TABLE OF CONTENTS

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All photos courtesy of Denver Metro Convention & Visitors Bureau

Copies of papers abstracted in the meeting program are available only from the authors. Requests for papers should be sent to the authors at the addresses shown in the program. Published annually prior to the meeting by the Institute for Operations Research and the Management Science. Individual issues of the program are available for $20US per copy. Orders must be prepaid and sent to INFORMS, P.O. Box 631704, Baltimore, MD 21263-1704.

Sponsors 2
Message from the General Chair 3
Program at a Glance 5
Schedule of Special Events 6
Schedule of Subdivision Business Meetings 9
Speaker Information 11
General Information 11
Guest Program, Guest Tours & Plant Tours 13
Networking & Social Events 14
Future Meetings 17
For Practitioners 19
Special Programs 21
Technical Program
- Plenary & Keynote Presentations 22
- Tutorials 25
- Software Demonstrations 27

Exhibitors 30
Invited & Sponsored Cluster Chairs 34
Floor Plans 38
Daily Planner 40
Technical Sessions 41
Session Chair Index 252
Author Index 255
Session Index 269
Master Track Schedule 278

INDEX OF ADVERTISERS

South-Western/Thomson ..... Inside Front Cover
John Wiley & Sons, Inc 4
Palgrave Macmillan 8
ECCH 10
Elsevier Science 12
Salford Systems 15
Palisade Corporation 16
Springer 18
SAS 20
Dash Optimization 24
OSCM 2005 Conference 29
INFORMS 37
Paragon Decision Technology ..... Inside Back Cover
Frontline Systems, Inc. ..... Back Cover

BACK TO OR ROOTS

SCIENCE TECHNOLOGY

INFORMS ANNUAL MEETING

October 24-27, 2004, Denver, Colorado

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MESSAGE FROM THE GENERAL CHAIR

University of Colorado at Boulder

Leeds School of Business

419 UCB
Boulder, Colorado 80309-0419

October 24, 2004

Dear Colleagues and Friends,

It is with great pleasure that I welcome you to Denver, a city that for four days will be the capital of the operations research community. It is an exciting period for our profession in at least three different fronts. First, successful business and industrial applications of operations research continue to demonstrate why what we do is extremely relevant to society. Second, operations research is playing an important part in the decision making during these times of trouble and unrest in the world. Models that are based on the core foundations of operations research are assisting governments around the world in tackling issues of utmost importance, such as those related to intelligence, emergency systems and the environment. Third, there are unlimited opportunities for significant contributions in science and technology. Historically, operations research has been linked to discovery in a variety of scientific fields and the development of innovative technology. However, we believe that OR has lost some traction in this area and this is why we would like everyone to reflect on the *Back to OR Roots* theme during our time together in Denver.

Our conference theme looks at the past for inspiration. It looks at the present and future for our strengths. This leads to the development of models to advance science and business and society, places where OR has not yet become a catchphrase. Undoubtedly, we can do a better job at reaching out and educating the engineers and chemists and biologists and physicists about what we can accomplish together. In this installment of the INFORMS annual meeting, we are expecting a record number of presentations, including those that address how OR contributes to science and technology.

Thanks to the hard work of Harvey Greenberg, we are reviving a lost tradition of publishing some of the tutorial presentations. A book containing the tutorials is dedicated to the memory of Carl Harris and is available for purchase at the meeting. We feel that the publication of the tutorials should be an integral part of the meeting and we hope that it will continue in the future. The meeting also includes four outstanding plenary presentations, which we encourage you to attend. The large number of contributed presentations that we received required the addition of a set of sessions to Wednesday's schedule. We should see this as an indication of success and change our mindset to consider INFORMS meetings as four-day affairs. Wednesday sessions are not the leftovers, but rather an integral part of our meeting.

The local committee and the INFORMS meetings office have worked hard to meet your high standards for this conference. In addition to a world-class academic program, the meeting includes plant and guest tours that should spark your interest. The general reception on Monday features a great local talent, Liza, who also happens to be my daughter's guitar teacher. Stop by the stage at Coors Field—I am sure that you won't be disappointed. Through the generosity of the Coors Brewing Company, we will enjoy free refreshments (read free beer) at the general reception. I do hope that you have a wonderful and intellectually stimulating time in Denver.

M. Laguna

Manuel Laguna
General Chair

NOTE:

Technical sessions are held at the Adam's Mark Denver. Check the Master Track Schedule on pages xxx-xxx for specific room locations.

KEY:
P-Plaza Building, Adam's Mark
T-Tower Building, Adam's Mark

Denver 2004 QUICK REFERENCE including the Master Track Schedule

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

BADGES REQUIRED FOR TECHNICAL SESSIONS

Denver 2004 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.

SATURDAY, OCTOBER 23

8:30am-5:30pm	CIST Conference	T – Silver, Colorado
5:00pm-8:00pm	Registration	P – Plaza Court
5:00pm-6:00pm	INFORMS Membership Meeting	P – Governor's Square 14

SUNDAY, OCTOBER 24

7:00am-5:00pm	Registration	P – Plaza Court
8:00am-9:30am	Technical Sessions (SA)	Adam's Mark
8:30am-5:00pm	CIST Conference	T – Silver, Colorado
9:30am-10:00am	Coffee Break	Plaza Court, Tower Lobby
10:00am-11:30am	Technical Sessions (SB)	Adam's Mark
11:40am-12:30pm	Plenary Presentation	P – Ballroom A
12:00pm-5:00pm	Exhibits, Job Placement, Email Ctr.	P – Exhibit Hall
12:30pm-1:30pm	Lunch Break (on your own)	
1:30pm-3:00pm	Technical Sessions (SC)	Adam's Mark
3:10pm-4:00pm	Plenary Presentation	P – Ballroom A
4:00pm-4:30pm	Coffee Break	Exhibit Hall, Tower Lobby
4:30pm-6:00pm	Technical Sessions (SD)	Adam's Mark
6:15pm-7:15pm	Subdivision Business Meetings	(see p.9)
7:30pm-9:00pm	Welcome Reception	Exhibit Hall

MONDAY, OCTOBER 25

7:00am-5:00pm	Registration	P – Plaza Court
8:00am-9:30am	Technical Sessions (MA)	Adam's Mark
9:00am-5:00pm	Exhibits, Job Placement, Email Ctr.	P – Exhibit Hall
9:30am-10:00am	Coffee Break	Exhibit Hall, Tower Lobby
10:00am-11:30am	Technical Sessions (MB)	Adam's Mark
11:40am-12:30pm	Plenary: Welcome & Awards	P – Ballroom A
12:30pm-1:30pm	Lunch Break (on your own)	
1:30pm-3:00pm	Technical Sessions (MC)	Adam's Mark
3:10pm-4:00pm	Plenary Presentation	P – Ballroom A
4:00pm-4:30pm	Coffee Break	Exhibit Hall, Tower Lobby
4:30pm-6:00pm	Technical Sessions (MD)	Adam's Mark
6:15pm-7:15pm	Subdivision Business Meetings	(see p.9)
7:30pm-9:30pm	General Reception	Coors Field

(Buses depart beginning at 7:00pm from Tower Building entrance.)

TUESDAY, OCTOBER 26

7:00am-5:00pm	Registration	P – Plaza Court
8:00am-9:30am	Technical Sessions (TA)	Adam's Mark
9:00am-5:00pm	Exhibits, Job Placement, Email Ctr.	P – Exhibit Hall
9:30am-10:00am	Coffee Break	Exhibit Hall, Tower Lobby
10:00am-11:30am	Technical Sessions (TB)	Adam's Mark
11:40am-12:30pm	Plenary Presentation	P – Ballroom A
12:30pm-1:30pm	Lunch Break (on your own)	
1:30pm-3:00pm	Technical Sessions (TC)	Adam's Mark
3:10pm-4:00pm	Keynote Presentations	P – Ballroom A & Ballroom E
4:00pm-4:30pm	Coffee Break	Exhibit Hall, Tower Lobby
4:30pm-6:00pm	Technical Sessions (TD)	Adam's Mark
6:15pm-7:15pm	Subdivision Business Meetings	(see p.9)

WEDNESDAY, OCTOBER 27

7:30am-12:00pm	Registration	P – Plaza Court
8:00am-9:30am	Technical Sessions (WA)	Adam's Mark
9:30am-10:00am	Coffee Break	Plaza Court, Tower Lobby
10:00am-11:30am	Technical Sessions (WB)	Adam's Mark
12:00pm-1:30pm	Technical Sessions (WC)	Adam's Mark

SCHEDULE OF SPECIAL EVENTS

FRIDAY, OCTOBER 22	LOCATION	TIME
Colloquia Registration & Dinner	T – Majestic Ballroom	4:30pm-9:00pm
SATURDAY, OCTOBER 23		
CIST Registration & Coffee	T – Silver Foyer	7:30am-9:00am
Combined Colloquia Registration	T – Majestic Ballroom	7:30am-9:00am
Combined Colloquia Breakfast	T – Majestic Ballroom	7:45am-8:30am
DSS Workshop	P – Governor's Square 12	8:00am-5:00pm
CIST Conference	T – Silver, Colorado	8:30am-5:30pm
Future Academician Colloquium	T – Columbine	8:30am-5:00pm
Future Practitioner Colloquium	T – Vail	8:30am-5:00pm
Teaching Effectiveness Colloquium	T – Savoy	8:30am-5:00pm
Meetings Committee Meeting	P – Suite 3754	8:30am-5:00pm
Combined Colloquia Lunch	T – Majestic Ballroom	12:00pm-1:30pm
Subdivisions Council Meeting	P – Governor's Square 9	12:00pm-5:00pm
ISR Editors' Meeting	P – Director's Row J	12:00pm-5:00pm
INFORMS Executive Committee Meeting	P – Director's Row G	1:00pm-5:00pm
Meeting Registration	P – Plaza Court	5:00pm-8:00pm
INFORMS Membership Meeting/Reception	P – Governor's Square 14	5:00pm-6:00pm
Roundtable Reception & Dinner	T – Majestic Ballroom	5:00pm-7:45pm
Roundtable Meeting	T – Majestic Ballroom	7:45pm-11:00pm
SUNDAY, OCTOBER 24		
New Member/First-Time Attendee Breakfast	P – Ballroom A	7:00am-8:00am
Meeting Registration	P – Plaza Court	7:00am-5:00pm
Guest Breakfast	P – Trattoria Restaurant	8:00am-9:00am
Nicholson Student Paper Prize Competition	P – Suite 3302	8:00am-9:30am
INFORMS Board Meeting	P – Governor's Square 12	8:00am-5:00pm
Roundtable Meeting	T – Majestic Ballroom	8:00am-5:00pm
CIST Conference	T – Silver, Colorado	8:30am-5:00pm
Colloquia Committee Meeting	P – Director's Row G	11:30am-12:30pm
Junior Faculty INFORMS Group Lunch	T – Windows	11:30am-1:00pm
MS Editors' Meeting/Lunch	P – Director's Row F	11:30am-1:00pm
Plenary: William P. Pierskalla	P – Ballroom A	11:40am-12:30pm
OR Editors' Meeting/Lunch	P – Director's Row J	12:00pm-1:00pm
CIST Lunch	T – North Convention Lobby	12:00pm-1:30pm
Roundtable Lunch	T – Majestic Ballroom	12:00pm-1:30pm
Job Fair	P – Ballroom D	12:00pm-2:00pm
Exhibits/Job Placement/Email	P – Exhibit Hall	12:00pm-5:00pm
Omega Rho Executive Committee/Annual Mtg.	P – Director's Row I	2:30pm-2:00pm
Plenary-Omega Rho: Seth Bonder	P – Ballroom A	3:10pm-4:00 pm
President's Reception-Roundtable	T – Majestic Ballroom	5:00pm-6:30pm
IOL Reception	P – Governor's Square 16	6:00pm-7:00pm
MSOM Reception	T – Windows	6:15pm-7:15pm
Student Affairs Committee Meeting	P – Plaza Court 8	6:30pm-7:30pm
Welcome Reception	P – Exhibit Hall	7:30pm-9:00pm
Minority Issues Forum Reception	P – Governor's Square 10	8:00pm-9:00pm
Student Reception	P – Governor's Square 14	8:00pm-10:00pm
Women in OR/MS Forum Reception	P – Governor's Square 15	8:00pm-10:00pm

All events take place in the Adam's Mark unless otherwise indicated.

For subdivision business meetings, see page 9.

KEY:
P-Plaza Building, Adam's Mark
T-Tower Building, Adam's Mark

COFFEE BREAKS

Sunday, Oct. 24
9:30am – 10:00am Plaza Court & Tower Lobby
4:00pm – 4:30pm Exhibit Hall & Tower Lobby

Monday, Oct. 25
9:30am – 10:00am Exhibit Hall & Tower Lobby
4:00pm – 4:30pm Exhibit Hall & Tower Lobby

Tuesday, Oct. 26
9:30am – 10:00am Exhibit Hall & Tower Lobby
4:00pm – 4:30pm Exhibit Hall & Tower Lobby

Wednesday, Oct. 27
9:30am – 10:00am Plaza Court & Tower Lobby

SCHEDULE OF SPECIAL EVENTS



MONDAY, OCTOBER 25

Board/Editors/Committee Chair Breakfast	P – Governor's Square 12	7:00am-8:00am
Meeting Registration	P – Plaza Court	7:00am-5:00pm
Denver Area Math Teachers Program	P – Governor's Square 16	8:00am-4:00pm
Guest Breakfast	P – Trattoria Restaurant	8:00am-9:00am
Exhibits/Job Placement/Email	P – Exhibit Hall	9:00am-5:00pm
Subdivisions Council Meeting	P – Director's Row I	10:00am-12:00pm
Plenary: Welcome & Awards	P – Ballroom A	11:40am-12:30pm
COIN-OR Users Meeting	P – Plaza Court 8	12:00pm-1:15pm
ACORD	T – Silver	12:00pm-2:00pm
Editors-in-Chief/Publications Committee Mtg.	P – Director's Row J	12:00pm-3:00pm
Roundtable Lunch	P – Governor's Square 12	12:30pm-1:30pm
Fellows Lunch	P – Ballroom D	12:45pm-2:30pm
Chapters/Fora Committee Meeting	P – Director's Row G	2:30pm-3:30pm
Section/Societies Committee Meeting	P – Director's Row I	2:30pm-3:30pm
Plenary: M. Elisabeth Paté-Cornell	P – Ballroom A	3:10pm-4:00pm
CPMS Isolated Practitioners Workshop	P – Governor's Square 9	6:00pm-7:00pm
General Reception	Coors Field	7:30pm-9:30pm

(Buses depart beginning at 7:00pm from the Tower Building entrance.)

TUESDAY, OCTOBER 26

Chapters/Fora Officers Breakfast	T – Silver	7:00am-8:00am
Decision Analysis Editors' Meeting	P – Director's Row J	7:00am-8:00am
Meeting Registration	P – Plaza Court	7:00am-5:00pm
MSOM Editors' Meeting	P – Director's Row I	7:30am-8:30am
Transportation Science Editors' Meeting	P – Director's Row G	7:30am-8:30am
Student Chapter Officers Meeting	T – Silver	8:00am-8:45am
Guest Breakfast	P – Trattoria Restaurant	8:00am-9:00am
CPMS Council Meeting	P – Governor's Square 16	8:00am-10:00am
Meetings Committee/Future Organizing Committees	P – Suite 3754	8:00am-5:00pm
Exhibits/Job Placement/Email	P – Exhibit Hall	9:00am-5:00pm
Plenary: James Q. Crowe	P – Ballroom A	11:40am-12:30pm
Trans. on Education Editors' Meeting/Lunch	P – Director's Row G	12:00pm-1:00pm
Sections/Societies Officers Lunch	P – Governor's Square 12	12:00pm-1:30pm
Academic/Practitioner Interface Lunch	T – Majestic Ballroom	12:30pm-1:30pm
Women in OR/MS Business Meeting/Lunch	P – Governor's Square 16	12:30pm-1:30pm
Education Committee Meeting	P – Director's Row I	2:00pm-3:30pm
Keynote: 2004 Edelman Reprise	P – Ballroom A	3:10pm-4:00pm
Keynote: Science of Better	P – Ballroom E	3:10pm-4:00pm
Future Organizing Committee Reception	P – Suite 3754	5:00pm-6:00pm

WEDNESDAY, OCTOBER 27

Meeting Registration	P – Plaza Court	7:30am-12:00pm

SCHEDULE OF SUBDIVISION BUSINESS MEETINGS

All events take place in the Adam's Mark unless otherwise indicated.

KEY:
P-Plaza Building, Adam's Mark
T-Tower Building, Adam's Mark

SUNDAY, OCTOBER 24	LOCATION	TIME
Information Systems	T – Silver	5:15pm-6:15pm
Railroad Applications	P – Governor's Square 11	5:45pm-6:45pm
Aviation Applications	P – Plaza Court 7	6:15pm-7:15pm
Data Mining	P – Plaza Court 2	6:15pm-7:15pm
eBusiness	Offsite	6:15pm-7:15pm
Energy, Natural Resources & the Environment	T – Biltmore	6:15pm-7:15pm
Forum on Education (INFORM-ED)	P – Suite 3454	6:15pm-7:15pm
Location Analysis	P – Suite 3312	6:15pm-7:15pm
Military Applications Society Council	P – Suite 3354	6:15pm-7:15pm
Minority Issues Forum & Panel Discussion	P – Governor's Square 9	6:15pm-7:15pm
Revenue Management & Pricing	T – Tower Court D	6:15pm-7:15pm
Simulation	T – Beverly	6:15pm-7:15pm
Social Sciences	P – Plaza Court 3	6:15pm-7:15pm
Decision Analysis Society Council Dinner	T – Colorado	6:30pm-8:30pm
Revenue Management & Pricing Board	T – Tower Court D	7:15pm-8:15pm
MONDAY, OCTOBER 25		
Decision Analysis Awards/Meeting	P – Director's Row E	4:30pm-7:15pm
Technology Management	P – Governor's Square 14	6:00pm-8:00pm
Applied Probability	P – Suite 3454	6:15pm-7:15pm
Computing Society	P – Governor's Square 17	6:15pm-7:15pm
Financial Services	P – Director's Row F	6:15pm-7:15pm
Manufacturing & Service Operations Mgt	T – Columbine	6:15pm-7:15pm
Health Applications	P – Governor's Square 11	6:15pm-7:15pm
Military Applications Society	P – Suite 3354	6:15pm-7:15pm
Public Programs & Processes	P – Suite 3304	6:15pm-7:15pm
SpORts in OR	T – Beverly	6:15pm-7:15pm
Telecommunications	P – Director's Row H	6:15pm-7:15pm
Transportation Science & Logistics	P – Governor's Square 10	6:15pm-7:15pm
Quality, Statistics & Reliability	P – Suite 3554	6:30pm-7:30pm
TUESDAY, OCTOBER 26		
Women in OR/MS Forum	P – Governor's Square 16	12:30pm-1:30pm
Artificial Intelligence	P – Director's Row F	6:15pm-7:15pm
Optimization	P – Ballroom E	6:15pm-7:15pm
Spreadsheet Productivity Research	P – Suite 3302	6:15pm-7:15pm



SPEAKER INFORMATION

Audio/Visual Equipment
Every room will be equipped with an LCD (data) projector and an overhead. Please follow these guidelines to insure 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 1/2 hour 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.

There will be a special Speaker Ready Room available near the Program Information Booth in the Governor's Square lobby 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 or 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).

COFFEE BREAKS

Sunday, Oct. 24
9:30am – 10:00am Plaza Court & Tower Lobby
4:00pm – 4:30pm Exhibit Hall & Tower Lobby

Monday, Oct. 25
9:30am – 10:00am Exhibit Hall & Tower Lobby
4:00pm – 4:30pm Exhibit Hall & Tower Lobby

Tuesday, Oct. 26
9:30am – 10:00am Exhibit Hall & Tower Lobby
4:00pm – 4:30pm Exhibit Hall & Tower Lobby

Wednesday, Oct. 27
9:30am – 10:00am Plaza Court & Tower Lobby

Exhibit Hall
Name badges must be worn for admittance to the Exhibit Hall, located in the Plaza Court area of the Adam's Mark during the following hours:

Sunday, Oct. 24	12:00pm-5:00pm & 7:30pm-9:00pm*
Monday, Oct. 25	9:00am-5:00pm
Tuesday, Oct. 26	9:00am-5:00pm

*The Exhibit Hall will reopen Sunday evening for a gala Welcome Reception and celebration of the TIMS 50th Anniversary.

Email Center
Bring your own laptop PC to the Email Center, located in the Exhibit Hall, to access your email and the web. Other computers are also available if you do not have a laptop. Name badges must be worn for admittance. The center will be open during the following hours:

Sunday, Oct. 24	12:00pm-5:00pm
Monday, Oct. 20	9:00am-5:00pm
Tuesday, Oct. 21	9:00am-5:00pm

Registration
The registration fee includes admittance to all technical sessions, the Exhibit Hall, the Welcome Reception on Sunday evening, and the General Reception on Monday evening at Coors Field. Meals–other than the two evening receptions–are not included.

Business Center
The Adam's Mark Business Center is located in the Lobby behind the Front Desk. It is open on Saturday and Sunday 7:00am-5:00pm and weekdays from 7:00am-9:00pm.

BADGES REQUIRED FOR TECHNICAL SESSIONS

Denver 2004 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.

GUEST PROGRAM, GUEST TOURS & PLANT TOURS

WHERE TO GO FOR LUNCH

The Adam's Mark is ideally located in the heart of downtown Denver on the popular 16th Street Mall, a mile-long pedestrian promenade lined with shops and restaurants. Free shuttle buses run its length, providing easy access from the hotel to all downtown attractions.



Denver 2004 QUICK REFERENCE including the Master Track Schedule

Don't miss this handy reference. It's a separate flier that came with your program.

GUEST PROGRAM

The program for registered guests includes a continental breakfast on Sunday, Monday and Tuesday mornings, the Welcome Reception on Sunday evening and the General Reception on Monday evening. 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 Breakfasts

Sunday, Oct. 19	8:00am – 9:00am
Monday, Oct. 20	8:00am – 9:00am
Tuesday, Oct. 21	8:00am – 9:00am

Trattoria Restaurant

GUEST TOURS

You may still be able to register for the following guest tours. Go to the INFORMS registration desk for information on availability. Buses for both tours will leave at the beginning time listed for each tour, and will return to the hotel at the ending time listed. Buses depart from the Tower building entrance.

Rocky Mountain High
Sunday, October 24
9:00am-5:00pm $60 (includes lunch)
This spectacular tour of the Rocky Mountains begins on Trail Ridge Road along the Continental Divide. High mountain vistas and great opportunities for wildlife sighting of bighorn sheep, elk and mule deer are featured. The tour stops in Estes Park, founded in 1870, one of Colorado's premier vacation resorts. Located in the park is the historic Stanley Hotel. Estes Park features opportunities for browsing in its many jewelry and curio stores. The tour also includes a gourmet box lunch picnic in a mountain setting.

Foothills Fandango
Monday, October 25
9:00am-1:00pm $20
Red Rocks Park, Lookout Mountain and Coors Brewery are the highlights of this tour. The Red Rocks Amphitheater is set amidst towering cliffs of sandstone and boasts excellent acoustics. The museum atop Lookout Mountain contains memorabilia from the Buffalo Bill Cody Wild West Show. A café located in the gift shop will provide an opportunity for you to purchase a quick snack. The final stop is Coors Brewery for a walking tour and an opportunity to sample Coors beer (proper ID required) and browse in the gift shop.

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 both tours will leave at the beginning time listed for each tour, and will return to the hotel at the ending time listed. Buses depart from the Tower building entrance.

Coors Brewing Company
Monday, October 25
8:15am-11:15am $25
This customized tour of Coors Brewing Company provides a fascinating example of the combination and integration batch processing (pre-brew and brewing processes) with modern automated assembly line processing (packaging), all based on the artisan art of the master brewer. The Golden, Colorado, plant is the largest single brewery in the world and where Coors brews the majority of its beers. Coors is the third-largest brewery in the U.S. and one of the largest in the world, based on volume.
Important! Please wear long pants and totally enclosed flat shoes for this tour.

Jeppesen
Tuesday, October 26
9:15am-12:15pm $25
Jeppesen, the world's foremost provider of integrated aviation information solutions and a subsidiary of The Boeing Company, will offer a tour of its print and distribution center. From this center Jeppesen distributes more than 2 billion air navigation charts annually. The company is the 2000 recipient of the Franz Edelman Award for achievement in operations research and the management sciences.

NETWORKING AND SOCIAL EVENTS

At the heart of the INFORMS Annual Meeting is exchange – the sharing of knowledge, ideas and perspectives that takes place not just during the formal technical program, but informally in hallways, over cups of coffee and at these special events.

SATURDAY, OCTOBER 23

INFORMS Membership Meeting & Reception
5:00pm-6:00pm
Plaza – Governor's Square 14
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, OCTOBER 24

Breakfast for New Members & First-Time Attendees
7:00am-8:00am (Ticket Required)
Plaza – Ballroom A
The INFORMS Board and Meetings Committee will host this breakfast to welcome and orient people who are new to INFORMS and the meeting. Continental breakfast will be served. New members and first-time attendees will receive a ticket for the breakfast with their registration materials.

Junior Faculty INFORMS Group Luncheon
11:30am-1:00pm
Tower – Windows
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. Sponsored by University of South Florida, McGill University, Washington University-Saint Louis, Duke University, University of Southern California and Intel Corporation.

INFORMS On-Line Reception
6:00pm-7:00pm
Plaza – Governor's Square 16
INFORMS On-Line (IOL) invites all meeting attendees to this reception. We'll celebrate the move of the COIN-OR resources (www.coin-or.org) resources to the INFORMS server. Sponsored by IBM.



Welcome Reception/50th Anniversary Celebration
7:30pm-9:00pm
Exhibit Hall

We're throwing a party and you're invited to celebrate the 50th anniversary of TIMS and its flagship journal, *Management Science*. There will be a giant anniversary cake, fun, food and great music. It's a party you don't want to miss. Cash bar, complimentary soft drinks.

Wear badge for admission. Your meeting registration fee covers admission to this reception. If your guest would like to accompany you, a guest registration must be purchased. The $50 guest fee also includes the General Reception and continental breakfast Sunday - Tuesday.

Minority Issues Forum Reception
8:00pm-9:00pm
Plaza – Governor's Square 10
Come meet old friends or make new ones while talking about minority issues and other intellectual issues and opportunities. The reception is sponsored by CenterPoint Energy Entex, Texas A&M University-Industrial Engineering Dept., University of Michigan-Industrial and Operations Engineering Dept., and Northwestern University-Industrial Engineering and Management Sciences Dept.

Women in OR/MS Forum Reception
8:00pm-10:00pm
Plaza – Governor's Square 15
Everyone interested in encouraging women in the OR/MS profession is invited to this reception. Light hors d'oeuvres and wine will be served. Sponsored by University of Colorado at Boulder, Leeds School of Business.

Student Reception
8:00pm-10:00pm
Plaza – Governor's Square 14
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 Jeppesen.*

MONDAY, OCTOBER 25

Welcome & Awards Ceremony
11:40am-12:30pm
Plaza – Ballroom A
Join the INFORMS Board and Denver Organizing Committee to honor and celebrate the achievements of our colleagues and all they have contributed to the field of OR/MS. The following awards will be presented: INFORMS Prize, George B. Dantzig Dissertation Awards, John von Neumann Theory Prize, Frederick W. Lanchester Prize, INFORMS President's Award, INFORMS Prize for the Teaching of OR/MS Practice, George E. Kimball Medal, George E. Nicholson Student Paper Competition Awards, INFORMS Expository Writing Award and the Bonder Scholarships for Health Care and Applied OR in Military Applications. New for 2004 is the INFORMS Impact Prize to recognize contributions that have had a broad impact on the field.

COIN-OR Users Group Meeting & Bag Lunch
12:00pm-1:15pm
Plaza – Plaza Court 8
Anyone interested in open-source software tools, open standards, and data and model repositories for OR is encouraged to attend the users meeting of the Computational Infrastructure for OR. This meeting will be the first users meeting under the auspices of the newly formed COIN-OR Foundation, Inc. Bring your own lunch and your ideas. The agenda for the meeting is posted on www.coin-or.org.

CPMS Isolated Practitioner Workshop & Reception
6:00pm-7:00pm
Plaza – Governor's Square 9
CPMS, The Practice Section of INFORMS, sponsors this workshop on topics of interest to isolated practitioners, the "Lone Rangers" of OR/MS. The 21st 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.

General Reception
Coors Field
7:30pm-9:30pm
Coors Fields is a must-see for anyone visiting Denver – and the perfect venue for our General Reception. You'll enjoy breathtaking views of both Denver's "field of dreams" and the Rocky Mountains from the club level of the stadium. Stop in at the elegant Mountain Ranch Club and tour the corporate hospitality suites.

Great food and drink will be served, with everything from ballpark hotdogs to vegetarian tacos. Our thanks to Coors for hosting beer and soda (a cash bar is also available for other beverages).

And don't miss entertainment by LIZA, a jazz-blues combo featuring the original songs and smooth voice of Liza Oxnard. A Denver-area sensation, Liza has been described as "soulful, sensual and gutsy" with a dynamic stage presence. She's played with several rock bands on the national touring circuit and performed in some of the country's top stages.

Wear badge for admission. Buses depart from the Tower building entrance beginning at 7:00pm. Buses will run continuously between the Adam's Mark and the reception (trip is only 5-10 minutes), with the last bus leaving the reception at 9:45pm.

If your guest would like to accompany you, a guest registration must be purchased (guests will receive a special badge). The $50 guest fee also includes the Welcome Reception and continental breakfast Sunday-Tuesday.

TUESDAY, OCTOBER 26

Women in OR/MS Forum Business Meeting & Luncheon
12:30pm-1:30pm
Plaza – Governor's Square 16
Interested in issues related to women professionals in OR/MS? Come join us for lively conversation at our business meeting.

Academic/Practitioner Interface Luncheon
12:30pm-1:30pm
Tower – Majestic Ballroom
Don't miss this opportunity to network with colleagues, both in the practice and academic arenas. INFORMS leaders and practice session speakers will facilitate roundtable discussions focusing on academic-practitioner collaboration. Sit-down luncheon - $25. Ticket required - sign up at the INFORMS registration desk.

COFFEE BREAKS

Sunday, Oct. 24
9:30am – 10:00am Plaza Court & Tower Lobby
4:00pm – 4:30pm Exhibit Hall & Tower Lobby

Monday, Oct. 25
9:30am – 10:00am Exhibit Hall & Tower Lobby
4:00pm – 4:30pm Exhibit Hall & Tower Lobby

Tuesday, Oct. 26
9:30am – 10:00am Exhibit Hall & Tower Lobby
4:00pm – 4:30pm Exhibit Hall & Tower Lobby

Wednesday, Oct. 27
9:30am – 10:00am Plaza Court & Tower Lobby

INFORMS Meetings

2005

April 17-19
INFORMS Spring Conference 2005
Applying Science to the Art of Business
Westin Mission Hills Resort
Palm Springs, California
Chair: Rina Schneur
www.informs.org/Conf/Practice05

July 11-15
IFORS Triennial 2005
The 17th Triennial Conference of IFORS
Hilton Hawaiian Village Beach Resort & Spa
Honolulu, Hawaii, USA
Chair, Organizing Committee: Jeffrey L. Arthur
Chair, Program Committee: Martine Labbé
www.informs.org/Conf/IFORS2005/

July 28-31
INFORMS Teaching of Management Science Workshop
Harrison Conference Center at Lake Bluff
Lake Bluff, Illinois
Chair: Stephen G. Powell
www.informs.org/Edu/TMSWorkshop/TMS05/

November 13-16
INFORMS Annual Meeting 2005 New Orleans
New Orleans Marriott & Sheraton New Orleans
New Orleans, Louisiana
Chair: James J. Cochran
www.informs.org/Conf/NewOrleans05

2006

November 5-8
INFORMS Annual Meeting 2006 Pittsburgh
Pittsburgh Convention Center & Westin Convention Center Hotel
Pittsburgh, Pennsylvania
Chair: Michael A. Trick
trick@cmu.edu

2007

November 4-7
INFORMS Annual Meeting 2007 Seattle
Washington State Convention and Trade Center & Sheraton Seattle
Seattle, Washington
Chair: Zelda B. Zabinsky
zelda@u.washington.edu

INFORMS Subdivision Meetings

2004

December 5-7
INFORMS RASIG Workshop
Burlington Northern & Santa Fe Railway Co.
Fort Worth, Texas
www.bnsf.com/workshop.html

December 5-8
Winter Simulation Conference 2004
Hilton Washington
Washington, DC
Chair: Jeffrey S. Smith
www.wintersim.org

2005

January 5-7
INFORMS Computing Society Conference
Loews Annapolis Hotel
Annapolis, Maryland
Co-Chairs: Bruce Golden, S. Raghavan, Ed Wasil
www.informs.org/Conf/Computing05

June 16-19
INFORMS Marketing Science Conference
Emory University
Atlanta, Georgia
Chair: Douglas Bowman, Emory University
www.bus.emory.edu/MKS2005/

June 26-28
Multi-Echelon/MSOM 2005
Northwestern University
Evanston, Illinois
Co-Chairs: Wallace J. Hopp & Martin A. Lariviere
www.kellogg.northwestern.edu/msom2005

July 6-8
INFORMS Applied Probability Society Conference
The Westin
Ottawa, Ontario, Canada
Chair: Doug Down
downd@mcmail.cis.mcmaster.ca

December 4-7
Winter Simulation Conference 2005
Hilton at Walt Disney World
Orlando, Florida
Chair: Brad Armstrong

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

Focus on Practice
Sunday – Wednesday
Track 32 – Tower, Vail
Track 33 – Tower, Savoy
Real-world applications are the focus of special tracks, designed for both practitioners and academics. Each 1½-hour session offers a presentation by invited speakers, with presenters from IBM, Ford, Jeppesen, Procter & Gamble and Level 3 Communications, as well as leading universities. Practitioners and academics are encouraged to attend. CPMS, The Practice Section of INFORMS, offers panels on

– *Academic/Practitioner Interaction and Cooperation*
– *Building and Managing an OR Consulting Firm*
– *Theory of Practice.*

Daniel H. Wager Prize Competition
Sponsored by CPMS, The Practice Section of INFORMS
Monday – Tuesday
Track 33 – Tower, Savoy
Contestants from AT&T Labs, General Electric, Merrill Lynch and other organizations present their best projects in this competition that emphasizes the quality and coherence of implemented OR work.

