights: The Case of Turkish Public Institutions

Fethullah Caliskan, Senior Researcher, TUBITAK TUSSIDE, Baris M. Kosuyolu Cad., No:48 P.K.14 Gebze, Kocaeli, 41401, Turkey, fcaliskan@tusside.gov.tr

In order to answer the question of whether or not it makes any sense to compare all organizations according to an common weight structure of an excellence management model, an empirical test is required. We first examined the criterion weightings of the EFQM and BQA excellence models. Then, a criterion weights estimation procedure was applied on data obtained from self assessment studies of very diverse set of public institutions with the perceptions of more than 10,000 employees.

3 - Bin Packing with Flexible Bin Sizes

Danny Myers, Department of Applied Statistics and Operations Research, Bowling Green State University, Bowling Green, OH, 43403, United States, myers@cba.bgsu.edu, Michael Jacob

The basic bin packing problem assumes a supply of uniformly dimensioned containers. We present an industrial bin packing application in which a variety of container sizes are available. In addition, one dimension of the containers can be viewed as flexible in that some of the packed items may extend beyond the container boundaries.

4 - Methods to Minimize Coil Marks

Hoyeon Chung, Professor, Jeonju University, 3Ga 1200, Hyoja-Dong, Wansan-Gu, Department of Industrial Engineering, Jeonju-Si, 560-759, South Korea, hychung@jj.ac.kr

Coil marks are generated by steel mill manufacturing, slit processing, material handling, and a variety of other causes. If these bad raw material coils with coil marks would be used in car part manufacturing these marks would diminish the exterior quality of the finished cars. In this study we recommend a method using sponge pads to prevent coil marks from occurring during the manufacturing process and also a device to minimize coil marks from occurring during the material handling process.

5 - The Implementation Model of Quality Management System (Qms) Based on Iso 9001:2000 in the Civil Construction Sector

Renata Maciel, 1, Universidade Federal de Pernambuvo, Rua AcadÍmico Hélio Ramos, s/n, CEP 5074, Recife, PE, 51021190, Brazil, remaciel@hotmail.com, Denise de Medeiros

The focus of the work is on the process of implementation of the system of Quality Management (SQM) in the Civil Construction sector. The model was constructed, called Key Points for the Implementation Process, with eleven steps towards helping companies implement SGQ or to evaluate their current systems efficiently.

■ WD26

Room 326

Improving Decision Tree Induction/Information Theory and Data-Mining Applications

Sponsor: INFORMS Computing Society/Data Mining

Sponsored Session

Chair: Sigurdur Olafsson, Assistant Professor, Iowa State University, Department of Industrial and Manufacturing Systems Engineering, Ames, IA, 50011, United States, olafsson@iastate.edu

Co-Chair: Shuning Wu, Iowa State University, IMSE, Ames, IA, 50010, United States, wsn97@iastate.edu

Co-Chair: Irad Ben-Gal, Dr., Tel Aviv University, Faculty of Engineering, Tel Aviv, Israel, Bengal@eng.tau.ac.il

1 - Post-Pruning in Regression Tree Induction: An Integrated Approach

Kweku-Muata Osei-Bryson, Professor, Virginia Commonwealth University, 1015 Floyd Avenue, Richmond, VA, 23284, United States, kmuata@isy.vcu.edu

A regression tree (RT) tree is a decision tree in which the target variable is continuous. The RT induction process involves the growth phase and the pruning phase. The pruning phase aims to generalize the RT that was generated in the growth phase.In this paper we present an integrated approach that also accomodates multiple relevant RT quality measures (e.g. accuracy, stability, simplicity).

2 - A Context Tree Method for Multistage Fault Detection and Isolation

Pierre Brice, Stevens Institute of Technology, Castle Point on Hudson, Hoboken NJ 07030, United States, pjbrice@stevens.edu, Wei Jiang

This paper proposes a generic system model based on context trees to predict system behaviors for the purpose of fault detection and isolation in a multistage software system. The approach consists of learning multistage model structures by capturing the expected statistical distribution of input/output at different stages and detecting departures from the expected model structures.

3 - Reinforcement Learning with Sub-Action Abstraction

Shahar Cohen, Tel Aviv University, Tel Aviv, Israel, shaharco@post.tau.ac.il, Evgeni Khmelnitsky, Oded Maimon

Representation abstraction in reinforcement learning enables the agent to ignore irrelevant aspects of the underlined task. The learning process, when incorporating representation abstraction, can be made faster and easier. The literature on reinforcement learning has only focused on a single form of representation abstraction, widely-known as state abstraction. In this work we propose a new form of representation abstraction.

4 - Multivariate Perturbation Trees: Protecting Privacy Against Record Linkage Attacks

Xiaobai Li, University of Massachusetts Lowell, College of Management, Lowell, MA, 01854, United States, Xiaobai_Li@uml.edu

We propose a tree-based data masking method for protecting privacy against record linkage attacks. The method recursively splits a dataset into smaller subsets such that data records within each subset are more homogeneous after each partition. The partition is made at the maximum variance dimension represented by the first principal component of the data at each partition. The confidential attribute values of a record in a subset are then masked using a rank-based swapping method.

■ WD27

Room 327

Studies of Multi-Stage and Multi-Level Complex Systems

Sponsor: Quality, Statistics and Reliability

Sponsored Session

Chair: Jye-Chyi (JC) Lu, Professor, Georgia Institute of Technology, 765 Ferst Drive, Atlanta, GA, 30022, United States, jclu@isye.gatech.edu

1 - Variation Source Identification in Manufacturing Using Nonlinear Measurements

Jean-Philippe Loose, University of Wisconsin-Madison, 1513 University Avenue, Madison, WI, United States, jploose@wisc.edu, Shiyu Zhou, Darek Ceglarek

This paper presents a variation source identification procedure in the presence of nonlinear measurements, which refers to the measurements that are related with the process variation sources through a nonlinear function. In the proposed procedure, the joint probability density of the measurements is determined as a function of the process parameters; then, series of statistical tests are performed to identify the variation source. A case study is used to illustrate the procedure.

2 - Impact of Product Variety on Manufacturing Complexity in Automobile Mixed-Model Assembly

Xiaowei Zhu, PhD Candidate, University of Michigan, 2415 Laurelwood Circle, Ann Arbor, MI, 48108, United States, xwzhu@umich.edu, S. Jack Hu, Yoram Koren

Automobile mixed-model assembly lines become very complex when the number of product variants is large, which, in turn, may impact quality and productivity. The paper considers the variety induced manufacturing complexity in manual assembly lines where operators must make choices in assembly. A complexity measure is proposed, and models are developed to evaluate the complexity at each station, then for the entire line. Complexity can be minimized by making systems design and operation decisions.

3 - Supply-Chain Oriented Robust Parameter Design
Jye-Chyi (JC) Lu, Professor, Georgia Institute of Technology, 765 Ferst Drive, Atlanta, GA, 30022, United States, jclu@isye.gatech.edu, Lingyan Ruan, Na An, David Rosen

This article introduces game theory commonly used in supply-chain analyses to solve potential conflicts between manufacturing partners at various process stages. Through our methods, the partners collaboratively decide settings of controllable variables to make product less sensitive to process noises, especially variations propagated from upstream processes. Modeling and solution strategies of this new research topic are provided along with illustrated examples and comparison studies.

4 - Coordinated Inventory Allocation-Facility Location Problem
Divya Mangotra, PhD Student, Georgia Institute of Technology, School of Industrial and Systems Engineering, Campus Box 0205, Atlanta, GA, 30022, United States, divya@gatech.edu, Jye-Chyi (JC) Lu

We propose a two-phase approximation method for solving a multi-echelon inventory coordination-facility location problem. Our model integrates facility, inventory and transportation costs with service levels and supply-demand variability. We present a numerical study and compare results for the coordinated and uncoordinated model. These results are generated for two cases - identical and non-identical retailers.

■ WD28

Room 328

Quality Applications and Methods

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: Theodore Allen, Associate Professor, Ohio State University, 1971 Neil Avenue, 210 Baker Systems, Columbus, OH, 43221, United States, prodec@ameritech.net

1 - Meso-Analysis Analysis of Six Sigma Projects and Resilience Modeling
Jason Schenk, The Ohio State University, 1971 Neil Avenue, 210 Baker Systems, Columbus, OH, 43210, United States, schenk.32@osu.edu, James Brady, Theodore Allen

39 six sigma projects were performed at a Midwest manufacturer. This paper describes attempts to mine data about the financial performance data of these projects to support decision-making about how the six sigma program should be run, i.e., meso-level decision support. We also describe future research related to resilience modeling.

2 - Multi-Fidelity Inverse Engineering With Nanotechnology and Other Applications
Ravi Rajagopalan, Graduate Teaching Associate, The Ohio State University, 1971 Neil Avenue, 210 Baker Systems, Columbus, OH, 43210, United States, vioravis@gmail.com, Theodore Allen, Deng Huang

Inverse design is the selection of inputs to match a desired output pattern. Multi-fidelity kriging optimization offers much promise to do this accurately compared with approaches that calibrate metamodels and then abandon experimental data. We proposed new methods incorporating discrete inputs and explore a variety of applications. We compare the proposed approaches with alternatives from the design literature.

3 - Optimal Focus Group Design to Augment Demand Data
Shih-Hsien Tseng, Graduate Research Associate, The Ohio State University, 1971 Neil Avenue, Columbus, OH, 43210, United States, shih_hsien@mail2000.com.tw, Theodore Allen

Focus groups facilitate forecasting of the demand for a new product. We explore the optimal planning of which prototypes to build and which questions to ask to augment data about demands for existing products. Also, the relationship of this problem with multifidelity modeling and accelerated testing is discussed.

4 - High Quality Voting Machine Allocation Applied in Ohio
Theodore Allen, Associate Professor, Ohio State University, 1971 Neil Avenue, 210 Baker Systems, Columbus, OH, 43210, United States, allen.515@osu.edu, Mikhail Bernshteyn, Steven Hertzberg

In the past, machines were allocated in a way that failed to account for variable ballot lengths resulting in systematic unfairness. This presentation focuses on defensible allocation of machines for a real world application in Cuyahoga, Ohio. Issues including variable arrival rates, machine capacity, and empirical service distributions are addressed.

■ WD29

Room 329

Dynamic Programming/Control

Contributed Session

Chair: Matthew Henry, University of Virginia, 111 Olsson Hall, Charlottesville, VA, 22904, United States, mhenry@virginia.edu

1 - An Approximate DP Approach to Pharmaceutical R&D Funding Decisions
Pinar Keles, ISE Department, Lehigh University, 1063 Mosser Road V203, Breinigsville, PA, 18031, United States, pik2@lehigh.edu, Joseph Hartman

We model a pharmaceutical R&D portfolio management problem as a dynamic, stochastic knapsack problem with dynamic programming where the budget is renewed at the end of each cycle and expected returns are delayed due to long development times. We present an approximate DP approach to solve this complex problem.

2 - Efficient PAC Learning for Episodic Tasks with Acycilc State Spaces
Spiridon Reveliotis, Associate Professor, ISyE, Georgia Institute of Technology, 765 Ferst Drive, Atlanta, GA, 30332, United States, spyros@isye.gatech.edu, Theologos Bountourelis

We consider the problem of computing the optimal policy for a task that evolves in an episodic manner over an acyclic state space, under incomplete knowledge of the (i) Action branching probabilities and (ii) The underlying cost structure. A novel efficient algorithm for this problem is proposed, and its convergence properties and computational complexity are rigorously characterized in the formal framework of computational learning theory.

3 - Optimal Node Visitation in Acyclic Stochastic Digraphs
Theologos Bountourelis, PhD Student, ISyE, Georgia Institute of Technology, 765 Ferst Drive, Atlanta, GA, 30332, United States, tbountou@isye.gatech.edu, Spiridon Reveliotis

Given a stochastic, acyclic, connected digraph with a single source node that is traversed repetitively by a control agent, we seek a control policy that will enable the visitation of the terminal nodes a certain number of times, while minimizing the expected number of the graph traversals. We formulate this problem as an MDP, derive a lower and an upper bound to the value of the optimal policy, and develop an asymptotically optimal randomized policy of polynomial complexity.

4 - Modelling the Reset Decision Embedded on Segregated Funds with Stochastic Dynamic Programming
Socratis Tapeinos, Doctorate Researcher, The University of Edinburgh, 49 Cotton Avenue, London, W3 6YE, United Kingdom, s.tapeinos@sms.ed.ac.uk, Tom Archibald

The reset option on the maturity guarantee of segregated funds is modelled as a Markov decision process. We model the tradeoff the policyholder faces: whether to rollover the current option or to exercise the reset right and substitute it with another whose maturity is farther in the future and whose exercise price is higher. We examine the effect of management fees, number of reset opportunities and level of maturity guarantee on the return to the policyholder.

5 - MODP Mechanism Design in Stochastic Decision Processes for Cyber Risk Management in SCADA Networks
Matthew Henry, University of Virginia, 111 Olsson Hall, Charlottesville, VA, 22904, United States, mhenry@virginia.edu, Yacov Haimes

This work extends the envelope approach to multi-objective dynamic programming [1] to permit sequential Pareto-optimization of multiple objectives in a decision process with non-differentiable formulation. Decisions are mapped to the parameters of a stochastic shortest path decision process, driving evolution of the equilibrium solution. The model is applied to SCADA network security risk assessment and management.

■ WD30

Room 330

Supply Chain Applications

Contributed Session

Chair: Rahul Marathe, Iowa State University, 2019, Black Engineering Building, Ames, IA, 50011, United States, rahulm@iastate.edu

1 - Multistage Stochastic Programming Approach in the Planning of Process Networks with Uncertain Yields
Bora Tarhan, PhD Candidate, 5000 Forbes Avenue, Department of Chemical Engineering, Carnegie Mellon University, Doherty Hall, Pittsburgh, PA, 15213, United States, btarhan@andrew.cmu.edu, Ignacio Grossmann

We consider a network of processes over multiple time periods in which product demands are specified. Major uncertainties are yields of each process, which can

be reduced investing in pilot plants. Uncertainties in the yields decrease with time. Problem consists of process selection, capacity expansions, and investment in pilot plants to maximize expected net present value. A mixed-integer/disjunctive programming model is proposed and solved with a duality-based branch and bound method.

2 - A Novel Primal Decomposition Approach for the Supply Chain Network Design Problem under Uncertainty

Ayman Ragab, Department of Industrial & Systems Engineering, Texas A&M University, 3131 TAMU, College Station, TX, 77845-3131, United States, ayman@tamu.edu, Lewis Ntaimo, Brett Peters

This talk presents a multi-stage stochastic programming model for the supply chain network design problem. The model involves three interrelated strategic decision sets: facility location, capacity acquisition and technology selection. To solve this problem, we derive a novel primal decomposition approach that exploits the special structure in the problem and uses column generation to guide the convergence of the iterative solutions towards optimality.

3 - Optimal Firm Investment and Exit with Random Demand

Dharma Kwon, UCLA Anderson School of Management, 110 Westwood Plaza, Los Angeles, CA, 90095, United States, dharma.kwon@gmail.com, Steven Lippman

We study the optimal re-investment and exit decision rule for the operation of a production plant with stochastic demand in a declining industry. In the model, a decision-maker has three options: (1) To continue operation, (2) To stop and exit the industry, and (3) To re-invest in the capital and boost the profit rate. We find the optimal threshold values of the profit rate for reinvestment and exit.

4 - Dynamic Inventory Allocation Under Imperfect Information and Capacitated Supply

Sylvana Saudale, University of Houston, E224 Engineering Building 2, Houston, TX, United States, ssaudale@uh.edu, Maher Lahmar

We consider a distribution system made of limited-capacity supplier that serves a sequence of retailers with stochastic demand. The supplier has limited information and sequentially decides on the amount to allocate to each retailer. We formulate the problem as a MDP and discuss optimal replenishment policies. We develop efficient heuristics to solve for homogenous retailers case and benchmark performance of our heuristics to optimal solution and other solution approaches.