2004 Franz Edelman Award Reprise
Sponsored by CPMS, The Practice Section of INFORMS

First Place: Motorola, Inc. and Emptoris, Inc.
Keynote: Reinventing the Supplier Negotiation Process at Motorola
Tuesday, October 26
3:10pm-4:00pm
Plaza, Ballroom A

Finalists:
– U.S. Dept. of Energy: The Adoption of Multi-Attribute Utility Theory for the Evaluation of Plutonium Disposition Options in the United Sates and Russia
– Routing Optimization for Waste Management
Tuesday, October 26
10:00am-11:30am
Track 33 – Tower, Savoy

CPMS Isolated Practitioner Workshop & Reception
Monday, October 25
6:00pm – 7:00pm
Plaza, Governor's Square 9
CPMS, The Practice Section of INFORMS, sponsors this workshop on topics of interest to isolated practitioners, the "Lone Rangers" of OR/MS. The 21st 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
Sunday – Wednesday
Track 1 – Plaza, Ballroom F
These 90-minute sessions offer an in-depth look at current methodologies. Springer will publish eight of the tutorials in a book dedicated to the memory of Carl Harris (available for purchase during the meeting). Topics include heuristic search for network design, computational finance, Markov decision chains and multiple criteria decision-making and other key topics

Software Demonstrations
Sunday – Tuesday
Track 47 – Tower, Century
See new product releases, case studies, and software presented by leading vendors and solution providers. Publishers will introduce new resources for use in academic settings.

Academic/Practitioner Interface Luncheon
Tuesday, October 26
12:30pm-1:30pm
Tower, Majestic Ballroom
Don't miss this opportunity to network with colleagues, both in the practice and academic arenas. INFORMS leaders and practice session speakers will facilitate roundtable discussions focusing on academic-practitioner collaboration. Sit-down luncheon - $25. Ticket required - sign up at the INFORMS registration desk.

Search the Technical Sessions
Be sure to check out the 47 technical session tracks, particularly those sponsored by INFORMS subdivisions, which offer many applications-oriented papers and sessions. You'll find presentations on manufacturing, supply chain, optimization, e-business, auctions, data mining and knowledge discovery, financial engineering, scheduling and many others.



JOB PLACEMENT SERVICES

INFORMS Job Placement Service
Sunday – Tuesday
Exhibit Hall
This service, open during exhibit hall hours, 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
Sunday, October 24
Track 2, Plaza – Ballroom E

THE ACADEMIC JOB SEARCH
8:00am-9:30am
This panel will discuss the academic interview process and the dos and don'ts associated with the job search, with comments by current and former search chairs.

THE INDUSTRY JOB SEARCH
10:00am-11:30am
The panel will discuss the industry interview process and the dos and don'ts associated with the job search. Participants include current and former industrial recruiters.

Time will be provided for questions and answers at both sessions.

Job Fair
Sunday, October 24
12:00pm-2:00pm
Plaza – Ballroom D
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.

2004 Combined Colloquia
Friday-Saturday
Tower – Majestic Ballroom, Columbine, Vail, Savoy
The 2004 Combined Colloquia will feature the Sixth 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.
Sponsored by Omega Rho.
Participation in the colloquia is by nomination only.

DSS Workshop
Saturday, October 23
8:30am-5:00pm, Fee: $75.00
Plaza – Governor's Square 12
This is a hands-on workshop where participants will learn Excel extended functionalities, Excel VBA and how these are used to develop decision support systems. Guidance on how to offer courses using this material will be provided.

CIST 2004 – 9th Conference on Information Systems and Technology
Saturday-Sunday
Tower – Silver, Colorado
The theme of the 2004 conference is *Mobility, Organizations, Systems and Technologies.* 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.

Nicholson Student Paper Competition
Sunday, October 24
8:00am-9:30am
Track 21 – Plaza, Room 3302
The George Nicholson Student Paper Competition honors outstanding student papers in the field of operations research and the management sciences.

Minority Issues Forum Business Meeting and Panel Discussion
Sunday, October 24
6:15-7:15pm
Plaza – Governor's Square 9
A short business meeting will be followed by a panel discussion, "The Future of OR in the US: How Can We Recruit and Retain Under-represented Groups for the Profession?" There are few researchers and practitioners in OR/MS who are also members of an under-represented group. This panel discussion will try to address this issue by bringing people together to discuss relevant concerns of recruiting and retaining under-represented students in the OR/MS profession. Hopefully, this panel will spark action items to help alleviate the problem.

Denver Area Math Teachers Program
Monday, October 25
8:00am-4:00pm
Plaza – Governor's Square 16
This program, geared to middle/high school/community college math and science teachers, will consist of introductory OR and computer application presentations followed by hands-on participation. Probability modeling, computer simulations, queueing models and linear programming models will follow an introduction to OR/MS. Participants, who are also welcome to attend technical sessions, will receive copies of all program materials: videos, software packages with instructions and teacher/student activity guides, and Teacher Introduction Modules.

Sessions in Honor of Pete Veinott
Monday, October 25
8:00am-3:00pm
Track 9 – Plaza, Plaza Court 7
Three sessions will honor Arthur F. (Pete) Veinott, Jr., Professor of Operations Research, Stanford University, Dept. of Management Science and Engineering. He served as Founding Editor of *Mathematics of Operations Research* (1974-1980) and was a founding member of the Department of Operations Research at Stanford University.



PLENARY & KEYNOTE PRESENTATIONS

PLENARY

Sunday, October 24
11:40am-12:30pm
Plaza-Ballroom A

We Have No Choice – Health Care Delivery Must Be Improved: The Key Lies in the Application of Operations Research

William P. Pierskalla
Professor, Department of Decisions, Operations and Technology Management
University of California, Los Angeles

Our health care system faces fundamental change over the next ten years. The bad news is: Quality gaps are everywhere. Costs are increasing at double-digit rates. Waste is extensive. Delivery systems are outmoded. Access for many is restricted. Many developed countries of the world have better health care systems' performances at lower costs. The keys to improvement are macro system changes some of which can borrowed and adapted from other countries and micro system changes built on information and decision-aiding models coupled with outcome measures and systems accountability. The good news is: Many more OR/MS persons are working on these improvements. New and excellent work is being done on health care operations management, on health care policy and economics and on OR/MS models in clinical practice. I will discuss the bad news, the good news, system trends and operational changes, and the many challenges facing health care delivery, which presents research opportunities for OR/MS.



William P. Pierskalla
William P. Pierskalla served as Dean of The Anderson School of Business at UCLA from 1993-1997. His current research interests include the management aspects of health care delivery and issues of global competition. Dr. Pierskalla has published over 50 referred articles in mathematical programming, transportation, inventory and production control, maintainability and health care delivery. He serves in an editorial capacity on *Production and Operations Management, International Transactions in Operational Research, Encyclopedia of Operations Research and Management Science, Health Services Management Research,* and the *Health Care Management Sciences Journal.* During his career, he also has provided consulting and advising services for corporate and non-profit organizations including MDAX Corp., Sun HealthCare Group, the National Institute of Health, the National Heart, Lung and Blood Institute, and the Mayo Clinic. Dr. Pierskalla served as President of ORSA (1982-1983) and President of IFORS (1989-1991), and was a winner of the Harold Larnder Prize, Canadian Operational Research Society (1993) and George Kimball Award, ORSA (1989).

OMEGA RHO DISTINGUISHED LECTURE

Sunday, October 24
3:10pm-4:00pm
Plaza-Ballroom A

Improving OR Support for Healthcare Delivery Systems: Guidelines from Military OR Experience

Seth Bonder
Founder and Former Chairman/CEO of Vector Research, Incorporated (VRI)

The health care delivery (HCD) system in the U.S. is in a crisis – access is limited, costs are increasing at unacceptable rates, and there are concerns about the quality of service. For over 40 years the operations research community has successfully addressed a spectrum of tactical-level issues to assist HCD unit managers, but has been unable to affect broader enterprise-wide planning and policy decisions which have large cost, access and effectiveness impacts. Over a similar period, military OR analysts have not only contributed to tactical-level issues, but have continued to grow over the years to address senior-level defense planning and policy decisions. Based on this experience and through examples, I will suggest some "lessons learned" to improve support to senior managers of HCD enterprises.



Seth Bonder
Throughout his distinguished career, Dr. Bonder has been a leader in applying operations research to national defense planning and policy issues, and subsequently to health care delivery re-engineering and disease management practices. He has published many papers in various OR and defense journals. Over the past ten years he has focused efforts on improving the planning and operations of health care delivery enterprises from its current retrospective, trial and error approach. He served as President of ORSA (1978-1979), President of the Military Operations Research Society and Vice-President of IFORS (1985-1988). Dr. Bonder has been the recipient of numerous awards, including the Patriotic Service Award from the Secretary of the Army, the George E. Kimball Medal, and the INFORMS President's Award. He is an INFORMS Fellow and a member of the National Academy of Engineering and a member of the U.S. Army Science Board.

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 36 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, Seth Bonder will be inducted as the 38th Honorary Member of Omega Rho.

PLENARY

Monday, October 25
3:10pm-4:00pm
Plaza-Ballroom A

Risk Analysis for Space Shuttle and Other Systems: The Importance of Problem Formulation

M. Elisabeth Paté-Cornell
Burton J. & Anne M. McMurty Professor and Chair, Management Science and Engineering
Stanford University

Risk assessment for engineering, medical, or other types of systems requires first an analysis of the functions to be performed, second identification of the failure modes, and third computation of the probabilities and consequences of different failure scenarios. The results can then be aggregated into a single probability of failure per time unit or operations, or the risk can be characterized by a probability distribution of the potential losses in the same time frame. One difficulty is often in the formulation of the problem. One cannot examine all failure scenarios in excruciating detail, especially when some parameters are continuous. Therefore, the analyst has to choose a level of aggregation to study classes of scenarios in a meaningful way, based in large part on the information available and the uncertainties in the performance of the different subsystems. I will illustrate these concepts through three examples: the tiles of the space shuttle, the analysis of patient risks in anesthesia, and a global framework for the analysis of terrorism risks.



M. Elisabeth Paté-Cornell
Dr. Paté-Cornell received a master's degree in operations research in 1972 and a PhD in Engineering-Economic Systems in 1978, both from Stanford University. Her primary areas of teaching and research are engineering risk analysis and risk management, decision analysis and engineering economy. Her research in recent years has focused on the extension of probabilistic risk analysis models to include organizational factors with application to a wide variety of problems such as the management of the tiles of the space shuttle, offshore platforms during oil and gas production, and anesthesia during surgery. She is a member of the President's Foreign Intelligence Advisory Board, the National Academy of Engineering and its Council, and the California Council on Science and Technology. Dr. Paté-Cornell is formerly a member of the Air Force Science Advisory Board, the NASA Advisory Council, and a past president and a fellow of the Society for Risk Analysis.



PLENARY

Tuesday, October 26
11:40am-12:30pm
Plaza-Ballroom A

Bringing Operations Research to Telecom

James Q. Crowe
Chief Executive Officer
Level 3 Communications, Inc.

Operations research is a key part of Level 3 Communications' business strategy. CEO James Crowe predicts that OR and optimization will revolutionize business over the next two decades, netting a competitive advantage for the companies smart enough to recognize its potential and power as a business enabler. Crowe will trace the role OR played in launching the company in 1997 and describe how Level 3 is integrating forecasting and optimization into its overall business processes.



James Q. Crowe
James Q. Crowe holds a B.S. in Mechanical Engineering from Rensselaer Polytechnic Institute and an MBA from Pepperdine University. From 1974 to 1986, he worked for Morrison-Knudsen Corporation, rising to Group Vice President. In 1986 he joined Omaha-based Peter Kiewit Sons, one of the nation's largest construction companies. At Kiewit he was named head of MFS Communications, building the division into the largest competitive local exchange carrier in the United States and Europe. Crowe took MFS public in 1993 and sold the company to WorldCom three years later, for more than $14 billion. In 1997, Crowe founded Level 3 Communications, which over the next few years built a 23,000-mile fiber-optic network designed to fully leverage Internet technology. Today, the Level 3 network serves as one of the largest Internet backbones in the world. Level 3 is also the world's largest distributor of software products to large enterprises, through its Software Spectrum subsidiary. With annual revenues of approximately $4 billion, Level 3 was named to the Fortune 500 only five years after its stock began trading publicly on the NASDAQ. Mr. Crowe was named Entrepreneur of the Year by Rensselaer Polytechnic Institute (2003) and received the Golden Plate Award, American Academy of Achievement (1999).

PLENARY & KEYNOTE PRESENTATIONS

Reprise Presentation

EDELMAN COMPETITION 2004 FIRST PLACE AWARD WINNER

Tuesday, October 26
3:10pm-4:00pm
Plaza-Ballroom A

Reinventing the Supplier Negotiation Process at Motorola

Presenters:

Mike S. Zafirovski, President and Chief Operating Officer, Motorola, Inc.

Theresa M. Metty, Senior Vice President and Chief Procurement Officer, Motorola, Inc.

Robert Harlan, Director, Corporate Sourcing, Motorola, Inc.

Tom Moore, Manager, Advanced Procurement Technology, Motorola, Inc.

To drastically cut costs, Motorola selected Emptoris's end-to-end, Internet negotiation platform. Combining innovative bidding, online negotiations and scenario-based optimization analysis, the solution identifies the best sourcing strategy while enhancing supplier relationships. Sourcing $15 billion and saving $700 million, including $200 million specifically driven by the platform's advanced capabilities, Motorola changed its negotiation paradigm and moved to a truly global process.

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. Every year, six to seven finalists compete in this "super bowl" of O.R. in practice. The 2004 finalists included Waste Management Inc.; Philips Semiconductors and Philips Optical Storage; Bombardier Aerospace; John Deere; State Scientific Center of Russian Federation Institute for Physics and Power Engineering, and Lawrence Livermore National Laboratory; and Hongkong International Terminals Ltd. In this Denver keynote session, the first-place Motorola-Emptoris team will reprise their winning presentation.

KEYNOTE

Tuesday, October 26
3:10pm-4:00pm
Plaza-Ballroom E

Science of Better: Marketing the OR Profession

Thomas M. Cook, Past President, INFORMS, and guests

INFORMS has made great progress in its campaign to market the OR profession. In the last year, hundreds of INFORMS members have used the Science of Better materials and become champions for OR. Come to this special session led by INFORMS Past President Tom Cook, who has shepherded the campaign, and hear from INFORMS members who have signed on by promoting OR among colleagues and clients. Then learn how you can use the new material to become an OR champion who proves the value that OR creates, sells OR better, and uses the new resources to multiply the effectiveness of our outreach. And share your thoughts about making still further strides in our mission to market our profession.

Plaza-Ballroom F

SUNDAY, OCTOBER 24

■ SA01
8:00am-9:30am
Heuristic Search for Network Design*
Ioannis Gamvros, Bruce L. Golden, S. Raghavan and Daliborka Stanojevic, University of Maryland

Network design problems arise in a wide variety of application domains – telecommunications, supply chain management, VLSI design, and transportation. We survey some recent, and successful, applications of heuristic search techniques for network design problems. In particular, we highlight the effective use of local search techniques and metaheuristics, notably tabu search and genetic algorithms, and the combination of the two. We provide some suggestions for the successful design of heuristic search techniques for network design problems.

■ SB01
10:00am-11:30am
Polyhedral Combinatorics*
Robert D. Carr, Sandia National Laboratories, and Goran Konjevod, Arizona State University

The session deals with theoretical issues in using linear and integer programming to solve or approximate combinatorial optimization problems. The speakers will show how structural properties of naturally arising polyhedra frequently come into play, beginning with an overview with special emphasis on the quality of linear relaxations of hard combinatorial problems. Then, the speakers will discuss formulation size, the integrality gap (a measure of how close an LP relaxation gets to an optimal solution), and cutting planes and separation.

■ SC01
1:30pm-3:00pm
Simulation Optimization
Fred W. Glover and James P. Kelly, OptTek Systems

This tutorial will demonstrate how these two traditional areas of OR are combined into a powerful decision-making system. Simulation models uncertainty while optimization seeks best policies. The sense in which these represent decision-making will be explained in the tutorial, which will include an example to optimize financial portfolio investments under uncertainty.

■ SD01
4:30pm-6:00pm
Computational Finance
Stavros A. Zenios, University of Cyprus

Quantitative methods have been gaining increasing importance in finance over recent decades. Not only have the celebrated models for options pricing evolved to unprecedented levels and are used routinely in industry, but policymakers have also come to rely on quantitative models for risk management and control. Today, OR tools plan an important role within the framework of enterprise-wide risk management. This tutorial will survey the current state-of-affairs from this perspective.

MONDAY, OCTOBER 25

■ MA01
8:00am-9:30am
Constraint Languages for Combinatorial Optimization*
Pascal Van Hentenryck, Brown University, and Laurent D. Michel, University of Connecticut

This tutorial reviews recent developments in the design and implementation of constraint languages for combinatorial optimization. In particular, it argues that constraint-based languages are a unifying technology to express combinatorial optimization problems, supporting a variety of solvers including constraint programming, local search, and mathematical programming.

■ MB01
10:00am-11:30am
Nonlinear Programming and Engineering Applications*
Robert J. Vanderbei, Princeton University

Interior-point methods for nonlinear programming make it possible to solve realistic- size models of engineering problems. After a brief review of interior-point methods for nonlinear programming, the speaker will devote much of the tutorial to a consideration of various applications drawn from such areas as FIR filter design, antenna array design, high-contrast imaging, new orbits in the n-body problem, trajectory planning, and others.

■ MC01
1:30pm-3:00pm
Computer-Aided Design for Electrical and Computer Engineering*
John W. Chinneck, Michel Nakhla, and Q.J. Zhang, Carleton University

This tutorial will provide an overview of applications of OR methods to solve and analyze complex problems in this growing area. The speakers will show how OR applies to the design of computer chips composed of millions of interconnected microscopic devices. Problems include how to pack the devices into the smallest possible area, how to route the interconnections, and how to simulate the behavior of a proposed design. They will also describe difficult design and optimization problems in other CAD areas, such as antenna design, radio- and microwave-frequency circuit design.

■ MD01
4:30pm-6:00pm
Markov Decision Chains
Arthur F. Veinott, Jr., Stanford University

This topic has a rich history in OR. For finitely many states and actions, the speaker will give a unified development of optimality concepts over long time horizons and discuss why they are important. The focus will be on the relations among the concepts as well as the existence, characterization and efficient computation of stationary optimal policies for them. The optimality concepts include maximum value and stopping value; maximum present value for fixed and for small interest rates; maximum reward rate; Cesàro overtaking and future-value optimality. Recent results show how to decompose each of these problems into a sequence of problems of two types, viz., maximum stopping value and maximum reward rate. Both types can be solved in polynomial time by reduction to linear programs and use of interior-point methods. For deterministic systems, both types can be solved in strongly polynomial time by combinatorial methods.

Eight of these tutorials (*) will be published by Springer. The book is dedicated to the memory of Carl Harris and will be available for purchase during the meeting.

TUTORIALS

TUESDAY, OCTOBER 26

■ TA01
8:00am-9:30am
Parallel Algorithm Design for Branch and Bound*
David A. Bader, University of New Mexico, and William E. Hart and Cynthia A. Phillips, Sandia National Laboratories

Large and/or computationally expensive optimization problems sometimes require parallel or high-performance computing systems to achieve reasonable running times. This tutorial will present techniques to assist the porting of serial optimization codes to parallel systems and discuss more fundamentally parallel approaches to optimization. The speakers will survey the state-of-the-art in distributed- and shared-memory architectures and give an overview of the programming models appropriate for efficient algorithms on these platforms. As a concrete example, they will discuss the design of parallel branch-and-bound algorithms for the problem of maximum parsimony in evolutionary trees.

■ TB01
10:00am-11:30am
Multiple Criteria Decision Making
Pekka Korhonen, Helsinki School of Economics

This tutorial will provide a brief introduction into the main principles of Multiple Criteria Decision Making (MCDM), and will overview basic concepts, formulations, and principles of solving multiple objective programming problems. To solve those problems requires the intervention of a decision-maker. That is why behavioral assumptions play an important role in multiple objective programming. Which assumptions are made affects which kind of support is given to a decision maker. The speaker will also discuss differences between Multiple Criteria Evaluation and Multiple Objective Programming Problems. The main tasks of computer programs are to prevent a decision maker from making "stupid" decisions and to help to find the most preferred solution. There are several common misunderstandings and pitfalls in MCDM. Some suggestions for avoiding them will be provided. The speaker will demonstrate how MCDM may bring some additional ingredients to other research areas like Data Envelopment Analysis (DEA).

■ TC01
1:30pm-3:00pm
Radiation Oncology and Optimization*
Allen Holder, Trinity University, and Bill J. Salter, University of Texas Health Science Center

The field of medical physics increasingly relies on optimization techniques to improve nuclear procedures in medicine. Several treatment facilities are cooperating with academics, and a plethora of optimization problems have followed from these relationships. The most heavily studied problem is the design of a treatment plan for external beam radiotherapy, and because the treatment goals vary from patient to patient and clinic to clinic, many optimization models have been suggested (linear, nonlinear, and integer). While treatment design is the most prevalent research topic, there are other clinical questions that are naturally addressed by optimization, with treatment error and delivery receiving recent attention. The objectives of this tutorial are to 1) present the clinical issues needed to understand the optimization models, 2) provide a concise development of the physics describing how high-energy particles interact with the anatomy, 3) review the optimization and medical literature on treatment design, and 4) introduce some emerging problems.

■ TD01
4:30pm-6:00pm
Optimization Methods for Rescheduling
Nicholas G. Hall, Ohio State University

Despite the extensive literature on scheduling problems, rescheduling has been much less well studied. Rescheduling problems arise when a previously planned optimal schedule is disrupted. In practice, frequent disruptions include: the arrival of new orders, delays in job availability, machine breakdowns, processing delays, order cancellations and changes in priorities. The rescheduling problem involves minimizing the cost of scheduling the revised data set, while minimizing the disruption to customer expectations and resource allocations. We will review the literature of this problem, and describe a variety of new optimization and approximation methods. Many new research directions and open problems will be discussed.

WEDNESDAY, OCTOBER 27

■ WA01
8:00am-9:30am
Issues and Possibilities in Contemporary Simulation
W. David Kelton, University of Cincinnati

Simulation remains one of the most frequently used OR techniques, yet its application often falls short of its potential. This tutorial is for newcomers to the possibilities with modern simulation methods and tools. It will start by discussing the different approaches and tools for building simulation models, including current software options, with examples. Then, additional focus will be given to estimating and rendering randomness in simulation models, including generating random numbers, variates, and processes. Finally, the important but often-neglected topics of designing and analyzing simulation experiments will be discussed. Throughout, the value of these possibilities to simulation projects will be stressed. Some modest proposals for the future direction of simulation research and software will also be offered.

■ WB01
10:00am-11:30am
Connecting mrp, MRP II and ERP Supply Chain Planning via Optimization Models*
Stefan Voss, University of Hamburg, and David L. Woodruff, University of California, Davis

This tutorial begins with a broad overview of operations research in the supply chain area; we then focus on optimization applications in production planning in a supply chain. We demonstrate by construction that we can begin with mrp and MRP II and end up with a useful basis for a planning model. In order to produce a useful model, we add extensions and ultimately arrive at models that bear little resemblance to mrp and certainly solutions for the optimization problems cannot be obtained using mrp or MRP II processing or logic. We display implementations of these models in five popular modeling languages. As time permits, we will highlight connections with hierarchical systems for planning and detailed scheduling.

Tower-Century

SUNDAY, OCTOBER 24

■ SB47
10:00am-10:45am
Decisioneering, Inc.
Lawrence Goldman
lgoldman@crystalball.com

Spreadsheet Simulation and Modeling Using Crystal Ball Professional
Easily teach risk analysis to your students! Crystal Ball–a simple, reliable, and convenient software simulation tool–enhances Excel by performing Monte Carlo analysis, optimization, and time-series forecasting. This presentation uses practical examples to show how Crystal Ball helps quantify and reduce operational and financial risks.

10:45am-11:30am
Syncopation Software
Chris Dalton
cdalton@syncopationsoftware.com

DPL 6.0 Professional: From Discounted Cash Flow to Decision Analysis in Minutes
See how easy it is to use DPL 6.0 to quickly develop a full decision analysis from a cash flow spreadsheet. The demonstration covers DPL's redesigned Excel interface and new Policy Summary filters as well as decision trees, influence diagrams, sensitivity, and time series percentiles. The demonstration includes a pharmaceutical R&D case.

■ SC47
1:30pm-2:15pm
Intelligent Automation, Inc.
Goutam Satapathy
goutam@i-a-i.com
Patrick Sodre Carlos
sodre@i-a-i.com

CybelePro®
United States government and industries have identified the need for agent-technology in modeling and simulation. Intelligent Automation offers CybelePro® (www.cybelepro.com), a robust and efficient agent infrastructure for rapid development and deployment of large-scale high performance agent-based simulation and decision support systems. We will demonstrate NASA's Airspace Concept Evaluation System (ACES) and air traffic flow control DST developed using Cybele.

■ SD47
4:30pm-5:15pm
GAMS Development Corp.
Alex Meeraus
alex@gams.com
Armin Pruessner
armin@gams.com

GAMS: A High Performance Modeling System for Large-Scale Modeling Applications
The General Algebraic Modeling System (GAMS) is a high-level modeling environment for mathematical programming problems. It consists of a language compiler and a stable of integrated high-performance solvers. GAMS is tailored for complex, large scale modeling applications. We show how to build large maintainable models that can be adapted quickly to new situations. Furthermore, we illustrate how easily GAMS can be interfaced with other applications such as Excel or embedded in user applications for solving real-world problems.

5:15pm-6:00pm
Interpretive Simulations
Tony Naidu
tony@interpretive.com

Active Learning Through Business Simulations
An overview of our broad range of fully administered business simulations, used by some of the leading business schools in the world, including Michigan, Wharton and Darden. Each simulation is designed with specific pedagogical objectives in mind, yet provides a realistic setting to challenge students. Whether your class size is 15 or 1500, undergraduate or MBA, domestic or international, marketing, management or operations, let one of our simulations become the cornerstone of your course.

MONDAY, OCTOBER 25

■ MA47
8:00am-8:45am
Frontline Systems, Inc.
Daniel H. Fylstra
dfylstra@frontsys.com

Premium Solver
See how Premium Solver handles the full spectrum of optimization problems, from linear programming to genetic algorithms. Our Solver DLL products supply easy-to-use optimization for your applications. Learn how to "do more with less," and how working with Excel can cut down the cost and complexity of using optimization technology.

8:45am-9:30am
Imagine That, Inc.
Anthony Nastasi
anthonyn@imaginethatinc.com

Simulation with Extend
This presentation provides an introduction to modeling with Extend by Imagine That Inc., an innovative leader in the simulation industry since 1987. Extend offers an unmatched suite of features along with a unique combination of power and ease of use. Consequently, Extend spans the full spectrum of simulation modeling applications from the classroom to Fortune 500 companies.

■ MB47
10:00am-10:45am
MINITAB, Inc.
David McClelland
dmcclelland@minitab.com

Introduction to MINITAB Release 14
MINITAB® Release 14 is the leading statistical software package used in education. More than 4,000 colleges, universities, and high schools worldwide choose MINITAB because it: contains all the methods students need and is easy to learn and use; parallels the approach used in virtually all the leading textbooks, making it compatible with any curriculum; produces stunning graphs that are simple to make, edit, and update; is used by thousands of distinguished companies students will want to work for, including GE, 3M, Toshiba, Bank of America and the Ford Motor Company.

10:45am-11:30am
Resampling Stats
Peter Bruce
pbruce@resample.com

Excel as a Platform for Data Mining
New tools make Excel an attractive platform for prototyping data mining solutions (teaching too). The topics and methods available in a comprehensive data mining add-in for Excel (XLMiner) are reviewed. These include neural nets, CART, K-nearest-neighbors, logistic and linear regression, Bayesian classifier, clustering, more. The key steps in the data mining process will be demonstrated in XLMiner for several methods.

SOFTWARE DEMONSTRATIONS

■ MC47
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 the MPL Modeling System for Optimization with New and Enhanced Features
We will demonstrate the newest release of MPL with many new enhancements to help solve real-world optimization problems. 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 (COIN, GLPK, LGO) have been added and existing solvers updated (CPLEX, XPRESS, XA, CONOPT). Data access has been improved with new native drivers (ORACLE, ADO) and offers now full XML/SOAP support for Internet connectivity.

■ MD47
4:30pm-5:15pm
ILOG, Inc.
Greg Glockner
gglockner@ilog.com

Bridging the Gap Between Model and User: Introducing New Optimization Technology that Helps Users Become Self Sufficient and Reduces the Support Needed by the OR Model Developer
Most business managers view optimization as a tool to inspire better decisions, not a replacement for human experience. Here, we will introduce innovative new technology from ILOG that combines business rules and optimization. This technology guides managers towards better decisions by empowering them to maintain, update and execute optimization models developed by operations researchers.

5:15pm-6:00pm
Paragon Decision Technology BV
Gertjan de Lange
g.de.lange@paragon.nl
Koos Heerink
koos.heerink@paragon.nl

AIMMS' Analytical Tools and Extensive Algorithmic Capabilities
See the power and extended capabilities of AIMMS: the solver independent and intuitive modeling environment. AIMMS provides a single medium in which to develop and turn advanced prototypes into robust and large-scale operational end-user systems. The AIMMS 3.5 release (Oct. 2004) includes new functionality that extends AIMMS' unique development tools and algorithmic capabilities. We will demonstrate: the graphical Math Program Inspector, a unique collection of tools to visually inspect and analyze linear mathematical programs; and the possibility of working with multiple mathematical programs simultaneously, and so opening up the possibility of constructing advanced and more efficient customized solution algorithms.

TUESDAY, OCTOBER 26

■ TA47
8:00am-8:45am
CreateASoft
Hosni Adra
hadra@createasoft.com

Simcad Process Simulator
Still working with code to build simulation models? Check out the new and intuitive approach to model building and simulation with Simcad Pro. Apply the value stream-mapping engine to your model to view process efficiencies and utilizations in real time.

8:45am-9:30am
Micro Analysis & Design
Ben Archer
barcher@maad.com

Introduction to Micro Saint Sharp
Micro Saint Sharp is a general-purpose simulation tool designed to be fast, modular and powerful. It can be used to simulate the complexities of systems within a variety of industries ranging from the military to healthcare. This presentation will provide an overview of Micro Saint Sharp and some of its new modeling capabilities.

■ TB47
10:00am-10:45am
Palisade Corp.
Dan Shikiar
dshikiar@palisade.com

Desktop Monte Carlo Simulation Software
Desktop Monte Carlo simulation software is changing the role of analysts, planners, and forecasters allowing for advanced risk analysis. Palisade Corporation, the world leader in risk, decision, and statistical analysis software, will describe the value of Monte Carlo simulation and demonstrate the use of @RISK, Palisade's Monte Carlo simulation add-in for Microsoft Excel.

10:45am-11:30am
SAS Institute, Inc.
Ed Hughes
ed.hughes@sas.com

SAS9: Meeting the Diverse Needs of the OR Analyst
With SAS9, SAS is better suited than ever to OR modeling. Our broad spectrum of analytics, improved and enhanced, is complemented by our strengths in data acquisition, cleansing and organization. It's easier to encapsulate and deploy analytic methods. And the SAS language ties it all together, facilitating innovative, customized solutions.

■ TC47
1:30pm-2:15pm
Dash Optimization
Nitin Verma
nitin.verma@dashoptimization.com

Fast Track Development of Optimization Applications Using Xpress-MP
This software tutorial focuses on developing and deploying complex hybrid algorithms. Xpress-IVE: visual development environment to analyze and fine tune search procedures of MIP/QP/SLP problems using search visualization tools. Xpress-Mosel: the next generation language provides developers modeling and programming functionality in one medium, leading to fast implementation of advanced algorithms.

2:15pm-3:00pm
Duxbury/Thomson
Curt Hinrichs
curt.hinrichs@duxbury.com

Using JMP IN® 5.1 in Data Analysis Courses
JMP IN® software is an ideal solution for instructors who need to teach statistical concepts in their classes. JMP IN is an intelligent, visual, interactive and easy way to use statistical software that allows students to learn statistical concepts quickly, and for instructors to spend less time on teaching how to use the software.

■ TD47
4:30pm-5:15pm
Responsive Learning Technologies, Inc.
Sam Wood
wood@responsive.net

Web-Based Exercises for Operations and Modeling Courses
Littlefield Technologies, the Supply Chain Game, and the Venture Capital Game are competitive web-based simulations used in Operations Management, Supply Chain Management, and Modeling courses in more than 30 universities. This demonstration of this software will include a description of existing assignments and pedagogy.

5:15pm-6: 00pm
Salford Systems
Mikhail Golovnya
info@salford-systems.com

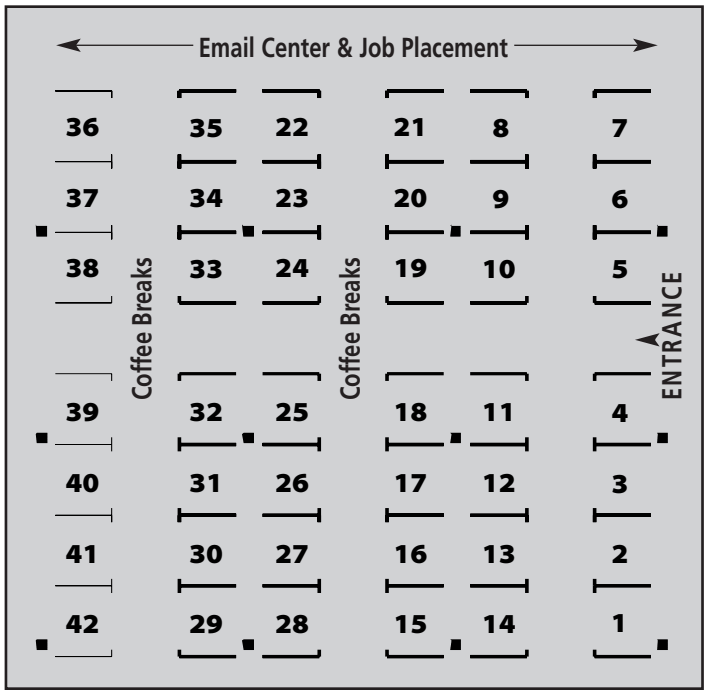
A Tour of Advanced Data Mining Products, Alternatives to Standard Statistical Modeling
Recent methodological developments using entirely new technology are showing enormous promise. Techniques recently developed by Stanford University Professor Jerome Friedman and Berkeley Professor Emeritus Leo Breiman will be discussed. TreeNet/ MART and Random Forests methodologies will be presented and the application and results of real-world analyses will be shown.

EXHIBITORS

Visit the Exhibit Hall to see innovative software products and the latest technical reference materials from these companies and organizations. Coffee breaks will be held in the Exhibit Hall.

Exhibits Open:

Sunday, Oct. 24,	12:00pm-5:00pm
	7:30pm-9:00pm
Monday, Oct. 25,	9:00am-5:00pm
Tuesday, Oct. 26,	9:00am-5:00pm



The Bionetics Corporation **Booth # 29**
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KMS Optimization Products specializes in design, development and application of mathematical programming optimizers and model management software. The software is used as an optimization toolkit by analysts in every sector of the economy. KMS also provides support for users of the software: support ranges from hotline assistance through complete application-system development.

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COIN-OR **Booth #42**
www.coin-or.org
The Computational Infrastructure for Operations Research is a community project to create an open infrastructure of algorithms, models, data and other digital tools for OR professionals and students. COIN-OR is run by the COIN-OR Foundation, Inc. and hosted on-line by INFORMS. Visit the booth and check out our current offerings.

Combined Book Display **Booth #15**
Review titles and special offers from EDP Sciences and University of Chicago Press.

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Simcad Process Simulator features new and improved tools specifically designed to facilitate and improve the transition and implementation of lean concepts in both manufacturing and service industries. With Simcad Pro's integration of dynamic value stream mapping, transition from process maps to value stream maps is instantaneous. CreateASoft also offers lean consulting implementation and process simulation services. NEW product announcement: Value Stream Mapper - standalone software to create, modify and share your value stream maps.

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Darden Business Publishing will be exhibiting a wide variety of case-method teaching materials that intensify the classroom learning experience. They offer text and multimedia cases, teaching notes, and interactive simulations that are all used in graduate, undergraduate and corporate training programs around the world. Visit our web site to learn more about Darden Business Publishing.

Dash Optimization **Booth # 7**
560 Sylvan Ave.
Englewood Cliffs, NJ 07632
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www.dashoptimization.com
Dash Optimization develops and markets Xpress-MP, the world's leading software product for modeling and optimization. The Dash Optimization booth will feature live demonstrations of Dash's Xpress-MP products. Dash offers linear, mixed integer, quadratic, non-linear, stochastic, and constraint programming capabilities. These components will be showcased along with Dash's modeling and programming language Mosel and Xpress-IVE windows development environment.

Decisioneering, Inc. **Booth # 35**
1515 Arapahoe St., Ste. 1311
Denver, CO 80202
303-534-1515
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Crystal Ball® is a suite of Microsoft® Excel-based tools that transform static business and operational spreadsheets into dynamic analytical models. Crystal Ball lets users perform Monte Carlo simulation, time-series forecasting, real options analysis and optimization within the spreadsheet framework. Applications include inventory optimization, project selection, cost estimation and financial analysis.

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Frontline Systems, Inc. **Booth # 31**
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Frontline Systems, developers of the Microsoft Excel Solver, will demonstrate the Premium Solver Platform upgrade which offers greater capacity, speed and ease-of-use; our Solver DLL Platform, callable by custom applications; and powerful dual-use Solver Engines for both platforms that solve large-scale optimization problems. Free trial CDs at the booth.

GAMS Development Corp. **Booth # 34**
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The General Algebraic Modeling System (GAMS) is a high-level modeling system for mathematical programming problems. It consists of a language compiler and a stable of integrated high-performance solvers. GAMS is tailored for complex, large scale modeling applications, and allows you to build large maintainable models that can be adapted quickly to new situations.

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EXHIBITORS

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LINDO Systems will highlight recent enhancements to our optimization modeling software including updates to the linear, integer and global solvers. 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.

Maximal Software, Inc. **Booth # 13**
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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.

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The INFORMS campaign to market our profession is in full swing. Visit this special booth where you will be able to obtain copies of the OR Champions Kit and the Executive Guide to Operations Research. You'll also be able to visit the campaign's two websites, www.orchampions.org and www.scienceofbetter.org, examine the sites' many features for explaining the benefits of OR to clients and organizations, and discuss your ideas with INFORMS staff and volunteers.

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Palisade Corp **Booth # 4**
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www.palisade.com
Palisade Corporation is a world leader in desktop risk analysis, decision analysis, optimization and statistical analysis software products. Since 1984, Palisade has used Monte Carlo simulation and genetic algorithm technology to help people make better decisions. Palisade products include: @RISK, Evolver, RISKOptimizer, PrecisionTree, StatTools and the DecisionTools Suite.

Paragon Decision Technology **Booth # 20**
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+31-23-5511 512
www.aimms.com
Paragon is the developer of AIMMS, the modeling tool of choice for OR professionals when developing optimization-based decision support applications or components, and when conducting research. It is used by leading companies in a wide range of industries in areas such as supply chain management, energy management, production planning, logistics, forestry planning, and risk-, revenue- and asset-management. AIMMS is used in leading universities around the world for teaching operations research and modeling as well as for research and graduation projects. Stop by our booth to learn about the latest AIMMS 3.5 Release. Register for our post-conference workshop on Wednesday October 27 at workshops@ paragon.nl.

Prentice Hall **Booth # 25**
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Stop by the Prentice Hall booth to see our latest offerings in the decision sciences. Some of the featured titles include: Laguna/Marklund's *Business Process Modeling, Simulation & Design;* Foster's *Managing Quality 2e;* Krajewski/Ritzman's *Operations Management* 7e; Heizer/Render's *Operations Management* 7e Flexible Version; and Bozarth/Handfield's *Operations and Supply Chain Management.* Interested in discussing future writing projects? We're interested in hearing your ideas!

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PLAZA BUILDING

Track Numbers are shown for Technical Session rooms.

PLAZA BUILDING

TRACKS
20-31

These Tracks are located in the Plaza Building on floors 3, 4 and 5.

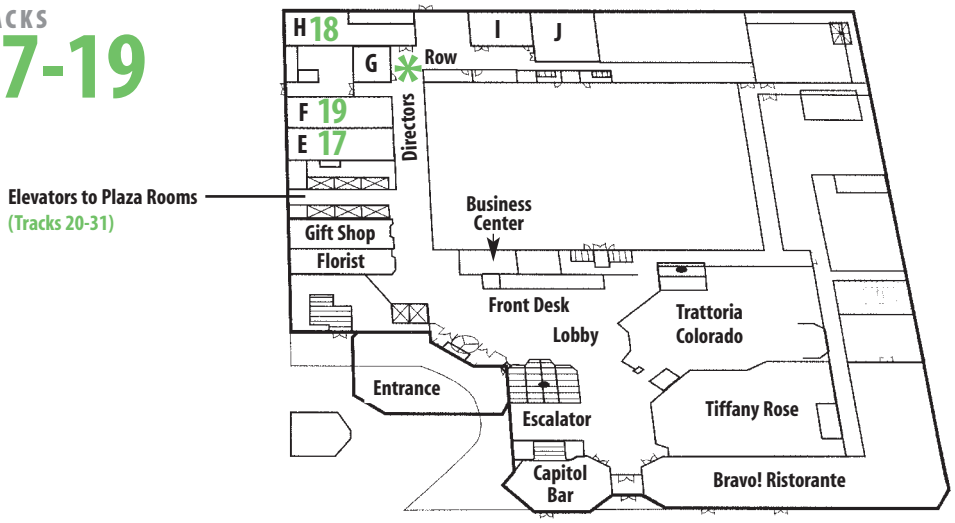
3rd Floor
Track 20 – Room 3304
Track 21 – Room 3302
Track 22 – Room 3312
Track 23 – Room 3354

4th Floor
Track 24 – Room 3402
Track 25 – Room 3404
Track 26 – Room 3412
Track 27 – Room 3454

5th Floor
Track 28 – Room 3504
Track 29 – Room 3502
Track 30 – Room 3512
Track 31 – Room 3545

STREET LEVEL–PLAZA BUILDING

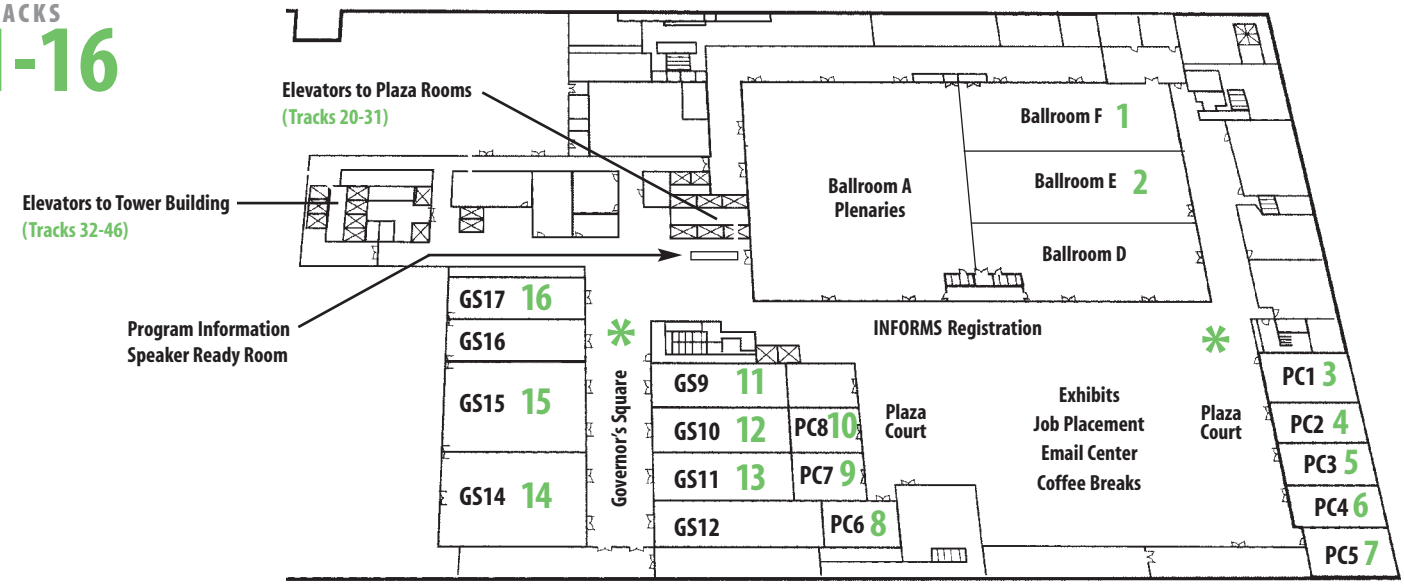
TRACKS
17-19



✻ Student Assistant Desks

CONCOURSE LEVEL–PLAZA BUILDING

TRACKS
1-16

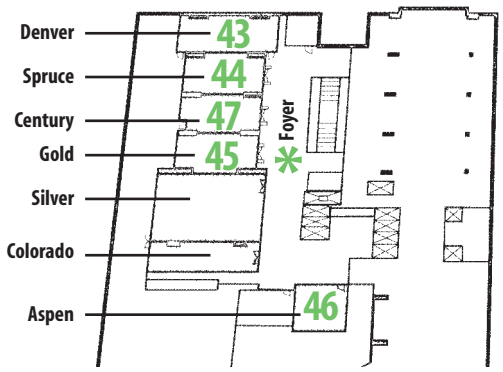


TOWER BUILDING

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MEZZANINE LEVEL–TOWER BUILDING

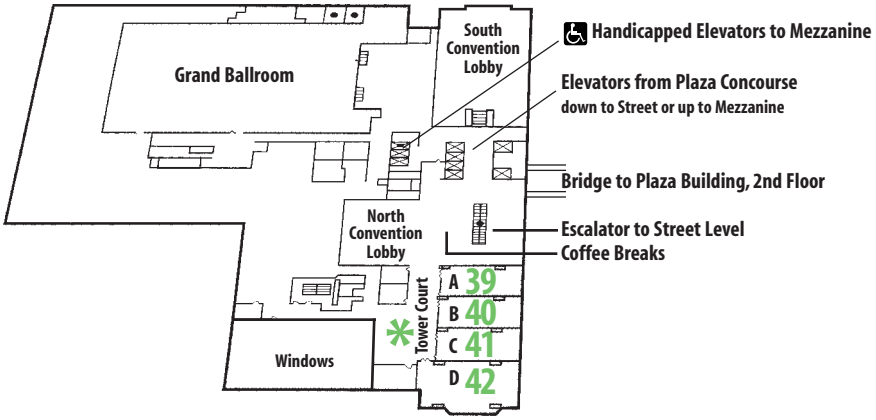
TRACKS
43-47



✻ Student Assistant Desks

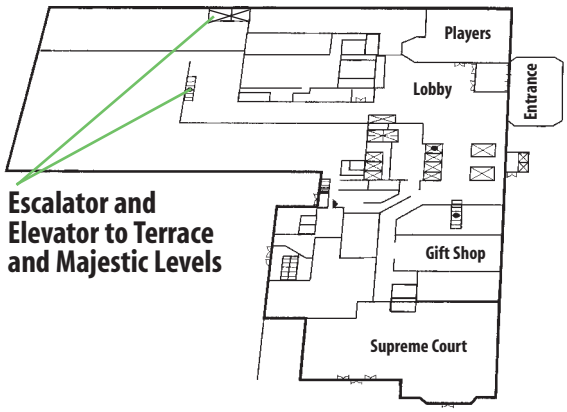
SECOND FLOOR–TOWER BUILDING

TRACKS
39-42



STREET LEVEL-TOWER BUILDING

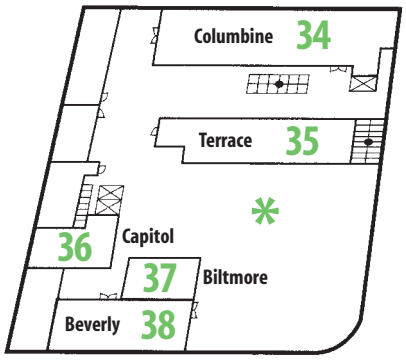
To access the Terrace and Majestic Levels, go to the Street Level and take the special escalator/elevator down.



TERRACE LEVEL-TOWER BUILDING

TRACKS
34-38

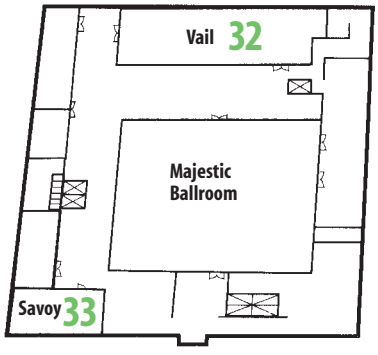
One Floor below
Street Level



MAJESTIC LEVEL-TOWER BUILDING

TRACKS
32-33

Two Floors below
Street Level



PLANNER

SUNDAY	MONDAY	TUESDAY	WEDNESDAY
SA 8:00 - 9:30	**MA** 8:00 - 9:30	**TA** 8:00 - 9:30	**WA** 8:00 - 9:30
SB 10:00 – 11:30	**MB** 10:00 – 11:30	**TB** 10:00 – 11:30	**WB** 10:00 – 11:30
Plenary 11:40 – 12:30 William P. Piersekalla Plaza-Ballroom A	**Welcome & Awards** 11:40 – 12:30 Plaza-Ballroom A	**Plenary** 11:40 – 12:30 James Q. Crowe Plaza-Ballroom A	**WC** 12:00-1:30
SC 1:30 – 3:00	**MC** 1:30 – 3:00	**TC** 1:30 – 3:00	
Plenary – Omega Rho 3:10 - 4:00 Seth Bonder Plaza-Ballroom A	**Plenary** 3:10 - 4:00 M. Elisabeth Paté-Cornell Plaza-Ballroom A	**Keynotes** 3:10 - 4:00 Edelman Reprise Plaza-Ballroom A Science of Better Campaign Plaza-Ballroom E	
SD 4:30 – 6:00	**MD** 4:30 – 6:00	**TD** 4:30 – 6:00	

How to Navigate the INFORMS Technical Sessions

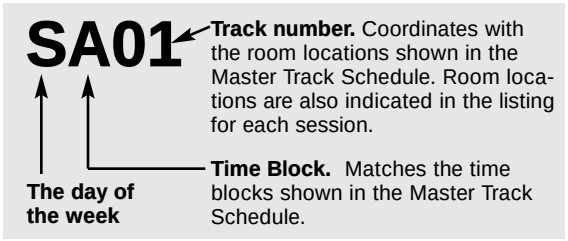
There are four primary resources to help you understand and navigate the INFORMS Technical Sessions:

- This technical session listing (pages 41-251), 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 252-276).
- The Floor Plans on pages 38-39 show you where technical session tracks are located.
- The "Master Track Schedule" on pages 278-279. 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 255-268) — the session code for your presentation(s) will be shown. Then refer to the full session listing for the room location of your session(s).

The Session Codes



Time Blocks

A – 8:00-9:30am
B – 10:00-11:30am
C – 1:30-3:00pm*
D – 4:30-6:00pm

Plenaries, keynotes and lunch breaks are interspersed among the technical session time blocks.
*On Wednesday, C Block is 12:00-1:30pm

Room Locations/Tracks

These are shown with the initial of the building, followed by the room name. For example:

P - Governor's Square E

T - spruce

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.

KEY: P - Plaza Building T - Tower Building

Sunday 8:00am-9:30am

■ SA01

P-Ballroom F

Tutorial: Heuristic Search for Network Design

Cluster: Tutorials- Denver 2004
Invited Session

1 - Heuristic Search for Network Design
Bruce Golden, Robert H. Smith School of Business, University of Maryland, Van Munching Hall, College Park, MD, 20742, United States, BGolden@rhsmith.umd.edu, Ioannis Gamvros, Daliborka Stanojevic, S. Raghavan

Network design problems arise in a wide variety of application domains - telecommunications, supply chain management, VLSI design, and transportation. We survey some recent, and successful, applications of heuristic search techniques for network design problems. In particular, we highlight the effective use of local search techniques and metaheuristics (e.g., tabu search and genetic algorithms) and the combination of the two. We provide some suggestions for the successful design of heuristic search techniques for network design problems.

■ SA02

P-Ballroom E

Panel: The Academic Job Search

Cluster: Job Placement Committee
Invited Session

Chair: Russell Meller, Assoc. Prof., Grado Department of Industrial & Systems Engineering, Virginia Polytechnic Institute & State University, 250 Durham Hall (0118), Blacksburg, VA, 24061, United States, rmeller@vt.edu

1 - A Panel Discussion: The Academic Job Search
Moderator: Russell Meller, Assoc. Professor, Grado Department of Industrial & Systems Engineering, Virginia Polytechnic Institute & State University, 250 Durham Hall (0118), Blacksburg, VA, 24061, United States, rmeller@vt.edu. Panelists: Zelda B. Zabinsky, Larry Robinson

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 or former search chairs, time will be provided for questions and answers.

■ SA04

P-Plaza Court 2

Optimization in Data Mining

Sponsor: Data Mining
Sponsored Session

Chair: Sigurdur Olafsson, Iowa State University, 2019 Black Engineering, Ames, IA, 50011, United States, olafsson@iastate.edu

1 - Constructing Better Decision Trees for Classification
John Chinneck, Professor, Carleton University, Systems & Computer Engineering, Ottawa, ON, K1S 5B6, Canada, chinneck@sce.carleton.ca, Ahmad Moghrabi

Most methods for constructing decision trees for classification use a single method for placing separating surfaces and a single rule (e.g. maximum total accuracy) for determining the exact placement of each individual surface. We have developed methods that can use a number of different separarating surface placement methods and a number of different policies for selection of the placement at each node in the tree. Empirical results are given.

2 - Impact of the Neural Network s-Sigmoid Function in the Presence of Imprecise Data on KDD
John F. Kros, Assistant Professor Decision Sciences, East Carolina University, 3206B Harold Bate Building, Greenville, NC, 27858, United States, krosj@mail.ecu.edu, Marvin L. Brown, Mike Lin

The s-Sigmoid Transfer Function is investigated and compared in this work. Specific imputation methods (case deletion, mean substitution, etc.) for dealing with imprecise data, various percentages of data missingness, and various data set sizes are compared using a Neural Network employing the s-Sigmoid Transfer Function. This research tests the impact of imprecise data on the Neural Network Transfer Function type in KDD under these different factors.

3 - Metric Nearness Problem and Solution Approaches
Vishv Jeet, The University of Texas at Austin, 1 University Station C2200, Austin, TX, 78712, United States, vjeet_a@mail.utexas.edu, Amit Partani

We consider a problem of finding an optimal matrix in the metric space. Matrices associated with practical problems viz. clustering, TSP, are often desired to be in metric space for developing efficient algorithms. The Metric Nearness Problem (MNP) is defined as finding a matrix in metric space and closest to a given matrix that gives minimum norm of the difference matrix. We consider efficient solution techniques for the MNP and its relation to All-Pair-Shortest-Path problem in a special case.

4 - Combinatorial Optimization Approach to Feature Selection
Sigurdur Olafsson, Iowa State University, 2019 Black Engineering, Ames, IA, 50011, United States, olafsson@iastate.edu, Jaekyung Yang

The feature selection problem is important in data mining and is inherently a combinatorial optimization problem. Based on this formulation, we analyze a new method for feature selection, and focus on its scalability. To improve scalability we develop an instance sampling strategy for the algorithm. An attractive property of the algorithm is that rigorous statements can be made concerning the solution quality when it is terminated in finite time, and numerical results show it performs well.

■ SA05

P-Plaza Court 3

Mixed-Integer Programming: Theory, Algorithms, and Applications

Sponsor: Optimization/ Integer Programming
Sponsored Session

Chair: Hanif Sherali, W. Thomas Rice Professor, Virginia Tech., Dept. of ISE (0118), VPI&SU, Blacksburg, VA, 24061, United States, hanifs@vt.edu

1 - Polynomially-Computable Lifting Functions for Two-Variable Integer Knapsack Inequalities
Alper Atamturk, University of California, 4141 Etcheverry Hall, MC 1777, Berkeley, CA, 94720-1777, United States, atamturk@ieor.berkeley.edu, Deepak Rajan

We will describe new valid inequalities for integer and mixed-integer knapsack problems based on polynomially-computable lifting functions for restrictions with two integer variables. A summary of computational experiments with the new inequalities will be presented.

2 - On Generalized Branching Method for Integer Programming
Sanjay Mehrotra, Northwestern University, IEMS Dept, 2145 North Sheridan Road, Evanston, IL, 60208, United States, mehrotra@iems.nwu.edu, Zhifeng Li

We will present a restructuring of computations in Lenstra's method for mixed integer programming. We formulate the problem of finding a provably good branching direction over an adjoint lattice. Consequently, we re-introduce this method without requiring problem dimension reduction and problem sparsity can possibly be exploited. At this stage of our software development we have solved all the previously solved difficult knapsack integer and market split problems, and several larger instances.

3 - Interleaving Two-Phased Jobs on a Single Machine with Application to Radar Pulsing
Cole Smith, University of Arizona, PO Box 210020, Tucson, AZ, 85721, United States, cole@sie.arizona.edu, Hanif Sherali

We examine a two-phase production process wherein after processing the first phase of any job, the job must be set aside for some exact duration, after which the machine must immediately begin processing its second phase. During this gap between job phases, the machine may be used to process other similar jobs. We analyze complexity, develop MIP models and algorithms for maximizing the number of jobs processed by some deadline, and for minimizing the makespan, and provide computational results.

■ SA06

P-Plaza Court 4

Modelling in Stochastic Programming

Sponsor: Optimization/Stochastic Programming
Sponsored Session

Chair: Gus Gassmann, Dalhousie University, School of Business Administration, Halifax, NS, Canada, hgassman@mgmt.dal.ca

1 - Solving a Stochastic Programming Fleet Assignment Model
Jay Rosenberger, University of Texas at Arlington, Industrial and Manufacturing Sys. Eng., Campus Box 19017, Arlington, TX, 76019-0017, United States, jrosenbe@uta.edu, Victoria Chen, Venkata Pilla

A two stage stochastic programming framework for solving the fleet assignment model (FAM) is presented. The solution to the first stage gives an initial crew compatible allocation (CCA) and the second stage assigns specific aircraft within the CCA. The talk will focus on computational issues and dimensionality reduction.

2 - A Review of Scenario Generation for Stochastic Programming and Simulation: A Modelling Perspective
Gautam Mitra, Brunel University, United Kingdom, gautam.mitra@brunel.ac.uk, Nico Di Domenica, Patrick Valente, George Birbilis

In this talk we consider alternative approaches to Scenario Generation which can be used to formulate two-stage (static) and multistage dynamic SP models. We investigate the modelling structure and software issues of integrating a scenario generator with an optimisation model to construct Stochastic Programming recourse problems and chance-constrained problems (CCP). We consider how the EV, SP recourse and CCP decision models can be evaluated within a descriptive framework of simulation.

3 - Modeling History-dependent Parameters in the SMPS Format for Stochastic Programming
Gus Gassmann, Dalhousie University, School of Business Administration, Halifax, NS, Canada, hgassman@mgmt.dal.ca

The SMPS format — old as it is — is still the only widely recognized way to communicate a stochastic programming problem to a solver. This talk describes several ways in which history-dependent parameters can be described effectively.

■ SA07

P-Plaza Court 5

Tutorial: Global Optimization in Integrated Computing Systems

Sponsor: Optimization/ Global Optimization
Sponsored Session

Chair: János D. Pintér, Pintér Consulting Services, Inc, Halifax , NS, Canada, jdpinter@hfx.eastlink.ca

1 - Global Optimization in Integrated Computing Systems
János D. Pintér, Pintér Consulting Services, Inc, Halifax , NS, Canada, jdpinter@hfx.eastlink.ca

We review several nonlinear global optimization software implementations for the Maple, Mathematica and Matlab platforms. Specifically, we introduce and demonstrate the software packages MathOptimizer, MathOptimizer Professional, TOMLAB /LGO (for Matlab) and the Maple Global Optimization Toolbox. The discussion will also highlight some of the benefits of using integrated computing systems.

■ SA08

P-Plaza Court 6

Discrete Optimization in Networks

Sponsor: Optimization/ Network Optimization
Sponsored Session

Chair: Georgia Perakis, Sloan Career Development Associate Professor of Operations Research, Sloan School, MIT, 50 Memorial Drive, Rm E53-359, Cambridge, MA, 02139, United States, georgiap@mit.edu

1 - Greedy Algorithms for Maximizing Submodular Functions over Independence Systems
Amr Farahat, Assistant Professor, Cornell University, Johnson Graduate School of Management, Ithaca, NY, United States, afarahat@mit.edu, Cynthia Barnhart

Motivated by several applications, we consider the maximization of submodular functions over independence systems. Building on the literature, we present a greedy algorithm, derive worst-case approximation guarantees and define a continuous relaxation of the original problem. Our bounds apply to the relaxed problem. This extends, and strengthens, previously known results for the standard best-in greedy. We discuss a connection with price equilibria in submodular exchange economies.

2 - A Large Neighborhood Search Heuristic for Graph Coloring
Hakan Yildiz, Tepper School of Business, Carnegie Mellon University, United States, hakanyil@andrew.cmu.edu, Michael Trick

We propose a new local search heuristic for graph coloring that searches very large neighborhoods. The heuristic is based on solving a maximum cut problem at each step. While the maximum cut problem is formally hard, fast heuristics that give ìgoodî cuts are available to solve this. We provide computational results on benchmark instances. The proposed approach is based on similar heuristics used in computer vision.

3 - Efficient Primal-Dual Algorithms for Network Design Problems with Nonlinear Concave Objectives

Dan Stratila, Doctoral Student, MIT, Operations Research Center, 77 Massachusetts Ave, E40-130, Cambridge, MA, 02139, United States, dstrat@mit.edu, Thomas Magnanti

Concave cost multicommodity flows (CCMCF) arise in many venues, including transportation, and supply chains, due to volume discounts, economies of scale, etc. We present a new class of network design primal-dual algorithms (PDA) for CCMCF, based on our recent general result on polynomially approximating concave costs over polyhedra. Our PDA operates directly on the nonlinear costs, yet is strongly polynomial, and approximately solves what we believe are the largest problems tackled so far.

■ SA09

P-Plaza Court 7

Joint Session Optimization/Computing/Health Applications: Data Mining in Bioinformatics

Sponsor: Optimization/ In Data-Mining, Computing, Health Applications
Sponsored Session

Chair: Stephen Billups, Director, Center for Computational Biology, University of Colorado at Denver, PO Box 173354, Campus Box 160, Denver, CO, 80217, United States, Stephen.Billups@cudenver.edu

1 - Machine Learning Applied to Uncovering Bacterial Gene Regulation

Mark Craven, Dept. of Biostatistics and Medical Informatics, Dept. of Computer Science, University of Wisconsin, 6730 Medical Sciences Center, 1300 University Ave., Madison, WI, 53706, United States, craven@biostat.wisc.edu

A central challenge in computational biology is to uncover the complete gene-regulatory network of an organism. We have been applying machine learning methods to the task of elucidating such networks in bacteria. I will discuss our work on developing probabilistic language models to predict regulatory elements in genomic sequences, and learning Bayesian network models that characterize regulatory relationships among genes.

2 - Information Fusion for Bioinformatics

Raj Acharya, Dept. of Computer Science and Engineering, Pennsylvania State University, Information Sciences & Technology Bdg., University Park, PA, 16802, United States, acharya@cse.psu.edu

In this talk, we will present information fusion needs for bioinformatics. We will describe algorithms for the fusion of multiple sources of bioinformatics data. We will also provide a description of a datawarehouse designed to perform Knowledge Integration of Bioinformatic data.

3 - Scalable Algorithms for Mining Biological and Clinical Data

Srinivasan Parthasarathy, Dept. of Computer and Information Science, Ohio State University, 395 Dreese Lab, 2015 Neil Ave., Columbus, OH, 43210, United States, srini@cis.ohio-state.edu

We report progress on the development of a scalable framework for mining biomedical and clinical data. First, we will cover the development of novel methods to accurately model the relevant spatial or structural relationships embedded in such data, in particular the use of graph-based methods to model structure and geometric orthogonal polynomials to model shape. Time permitting, we will then describe some parallel algorithms, to efficiently mine such data.

4 - Clustering Gene Expression Time Series Data

Stephen Billups, Director, Center for Computational Biology, University of Colorado at Denver, PO Box 173354, Campus Box 160, Denver, CO, 80217, United States, Stephen.Billups@cudenver.edu

We present an algorithm for clustering gene expression time series data. The algorithm represents the characteristic behavior of each cluster by a polynomial while also allowing for gene specific parameters controlling the variation. A time-warping algorithm is used to align clusters differing only by temporal shifts. The algorithm is used to analyze hormone dependent phasic variation in the endometrium.

■ SA10

P-Plaza Court 8

Information and Uncertainty in Transportation Networks

Sponsor: Transportation Science & Logistics
Sponsored Session

Chair: Yi-Chang Chiu, Assistant Professor, Department of Civil Engineering, 500 W. University Ave., University of Texas at El Paso, El Paso, TX, 79968, United States, chiu@utep.edu

1 - Sampling Methods for Evaluating Transport Network Equilibrium with Demand Uncertainty

Avinash Unnikrishnan, Graduate Student, University of Texas Austin, 3212 Red River Street, Apt #114, Austin, TX, 78705, United States, avinash@mail.utexas.edu, Satish Ukkusuri, S. Travis Waller

Efficient methodologies for evaluating the expected performance of transportation network equilibrium subject to long-term uncertain demand will be presented. Current practices which use deterministic values for origin-destination demand have been shown to provide substantially biased results. The aim of this work is to examine multiple efficient sampling algorithms for the most appropriate method then tailor the algorithm for the network equilibrium problem with uncertain future demand.

2 - User Equilibrium with Recourse

S. Travis Waller, University of Texas - Austin, Dept. of Civil Eng., ECJ 6.204, Austin, TX, 78712, United States, stw@mail.utexas.edu, Satish Ukkusuri

This presentation deals with network equilibrium where all users have the ability to update their paths given limited information. Each user will follow their least expected cost online shortest path (shortest path with recourse) at equilibrium. For this, an LP formulation for the online shortest path is required for the subproblem and will be discussed. We introduce several examples, the behavior of User Equilibrium with Recourse under various network designs, and a problem formulation.

3 - A Risk Decision Model for Making ITS Communication Technology Acquisition Decisions

Yi-Chang Chiu, Assistant Professor, Department of Civil Engineering, 500 W. University Ave., University of Texas at El Paso, El Paso, TX, 79968, United States, chiu@utep.edu

Acquiring communication technologies for traffic operations and Intelligent Transportation Systems (ITS) applications can be an overwhelming task due to rapid technological advancements and various uncertain cost and risk factors. This presentation discusses an effective decision model that copes with this issue from standpoints of life-cycle cost and a decision maker's perceived risk.

4 - An Auction Based Methodology to Compare Online Algorithms in a Competitive Environment

Miguel Andres Figliozzi, University of Sydney, Institute of Transport Studies, Faculty of Economics and Business, University of Sydney, NSW 2006, Australia, miguel@its.usyd.edu.au, Patrick Jaillet, Hani S. Mahmassani

Traditional approaches to evaluate the performance of online algorithms (i.e. competitive analyses) are ill-suited for application in real-time marketplace settings. We propose a methodology to evaluate the performance of online algorithms in a competitive environment setting using a sequential auction framework. Behavioral assumptions and properties are discussed. The methodology is applied to online vehicle routing algorithms.