5 - Meeting a Capacity Service Level Constraint for Uncertain Demand with Lead Times

Rahul Marathe, Iowa State University, 2019, Black Engineering Building, Ames, IA, 50011, United States, rahulm@iastate.edu, Sarah Ryan

A service provider determines timing and sizes of capacity expansions by a stationary policy to minimize infinite time horizon cost under a service level constraint. When the demand follows a geometric Brownian motion and there is a fixed expansion lead time, the service level can be found by methods to evaluate partial barrier options. Numerical optimization shows that accumulating shortages before the expansion start is optimal for low growth, low volatility demand; and for smaller lead times.

■ WD31

Room 331

Simulation-Optimization

Contributed Session

Chair: Mohamed Ahmed, Professor, Kuwait University, Faculty of Science, Safat Box 5969, Kuwait, ku, 13060, Kuwait, wakeel@kuc01.kuniv.edu.kw

1 - A Modification of the Simulated Annealing for Discrete Stochastic Optimization

Talal Alkhamis, Associate Professor, Kuwait University, Faculty of Science, Safat 5969, Kuwait, 13060, Kuwait, alkhamis@kuc01.kuniv.edu.kw

In this paper we present a modification of the simulated annealing algorithm (SA) for solving discrete stochastic optimization problems where the acceptance probability depends on whether the objective function values indicate statistically significant difference at each iteration. We show that the proposed modification converges almost surely to the set of optimal solutions.

2 - Optimal Pricing Policies for Bundles of Products and Services with Customer Down-Payments

Juan-Carlos Ferrer, Assistant Professor, P. Universidad Católica de Chile, Casilla 306 Correo 22, Santiago, Chile, jferrer@ing.puc.cl, Hugo Mora, Gabriel Bitran

This article examines the pricing decision of a provider that offers a bundle of products and services using a two-part tariff scheme. The pricing policy consists on a membership fee that is paid once by the customer at the beginning and a periodic fee paid on a monthly basis. We examine two cases, a monopoly and a duopoly. We conclude that firms will charge a higher membership fee in the duopoly case compared to the monopoly case in order to reduce the effect of supplier surfing.

3 - Applying Bayesian Estimation to Noisy Simulation Optimization

Geng Deng, Graduate Student, University of Wisconsin-Madison, 4723 Sheboygan Avenue, Apt. 118, Madison, WI, 53705, United States, geng@cs.wisc.edu, Michael Ferris

Simulations are typically governed by input parameters, choices of which lead to improved operation. The accuracy of a simulation run is often dependent on the number of replications. We describe an optimization algorithm that handles the tradeoff between simulation accuracy and quality of the optimized solution. Our methods apply Bayesian techniques to guide appropriate sampling strategies, while simultaneously enhancing algorithmic efficiency to obtain solutions of a desired accuracy.

4 - Multiobjective Simulation Optimization: SPGA

Hamidreza Eskandari, Research Associate, University of Central Florida, IEMS Department, 4000 Central Florida Boulevard, Orlando, FL, 32816, United States, eskandar@mail.ucf.edu, Christopher D. Geiger

We present a new approach, called stochastic Pareto genetic algorithm (SPGA), for multiobjective optimization of simulation models. New genetic operators are employed to enhance the algorithms performance in terms of convergence behavior, computational effort and its robustness against uncertain objective functions. Computational results for a few test problems indicate that SPGA is a promising approach and it outperforms the improved nondominated sorting genetic algorithm (NSGA-II).

5 - Redundancy Optimization of Reliability Models Subject to Imperfect Fault Coverage

Mohamed Ahmed, Professor, Kuwait University, Faculty of Science, Safat Box 5969, Kuwait, ku, 13060, Kuwait, wakeel@kuc01.kuniv.edu.kw

We develop a search procedure for redundancy optimization of reliability models. We consider those systems where the reliability cannot be evaluated exactly but must be estimated through Monte Carlo simulation. We show that the search process converges to the optimal set with probability one. The proposed procedure is illustrated through numerical examples of redundancy optimization for reliability systems subject to imperfect fault coverage.

■ WD32

Room 332

Computer Assisted Analysis

Contributed Session

Chair: John Newman, Professor, Coppin State University, MNSC Department, 2500 W. North Avenue, Baltimore, MD, 21216, United States, jnewman@coppin.edu

1 - Endogenous Volatility for Hedging Options with Transactions Costs

Yonggan Zhao, Associate Professor, Dalhousie University, 6100 University Avenue, Suite 2010, Halifax, NS, B3H 3J5, Canada, Yonggan.Zhao@Dal.Ca, Leonard MacLean, William Ziemba

This paper studies a pricing and hedging model with an endogenous volatility for the calculation of delta over time. With transaction costs, the optimal hedging volatility is substantially different from the stock's volatility under the criterion of minimizing the total absolute replication error weighted by the probabilities that the option is in or out of the money. Data on S&P 500 index cash options are used to illustrate the model.

2 - Development of a User-Interface for MOLP Software ADBASE

M. D. Sarder, PhD Candidate, University of Texas at Arlington, 1505 E. Lamar Boulevard, Apt # 292, Arlington, TX, 76011, United States, bsarder@hotmail.com, Abu Masud, Bonnie Boardman

This paper describes the need for and process of developing user interface software that works together with ADBASE and removes the problems associated with using ADBASE. The principles behind the development of this software were the goal of providing versatility and flexibility to solve MOLP problems with an interactive user interface. Another principle was to maintain a database to store and retrieve problem data when necessary.

3 - Journal Influence and Quality Ranking for Operations Research and Management Science

Andrew Lim, Associate Professor, Department of Industrial Engineering and Engineering Management, Hong Kong University of Science and Technology, Clear Water Bay, Kowloon, Hong Kong, China, iealim@ust.hk, Vendy Wen, Zhou Xu, Brenda Cheang

This paper reports a quantitative and qualitative study on the ranking of journal influence in the area of Operations Research and Management Science. The methodology employed is an extension of the PageRank algorithm, which in fact, is a special random walk. The methodology employed is followed by extensive justifications through axiomatic analysis. As well, an exhaustive set of experiments were conducted, releasing very insightful details.

4 - A Methodology for Line-of-Sight Target Acquisition and Exposed Area Assessment

Dr. Steven Yuhaski, Operations Research Analyst, Natick Soldier Center, Supporting Science & Technology Directorate, 1 Kansas Street, Natick, MA, 01760, United States, steve.yuhaski@natick.army.mil, Robert Auer

A technique has been developed to determine whether a line-of-sight, emanating from a given point on a battlefield, intersects a target. The target may be either partially or totally obstructed by the terrain or features. Constraints, generated a priori, about the terrain, are used repeatedly to assess the exposed target area. To accommodate movement, a zoning of the planar surface of the terrain is implemented to efficiently select the subset of elements that might obstruct the target.

5 - Enhancing a Decision Support System with Creativity - An Empirical Study

John Newman, Professor, Coppin State University, MNSC Department, 2500 W. North Avenue, Baltimore, MD, 21216, United States, jnewman@coppin.edu

Recent research suggests that creativity can enhance the performance of people for a variety of tasks, including decision making. Creativity enhancements can be delivered through a decision making support system. In theory, such delivery should improve the decision performance of the system's user. This paper tests the theory empirically and discusses the implications for decision making.

■ WD33

Room 333

Issues in National Airspace System (NAS) Modeling

Sponsor: Aviation Applications
Sponsored Session

Chair: Gerald Shapiro, CNA Corporation, Gerald.CTR.Shapiro@faa.gov

1 - A Microscopic Simulation Approach for Network-Based Airlines Competition Analysis

Ahmed Abdelghany, Assistant Professor, Embry-Riddle Aeronautical University, 600 S. Clyde Morris Boulevard, Daytona Beach, FL, United States, abdel776@erau.edu, Khaled Abdelghany, Gregory Coldren

A network-based modeling framework for airlines competition analysis is presented. The framework adopts a microscopic simulation approach in which passengers are represented at the individual level. The model estimates the airlines market share and flights load factor as function of their supply-related decisions including flight schedule, seat inventory control, and ticket distribution. Simulation experiments that illustrate the model functionalities are presented.

2 - Strategic Analysis Using the FAA's NAS Strategy Simulator

Anne Suissa, Operations Research Analyst, FAA ATO-P Office of Strategy, 800 Independence Avenue SW, Washington, DC, 20591, United States, anne.suissa@faa.gov, Dan Goldner, Stephanie Chung

The Federal Aviation Administration's NAS Strategy Simulator (NSS) investigates impacts of system and policy changes to the National Airspace System (NAS). The NSS models three key sectors: passengers & cargo, airlines, and the NAS. The model simulates in one-year increments calculating metrics for each sector, and includes eight user group categories. The model's interfaces allow users to change input controls representing system or policy changes and to view future trends in real-time.

3 - Changing the Airline Industry

John Kettelle, kettelle@earthlink.net, Mark Tedone

This paper starts with justifying an estimate that, if it were a single airline, the whole domestic airline industry could deliver its current passenger traffic for $15B a year less that it does now. It then explores ways to build competition into this concept. This potential payoff is enhanced by the increased traffic and revenue that would be expected. It ends with a discussion of how there may be room for similar enhancements in other "industries".

■ WD34

Room 334

Routing Applications II

Sponsor: Transportation Science & Logistics
Sponsored Session

Chair: Michel Gendreau, Director, CIRRELT / Univ. de Montréal, C.P. 6128, succ. Centre-ville, Montreal, QC, H3C 3J7, Canada, michelg@crt.umontreal.ca

1 - Elementary Shortest Paths Embedded in a Column Generation Framework for Location-Routing Problems

Suat Bog, sbog@ku.edu.tr, Selcuk Savas, Metin Turkay

Our work proposes a column generation algorithm for the solution of the capacitated location-routing problem (LRP). The master problem is a set-partition based formulation which proved to be useful for a variety of routing problems. For the subproblem we solve the elementary shortest path problem with resource constraints. The resulting algorithm is tested on various LRP benchmarks. The proposed column generation algorithm gave tight gaps for most of the benchmark problems.

2 - Modeling and Optimizing Transportation Decisions in a Manufacturing Supply Chain

Suleyman Karabuk, Assistant Professor, University of Oklahoma, School of Industrial Engineering, 200 West Boyd, Room 124, Norman, OK, 73019, United States, karabuk@ou.edu

We describe a transportation problem we observed at the trucking division of a manufacturer that owns and operates a large number of facilities in all stages of the supply chain. The problem involves scheduling of pick-up and delivery of daily inventory movement between plants. We develop integer programming models that are based on the current workflow of the schedulers and capture and optimize crucial aspects of the problem. We validate the models and demonstrate their use with actual data.

3 - Unified Heuristic for the Location-Routing Problem

Abdulrahman Alenezi, aalenezi@purdue.edu, Leyla Ozsen

We present a unified cluster first route second heuristic for the Location-Routing Problem. The special cases of this heuristic solves the VRP and MDVRP as well. We present preliminary results for all three problems.

4 - Arc Routing Problems with Time-Dependent Service Costs

Michel Gendreau, Director, CIRRELT / Univ. de Montréal, C.P. 6128, succ. Centre-ville, Montreal, QC, H3C 3J7, Canada, michelg@crt.umontreal.ca

We study a variant of the Capacitated Arc Routing Problem, motivated by winter gritting applications, in which service costs depend upon the time at which service is performed. Our problem-solving approach first transforms the arc routing problem into an equivalent node routing problem, which is then solved by column generation.

■ WD35

Room 335

Network Behavior with Information

Sponsor: Transportation Science & Logistics
Sponsored Session

Chair: Satish Ukkusuri, Assistant Professor, Department of Civil and Environmental Engineering, Rensselaer Polytechnic Institute, JEC-4032, 110 8th Street, Troy, NY, 12180, United States, ukkuss@rpi.edu

1 - User Equilibrium with Recourse

Avinash Unnikrishnan, University of Texas Austin, 6.512 ECJ Hall, Austin, United States, avinash@mail.utexas.edu, S. Travis Waller

A traffic equilibrium formulation, accounting for online information and user recourse is provided. The User Equilibrium with Recourse (UER) is formulated as a mathematical program, which is proved to satisfy all the optimality conditions. The presented solution method solves an online shortest-path problem as a sub-routine to arrive at the optimal UER solution. The above model is highly beneficial in understanding network flow behavior under information provision.

2 - Robust Behavior-Consistent Traffic Routing Under Information Provision

Alexander Paz, apaz@purdue.edu, Srinivas Peeta

A fuzzy control framework is used to determine behavior-consistent traffic routing strategies based on the estimation of driver behavior. H-infinity filtering is used to optimize controller parameters and achieve greater computational efficiency. Significant differences in terms of total system travel time can be obtained when the behavior-consistent approach is compared to traditional assignment approaches.

3 - Dynamic Traffic Equilibrium Under Information: An Experimental Network Game Approach
Gitakrishnan Ramadurai, Renssalaer Polytechnic Institute, Department of Civil and Environmental Engineering, Troy, NY, 12180, United States, ramadg@rpi.edu, Satish Ukkusuri

User equilibrium behavior decisions are based on complete information of the network state. This is justified by two arguments: i) Users gain information traveling over the network repeatedly, and ii) ATIS can provide complete information about network state. In this paper, the above two arguments are examined. First, existence of equilibrium is investigated in a multi-player experimental game. Second, whether or not provision of real-time information aids in achieving equilibrium is tested.

4 - Exploring User Behavior in Online Network Equilibrium Problems
Satish Ukkusuri, Assistant Professor, Department of Civil and Environmental Engineering, Rensselaer Polytechnic Institute, JEC-4032, 110 8th Street, Troy, NY, 12180, United States, ukkuss@rpi.edu, Gopal Patil

We develop an online traffic assignment model which incorporates the en-route recourse actions. While accounting for recourse using an online shortest path algorithm, we incorporate travelers cost perception behavior using logit route choice model. Numerical results on a test network are demonstrated to show the benefit of the developed model over the traditional static traffic assignment.

■ WD36

Room 336

Military Applications II

Contributed Session

Chair: LTC John Willis, TRADOC Analysis Center, ATTN: ATRC-RDM, Box 8695, Monterey, CA, 93943, United States, john-willis@us.army.mil

1 - Enhancing Joint Task Force Leadership Skills: Mental Modeling and Decision Analysis Approaches
Igor Linkov, Senior Scientist, Cambridge Environmental, 58 Charles Street, Cambridge, MA, 02141, United States, Linkov@cambridgeenvironmental.com, F. Kyle Satterstrom, George Fenton, Barclay Lewis, Rayland Gaskins

Today's war requires cognitive skills from a warfighter who must deal with social, cultural, and language barriers. We report use of mental modeling and decision analysis tools for overcoming cognitive and cultural barriers in Joint Task Force (JTF) operations. Components of shared mental models of JTF staff members' understanding of jointness, cultural differences among the Services, and operational capabilities and environments will be presented.

2 - Interfiring and Interkiling Times in Modeling a Combat
Yoon Hong, Professor, Department of ISE, Hansung University, 389, 3-Ga, Samsun-dong, Sungbuk-Gu, Seoul, 136-792, South Korea, yhong@hansung.ac.kr

The probability characteristic of the time between firings or killings performs a crucial role in the analysis of a combat. These terms are widely known in a stochastic combat modeling. The data from the field exercises are rearranged and utilized to obtain the appropriate probability distributions of the random times of interest. This study is limited to the particular entities, for instance, combatants or equipments. Comparisons and suggestions are presented.

3 - Loss-Tolerant Bottleneck Assignment Problem
Andrew Vakhutinsky, Akamai Technologies, Inc., 8 Cambridge Center, Cambridge, MA, 02142, United States, avakh2000@yahoo.com, Frederick Zeitz

We propose an approach to solving the following problem: Given a bi-partite graph with an integer number of deliveries available at each source node and delivery revenue coefficient between each pair of source-destination nodes, find an assignment between source and destination nodes to maximize the smallest revenue at the destination subject to the condition that one or more of the highest revenue deliveries to each destination is lost. The problem can be applied to the radar jamming.

4 - PHM Consequence Engine
Daniel Briand, Sandia National Labs, PO Box 5800 MS 1011, Albuquerque, NM, United States, dbriand@sandia.gov, Kelly Lowder

The consequence Engine (CE) is a forward looking simulation that predicts the effect operational strategies and repair/replace/inspect/wait strategies will have on the modeled system once PHM methods detect a change in a component's remaining useful life or time-to-failure. The CE optimizes alternative operations and maintenance schedules to provide a set of alternatives each with an expected cost/benefit, such as maximizing system availability while minimizing cost.