■ SA11

P-Governor's Square 9

Joint Session TSL/ Aviation: Air Traffic Management I

Sponsor: Transportation Science & Logistics, Aviation Applications
Sponsored Session

Chair: Michael Ball, Professor, University of MD, Robert H Smith School of Business, University of MD, College Park, MD, 20742, United States, MBall@rhsmith.umd.edu

1 - Demand Uncertainty in Ground Delay Programs

Thomas Vossen, University of Colorado, UCB 419, Boulder, CO, 80309, United States, Thomas.Vossen@Colorado.edu

The FAA and the aviation community have adopted new operational procedures for managing Ground Delay Programs (GDPs) based on the CDM paradigm. We consider the impact these procedures have had on aircraft arrival time uncertainty and the consequences of this uncertainty for GDP performance. We discuss procedures to plan GDPs in the presence of demand uncertainty, and investigate potential benefits of demand uncertainty reduction.

2 - Stochastic Optimization Models for Air Traffic Flow Management
Avijit Mukherjee, University of California - Berkeley, 107E McLaughlin Hall, U.C. Berkeley, Berkeley, CA, 94720, United States, avijit@berkeley.edu, Mark Hansen

We present stochastic optimization models for ATFM that account for uncertainty in enroute airspace capacity, along with that at an airport. It is assumed that the convective weather is present in the vicinity of the airport, and thereby impacting throughput of some of the standard arrival fixes of the airport, along with the acceptance rate of the airport itself. The main decisions are ground delay and local rerouting of flights that are inbound towards the airport.

3 - A Stochastic Air Traffic Management Model that Incorporates Probabilistic Forecasts
F. Wesley Wilson, NCAR, PO Box 3000, Boulder, CO, 80307, United States, wes@ucar.edu

Reoccurring low clouds have a major impact on air traffic at the San Francisco International Airport (SFO). The SFO Marine Stratus Forecast System provides deterministic forecasts for the time of cloud dissipation, which is vital to efficient air traffic management decisions. Stochastic air traffic management models are designed to use probabilistic forecasts. We shall describe a process used to create probabilistic forecasts based on these deterministic forecasts.

4 - Termination Strategies for Ground Delay Programs Under Uncertainty
Tasha Inniss, Assistant Professor of Mathematics, Spelman College, 350 Spelman Lane, SW, Box 320, Atlanta, GA, 30314-4399, United States, TInniss@spelman.edu

We present strategies for addressing uncertainty of marine stratus burnoff time at San Francisco's International Airport (SFO). We develop, analyze, and compare alternative strategies to assist traffic flow managers in determining how and when to end a ground delay program. The techniques range from heuristics to optimization-based stochastic models that use real-time weather data collection and PDFs of burnoff times. The models are easily extended to other traffic flow management initiatives.

5 - Algorithms for En Route Resource Allocation
Robert Hoffman, Metron Aviation, 131 Elden St Suite 200, Herndon, VA, 20170, United States, hoff@metronaviation.com

Real-time allocation of airport arrival resources has been highly refined state by the CDM community while the formal allocation of en route resources such as flow constrained areas is still in its infancy. We present a practical algorithm for strategic allocation of en route resources that applies ground delay, rerouting, and air delay to offload potentially saturated airspace, which balances equity and efficiency while offering flexibility to air carriers via expression of route preferences.

■ SA13

P-Governor's Square 11

Airline Operations

Sponsor: Aviation Applications
Sponsored Session

Chair: Stefan Karisch, Carmen Systems, 1800 McGill College Avenue, Suite 2800, Montreal QC H3A 3J6, Canada, stefank@carmensystems.com

1 - Monitoring and Controlling Key Performance Indicators in Airline Operations
Stefan Karisch, Carmen Systems, 1800 McGill College Avenue, Suite 2800, Montreal QC H3A 3J6, Canada, stefank@carmensystems.com

Key Performance Indicators (KPIs) are used to measure the performance of an airline system, both from a financial and an operational point of view. The objective of our ongoing research is to identify KPIs and understand the functional relationship between them and the important performance characteristic(s) of an airline. In the presentation, we will present preliminary results for a selection of KPIs and show how these can be monitored and controlled. This will be done using a simulation model based on operational data of a North American airline.

2 - Experiments with the Repair Game
Sven Grothklags, University of Paderborn, Dept. of Computer Science, Fuerstenallee 11, 33102 Paderborn, Germany, sven@ubp.de, Ulf Lorenz, Thomas Sauerwald

An important insufficiency of modern industrial plans is their lack of robustness. Disruptions prevent companies from operating as planned before and induce high costs for trouble shooting. The main reason for the severe impact of disruptions stems from the fact that planners do traditionally consider the precise input to be available at planning time. In practice, however, there are often only distributions over the possible input data available. The Repair Game is a formalization of a planning task, which brings two branches of computer science - game tree search and logistic planning optimization with OR tools - together. Playing it performs disruption management and generates robust plans with the help of game tree search. We present the game definition and a detailed motivation. Experimental results are encouraging and indicate that our new method can significantly reduce disruption costs. Our method outperformed the traditional one by means of simulations.

3 - Efficient Estimation of Nested Logits Using Choice-Based Samples
Frank Koppelman, Professor, Civil and Environmental Engineering, Northwestern University, Evanston, IL, United States, f-koppelman@northwestern.edu, Laurie Garrow

We show the exogenous sampling maximum likelihood estimator (ESML) can be used to solve for the parameters of nested logit (NL) models using choice-based samples. ESML gives consistent estimates of all parameters except for constants; consistent estimates can be recovered using population share information when models are specified with a full set of constants. This is an extension of an earlier proof published in 1977 for multinomial logits. Our finding is significant because it provides researchers with a practical method of estimating NL models using choice-based data.

4 - An Optimization Approach to Solving the Airline Crew Pairing Problem
Amy Cohn, University of Michigan, 2797 IOE Building, 1205 Beal Avenue, Ann Arbor, MI, 48109-2117, United States, amycohn@umich.edu, Shervin AhmadBeygi

The airline crew pairing problem is typically solved using enumeration-based algorithms such as multi-label shortest-path approaches. We present a new approach based on a novel IP formulation of the problem. The goals of this approach are to enable us to solve much larger crew scheduling problems (for example, those considering all flights in a network and not just those of one fleet type) and to solve existing problems more quickly, for incorporation in robust planning and real-time recovery models.

■ SA14

P-Governor's Square 14

Organizational Learning and Knowledge Management-I

Sponsor: Technology Management
Sponsored Session

Chair: Anita Tucker, Assistant Professor, University of Pennsylvania, 551 Jon M. Huntsman Hall, 3730 Walnut Street, Philadelphia, PA, 19104-6340, United States, tuckera@wharton.upenn.edu

1 - Innovative Knowledge Creation Management for R&D Organizations
Kiyoshi Niwa, Professor, The University of Tokyo, Komaba 3-8-1, Meguro-ku, Tokyo, 153-8902, Japan, niwa@idea.c.u-tokyo.ac.jp

This paper discusses three methods for innovative knowledge/concepts creation. The first involves a method to create new knowledge relationships by combining tacit human knowledge and explicit computer knowledge. The second involves the empowerment of concept creators separated from project execution to create discontinuous concepts. The third method involves innovation initiatives to allow direct communications between top executives and researches at corporate education centers.

2 - A Production Economic Framework for Modeling Learning by Watching and Doing
David Moore, Assistant Professor, Colorado School of Mines, Economics and Business, 816 15th St., Golden, CO, 80401, United States, dmoore@mines.edu

Production economics help define a space of feasible input-output combinations modeling opportunities to learn by watching and doing within a production system. The scope and level of aggregation represented in this space determine the identifiable opportunities for fruitful knowledge transfer. Optimal learning curves may be forecasted using the current production space and applied to planning, scheduling and capacity decisions. Implications for semiconductor manufacturers are discussed.

3 - The Dynamics of Learning by Doing under Constraints
Brad Morrison, MIT Sloan School of Management, 50 Memorial Drive E53-339, Cambridge, MA, 02142, United States, morrison@mit.edu, Nelson Repenning

Traditional learning curve theory considers production in isolation from other demands for resources. Yet many learning situations force tradeoffs of the learner's time between a new skill and a habitual means of accomplishing tasks to meet output goals. Building on learning curve theory, we incorporate a minimum throughput constraint on the learner. We use simulation analysis, characterize the tipping point between two modes of behavior, and discuss implications for managing implementation.

4 - Outsourcing: Enabler or Inhibitor of Innovation? Evidence From the Semiconductor Industry
Marcin Strojwas, Doctoral Candidate, Harvard Business School, Soldiers Field Rd., Boston, MA, United States, mstrojwas@hbs.edu

What types of projects are being outsourced and how do they perform? I examine this question with data from 461 chip projects. I find that vertically integrated firms possess distinct advantages when they outsource manufacturing on a leading edge product while specialized design firms possess efficiency advantages on projects that utilize more mature technologies. I isolate which effects are due to a single firm possessing integrated internal design and manufacturing 1)EXPERTISE vs 2)CONTROL.

■ SA15

P-Governor's Square 15

Data Mining and Knowledge Discovery: Building Better Business Results

Cluster: Data Mining and Knowledge Discovery
Invited Session

Chair: Marty Ellingsworth, EVP & CTO, Full Capture Solutions, Inc., 330 Roberts Street, Suite 400, East Hartford, CT, 06108, United States, MartyElls@aol.com

1 - Text Mining Triumphs: Tested Ideas for Mining Unstructured Text at Your Company
Russell Albright, SAS Institute, Cary, NC, United States, russell.albright@sas.com

We provide an overview of the current state of the art in text mining. Several real-world collections are used to demonstrate what text mining is, how it works, and what kinds of problems it can help solve. A framework for deciding when and how to use text mining effectively is presented.

2 - Mixed-data Models for Accurate Predictive Signal for use in Collections, Recovery and Attrition
Mike Meyer, United States, mike.meyer@intelligentresults.com

Mixed-data models can predict customer behavior significantly better than traditional solutions. By combining unstructured customer communications with traditional structured data, companies can better predict customer behavior and implement more effective treatment strategies. Such models helped an auto loan lender target outsourcing assignment strategies, driving revenues that were 68% greater than their champion custom solution, and how these methods can improve other portfolio types.

3 - Scheduling Calls and Targeting Customers to Improve Contact Rates
JT Lehman, Principal, Analytic Business Development, 1300 N. Prospect Ave. Suite 305, Milwaukee, WI, 53202, United States, jt@jtlehman.com

Outbound call centers reach customers only about 20% of the time. Call centers can improve their contact rate, and hence many of their key performance indicators, if they predict when customers are home, and schedule calls accordingly. This application requires surprisingly little commonly available data, continuously learns, and improves the contact rate 35%. Strategies include targeting customers most likely to pickup, scheduling calls, and staffing when customers are most reachable.

■ SA16

P-Governor's Square 17

XML, Open Source Software, and Optimization

Sponsor: Computing Society
Sponsored Session

Chair: Gordon Bradley, Professor, Operations Research Department, Naval Postgraduate School, Monterey, CA, 93943, United States, gbradley@nps.edu

1 - An XML-Based Standard Form for Linear Programming Problem Instances
Kipp Martin, Graduate School of Business, University of Chicago, 1101 East 58th Street, Chicago, IL, 60637, United States, kipp.martin@gsb.uchicago.edu, Robert Fourer, Leo Lopes

One way to encourage modeling language and solver compatibility is to use a standard representation of a problem instance. We present LPFML Schema, a W3C Schema for representing linear programming problem instances in XML. We describe a library of open-source C++ classes that facilitate the exchange of information between modeling languages and solvers. We show how these classes are used to provide previously unavailable modeling language-solver connections.

2 - Network and Graph Markup Language (NaGML)
Gordon Bradley, Professor, Operations Research Department, Naval Postgraduate School, Monterey, CA, 93943, United States, gbradley@nps.edu

The Network and Graph Markup Language (NaGML) is a family of xml languages for network and graph data files. The topology, node properties, and arc properties are validated against the user's specification for the data values. NaGML is a part of a component architecture that reads, validates, processes, displays, and writes network and graph data.

3 - Panel Discussion: Optimization Web Services Panel: Next Steps
Moderator: Leo Lopes, University of Arizona, 1127 E North Campus Drive, Tucson, AZ, 85721, United States, leo@sie.arizona.edu, Panelists: Obi Ezechukwu, Kipp Martin, Gordon Bradley, Robert Fourer, Matt Saltzman

This panel will briefly summarize progress and new developments since the first discussions on Standards and Web Services at INFORMS Miami Beach 2001. It will then open the floor for discussions about next steps in Standardization and Development, and provide a forum for user feedback.

■ SA17

P-Directors Row E

Decision Analysis in Pharmaceutical Industry

Sponsor: Decision Analysis
Sponsored Session

Chair: Kazuo J. Ezawa, Director, Bristol-Myers Squibb Company, Route 206 & Proviceline Road, Princeton, NJ, 08540, United States, kazuo.ezawa@bms.com

1 - A Collection of Pharma-Oriented Decision Analyses
Jack Kloeber, Director, J&J Pharma Group Portfolio Management, JJPS Bldg 700 Rte 202 South, Raritan, NJ, 08869, United States, jkloeber@prdus.jnj.com

Apart from Portfolio Analysis and Management Issues, decision analysis is a perfect methodology for helping drug development teams clarify, structure, brainstorm, assess, and decide upon courses of action. I will review three cases where the Decision Analyst has added considerable value to the drug development process ñ apart from the classic three-phase, go/no-go drug development decisions.

2 - Pharmaceutical Pipeline Sourcing Strategy
Michael Voth, Director, Bristol-Myers Squibb Company, United States, michael.voth@bms.com

A typical large pharmaceutical company grows its pipeline of compounds through a combination of internal discovery, in-licensing from third parties, partnerships, and acquisitions. Each potential source of growth has unique features. For example, internal discovery investments produce compounds for the development pipeline but also build capabilities for future production. In-licensing investments provide risk and growth management advantages by enabling compounds to be brought into development to fill pipeline gaps after certain early development risks have been resolved, but may be burdened by costly deal terms. This talk presents a decision analytic framework for analyzing pipeline sourcing strategy considering the unique features of alternative sources of future growth.

3 - Modeling Global Therapeutic Demand for Hemophilia A
Jeff Stonebraker, GlaxoSmithKline, Five Moore Drive, Research Triangle Park, NC, 27709, United States, jeffrey.s.stonebraker@gsk.com, Donald Keefer

A new model based on probability-encoding principles and discrete approximation techniques from decision analysis was developed to estimate the global therapeutic demand for hemophilia A using population-based epidemiology and treatment modalities. This demand model resulted in a better understanding of the future therapeutic needs of the global hemophilia community and improved decision-making within Bayer.

■ SA18

P-Directors Row H

Decision Analysis Applications

Sponsor: Decision Analysis
Sponsored Session

Chair: Timothy Nieman, Geomatrix Consultants, 2101 Webster St., 12th Floor, Oakland, CA, 94612, United States, tnieman@geomatrix.com

1 - Incorporating Learning Models in Structuring and Valuing R&D Projects
Phil Beccue, Director, Strategic Portfolio Management, Baxter Bioscience, One Baxter Way, Westlake Village, CA, 91362, United States, phil_beccue@baxter.com

Some real options frameworks require a single downstream decision after key information is revealed. However, in drug development, R&D projects are typically characterized as a series of growth options, where it is essential to capture the dynamics of uncertainty evolution over time. I will discuss practical techniques for structuring real options problems, focusing on developing the requisite learning models which capture changes in the value driver for the product.

2 - Elicitation of Probabilities of Success in an R&D Portfolio: A 7-Year Case Study
Jeff Andersen, Eli Lilly & Co, Lilly Corporate Center, Indianapolis, IN, 46285, United States, ANDERSEN_JEFF_W@LILLY.COM, John Andersen, Amy Calvin

Effective quantification of the technical feasibility of research activities can be an integral component of an R&D portfolio process. However, many hurdles can obstruct a quality assessment, including bias, lack of calibration, and organizational resistance. This presentation provides a case study of the implementation of an assessment of technical feasibility in an R&D portfolio. Data will be presented comparing probability assessments to actual success rates over a 7-year period.

3 - Convince Me Your Complex Analysis is Correct
Frank Koch, ChevronTexaco, 4800 Fournace Place, Bellaire, TX, 77401, United States, FGKO@chevrontexaco.com, Gary Hagstrom

ChevronTexaco has a well-established track record of using decision analysis across the organization. This talk discusses issues identified through experience as critical to the firm's decision-makers, including: problem definition, confidence in inputs, quality control, and believability.

4 - A Structured Process for Developing a Performance Confirmation Plan for the Yucca Mountain Project
Timothy Nieman, Geomatrix Consultants, 2101 Webster St., 12th Floor, Oakland, CA, 94612, United States, tnieman@geomatrix.com, James Blink, Barry Goldstein, Ahmed Monib, John Beesley, James Duguid, Karen Jenni

The Nuclear Regulatory Commission requires that the U.S. Department of Energy (DOE) develop and document a Performance Confirmation (PC) Plan for the proposed Yucca Mountain Repository as part of a License Application. This paper describes the structured, decision-analytic process the Project used to evaluate candidate parameters and proposed PC activities in terms of the value of including each in an overall PC Plan.

■ SA19

P-Directors Row F

Intelligent Agents

Sponsor: Artificial Intelligence
Sponsored Session

Chair: Jacquelyn Rees, Assistant Professor of Management, Purdue University, 403 West State Street, West Lafayette, IN, 47907, United States, jrees@mgmt.purdue.edu

1 - Discrimination with Strategic Behavior
Fidan Boylu, Ph. D Student, University of Florida, Decision & Information Sciences, Gainesville, FL, 32611, United States, fidan@ufl.edu, Gary Koehler, Haldun Aytug

Anticipating that rational agents being classified by a principal using discriminant functions might attempt to alter their true attribute values to achieve a positive classification, we develop inference methods to determine discriminant functions and show that this strategic behavior results in an alteration of the usual learning rule.

2 - Reinforcement Learning in Leader-Follower Multiagent Systems
Kurian Tharakunnel, Information and Decision Sciences, University of Illinois at Chicago, 601 South Morgan Street MC 294, Chicago, IL, 60607-7124, United States, kthara1@uic.edu, Siddhartha Bhattacharyya

We study reinforcement learning in multiagent systems where one of the agents is a leader who acts to influence the decisions of other agents called followers. Applications include price coordination, energy market regulation, and pollution control. A new learning algorithm is proposed and illustrated with an example from the literature.

3 - Collecting Millions of Observations Right Now! How Data-Collecting Agents Simplify Academic Research
Chuck Wood, Assistant Professor, University of Notre Dame, 230 Mendoza College of Business, Notre Dame, IN, 46556-5646, United States, cwood1@nd.edu, Robert Kauffman

We investigate how new agent-based software tools reduce the pressure to reach adequate sample sizes, and can enable research that is nearly impossible when utilizing non-online research methodologies. We develop a framework that illustrates the strengths and weaknesses of these new research tools, and give an example of a data-collecting tool.

4 - Simulating Heterogeneous Sellers in Online Exchanges
Shubho Bandyopadhyay, Assistant Professor, University of Florida, Decision & Information Sciences, Warrington College of Business, Gainesville, FL, 32611, United States, shubho@ufl.edu, Jacquelyn Rees

We simulate the competition between heterogeneous sellers for a demand that has been put forth in an online exchange. We model software agents that learn the ideal game-theoretic behavior over time by using a Q-learning algorithm. The results have implication of the design of artificial agents in online environments.

■ SA20

P-Room 3304

Simulation Modelling

Sponsor: Health Applications
Sponsored Session

Chair: Michael Carter, Professor, University of Toronto, Mechanical & Industrial Engg, 5 Kings College Rd, Toronto, ON, M5S 3G8, Canada, carter@mie.utoronto.ca

1 - Pre and Post-Simulation Modeling of Outpatient Clinics
Mark Isken, Asst. Professor of MIS, Oakland University, 317 Elliott Hall, Rochester, MI, 48309, United States, isken@oakland.edu, Tim Ward

Simulation modeling has been widely used to study outpatient clinic operations. We report on recent work focusing on the important data preparation and data analysis work that takes place before and after simulation modeling. Specifically we will discuss the use of sensor networks for automated data collection and the use of polynomial regression and Gaussian radial basis function based metamodels of a large outpatient clinic simulation model.

2 - Redesigning Patient Service Centers Using Simulation
Thomas Rohleder, Professor, Haskayne School of Business, University of Calgary, 2500 University Drive NW, Calgary, AB, T2N 1N4, Canada, tom.rohleder@haskayne.ucalgary.ca

Simulation models were developed to help a medical testing organization redesign their patient service centers where patient medical samples are collected. The challenge was to reduce patient waiting time in an environment with increasing demand and limited resources. We report on the redesign effort including several unanticipated and interesting results.

3 - Resource Allocation in General Internal Medicine, Toronto Western Hospital: A System Dynamics Model
Hannah Wong, Graduate student, University of Toronto, Mechanical & Industrial Engg, 5 Kings College Rd, Toronto, ON, Canada, hjwong@mie.utoronto.ca, Somayeh Sadat, Michael Carter

The objective of this study is to model patient flow and resource utilization of General Internal Medicine (GIM) units at Toronto Western Hospital using system dynamics. GIM units provide non-surgical health care to adult patients who may be affected by a variety of medical problems. As increases in the elderly population increase the demand for medical resources, this model will serve as a decision support tool for the effective allocation of resources.

■ SA21

P-Room 3302

Finalists- Nicholson Student Paper Prize Competition

Cluster: Nicholson Student Paper Prize
Invited Session

Chair: Siriphong Lawphongpanich, University of Florida, Dept. of Industrial & Systems Eng., P.O. Box 11-6595, Gainesville, FL, 32611, United States, lawphong@ise.ufl.edu

1 - Nicholson Student Paper Prize Competition,

This session features selected finalists in the Nicholson Student Paper Prize Competition. It represents an opportunity for faculty, professionals and other students to see some of the best research being performed by students. All are welcome.

2 - Modeling and Analysis of Protein Design Under Resource Constraints

Yuval Nov, Stanford University, Stanford, CA, United States, yuvaln@stanford.edu, Lawrence Wein

The potency, or fitness, of a protein-based drug can be enhanced by changing the sequence of its underlying protein. We present a novel stochastic model for the sequence-fitness relation, and estimate its four parameters from industrial data. Using this model, we formulate and analyze two variants of the protein design problem. In the single-period design problem, the designer needs to decide under capacity constraints which set of sequences to screen in order to maximize the expected fitness of the best sequence in the set. In the more general two-period design problem, the designer can afford two screening rounds, and needs to allocate resources optimally across the two periods to maximize the same objective function. Analytical and simulation results allow us to assess the utility of the proposed design strategies for various parameter regimes.

3 - Self-Interested Routing in Queueing Networks

Ali Kemal Parlakturk, Stanford University, 1300 Oak Creek Dr #308, Palo Alto, CA, 94304, United States, pturk@stanford.edu, Sunil Kumar

We study self-interested routing in stochastic networks, taking into account the discrete stochastic dynamics of such networks. We analyze a two station multi-class queueing network in which the system manager chooses the scheduling rule and individual customers choose routes in a self-interested manner. We show that this network can be unstable in Nash equilibrium under some scheduling rules. We also design a non-trivial scheduling rule that negates the performance degradation due to self-interested routing and achieves a Nash equilibrium with performance comparable to the first-best solution.

4 - Robust Conic Optimization

Melvyn Sim, National University of Singapore, Singapore, dscsimm@nus.edu.sg

In earlier proposals, the robust counterpart of conic optimization problems exhibits a lateralincrease in complexity, that is, robust linear programming problems (LPs) become second order cone problems (SOCPs), robust SOCPs become semindefinite programming problems (SDPs), and robust SDPs become NP-hard. We propose a new robust counterpart for general conic optimization problems that (a) preserves the computational tractability of the nominal problem and (b) allows us to provide a guarantee on the probability that the robust solution is feasible, when the uncertain coeffcients obey independent and identically distributed normal distributions. Specifically the robust conic optimization problem retains its original structure, that is, robust LPs remain LPs, robust SOCPs remain SOCPs and robust SDPs remain SDPs; moreover, when the data entries are independently distributed, the size of the proposed robust problem especially under the l2 norm is practically the same as the nominal problem.

■ SA22

P-Room 3312

Location Modeling I

Sponsor: Location Analysis
Sponsored Session

Chair: Oded Berman, Professor, Joseph L. Rotman School of Management, University of Toronto, 105 Saint George Street, Toronto, ON, M5S 3E6, Canada, Berman@Rotman.Utoronto.Ca

1 - Locating Facilities that Serve Cycles, Not Nodes

Richard Larson, Professor, MIT, Civil and Environmental Engineering, Room 1-170, Cambridge, MA, 02139, United States, rclarson@mit.edu, Michael Metzger

Consider a variant of the k-median and k-center problems. “Customers” are not nodes but rather cycles on the graph, weighted by frequency of occurrence. ‘Servers’ at the p facilities travel to the tours and ‘service’ each tour customer following the tour path. We present methods for locating the facilities housing the servers, including optimal methods for p=1 and heuristics for the general case.

2 - Locating Capacitated Facilities to Maximize Captured Demand

Mozart Menezes, Mr., University of Toronto, Rotman School of Management, 105 St. George St., Toronto, ON, M5S 3E6, Canada, menezes@rotman.utoronto.ca, Oded Berman, Rongbing Huang, Seokjin Kim

We consider the problem of locating facilities on a network to maximize the expected number of captured demands when demands are stochastic. Customers travel to a closest facility to obtain service. If a facility is congested,they attempt to obtain service from the next closest facility from its current position.

3 - The 1-Minimax and 1-Maximin Problems with Demand Weights of General Probability Distributions

Jiamin Wang, Professor, Long Island University, C.W. Post Campus, Department of Management, 720 Northerm Boulevard, Brookville, NY, NY11355, United States, jiamin.wang@liu.edu, Oded Berman

This study investigates the 1-minimax and 1-maximin location problems when demand weights are random variables with general continuous probability distributions. Properties of the optimal solutions are presented and solution procedures are developed. We also identify some known probability distributions under which it is easier to search for an optimal solution.

4 - The Multiple Server Location Problem

Zvi Drezner, Professor, California State University-Fullerton, Dept of Info. Systems and Decision Sci., Langsdorf Hall 540, Fullerton, CA, 92834, United States, zdrezner@fullerton.edu, Oded Berman

We introduce and solve the Multiple Server location problem. A given number of servers are to be located at nodes of a network, one or more servers in each node. There is no limit on the number of servers that can be established at each node. Each customer at a node selects the closest server. The objective is to minimize the sum of the travel time and the average time spent at the server, for all customers.

■ SA23

P-Room 3354

Joint Session Military App./ Simulation: Advancements in Military Modeling and Simulation

Sponsor: Military Applications, Simulation
Sponsored Session

Chair: John Willis, Major, US Army TRADOC Analysis Center, ATTN: ATRC-RDM, Box 8695, Monterey, CA, 93943, United States, johnwillis@us.army.mil

1 - Agent-Based Simulations Supporting Military Analyses

Tom Lucas, Naval Postgraduate School, 1411 Cunningham Road, Monterey, 93943, United States, twlucas@nps.edu, Thomas Cioppa

The US Army Training and Doctrine Command Analysis Center (TRAC) conducted two experiments using agent-based simulations. The first effort supported the US Army Soldier Battle Lab in examining implications of the infantry platoon for the US Army’s Future Force in an urban environment. The second effort is in support of the Future Combat System (FCS) analysis. This presentation will explain the methodology and insights gained from both experiments.

2 - Data Farming: “Accidental” VV&A

Tom Lucas, Naval Postgraduate School, 1411 Cunningham Road, Monterey, 93943, United States, twlucas@nps.edu, Brian Widdowson, Susan Sanchez

The VV&A process continues to be one of the fundamental challenges for those using complex, high-dimensional military models. In this talk we discuss several high-dimensional, space-filling designs that we have found useful in exploring a variety of military simulations over a breadth of scenarios. We present several examples of ìunexpected resultsî that were uncovered in these explorationsóand likely would have remained hidden with traditional designs.

3 - Research Plan Development for Modeling and Simulation of Urban Operations

John Willis, Research Analyst, TRADOC Analysis Center, ATTN: ATRC-RDM Box 8695, Monterey, CA, 93943, United States, John.Willis@trac.nps.navy.mil

To combat deficiencies in urban operations (UO) representation in M&S, the Army Model and Simulation Office (AMSO) formed a UO Focus Area Collaborative Team (FACT). The UO FACT employs a systematic approach that is designed to (1) identify the best Army and joint UO M&S projects that will address prioritized deficiencies and (2) identify potential collaboration opportunities. This paper details the methodology and results of the UO FACT including details of current priorities and projects.

4 - United We Stand: Leveraging Concurrent Efforts to Support Infantry Soldier System Acquisition

Phillip G Martin, Analyst, Operations Research Center, United States Military Academy, West Point, NY, 10996, United States, Phillip.Martin@usma.edu, Bobbie Foote, Gregory Boylan, Michael Kwinn, Paul West, Eric Tollefson

In order to quickly field technologically-advanced equipment to Infantry soldiers, the military community needs better high-resolution simulation capability. To address that need, we conducted a thorough analysis of the requirements and alternatives, using sound systems engineering methodology, and recommended a set of simulations that supports Infantry soldier system acquisition. This presentation will describe our process and results, as well as the initial stages of implementation.

■ SA24

P-Room 3402

Project Scheduling and Sports Applications

Contributed Session

Chair: Guidong Zhu, Student, University of Texas at Austin, Management Science and Information Syste, Campus Mail B6500, Austin, TX, 78712, United States, Guidong.Zhu@phd.mccombs.utexas.edu

1 - Modelling One-Day Cricket Batting Orders
Bruce Bukiet, Associate Professor, New Jersey Institute of Technology, Department of Mathematical Sciences, New Jersey Institute of Technology, Newark, NJ, 07102, United States, bukiet@m.njit.edu, Matthew Ovens

We develop a method to compute efficiently the expected performance of a cricket batting order in an innings. We employ a Markov Chain approach to study the progress of runs for a set of 11 non-identical players. Considering over by over performance for player pairings greatly reduces computational load. The technique allows us to quantify the influence of batting order, among other applications. This work is a first step toward a full analysis of batting orders in One-Day cricket.

2 - Performance of Resource-Constrained Project Scheduling Heuristics in Iterative Projects
Tyson Browning, Assistant Professor of Enterprise Operations, Texas Christian University, M.J. Neeley School of Business, TCU Box 298530, Fort Worth, TX, 76129, United States, tyson@alum.mit.edu, Ali Yassine

A number of RCPS heuristics have been proposed for non-iterative (acyclic) activity networks, but many projects such as product development are iterative. We explore the performance of a number of established RCPS heuristics (plus some new ones) on iterative activity networks.

3 - Priority Rule-Based Heuristic for Preemptive Resource-Constrained Project Scheduling Problem
Jirachai Buddhakulsomsiri, Assistant Professor, University of Michigan-Dearborn, 4901 Evergreen Rd., Dearborn, MI, 48103, United States, jirachai@umich.edu, David Kim

This study presents a priority rule-based heuristic for the multi-mode resource-constrained project scheduling problem with the splitting of tasks around unavailable resources (due to resource vacations). A new concept called moving resource strength is developed to help identify project situations where task splitting is likely to be beneficial during scheduling. The concept is implemented in priority rule-based heuristics to control the number of task splitting when scheduling.

4 - Schedule Recovery for Disrupted Resource-constrained Projects
Guidong Zhu, Student, University of Texas at Austin, Management Science and Information Syste, Campus Mail B6500, Austin, TX, 78712, United States, Guidong.Zhu@phd.mccombs.utexas.edu, Jonathan Bard, Gang Yu

We study the recovery problem when an ongoing project schedule is disrupted. We identified different types of disruptions and proposed an ILP formulation, which is solved with a hybrid MIP/CP procedure. The complexity of several special cases is analyzed. Numerical experiments are performed to test the efficiency of the procedure and to determine the effects of different factors related to the recovery process.

■ SA25

P-Room 3404

Tools vs. Concepts

Sponsor: Education (INFORM-ED) SPONSORED/INVITED Sponsored Session

Chair: Sam Savage, Consulting Professor, Stanford University, Terman Engineering Ctr., Stanford, CA, 94303, United States, savage@stanford.edu

1 - Tools vs. Concepts
Sam Savage, Consulting Professor, Stanford University, Terman Engineering Ctr., Stanford, CA, 94303, United States, savage@stanford.edu

To quote Gene Woolsey, "A pencil is a crutch, a calculator is a wheelchair, and a computer is an ambulance." This session will explore the relationship between the classroom use of management science software tools and the understanding of the underlying concepts. Where do tools rehabilitate and where do they cause atrophy?

2 - Are Shadow Prices Obsolete?
Stephen Powell, Faculty, Dartmouth College, Tuck School of Business, Hanover, NH, 03755, United States, Stephen.G.Powell@Dartmouth.EDU

Shadow prices are fundamental in the theory of linear programming, but what role should they play in teaching management science to end-user modelers (like MBAs)? We argue that spreadsheet software makes shadow prices a minor special case of the broader concept of output sensitivity.

3 - Operations Research Concepts that Everyone should Understand
Peter Bell, Professor, Ivey School of Business, University of Western Ontario, London, N6A 3K7, Canada, pbell@ivey.uwo.ca

This presentation will suggest that concepts from the introductory OR course have immediate value to everyone, especially those involved in managing organizations. These concepts will be discussed along with example applications from life and work.

4 - The Value of Information: a Foundational Concept in the Information Age
Sam Savage, Consulting Professor, Stanford University, Terman Engineering Ctr., Stanford, CA, 94303, United States, savage@stanford.edu

I used to pay lip service to the theory of the value of information until I had a tool that allowed me to flip trees. Now my horizons have been expanded to include: the Value of Obfuscation for increasing the fog of war, and a mindle for mixed strategy games.

■ SA26

P-Room 3412

Make-to-Stock Queues

Cluster: Stochastic Models for Manufacturing Systems
Invited Session

Chair: Baris Balcioglu, University of Toronto, Dep. of Mechanical and Industrial Engineering, 5 King's College Road, Toronto, ON, Canada, baris@mie.utoronto.ca

1 - Supply Information Sharing by a Make-to-Stock Manufacturer
Apurva Jain, University of Washington Business School, Management Science Department, Box 353200, Seattle, WA, 98195-3200, United States, apurva@u.washington.edu

A make-to-stock manufacturer shares the information about stock availability in its warehouse with its retailers. The retailers make use of the information by changing their ordering policy. We build a continuous time production-inventory model to explore the manufacturer's incentive for sharing this information and develop insights into who should be given this information. We compare this practice with other operational incentives manufacturer can provide to its retailers.

2 - Optimal Control of A Parallel Make-to-Stock Queueing System
Jihong Ou, Associate Professor, Business School, National University of Singapore, 1 Business Link, BIZ 1 Building, Singapore, 117592, Singapore, bizoujh@nus.edu.sg, Weiyi Ning, Heng-Qing Ye

We consider a parallel make-to-stock queueing system that produces components for a single product. The product's demand arrives in a Poisson process with each demand requiring one unit of each component. We prove that the optimal control of the system is a dynamic base stock policy in which each component's produce-up-to level is affected by the stock levels of the other components. We also show that the dynamic base stock levels are bounded above for all components.

3 - Analysis of Correlated Demand in Make-to-Stock Queues
Baris Balcioglu, University of Toronto, Dep. of Mechanical and Industrial Engineering, 5 King's College Road, Toronto, ON, Canada, baris@mie.utoronto.ca

Introducing autocorrelation of demand process into analysis often results in loss of tractability. As a viable solution, we propose to approximate the autocorrelated demand by a three-parameter renewal demand process. With this approach, we are able to observe the impact of autocorrelation on optimal base-stock level and inventory cost of a single product make-to-stock queueing system.

4 - Incorporating Advanced Demand Information in Production-Inventory Systems
Setareh Mardan, University of Minnesota, Mechanical Engineering Dept., 111 Church Street SE, Minneapolis, MN, 55455, United States, smardan@me.umn.edu, Saif Benjaafar, William L. Cooper

We consider a capacitated supply system where the manufacturer has access to advanced demand information in the form of order announcements sent by customers. We formulate the model as a continuous-time infinite-horizon MDP and study the existence and the structure of the optimal policy that minimizes discounted expected total costs.

■ SA27

P-Room 3454

Tutorial: A Tutorial Introduction to the Cross-Entropy Method

Sponsor: Applied Probability
Sponsored Session

Chair: Ad Ridder, Vrije Universiteit Amsterdam, de Boelelaan 1105, Amsterdam, NL, 1081HV, Netherlands, aridder@feweb.vu.nl

1 - A Tutorial Introduction to the Cross-Entropy Method
Dirk Kroese, University of Queensland, Department of Mathematics, Brisbane, Australia, kroese@maths.uq.edu.au, Reuven Rubinstein

The cross-entropy (CE) method is a versatile and powerful new technique for efficient simulation and optimization. In this tutorial we give a gentle introduction to the CE method. We start with two simple examples in rare event simulation and combinatorial optimization. In the middle section of the talk we will explain the cross-entropy concept in more detail. We will conclude with an application in combinatorial optimization.

■ SA28

P-Room 3504

Process Monitoring and Diagnosis for Auto-Correlated Data

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: Shiyu Zhou, Assistant Professor, University of Wisconsin - Madison, 1513 University Ave., Department of Industrial Engineering, Madison, WI, 53706, United States, szhou@ie.engr.wisc.edu

1 - Monitoring Autocorrelated Data: A Review
Don Wardell, Associate Professor, The University of Utah, Management Dept., 1645 E Campus Center Dr. Rm 106, Salt Lake City, UT, 84112, United States, mgtdgw@business.utah.edu

In the last 3 decades numerous articles have been written on monitoring autocorrelated data. The authors of such research span many fields. Much of the research has been what I would term “incremental,” while a smaller portion has been more innovative. In this presentation, I will review, classify and synthesize the work that has been done to date. Then I will seek to identify directions for future research.

2 - Linear Filtering Methods for Statistical Process Control with Autocorrelated Data
Daniel W. Apley, Professor, Northwestern University, Dept. of Industrial Engineering, 2145 Sheridan Rd., Evanston, IL, 60208-3119, United States, apley@northwestern.edu

Many control charting methods, in particular those for autocorrelated data, can be viewed as charting the output of a linear filter applied to the process data. We propose a generalization of this concept, in which the filter parameters are optimally selected to minimize the out-of-control ARL while constraining the in-control ARL to some desired value. A number of interesting characteristics of the optimal filters are discussed.

3 - Recurrence Quantification Approach for Feature Extraction in Contaminated Nonlinear Sensor Data
Satish Bukkapatnam, Associate Professor, Oklahoma State University, School of IE & M, 322 Engineering North, Stillwater, OK, 75078, United States, satish.t.bukkapatnam@okstate.edu

Recurrence analysis quantifies correlations in nonlinear signals, where signals are aperiodic and exhibit regularity in state space. We use recurrence analysis to extract local eigenvalues from nonlinear signals. These eigenvalues form anomaly-sensitive features. The approach is applied for detecting anomalies in plate structures instrumented with an optical strain gage array.

4 - Statistical Process Monitoring for Autocorrelated Data
Nien Fan Zhang, Supervisory Mathematical Statistician, National Institute of Standards and Technology, 100 Bureau drive, Gaithersburg, MD, 20899, United States, zhang@nist.gov

In the past years, statistical process control (SPC) methodologies have been widely used in industry for process monitoring. However, the typical assumption that the process data are statistically independent is often invalid. Recently, SPC charts have been developed to accommodate autocorrelated data. This article discusses different approaches for dealing with process autocorrelation when process control charts are used.

■ SA29

P-Room 3502

Forestry Applications - I

Cluster: Forestry Applications
Invited Session

Chair: Susan King, Operations Research Analyst, USDA Forest Service, Northeastern Research Station, 11 Campus Blvd., Suite 200, Newtown Square, PA, 19073, United States, sking01@fs.fed.us

1 - Optimal Continuous Cover Forest Management with Stochastic Prices and Set up Costs
Peter Lohmander, Professor, SUAS, University Campus, Umea, 901 83, Sweden, peter.lohmander@sekon.slu.se

The optimal continuous cover forest management problem is solved for the case where prices are stochastic processes and there are set up costs. The problem is solved via a stochastic dynamic programming model, which is programmed in Perl/CGI, now available on the internet. Continuous cover forest production models based on empirical studies in Sweden are used in a case study together with recently estimated stochastic price parameters.

2 - Optimal Upgrading of Forest Road Networks: Is Scenario Analysis an Appropriate Tool?
Leif Olsson, Mid Sweden University, FSCN, Holmgatan 10, Sundsvall, 85170, Sweden, leiols69@icqmail.com

A 2-stage stochastic linear model was developed to optimise upgrades of a forest road network in Sweden. Solutions were compared to deterministic model output from a scenario analysis. Scenario analysis yields quick, near-optimal solutions, but with option values greater then zero. This, as well as inspection of the suggested road improvements indicates lack of solution flexibility from scenario analysis. The two-stage stochastic model should be used when solution time is reasonable.

3 - Applying Vendor Managed Inventory with Postponement Strategy in Wood Processing Industries
Peter Rauch, BOKU - University of Natural Resources and Applied Life Sciences, Vienna, Feistmantelstr. 4, Vienna, 1180, Austria, peter.rauch@boku.ac.at, Manfred Gronalt

Production volume of solid structure timber (SST) is largely dependent upon the wood construction business. Variability in demand and seasonal factors can cause SST inventories to be overstocked for one type and out of stock for another. We present an approach for vendor managed inventory where the raw material stock for SST is managed by the supplier. An inventory control system is established which reduces the overall raw material stock while increasing the SST service level.

4 - A Fiber Property Based Stochastic Model for the Supply Chain of the Pulp and Paper Industry
Daniel Hultqvist, Ph.D Student, Mid Sweden University, Holmgatan 10, Sundsvall, 851 70, Sweden, daniel.hultqvist@mh.se, Leif Olsson

In this paper a stochastic model for procuring pulp and paper mills based on fiber properties is presented. Tools are available for roughly predicting the fiber properties in the standing forest. Given this data and the preferred properties at the mill this model will propose harvest sites and destination of the roundwood. The underlying optimization problem is a MIQP.

■ SA30

P-Room 3512

Advanced SPC using Multiscale Wavelets Analysis

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: Jionghua (Judy) Jin, Assistant Professor, The University of Arizona, Dept. of Systems and Industrial Engineering, Systems & Industrial Engineering, Tucson, AZ, 85750, United States, jhjin@sie.arizona.edu

1 - A Generalized Change Point Detection Model Based On Discrete Wavelet Transform And Clustering
Shing Chang, United States, changs@ksu.edu

In this paper, we propose a multiscaled decomposition method to identify multiple change points for phase I of control charting. Specifically, we apply a discrete wavelet transform (DWT) to a HDS and separate the decomposed layers of signals into level shifts or noise changes.

2 - Multiscale Variability Decomposition and Analysis for Process Condition Monitoring
Huairui Guo, Department of Systems & Industrial Engineering, University of Arizona, Tucson, AZ 85721, United States, huairui@email.arizona.edu, Jionghua (Judy) Jin

The inevitable process disturbances or unanticipated process changes generally

cause a mixture of unknown variation patterns. In this presentation, the multi-scale wavelet transforms is used to decompose the variation patterns at different scales for effective identification of various patterns. A new method will be presented to discuss how to choose effective informative monitoring features for process monitoring and variation pattern estimation.

3 - An Integrated Methodology for Multi-sensor Machinery Health Diagnosis and Prognosis

David He, Associate Professor, Department of Mechanical and Industrial Engineering, The University of Illinois at Chicago, 842 West Taylor Street, 3049 ERF, Chicago, IL, 60607, United States, davidhe@uic.edu

An integrated methodology for multi-sensor machinery health diagnosis and prognosis will be presented. The presented methodology is developed based on the integration wavelet decomposition of sensor signals and the reasoning of a model-driven statistical learning method, called the hidden semi-Markov models (HSMMs). The methodology is illustrated with real multi-sensor machinery diagnostic and prognostic applications

4 - Analysis of Complex Two-dimensional Data for the In-Process Monitoring and Control

Jye-Chyi Lu, Professor, Department of Industrial and Systems Engineering, Georgia Institute of Technology, Atlanta, GA 30332, United States, jclu@isye.isye.gatech.edu, Myong-Kee Jeong

We present a structured wavelet model useful in handling a potentially large size of two-dimensional data exhibiting many peaks and valleys. We compare some available data reduction procedures (e.g., 2-D wavelet transform, functional data analysis) with the structured wavelet model. A real-life example is presented to show the efficiency of our proposed procedure.

■ SA31

P-Room 3545

Joint Session Applied Probability/Minority Issues: Call Center Models for Design and Analysis

Sponsor: Applied Probability/Minority Issues
Sponsored Session

Chair: William Massey, Professor, Princeton University, ORFE Department, Engineering Quadrangle, Princeton, NJ, 08544, United States, wmassey@princeton.edu

1 - Approximating the Transitions of An Ornstein-Uhlenbeck Process with Two Sided Drift

Brian Rider, Professor, University of Colorado at Boulder, Boulder, CO, United States, rider@math.duke.edu

Motivated by call centers, we consider an Ornstein-Uhlenbeck type process that arises from the diffusion limit of a multiserver queue with abandonment. We introduce an approximation to the transition density of this process which is used to estimate a service level metric for the call center. This is joint work with Dane Boris of Duke University.

2 - Call Center Staffing for Profit Optimality

Robert Hampshire, Princeton University, ORFE Department, Princeton, NJ, United States, rhampshi@princeton.edu, William Massey

We model a call center as a multiserver queue with additional waiting spaces and abandonment. We assume that there is a reward for every successful service completion, a penalty for an abandoned call, and a cost for the number of agents and telephone lines used. Using the limiting fluid model for the queueing system, we can use the theory of optimal control to formulate a optimal staffing strategy for profit optimality.

3 - An Optimal Design of the M/M/C/K Queue for Call Centers

William Massey, Professor, Princeton University, ORFE Department, Engineering Quadrangle, Princeton, NJ, 08544, United States, wmassey@princeton.edu, Rodney Wallace

We develop an optimal design analysis for the M/M/C/K queueing system. The number of servers C corresponds to the number of agents and C+K corresponds to the number of telephone lines. Our goal is to find the optimal (C,K) pair for this multi-server, loss and delay queueing system by holding two key service metrics below their given target values, for a predetermined level of offered load traffic.

4 - Resource Pooling and Staffing in Call Centers with Skill-Based Routing

Rodney Wallace, IBM, Global Services, Silver Springs, MD, United States, rodney.wallace@us.ibm.com, Ward Whitt

We discuss recent work addressing the problem of determining the staff requirements for skill-based routing in call centers by seeking simplification through resource pooling. We then analyze classical queueing models to determine an initial estimate for the total staff needed in the call center. Finally, we perform simulations to make improvements in the initial assignment and test the effectiveness of the proceedure.

■ SA32

T-Vail (Majestic Level)

Balancing Data Quality and Confidentiality

Cluster: OR Practice
Invited Session

Chair: Lawrence Cox, Associate Director, National Center for Health Statistics, 3311Toledo Road, Room 3211, Hyattsville, MD, 29782, United States, lgc9@cdc.gov

1 - Heuristic Clustering with Group Size Constraints for Minimum Information Loss Microaggregation.

Sumitra Mukherjee, Professor, Nova Southeastern University, School of Computer & Information Science, 3301 College Avenue, Fort Lauderdale, FL, 33314-9918, United States, sumitra@nova.edu, Michael Laszlo

Microaggregation is a disclosure limitation technique in which records are aggregated into groups of at least a minimum required size; actual values of individual records are replaced by group means prior to release. We present results of our computational experiments with a new heuristic clustering method for minimum information loss microaggregation based on minimum spanning tree partitioning. Our results are comparable to the best reported results in the literature.

2 - New Approaches to Disclosure Limitation While Answering Queries to a Database: Protecting Numerical

Daniel Rice, Assistant Professor, Loyola College in Maryland, 4501 N. Charles Street, Sellinger School of Business, Baltimore, MD, 21210, United States, drice2@loyola.edu, Robert Garfinkel, Ram Gopal

Confidentiality via Camouflage (CVC) is a practical method for giving unlimited, correct, numerical responses to queries of on-line databases without compromising confidential numerical data. We identify two distinct types of insider information, knowledge of data or of the algorithm used to answer queries. Alternative forms of CVC are shown to protect against one or the other type of threat. A combination can be used when we are unable to specify the type of threat that is present.

3 - Why Multiply Impute when you can Sufficiently Perturb?

Krish Muralidhar, University of Kentucky, Gatton College of Business & Economics, Lexington, KY, 40506, United States, krishm@uky.edu, Rathindra Sarathy

Two techniques that can be used for statistical disclosure limitation are multiple imputation and data perturbation. In this study, we compare the effectiveness of multiple imputation and data perturbation for numerical microdata. The results indicate that, in the absence of missing data, the performance of data perturbation is better than that of multiple imputation. Further, since perturbation requires only one data set to be analyzed, it is easier to use.

■ SA33

T-Savoy (Majestic Level)

Project Management and Scheduling

Cluster: Scheduling
Invited Session

Chair: Willy Herroelen, Professor dr., Department of Applied Economics , K.U.Leuven, Naamsestraat 69, Leuven, BR, B-3000, Belgium, Willy.Herroelen@econ.kuleuven.ac.be

1 - The Trade-off Between Stability and Makespan in Resource-constrained Project Scheduling

Stijn Van de Vonder, K.U.Leuven, Department of Applied Economics, Naamsestraat 69, Leuven, B-3000, Belgium, Stijn.VandeVonder@econ.kuleuven.ac.be, Erik Demeulemeester, Willy Herroelen, Roel Leus

We address the potential trade-off between quality robustness (measured in terms of project duration) and solution robustness (stability, measured in terms of the deviation between the planned and realized activity start times) of a project baseline schedule. We investigate whether it is better to concentrate safety time in order to protect the project completion or to scatter safety time throughout the baseline schedule in order to enhance stability.

2 - Resource Leveling in Allocating Operating Room Time

Jeroen Beliën, K.U.Leuven, Department of Applied Economics, Naamsestraat 69, Leuven, B-3000, Belgium, jeroen.belien@econ.kuleuven.ac.be, Erik Demeulemeester

We present a decision tool that visualizes, optimizes and evaluates cyclic surgery schedules. The algorithms behind it aim at minimizing peaks in expected resource usages, i.e. controlling the artificial variability (arising from elective cases). As such, these resources are better protected against natural variability, i.e. the variability due to uncertainty inherent to health care. Extensive computational and simulation results are provided.

3 - A Comparison Between Proactive and Reactive Scheduling in Project Scheduling

Stijn Van de Vonder, K.U.Leuven, Department of Applied Economics, Naamsestraat 69, Leuven, B-3000, Belgium, Stijn.VandeVonder@econ.kuleuven.ac.be, Roel Leus, Willy Herroelen, Erik Demeulemeester

The aim of this paper is twofold. We provide an extensive framework to classify the crucial decisions to be taken in project scheduling under uncertainty. An experimental set-up is used to investigate several combinations of proactive and reactive scheduling techniques and to report on both their makespan and stability performance.

■ SA34

T-Columbine (Majestic Level)

Managing Supply Chains of Perishable Goods

Sponsor: Manufacturing and Service Operations Management
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 - How Should a Firm Manage Deteriorating Inventory?

Mark Ferguson, Assistant Professor of Operations Management, Georgia Institute of Technology, College of Management, 800 West Peachtree Street, NW, Atlanta, GA, 30332-052, United States, mark.ferguson@mgt.gatech.edu

Firms selling goods whose quality level deteriorates over time often face difficult decisions when unsold inventory remains. We present a dynamic model that captures the effect of internal competition between a firm's old and new product. We characterize the firm's optimal strategy and find conditions under which the firm is better off carrying all, some, or none of its leftover inventory to the next period.

2 - Sharing Information to Manage Perishables

Michael Ketzenberg, Assistant Professor, College of Business, Colorado State University, Fort Collins, CO, 80523, United States, Michael.Ketzenberg@business.colostate.edu

We address the value of information sharing in the context of a two-echelon, serial supply chain with a retailer and a supplier that provide a perishable product to consumers. We evaluate information sharing under two supply-chain structures (centralized and decentralized) where both supply chain members share their inventory levels and replenishment policies with each other. The former supply chain structure corresponds to the industry practice of vendor-managed inventory.

3 - A Perishable Inventory Problem with Positive Replenishment Lead Times and Backlogging

Andreea Popescu, Ph.D Student, School of Industrial and Systems Engineering, Georgia Institute of Technology, 765 Ferst Drive NW, Atlanta, GA, 30332-0205, United States, andreeap@isye.gatech.edu, Pinar Keskinocak, Ellis Johnson

Motivated from the current practices of freight forwarders for booking air cargo capacity to satisfy the demand of their shippers, we study a perishable inventory problem (cargo capacity) where there is a positive replenishment lead time (cargo capacity has to be booked in advance) and unmet demand can be backlogged (can be shipped on later flight) by incurring a penalty.

4 - Inventory Replenishment Policies and Substitution Decisions for Perishable Items

Borga Deniz, Doctoral Student, Tepper School of Business, Carnegie Mellon University, Pittsburgh, PA, 15213, United States, bdeniz@andrew.cmu.edu, Alan Scheller-Wolf, Itir Karaesmen

For many perishable products separate demand streams can be observed for different aged items, while at the same time products that are of different ages may be substitutes for each other. Decisions on how to replenish inventory and fulfill demand become complicated in such an environment. We consider these questions, by investigating various replenishment and fulfillment policies over an infinite horizon. We also compare these policies with the optimal solution found via dynamic programming.

■ SA35

T-Terrace (Terrace Level)

Inventory Theory

Sponsor: Manufacturing and Service Operations Management
Sponsored Session

Chair: Dan Adelman, Associate Professor, University of Chicago, Graduate School of Business, 1101 East 58th Street, Chicago, IL, 60637, United States, dan.adelman@gsb.uchicago.edu

1 - A Constant Approximation Algorithm for the One Warehouse Multi-Retailer Problem

Retsef Levi, Ph.D Student, ORIE Department, Cornell University, 206, Rhodes Hall, Cornell University, Ithaca, NY, 14853, United States, rl227@cornell.edu, Robin Roundy, David Shmoys

A central warehouse supplies N retailers, each facing demands over T periods. A fixed individual transportation cost is incurred each time the warehouse supplies retailer. A fixed ordering cost is incurred each time the warehouse orders from external supplier. A linear cost is incurred for holding inventory in the warehouse and retailer premises. We wish to minimize the overall ordering, transportation and holding cost. We use LP-based methods to give the first constant approximation algorithm.

2 - Risk Aversion in Inventory Management

David Simchi-Levi, Professor, MIT, 77 Massachusetts Ave., 1-171, Cambridge, MA, 02139, United States, dslevi@mit.edu, Melvyn Sim, Peng Sun, Xin Chen

We propose a general framework for incorporating risk aversion in multi-period inventory models as well as multi-period models that coordinate inventory and pricing strategies. In each case, we characterize the optimal policy for various measures of risk that have been commonly used in the finance literature.

3 - Using Shapley Value to Allocate Profits from Inventory Pooling

Eda Kemahlioglu Ziya, University of North Carolina at Chapel Hill, CB #3490, McColl Building, Chapel Hill, NC, United States, kemahlio@isye.gatech.edu, John Bartholdi, III

We consider a decentralized, two-echelon supply chain where the supplier bears the inventory risk. We model the relationship among the supplier and the retailers as a cooperative game where the players can form inventory-pooling coalitions. Using Shapley value to allocate the total supply-chain profit, we analyze the effect of demand variance on the allocations. We also consider strategic retailer coalitions and whether the retailers can increase their profit allocations through them.

4 - Duality and Existence of Optimal Policies for Generalized Joint Replenishment

Dan Adelman, Associate Professor, University of Chicago, Graduate School of Business, 1101 East 58th Street, Chicago, IL, 60637, United States, dan.adelman@gsb.uchicago.edu, Diego Klabjan

We establish a duality theory for a broad class of inventory problems on continuous spaces that includes the classical joint replenishment problem and inventory routing. Using this theory, we establish the existence of an optimal policy, which has been an open question. We show how a primal-dual pair of infinite dimensional linear programs encode both cyclic and non-cyclic schedules, and provide various results regarding cyclic schedules.

■ SA36

T-Capitol (Terrace Level)

Financial Engineering

Cluster: Financial Engineering
Invited Session

Chair: Roger Lee, Stanford University, Dept of Mathematics, Building 380, Stanford, CA, 94305-2125, United States, roger@math.Stanford.EDU

1 - Relative Value Pricing of Derivative Securities

Juyoung Lim, Instructor, University of Texas at Austin, Department of Mathematics, 1 University Station, Austin, TX, 78712, United States, limju@math.utexas.edu, Marco Avellaneda

Relative value pricing is to price a derivative security in line with other derivatives that have common underlyings or stochastic factors. We develop a new technique called 'marginalization' using coarea formula from geometric measure theory, giving a unified and systematic view of relative value pricing. Popular application such as relative pricing of index option and swaption is demonstrated.

2 - Robust Replication of Volatility Derivatives
Roger Lee, Stanford University, Dept of Mathematics, Building 380, Stanford, CA, 94305-2125, United States, roger@math.Stanford.EDU, Peter Carr

Define the realized variance of a price process S to be the quadratic variation of log(S) on [0,T]. (In practice, one uses the sample variance of the daily or weekly returns of S.) Via trading in S and in T-expiry options, we replicate contracts paying general functions of realized variance, such as its square root, realized volatility. Without imposing any specific volatility model, we make only a correlation assumption, and we show how to correct for deviations from that assumption.

3 - Modeling and Analysis of Transaction Costs in Dynamic Hedging
James Primbs, United States, japrimbs@stanford.edu, Yuji Yamada, Mayank Jain

In this talk we use a numerical scheme to compute the moments of the hedging loss distribution of dynamic hedging strategies under transaction costs. We develop models of fixed and proportional transaction costs that allow for efficient computational methods to be applied. This allows us to study the effects of these costs on dynamic hedging strategies for derivative securities. In particular, we analyze tradeoffs between frequency of portfolio rebalancing and hedge accuracy and cost.

4 - Pricing Take or Pay Swing Options
Sheldon Ross, Professor, UNiversity of Southern California, Dept of Ind. and Systems Eng, Los Angeles, CA, 90089-0193, United States, ross@ieor.berkeley.edu

A take or pay swing option enables one to exercise an option at the end of any of n days. The option can be exercised, at a constant stike, up to m times and, if penalties are to be avoided, must be exercised at least r times. Assuming a risk neutral geometric Brownian motion, the objective is to bound the expected return from an optimal policy. Our method uses efficient simulation procedures to evaluate heuristic policies as well as policies based on knowing the future.

■ SA37

T-Biltmore (Terrace Level)

Natural Gas Market Models

Sponsor: Energy, Natural Resources and the Environment
Sponsored Session

Chair: Steve Gabriel, Assistant Professor, University of Maryland, Dept. of Civil & Env.. Engineering, 1143 Martin Hall, College Park, MD, 20742, United States, sgabriel@umd.edu

1 - Recent Numerical Results for a Natural Gas Equilibrium Model for North America
Steve Gabriel, Assistant Professor, University of Maryland, Dept. of Civil & Env.. Engineering, 1143 Martin Hall, College Park, MD, 20742, United States, sgabriel@umd.edu, Jifang Zhuang, Supat Kiet

We provide recent numerical results for a mixed complementarity model using a very detailed characterization of the North American natural gas market based on a Nash-Cournot game theory formulation. The resulting model contains: 14 separate regions in Canada and the US, 132 pipelines and over 80 individual players in these regions. We present results that discuss market power issues for the natural gas marketers in each consumption region as well as other topical cases.

2 - A Micro-Level Approach to Solving Market Equilibria in Natural Gas
Supat Kiet, Ph.D Candidate, University of Maryland, Dept. of Civil & Env. Eng., College Park, MD, 20742, United States, supat@wam.umd.edu, Steve Gabriel

We present recent results concerning solving a complementarity-based market equilibrium in the natural gas sector when no closed-form expression for production or consumption curves are present due to micro-level data. This work is novel in that it unites both complementarity/variational inequality modeling with the micro-level data concept.

3 - Determining Well-head Gas Prices in Colombia for a Deregulated Market
Yris Olaya Morales, Colorado School of Mines, Division of Economics and Business, Golden, CO, 80401, United States, yolaya@Mines.edu

Interconnection of markets and open access to pipelines allows competition in oligopolistic gas markets. Capacity constraints however, isolate markets, increasing market power of suppliers. In this model of the Colombian market, deregulated, asymmetric suppliers share a constrained transportation network. The results show that congestion of the network increases market power.

■ SA38

T-Beverly (Terrace Level)

Simulation of Manufacturing Systems

Sponsor: Simulation
Sponsored Session

Chair: Walid Abdul-Kader, Associate Professor, University of Windsor, 401 Sunset Avenue, Windsor, ON, N9B 3P4, Canada, kader@uwindsor.ca

1 - Impact of Preventive Maintenance on Unreliable Multi-Machine Production Line Performance
Steven Noseworthy, Industrial Technology Advisor, National Research Council, P.O. Box 4920, St-John's, NF, A1C5R3, Canada, steven.noseworthy@nrc.ca, Walid Abdul-Kader

This paper studies how preventive maintenance applied to a serial production line can impact the production output and cost. This area of research is becoming increasingly important as manufacturers strive to lower buffer inventories while incorporating more complex automation and machinery. A simulation-based experimental design methodology is used to analyze and evaluate results when time-based preventive maintenance is performed on the unreliable machines of a multi-machine serial production line. A hypothetical relationship between Mean Time to Failure (MTTF) and preventive maintenance (PM) was incorporated into the simulation model. The simulation-based experimental design methodology and economical analysis outlined in this paper can be easily applied to complex manufacturing production lines. It can assist managers in making informed decisions on the most appropriate level of PM and buffer capacity for the environment they operate.

2 - Performance Evaluation of a Series-Parallel Production Line
Walid Abdul-Kader, Associate Professor, University of Windsor, 401 Sunset Avenue, Windsor, ON, N9B 3P4, Canada, kader@uwindsor.ca, Steven Noseworthy

This research work addresses the problem of performance estimation of a multi-product production line composed of m unreliable workstations and (m-1) intermediate buffers. The series-parallel line configuration is addressed and compared to other studies. The modeling approach integrates in a more representative manner the many parameters that impact the capacity of the manufacturing system. These are: workstations' failure, repair, and set-up as product type changes. Numerical examples are presented to show the different steps of the simulation methodology and to assess the contribution of buffers location / allocation.

3 - Simulation of an Assembly Line — A Case Study
Walid Abdul-Kader, Associate Professor, University of Windsor, 401 Sunset Avenue, Windsor, ON, N9B 3P4, Canada, kader@uwindsor.ca

This paper considers the modeling of an assembly line composed of various workstations. The latter are subject to random failure and repair. A case study is presented to evaluate different scenarios that have an impact on the overall capacity of the assembly line. The scenarios relate to buffering strategies and preventive maintenance policies.

■ SA39

T-Tower Court A (2nd Floor)

Retail Supply Chain Management I: Managing Variety

Cluster: Supply Chain Mgmt & Operations
Invited Session

Chair: Stephen Smith, Professor, Santa Clara University OMIS, 500 El Camino Real, Kenna Hall 323C, Santa Clara, CA, 95053-0382, United States, SSmith@scu.edu

Co-Chair: Naren Agrawal, Associate Professor, Santa Clara University, OMIS Department, Santa Clara, CA, 95053, United States, NAgrawal@scu.edu

1 - Retail Assortment Planning Using Conjoint Preference Data
Stephen Smith, Professor, Santa Clara University OMIS, 500 El Camino Real, Kenna Hall 323C, Santa Clara, CA, 95053-0382, United States, SSmith@scu.edu

This paper compares various methodologies for selecting an assortment of products for a retail category, based on heterogeneous market segments and customer satisficing choice behavior. A data set developed through conjoint analysis of responses gathered via the internet is used to illustrate the methodologies and to derive insights regarding the sensitivity of the results to various input assumptions.

2 - Bundling Retail Products: Models and Analysis
Kumar Rajaram, Associate Professor, UCLA Anderson School, 110 Westwood Plaza, Los Angeles, CA, 90095, United States, kumar.rajaram@anderson.ucla.edu, Christopher Tang, Kevin McCardle

We consider the impact of bundling products on retail merchandising. We consider two broad classes of retail products: basic and fashion. For these product classes, we develop models to calculate the optimal bundle prices, order quantities and profits under bundling. We use this analysis to establish conditions and insights under which bundling is profitable.

3 - Assortment Planning and Inventory Management under a Locational Consumer Choice Model

Vishal Gaur, New York University, 8-72, 44 West 4th St., New York, NY, 10012, United States, vgaur@stern.nyu.edu, Dorothee Honhon

We consider a single-period assortment planning and inventory decision model wherein consumer preferences and product variants are defined by points in an attribute space, and each consumer picks the closest available variant. We determine the structure of the optimal solution under both static and dynamic substitution. Our results show how price and product position can be used as tools to manage demand substitution in order to improve profits.

4 - The Effect of Product Variety and Inventory Levels on Misplaced Products: A Longitudinal Study

Zeynep Ton, Assistant Professor, Harvard University, Morgan Hall T61, Soldiers Field Road, Boston, MA, 02163, United States, zton@hbs.edu, Ananth Raman

From a 4 year study of 333 stores of a large retailer we show that increasing product variety and inventory levels is associated with an increase in misplaced products and that increasing misplaced products is associated with a decrease in store sales.Hence,we highlight a consequence of increased product variety and inventory levels that had been previously overlooked in studies of retail product variety and inventory management.Our study also makes contributions to quality management literature

■ SA40

T-Tower Court B (2nd Floor)

Supply Chain Management I

Cluster: Supply Chain Mgmt & Operations
Invited Session

Chair: Ravi Anupindi, University of Michigan, 701 Tappan Ave, D3217, Ann Arbor, MI, 48109, United States, anupindi@umich.edu

1 - Flexible Capacity as a Deterrent to Entry

Rodney Parker, Yale University, 135 Prospect Street, P.O. Box 208200, New Haven, CT, 06520, United States, rodney.parker@yale.edu, Roman Kapuscinski

An incumbent firm, facing potential competition from an entrant firm, chooses to invest in product-flexible capacity. We show the circumstances under which this investment will deter market entry by the second firm. We compare the performance of the flexible capacity to equivalent dedicated capacity on the basis of absolute profits, relative entry-deterrence value, and amount of capacity required to deter entry, under constant elasticity and linear demand scenarios.

2 - Impact of Information Leakage in a Supply Chain

Krishnan S. Anand, The Wharton School, University of Pennsylvania, Philadelphia, PA, 19104, United States, anandk@wharton.upenn.edu, Manu Goyal

Information Sharing within a supply chain can be consensual or inadvertent. We study how the latter can arise from the terms of contract, even if undesirable for one or more parties. Such information leakage may lead to lowered investment in information acquisition, and hence reduce both firm and supply chain profits.

3 - Capacity Investment, Flexibility and Market Competition

Ravi Anupindi, University of Michigan, 701 Tappan Ave, D3217, Ann Arbor, MI, 48109, United States, anupindi@umich.edu, Li Jiang

We provide a comprehensive analysis of capacity investment decisions in a duopoly model with demand uncertainty. We consider a three-stage game of capacity investment production and market competition (price or quantity). We show that when both firms have some flexibility, the two forms of market competition are strategically equivalent. We illustrate several other properties of the duopoly models.

4 - Solving a Dynamic Principal-Agent Model by Truthful Revelation Contracts

Hao Zhang, Marshall School of Business, University of Southern California, United States, zhanghao@usc.edu

Consider a mini supply chain with a seller and a buyer. The buyer's type (preferences) changes over time, whose transition is influenced by the buyer's purchase quantities. The seller only observes those purchases. What is her best pricing mechanism? This and many other OM problems can be formulated as a dynamic Principal-Agent model with hidden states. Though several special cases of this model are well studied, the general case has been overlooked. The talk will discuss a general solution.