5 - Quick Turn-Around Analysis for the US Army's Rapid Equipping Force
LTC John Willis, TRADOC Analysis Center, ATTN: ATRC-RDM, Box 8695, Monterey, CA, 93943, United States, john-willis@us.army.mil

The US Army's Rapid Equipping Force (REF) is designed to increase mission capability while reducing risk to Soldiers. The REF equips operational units with off-the-shelf solutions that can be researched, developed and acquired quickly. The Army needs a means to assess emerging requirements and to recommend solutions for rapid fielding. This paper describes a quick-turnaround methodology to support the evaluation of REF solutions, the design of TTPs, and the distribution of capabilities.

■ WD37

Room 337

Supply Chain Simulation

Contributed Session

Chair: Ananth Krishnamoorthy, PhD Candidate, Oklahoma State University, 322 Engineering North, Stillwater, OK, 74078, United States, ananth.krishnamoorthy@okstate.edu

1 - Simulating an Oil Supply Chain
Eric Wainwright, CTO, Decisioneering, Inc., 1515 Arapahoe Street, Suite 1311, Denver, CO, 80202, United States, ewainwright@crystalball.com, Samik Raychaudhuri

In this presentation, we demonstrate a simulation of an oil supply chain consisting of multiple echelons: Refineries, Storage Points, Depots and Retail Outlets. The simulation model can be used to develop and test specific rules or strategies for decision making at particular levels of supply chain. Use of an interactive software (Crystal Ball) helps in analyzing multiple scenarios and optimize some of the decisions.

2 - Operational Performance Analysis of Introducing e-Procurement in a Public Sector Healthcare System
Sergio Maturana, Professor, Catholic University of Chile, Casilla 306, Correo 22, Depto. Ing. Industrial y de Sistemas, Santiago, RM, Chile, smaturan@ing.puc.cl, Ronny Gonzalez

Currently all Chilean government agencies, including government-run hospitals, have to purchase their supplies in an e-marketplace. This is profoundly changing the healthcare supply chain. It has also forced Cenabast, a government-run hospital supplier, to redefine its role. We present a simulation-based analysis of the operational performance of alternative designs for implementing e-procurement identifying those activities that Cenabast could perform that add more value to the hospitals.

3 - A Business Process Driven Supply Chain Simulation Framework
Wei Wang, R&D Engineer, IBM, Building 19, Zhongguancun Software Park, 8 Dongbeiwang West Road, Haidian District, Beijing, 100094, China, wangwcrl@cn.ibm.com, Hongwei Ding, Jin Dong, Changrui Ren

This article presents a supply chain simulation framework based on business process for a tactical-level decision making. It consists of a supply chain modeling library, a business process simulator, and a modeling and analysis environment. Industry knowledge is embedded in the library in term of representative supply chain entities, business rules and operation policies. Operations and dynamics are built in process elements. The simulation is thus driven by the process engine via token flows.

4 - Supply Chain Diagnostics with Probabilistic Boolean Networks
Chia-Hui Huang, Research Scholar, Department of Industrial and Operations Engineering, University of Michigan, 1205 Beal Avenue, Room 1815, Ann Arbor, MI, 48109-2117, United States, leohuang@umich.edu, Han-Ying Kao

In supply chain systems, the key factors concerning customers and suppliers constitute intricate causal relationships with industrial performance. The aim of this paper is to propose probabilistic Boolean networks (PBN) as knowledge bases for supply chain diagnostics. PBN is a promising model that generalizes the rule-based interactions in complex temporal stochastic settings. This study also develops the simulation algorithm for diagnostic reasoning in a two-echelon supply chain.

5 - Value of Tactical Collaboration in Supply Chains
Ananth Krishnamoorthy, PhD Candidate, Oklahoma State University, 322 Engineering North, Stillwater, OK, 74078, United States, ananth.krishnamoorthy@okstate.edu, Manjunath Kamath, Ricki Ingalls

We examine the value in collaborative master planning in a two-echelon supply chain. We develop broad guidelines and managerial insights for collaboration by analyzing results from experiments conducted using an integrated supply chain model. We attempt to answer the following questions - When should a company collaborate? How does collaboration influence decisions about structure, investments and process improvement efforts in a supply chain?

■ WD38

Room 338

Operations Management II

Contributed Session

Chair: Sungsu Kim, Department of Industrial and Manufacturing Engineering, Pennsylvania State University, 310 Leonhard Building, University Park, PA, 16802, United States, sungsu@psu.edu

1 - Optimal Compensation of Procurement and Hedging Managers

Masha Shunko, Carnegie Mellon University, 6739 Wilkins Avenue, Pittsburgh, PA, 15217, United States, mshunko@cmu.edu, Laurens Debo, Nicola Secomandi, Lin Nan

As financial trading of commodities becomes an important risk management tool for organizations, there is an increasing need for understanding interaction between hedging and procurement. In the value-maximizing setting with a risk-averse principal and two risk-averse managers, we develop a model that examines interaction between the hedging and procurement managers, look at the optimal compensation strategies for both and analyze how these strategies change as a function of relevant parameters.

2 - Plants-within-Plant (PWPs) Using Multiple Focus

Ashwini Chaube, Student, Indian Institute of Technology Bombay, Hostel 7, Room 171, IIT Bombay, Powai, Mumbai, MS, 400076, India, ashwini.chaube@gmail.com, A. Subash Babu

In the present study, overall focus of PWPs or focused factories has been quantified in terms of product focus, process focus, market focus and strategy focus. Based on this, a multi-objective and non-linear model has been developed and solved using a heuristics, for the design of PWPs with product and resource allocation. The results obtained for various problems have been analyzed and interesting observations have been made, the details of which have been presented in the paper.

3 - Price-Driven Market Equilibria and VCG Auctions for a Linear Economic Model

Jose Prina, Cornell University, 206 Rhodes Hall, Cornell University, Ithaca, NY, 14853, United States, jprina@orie.cornell.edu, Robin Roundy

We study pricing schemes that lead to equilibria in settings where a class of linear optimization models is suitable; specifically, markets where profit maximizing agents sell goods or services, and receive payments from a market intermediary that generally has complete information and pursues efficient solutions. We also study the application of VCG auctions in this setting and investigate the allocation of revenue under these alternate market mechanisms.

4 - Using Student-Managed Company Analysis Teams for Experiential Learning in an Operations Core Course

Raymond Jacobs, Professor of Business, Ashland University, Dauch College of Business and Economics, 401 College Avenue, Ashland, OH, 44805, United States, rjacobs@ashland.edu, Richard Symons, Daniel Fox

An Operations Management course was enhanced to promote experiential learning and support the College's competency-based learning framework. Each student team selects a manager to lead the analysis. Managers develop a "contract" for team members to sign, defining individual responsibilities and gaining student commitment. Students select a company, arrange plant visits, and develop questions addressing key operations issues. Student learning improved and ties to companies were built.

5 - Workforce Cross-Training Decision with Minimizing Number of Workers Under Various Factors in Parallel System

Sungsu Kim, Department of Industrial and Manufacturing Engineering, Pennsylvania State University, 310 Leonhard Building, University Park, PA, 16802, United States, sungsu@psu.edu, David A. Nembhard

We study workforce cross-training decision with the objective of minimizing the number of workers for satisfying given production requirements under various factors in parallel system. We consider factors such as number of tasks, the length of time horizon/unit time period, upper-bound of cross-training level, worker selection rule, and production requirement level, and explore their effects on worker assignment schedule and cross-training decision in order to provide managerial insights.

■ WD39

Ballroom B

Applications of Integer Programming

Contributed Session

Chair: Shabbir Ahmed, Associate Professor, Georgia Institute of Technology, 765 Ferst Drive, Atlanta GA 30068, United States, sahmed@isye.gatech.edu

1 - The Impact of Distribution System Characteristics

Iqbal Agha, Professor, Isenberg School of Management, Finance & OM, University of Massachusetts, Amherst, MA, 01003, United States, aiali@som.umass.edu, Debra O'Connor

This paper examines the extent to which spatial and demand characteristics affect the ease of obtaining an optimal solution to a distribution model. Problem characteristics, reflected in a model's parameters, can render the model for one supply chain instance to be intractable and that for another to yield an optimal solution instantaneously. We introduce echelon-flow-based valid inequalities to explicate the extent to which problem characteristics impact model tractability.

2 - A Tabu Search Algorithm with Variable Clustering for the Unicost Set Covering Problem

Gary Kinney, Air Force Institute of Technology, 2950 Hobson Way, WPAFB, OH, 45433, United States, gary.kinney@afit.edu, Wes Barnes, Bruce Colletti

We develop a Tabu Search algorithm to solve the unicost Set Covering Problem (USCP-TS). We solve a LP relaxation of the problem and use the LP optimum to construct a quality solution profile. We cluster the variables based on the profile to partition the solution space. USCP-TS outperforms CPLEX (under varied settings) in solution quality for 53 of 65 benchmark problems.

3 - Reconstruction and Applications of Imperfect Phylogenies (Steiner Trees over Hypercubes)

Srinath Sridhar, Graduate Student, Carnegie Mellon University, 5000 Forbes Avenue, Pittsburgh PA 15213, United States, srinath@cs.cmu.edu, Russell Schwartz

We consider the problem of finding optimal Steiner minimum trees when the underlying graph is an m-cube. We develop and implement a new algorithm that runs in polynomial time if the size of the minimum Steiner tree is at most an additive constant q larger than the number of dimensions m of the graph. Our work is motivated by the problem of reconstructing phylogenetic trees for different human ethnic groups or for humans and closely related primates.

4 - Polyhedral Stochastic Integer Programming

Shabbir Ahmed, Associate Professor, Georgia Institute of Technology, 765 Ferst Drive, Atlanta, GA, 30068, United States, sahmed@isye.gatech.edu, Yongpei Guan, George Nemhauser

We present polyhedral results for scenario based models of some stochastic integer programs. The key idea is to combine valid inequalities from scenario subproblems to derive new inequalities for the overall problem. We illustrate the procedure by developing inequalities for stochastic lot-sizing problems.

■ WD40

Room 401

Using Optimization for Environment, Energy, and Natural Resources

Contributed Session

Chair: Adekola Oyenuga, Visiting PhD Student, Decision Sciences Department, London Business School, Regent's Park London NW1 4SA, UK., London, NW1 4SA, United Kingdom, aoyenuga.phd@london.edu

1 - A Mathematical Approach in Heat Conduction Problems

Nedim Sozbir, Sakarya University, Mechanical Engineering Deptarment, Sakarya, 15187, Turkey, sozbir@sakarya.edu.tr, Hasan Ríza Guven, Ismail Ekmekci

An algorithm is obtained to solve linear algebraical equations after applying the finite difference method in solution of conduction problems. This algorithm has three steps: Transformation of the original system to an auxiliary linear system; Solution of auxiliary linear system; and Determination of the roots of original system using the solution vector of the auxiliary linear system. The decrease in the number of iterations is significant reducing the computer operation time.

2 - Economic Optimisation of Hydrogen Infrastructure Investment
Jogeir Myklebust, PhD Student, NTNU, IOT, Gloeshaugen, 7491, Trondheim, Norway, jogeirm@iot.ntnu.no, Asgeir Tomasgard

The coming market for hydrogen requires equipment to produce it from primary energy sources as well as facilities for shipping it and the potential by-product CO2 to their markets. Most of these investments are irreversible and subject to economies of scale. The alternative supply chains are modelled using large scale MILP in order to determine the location, timing and types of investment that minimises the present value of the costs of meeting exogenous hydrogen demand.

3 - Optimal Endogenous Carbon Taxes for Electric Power Supply Chains with Power Plants
Trisha Woolley, University of Massachusetts, Isenberg School of Management, Amherst, MA, 01003, United States, twoolley@som.umass.edu, Anna Nagurney, Zugang Liu

We develop a modeling and computational framework that allows for the determination of optimal carbon taxes applied to electric power plants in the context of electric power supply chain (generation/ distribution/ consumption) networks. This includes three distinct types of carbon taxation environmental policies, a decentralized scheme and two versions of a centralized scheme. We discuss the behavior of the various decision-makers and also provide numerical results for 12 examples.

4 - Second Best Prices for a Stochastically Available Service with Compensation for Interruptions
Adekola Oyenuga, Visiting PhD Student, Decision Sciences Department, London Business School, Regent's Park London NW1 4SA, UK., London, NW1 4SA, United Kingdom, aoyenuga.phd@london.edu

I propose an alternative approach to allocating a stochastic service using a price for deliveries and compensation for interruptions. The interruption applicable to any consumer is a fraction of his uninterrupted demand and is obtained by equalizing his marginal utility from the service with a spot price while the compensation is equal to a hypothesized loss when interrupted. A form of market organization is suggested, Second-Best service prices are derived and the utility's incentives examined.

■ WD42

Room 403

Scheduling Applications III

Contributed Session

Chair: Natasa Vidic, PhD Candidate, University of Pittsburgh, 1048 Benedum Hall, Pittsburgh, PA, 15261, United States, natasa_vidic@yahoo.com

1 - Real-Time Oriented Lotsizing and Scheduling of Flexible Job-Shops
Thomas van Brackel, University of Paderborn, Warburger Strafle 100, Paderborn, 33102, Germany, tvb@upb.de

A new approach controlling job-shop systems in real-time is introduced. This approach is capable of handling occurring disturbances in order to ensure an efficient execution of the production plan. Known models are expanded by the integration of disturbances, installing a flexible production structure and lotsizing aspects. To solve this new problem, an efficient genetic algorithm is developed which is able to conduct a rescheduling simultaneous to the execution of the production processes.

2 - Satellite Mission Scheduling with Dynamic Tasking
Stephen Billups, Associate Professor, University of Colorado at Denver and Health Sciences Center, Department of Mathematical Sciences, Campus Box 170, PO Box 173364, Denver, CO, 80217-3364, United States, Stephen.Billups@cudenver.edu

"Satellite Mission Scheduling with Dynamic Tasking" involves scheduling tasks for a satellite where new requests can arrive at any time. Problem characteristics include differing processing times, priorities, and time window constraints for individual tasks as well as order-dependent setup times between tasks. We examine a hybrid evolutionary algorithm for creating a schedule in advance and a novel technique for reusing partial solutions to adjust for incoming requests in real-time.

3 - Understanding and Evaluating Scheduling Practices in Urban High Schools
Natasa Vidic, PhD Candidate, University of Pittsburgh, 1048 Benedum Hall, Pittsburgh, PA, 15261, United States, natasa_vidic@yahoo.com, Mary Besterfield-Sacre, Bryan A. Norman, Erica Halverson

The goal of this research is to create a more systemic approach to course scheduling in urban high schools that ensures equity and access for all high school students. We develop a comprehensive model to show the potential for improving the course master scheduling process in order to create a more equitable system with an emphasis on math and science courses.

4 - Single Machine Scheduling Under Uncertainty
Ihsan Sabuncuoglu, Professor, Bilkent University, Department of Industrial Engineering, Ankara, 06800, Turkey, sabun@bilkent.edu.tr, Selcuk Goren

In this study, we consider the single machine scheduling problem with random processing times and machine breakdowns. We take a proactive point of view and define several robustness and stability measures. We propose a branch-and-bound algorithm for minimizing expected total tardiness (one of the robustness measures) in the case where only source of uncertainty is processing time variability. We also develop simulation based beam search algorithms for the problems with machine breakdowns.

■ WD43

Room 404

Multicriteria Decision Making II

Contributed Session

Chair: Kash Barker, Graduate Student, Systems and Information Engineering, University of Virginia, PO Box 400747, 151 Engineer's Way, Charlottesville, VA, 22904, United States, kashbarker@virginia.edu

1 - Bicriteria Rescheduling with Controllable Processing Times
Ayten Turkcan, METU, Middle East Technical University, Department of Industrial Engineering, Ankara, 06531, Turkey, ayten@ie.metu.edu.tr

In this study, bicriteria rescheduling with controllable processing times problem is solved. We consider machine breakdown in a parallel machine environment. We propose an algorithm to find a set of nondominated solutions optimizing both efficiency and stability measures. The efficiency measure is the minimization of manufacturing cost and the stability measure is minimization of difference of starting and finishing times in the initial and final schedules.