■ SA41

T-Tower Court C (2nd Floor)

Supply Chain Pricing and Sourcing

Contributed Session

Chair: Murat Erkoc, University of Miami, Industrial Engineering Dept., Coral Gables, FL, United States, merkoc@miami.edu

1 - Distribution Planning Models for the Motion Picture Industry

Barbara Somlo, Ph.D. Candidate, UCLA Anderson School DOTM, 110 Westwood Plaza, Gold Building B5.12, Los Angeles, CA, 90095, United States, barbara.somlo@anderson.ucla.edu, www.bsomlo.com, Kumar Rajaram, Reza Ahmadi

We consider the motion picture distributor's problem of choosing the best set of theaters to optimize profits for a given new movie. To address this problem, we develop an integer program based optimization model and an estimation procedure to calculate the box office sales at the theater level as a function of movie attributes and theater characteristics. We test the model on real box office data and show that it has the potential to greatly improve on existing industry practice.

2 - Competition under Time-Varying Demand Functions and Dynamic Lot Sizing Costs

Joern Meissner, Columbia Business School, 2840 Broadway #284, www.meiss.com, New York, 10025, United States, joe@meiss.com, Awi Federgruen

We develop a competitive pricing model which combines the complexity of time-varying demand and cost functions and that of scale economies arising from dynamic lot sizing costs. Fixed as well as variable procurement costs are incurred for each procurement order, along with inventory carrying costs. We establish the existence of a price equilibrium and associated optimal dynamic lotsizing plans. We also design efficient procedures to compute the equilibrium prices and dynamic lotsizing plans.

3 - Channel Performance of a Retailer Fixed Markup Policy under Price Dependent Demand

Yong Liu, University of Cincinnati, Department of QA/OM, College of Business, University of Cincinnati, Cincinnati, OH, 45221, United States, liyo@email.uc.edu, Michael Fry

We examine the behavior of a manufacturer and a retailer facing price dependent demand. We investigate their decisions and resulting profits under a traditional price only contract and under a retailer fixed markup (RFM) policy. Our results reveal that the efficiency of an RFM policy highly depends on two factors: the nature of the demand function and the relative power of different players in the supply chain.

4 - Pricing and Production Planning under Random Yield and Demand

Burak Kazaz, Assistant Professor, University of Miami, School of Business, 414 Jenkins Building, Coral Gables, FL, 33124, United States, bkazaz@miami.edu

We analyze a modeling approach benefiting agricultural businesses in their pricing and production planning problems under yield and demand uncertainty. Two models are presented where the producer sets prices at different points in time. The optimality conditions that guarantee unique solutions are explored for both models.

5 - Role of Inspection under Price-dependent and Price/Quality-dependent Demand

Murat Erkoc, University of Miami, Industrial Engineering Dept., Coral Gables, FL, United States, merkoc@miami.edu, Haresh Gurnani, Mingzhou Jin

We examine the optimal inspection and pricing policies in a supply chain with a single seller and single buyer. First, we investigate the role of inspection when the end consumer demand is influenced only by price. Next we extend our analysis to the case where demand is also quality-dependent. We compare the both cases and analyze the interaction between demand structure, pricing, quality, and inspection.

■ SA42

T-Tower Court D (2nd Floor)

Revenue Management and Dynamic Pricing I

Sponsor: Revenue Management & Dynamic Pricing
Sponsored Session

Chair: Abhijit Gosavi, Assistant Professor, SUNY, Buffalo, 317 Bell Hall, Buffalo, NY, 14228, United States, agosavi@buffalo.edu

1 - Combined Pricing and Seat Allocation in an Airline Network

Tapas K. Das, University of South Florida, 4202 E. Fowler Avenue, Tampa, FL, 33620, United States, das@latte.eng.usf.edu, Baskar Mohan

This paper presents a model for combined pricing and seat allocation model for maximizing revenue in an airline network. A reinforcement learning based computational methodology is developed and tested on a sample network having ten flight legs, 30 ODs, and three fare classes in each OD.

2 - A Joint Pricing and Revenue Management Model
Ioana Popescu, Assistant Professor of Decision Sciences, INSEAD, Blvd. de Constance, Fontainebleau, 77300, France, ioana.popescu@insead.edu, Ayse Kocabiyikoglu

Standard revenue management (RM) models optimize booking limits assuming prices are fixed in advance. We extend the basic EMSR model for RM to simultaneously optimize prices and capacity allocations. Based on a general stochastic model of demand, we provide conditions for the objective function to be concave. In this case, the optimal price-allocation solution is unique and can be computed efficiently.

3 - Decentralized Overbooking Decisions
Itir Karaesmen, University of Maryland, Robert H. Smith School of Business, College Park, MD, 20742, United States, itir@umd.edu, Guruprasad Pundoor

Building on our earlier work on overbooking with substitutable resources, we show how overbooking decisions differ in a de-centralized environment. We analyze the overbooking problem for a service network, where each member of the network owns inventory but agress to share it with other members of the network in case of oversales. Structural results and numerical examples are presented.

4 - Strategies for Dynamic Pricing of Seasonal Goods
Jay Neelakantan, United States, jn23@acsu.buffalo.edu, Abhijit Gosavi, Rajan Batta

We present a dynamic programming model for decision-making related to inventory and pricing of seasonal semi-perishable goods. We will present numerical results obtained from a dynamic program and from a simulator. We will also discuss extensions to multiple-product scenarios.

■ SA43

T-Denver (Mezzanine)

Panel: Intersection of Product Development and Supply Chain Management Research

Cluster: New Product Development
Invited Session

Chair: Nitin Joglekar, Asst. Professor, Boston University, 595 Commonwealth Avenue, Boston, MA, 02215, United States, joglekar@bu.edu

1 - Intersection of Product Development and Supply Chain Management Research
Moderator: Nitin Joglekar, Asst. Professor, Boston University, 595 Commonwealth Avenue, Boston, MA, 02215, United States, joglekar@bu.edu, Panelists: Edward Anderson, Kamalini Ramdas, Jayashankar Swaminathan, Eric Johnson, Gilvan C. Souza

Developing products that take advantage of supply chain capabilities is a growing phenomenon in the practitioner community. This panel will discuss emerging product development research that can account for recent innovations in capacity management, close loop supply chains, inventory placement, postponement, product-process integration, sensor technologies and variety management practices.

■ SA44

T-Spruce (Mezzanine)

Auctions with Limited Communication

Cluster: Auction Theory & Applications
Invited Session

Chair: Rudolf Muller, Maastricht University, Department of Quantitative Economics, P.O. Box 616, Maastricht, 6200 MD, Netherlands, R.Muller@KE.unimaas.nl

1 - Auctions with Severely Bounded Communication
Liad Blumrosen, The Hebrew University, Givat-Ram, Jerusalem, 91904, Israel, liad@cs.huji.ac.il, Noam Nisan, Ilya Segal

We study auctions with severe bounds on the communication allowed: each bidder may only transmit t bits of information to the auctioneer. We consider both welfare-maximizing and profit-maximizing auctions under this communication restriction. For both measures, we determine the optimal auction and show that the loss incurred relative to unconstrained auctions is mild. We prove some surprising properties, e.g., that asymmetric auctions are better than symmetric ones.

2 - The Private Value Single Item Bisection Auction
Elena Grigorieva, Maastricht University, Department of Quantitative Economics, P.O.Box 616, Maastricht, 6200 MD, Netherlands, e.grigorieva@ke.unimaas.nl, Dries Vermeulen, P.Jean-Jacques Herings, Rudolf Muller

We present a new single item auction, the bisection auction, and prove its strategic equivalence to the Vickrey and English auctions. We show that the proposed auction is more economical in its demand for information on the valuations of the players. Comparing the expected number of information bits transmitted from the players in the truthtelling equilibrium we show that the bisection auction requires far less communication than the Vickrey and English auctions.

3 - Applying Learning Algorithms to Preference Elicitation in Combinatorial Auctions
David C. Parkes, Harvard University, Div. of Engineering and Appl. Sciences, 33 Oxford Street, Cambridge, MA, 02138, United States, parkes@eecs.harvard.edu

Preference elicitation is an important bottleneck in combinatorial auctions. We consider the parallels between the preference elicitation problem and the problem of learning an unknown function from learning theory. Learning algorithms can be used as a basis for preference elicitation in combinatorial auctions with a polynomial number of queries and polynomial communication complexity. In particular, we obtain an algortihm that elicits XOR bids with polynomial communication.

■ SA45

T-Gold (Mezzanine)

Algorithmic Game Theory

Cluster: Game Theory
Invited Session

Chair: Tim Roughgarden, Assistant Professor, Stanford University, Gates Building, 353 Serra Mall, Stanford, CA, 94305, United States, tim@cs.stanford.edu

1 - Reducing the Efficiency Loss of Supply Function Equilibria
Ramesh Johari, Stanford University, Terman 319, Stanford, CA, 94305, United States, rjohari@stanford.edu, John Tsitsiklis

Motivated by models for electricity markets, we consider the design of market mechanisms where multiple suppliers compete to satisfy an inelastic demand. Each firm submits a supply function, and a single price is chosen to clear the market. We show that by appropriately restricting the space of supply functions that firms can bid, it is possible to design a mechanism with low efficiency loss even in the presence of market power.

2 - Pricing and Competition in Communication Networks
Asuman Ozdaglar, Assistant Professor, MIT, 77 Massachusetts avenue, 32-D630, Cambridge, MA, 02139, United States, asuman@mit.edu, Alp Simsek, Daron Acemoglu

We study the flow control and routing decisions of self-interested users in a network where service providers set prices for use of bandwidth and compete for user demand. We define the equilibrium of the system as the price equilibrium among service providers and the corresponding user equilibrium. We introduce a new approach based on critical point theory to study the properties of the equilibrium.

3 - How to Make Everybody Happy (on approximately fair allocations of indvisible goods)
Amin Saberi, Microsoft Research, One Microsoft Way, Redmond, WA, United States, saberi@cc.gatech.edu, Vangelis Markakis, Dick Lipton, Elchanan Mossel

We will study the problem of fairly allocating a set of indivisible goods with an algorithmic perspective. The criterion that we focus on is the envy. We will show that there exist allocations in which the envy is bounded and present algorithms for computing them. We also look at the optimization problem of finding an allocation with minimum possible envy and show its connection to job scheduling. We also obtain approximation algorithms as well as hardness results.

4 - The Price of Stability for Network Design
Tom Wexler, Cornell University, 4106 Upson Hall, Ithaca, NY, 14850, United States, wexler@cs.cornell.edu, Elliot Anshelevich, Eva Tardos, Jon Kleinberg, Anirban Dasgupta, Tim Roughgarden

We introduce a network creation game in which players seek to connect pairs of nodes as cheaply as possible, and edge costs are divided equally among all players using them. Using a potential argument of Monderer and Shapley, we show that Nash equilibria exist, and the best such solutions are within a log factor of the optimal centrally designed solution. We show this bound is tight, and extend the model to include generalized connectivity requirements, buy-at-bulk edge costs, and latencies.

■ SA46

T-Aspen (Mezzanine)

Economics

Contributed Session

Chair: Bing Jing, Professor, New York University, 44 West 4th Street, KMC8-80, IOMS Dept., Stern School of Business, New York, NY, 10012, United States, bjing@stern.nyu.edu

1 - Policy Learning by Artificial Agents in Electricity Markets

Steven Kimbrough, Professor, University of Pennsylvania, 103 Bentley Avenue, Bala Cynwyd, PA, 19004, United States, kimbrough@wharton.upenn.edu, Ming Lu, Frederic Murphy

We report both analytic and agent-based simulation results of learning by artificial agents in an extended Cournot game. The paper investigates a novel but intuitively attractive form of learning, which we call learning in policy space. Under this regime, agents learn effectively and achieve tacit collusion, at the expense of their customers. We apply the model to electricity markets.

2 - M2 Velocity in the United States: The Evidence Since 1991

A. M. M. Jamal, Professor, Southeastern Louisiana University, 1104 Rue Cannes, Hammond, LA, 70403, United States, ajamal@selu.edu, Shakil Quayes, Yu Hsing

This paper develops a model of the M2 velocity that simultaneously estimates the functional form and the parameters of the velocity equation. The study is based on the data since 1991, a period characterized by an abrupt shift in the magnitude of the velocity. The results show that a standard logarithmic equation may not be appropriate for specifying the velocity function. The estimated coefficients of the accepted model should provide useful information to policy makers

3 - A Theory of Reciprocity Without Beliefs of Intentions

Jill Stowe, Fuqua School of Business/Duke University, Box 90120, Durham, NC, 27708-0120, United States, stowe@duke.edu, William Neilson

An intentions-free theory of reciprocal behavior is proposed. Different behavioral patterns involving reciprocity are distinguished and modeled based on characteristics of games which are observable. Specifically, reciprocal behavior is determined only by the payoffs in the game. The model is applied to the investment game and a modified investment game. The distinction between the two games allows us to make predictions concerning the "amount of reciprocity" in different situations.

4 - Regression Quantiles: An Application

Subhash Narula, Professor, Virginia Commonwealth University, School of Business, VCU 1015 Floyd Ave, Richmond, VA, 23284-4000, United States, snarula@vcu.edu, John Wellington

Unlike least squares regression, the empirical regression quantiles provide a good starting solution for the robust regression procedures, estimators for the trimmed regression analysis, and serve well as good descriptive statistics for the data. Our objective is to show, with a real estate data, how regression quantiles may be used in practical situation in preference to the least squares or the minimum sum of absolute errors regression.

5 - Nonconvex Production Technology and Price Discrimination

Bing Jing, Professor, New York University, 44 West 4th Street, KMC8-80, IOMS Dept., Stern School of Business, New York, NY, 10012, United States, bjing@stern.nyu.edu

Extending the model of Mussa and Rosen (1978), this paper investigates how a monopolist's product line design may crucially depend on the non-convexities in its unit cost function. Absent a variety constraint, we show that the firm does not offer those qualities where the unit cost exceeds its convex envelope. We also characterize the optimal location of quality levels when the firm can offer only a limited number of varieties. The firm's profit is a supermodular function of its quality levels.

Sunday 10:00am-11:30am

■ SB01

P-Ballroom F

Tutorial: Polyhedral Combinatorics

Cluster: Tutorials- Denver 2004
Invited Session

Robert Carr, Sandia National Laboratories, Mail Stop 1110, P.O. Box 5800, Albuquerque, NM , 87185-1110, United States, rdcarr@sandia.gov, Goran Konjevod

1 - Polyhedral Combinatorics
Robert Carr, Sandia National Laboratories, United States, Goran Konjevod

The session deals with theoretical issues in using linear and integer programming to solve or approximate combinatorial optimization problems. The speakers will show how structural properties of naturally-arising polyhedra frequently come into play, beginning with an overview with special emphasis on the quality of linear relaxations of hard combinatorial problems. Then, the speakers will discuss formulation size, the integrality gap (a measure of how close an LP relaxation gets to an optimal solution), and cutting planes and separation.

■ SB02

P-Ballroom E

Panel: The Industry Job Search

Cluster: Job Placement Committee
Invited Session

Chair: David Kim, Associate Professor, Oregon State University, 121 Covell Hall, Dept. of IME, Corvallis, OR, 97331, United States, david.kim@orst.edu

1 - A Panel Discussion: The Industry Job Search
Moderator: David Kim, Associate Professor, Oregon State University, 121 Covell Hall, Dept. of IME, Corvallis, OR, 97331, United States, david.kim@orst.edu, Panelists: Susan Owen, Daniel Soto

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 or former industrial recruiters, time will be provided for questions and answers.

■ SB03

P-Plaza Court 1

Multilevel Metaheuristics

Cluster: Multiscale and Multilevel Methods
Invited Session

Chair: Michel Toulouse, Professor, University of Manitoba, 545 Machray Hall, Winnipeg, MB, R3T 2N2, Canada, toulouse@cs.umanitoba.ca

1 - Feature Selection Using a Multi-level Approach
Idowu O. Oduntan, student, Univeristy of Manitoba, Department of Computer Science, Winnipeg, MB, R3T 2N2, Canada, oduntan@cs.umanitoba.ca, Michel Toulouse, Richard Baumgartner, Christopher Bowman, Ray Somorjai

Feature selection is a significant process in pattern recognition that involves finding an 'optimal' subset from the original set of features, which mostly enhances a recognition task (such as classification). This paper presents a feature selection technique that is based on multi-level paradigm. We apply this technique to determine a subset of features that enable accurate and robust classification of biomedical dataset.

2 - Multilevel, Cooperative Parallel Search, Network Design
Teodor Gabriel Crainic, Professor, ESG, UQAM and Centre for Research on Transportation, CP 8888, succ. centre Ville, Montreal, QC, H3C 3P8, Canada, theo@crt.umontreal.ca, Ye Li, Michel Toulouse

We proposed a cooperative parallel meta-heuristic for capacitated multicommodity network design based on multilevel paradigm. We identify and discuss challenges related to the design and implementation of such methods and present a first analysis of algorithmic behavior.

3 - RAMP: A New Approach for Combinatorial Optimization
Cesar Rego, Associate Professor, University of Mississippi, School of Business Administration, Oxford, MS, 38677, United States, crego@bus.olemiss.edu

We propose a new metaheuristic approach utilizing a primal-dual framework based on an effective combination of scatter search and surrogate constraint relaxation. Variations using path-relinking, Lagrangean relaxation and composite strategies are also discussed. Computational results show this approach provides outstanding results for all classes of combinatorial problems for which it has been tested.

■ SB05

P-Plaza Court 3

Robust/Stochastic Optimization

Sponsor: Optimization/ Integer Programming
Sponsored Session

Chair: Alper Atamturk, University of California, 4141 Etcheverry Hall, MC 1777, Berkeley, CA, 94720-1777, United States, atamturk@ieor.berkeley.edu

1 - Robust Game Theory
Michele Aghassi, MIT, 77 Mass Ave, Bldg E40-131, Cambridge, MA, United States, maghassi@mit.edu, Dimitris Bertsimas

We propose a distribution-free model of incomplete-information games, in which the players use a robust optimization approach to payoff uncertainty. Our ``robust game" model relaxes the assumptions of Harsanyi's Bayesian game model, and provides an alternative, distribution-free equilibrium concept, for which, in contrast to ex post equilibria, existence is guaranteed. We focus our discussion on situations without private information. We briefly discuss numerical results.

2 - Polyhedral Results for Stochastic Lot-sizing Problems
Yongpei Guan, Georgia Tech, United States, guanyp@isye.gatech.edu, Shabbir Ahmed, George Nemhauser

We show that the recently introduced (Q,S_Q)-inequalities describe the convex hull for the two period stochastic uncapacitated lot-sizing problem. We analyze the underline stochastic integer program structure and develop further extensions of the (Q, S_Q) inequalities. Then, we derive valid inequalities for other stochastic lot-sizing problems. Preliminary computational results for multi-item stochastic capacitated lot-sizing problems are discussed.

3 - Dynamic Optimization with Model Uncertainty and Learning
George Shanthikumar, Professor, University of California, IEOR Department, Berkeley, CA, 94720-1777, United States, shanthikumar@ieor.berkeley.edu, Andrew Lim

We consider dynamic optimization problems with partial probabilistic characterization. We know that the true probability measure is within a fully characterized family of measures. We solve the dynamic programming problem with data driven learning. We discuss robust optimization with knightian learning and compensative optimization using operational statistics. We apply this to inventory control and revenue management.

■ SB06

P-Plaza Court 4

Markov Decision Processes - Optimization and Evaluation

Sponsor: Optimization/Stochastic Programming
Sponsored Session

Chair: Peng Sun, Assistant Professor of Decision Sciences, Duke University, Fuqua School of Business, Duke University, Durham, NC, 27708, United States, psun@duke.edu

1 - Bellman Error Minimization via Linear Programming with Performance Guarantees
Daniela de Farias, Massachusetts Institute of Technology, Cambridge, MA, United States, pucci@mit.edu, Benjamin Van Roy

We introduce a new algorithm based on linear programming that approximates the differential value function of an average-cost Markov decision process via a linear combination of pre-selected basis functions. We establish an error bound that scales gracefully with the number of states without imposing the (strong) Lyapunov condition required by a similar algorithm in the literature. We propose a path-following method that automates selection of important algorithm parameters.

2 - Biases and Variance in Value Function Estimates
Peng Sun, Assistant Professor of Decision Sciences, Duke University, Fuqua School of Business, Duke University, Durham, NC, 27708, United States, psun@duke.edu, Duncan Simester, Shie Mannor, John Tsitsiklis

We consider the bias and variance in value function estimates that result from reliance on empirical estimates of the model parameters. Using a second order approximation, we provide closed-form expressions for the bias and variance, which can be used to derive confidence intervals around the value function estimates. We validate these findings using a large database describing the transaction and mailing histories for customers of a mail-order catalog firm.

3 - Optimality Inequalities for Average Cost Markov Decision Processes with Inventory Applications
Mark Lewis, Assistant Professsor, University of Michigan, Industrial and Operations Engineering, 1205 Beal Avenue, Ann Arbor, MI, 48109-2111, United States, melewis@engin.umich.edu, Eugene Feinberg

We present conditions to guarantee convergence of both the optimal discounted cost value function and policies to those for the average cost case in general state and action space Markov decision processes. Inventory and stochastic cash balance models (with fixed costs) are natural candidates for the application of our results. Extension of the classic models for a general demand distribution are discussed in detail.

■ SB07

P-Plaza Court 5

Uncertainty Quantification for Financial Decisions in the Electric Energy Industry

Sponsor: Optimization/ Global Optimization
Sponsored Session

Chair: Dan Berleant, Department of Electrical and Computer Engineering, Iowa State University, Ames, IA, 50011, United States, berleant@iastate.edu

1 - Optimizing Electric Power Bidding Under Severe Uncertainty
Dan Berleant, Department of Electrical and Computer Engineering, Iowa State University, Ames, IA, 50011, United States, berleant@iastate.edu, Mei-Peng Cheong, Gerry Sheblé, George Kahrimanis

Traditional probabilistic methods cannot flexibly account for uncertainty about uncertainty, such as uncertainty about the specific forms of the probability distributions describing important model variables. Our goal is to guide bidding to sell blocks of electric power, in the presence of model uncertainty expressed with bounded families of distributions.

2 - Valuation of Generation Asset Investment within Bounds of Maximum Uncertainty
Gerry Sheblé, Department of Electrical and Computer Engineering, Iowa State University, Ames, IA, United States, gsheble@iastate.edu, Mei-Peng Cheong, Wang Yu

Within the deregulated electricity market, each generation company has a portfolio composed of generation units. A global optimization method is needed to optimize the portfolio performance through the entire lifespan.We propose a valuation strategy for this investment opportunity using an interval-based Markov Chain model coupled with Real Option analysis.

■ SB08

P-Plaza Court 6

On the Price of Anarchy

Sponsor: Optimization/ Network Optimization
Sponsored Session

Chair: Georgia Perakis, Sloan Career Development Associate Professor of Operations Research, Sloan School, MIT, 50 Memorial Drive, Rm E53-359, Cambridge, MA, 02139, United States, georgiap@mit.edu

1 - Design of Market Mechanisms for Network Resource Allocation
Ramesh Johari, Stanford University, Terman 319, Stanford, CA, 94305, United States, rjohari@stanford.edu, John Tsitsiklis

We consider the optimal design of market mechanisms for resource allocation among multiple competing users. Users submit demand functions, and a price is chosen to clear the market. We restrict attention to “simple” mechanisms, i.e., those where users choose only a scalar bid. Under certain assumptions, we establish that a mechanism first proposed by Kelly uniquely minimizes efficiency loss when users fully anticipate the effects of their actions on the price.

2 - Market Clearing Prices and Efficiency of Wardrop/Nash Equilibria
Amit Agarwal, United States, aagarwal@cs.princeton.edu, Rahul Garg, Vikas Bansal

3 - Computational Complexity, Fairness, and the Price of Anarchy ofthe Maximum Latency Problem
Nicolas Stier-Moses, Columbia Business School, Uris Hall, Room 418, 3022 Broadway, New York, NY, 10027, United States, nicolas.stier@columbia.edu, J. R. Correa, A. S. Schulz

We study the NP-hard problem of minimizing the maximum latency of static flows in networks with congestion. We show that an optimal solution to this problem has average latency within a constant factor of an optimum and, if latencies are linear, all flow-carrying paths have equal length. Also, an optimal flow w.r.t. the average latency is near-optimal for the maximum latency, and so is a Nash equilibrium. In contrast, the price of anarchy is unbounded for instances with multiple sources.

4 - On the Price of Anarchy
Georgia Perakis, Sloan Career Development Associate Professor of Operations Research, Sloan School, MIT, 50 Memorial Drive, Rm E53-359, Cambridge, MA, 02139, United States, georgiap@mit.edu

In this talk we characterize the inefficiency between user and system optimal solutions (also referred to as the ``price of anarchy”), when costs are non-separable, asymmetric and nonlinear, generalizing earlier work under separable costs. The generalization in this work models traffic equilibria, competitive multi-period pricing and competitive supply chains. The bounds established in this talk are tight and explicitly account for the degree of asymmetry and nonlinearity of the cost functions.

■ SB09

P-Plaza Court 7

Convex Optimization in Machine Learning I

Sponsor: Optimization/ In Data-Mining
Sponsored Session

Chair: Gert Lanckriet, Ph.D. Candidate, U.C. Berkeley, 262M Cory Hall, U.C. Berkeley, Berkeley, CA, 94720, United States, gert@cs.berkeley.edu

1 - Learning with Multiple Kernels : Conic Duality and the SMO algorithm
Gert Lanckriet, Ph.D Candidate, U.C. Berkeley, 262M Cory Hall, U.C. Berkeley, Berkeley, CA, 94720, United States, gert@cs.berkeley.edu, Francis Bach, Michael Jordan

Classical kernel-based classifiers are based on a single kernel. Often though, it is desirable to base classifiers on combinations of multiple kernels. For support vector machines (SVM) this requires solving a quadratically-constrained quadratic program (QCQP). We propose a novel dual formulation of the QCQP and show how to exploit Moreau-Yosida regularization and SMO techniques to solve this QCQP significantly more efficient than what general-purpose optimization toolboxes can achieve.

2 - Computing Regularization Paths for Learning Multiple Kernels
Francis Bach, United States, fbach@cs.berkeley.edu, Romain Thibaux, Michael Jordan

The problem of learning a conic combination of kernels for classification or regression can be achieved via the regularization by a block 1-norm. We present an algorithm that computes the entire regularization path for these problems by using numerical continuation techniques. We show empirically that the effect of the block 1-norm regularization differs notably from the (non-block) 1-norm regularization commonly used for variable selection.

3 - Estimation and Classification with Interval ata via Robust Optimization
Laurent El Ghaoui, United States, elghaoui@eecs.berkeley.edu

We consider estimation and classification problems where the input data is only known up to intervals. We pose estimation and classification problems where the loss function is replaced the worst-case value over all possible realizations of the “data” within its known bounds. For several important classes of problems (support vector machines, logistic regression, etc) these “minimax” problems can be reduced to convex optimization problems amenable to e.g. efficient interior-point methods.

4 - Minimax Probability Machines with Local Probabilistic Error Predictions
Greg Grudic, Assistant Professor, University of Colorado at Boulder, Department of Computer Science, 430 UCB, Boulder, CO, 80309-0430, United States, Gregory.Grudic@Colorado.EDU

The Minimax Probability Machine Classification (MPMC) framework builds state of the art classifiers by minimizing the maximum probability of misclassification. MPMC is unique in that it that gives direct estimates of this global accuracy bound. However, the accuracy bound that is minimized is global, and independent of the instance currently being classifier. We extend the MPMC framework, by estimating locally optimal accuracy bounds for individual classification predictions.

■ SB10

P-Plaza Court 8

Joint Session TSL/Railroad Applications: Mathematical Programming-Based Marine Transportation and Logistics

Sponsor: Transportation Science & Logistics, Railroad Applications
Sponsored Session

Chair: Kevin Furman, ExxonMobil Research & Engineering, 1545 Route 22 East, Annandale, NJ, 08801, United States, kevin.c.furman@exxonmobil.com

Co-Chair: Marco Duran, ExxonMobil Research & Engineering, 1545 Route 22 East, Annandale, NJ, 08801, United States, marco.a.duran@exxonmobil.com

1 - Integrated Inventory Management and Ship Scheduling of LNG
Marielle Christiansen, Professor, Norwegian University of Science and Technology, Alfred Getz vei 1, Trondheim, N-7491, Norway, Marielle.Christiansen@iot.ntnu.no, Ole-Tobias Frich, Richard Horgen

The gas field Snøhvit (Snow White) north of Norway will start its production next year. We have developed a tactical planning model for Statoil where we consider both the production and storages close to Snøhvit and the transportation of LNG (liquefied natural gas) to terminals in Europe and America. The underlying mathematical model is an integrated inventory management and ship scheduling model, where spot trade is included in the model. It is solved by use of standard optimization software.

2 - Robust Models for Tank Container Repositioning
Martin Savelsbergh, Georgia Institute of Technology, School of Ind and Sys Engineering, Georgia Institute of Technology, Atlanta, GA, 30332, United States, mwps@isye.gatech.edu, Alan Erera, Juan Morales

Tank containers are a safe and cost-effective way to transport liquid chemical products globally. To cost-effectively serve customer demands which are by nature geographically and temporally imbalanced, tank fleet operators utilize asset repositioning models. We develop new weekly repositioning models that determine robust plans given uncertain customer requests but do not rely on probabilistic information.

3 - Marine Inventory Routing
David Ronen, Professor, University of Missouri-St. Louis, College of Business Administration, One University Place, St. Louis, MO, 63121, United States, david.ronen@umsl.edu

Marine inventory routing problems are faced by oil and chemical companies and other manufacturers of large quantities of liquid bulk products. This presentation will: (1) characterize the marine inventory routing problem, (2) Differentiate it from the familiar inventory routing problem, (3) provide classification of marine inventory routing problems, (4) review the limited research done in this area, and (5) identify areas where additional research has large potential leverage.

4 - Optimization and Logistics of Combined Marine Transportation/Inventory Systems
Marco Duran, ExxonMobil Research & Engineering, 1545 Route 22 East, Annandale, NJ, 08801, United States, marco.a.duran@exxonmobil.com, Lifei Cheng

We present a decision support framework, based on the integration of discrete event simulation and stochastic optimal control, for the optimization and logistics of combined marine transportation/inventory systems. We apply the approach to a complex and large-scale world-wide crude oil marine transportation problem. We formulate the problem as a Markov decision process. Near-optimal control policies are obtained using approximate methods based on Dynamic Programming principles.

■ SB11

P-Governor's Square 9

Algorithm Issues in Dynamic Traffic Assignment

Sponsor: Transportation Science & Logistics
Sponsored Session

Chair: Henry Liu, Assistant Professor, Utah State University, Civil and Environmental Engr., 4110 Old Main Hill, Logan, UT, 84322, United States, xliu@cc.usu.edu

1 - Quasi-Variational Inequality Formulation for the Dynamic Network User Equilibrium Problem
Jeff Ban, Ph.D Student, University of Wisconsin at Madison, United States, ban@cae.wisc.edu, Henry Liu, Bin Ran

In this paper, we formulate path-based discrete-time Dynamic User Equilibrium Problem with quasi-variational inequalities (QVI). The solution procedure with the QVI formulation is outlined and its sub-problem by temporarily relaxing the dynamic flow propagation constraints is derived. This relaxed sub-problem is further formulated as a finite-dimensional nonlinear complementarity problem (NCP). Finally, an illustrative example is presented.

2 - Embedding Micro-simulation with Equilibrium Traffic Assignment
Henry Liu, Assistant Professor, Utah State University, Civil and Environmental Engr., 4110 Old Main Hill, Logan, UT, 84322, United States, xliu@cc.usu.edu, Anthony Chen, Pitu Mirchandani, Wenteng Ma

To achieve more realistic traffic assignment for the urban network, we embed microscopic traffic simulation model Paramics as the network loading tool in the equilibrium traffic assignment. Link travel times with turn penalties are obtained from the micro-simulation instead of using the link performance functions. The qualitative improvement of the proposed approach comparing with the conventional static traffic assignment method is validated with a real-life traffic network.

3 - Findings in Evacuation Route Choice Decision and Optimal Real-Time Evacuation Strategies
Yi-Chang Chiu, Assistant Professor, Department of Civil Engineering, 500 W. University Ave., University of Texas at El Paso, El Paso, TX, 79968, United States, chiu@utep.edu, Pitu Mirchandani, Pavan Korada

We discuss an evacuation modeling, solution procedure and simulation experiments under flooding scenarios. Of particular focus is the system performance degradation resulted from individual route choice decision deviating from the optimal solution, and the real-time pre-trip and en-route control schemes to influence the system toward optim um under the behavioral setting.

■ SB12

P-Governor's Square 10

Crossdocking

Sponsor: Transportation Science & Logistics
Sponsored Session

Chair: Kimberly Ellis, Associate Professor, Virginia Tech, Industrial and Systems Engineering, 250 Durham Hall (0115), Blacksburg, VA, 24060, United States, kpellis@vt.edu

1 - Door Allocation at Intermediate Consolidation Terminals of LTL Carriers
Feng-Tien Yu, Assistant Professor, Department of Logistics Management, National Kaohsiung First University of Science and Technology, 2, Juoyue Rd., Nantz District, Kaohsiung, Kaoshiung, 811, Taiwan, vincent@ccms.nkfust.edu.tw, Katta Murty, Dushyant Sharma

This paper deals with the door allocation problem that is common to LTL carriers that move freight through a hub-and-spoke transportation network. We developed an on-line approach for allocating doors to arriving inbound trailers. Using this we developed approaches for allocating doors to destinations that help to minimize the expected man-hours for consolidating freight daily. Computational results indicate that the man-hour requirement can be reduced by over 20% compared to current practice.

2 - Staging Strategies for Unit-Load Crossdocking
Kevin Gue, Associate Professor, Department of Industrial & Systems Engineering, Auburn University, Auburn, AL, 36849, United States, kevin.gue@auburn.edu

Crossdocks in the retail and transportation industries stage freight on the dock to facilitate dense loading of trucks, to price or check shipments, to ensure shipment integrity, and so on. We discuss several staging strategies found in practice and describe a Markov model of throughput capacity for a strategy popular in retail crossdocks.

3 - Equipment Matching and Balancing for an Express Package Network
Amy Cohn, University of Michigan, 2797 IOE Building, 1205 Beal Avenue, Ann Arbor, MI, 48109-2117, United States, amycohn@umich.edu

We consider the integration of two important planning problems for express package networks — load matching and equipment balancing. We present models and algorithms to address this challenging combinatorial problem.

4 - Improving Hub Operations in a Less-than-Truckload Freight Distribution Network
Kimberly Ellis, Associate Professor, Virginia Tech, Industrial and Systems Engineering, 250 Durham Hall (0115), Blacksburg, VA, 24060, United States, kpellis@vt.edu, Amy Brown

The performance of a less-than-truckload (LTL) distribution network is highly dependent on the speed and accuracy of the hub operations. The focus of this research effort is to improve hub operations in order to reduce costs and increase service performance levels. Specifically, new approaches are investigated for assigning trailers to dock doors and sequencing the unloading of freight shipments at hubs. The solution approaches are evaluated in an industry case study.

■ SB13

P-Governor's Square 11

OR Applied to Railroads I

Sponsor: Railroad Applications
Sponsored Session

Chair: Krishna Jha, Research Director, Innovative Scheduling Systems, 2153 SE Hawthorne Rd, Suite 128, Gainesville, FL, 32641, United States, kcjha@ufl.edu

1 - Algorithms for Optimizing Rail Yard Operations
Guvenc Sahin, United States, guvencs@ufl.edu

Yards are the nerve centers of any railroad where inbound trains bring blocks, blocks are reclassified and loaded onto the outbound trains. Efficient yard operations can improve the throughput of any yard. In this presentation, we describe new algorithmic approaches for optimizing yard operations that can be used for planning as well as real-time scheduling.

2 - Classification Yard Simulation
Edwin R "Chip" Kraft, Director, Operations Planning, Transporation Economics + Management Systems, Inc., 116 Record St, Frederick, Md, 21701, United States, ckraft@temsinc.com

SWITCH-IT is a new interactive tool for simulating railroad hump and flat-switching yards. It can evaluate the impact of infrastructure modifications, train crew size, freight car inspection and repair policies, and switch engine performance on the overall productivity and effectiveness of the car classification process. SWITCH-IT animates car and train movements, color-coding cars by destination so yard operating strategies can easily be understood and communicated.

3 - Data Envelopment Analysis of Railyard Efficiency
Michael Gorman, Professor, Univerisity of Dayton, School of Business, Dept of MIS/OM/DSC, 300 College Park, Dayton, OH, 45469, United States, Michael.Gorman@notes.udayton.edu

Data Envelopment Analysis (DEA) is a well-tested and wide spread methodology for evaluating the relative efficiencies of similar production units. For examples, it has been used in education (schools and districts), banking (branches), and utilities (power plants) to name a few applications. We describe the methodology and explore the application of DEA to railyards using data from Burlington Northern Santa Fe and discuss the applicability of the method to railyards.

■ SB14

P-Governor's Square 14

Organizational Learning and Knowledge Management-II

Sponsor: Technology Management
Sponsored Session

Chair: Charles Weber, Assistant Professor, Portland State University, P.O. Box 751, Portland, OR, 97207, United States, charles.weber@etm.pdx.edu

1 - Organizational Learning Curves for Customer Dissatisfaction: Heterogeneity across Airlines
Michael Lapré, Vanderbilt University, Owen Graduate School of Management, 401 21st Avenue South, Nashville, TN, 37203, United States, michael.lapre@owen.vanderbilt.edu, Nikos Tsikriktsis

Does customer dissatisfaction follow a learning-curve pattern? With complaint data against the 10 major US airlines, we test H1: complaint rates follow a U-shaped function of experience, H2: focused airlines learn faster to reduce complaint rates than full-service airlines, and H3: organizational learning curves for complaint rates are heterogeneous across airlines. H1 and H3 are supported, H2 is rejected. We extend a knowledge-based view of managing learning curves from factories to airlines.

2 - An Empirical Test of the Value of Focus in Developing and Implementing Improvement Projects
Ingrid Nembhard, Doctoral Candidate, Harvard University, Morgan Hall T-20, Soldiers Field Road, Boston, MA, 02163, United States, inembhard@hbs.edu, Anita Tucker, Amy Edmondson, Richard Bohmer, Laura Feldman

We present data from 23 neonatal intensive care units (NICUs) that collaboratively developed 93 guidelines for improving care in one of seven areas (i.e. infection, pain control, etc.). We examine speed of implementation—how fast the NICUs changed their practices in accordance with these guidelines. Specifically, we test whether focus—undertaking fewer changes or limiting changes to a targeted area—resulted in faster implementation, controlling for organizational factors such as leadership.

3 - Orchestrated Learning in Highly Differentiated Organizations
Charles Weber, Assistant Professor, Portland State University, P.O. Box 751, Portland, OR, 97207, United States, charles.weber@etm.pdx.edu

An empirically grounded model of the VLSI circuit manufacturing lifecycle indicates that organizational performance constitutes a delayed reward for prolonged continuous improvement efforts, which occur at the subsystem level and are not reflected in organization-level metrics. By coordinating the activities of subsytems, organizations can orchestrate timed, punctuated surges in organizational performance, which tend to occur years after they have been planned.

■ SB15

P-Governor's Square 15

Recent Advances for Mining Business Data

Cluster: Data Mining and Knowledge Discovery
Invited Session

Chair: Nick Street, Associate Professor, University of Iowa, S232 Pappajohn Business Bldg, Iowa City, IA, 52242, United States, nick-street@uiowa.edu

1 - Learning to Rank
Nick Street, Associate Professor, University of Iowa, S232 Pappajohn Business Bldg, Iowa City, IA, 52242, United States, nick-street@uiowa.edu, Kaan Ataman

Many classifiers return a score, allowing the user to rank examples by probability of membership in the positive class. However, the underlying optimization problem typically maximizes classification accuracy. We develop an LP formulation similar to SVMs that directly maximizes correct relative rankings, or equivalently, the area under the ROC curve.

2 - Ensemble Optimization via Semi-definite Programming
Yi Zhang, University of Iowa, Iowa City, IA, 52242, United States, yi-zhang-2@uiowa.edu, Nick Street, Samuel Burer

A classification ensemble is a group of classifiers that work together to accomplish a classification task. There is evidence that a subset of classifiers may sometimes outperform the whole set. We propose an algorithm that formulates the subset selection as a semi-definite programming problem whose objective is to maximize both the strength and the diversity of the selected ensemble. Computational results on a variety of datasets will be presented.

3 - Discovering Quantitative Rules Using Data Mining
Balaji Padmanabhan, Assistant Professor, The Wharton School, 561 Jon M Huntsman Hall, 3730 Walnut Street, Philadelphia, PA, 19104, United States, balaji@wharton.upenn.edu, Hong Zhang

There are several data mining approaches for learning rules. We study statistical quantitative rules, in which the right hand side (RHS) of the rule can be any statistic computed for the LHS of the rule - a powerful extension of the rules considered before. We present a non-parametric approach based on resampling for learning all significant SQ rules. We apply our methods to learning significant market share rules from online consumer purchase data and financial data and report the results.

4 - Information Acquisition for Decision Making Under Uncertainty.
Maytal Saar-Tsechansky, Assistant Professor, University of Texas, CBA 3.216, Austin, TX, United States, Maytal.Saar-Tsechansky@mccombs.utexas.edu

Businesses increasingly take advantage of predictive modeling thereby influence repetitive decisions for which relevant data can be gathered. While predictions can be improved with more feedback, obtaining the necessary information comes with a cost. Research in Active Learning studies the selective acquisition of labels for inductive model building. I discuss and demonstrate new active learning methods that improve decision-making for a given cost.

■ SB16

P-Governor's Square 17

XML and Web Services in Optimization

Sponsor: Computing Society
Sponsored Session

Chair: Leo Lopes, University of Arizona, 1127 E North Campus Drive, Tucson, AZ, 85721, United States, leo@sie.arizona.edu

1 - Optimization in Distributed Applications: Provide Web-Based Services with XML/SOAP
Bjarni Kristjansson, President, Maximal Software, Inc., 2111 Wilson Boulevard, Arlington, VA, 22201, United States, bjarni@maximalsoftware.com

In this presentation we will explore how innovative new technologies, such as XML and SOAP, are creating new opportunities for solving optimization problems within distributed applications. We will demonstrate how optimization and modeling services can be packaged into component libraries based on industry standards such as ActiveX/Com and JavaBeans. This allows seamless integration of optimization into easily maintainable applications.

2 - Algebraic Modeling Systems and XML Technologies
Kipp Martin, Graduate School of Business, University of Chicago, 1101 East 58th Street, Chicago, IL, 60637, United States, kipp.martin@gsb.uchicago.edu

We describe four scenarios for incorporating XML technologies into algebraic modeling languages and systems. They are: 1) instance representation, 2) model representation, 3) using XPath to query raw XML data, and 4) using XPath and XQuery as an algebraic modeling language. We discuss the advantages and disadvantages of each with particular emphasis on scenario four.

3 - Building Optimization Web Services with the Elsinore Framework
Obi Ezechukwu, United Kingdom, oce@doc.ic.ac.uk

Existing model representation formats are unsuitable for Internet distributed computing architectures, due not only to their syntax but also to limited degrees of portability. This paper describes the Elsinore framework, which is an XML based framework that enables the encoding of models, instance data and solution information in XML. It illustrates the role of the framework's components, specifically its constituent markup languages AML and ORML, in the creation of optimization web-services.

4 - A Unified XML-Based Framework for Optimization Services
Jun Ma, Northwestern University, Dept of Industrial Eng & Mgmnt Sciences, Evanston, IL, 60208-3119, United States, maj@northwestern.edu, Robert Fourer, Kipp Martin, Leo Lopes

We introduce a general design for "Optimization Services", an XML-based architecture intended as a unified framework for next-generation optimization systems. Through standardization of optimization representation, communication, discovery, and registration, this framework provides an open infrastructure for all modeling system components, including modeling languages, optimization servers, clients, interfaces, analyzers, solvers and function simulators.

■ SB17

P-Directors Row E

Decision Analysis: Foundations, Theory, and Practice

Sponsor: Decision Analysis
Sponsored Session

Chair: Ali Abbas, Stanford University, Dept. of Mgmt Science and Engineering, Terman Engineering Center, Stanford, CA, 94305, United States, aliabbas@stanford.edu

1 - Attribute Dominance Utility (ADU)
Ali Abbas, Stanford University, Dept. of Mgmt Science and Engineering, Terman Engineering Center, Stanford, CA, 94305, United States, aliabbas@stanford.edu, Ronald A. Howard

We present an analogy between joint cumulative probability and a class of multi-attribute utility functions, which we call attribute dominance utility (ADU). This class uses marginal-conditional assessments or the method of copulas to incorporate utility dependence. Furthermore, we show that any utility function can be decomposed into ADU. We introduce the notion of utility inference analogous to Bayes' rule for probability and a graphical representation of ADU, which we call utility diagrams.

2 - Reflections on the Foundations of Decision Analysis
Ronald A. Howard, Stanford University, Terman Engineering Center, Stanford, CA, United States, rhoward@stanford.edu

Decision analysis arose from three foundations: the dynamic systems methodology of systems engineering developed in the years following the second world war, the theory of making decisions under uncertainty that dates back to Bernoulli in 1738, and the understanding that probability characterizes a person's information developed by Bayes, Laplace, Cox, and Jaynes.

3 - The Evolution of Decision Analysis: Now on the World-Wide Web
James Matheson, Chairman and CFO, SmartOrg Inc., 855 Oak Grove Avenue, Suite 202, Menlo Park, CA, 94025, United States, jmatheson@smartorg.com

In the 1960's, much of the effort of a decision analysis application was building a decision evaluation model either by submitting punched cards to a large mainframe computer or communicating with a ìmodernî a time-shared computer system. Today, web-based systems evaluate sophisticated decision models as quickly as the inputs can be entered. This paper will present the characteristics the made this evolution possible and the conditions required for maintaining quality in the new environment.

■ SB18

P-Directors Row H

Appraisal of Graduate Decision Programs

Sponsor: Decision Analysis
Sponsored Session

Chair: Ralph Keeney, Fuqua School of Business, Duke University, Durham, NC, 27708, United States, keeney@duke.edu

1 - Appraisal of Graduate Decision Programs
Ralph Keeney, Fuqua School of Business, Duke University, Durham, NC, 27708, United States, keeney@duke.edu, Detlof von Winterfeldt, Kelly See

The Decision Analysis Society sponsored this inventory and appraisal of both prescriptive and descriptive graduate decision programs at U.S. universities. We present the motivation for the study, the definition and selection of decision programs, the criteria used for appraisal, the information collection, development of the evaluation function for appraisal, the peer review, and the results.

■ SB19

P-Directors Row F

Tutorial: Operations Research Problems in Data Analysis

Sponsor: Artificial Intelligence
Sponsored Session

Chair: Peter L. Hammer, Director of RUTCOR, Rutgers University, 640 Bartholomew Road, Piscataway, NJ, 08854, United States, hammer@rutcor.rutgers.edu

1 - Methodology and Applications of LAD
Peter L. Hammer, Director of RUTCOR, Rutgers University, 640 Bartholomew Road, Piscataway, NJ, 08854, United States, hammer@rutcor.rutgers.edu

We plan to describe the basic steps of LAD (identification of cut points, binarization of variables, pattern generation, model formation, validation) and algorithms for carrying them out. We shall describe several real-life applications of LAD to a variety of areas, including biomedical problems (risk stratification in cardiology, ovarian cancer detection), productivity evaluation, investment risk assessment, and text mining.

2 - Algorithmic Aspects of LAD
Endre Boros, Professor of Operations Research, RUTCOR, Rutgers University, 640 Bartholomew Road, Piscataway, NJ, 08904, United States, boros@rutcor.rutgers.edu

We survey several mathematical/algorithmic issues related to the Logical Analysis of Data (LAD). In particular we shall present various models and algorithms for feature generatin/selection and also for pattern generation.

■ SB20

P-Room 3304

Resource Planning in Health Care

Sponsor: Health Applications
Sponsored Session

Chair: Murray Côté, Assistant Professor, University of Florida, Dept. of Health Services Admin., Gainesville, FL, 32610-0195, United States, mjcote@phhp.ufl.edu

1 - Taxonomy of Hospital Efficiency Studies Using Data Envelopment Analysis
Liam O'Neill, Assistant Professor, Cornell University, Policy Analysis & Mgmt. Dept., Ithaca, NY, 14853, United States, lo22@cornell.edu, Markus Kraus, Marion Rauner, Kurt Heidenberger

This paper provides the first taxonomy of hospital efficiency studies that use DEA and related techniques. A cross-cultural comparison reveals significant differences across countries. Compared with US studies, European studies were more likely to measure allocative as well as technical efficiency, use longitudinal data, and use fewer observations.

2 - Optimal Location-Allocation for the VA using Simulated Annealing
Siddhartha Syam, Associate Professor, Marquette University, Management Department, Milwaukee, WI, 53201-1881, United States, syams@mu.edu, Murray Côté

The goals of this research are to (a) identify the ideal hospitals in which to locate the Veteran's Administration's facilities for the treatment of traumatic brain injuries (TBI) and (b) determine the optimal allocation of patients to the various facilities. The primary methodology employed is Simulated Annealing. Many real-world factors such as patient retention rates, various degrees of de-centralization, market share constraints, and economies of scale are included.

3 - Emergency Department Demand and Capacity Matching
Murray Côté, Assistant Professor, University of Florida, Dept. of Health Services Admin., Gainesville, FL, 32610-0195, United States, mjcote@phhp.ufl.edu, Elif Akcali, Dave Eitel, Chin-I Lin

Successful management of emergency department (ED) throughput is highly dependent upon the ED's capacity and the overall capacity of its hospital. For capacity planning, the ED requires predictions of demand, classification of demand by triage level, and preparation of the ED's resources to satisfactorily meet demand. We analyze these issues with respect to an ED in York, Pennsylvania.

■ SB21

P-Room 3302

Economics

Contributed Session

Chair: Manel Baucells, IESE Business School, Ave. Pearson 21, Barcelona, Spain, mbaucells@iese.edu

1 - The Role of Telecommunications Infrastructure in Regional Economic Growth of China

Lei Ding, School of Public Policy, George Mason University, 10404 Vineyard LN 132, Fairfax, VA, 22030, United States, lding@gmu.edu

With a sample of 29 regions for the period 1986-2002, this paper uses a dynamic fixed effects model for estimation, which allows us to test the relationship between regional economic growth and initial economic conditions and telecom infrastructure in China. The results show that telecom is both statistically significant and positively correlated to regional economic growth in China. The results further indicate that the telecom investment is subject to diminishing returns.

2 - A Field Study of Stakes, Frequency, Domain, and Framing in Decisions under Uncertainty

Manel Baucells, IESE Business School, Ave. Pearson 21, Barcelona, Spain, mbaucells@iese.edu, Cristina Rata

Our survey analysis of 261 real decisions suggests that the sum of frequent and small decisions amount to more than less frequent and more important decisions. Framing and domain have a strong influence on the probability of taking risks. Whether the decision is monetary or not does not seem to influence risk attitudes, which is similar across groups.

■ SB22

P-Room 3312

Location Modeling II

Sponsor: Location Analysis

Sponsored Session

Chair: Zvi Drezner, Professor, California State University-Fullerton, Dept of Info. Systems and Decision Sci., Langsdorf Hall 540, Fullerton, CA, 92834, United States, zdrezner@fullerton.edu

1 - A Branch-and-Bound Algorithm for the Generalized Quadratic Assignment Problem

Peter Hahn, Adjunct Associate Professor, University of Pennsylvania, 2127 Tryon Street, Philadelphia, PA, 19146, United States, hahn@seas.upenn.edu, Bum-Jin Kim, Thomas Hildebrandt

The Generalized Quadratic Assignment Problem (GQAP) describes a broad class of integer programming problems, wherein M inter-related entities are assigned to N destinations, constrained by the destinations' ability to accommodate them. We present recent branch-and-bound results on a variety of problem instances and discuss improvements in our algorithm using sub-gradient optimization for achieving lower bounds on the Generalized Linear Assignment Problem; a step in calculating GQAP lower bounds.

2 - Optimal Location Problem for Urban Emergency Vehicles with Continuous-time Markov Chain

Keisuke Inakawa, Mr, Nanzan University, 27 Seirei-cho, Seto, AC, 4890863, Japan, d02bb002@nanzan-u.ac.jp, Atsuo Suzuki

This paper gives a model where emergency vehicles cooperate in responding to service calls from the public in a city. In the model, each service call is processed by the nearest idle vehicle. We construct a continuous-time Markov chain model. The objectives we are interested in are both call loss probability and expected response time. As an example of application, we apply the model to the ambulance system of Seto city in Japan which has 4 ambulances, and we decide the optimal home locations.

3 - A Comparison of Four Covering Models for Ambulance Location

Erhan Erkut, Professor, University of Alberta School of Business, School of Business, 3-40G Business Building, Edmonton, Canada, T6G 2R6, Canada, erhan.erkut@ualberta.ca, Armann Ingolfsson, Thaddeus Sim

We compare the maximum covering location model to the maximum expected covering location model and two other recent models that take into account variability in travel times. We report the results of an empirical comparison using data from Edmonton.

4 - The Multi-purpose Trip Location Problem on Networks

Rongbing Huang, Mr., University of Toronto, Rotman School of Management, 105 St. George St., Toronto, ON, M5S 3E6, Canada, huang@rotman.utoronto.ca, Oded Berman

The problem of locating facilities that serve customers who may visit several facilities in a single trip is studied. For the minisum problem, we prove that there exists a dominating location set on a general network. We also study the problem of maximizing total coverage when multi-purpose trip is presented.

■ SB23

P-Room 3354

Probabilistic and Combinatorial Methods in Military Applications

Sponsor: Military Applications

Sponsored Session

Chair: Don Grundel, AFRL/MNGN, 101 W Eglin Blvd, Ste 331, Eglin AFB, FL, United States, don.grundel@eglin.af.mil

1 - Coupled Detection Rates and Time to Engage

Myungsoo Jun, UF GERC, 1350 N. Poquito Road, Shalimar, FL, 32579-1163, United States, mjun@gerc.eng.ufl.edu, David Jeffcoat

We consider a particular type of system interaction, called cueing, by which we mean any information that provides focus to a search. The effect of cueing is derived using a Markov chain analysis and convergence properties are examined. We also provide a bound of convergence rates without explicitly computing matrix exponentials.

2 - Markov Possibility Models

Henry Pfister, AFRL/MNGN, 101 W Eglin Blvd, Ste 331, Eglin AFB, FL, 32542, United States, pfister@eglin.af.mil

Markov possibility models extend classic Markov chain models to include a unique measure of uncertainty. Replacement of the transition probability in a Markov chain with a possibility measure leads to a new set of steady state solutions. Equipment replacement is analyzed using this model. This larger set of decision models allows for more realistic modeling of complex stochastic systems. Applications include power grids, transportation networks, production planning, and military operations.

3 - Local Search for the Multidimensional Assignment Problem

Lewis Pasiliao, AFRL/MNGN, 101 W Eglin Blvd, Ste 331, Eglin AFB, FL, 32542, United States, pasiliao@eglin.af.mil

The Multidimensional Assignment Problem (MAP) is an extension of the two-dimensional assignment problem. Although the two-dimensional assignment problem has been shown to be solvable in polynomial time, extending the dimensions to three makes the problem NP-complete. The MAP has many practical applications including the data association for the multisensor multitarget problem. This work investigates k-exchange local search neighborhoods.

■ SB24

P-Room 3402

Project Management

Contributed Session

Chair: Matthew Liberatore, Professor, Villanova University, 800 Lancaster Avenue, Villanova, PA, 19085, United States, matthew.liberatore@villanova.edu

1 - An Adjustment to the Linear Programming Solution of the Cost/Time Trade-off Problem for CPM

John Moussourakis, Rider University, 2083 Lawrenceville Rd, Lawrenceville NJ, United States, moussourakis@rider.edu, Cengiz Haksever

The linear programming model has been proposed in the literature for the solution of small or intermediate size CPM project networks.However,this model does not guarantee that the pertinent activity analysis estimates(ES,LS,etc) will be computed correctly for activities outside the critical path.In this paper we propose an adjustment to the model to alleviate this shortcoming.

2 - On Multiple Resource Allocation in Project Management

Carlton` Scott, UCI, GSM, Irvine, United States, chscott@uci.edu, Thomas Jefferson

In this paper, we assume that the activity duration is a function of multiple resources and that a finite amount of each resource is available for distribution over the entire project. The objective is to allocate multiple resources to each activity so that the critical path is as short as possible. We formulate this problem as a minimax mathematical program, which reduces to a geometric program.

3 - An Effective Heuristic for the Stochastic Time-cost Trade-off Problem

Gary Mitchell, Ph.D Candidate, University of Washington, Box 353200, Seattle, WA, 98195-3200, United States, gfmitch2@u.washington.edu, Ted Klastorin

We consider the project time-cost trade-off problem with stochastic task durations from a project planning perspective. We develop a model that assumes an inverse relationship between resource allocation and expected task durations as well as tardiness and earliness costs. We develop and, using a numerical example, describe an effective heuristic for this problem.

4 - Reducing Project Completion Time by Removing Precedence Relationships
Matthew Liberatore, Professor, Villanova University, 800 Lancaster Avenue, Villanova, PA, 19085, United States, matthew.liberatore@villanova.edu, Bruce Pollack-Johnson

The traditional approach to reducing project completion time has been to shorten the time required for performing a particular activity, often called crashing. We propose the addition of a second method: removing precedence relationships. We present an approach for reducing project completion time that considers both crashing and the removal of precedence relationships. A mathematical programming formulation and heuristics for the standard time-cost problem are appropriately extended.

■ SB25

P-Room 3404

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

Sponsor: Education (INFORM-ED) SPONSORED/INVITED
Sponsored Session

Chair: Christopher J. Zappe, Bucknell University, 113 Marts Hall, Lewisburg, PA, 17837, United States, zappe@bucknell.edu

1 - Fifth Annual INFORMS Case Competition,

The four finalists for the 2004 INFORMS Case Competition will deliver final presentations of their cases to a panel of judges and the audience. All are welcome to attend and observe these presentations as well as to ask questions of the finalists. The winner of the competition will be selected by the judges at the end of the four presentations. The winner and runners-up will be announced at the INFORM-Ed Annual Business Meeting in Denver.

■ SB26

P-Room 3412

Material Planning and Inventory Control

Cluster: Stochastic Models for Manufacturing Systems
Invited Session

Chair: Ananth Krishnamurthy, Assistant Professor, Rensselaer Polytechnic Institute, Dept. of DSES, 110 8th Street, Troy, NY, 12180, United States, krisha@rpi.edu

1 - Using Mean Value Analysis (MVA) to Set Card Levels for CONWIP in a Multiproduct Manufacturing System
Rajan Suri, Professor, University of Wisconsin, Center for Quick Response Manufacturing, 1513 University Avenue, Madison, WI, 53706, United States, suri@engr.wisc.edu, Rahul Shinde

CONWIP has been introduced as an alternative to kanban for production control in manufacturing. CONWIP uses production cards for material control along each routing. In systems with different routings, only heuristic techniques have been used for setting the number of cards for each routing. By combining Mean Value Analysis (MVA) with nonlinear programming we can determine the number of cards needed for each route in order to achieve production targets for all products exactly.

2 - E-POLCA to Control Multi-product, Multi-machine Job Shops
Diederik Claerhout, University of Antwerp, Prinsstraat 13, Antwerp, 2000, Belgium, diederik.claerhout@ua.ac.be, Nico Vandaele

We propose a supporting framework for the new material control system Paired-cell Overlapping Loops of Cards with Authorization (POLCA), which combines the advantages of push systems and pull systems. In our load based version of the POLCA system, we rely on a multi-product, multi-machine queueing network to determine release authorizations and allowed workloads. We report on our experiences in a metal shop of Dana Corporation. They are implementing an POLCA system without paper based cards.

3 - Production and Inventory Control Strategies for Multi-product Systems with Shared Resources
Ananth Krishnamurthy, Assistant Professor, Rensselaer Polytechnic Institute, Dept. of DSES, 110 8th Street, Troy, NY, 12180, United States, krisha@rpi.edu, Kumar Satyam

We study a manufacturing system producing multiple products using one or more shared resources. We analyze the underlying queuing models using parametric decomposition techniques to determine how system configuration, variability in demand and processing times influence the tradeoffs with respect to throughput, inventory, and service levels.

4 - Push-Pull Production Planning
David Yao, United States, yao@ieor.columbia.edu, Yingdong Lu, Feng Cheng, Grace Lin, Markus Ettl

We study a manufacturing system with a Build-to-Plan (Push) process in the first stage of production and followed by an Assembly-to-Order (Pull) process. We present a nonlinear optimization model to minimize the total manufacturing cost subject to the service level and the capacity constraints. Efficient algorithms are developed by exploring the structure of the problem formulation with numerical analyses showing the performance improvement over the “as is” production-smoothing strategy.

■ SB27

P-Room 3454

The Cross-Entropy Method for Monte-Carlo Simulation

Sponsor: Applied Probability
Sponsored Session

Chair: Dirk Kroese, University of Queensland, Department of Mathematics, Brisbane, Australia, kroese@maths.uq.edu.au

1 - Importance Sampling of Large-scale Markov Chains using Cross-entropy
Ad Ridder, Vrije Universiteit Amsterdam, de Boelelaan 1105, Amsterdam, NL, 1081HV, Netherlands, aridder@feweb.vu.nl

We consider rare events in Markov chains that model stochastic systems such as reliability or queueing systems, and we assume that the state space is too large for exact calculation of the probabilities by solving the associated linear equations. We investigate the alternative approach of probability estimation through simulations, where we apply adaptive importance sampling using the cross-entropy method for obtaining asymptotically optimal variance reductions.

2 - The Cross-Entropy Method for Network Reliability Estimation
Dirk Kroese, University of Queensland, Department of Mathematics, Brisbane, Australia, kroese@maths.uq.edu.au

Consider a network with unreliable links. Estimating the reliability of the network (expressed as the probability that certain nodes in the network are connected) is difficult. We explain how the Cross-Entropy (CE) method can be used to obtain more efficient network reliability estimation procedures. Three techniques of estimation are considered: Crude Monte Carlo (CMC), Permutation MC and the Merge Process. We show that the CE method yields a speed-up over all three techniques.

3 - The Transform Likelihood Ratio Method for Rare Event Simulation with Heavy Tails
Reuven Rubinstein, Technion, Israel Institute of Technology, Haifa, Israel, ierrr01@ie.technion.ac.il, Dirk Kroese

We present a novel method, called the transform likelihood ratio (TLR) method, for estimation of rare event probabilities with heavy-tailed distributions. We present various simulation results which support the efficiency of the TLR method.

■ SB28

P-Room 3504

Monitoring and Diagnosis for Engineering Systems with Complex Topologies

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: Shiyu Zhou, Assistant Professor, University of Wisconsin - Madison, 1513 University Ave., Madison, WI, 53706, United States, szhou@engr.wisc.edu

1 - Robust Estimation for Sensor Network with Potential Sensor Failures
Jung Jin Cho, Texas A&M University, Dept of Industrial Engineering, College Station, TX, 77843-3131, United States, jjcho@neo.tamu.edu, Yu Ding

Sensor innovations enable manufacturers to distribute redundant sensors in manufacturing processes for monitoring, detection, and diagnosis. The large number of sensor in a distributed sensor system presents a high probability that at least some sensors may malfunction. Abnormal sensor readings can cause frequent false alarms and jeopardize productivity. This paper presents a robust estimation procedure that will automatically identify the observations related to suspected sensor failures.

2 - Sequential Root Cause identification through Refined Multistage Process Model
Qiang Huang, Assistant Professor, University of South Florida, 4202 E. Fowler Ave. ENB118, Tampa, FL, United States, huangq@eng.usf.edu, Hui Wang

When different error sources could generate same error pattern on product features, root cause identification is complex, especially in multistage manufacturing processes. This study proposes ìequivalent errorî concept and modeling procedure to transform multiple error sources into equivalent single source. Then a sequential root cause identification procedure is proposed, i.e., identifying equivalent error components first, and distinguishing different error sources in those components.

3 - Variation Source Identification for Complex Manufacturing Processes Based on Common Eigenspace
Shiyu Zhou, Assistant Professor, University of Wisconsin - Madison, 1513 University Ave., Department of Industrial Engineering, Madison, WI, 53706, United States, szhou@ie.engr.wisc.edu, Nong Jin

This paper presented a data-driven variation source identification method for complex manufacturing processes based on the analysis of the covariance matrix of process quality measurements. The identification procedure utilizes the fact that the eigenspace of the quality measurement covariance matrix can be decomposed into a subspace due to variation sources and a subspace purely due to system noise. A testing procedure and a case study are presented.

4 - Feature Extraction and Classification for Network Intrusion Detection
Xuejun Zhu, Systems and Industrial Eng, University of Arizona, Tucson, AZ, 85721, United States, xzhu@email.arizona.edu, Jionghua (Judy) Jin

Network intrusion detection is a very challenging problem due to the high dimensional data and complex data structure of various intrusion characteristics. A new feature extraction and classification method is developed by integrating the genetic algorithm and LS-SVM learning algorithm. A case study is used to demonstrate the effectiveness of the methodology and implementation procedures.

■ SB29

P-Room 3502

Forestry Session - Fire Applications I

Cluster: Forestry Applications
Invited Session

Chair: Jeffrey Prestemon, USDA Forest Service, Southern Research Station, Forestry Sciences Lab, Research Triangle Park, NC, 27709, United States, jprestemon@fs.fed.us

1 - Minimum Spanning Trees and Multiobjective Optimization for Smart Growth Land Development Planning
Jose A. Faria, Ph.D Candidate, University of Maryland, Dept. of Civil & Env. Eng., College Park, MD, 20742, United States, josefaria@compuserve.com, Steve Gabriel, Glenn E. Moglen

A new multiobjective optimization formulation applied to land development that takes into account the concerns of stakeholders with competing objectives and constraints related to growth in certain zonal classes among other restrictions. Minimum spanning trees (MST's) are used to measure the extent of infrastructure that a planner might want to minimize. The use of embedding MSTs into Smart Growth is novel, we provide some recent results and a proposed methodology to efficiently find solutions.

2 - Managing Forest Fire Risk with Effective Fuels Treatment Design at the Landscape Scale
Michael Bevers, USDA Forest Service, Rocky Mountain Research Station, 2150A Centre Avenue, Suite 361, Fort Collins, CO, 80526, United States, mbevers@fs.fed.us, Brian Kent, Carol Raish

Forest fire managers are faced with the difficult task of choosing, from sets of suitable fuel treatments for each stand, the combination of treatments across a landscape that provides the greatest protection to the values at risk given a limited fuels treatment budget. We describe an approximate chance-constrained optimization approach to address this problem for large-scale landscapes. We report results for some hypothetical test cases.

3 - Optimizing the Placement and Scheduling of Fuel Removals
John Hof, USDA Forest Service, Rocky Mountain Research Station, 2150A Centre Ave., Suite 361, Fort Collins, CO, 80526, United States, jhof@fs.fed.us

This presentation will explore optimization options for placing and scheduling fuel removals. Creating and maintaining a pre-specified set of forest conditions is a difficult problem because it is intrinsically nonlinear. I will also look at methods for capturing spatial relationships suggested by fire behavior, which is also difficult because fire origins and behavior are quite random. I outline an approach to managing this uncertainty based on spatial diversification.

4 - Spatial Arrangement of Fuel Treatments with Budget, State Treatment Allocation, and WUI Constraints
Jeffrey Prestemon, USDA Forest Service, Southern Research Station, Forestry Sciences Lab, Research Triangle Park, NC, 27709, United States, jprestemon@fs.fed.us, Karen Abt, Robert Huggett, Jr

We describe a spatial market equilibrium model, solved at the level of the State, which accounts for market impacts on the net cost of treatments. The LP model maximizes acres treated in high-risk forests. Constraints include budget, wood production capacity, State treatment area minimums, and Wildland Urban Interface proportion minimums. Results show how market prices, aggregate producer and consumer welfare, and area treated by State are affected by alternative budget limits.