2 - Optimal Warranty for Two-Attribute Policies
Jay Patankar, Professor, The University of Akron, 259 S. Broadway, College of Business Administration, Akron, 443254801, United States, jgp@uakron.edu, Amit Mitra

A warranty policy involving two attributes, for example time and usage, is considered. The paper analyzes a situation where a product is repaired on failure within the specified parameters, with the failure distribution of the repaired items being different from that of new items. A model is developed that incorporates expected warranty costs per unit sales and market share.

3 - Grouping Schemes for Data Envelopment Analysis to Solve Multiple Criteria Optimization Problems
Mauricio Cabrera-Ríos, Associate Professor, Universidad Autónoma de Nuevo León, Posgrado FIME, Av. Universidad S/N, San Nicolás de los Garza, NL, 66450, Mexico, mcabrera@mail.uanl.mx, María Guadalupe Villarreal-Marroquín

In the industry it is common to find optimization problems requiring the compromise between multiple measures in conflict. Finding solutions in an efficient manner to this kind of problems is critical if optimization is to be applied in these cases. In this work, data grouping schemes are proposed to make the solution process to multicriteria optimization problems efficient via Data Envelopment Analysis. The preliminary results of different schemes are reported.

4 - Scoring Rules, Generalized Entropy and Utility Maximization
Victor Richard Jose, Duke University, Durham, NC, 27708-0120, victorrichmond.jose@duke.edu, Robert Winkler, Robert F. Nau

This paper fleshes out the connections between measures of information coming from three seemingly distinct but surprisingly intertwined strands of literature: decision analysis, entropy and scoring rules. We discuss normalized forms of the pseudospherical and power scoring rules that arise from the solution of expected-utility-maximization problems and yield expected score functions that are generalized measures of divergence.

5 - Hierarchical Multiobjective Decisionmaking for Preparedness
Kash Barker, Graduate Student, Systems and Information Engineering, University of Virginia, PO Box 400747, 151 Engineer's Way, Charlottesville, VA, 22904, United States, kashbarker@virginia.edu, Yacov Haimes

Preparedness plans for disruptions such as terrorist attacks, natural disasters, and accidents have recently been shifted toward "resilience and recovery," thus disregarding the previous narrow focus of only "prevention and protection." We present results on a hierarchical multiobjective decisionmaking framework to effectively invest for federal, state, and local preparedness objectives. Highlighted are those objectives that promote an acceptable cost and recovery time of critical infrastructures and key resources.

■ WD44

Room 405

Simulation I and Heuristics

Contributed Session

Chair: Vinicius Armentano, Universidade Estadual de Campinas, Av. Albert Einstein, 400, Campinas, SP, 13083-970, Brazil, vinicius@densis.fee.unicamp.br

1 - Holonic Supply Chain: A Simulation Study

Philip Huang, Professor, Virginia Tech, 1007 Pamplin Hall, Blacksburg, VA, 24061, United States, phhuang@vt.edu, Sheneeta White

As market place gets competitive, a company needs to explore alternative strategy. In this paper, we examine a novel approach to structure a company's supply chain, which allows suppliers to form a consortium. When the company has material need, it will broadcast the information to the consortium. Its members will then negotiate to determine the distribution of this order. We are conducting a simulation experiment to test the strength of this new structure.

2 - Multiobjective Time-Dependent Optimal Experimental Design of Sampling Networks

Brent Thomas, Operations Researcher, RAND, 1776 Main Street, Santa Monica, CA, 90407, United States, bthomas@rand.org

Optimal experimental design (OED) is used to develop sampling networks in a contaminant transport scenario. The network could be used to improve the flow simulation, or to monitor contaminant flow, or both. A nondominated sorting genetic algorithm, NSGA-II, develops the Pareto surface of these objectives in concert with design cost. As time factors into both costs (through the discount rate) and kinetics, the approach addresses time dependency in the OED.

3 - Quasielastic Phenomenological Isotropic Optimization Medium Simulation for Phenomenal Liquid Crystal

Chang Chia-Fu, No. 949, Da Wan Road, Yung-Kang City, Tainan Hsien, 710 Taiwan, R.O.C., anderson880@yahoo.com.tw, Chen Wi-Ci, Win Zou-Ni

The problems of these two technologies have caused more and more product designers to turn to liquid crystal (LC) displays, which have consequently experienced phenomenal growth. The success of liquid crystal displays has fostered continued development, to the point where full-color video displays have been realized which can rival. Details of the lens structure and of the devices fabrication and performance are described. Simulation using the Jones matrix method. Director can change from point to point and is, in general, a function of space. The transition can be approached by changing the impurity concentration or, indirectly, by tuning the temperature since the pinning strengths of the random and crystal potential have in general a different temperature dependence. Light from conventional light source or laser is passed through a polarizer and then incident on the specimen. The resist profile simulation is carried out using the combined data thus obtained. The nematic liquid crystal is clear only when a long range order exists, in the whole medium. At the nematic-isotropic, transition temperature, the medium becomes isotropic and looks clear and transparent.

4 - Performance Analysis of Production Systems Operating with the PAC System

Corinne MacDonald, Assistant Professor, Dalhousie University, 5269 Morris Street, Halifax, NS, B3J 2X4, Canada, Corinne.macdonald@dal.ca, Eldon Gunn

We present some recent work on the performance analysis of manufacturing systems operating under a Production Authorization Card (PAC) system. Our analysis framework uses simulation to construct neural network metamodels. These metamodels provide a convenient framework to examine appropriate control strategies for a given production system.

5 - A Multistart Memory-Based Constructive Heuristic for the Container Loading Problem

Vinicius Armentano, Universidade Estadual de Campinas, Av. Albert Einstein, 400, Campinas, SP, 13083-970, Brazil, vinicius@densis.fee.unicamp.br, Olinto Araujo

We address the container loading problem which involves the selection of boxes in order to maximize the volume utilization subject to orientation and stability constraints. We propose a multi-start memory-based constructive heuristic with a load arrangement that is based on maximal cuboids that fit in given empty spaces. Computational tests on several instances from the literature show that the proposed method outperforms other approaches.

■ WD45

Room 406

Tutorial: Peer-to-Peer Technologies: A Research-Oriented Introduction

Cluster: Tutorials

Invited Session

1 - Peer to Peer Technologies: A Research-Oriented Introduction

Ramayya Krishnan, H. John Heinz III School of Public Policy and Management, Carnegie Mellon University, 4800 Forbes Avenue, Pittsburgh, PA, United States, rk2x@andrew.cmu.edu, Michael Smith, Rahul Telang

P2P technologies — Napster, Kazaa, and Bit Torrent in file sharing and grid computing in shared services computing — offer network infrastructure that is widely used for large scale, high bandwidth information exchange or for high end computation. In this tutorial, we will discuss interesting research issues - predictive modeling and incentive engineering - that arise in the context of these peer to peer networks.

■ WD47

Room 408

Supply Chains and Information

Contributed Session

Chair: Faisal Al-Khateeb, United Arab Emirates University, PO Box 23324, Al-ain, United Arab Emirates, faisal.alkhateeb@uaeu.ac.ae

1 - The Value of Information in Supply Chains

Larry J. LeBlanc, Professor, Vanderbilt University, Owen Graduate School of Management, 401 21st Avenue South, Nashville, TN, 37203, Larry.LeBlanc@owen.vanderbilt.edu, James Hill, Jerry Harder

We present a method for determining the value of information sharing (forecast accuracy) when planning production in a make-to-order supply chain environment. We examine the interaction of forecast errors, shortage vs. holding costs, and the cost of delaying production in a two-stage supply chain of a single product facing uncertain demand. We report computational results showing how to find the value of improved forecast accuracy

2 - Incentive-Compatible Allocation Policy: Individual versus Social Optimization

Kwan Wee, Singapore Mangement University, Singapore, Singapore, kewee@smu.edu.sg

We consider two customer allocation policies for a two-server queuing system: one induced by individuals' self-interest while the second based on social benefits. We show that in the equilibrium, when the servers incur penalty with respect to customers' waiting time, there is a threshold such that when the per unit time penalty exceeds the threshold, the social optimum induces higher service rates from the servers than the individual optimum; otherwise the result is reversed.

3 - Uncertainty Principles in Downstream Demand Inference (DDI)

Mohammad Ali, PhD Researcher, Buckinghamshire Business School, Goreland Lane, Chalfont St. Giles, Hp8 4AD, United Kingdom, m.ali@bcuc.ac.uk, John Boylan

In this paper, we present Uncertainty Principles to show that it is not possible for an upstream member in supply chains to accurately infer the consumer demand without any formal Information Sharing mechanism with the downstream member. Thus, we conclude that Demand Information Sharing has some value in reducing the Bullwhip Effect.

4 - Production Scheduling Under Demand Uncertainty With Time-Fence Driven Expediting/Cancellation Costs

Gregory DeYong, Doctoral Student, Indiana University, 1309 East Tenth Street, Bloomington, IN, 47405, United States, gdeyong@indiana.edu, Robert Jacobs, Kyle Cattani

The effects of a planning time fence complicate and transform rolling-horizon scheduling problems. This research develops rolling-horizon, fixed time fence scheduling for a discrete scheduling problem under uncertainty, with time-sensitive cancellation and expediting costs. We model a capital goods manufacturer to evaluate optimal and heuristic approaches to scheduling and study sensitivity of key variables. Use of a discrete-time Markov approach enhances understanding of the system states.

5 - Performance Analysis of Information Security in the Supply Chain Management

Faisal Al-Khateeb, United Arab Emirates University, PO Box 23324, Al-ain, United Arab Emirates, faisal.alkhateeb@uaeu.ac.ae

Information security has become an integral part of supply chain management. The importance of security is more evident as the value of system assets to protect increases. The main focus of this research is on the performance analysis of information security (PAIS) through supply chain management (SCM) drivers. To have a reliable security information system, each driver should have full control, feedback, and recovery for their own security.

■ WD49

Room 410

Reverse Supply Chain Analysis

Contributed Session

Chair: Thomas Sloan, University of Massachusetts Lowell, 1 University Avenue, College of Management, Lowell, MA, 01854, United States, Thomas_Sloan@uml.edu

1 - A Computational Analysis of Environmental Cost Impact on the Closed-Loop Network Design Problem

Dagoberto Garza, Assistant Professor, Tecnológico de Monterrey, Quality and Manufacturing Center, Eugenio Garza Sada 2501 Col. Tecnológico, Monterrey, NL, 64849, Mexico, dagarza@itesm.mx, Julio Mar

The extend interest in environmental aspects has originated several recovery models related to product recycling. Most models are focused in the design of a closed-loop supply chain (CLSC) considering infrastructure and transportations costs exclusively without environmental costs. In this work, a CLSC design model is presented with both economics and environmental costs. A series of experiments are used to study the effect of environmental costs under diverse scenarios and objectives.

2 - Computing Optimal Ordering Decisions to an Inventory Problem with Returns

Rahul Upreti, Doctoral Candidate, The University of Alabama, 300 Alston, Tuscaloosa, AL, 35487, United States, rupreti@cba.ua.edu, Charles Schmidt

A firm sells items in containers some of which may return from the field after a random number of time periods. Each period, some of the containers in the field are discarded and some are returned to the firm, which also buys new containers. We model the situation as a DTMC and using the Matrix-analytic technique to solve the associated QBD process, compute the operating characteristics over an infinite horizon under two cases - 1) No ordering policy, and 2) s,S ordering policy.

3 - Analysis of a Disassembly Machine with Kanban Control

Aybek Korugan, Assistant Professor, Bogazici Univeristy, Industrial Engineering Department Bebek, Istanbul, 34342, Turkey, aybek.korugan@boun.edu.tr, Gokce Nadir, Mehmet Can Aslantas, Burcu Sinsoysal

As a result of increasing environmental concerns remanufacturing activities are performed more frequently. The uncertainty in quality, quantity and timing of the return flow generates a unique control problem in the shopfloor. In this study we investigate the control of the disassembly process, a characteristic subprocess of remanufacturing activities, with kanbans. Here we use synchronization queues in order to keep track of faulty components disassembled from a returned product.

4 - Sustainable Supply Chains: The Impact of Supply Uncertainty on Green Manufacturing

Thomas Sloan, University of Massachusetts Lowell, 1 University Avenue, College of Management, Lowell, MA, 01854, United States, Thomas_Sloan@uml.edu

Many firms have begun efforts to green their operations as a result of regulations, consumer preferences, and/or economic pressures. While environmentally responsible manufacturing may be desirable, it raises significant challenges in terms of product design, material procurement, and supply chain management. Motivated by an application in healthcare, we develop a model to evaluate different supply alternatives, each characterized by different levels of reliability and environmental impact.

■ WD50

Room 411

Reverse Supply Chain Optimization

Contributed Session

Chair: Xiuli (Shelly) Qu, Purdue University, 315 N. Grant Street, West Lafayette, IN, 47906, United States, qu@ecn.purdue.edu

1 - Modeling Close-loop Supply Chain Systems with Stochastic Dynamic Programming

Guiping Hu, PhD Candidate, University of Pittsburgh, 1048 Benedum Hall, Pittsburgh, PA, 15213, United States, guh5@pitt.edu, Bopaya Bidanda, Yan Wang, Lizhi Wang

Close-loop supply chain systems are attracting increasing attention because of cost competition, resource constraints and environmental issues. Electronic products are of particular concern due to short lifecycles and hazardous material. We formulate close-loop supply chain with Stochastic Dynamic Program methodology. By applying the reverse logistics concept and Markov Decision Process technique, we will be able to provide guidelines for product management throughout the close-loop lifecycle.

2 - Pricing and Positioning the Remanufactured Product in Terms of Cost and Quality

Gokce Esenduran, University of North Carolina, Chapel Hill, Kenan-Flagler Business School, Chapel Hill, NC, United States, gokce_esenduran@unc.edu, Necati Aras, I. Kuban Altinel

We are concerned in the determination of the selling price of the manufactured product and the selling price and quality level of the remanufactured product from OEM's perspective. We propose a mathematical programming model using a linear relation between customer demand, and prices and quality. Assuming a functional relation between the cost and quality of the remanufactured product, the model is then used to generate insights by studying its behavior under various price and quality scenarios.

3 - Methodology for Reverse Supply Chain Design in Consumer Electronics Industry

Santhanam Rajagopalan, Graduate Teaching Associate, University of Texas, Arlington, 312 Uta Boulevard, 201, Arlington, TX, 76010, United States, sanmanisha@yahoo.com, Donald Liles, Srikanth Yellepeddi

In today's business, reverse supply chain (RSC) activities are becoming mandatory due to the legislations and associated economic benefits. The process of designing an efficient RSC system is one of the most strategic imperatives for an enterprise. This research proposes a methodology for designing the same within consumer electronics segment.

4 - Determining the Impact of Plastic Versus Metal Intensity on Reverse Automotive Production

Xiuli (Shelly) Qu, Purdue University, 315 N. Grant Street, West Lafayette, IN, 47906, United States, qu@ecn.purdue.edu, Julie A. S. Williams

Automotive shredders need a reverse production planning strategy that includes determining the purchase price for vehicle hulks based on hulk composition. An important aspect of hulk composition is ferrous metal versus plastic content. We present a NLP model to make purchasing and processing decisions, develop an approximate hulk supply function, and compare two hulk pricing strategies. Our results indicate that the optimal purchasing and processing decisions can increase profit significantly.

■ WD52

Room 413

Revenue and Inventory Management

Sponsor: Revenue Management & Pricing

Sponsored Session

Chair: Opher Baron, University of Toronto, 105 St. George Street, Toronto, ON, M5S 3E6, Canada, Opher.Baron@Rotman.Utoronto.Ca

Co-Chair: Joseph Milner, Professor, milner@rotman.utoronto.ca

1 - Models of Consumer Behavior in Waiting for Last Minute Discounts

Anton Ovchinnikov, Assistant Professor, Darden School of Business, University of Virginia, 100 Darden Boulevard, Charlottesville, VA, 22903, United States, anton@rotman.utoronto.ca, Joseph Milner

We consider the behavior of customers who strategically decide whether to wait for a last minute discount or to purchase early at full price. We suggest a game theoretic model and characterize the structure of equilibrium behavior. Then we suggest heuristic models of bounded rationality and analyze to what extent their predictions agree with or differ from the game theoretic model. We discuss the implications for firms that offer last-minute discounts.

2 - Value of Dynamic Pricing in a Decentralized Supply Chain
Tamer Boyaci, Associate Professor, Desautels Faculty of Management, McGill University, 1001 Sherbrooke Street West, Montreal, QC, H3A1G5, Canada, tamer.boyaci@mcgill.ca, Saibal Ray, Yuyue Song

We study a decentralized manufacturer-retailer chain in a two-period non-stationary framework with price-sensitive, stochastic correlated retail demand. We allow one or more retail and wholesale pricing (i.e. contracting) opportunities. We show how optimal decisions behave temporally and are affected by system characteristics. Comparing profits with the centralized scenario, we show how the value of pricing flexibility and the division of supply chain profits are influenced by decentralization.

3 - Optimal Production and Admission Policies in Make-To-Stock/Make-To-Order Manufacturing Systems
Tieming Liu, Assistant Professor, Oklahoma State University, 322 Engineering North, Stillwater, OK, 74078, United States, tieming.liu@okstate.edu, Seyed Iravani, David Simchi-Levi

We study production and admission controls in manufacturing systems that produce two types of products. The first type consists of identical items that are produced to stock, while the second are products with varying features that are produced to order. We show a modified basestock policy is optimal with exponential production times and Poisson arrival demands for each product. We extend the results to problems with multiple make-to-order products and with cancelable make-to-stock backorders.

4 - Multiple Unit Dynamic Pricing with a Secondary Market
Joseph Milner, Professor, milner@rotman.utoronto.ca, Binbin Liu

We study the dynamic pricing policy of a firm in which a common price is used for multiple item types and a secondary market such as a discount or outlet store exists. We consider cases when the firm should discount the price in the primary market, when the firm should sell units to a secondary market, and cases where inventory should be moved to an outlet. The model provides insights into the effect of alternate distribution channels on pricing policy.

■ WD53

Room 414

Data Issues in Supply Chain Management

Contributed Session

Chair: Zhong-Xian Wang, Professor, Department of Management & Information Systems, Montclair State University, Montclair, NJ, 07043, United States, wangj@mail.montclair.edu

1 - Costs, Benefits and Risks of RFID for Managing Supply Chains
Ertunga Ozelkan, Assistant Professor, University of North Carolina, Charlotte, 9201 University City Boulevard, Charlotte, NC, 28223, United States, ecozelka@uncc.edu, Agnes Galambosi

Although there is a strong push for Radio Frequency Identification (RFID) by some large corporations and government agencies, many supply chain players are still skeptical. This paper discusses the costs, benefits, and risks of RFID. A simulation and break-even analysis are conducted to understand when implementing RFID becomes more desirable than not implementing it. It is shown that although, RFID implementation is not risk-free, as margins and volumes go up, the risk decreases significantly.

2 - On Design of Data Quality Monitor for Supply Chain Optimizer
Guoquan Liu, Engineer, Intel Corporation, No. 999 YingLun Road, Waigaoqiao Free Trade Zone, Pudong, Shanghai, 200131, China, george.liu@intel.com, Zhenying Zhao

The data quality (DQ) monitor is an effective way to improve the DQ to guarantee accurate optimal solutions. The paper presents the requirements for a DQ monitor which take into account the requirements for a linear programming algorithm - a powerful and popular mathematical model for supply chain optimization.

3 - Using Real-Time Information for Improved Supply Chain Decision Making
Mahesh Srinivasan, The Pennsylvania State University, 463A Business Building, Department of SC&IS, University Park, PA, 16802, United States, maheshs@psu.edu, Doug Thomas

We develop decision making models to use real-time information for improved inventory decisions within the context of a supply chain. We consider 2 major problems - inventory systems with order crossover and inventory systems with two supply modes. We use dynamic programming based optimization to investigate optimal policies and use simulation to arrive at near-optimal inventory policies and mode choices.

4 - A Rational Agent Framework for Multi-Agent Supply Chain Modeling
Ramakrishna Govindu, Wayne State University, 4815 Fourth Street, Detroit, MI, 48202, United States, ah0776@wayne.edu, Ratna Babu Chinnam

Multi-agent systems have emerged as an intrinsic paradigm for modeling complex systems such as supply chains. However, their development process remains involved and extremely time consuming. We develop a "software agent-component based framework" for SC modeling and validate it using "Tamagotchi" case. We share the details of extending it to make it a "Rational Agent Framework" by incorporating goal-directed rationality through Belief-Desire-Intention (BDI) model of human practical reasoning.

5 - Choosing Data Warehouse Methodology and Managing Data Warehouse Operational Cycle
Zhong-Xian Wang, Professor, Department of Management & Information Systems, Montclair State University, Montclair, NJ, 07043, United States, wangj@mail.montclair.edu, Qiyang Chen

With so many data warehousing methodologies to choose from, a major problem for many firms is which one the company should utilize for its situation. Several attributes have been used to evaluate the various methodologies. Given the need to respond to internal and external changes, the design of the data warehouse must be flexible enough to adapt to changes in the business cycle.

■ WD54

Room 415

Telecommunications

Contributed Session

Chair: Cheng-Huang Hung, Assistant Professor, Department of Information Management, National Taiwan University of Science and Technology, 43 Sec. 4, Keelung Road, Taipei, 106, Taiwan, alexhung@cs.ntust.edu.tw

1 - Robust Analysis for Securing Localization in Wireless Sensor Networks
Wei Ye, University of Southern California, 2677 Ellendale Pl #205, Los Angeles, CA, 90007, United States, yewei@usc.edu, Fernando Ordonez

Wireless Sensor Networks (WSNs) are one of the active research problems in the world. Most problems in energy limited WSNs are based on the correct location position references, but the study for malicious attacks has been mostly ignored. In this paper, we present robust optimization methods to make the location estimate attack-tolerant in hostile environments. Our computation simulations show our robust methods outperform alternative methods to get the attack-tolerant location estimation.

2 - On the Performance of MANETS Routing Protocols in Various Fading Environments
Dr. Timothy I Matis, Assistant Professor, Department of Industrial Engineering, Texas Tech University, PO Box 43061, Lubbock, TX, 79409, United States, timothy.matis@ttu.edu, Ivan Guardiola

In this presentation, we examine the end-to-end performance of popular routing protocols for mobile ad-hoc networks (MANETS) under various multipath fading models. Our findings demonstrate the strong impact that fading has on the performance of a protocol, and we suggest possible remedial measures.

3 - Internet Service Provider Peering
Gireesh Shrimali, Stanford University, 444 San Antonio 9C, Palo Alto, CA, 94306, United States, gireesh@stanford.edu, Sunil Kumar

We look at paid Internet Service Provider (ISP) peering. Under reasonably general cost models, we show that one peer acts as a monopolist, and provide a characterization of the monopolist. Moreover, we show that it is still possible for both peers to be better off. We then look at the common ``Bill-and-Keep" peering, where no money exchanges hands, and establish sufficient conditions for neither ISP to be a monopolist and for both peers to be better off due to peering.

4 - Wireless Network Access Point Location Problem Under Level of Service Constraints
Cheng-Huang Hung, Assistant Professor, Department of Information Management, National Taiwan University of Science and Technology, 43 Sec. 4, Keelung Road, Taipei, 106, Taiwan, alexhung@cs.ntust.edu.tw, Chia-He Lin

We consider the problem that minimizes the number of wireless network access points to satisfy some desired level of service constraints. We develop a network-flow based algorithm. The performance of our algorithm and the comparisons of performance between the existed formulations and algorithms are presented.

■ WD55

Room 416

Management of Technology in Information Systems

Contributed Session

Chair: Reuven Levary, Professor, Saint Louis University, 3674 Lindell Boulevard, Saint Louis, MO, 63108, United States, levarypr@slu.edu

1 - The Software Outsourcing Practices of Hong Kong SMEs

C.H. Cheng, Associate Professor, The Chinese University of Hong Kong, Department of Systems Engineering, & Engineering Management, Shatin, NT, Hong Kong, chcheng@se.cuhk.edu.hk, K.F. Wong

Due to the geographical proximity, and cultural and language affinity, many Hong Kong small and medium enterprises (SMEs) outsource their software development activities to China. We conduct a study to examine these activities in China through interviewing eight SME executives. Specifically through our study, we hope to increase our understanding of how the decisions are made, how the operations are managed, and how the concerns are addressed.

2 - Two-Tier Decision Model for IT Outsourcing

Edward Chen, Associate Professor, University of Massachusetts, Management Department, 1 University Avenue, Lowell, MA, 01854, United States, edward_chen@uml.edu

Information technology (IT) outsourcing becomes a major issue of large companies today. They are tapping the rich IT resources oversea to improve their bottom line. The task is critical and complex as it affects the company not only economically but also organizationally and strategically. This study proposes a two-tier decision model to facilitate the decision process. This model also provides a framework for managers to utilize decision aids in problem-solving.

3 - Winners-Take-Some: The Impact of Conversion Technologies on Network Effects in Digital Goods Markets

Zhechao Liu, University of Pittsburgh, Katz Graduate School of Business, 245 Mervis Hall, Pittsburgh, PA, 15213, United States, zhliu@katz.pitt.edu, Michael Smith, Chris Kemerer

The traditional "winner-take-all" assumption has been documented in many IT markets characterized with network effects. We derive an analytical model that endogenizes the provision of the conversion technology in the presence of network effects. The market equilibrium supports our hypothesis that the existence of the converter mediates the network effects of the pre-existing installed base and the conversion equilibrium is more sustainable the higher the degree of convertibility.

4 - Antecedents of Open Source Software Success

Jing Wang, Kent State University, A409, College of Business Administration, Kent State University, Kent, OH, 44242, United States, jwang2@kent.edu, Michael Hu, Marvin D. Troutt, Murali Shanker

Open source software (OSS) projects are emerging as a significant economic, social, and cultural phenomenon. Nonetheless, little is known on why certain projects like Apache and Linux succeed whereas many others fail. This research seeks to investigate factors relating to the success and evolution of OSS projects. Findings of this research provide guidelines on how to produce OSS products that have a greater chance of being deployed and how to promote open source software diffusion.

5 - Intrusion Detection Using an Adaptive Expert System

Reuven Levary, Professor, Saint Louis University, 3674 Lindell Boulevard, Saint Louis, MO, 63108, United States, levarypr@slu.edu

An adaptive expert system for intrusion detection that utilizes fuzzy sets is described. This system has the ability to adapt to the type and/or degree of threat. Examples of rule sets are provided. The adaptive ability of the system is demonstrated by experimenting with the system using simulation.

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Visoldilokpun, Siriwat SC26
Viswanathan, Siva MC14, TA15, WC55
Viswanath, Kannan TB35, TB40
Vitoriano, Begoña TC19
Vits, Jeroen SB14
Vlasiou, Maria WB05
Vohra, Rakesh SB53
Vojnovic, Milan TD41
Volinsky, Chris TB26
Volovoi, Vitali SA27
Volz, Marcus WC44
von Winterfeldt, Detlof TA18
Vormbrock, N. WC12
Vossen, Thomas MA33
Voss, Stefan SC07, WA32, WB06, WD06
Vovsha, Peter SA35, SC36
Vulcano, Gustavo SC16, TB52

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Wachtel, Ruth E. SA30
Wadhwa, Vijay WA43
Waechter, Andreas SA02, SB02
Wagner, Janet SC46, TC12
Wagner, Michael TB36
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Walczak, Darius SB46
Walensky, Rochelle MC30
Walker, Joan SC36, TA33
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Waltz, Richard MB03, MD10
Waltz, Zachary MC43
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Wang, Charles WC32
Wang, Cheng (Marshal) WD01
Wang, Chin-I WB25
Wang, Chi-Tai WA55
Wang, Chi-Tai MB25
Wang, Chung-Jui SD31
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Wang, Haibo SC51
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Wang, Hsueh-Ming WB11
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Wang, Jian WD16
Wang, Jianfeng TD33
Wang, Jianrui (Jerry) MA17
Wang, Jing WD55
Wang, Limin WB43
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Wang, Lin MB34
Wang, Lizhi MD27, WA19, WD50
Wang, Ming-En MB34
Wang, Nan WC50
Wang, Pengyuan TD03
Wang, Qinan SB55
Wang, Seung-Jin WD25
Wang, Shanshan TA26
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Wang, Wei WC37, WC50, WD37
Wang, WeiZhao MA01
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Wang, Yan WA19
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Wang, Yimin SA47
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Wang, Yulan TD24, TD46
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Wan, Hong SA14, TD17, WA29
Ward, Amy SC35, TC41
Wardell, Don TC13, TD13
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Ward, Jeff WC36
Warner, Jon WB36
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Wasil, Edward SC31, TB06, TC07
Wassick, John WD12
Watewai, Thaisiri TA16
Wathen, Samuel SA07
Wati, Sharon WC14
Watson, Jean-Paul SA06, TB06
Watson, Layne TD03
Watson, Noel SB08
Wattal, Sunil TA14
Webb, Robert WB29
Webb, William MA25
Weber, Bruce SB37
Weber, Charles SD08
Weber, James SC13
Weber, Klaus SB24
Weber, Roberto MA15
Weber, Stefan SA31, MC31
Weber, Theophane MD50, WA41
Weber, Thomas MA54, MB37, IS-M, MC14, MD54
Webster, Scott WC32
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Wee, Kwan TA46, WD47
Wei, Heng MA36
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Weinstein, Milton MC20, MC30
Weintraub, Andres , SC19, SD19, MB19
Weintraub, Gabriel Y. TC50, TD52
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Weissman, Tsachy SD41
Welch, Charles TA11
Wellington, John SD14
Wendell, Richard TB32
Weng, Michael MC27
Wentworth, William WB08
Wen, Vendy WD32
Wernz, Christian TC24
Wesolowsky, George O. MD40
West, Dave TB12
West, Paul MA22
West, William WC36
Weyant, John P. SC49
Whinston, Andrew B. MC14, MD14, TA14
Whitaker, Jonathan SB37
White, Chip SD36, WB35
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Whitman, Peter WC40
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Wieland, Jamie TC17
Wierman, Adam SD42
Wikum, Erick MC38
Wild, Stefan WC29
Wiley, Mark MC10
Wilhelm, Wilbert MA25, WB50
Willemain, Thomas WB13, WC17, WD18
Willems, Sean SA47, MB24, MC53
Williams, Anthony MD06
Williams, Arthur TC30
Williams, Brian TD07
Williams, Gerald H. SB15
Williams, Julie A. S. SB30, WD50
Williams, Justin MD29
Williamson, David TC01
Williams, Pamela SC02
Willinger, Marc MD52
Willis, Deanna TA43, WC27
Willis, Henry MB18
Willis, LTC John WD36
Willoughby, Ph.D., Keith MD30
Wilson, Alicia MD44, WB20
Wilson, Bradley MC22
Wilson, James MC17
Wilson, John SB17, TB52
Wilson, Rick SC11
Windle, Robert J. SA33, WA51
Winkler, Robert SC21, MA21, WD43
Winston, Wayne SA11
Wittevrongel, Sabine IS-M
Wolfers, Justin MA15
Wolff, Ronald MD05
Wolf, James R. MC15
Wolsey, Laurence WA47
Wolter, Jason MA22
Wolter, Kati MC02
Womer, Keith TB05
Wong, Ernest TB22, WC36
Wong, K.F. WD55
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Wood, Kevin MA18
Woodruff, David SC07, WA32
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Woolley, Trisha WD40
Wooten, Russell TB25
Worsöe, Ulf SD18
Wortman, Martin SD47, MD12
Wright, Ronald TB13
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Wu, Amy Ping SC37
Wu, Chen-hung SA27
Wu, Chongqi MA54
Wu, David WC23
Wu, Diana SC04
Wu, Huaiqing WB27
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Wu, Jeff C. F. SB28, SD28, MA28, TD28, WB27
Wu, Jeff SB28
Wu, Kan SB36
Wu, Kuang-Yao WA50
Wu, Qing-Rong WB43
Wu, Shengnan TD34, WD20
Wu, Shuning TD26
Wu, Sze-Jung SD29
Wu, Teresa TD26
Wu, Tony MC35
Wu, Xinmin MA53
Wu, Yaozhong SB09, MA09
Wu, Zhengping TC54
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Wynter, Laura WB30, WC16
Wysk, Rick MA17

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Xia, Cathy TA41, TB17, WB30
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Xia, Nan TD54
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Xiao, Baichun SB17
Xiao, Wenli SC17
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Xia, Yusen SA04, SB42
Xie, Jinhong SA54
Xie, Ming TC40, WD20
Xie, WDi WB03
Xin Jiang, Albert WA15
Xing, Eric TC18
Xingzheng, Ai WA05
Xiong, Hongxia MA54
Xi, Youmin WC54
Xi, Yufang MC01
Xue, Mei MC54, MD54
Xu, Heng TB14
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Xu, Huifu SD03
Xu, Jianhua MA40
Xu, Juntian IS-M
Xu, Jie MB17
Xu, Lin TD19
Xu, Ping Josephine SA47
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Xu, XiaoWei SA14, SD14
Xu, Yan MD02
Xu, Yaquan SC51
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Xu, Yu WC31
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Yamada, Yuji MD31
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Yang, Wei SB17
Yang, Xiaodong SC14
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Yang, Zheng WA38
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Yan, Houmin SB55, WC32
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Yano, Candi MA46, MB12, WB32
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Yao, Dongqing WB14
Yao, Jian SA18
Yao, Ruozhen WD11
Yao, Tao SB12, WA14, WB09
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Yates, Justin MB04, MC02, WA35
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Yechiali, Uri TA41
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Ye, Heng-Qing SC41, WA17
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Yi, Dong-Ju TD25
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Yin, Wenjun SA51, SC51, TC40, TD40, WD20
Yin, Yafeng SB35, TA34
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Yong, Hai Ein (Jean) MB30
Yoshii, Kunihisa MC29
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Young, Virginia R. TD31
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Zayas-Castro, José MC27
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Zhang, Ai Jun WA04
Zhang, Alex MD25
Zhang, Bin SC51, TD40
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Zhang, Changyong TA07
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Zhang, Fuqiang MB46, TA23, TB48, TC54
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Zhang, Jiawei SB40, MC47
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Zhang, Jun MC54, MD54, WA46
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Zhang, Kuilin SA36
Zhang, Lei SB35, TA34, TD36
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Zhao, Hairong MC42
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Zhao, Lei TA53
Zhao, Ming MB04, MC02, TC04
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Zhao, Xuan MD47, TC46
Zhao, Xuying WB46
Zhao, Xuying MB42
Zhao, Yao MD53, TC32, WA37
Zhao, Yonggan WD32
Zhao, Zhenying TD14, WD53
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Zhou, Sean TC32
Zhou, Sherry Z.F. WC20
Zhou, Shiyu MB27, MB28, WC28, WD27
Zhou, Shu (Vickii) SB04
Zhou, Weihua SB42, WB41
Zhou, Xian MD42
Zhou, Xuesong TC38
Zhou, Yingjie MA39
Zhou, Yong-Pin SA52, MB23
Zhou, Yu SA28
Zhou, Zach SB37
Zhou, Zhihong SD07
Zhu, Adam TC54
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Zhu, Chengbin WA24
Zhu, Dan TD26
Zhu, Guidong TA32
Zhu, Kaijie TC05, WC20
Zhu, Kevin SB37
Zhu, Minghua SC51, TD40
Zhu, Wenge MA24
Zhu, Xiaowei WD27
Zhu, Xiaowei WB53
Zhu, Xiaoyan WB50
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Zia, Leila TD27
Ziemba, William WD32
Ziliaskopoulos, Athanasios TA35, TC36
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Zimmerman, David MC27, TC27, WC27
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Zimmerman, Rae MA34
Zimmerman, Terry SA06
Zinchenko, Yuriy WA03
Zinkevich, Martin WC01
Zipkin, Paul H. TA48, TB39, TD24
Zipkin, Paul SA52
Zitzewitz, Eric MA15
Ziya, Serhan SC29
Zografos, Kostas TB25
Zorych, Ivan SD11
Zou, Li SA33
Zou-Ni, Win WD44
Zuluaga, Luis SB03
Zwart, Bert SA41

Sunday, 8:00am - 9:30am

SA01 Geometric Optimization
SA02 Joint Session Open-Source/ICS: Applications of the Nonlinear Optimization Software IPOPT I
SA03 Interior Point Methods for Linear Programming
SA04 Managing Supply Chain Uncertainties
SA05 Computational Developments in Stochastic Integer Programming
SA06 Applications of Constraint Programming
SA07 New Books in Business Statistics
SA08 Technology Strategy: Entry, Adoption, and Acquisition
SA09 R&D Decisions in Entrepreneurial Settings
SA11 Real-Life Sports Applications
SA12 2006 Dantzig Dissertation Award Finalists
SA13 Teaching Case Competition I
SA14 Optimization in Quality Control
SA15 Laboratory Auctions Experiments
SA16 Dynamic Pricing and Inventory Control
SA17 Multiechelon Revenue Management Models
SA18 Investment Incentives and Risk Management in Electricity Markets
SA19 Forestry Applications I
SA20 Communicating with Decision Makers
SA21 Decisions and Games Involving Outcomes Over Space and Time
SA22 Missions and Means Framework: Mathematical Perspectives
SA23 Business Applications II
SA24 Perspectives on the Journal
SA25 Panel Discussion: OR Entrepreneurship #1
SA26 Data Mining Applications in HealthCare
SA27 Maintenance for Dynamic Environments
SA28 Multiscale Wavelets Analysis and Applications
SA29 Resource Allocation and Facility Location in Healthcare
SA30 Contemporary Operational and Strategic Issues in Hospitals
SA31 Financial Engineering
SA32 Best Financial Services Student Paper Competition
SA33 Modeling the National Airspace System (NAS)
SA34 Games of Coorporation and Competition in Transportation
SA35 Theoretical and Practical Applications of Integrating Demand and Network Models
SA36 Dynamic Problems in Rail and Road Transportation
SA37 Economics of Information Systems
SA38 RASIG Student Paper Session: Top 3
SA39 Where Do We Want to Go in Practice? (In observance of Arthur Geoffrion's retirement)
SA40 Location Analysis: Models, Algorithms and Applications
SA41 Queueing Methods and Applications
SA42 Logistics Scheduling
SA43 What Would Not Have Been Possible without the Work of Thomas L. Saaty
SA44 Applied Probability I
SA45 Tutorial: Location, Transport and Land-Use: Modeling Spatial-Temporal Information
SA46 Tutorial: Pricing and Revenue Management
SA47 Inventory and Logistics Management
SA48 Retail Supply Chain Management
SA49 History of OR/MS I
SA50 INFORMS Optimization Society Award Session
SA51 Data Envelopment Analysis I
SA52 Customer Behavior in Revenue Management
SA53 Revenue Management and Beyond
SA54 Interfaces Between Marketing, Operations and Technology I
SA55 Supply Chain Logistics I

Sunday, 10:00am - 11:30am

SB01 Applications of the Arora-Rao-Vazirani Algorithm
SB02 Joint Session Open-Source/ICS: Applications of the Nonlinear Optimization Software IPOPT II
SB03 Applications of Linear Programming
SB04 Strategic Interactions in Supply Chains
SB05 Optimization Approaches in Financial Engineering I
SB06 Novel Randomization Approaches in Search
SB07 New Books in Optimization
SB08 Behavioral Operations
SB09 Empirical and Experimental Research in New Product Development
SB10 Software Demonstration
SB11 OR in SpORts I
SB12 2006 Dantzig Dissertation Award Finalists
SB13 Teaching Case Competition II
SB14 Quality Control
SB15 Procurement and Combinatorial Auctions I
SB16 Topics in Revenue Management and Pricing
SB17 Revenue Management Models
SB18 Models of Energy Markets
SB19 Forestry Applications II
SB20 Portfolio Decision Analysis
SB21 Ideas Relevant to Multiattribute Decision Analysis Practice
SB22 Mission and Means Framework - Applications
SB23 CONDIE (Committee on Next Decade in Industrial Engineering) Progress Report
SB24 Cultural Pragmatics in Professions
SB25 Panel Discussion: OR Entrepreneurship #2
SB26 Data Mining and Statistical Modeling in Environmental Problems
SB27 Process Mining
SB28 Best Student Paper Presentation Session
SB29 Healthcare Engineering to Inform Policymakers
SB30 Pierskalla Award Presentations
SB31 Topics in Portfolio Optimization
SB32 Consumer Level Financial Modeling
SB33 Delay Models for Aviation Operations
SB34 Transportation Infrastructure Management
SB35 Models and Methods for Road Pricing: I
SB36 Manufacturing Facility Design
SB37 Business Value of Information Technology
SB38 Railway Decision Support Models
SB39 Where Do We Want to Go in Research? (In observance of Arthur Geoffrion's retirement)
SB40 New Location Models and Algorithms
SB41 Call Centers
SB42 Contemporary Scheduling
SB43 New Developments and Applications of the AHP and ANP
SB44 Applied Probability II
SB45 Tutorial: Math Programming Approaches to Approximate Dynamic Programming
SB46 Tutorial: A Practical Approach to Pricing Optimization
SB47 Risk, Financing, and Operations
SB48 Supply Chain Management - Contexts and Concepts
SB49 History of OR/MS II
SB50 Network Design
SB51 Data Envelopment Analysis II
SB52 Revenue Management Education and Material
SB53 Dynamic Models of Selling Mechanisms
SB54 Inventory Games in Supply Chain
SB55 Supply Chain Logistics II

Sunday, 1:30pm - 3:00pm

SC01 Algorithms for Discrete Stochastic Optimization Models
SC02 Joint Session Open-Source/ICS: Open-Source Optimization Packages for Engineering Design
SC03 Approximate Dynamic Programming
SC04 Laboratory Experiments in Supply Chain and Operations Management
SC05 Stochastic Programming
SC06 Constraint Programming Tools
SC07 Supply Chain Management Books
SC08 KLIC I
SC09 Management of Innovation & New Product Development in Complex Systems Environments
SC10 Software Demonstration
SC11 OR in SpORts II
SC12 Nicholson Student Paper Prize Competition, I
SC13 Teaching OR/MS with Cases
SC14 Quality Monitoring
SC15 Procurement Auctions in OM
SC16 Revenue Management and Pricing under Various Market Models
SC17 Revenue Management Models with Customer Behavior
SC18 Advances in Geometric Programming
SC19 Forestry Applications III
SC20 The Value of Information
SC21 Panel Discussion: Decision Analysis: Foundations in Mathematics, Science, and Engineering
SC22 Air Force Supply Chain Analysis
SC23 Joint Session New Frontiers/ED: Innovative OR Teaching in Industrial Engineering from the OR Division of IIE
SC24 Micro-Institutional Processes
SC25 Panel Discussion: OR Entrepreneurship #3
SC26 Data Mining in Decision-Making
SC27 Joint Session QSR/ Health Applications: Quality and Statistical Decision-Making in Healthcare Applications I
SC28 Panel Discussion: 10 Years Anniversary for the QSR Section: Past, Current and Future
SC29 Stochastic Models in Health Care
SC30 Pierskalla Award Presentations
SC31 Metaheuristics and Vehicle Routing I
SC32 Modeling in Financial Services
SC33 Performance Analysis of the National Airspace System (NAS) Using Operations Forecasting
SC34 Joint Session TSL/PPP: Operations Research and Non-Profit Applications
SC35 Recent Development and Applications of the Continum Approximation Method
SC36 Panel Discussion: Integrating Demand and Network Models
SC37 Economics of IS
SC38 RASIG Roundtable I - Railroad Capacity Network Allocation and Investment
SC39 Where Do We Want to Go in Education? (In observance of Arthur Geoffrion's retirement)
SC40 Medical Location Issues
SC41 Diffusion Approximations and Applications
SC42 Improving Scheduling Decision-Making
SC43 AHP/ANP Applications in Operations Management
SC44 JFIG Paper Competition Finalists I
SC45 Tutorial: Model Uncertainty, Robust Optimization and Learning
SC46 Tutorial: Enhance Your Own Research Productivity Using Spreadsheets (From Sin to Salvation)
SC47 New Supply Chain Initiatives
SC48 Supply Chain Management with Asymetric Information
SC49 Alan S. Manne (1925-2005): Innovative Energy, Environment and Operations Modeler
SC50 Network Design
SC51 Applications of Data Mining/Machine Learning
SC52 Topics in Revenue Management and Pricing
SC53 Pricing and Revenue Management: New Models
SC54 Panel Discussion: Integrated Operations and Marketing for Serving Emerging Markets
SC55 Supply Chain Management I

Sunday, 4:30pm - 6:00pm

SD01 Optimization on Graphs
SD02 Joint Session Open-Source/ICS: New in COIN-OR
SD03 Variational Inequalities, MPECs and Maximum Likelihood Estimation
SD04 OM/Finance Interface
SD05 Probabilistic and Dominance-Constrained Optimization
SD06 Algorithmic Topics in Constraint Programming
SD07 Computational Approaches for Large Scale Optimization Problems
SD08 KLIC II
SD09 Sciences of the Artificial Since Simon 1969: Design, Problem Solving, and System Improvement in Management
SD10 Software Demonstration
SD11 BUGS: Using OR to Study Baseball, Umpiring, Golf and Soccer
SD12 Nicholson Student Paper Prize Competition, II
SD13 Innovations in Undergraduate Operations Research Curricula
SD14 Statistical Models
SD15 Auctions in the Wild: Field Studies of Reverse Auctions
SD16 Advances in Revenue Management
SD17 Production & Scheduling I
SD18 Geometric Programming: Applications and Software
SD19 Forestry Applications IV
SD20 DA Arcade 1
SD21 Decision Analysis for Healthcare Entities
SD22 OR in Information Fusion
SD23 Strategic Decisions in Services Offshoring
SD24 Language, Culture, and Representation in Markets
SD25 Select Business Modeling Case Studies in Telecommunications Industry
SD26 Mathematical Programming in Data Mining Machine Learning
SD27 Sequential Analysis and Model Selection Problems
SD28 Panel Discussion: Teaching Experimental Design and Statistical Process Control Methods
SD29 System Analysis and Design in Healthcare
SD30 Optimization of Medical Decisions
SD31 Optimization Approaches in Financial Engineering II
SD32 Corporate Financial Modeling
SD33 Air Traffic Management
SD34 Distribution Problems in Facility Logistics I
SD35 Network Design and Other Strategic Issues in Transportation
SD36 Inventory, Production and Distribution Applications
SD37 Economics of IS 2
SD38 Roundtable II - Tactical and Operational Capacity Management
SD39 OK, Now How Do We Get There from Here? (In observance of Arthur Geoffrion's retirement)
SD40 Recent Developments in Location Analysis
SD41 Learning and Adaptive Algorithms
SD42 Scheduling: New Models and Metrics
SD43 AHP/ANP Theory and Applications
SD44 JFIG Paper Competition Finalists II
SD45 Tutorial: Electricity Deregulation: What is Wrong & How We Got There
SD46 Tutorial: Opt Art
SD47 Managing Uncertainty and Risk in Supply Chains
SD48 Game Theory Applications in Supply Chain Management
SD49 History of OR and Management Science
SD50 Wireless Systems
SD51 Implementation Issues in Data Mining/Machine Learning

SD52 Competition and Pricing
SD53 Topics in Revenue Management and Pricing
SD54 Interfaces Between Marketing, Operations and Technology II
SD55 Computer Science - Applications to OR

Monday, 8:00am - 9:30am

MA01 Optimization in Wireless Networks
MA02 Joint Session Open-Source/ICS: Mixed-Integer Nonlinear Programming with COIN-OR
MA03 Robust Optimization Theory and Applications
MA04 Lifting in Mixed Integer Programming
MA05 Sampling Methods in Stochastic Programming
MA06 Breaking Symmetries
MA07 High Throughput Optimization
MA08 Joint Panel Discussion TMS/NPD: Early Career Strategies in Interdisciplinary Areas - Perspectives from TMS and NPD
MA09 Emerging Issues in Innovation
MA10 Software Demonstration
MA11 Joint Session Minority/ Optimization: Discrete Optimization I
MA12 Mentoring: Perspectives of Winners of the Award for the Advancement of Women in OR/MS
MA13 Teaching Decision Support System (DSS) Development
MA14 Procurement and Combinatorial Auctions II
MA15 Prediction Markets I
MA16 Revenue Management with Demand Learning
MA17 Simulation-Based Shop Floor Control
MA18 Operations Research and Homeland Security
MA19 Forestry Applications V
MA20 Joint Session DAS/ENRE: R&D. Electricity, and Climate Change
MA21 Eliciting, Evaluating, and Combining Expert Judgments
MA22 Joint Session MAS/DAS: Military Decision Analysis
MA23 Emergent Models and Factors that Drive Efficiency Gains
MA24 Product Development I
MA25 Integer Programming
MA26 Joint Session DM Invited/DM Sponsored: New Approaches and Problems for Data Mining
MA27 Prognostics and Adaptive Decision Making
MA28 Robust Parameter Design: New Ideas and Applications
MA29 Health Care Systems Optimization
MA30 OR in Nurse Planning
MA31 Finance and Stochastics
MA32 Portfolio Optimization and Firm Valuation
MA33 Joint Session Aviation App./TSL: Models for Managing Air Traffic Delays
MA34 Joint Session TSL/Counter Terrorism: Urban Transportation Planning Models I: Transportation System Risk, Security, and Emergency Response
MA35 Hazard Management and Evacuation I
MA36 Urban Transportation Planning Models II: Land Use and Transportation
MA37 ISR Special Issue Session
MA38 Experiences and Opportunities in Rail Fleet and Crew Management
MA39 Ethics in OR
MA40 Joint Session SOLA/Minority Issues/ Public Programs: Public-Sector Facility Location and Urb an Planning
MA41 Joint Session AP/Minority: Queues and Call Centers
MA42 Advances in Multi-Machine Scheduling
MA43 AHP/ANP Applications
MA44 The Resilient Enterprise - Challenges in Supply Chain Security and Resilience
MA45 Tutorial: Semidefinite and Second Order Cone Programming and Their Application to Shape Constrained Regression and Density Estimation
MA46 Panel Discussion: Marketing your OR/MS Skills
MA47 Integrated and Robust Planning for Freight Transportation
MA48 Service Management
MA49 Integration in Closed-Loop Supply Chains
MA50 Network Resilience and Reliability
MA51 Environmental Issues, Innovation and Supply Chain Management
MA52 Risk and Uncertainty in Revenue Management
MA53 Inventory Management: Lead Time and Yield Uncertainty
MA54 Pricing: The Interface of Operations and Marketing
MA55 Technical Issues in DEA

Monday, 10:00am - 11:30am

MB01 Online Network Design
MB02 Joint Session Open-Source/ICS: Open-Source Branch-and-Bound Solvers from Sandia National Laboratories
MB03 Advances in Large-Scale Nonlinear Optimization
MB04 Advances in Integer Programming
MB05 Sampling-Based Methods for Stochastic Integer Programs
MB06 Project Management
MB07 The Science of (Optimizing) Better
MB08 KLIC III
MB09 Innovation and the Management of the Development Process
MB10 Software Demonstration
MB11 Joint Session Minortiy/Optimization: Discrete Optimization II
MB12 Leadership in Service Activities
MB13 Tutorial: Teaching a Traditional Optimization Course in a Non-traditional Manner
MB14 Online Auctions I
MB15 Prediction Markets II
MB16 Dynamic Pricing: Issues and Challenges
MB17 Simulation
MB18 Joint Session Counter Terrorism/DAS: Risk and Decision Analysis Applications for Homeland Security I
MB19 Mining Applications
MB20 Carnegie Mellon University: Decision Models
MB21 Bringing Decision Skills to Youth
MB22 Maintenance Modeling and Analysis
MB23 Service Quality and Customer Satisfaction in Global Services Sourcing
MB24 Daniel H. Wagner Prize Competition
MB25 OR Practice in Semiconductor Manufacturing
MB26 Education Panel: Data Mining from Statistical and OR Perspectives
MB27 Predicative Modeling and Control of Manufacturing Quality
MB28 IIE Transactions/Quality and Reliability Engineering
MB29 Optimization in Medicine and Biology
MB30 Decision Support Models
MB31 Risk Management and Operations
MB32 Project Scheduling
MB33 Applications in Airline Operations Recovery
MB34 Hazard Management and Evacuation II
MB35 Urban Transportation Planning Models III: Goods Movement
MB36 Traffic Network Design Modeling Advances
MB37 IT Value
MB38 Issues in Real Time Train Dispatching Systems
MB39 Great Unsolved Problems in OR - I
MB40 Location Models
MB41 The Applied Probability Society Markov Lecture
MB42 Supply Chain Scheduling & Related Problems
MB43 AHP/ANP Group Consensus and Multi-Decisions Decision Making
MB44 Supply Chain Security and Vulnerability
MB45 Tutorial: Robust and Data-Driven Optimization: Modern Decision-Making under Uncertainty
MB46 Incentive Issues in Supplier Management
MB47 Supply Chain Optimization I
MB48 Managing Operations in Health Care Industry
MB49 Optimization in Closed-Loop Supply Chains
MB50 Wireless Networks
MB51 Designing and Managing Product and Service Variety

MB52 Revenue Management Theory
MB53 Inventory Management: Role of Information
MB54 Design and Operation of Distribution Channels
MB55 Modeling Issues in DEA

Monday, 12:30pm - 1:30pm

Interactive Session

Monday, 1:30pm - 3:00pm

MC01 Optimization in Network Coding
MC02 Joint Session Open-Source/ICS: Cuts & Constraints
MC03 Advances in Large-Scale Numerical Optimization
MC04 Advances in Mixed Integer Programming
MC05 Risk Analysis in Military Applications
MC06 Finance-Risk Management I
MC07 Applications of Semidefinite Programming
MC08 KLIC IV
MC09 Simulation I
MC10 Software Demonstration
MC11 Energy
MC12 Joint Session WORMS/INFORMS-ED: Academia and Industry Collaboration: Research and Development
MC13 Education
MC14 Sponsored Search
MC15 Online Auctions II
MC16 Pricing and Demand Models in Revenue Management
MC17 Statistical Methods, Quality Control, and Simulation
MC18 Joint Session Counter Terrorism/DAS: Risk and Decision Analysis Applications for Homeland Security II
MC19 Joint Session ENRE/Optimization: Optimization/Equilibrium Models and Algorithms in Energy
MC20 Joint Session DAS/Health Applications: Decision Modeling in Health Care Applications
MC21 MARA 2006 - An International Initiative in Decision Analysis
MC22 Agent Based Modeling and Simulation for National Security Analysis
MC23 Sourcing Models in a Global Economy: Comparing R&D, BPO, and IT Services
MC24 Daniel H. Wagner Prize Competition
MC25 Portfolio Optimization
MC26 Joint Session DM Invited/DM Sponsored: Applications of Machine Learning
MC27 Joint Session QSR/ Health Applications: Quality and Statistical Decision-Making in Healthcare Applications II
MC28 Wavelets, Data Mining, and Statistical Modeling
MC29 Optimization
MC30 HIV Models
MC31 New Directions in Risk Management and Hedging
MC32 Real Options in Project Governance
MC33 Next Generation Air Transportation System (NGATS)
MC34 Routing Applications I
MC35 Integrated Logistics Network Design and Inventory Management
MC36 Dynamic Programming Applications in Transportation Logistics
MC37 Piracy and Copyright Issues in Markets for Information Goods
MC38 Emerging Trends in Intermodal Transportation
MC39 Great Unsolved Problems in OR - II
MC40 Location Modeling
MC41 Asymptotic Limit Theorems for Stochastic Networks
MC42 Discrete Manufacturing Problems
MC43 Operations Research in Public Sector
MC44 An Interactive Panel/Audience Discussion: Balancing Research and Teaching - An Academic Dilemma (Joint JFIG/ED Session)
MC45 Tutorial on Agent-Based Modeling and Simulation
MC46 Supply Chain Disruptions
MC47 Equilibrium and Allocation Models in Operations
MC48 MSOM Fellows: Awards and Presentations
MC49 Consumer, Production and Sustainability: Topics in Closed Loop Supply Chains
MC50 Econometric Applications in Operations Management
MC51 Joint Session Planning & Responding/Counter Terrorism: Planning for and Responding to Explosive Terrorist Attacks
MC52 Panel Discussion: Is Revenue Management Working in Practice?
MC53 Inventory Management I
MC54 Interface of Operations and Marketing I
MC55 Data Envelopment Analysis and Resource Allocation

Monday, 4:30pm - 6:00pm

MD01 Matching Markets
MD02 Joint Session Open-Source/ICS: Open Source, Distributed Computing, and Operations Research
MD03 Large-Scale Nonlinear Optimization
MD04 Recent Advances in Integer Programming
MD05 Control and Analysis of Queues
MD06 Quality Management
MD07 Software for Semidefinite Programming
MD08 TMS Distinguished Speaker
MD09 Open Innovation, Open Source, Networks
MD10 Software Demonstration
MD11 New Methods in Economic and Environmental Modelling
MD12 Work Life Balance
MD13 Joint Session INFORMS-ED/WORMS: Academia and Industry Collaboration: Education and Training
MD14 Empirical Studies of e-Commerce
MD15 Online Auctions III
MD16 Revenue Management and Pricing
MD17 Data and Pricing
MD18 Joint Session Counter Terrorism/DAS: Risk and Decision Analysis Applications for Homeland Security III
MD19 Risk Management in Energy Markets
MD20 DAS Awards
MD21 Bring OR into Your Local High School: Mission Not Impossible
MD22 Military Logistics Research at RAND (Session 1 of 2)
MD23 Implementing Best Practices for Sourcing
MD24 Daniel H. Wagner Prize Competition
MD25 OR Aplications at HP
MD26 Multidimensional Scaling and Manifold Learning
MD27 Reliability Optimization 1
MD28 IEEE Transactions on Automation Science and Engineering Paper Session
MD29 Applications of Operations Management in Acute Care Settings
MD30 Panel Discussion: Operational Issues Facing Health Care Practitioners
MD31 Frontiers of Financial Engineering
MD32 Exploring the Meaning of Project Control: Panelists' Perspectives & Research Recommendat ions
MD33 Airline Industry Applications I
MD34 Urban Transportation Planning Models V: Public Transit
MD35 Urban Transportation Modeling Session IV: New Problems and Methods
MD36 Warehousing and Facility Logistics
MD37 Tutorial — Social Networks and e-Markets: Incentives and Monetization
MD38 Academic Contributions to Railroad Operations Research
MD39 Great Unsolved Problems in OR - III
MD40 Location and Layout
MD41 Many-Server Queues in the QED Regime
MD42 Recent Advances in Scheduling Research
MD43 Threats to Life and Limb in 2006
MD44 Panel Discussion: The Industry Job Search
MD45 Tutorial: Decision Making Under Conflicting Criteria
MD46 Applications of Robust Optimization

MD47 Relational Contracts, Information-sharing and Negotiation
MD48 Competitive Inventory Models
MD49 Planning and Control Issues in Closed-Loop Supply Chains
MD50 Adaptive Inventory Policies in Information-Rich Supply Chains
MD51 Planning for and Responding to a Flu Pandemic
MD52 Topics in Revenue Management and Pricing
MD53 Inventory Management II
MD54 Interface of Operations and Marketing II
MD55 Technology Management Applications in Service Industry

Tuesday, 8:00am - 9:30am

TA01 Information Aggregation
TA02 Joint Session Open-Source/ICS: Open Source Modeling Tools
TA03 Discrete and Continuous Global Optimization
TA04 Functions of Binary Variables and Integer Programming
TA05 Business Process Risk Management
TA06 Metaheuristics and Vehicle Routing II
TA07 Decomposition Methods in Integer Programming
TA08 Management of Innovation and Technological Change
TA09 Multi-Firm New Product Development
TA10 Software Demonstration
TA11 Economic Healthcare Models
TA12 Spreadsheet Engineering and Auditing
TA13 Tutorial: Pedagogical Research - An Introductory How-to Workshop
TA14 e-Commerce and the Internet Market
TA15 Online Auctions IV
TA16 Revenue Management: Methods and Applications
TA17 Simulation in Financial Engineering
TA18 Joint Session Counter Terrorism/DAS: Terrorism Risk Analysis
TA19 Agent-Based Modelling of Energy Markets
TA20 DA Arcade 2
TA21 Intertemporal Choice
TA22 Military Logistics Research at RAND (Session 2 of 2)
TA23 Outsourcing and Offshoring of Services
TA24 Daniel H. Wagner Prize Competition Awards
TA25 Applications of OR
TA26 Joint Session DM Invited/DM Sponsored: Data Mining Applications in E-commerce
TA27 Technometrics
TA28 Optimal DOE in Computer Science and Bioinformatics
TA29 New Directions in Modeling Patient Perspective in Liver Transplantation
TA30 Perspectives on Influenza Vaccine Supply Chain
TA31 Financial Engineering: Methods and Applications
TA32 Topics in Project Management
TA33 Modeling Airline Customer Behavior
TA34 Models and Methods for Road Pricing: II
TA35 Dynamic Traffic Network Modeling Advances II
TA36 Urban Transportation Planning Models VI: Dynamical Systems Approaches to Modeling Traffic Dynamics
TA37 Data Confidentiality and Disclosure Limitation I
TA38 Disaster/Accident Management
TA39 Logistics I
TA40 Tutorial: Unifying Facility Restricted Location and Layout Theory
TA41 Queueing: Old Problems and New Techniques
TA42 Job-Shop Scheduling
TA43 Multi Criteria Supply Chain Optimization
TA44 Panel Discussion: The Academic Job Search
TA45 Tutorial: Linear Equations, Inequalities, Linear Programs (LP), and a New Efficient Algorithm
TA46 Joint Pricing and Production Planning in Supply Chains
TA47 Operations Support Applications in the Automotive Industry
TA48 Inventory and Production Strategies
TA49 Extending Product Useful Life Through Services and Remanufacturing
TA50 OM Applications of Approximate Dynamic Programming
TA51 Planning for and Responding to Hurricanes
TA52 Revenue Management in Railroads
TA53 Multi-Item Inventory Management
TA54 Managing Supply Systems with Stochastic Leadtimes: Role of Information, Emergency Orders and Fast Deliveries
TA55 AI Approaches for Business Problems

Tuesday, 10:00am - 11:30am

TB01 Control and Optimization of Networks
TB02 Joint Session Open-Source/ICS: Easier to Use: Open-Source Software
TB03 MINLP Theory & Algorithms
TB04 Integer Programming
TB05 Supply Chain Models and Design
TB06 Metaheuristics in Logistics and Transportation
TB07 Application of Iterative Methods in Interior-Point Methods
TB08 IT Capabilities: Generative Mechanisms and Performance Implications
TB09 Emerging Issues in New Product Development
TB10 Software Demonstration
TB11 Healthcare Logistics
TB12 Spreadsheets in Practice
TB13 Strategies for Enhancing the Quality and Quantity of Pedagogical Research in OR/MS
TB14 Peer-to-Peer Systems and Applications
TB15 Auctions and Marketing
TB16 Robustness in Revenue Management
TB17 Pricing in IT Services
TB18 Joint Session Counter Terrorism/DAS: Game Theory and Related Methods for Security
TB19 Environmental Policy in Product Design and Development
TB20 Health Care Applications
TB21 Behavioral Decision Making
TB22 Research at USMA Addressing Department of Defense Strategic and Operational Needs
TB23 Best Practices in Sourcing Services
TB24 Industry Applications I
TB25 Joint Session OR Practice/CPMS: Edelman - Reprise of 2006 Edelman Award Finalists
TB26 New Data Mining Techniques for Business Applications
TB27 Wavelets in Statistical Applications
TB28 Quality Control of Multistage Systems
TB29 Joint Healthcare/Simulation: Simulation in Health Care
TB30 Returns to Scale Analysis Using DEA for Healthcare Services
TB31 Financial Engineering: Modelling and Computation
TB32 Project Management in Economically Competitive Environments
TB33 Joint Session Aviation App./TSL: Topics in Airline Planning
TB34 Traffic Network Modeling Advances
TB35 Hazard Management and Evacuation III
TB36 Information and Online Network Routing
TB37 Data Confidentiality and Disclosure Limitation II
TB38 Simulation Applications in Transportation
TB39 Great Unsolved Problems In OR - IV
TB40 Location and Networks
TB41 Hybrid Tutorial: Large Deviations for Constrained Diffusions
TB42 Scheduling Problems in Service/Industry
TB43 MCDM Applications
TB44 Applications of MS/OR in Nonprofit Operations and Public Sector
TB45 Tutorial: Aviation Security System Design and Optimization Using Operations Research Mode
TB46 Complex Production Planning Problems
TB47 Managing Supply Under Uncertainty
TB48 Service Operations with Customer Behavior

TB49 Life Cycle Considerations in Closed Loop Supply Chains
TB50 Empirical Research in Operations Management
TB51 OR and Disaster Planning
TB52 Choice and Strategic Behavior in Revenue Management
TB53 Pricing and Inventory Management
TB54 Go to Market Strategies: An Operations, Technology, and Marketing Perspective
TB55 Agents

Tuesday, 12:30pm - 1:30pm
Interactive Session

Tuesday, 1:30pm - 3:00pm

TC01 Identifying and Pricing Profitable Keywords for Search-Based Advertising Services
TC02 Joint Session Open-Source/ICS: Open-Source Application Programming Interfaces for Optimi
TC03 Stochastic Global Optimization
TC04 Integer Programming
TC05 Flexibility, Information and Competition in Supply Chains
TC06 Metaheuristic Use In Transportation Logistics
TC07 ICS Prize Winner 2005
TC08 Decision Analysis in Technology Management
TC09 New Product Configurations, Positioning and Portfolios
TC10 Software Demonstration
TC11 Healthcare Operations Management
TC12 Research on Spreadsheets
TC13 PART 1: "Effective Use of Software in the MS/OR Classroom" - INFORMS Transactions on Education Special Issue
TC14 The Value of RFID Visibility
TC15 New Looks at Auctions
TC16 New Directions in Dynamic Pricing and Revenue Management
TC17 Simulation-Optimization
TC18 Dynamic Social Network Models in Counterterrorism
TC19 Oligopoly Expansion, Market Model with Network, Conjectured Price-Response, Pumping Scheduling
TC20 DA Arcade 3
TC21 Panel Discussion: NSF
TC22 Dynamic Decision Networks Assisting Future Combat Systems
TC23 Non-U.S. Perspectives and Cultural Issues in Services Offshoring
TC24 Game Theory I
TC25 Joint Session OR Practice/CPMS: Edelman - Reprise of 2006 Edelman Award Finalists (continued)
TC26 Joint Session DM Invited/DM Sponsored: Applications of Automated Learning to Customer Relationship Management
TC27 Joint Session QSR/ Health Applications: Quality and Statistical Decision-Making in Healthcare Applications III
TC28 Sensor Systems I
TC29 Operations Research to Inform Healthcare Policymakers
TC30 Healthcare Resource Allocation
TC31 Quantitative and Computational Problems in Finance
TC32 Optimizing the Supply Chain
TC33 Robustness in Aviation Planning
TC34 Maritime Transportation and Port Logistics
TC35 Auctions and Pricing in Air and Land Transportation
TC36 Transportation Network Optimization
TC37 Data Management for Process and Decision Analysis
TC38 Traffic Management
TC39 Great Unsolved Problems in OR - V: Paper Presentation and Panel
TC40 Facilities Planning & Design
TC41 Heavy Traffic Analysis of Stochastic Processing Networks
TC42 Emerging Areas in Scheduling
TC43 Interactive Multi-Criteria Optimization
TC44 Joint Session JFIG/ED: An Interactive Panel/Audience Discussion: Planning, Designing, and P
TC45 Tutorial: Game Theory in Supply Chain Analysis
TC46 Supply Chain Operations Planning
TC47 Supply Chain Optimization II
TC48 Managing Service Capacity and Quality
TC49 The Impact of Regulation in Closed-Loop Supply Chains
TC50 Economics of Queues and Service Differentiation
TC51 Panel Discussion: Humanitarian Supply Chain Management
TC52 Revenue Management and Pricing in Operations
TC53 Supply Chain Sourcing Decisions
TC54 Inventory Decisions with Marketing Considerations
TC55 Artificial Intelligence

Tuesday, 4:30pm - 6:00pm

TD01 Graph-Theoretic Approximation Algorithms
TD02 Joint Session Open-Source/ICS: Open Source in Teaching
TD03 Engineering Applications in Global Optimization
TD04 Cutting Planes in Integer Programmming
TD05 Operations Management in Supply Chains
TD06 Rich Vehicle Routing Problems
TD07 Black Box Optimization
TD08 Panel Discussion: ETMERC - Engineering and Technology Management Education and Rese
TD09 Product Development II
TD10 Software Demonstration
TD11 Healthcare Resource Management
TD12 Beyond Spreadsheets
TD13 PART 2: "Effective Use of Software in the MS/OR Classroom" - INFORMS Transactions on Education Special Issue
TD14 Supply Chain Execution and Optimization
TD15 Panel Discussion: What Should We Teach Students About Auctions?
TD16 Selected Topics in Revenue Management
TD17 Joint Session SIM/QRS: Statistical Methods in Quality Control and Simulation I
TD18 Terrorism: Society and Energy Issues
TD19 Algorithms for Electricity Market Models: Dynamics and Uncertainty
TD20 Risk Analysis in Decision Analysis
TD21 Best of Decision Analysis Affinity Group
TD22 Optimizing the Air Force Academy
TD23 Global Sourcing: Trends, Decisions and Strategies
TD24 Contracts
TD25 Management of Technology I
TD26 Data Mining Applications
TD27 Reliability Optimization 2
TD28 Design and Analysis of Experiments
TD29 Combinatorial Optimization in Medicine & Healthcare
TD30 Decision Models in Healthcare
TD31 Financial Engineering
TD32 Supply Chain Optimization I
TD33 Estimation of Airport Capacity I
TD34 Hazard Management and Evacuation IV
TD35 Distribution Problems in Facility Logistics II
TD36 Urban Transportation Planning Models VII: Network Equilibrium
TD37 Evaluating Strategies for the e-Commerce Channel
TD38 Transportation Logistics
TD39 Logistics II
TD40 Facility Location
TD41 Stochastic Networks: Algorithms and Analysis
TD42 Supply Chain Scheduling and Optimization
TD43 Multiple Criteria Approaches to Wireless Network Applications
TD44 Analytic Hierarchy Process
TD45 Tutorial: Planning for Disruptions in Supply Chain Networks
TD46 Supply Chain Collaboration Issues

TD47 Leveraging Operations to Improve Supply Chain Performance
TD48 Customer Behavior in Operations Management
TD49 Closed-Loop Supply Chain Marketing and Strategic Issues
TD50 Retail Operations
TD51 Joint Session Planning & Responding/Counter Terrorism: Planning for and Responding to Biological or Chemical Terrorist Attacks
TD52 Dynamic Pricing and Optimization
TD53 Supply Chain Production Decisions
TD54 Supply Chain Applications
TD55 Production & Scheduling II

Wednesday, 8:00am - 9:30am

WA01 Reputation and Ranking Systems
WA02 Joint Session Open-Source/ICS: Open-Source Application Programming Interfaces for Optimization II
WA03 Large Scale Optimization Models and Solution Approaches in Health Applications
WA04 Scheduling Applications I
WA05 Coordination and Outsourcing of Supply Chain Processes
WA06 Heuristic Techniques
WA07 Global Optimization: Software and Applications
WA08 Building Regional Innovation Systems Through Entrepreneurship: Beyond Market Incentives
WA09 Business Applications I
WA11 Medical Appointment Scheduling
WA12 Enterprise-Wide Optimization: Petroleum & Energy Industries
WA13 Teaching Operations Research in a Liberal Arts Setting
WA14 E-Business/Commerce I
WA15 Auctions and Computer Science
WA16 Forecasting: Issues, Models, and Challenges
WA17 Shipping, Maritime, and Supply Chain Logistics
WA18 Modeling Systems
WA19 Optimization Under Uncertainty in an Electric Power System
WA20 Risk Assessment in Decision Analysis
WA21 Risk Management
WA22 Joint Session MAS/ED: Social Network Analytics: Methods and Applications
WA23 Risks and Gains of Offshore Outsourcing
WA24 Supply Chain Coordination
WA25 Management of Technology II
WA26 Applications of Data Mining in Exploratory Research
WA27 Data Mining/Statistical Modeling and Process Monitoring
WA28 Data Mining for Process Control
WA29 Patient Scheduling and Flow
WA30 Marketing I
WA31 Portfolio Optimization in Finance-Risk Management
WA32 Risk and Supply Chain Management
WA33 Estimation of Airport Capacity II
WA34 Modeling and Analysis of Intra and Inter-Plant Logistical Problems
WA35 Urban Transportation Planning Models VIII: Trip Distribution and Assignment
WA36 Analysis for Defense Transformation II
WA37 Supply Chain Management II
WA38 Transportation Problems in Urban Planning
WA39 Education and Discrete Optimization
WA40 Logistics/Transportation Issues in Facility Location
WA41 Performance Bounds for Queueing Networks and Related MDPs
WA42 Scheduling and Network Optimization
WA43 Multi Criteria Mathematical Programming
WA44 Combinatorics
WA45 Tutorial: Approximate Dynamic Programming for Large-Scale Resource Allocation
WA46 Supply Chain Flexibility
WA47 Optimization Methods in Production Planning and Scheduling
WA48 Operations Management in Commodity Markets
WA49 Game-Theoretic Models in Closed-Loop Supply Chains and Reverse Logistics
WA50 Optimization Techniques I
WA51 Aviation Applications
WA52 Bilevel Programming and Revenue Management
WA53 Supply Chain III
WA55 Production & Scheduling III

Wednesday, 10:00am - 11:30am

WB01 Algorithms, Games, and Computation
WB03 Sphere Packing
WB05 Machine Scheduling Problems
WB06 Metaheuristics for Data Mining Problems
WB07 Cyberinfrastructure and Integer Programming
WB08 RFID in Supply Chain and Services Management
WB09 Sustainable Development
WB11 Medical Decision Making
WB12 Enterprise-Wide Optimization: Process Industry Supply Chain
WB13 Teaching Problem Formulation
WB14 Auctions
WB15 The Economic Theory of Auctions I
WB16 Topics in Pricing
WB17 Simulation of Service Chains and Health Care Systems
WB18 Marketing II
WB19 Capacity and Transmission Expansions in Restructured Markets
WB20 Solution Techniques I in Decision Analysis
WB21 E-Business/Commerce II
WB22 Naval Applications
WB23 Panel Discussion: Managing Global Human Resources
WB24 Supply Chain Competition and Coordination
WB25 Innovation/Entrepreneurship
WB26 Data Mining, Knowledge Management and Applications
WB27 Recent Advances in Computer Experiments
WB28 Accelerated Testing and Testing Plans
WB29 Constraint Programming
WB30 Optimization Techniques
WB31 Portfolio Construction in Finance-Risk Management
WB32 Supply Chain Management with Disruptions
WB33 Indicative Trends in the National Airspace System (NAS) Performance
WB34 Urban Transportation Planning Models IX: Fuel Infrastructure
WB35 Dynamic Routing Problems
WB36 Risk Analysis
WB37 Supply Chain Management for Manufacturing
WB38 Vehicle Routing
WB39 Forecasting
WB40 Applications
WB41 Recent Trends in Make-to-Stock Queue Modelling
WB42 Production & Scheduling
WB43 Multiple Criteria Routing for Business Applications
WB44 Networks & Graphs
WB45 Tutorial: Multi-Echelon Production/Inventory Systems: Optimal Policies, Heuristics, and Algorithms
WB46 Managing Risks and Cost Benefits in Complex Supply Chains
WB47 Models and Algorithms for Complex Inventory Problems
WB48 Information and Operations Management
WB50 Optimization Techniques II
WB51 Scheduling in Aviation Applications
WB52 Pricing in Networks
WB53 Quality Issues in Supply Chain Management
WB54 Product and Service Development for New Markets
WB55 Scheduling

Wednesday, 1:30pm - 3:00pm

WC01 Online Optimization
WC02 Game Theory II
WC03 Discrete Optimization
WC06 Advances in Heuristic Methods
WC07 Computational Systems for Distributed Optimization
WC08 Panel Discussion: Service Industry - The Next Frontier for Technology Management
WC09 Flexible Manufacturing Systems
WC11 Radiation Therapy Planning
WC12 Enterprise-Wide Optimization: Robustness and Uncertainty
WC13 Automation for Homework and Exams
WC14 Cost/Performance Analysis
WC15 The Economic Theory of Auctions II
WC16 Revenue Management in the IT Industry
WC17 Simulation II
WC18 Risk Analysis
WC19 Economic Models of Distributed Energy Resources
WC20 Solution Techniques II in Decision Analysis
WC21 Hypergame Theory - Reasoning and Context
WC22 Analysis for Defense Transformation I
WC23 Semiconductor Manufacturing
WC24 Supply Chain Inventory Management
WC25 Industry Applications II
WC26 Data Mining in RFID Applications
WC27 Joint Session QRS/Health Applications: Quality and Statistical Decision-Making in Healthcare Applications IV
WC28 Sensor Systems II
WC29 Continuous Optimization
WC30 Queueing & Stock Models
WC31 Finance-Risk Management II
WC32 Supply Chain Risk Management I
WC33 Airline Industry Applications II
WC34 Dynamic Traffic Network Modeling Advances I
WC35 Urban Transportation Planning Models X: Day-to-Day Planning Models
WC36 Military Applications I
WC37 Supply Chain Practice I
WC38 Operations Management I
WC39 Linear Programming
WC40 Environment, Energy, and Natural Resources
WC41 Queueing Applications in Manufacturing and Services
WC42 Scheduling Applications II
WC43 Multicriteria Decision Making I
WC44 Use of Optimization in Networks & Graphs
WC45 Tutorial: Complementarity-Based Modeling of Electric Power Markets: Transmission Constraints and Market Power
WC47 Supply Chain Risk Management II
WC48 Price and Lead Time Decisions
WC50 Supply Chain Practice II
WC51 Scheduling/Maintenance in Aviation Applications
WC52 Data-Driven Research on Pricing and Revenue Management
WC53 Information Sharing in Supply Chain Management
WC54 Strategic Planning
WC55 Information Systems

Wednesday, 3:30pm - 5:00pm

WD01 Solution Techniques in Integer Programming
WD02 Economics
WD03 Discrete Optimization via Integer Programming
WD06 Metaheuristic Development Framework (MDF)
WD07 Tuning, Pre- and Post-Processing in Conic Optimization
WD08 Technology Management and Service Industry
WD09 Manufacturing
WD11 Novel Applications
WD12 Enterprise-Wide Optimization: Process Scheduling
WD13 Innovative Approaches to Bringing Communication into Engineering and Business Undergraduate Courses
WD14 Metaheuristics
WD15 Auction Theory
WD16 Revenue Management & Its Application
WD17 Simulation of Supply Chain Systems
WD18 Reliability
WD20 Decision Support Systems
WD21 DA Arcade 4
WD22 Informing Infrastructure Decisions
WD23 Service Industry Applications
WD24 Supply Chain Optimization II
WD25 Industry Applications III
WD26 Improving Decision Tree Induction/Information Theory and Data-Mining Applications
WD27 Studies of Multi-Stage and Multi-Level Complex Systems
WD28 Quality Applications and Methods
WD29 Dynamic Programming/Control
WD30 Supply Chain Applications
WD31 Simulation-Optimization
WD32 Computer Assisted Analysis
WD33 Issues in National Airspace System (NAS) Modeling
WD34 Routing Applications II
WD35 Network Behavior with Information
WD36 Military Applications II
WD37 Supply Chain Simulation
WD38 Operations Management II
WD39 Applications of Integer Programming
WD40 Using Optimization for Environment, Energy, and Natural Resources
WD42 Scheduling Applications III
WD43 Multicriteria Decision Making II
WD44 Simulation I and Heuristics
WD45 Tutorial: Peer-to-Peer Technologies: A Research-Oriented Introduction
WD47 Supply Chains and Information
WD49 Reverse Supply Chain Analysis
WD50 Reverse Supply Chain Optimization
WD52 Revenue and Inventory Management
WD53 Data Issues in Supply Chain Management
WD54 Telecommunications
WD55 Management of Technology in Information Systems