■ SB30

P-Room 3512

Recent Developments in the Theory and Application of Statistical Process Control

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: Zachary G. Stoumbos, Professor, Rutgers University, Department of Management Science & Information Systems, The Janis H. Levin Building, 94 Rockafeller Road, Piscataway,, NJ, 08854-8054, United States, stoumbos@andromeda.rutgers.edu

1 - Multivariate EWMA and Shewhart Control Charts for Monitoring the Mean Vector and Covariance Matrix
Marion R. Reynolds, Jr., Professor, Virginia Polytechnic Institute and State University, Departments of Statistics and Forestry, Blacksburg, VA, 24061-0439, United States, mrr@vt.edu, Zachary G. Stoumbos

Multivariate control charts are used to monitor multiple process variables. We propose and investigate combinations of multivariate EWMA (MEWMA) and Shewhart charts for simultaneously monitoring the mean vector and covariance matrix. These multivariate charts are based on sample means and squared deviations from target, with and without regression adjustment. Such combinations of MEWMA charts offer excellent performance for detecting various changes in the mean vector and covariance matrix.

2 - Treatment of Time Series Modeling Errors in Control Charts for Autocorrelated Data
Daniel W. Apley, Professor, Northwestern University, Dept. of Industrial Engineering, 2145 Sheridan Rd., Evanston, IL, 60208-3119, United States, apley@northwestern.edu, Hyun Cheol Lee

Statistical process control methods for autocorrelated data have been the subject of extensive research over the past two decades. Most methods involve representing the autocorrelation via a time series model and are usually quite sensitive to modeling errors. We will discuss recent analytical results that quantify the effects of modeling errors on some common control charts for autocorrelated data, as well as approaches for modifying the charts so that they are more robust to modeling errors.

3 - On-Line Monitoring of Volatility and Value-at-Risk Accuracy
Joe H. Sullivan, Professor, Mississippi State University, College of Business, MSU, MS, 39762-9582, United States, jsullivan@cobilan.msstate.edu, Zachary G. Stoumbos

An important question is whether financial risk assessments, such as volatility or value at risk (VaR), are currently accurate. In contrast to past research based on backtesting large samples, we develop highly efficient tools for fast, on-line, real-time assessment, based on time windows that vary adaptively with the data. We also propose a continuous compromise between detection power and purity, whereas previous work has adopted an extreme of the continuum, which we argue is seldom optimal.

4 - A Self-Starting Multivariate Exponentially Weighted Moving Average Chart
Douglas M. Hawkins, Professor, School of Statistics, University of Minnesota, 313 Ford Hall, 224 Church St. SE, Minneapolis, MN, 55455-0493, United States, doug@stat.umn.edu, Edgard M. Maboudou-Tchao

Multivariate statistical quality control arises when you have a vector of process measurements. The MEWMA is a good multivariate SPC tool, but assumes you know the in-control mean and covariance matrix. ëSelf-starting' methods use the stream of process data to simultaneously estimate the parameters and control the system. We define a self-starting MEWMA chart which can be used without a long learning process, and illustrate it with data gathered in an alumina smelter.

■ SB31

P-Room 3545

Call Center Models

Sponsor: Applied Probability
Sponsored Session

Chair: Andrew Ross, Lehigh University, 200 West Packer Ave, Bethlehem, PA, 18015, United States, amr5@lehigh.edu

1 - Modeling Overload Situations in Call Centers
Ger Koole, professor, Vrije Universiteit, Department of Mathematics, De Boelelaan 1081a, Amsterdam, 1081 HV, Netherlands, koole@cs.vu.nl, Tania Jimenez

Temporary overload situations in queues can be approximated by fluid queues. We strengthen earlier results on the comparison of multi-server tandem systems with their fluid limits. At the same time we give conditions under which economies of scale hold. We apply the results to call centers.

2 - Staffing Call Centers using Simulation and an Analytic Center Cutting Plane Method
Julius Atlason, University of Michigan, 1205 Beal Ave, Ann Arbor, MI, 48109-2117, United States, jatlason@umich.edu, Shane Henderson, Marina Epelman

Two important staffing decisions are how many call takers to employ at any time during the day and how to assign them to shifts. The decisions are dependent and making good decisions can be difficult, especially when demand is time varying. We present a simulation-based algorithm that uses an analytic center cutting plane method to make these two decisions jointly to reduce costs and/or improve performance. We compare our method with queuing methods through an extensive computational experiment.

3 - Analysis and Modeling of Retrials in Call Centers
Armann Ingolfsson, University of Alberta, School of Business, Edmonton, AB, T6G 2R6, Canada, armann.ingolfsson@ualberta.ca, Geert Jan Franx

We illustrate how aspects of retrial behavior such as the probability that an abandoned call will result in a retrial and the distribution of the time until retrial can be estimated from individual call data. We discuss the benefits of using call level data compared to aggregated data, as typically provided in reports from Automatic Call Distributors. Finally, we describe a numerically tractable model for the time-dependent behavior of call centers that experience abandonments and retrials.

4 - Added Service Capacity Problem for Call Centers
Atul Bhandari, Ph.D Candidate in Operations Reserch, Tepper School of Business, Carnegie Mellon University, 5000 Forbes Avenue, Pittsburgh, PA, 15213, United States, atulb@cmu.edu, Alan Scheller-Wolf, Mor Harchol-Balter

The Added Service Capacity problem is a service-cost tradeoff problem relevant to Call Centers. Job arrival is time-varying Poisson and service is exponential. A job's opportunity cost is proportional to its place in queue. Service occurs at a standard rate, but can be temporarily increased for a fixed cost and an operating cost is incurred for the duration of increased rate. We minimize total cost using Balance Inequalities and Disjunctive Programming which gives a Linear Program formulation.

■ SB33

T-Savoy (Majestic Level)

JFIG Panel on Research and Publications

Sponsor: JFIG, Junior Faculty Interest Group
Sponsored Session

Chair: Cynthia Barnhart, MIT, 77 Massachusetts Avenue, Room 1-235, Cambridge, MA, 02139, United States, cbarnhar@mit.edu

1 - Panel: The Why's, What's, Where'sand How's of Publishing
Moderator: Cynthia Barnhart, MIT, 77 Massachusetts Avenue, Room 1-235, Cambridge, MA, 02139, United States, cbarnhar@mit.edu, Panelists: Terry Harrison, Garrett van Ryzin, Wallace J. Hopp

In this panel discussion, we will discuss the role of publishing in academia. We plan to: 1) provide an overview of the publication outlets for Engineering and Business School faculty; 2) describe how the publishing process works; 3) present strategies for picking topics for publication; and 5) discuss the the research/practice interface

■ SB34

T-Columbine (Majestic Level)

The Impact of the Internet on Operations

Sponsor: Manufacturing and Service Operations Management
Sponsored Session

Chair: Jeannette Song, Professor, Duke University, The Fuqua School of Business, Duke University, Durham, NC, 27708, United States, jssong@duke.edu

1 - Analysis and Comparison of Queuing Systems with Different Levels of Delay Information
Pengfei Guo, Duke University, PO Box 368, Fuqua School of Business, Durham, NC, 27708, United States, pg18@duke.edu, Paul Zipkin

In this paper we consider a queue with balking under three levels of customer delay information: no information, partial information (the system occupancy) and full information (the exact waiting time). Closed form expressions of the equilibrium system under the above three delay information are given for a M/M/1 queue. Numerical comparison shows that more accurate delay information can improve performance on all dimensions, thus benefiting all parties.

2 - Online Purchasing Strategies for Dynamically Priced Perishable Products
Yong-Pin Zhou, Assistant Professor, University of Washington Business School, Box 353200, Seattle, WA, 98195-3200, United States, yongpin@u.washington.edu, Ming Fan, Minho Cho

Dynamic pricing is a standard practice for firms that use revenue management. We study the strategic response of customers to such pricing approaches, with the help of the demand and price data available on the Internet these days. Based on the model in Gallego and van Ryzin (1994), we construct and analyze a threshold purchasing policy for such strategic customers and conduct simulation to examine the policy's benefit for the strategic customer and its impact on the selling firm's revenue.

3 - Online vs Offline Price Competition: Market Outcomes and the Effect of Internet Shopping Penetration
Cheryl Druehl, University of Maryland, Decision and Information Technology, Robert H. Smith School of Business, College Park, MD, 20742, United States, cdruehl@rhsmith.umd.edu, Evan Porteus

Building on our reservation price model, we characterize the Nash equilibria to a single product, dual market game in terms of Internet shopping penetration, niche appeal of the Internet product, and degree of innovation. Finding an Internet firm cannot rely on increases in penetration for profit/share improvement, we identify conditions under which unwarranted enthusiasm for the online firm's prospects appear. We also discuss the online choice between being a niche player and a mass marketer.

4 - Free-Riding in a Multi-Channel Supply Chain
Xiaona Zheng, Duke University, Box 90120, Duke Univeristy, Durham, NC, 27708, United States, xz17@duke.edu, Fernando Bernstein, Jeannette Song

We consider a manufacturer selling a product through a retailer and its own direct store. Customers may choose to buy the product at either store, or they may choose to purchase a similar, lower-end, competing product. We suggest that a manufacturer considering direct sales to offer costly service to its customers should evaluate: convenience of purchasing the product at the retail store; existence of similar, lower-end, competing products; how consumers differ in their need to obtain service.

■ SB35

T-Terrace (Terrace Level)

Supply Chain Disruptions

Sponsor: Manufacturing and Service Operations Management
Sponsored Session

Chair: Brian Tomlin, Assistant Professor, University of North Carolina at Chapel Hill, CB3490, McColl Building, Chapel Hill, NC, 27599, United States, brian_tomlin@unc.edu

1 - Location/Inventory Modeling with Unreliable Suppliers
Lawrence Snyder, Asst Professor, Lehigh University, Dept of Industrial & Systems Engineering, 200 West Packer Ave, Mohler Lab, Bethlehem, PA, 18015, United States, lvs2@lehigh.edu

We present a model for choosing DC locations, customer assignments, and inventory policies at the DCs when demands are stochastic and the DCs' suppliers are unreliable. DCs are assumed to follow a (Q,R)-like inventory policy that accounts for both demand and supply uncertainty. We solve the problem using Lagrangian relaxation. The subproblem is itself a non-linear IP but can be solved efficiently. We present computational results and suggest insights gained from the model.

2 - Analyzing a Bioterror Attack on the Food Supply: The Case of Botulinum Toxin in Milk
Lawrence Wein, Paul E. Holden Professor of Management Science, Graduate School of Business, Stanford University, Stanford, CA, 94305-5015, United States, wein_lawrence@gsb.stanford.edu, Yifan Liu

We analyze a cows-to-consumers supply chain that is the victim of a bioterror attack with botulinum toxin. We quantify the extent of agent dissemination, and assess the value of in-process testing and toxin inactivation via heat pasteurization.

3 - Supply Chain Disruptions
Thomas Schmitt, Director GTTL Program, University of Washington, Box 353200, Seattle, WA, 98115, United States, glennsch@u.washington.edu, Sanjay Kumar, Kathryn Stecke, Mark Ehlen

Disruptions in electric power, telecommunications, transportation and manufacturing introduce complicated bullwhip, queuing and expediting effects in supply chains. Sandia National Laboratories asked us to help in developing an "agent-based" model of northwestern supply networks. Using three case studies of Northwest electronics firms, we characterize the nature of high-tech supply chains in the Pacific Northwest, and simulate performance in terms of shortages, inventory and expediting.

4 - On the Value of Dual-Sourcing and Mix-Flexibility in Unreliable Supply Chains
Brian Tomlin, Assistant Professor, University of North Carolina at Chapel Hill, CB3490, McColl Building, Chapel Hill, NC, 27599, United States, brian_tomlin@unc.edu, Yimin Wang

We investigate the benefits of dual-sourcing and mix-flexibility in unreliable supply chains. In doing so, we consider different investment criteria: Risk-Neutrality, Loss Aversion and Conditional Value-at-Risk.

■ SB36

T-Capitol (Terrace Level)

Computational and Empirical Issues in Finance

Cluster: Financial Engineering
Invited Session

Chair: Antje Berndt, Assistant Professor, Cornell University, 226 Rhodes Hall, Ithaca, NY, United States, antje.berndt@cornell.edu

1 - From Implied to Spot Volatilities
Valdo Durrleman, Stanford University, 450 Serra Mall, Bldg 380, Stanford, CA, 94305, United States, valdo@math.stanford.edu

This talk is concerned with the link between implied volatilities and the spot volatility. Such a link is of practical interest since it relates the fundamental quantity for pricing derivatives (the spot volatility) which is not observable, to directly observable quantities. We first review some of the problems and solutions in the area. Then, we explain how the dynamics of the spot volatility and of the implied volatility surface relate to each other. Finally, we discuss practical implications.

2 - Risk Minimization: A Robust Framework for Hedging Insurance Policies with Guarantees
Maria-Cristina Patron, Postdoctoral Associate, CTC Manhattan, 55 Broad Street, 3rd Floor, New York, NY, 10004, United States, patron@tc.cornell.edu, Yohan Kim, Thomas F. Coleman, Yuying Li

We investigate hedging the options embedded in variable annuities with guarantees. We describe effective and efficient numerical methods to account for the various risk factors: e.g., interest rate risk, volatility risk, jump risk. Due to the financial market incompleteness, we compute hedging strategies using risk minimization. Numerical results are presented.

3 - The Stochastic Supply Curve for a Security's Price
Marcel Blais, Graduate Student, Cornell University, Center for Applied Mathematics, 657 Rhodes Hall, Ithaca, NY, 14853, United States, mblais@cam.cornell.edu, Philip Protter

Cetin et al have proposed an extension of the usual models for asset prices which incorporates liquidity. They have postulated the existence of a stochastic supply curve which gives a security's price as a function of trade size. This allows for an analysis of stock prices incorporating liquidity and leads to a new ability to determine the liquidity component in prices of derivatives. Using statistical analysis we show such a supply curve does in fact exist, and we show how it changes over time.

4 - Risk and Return on Corporate Default from Default Swap Rates and EDFs
Antje Berndt, Assistant Professor, Cornell University, 226 Rhodes Hall, Ithaca, NY, United States, antje.berndt@cornell.edu, Rohan Douglas, Darrell Duffie, Mark Ferguson, David Schranz

We estimate recent default risk premia for U.S. corporate debt, based on a close relationship between default probabilities, as estimated by Moody's KMV EDFs, and default swap (CDS) market rates. The default-swap data, obtained through CIBC from 22 banks and specialty dealers, allow us to establish a strong link between actual and risk-neutral default probabilities for the 69 firms in the three sectors that we analyze: broadcasting and entertainment, healthcare, and oil and gas.

■ SB37

T-Biltmore (Terrace Level)

Stochastic Energy Market Models

Sponsor: Energy, Natural Resources and the Environment
Sponsored Session

Chair: Chung-Li Tseng, Associate Professor, Department of Engineering Management, University of Missouri - Rolla, Rolla, MO, 65409, United States, chungli@umr.edu

1 - The Price Duration Curve under an Oligopoly Electricity Market
Jorge Valenzuela, Assistant Professor, Auburn University, 207 Dunstan Hall, Auburn University, Auburn, AL, 36849, United States, jvalenz@eng.auburn.edu, Mainak Mazumdar

In this talk we define the "price duration curve" using probability considerations and provide a procedure for constructing it. This curve is expected to be useful in the long-term prediction of market price and is similar in spirit to the load duration curve. It shows the proportion of time over a given time horizon during which the real time market price of electricity is expected to exceed specified dollar amounts.

2 - Computation of Cournot/Nash Equilibrium for the Two-Stage Stochastic Programming Games
Talat Genc, University of Guelph, Department of Economics, Guelph, ON, N1G 2W1, Canada, tgenc@email.arizona.edu, Suvrajeet Sen

We model two-stage investment-production decisions under uncertainty in an oligopolistic market using a stochastic programming formulation. We discuss a decomposition algorithm for computing the equilibrium and provide an interpretation of its implementation in a market.

3 - Evaluation of an Appliance Cycling Load Management Program
Frank Felder, Assistant Research Professor, Bloustein School of Planning and Public Policy, United States, ffelder@rci.rutgers.edu

This paper evaluates a New Jersey load management program in the context of restructured wholesale electricity markets. The existing program's capacity, energy, and transmission/distribution benefits are briefly discussed. A stochastic optimization model is presented to analyze the energy benefits including the program's terms and conditions and activation policies. Implications for the program's structure and management are discussed.

4 - A Stochastic Natural Gas Equilibrium Model for North America
Jifang Zhuang, Ph.D Candidate, University of Maryland, Dept. of Civil & Env. Eng., College Park, MD, 20742, United States, zhuang@wam.umd.edu, Steve Gabriel

We provide a new stochastic Nash-Cournot model for the North American natural gas sector. Individual players such as producers, pipelines, marketers, storage and peak operators are modeled as solving stochastic optimization problems, some of which are Nash-Cournot, some are perfect competition-based. Combining the KKT conditions to these stochastic optimizations with market clearing conditions, gives rise to a complementarity problem. We analyze and illustrate results on a small example.

■ SB38

T-Beverly (Terrace Level)

Estimation of Cycle Time - Throughput Curves via Simulation

Sponsor: Simulation
Sponsored Session

Chair: John Fowler, Professor, Arizona State University, Department of Industrial Engineering, Tempe, AZ, United States, john.fowler@asu.edu

1 - Procedures for Efficient Cycle Time-Throughput (CT-TH) Curve Generation
John Fowler, Professor, Arizona State University, Department of Industrial Engineering, Tempe, AZ, United States, john.fowler@asu.edu, Gerald Mackulak, Barry L. Nelson, Bruce Ankenman

Generation of CT-TH curves requires precise and accurate estimates of cycle time at various throughput levels. Since computing budgets are generally limited, we provide guidelines for simulation practitioners by suggesting a family of metamodels for mean, variance, and higher moment estimation and an indirect method for estimating quantiles.

2 - Indirect Estimation of Cycle Time Quantiles from Discrete Event Simulation
Jennifer McNeill, Arizona State University, Dept. of Industrial Engineering, Tempe, United States, jennifer.mcneill@asu.edu, Gerald Mackulak, John Fowler, Barry L. Nelson

We present a new technique for estimating cycle time quantiles from simulation models run at a single traffic intensity. The Cornish-Fisher expansion is used for this approximation, and we show that for an M/M/1 system and a full factory simulation model, the technique provides accurate results for the most commonly estimated quantiles without requiring unreasonable sample sizes. It provides the advantages of being easy to implement and providing multiple quantiles from a single set of runs.

3 - Variance-Based Cycle Time - Throughput Confidence Intervals
Rachel Johnson, Arizona State University, Dept. of Industrial Engineering, Tempe, AZ, 85287, United States, Rachel.T.Johnson@asu.edu, Major Sonia Leach, Gerald Mackulak, John Fowler

Since the variance of cycle time generally increases as the throughput increases, an equal allocation of effort at each simulated throughput level will result in confidence intervals of different widths. This presentation discusses an approach for generating nearly equal sized mean cycle time confidence intervals at selected throughput levels when the computing budget is fixed (limited). The simulation effort allocation procedure is based on asymptotic variance.

4 - Multi-product Cycle Time and Throughput Evaluation via Simulation on Demand
Gerald Mackulak, Associate Professor, Arizona State University, Dept. of Industrial Engineering, Tempe, AZ, 85287, United States, mackulak@asu.edu, Barry L. Nelson, Bruce Ankenman, John Fowler

In this presentation, we discuss the next generation of semiconductor factory simulation tools, which we call complete response-surface mapping (cRSM). More specifically, we discuss the basic research and software development necessary to produce the capability to provide simulation results on demand for cycle-time measures as a function of throughput and product mix.

■ SB39

T-Tower Court A (2nd Floor)

Retail Supply Chain Management II: Supply Chain Coordination

Cluster: Supply Chain Mgmt & Operations
Invited Session

Chair: Naren Agrawal, Associate Professor, Santa Clara University, OMIS Department, Santa Clara, CA, 95053, United States, NAgrawal@scu.edu

Co-Chair: Stephen Smith, Professor, Santa Clara University OMIS, 500 El Camino Real, Kenna Hall 323C, Santa Clara, CA, 95053-0382, United States, SSmith@scu.edu

1 - Procuring Fast Delivery: Sole Sourcing with Information Asymmetry
Gerard Cachon, The Wharton School, 543 JMHH, Philadelphia, PA, 19104, United States, cachon@wharton.upenn.edu, Fuqiang Zhang

This paper studies, in the context of a queuing model, a buyer that sources a good or service from a single supplier chosen from a pool of potential suppliers. The buyer minimizes the sum of her procurement cost, inventory holding cost and backorder penalty cost. Suppliers maximize their own profit. We evaluate several strategies for the buyer, including take-it-or-leave-it offers and auctions. Although optimal strategies are evaluated, we identify a simple strategy that is nearly optimal.

2 - Market Dynamics in a Retail Supply Chain under Item-level RFID
Gary Gaukler, Ph.D. Candidate, Stanford University, Stanford, CA, 94305, United States, Gaukler@stanford.edu, Warren Hausman, Ralf Seifert

The benefits from item-level RFID are typically asymmetrically distributed between manufacturer and retailer. We model the ensuing market dynamics between manufacturer and retailer and examine two scenarios: the manufacturer vs. the retailer driving the RFID implementation. We also determine how the cost of RFID tags should be shared in an optimal fashion in both scenarios.

3 - Retail and Wholesale Pricing Decisions under Demand Uncertainty
Goker Aydin, University of Michigan, Dept. of Ind. & Opns. Engr., Ann Arbor, MI, United States, ayding@umich.edu

We consider wholesale and retail pricing decisions for a product with a single-period selling season. The manufacturer sets the wholesale price, while the retailer determines the retail price and the inventory level. We investigate how the sequence of the pricing decisions affects the equilibrium outcome in this supply chain.

4 - Risk Reallocation Through Cost Sharing Contracts In VMI Systems
Naren Agrawal, Associate Professor, Santa Clara University, OMIS Department, Santa Clara, CA, 95053, United States, NAgrawal@scu.edu

We develop a methodology to determine how the presence of demand as well as input cost risk affects decisions and financial and operational performance in supply chains. We use this methodology to quantify the outcomes and supply chain performance with and without the VMI regime. We discuss how the preferences of the supply chain participants towards VMI vary under different conditions, and quantify the nature and magnitude of risk that each participant is exposed to.

■ SB40

T-Tower Court B (2nd Floor)

Operational Hedging

Cluster: Supply Chain Mgmt & Operations
Invited Session

Chair: Jan Van Mieghem, Professor, Kellogg School of Management, Northwestern University, Evanston, IL, 60208, United States, VanMieghem@kellogg.northwestern.edu

1 - Valuation of Real Options in Incomplete Markets
Vishal Gaur, New York University, 8-72, 44 West 4th St., New York, NY, 10012, United States, vgaur@stern.nyu.edu, Sridhar Seshadri, Marti Subrahmanyam

In an incomplete market economy, all claims cannot be priced uniquely based on arbitrage. We first show that tighter price bounds can be determined by considering all possible portfolios of unattainable claims for which there are bid/offer prices. We then examine how a price-taking firm can "package" new assets in order to take advantage of the incompleteness since the market places a premium on claims that improve its spanning. We apply our framework to the valuation of real options.

2 - Managing Operational and Financial Risks
Nils Rudi, Assistant Professor, Simon School of Business, University of Rochester, CS 3343, Simon School, University of Rochester, Rochester, NY, 14627, United States, rudi@simon.rochester.edu, Jan Van Mieghem, Jiri Chod

Two major risks stem from market uncertainty. The opportunity costs represent operational risk. Financial risk is a consequence of cash flow variability if the decision maker is risk averse. We formulate a simple model of a risk averse firm that invests in a real asset under market uncertainty, considering four instruments of risk management: portfolio diversification, resource flexibility, financial hedging and forecasting. We analyze the effect of these four instruments on both types of risk.

3 - Operational Hedging: A Mathematical Framework
Onur Boyabatli, INSEAD, Boulevard de Constance, Fontainebleau Cedex 77305, France, onur.BOYABATLI@insead.edu, Beril Toktay

Operational hedging, drawing on purely operational tools to hedge risks, constitutes an important part of firm-level risk management programs. We present a mathematical framework for operational hedging (OH) that incorporates OH strategies discussed in several academic fields. We demonstrate sufficiency conditions for the proposed framework using stochastic orderings. We discuss the advantages of the proposed framework and effectiveness of OH in the firm-level risk management programs.

4 - Effects of Taxes and Bankruptcy Risk on Inventories and Dividends
Matthew Sobel, Professor, Case Western Reserve University, Department of Operations, 10900 Euclid Ave., Cleveland, OH, 44106-7235, United States, mjs13@weatherhead.cwru.edu, Martin Shubik, Lode Li

We introduce taxes and bankruptcy risk in a previous stochastic dynamic model of inventory and financial decisions to maximize the expected present value of dividends. Without either generalization the optimal policy is myopic, it is a monotone function of the levels of inventory and retained earnings, and is explicitly characterized when inventory/backorder costs and capital subscription penalties are linear.

■ SB41

T-Tower Court C (2nd Floor)

Supply Chain Production Management

Contributed Session

Chair: Robert Setoputro, Universtiy of WI-Milwaukee, School of Bus. Adm, P.O. Box 742, Milwaukee, WI, 53201, United States, robseto@uwm.edu

1 - Finite Horizon Planning for a Production System with Lumpy Demand
Bhaba Sarker, Elton G. Yates Professor, Louisiana State University, Dept. of Indust. & Mfg. Sys. Engineering, 3128 CEBA Building, Baton Rouge, LA, 70803-6409, United States, bsarker@lsu.edu, Ahmed Diponegoro

This research develops an ordering policy for raw materials and determines an economic batch size for a product in a manufacturing system that supplies finished products to customers for a finite planning horizon. In this model, an optimal multi-ordering policy for procurement of raw materials and production cycle time for a two-stage production and supply system is developed to minimize the total cost incurred due to raw materials and finished goods inventories.

2 - Optimal Dynamic Production and Transshipment Policies for a Two-Location Make-To-Stock System
Hui Zhao, Assistant Professor of Management, Purdue University, Krannert School of Management, 403W. State Street, West Lafayette, IN, 47906, United States, zhaoh@purdue.edu, Jennifer Ryan, Vinayak Deshpande

Previous literature on transshipment has mainly considered it as a way to fill emergency demand and has seldom considered capacity issues. In this paper, we analyze the optimal production and transshipment policy for a system in which transshipment can be also used to achieve production flexibility. We prove that the optimal production policy belongs to the "hedging point" policy family, while the optimal demand filling policy belongs to the "state-dependent rationing" policy family.

3 - Master Production Schedule and Advanced Order Commitment Policy in Make-to-Order Supply Chains
Powell Robinson, Associate Professor, Texas A&M University, Mays Business School, INFO Dept, 322 Wehner Bldg, College Station, TX, 77843-4217, United States, probinson@cgsb.tamu.edu, Funda Sahin, Li-Lian Gao

We study the impact of operational and MPS design factors on cost and schedule stability in a two-stage make-to-order supply chain. An experimental framework, based on computer simulation is developed to determine the optimal parameter settings for MPS design factors under a variety of operating conditions.

4 - Enhancing the Order Promising Function with Economic Criteria
Hernan Wurgaft, SUNY Maritime College, 6 Pennyfield Avenue, Throgs Neck, NY, 10465, United States, hwurgaft@sunymaritime.edu

The operations of many supply chains involve an order promising function to determine the appropriate response to customer orders. A typical order promising function focuses on delivery dates and quantities, and it is based on inventory availability checks and on the construction of feasible schedules. We discuss enhancements to the ordering promising function by taking into account opportunity cost factors to produce alternative promises at different prices.

5 - Optimal Return Policy and Modular Design for Build-to-Order Products
Robert Setoputro, Universtiy of WI-Milwaukee, School of Bus. Adm, P.O. Box 742, Milwaukee, WI, 53201, United States, robseto@uwm.edu, Samar Mukhopadhyay

A BTO product enables the firm to customize the product to the requirement of the customers. The firm will see an increase in demand, but face some operational difficulties. One of these is related to the return policies. A tremendous advantage can be gained by the firm if it could offer a return policy for BTO product. We propose the use of modularity in the product design as a solution to this problem. We develop a profit-maximization model and obtain a number of managerial guidelines.

■ SB42

T-Tower Court D (2nd Floor)

Pricing On-Demand Information Services

Sponsor: Revenue Management & Dynamic Pricing
Sponsored Session

Chair: Costis Maglaras, United States, c.maglaras@columbia.edu

1 - Revenue Management in Service Systems with Unknown Demand Characteristics
Philipp Afeche, Kellogg School of Management / Northwestern University, 2001 Sheridan Road, Evanston, IL, 60208, United States, p-afeche@kellogg.northwestern.edu, Baris Ata

Consider the revenue management problem of a capacity constrained provider who serves delay-sensitive customers and is uncertain about the underlying demand characteristics. How to dynamically price the service to generate revenue and learn customer demand? We derive insights into this problem by studying and comparing alternative pricing and learning approaches.

2 - Pricing Information Services with Real-time Choice of Service Level
Assaf Zeevi, Columbia University, United States, assaf@gsb.columbia.edu, Costis Maglaras

A service provider delivers to end-users two service levels of an otherwise identical ``product." The users choose between service levels based on price and quality. We investigate near-optimal pricing rules and derive insights that suggest when such service differentiation is economically justified.

3 - Revenue Management through Dynamic Cross-Selling in E-commerce Retailing
Serguei Netessine, Assistant Professor, The Wharton School, University of Pennsylvania, 3730 Walnut St. Suite 500, Philadelphia, PA, 19104, United States, netessin@wharton.upenn.edu, Sergei Savin

We consider the problem of dynamically cross-selling products (e.g., books) or services (e.g., travel reservations) in the e-commerce setting. Given consumer preferences and product inventories, two issues are analyzed: (1) how to select items to cross-sell and (2) how to price product packages to maximize profits.

4 - Fairness and Incentive Compatibility in Capacity Allocation and Scheduling
Sunil Kumar, Stanford University, Grad School of Business, Stanford, CA, 94305, United States, skumar@stanford.edu, Ramandeep Randhawa

Fairness as a criterion for capacity allocation among, or scheduling, heterogeneous users is prevalent in literature. We study whether fair allocation and scheduling mechanisms can also be incentive compatible. Obtaining a negative answer, we study ways in which this trade-off can be resolved.

■ SB43

T-Denver (Mezzanine)

Product Variety Management

Cluster: New Product Development
Invited Session

Chair: Aydin Alptekinoglu, Assistant Professor, University of Florida, Warrington College of Business, Decision and Information Sciences, Gainesville, FL, 32611-7169, United States, aalp@ufl.edu

1 - Optimizing Supply Chain Structure under Delayed Product Differentiation
Ting Shen, Stanford Univerity, Dept. of Manag. Sci. & Eng., Stanford, CA, 94305, United States, tingshen@stanford.edu

We develop a model in which a firm produces a product with N customizable components that can either be customized by the suppliers or by the producer. The objective is to determine the optimal supply chain structure-who should perform the customization tasks given the producer's customization capacity constraint. Our approach is to maximize the total net value from delayed product differentiation for the firm. We will discuss the basic model and its application at General Motors.

2 - Product Variety and Supply Chain Coordination
Praneet Singh, Simon School of Business, University of Rochester, CS 4341, Simon School, University of Rochester, Rochester, NY, 14627, United States, singhpr@simon.rochester.edu, Nils Rudi, Harry Groenevelt

We model the strategic pricing interaction between a manufacturer and retailer in a multi-product setting. The manufacturer sets the wholesale price and the retailer decides on the optimal assortment to offer and the associated quantities to stock. We demonstrate the structure of the retailer's optimal assortment and characterize the manufacturer's profit function. Finally, we study the performance of the supply chain and examine alternative coordinating contracts in a multi-product setting.

3 - Drug Development Portfolios: Selection and Valuation
Karan Girotra, The Wharton School, University of Pennsylvania, Philadelphia, PA, 19104, United States, karang@wharton.upenn.edu, Karl Ulrich, Christian Terwiesch

High failure rates, technological dependence between candidate compounds, high fixed costs and substantial premiums for swift development, all present some unique challenges with respect to evaluating and managing the risks and rewards associated with drug development portfolios. We study the selection and valuation of these portfolios consistent with the unique paradigm of the drug development process.

4 - Leadtime - Variety Tradeoff between Mass Produced and Mass Customized Products
Aydin Alptekinoglu, Assistant Professor, University of Florida, Warrington College of Business, Decision and Information Sciences, Gainesville, FL, 32611-7169, United States, aalp@ufl.edu, Charles Corbett

Mass production, the dominant form of making products available in the market, emphasizes standardization (low variety) in the interest of supply chain efficiency, and usually targets zero delivery leadtime via a make-to-stock system. Mass customization offers the opposite proposition: very high variety, but some delay in delivery as it usually involves a make-to-order system. We explore the lead-time - variety tradeoff, which has been gaining prominence by the advent of mass customization.

■ SB44

T-Spruce (Mezzanine)

Auctions 1

Cluster: Auction Theory & Applications
Invited Session

Chair: Joni Jones, University of South Florida, 4202 East Fowler Avenue, CIS1040, Tampa, FL, 33620, United States, jjones@coba.usf.edu

1 - Effect of Auction Design Parameters on Auction Effectiveness: Evidence from a Field Experiment
Sunil Mithas, University of Michigan, 1364 McIntyre St, Ann Arbor, MI, 48105, United States, smithas@bus.umich.edu, Joni Jones

This paper presents an empirical investigation into the effect of auction parameters on reverse auction outcomes. Field data from over six hundred procurement auctions show the number of bids, reserve price, and information sharing affect buyer surplus while bid increment and the presence of incumbents does not affect buyer surplus.

2 - Dynamic Models for Online Auctions
Wolfgang Jank, Assistant Professor, Smith School of Business, University of Maryland, 4322 Van Munching Hall, College Park, MD, 20742, United States, wjank@rhsmith.umd.edu, Galit Shmueli

We propose a dynamic modelling approach for online auction data. By dynamic modelling, we mean that we are not only interested in the magnitude of the current bid at any point in the ongoing auction, but also in the speed at which the bids are increasing and in the rate at which their speed is changing. To this end, we propose and develop functional regression models that study the effect of certain auction characteristics on the dynamics of the bidding process.

3 - Comparison of Procurement Auctions
Mike Freimer, mbf10@psu.edu, The Pennsylvania State University, The Smeal College of Business Administra, 509N Business Administration Building I, University Park, PA, 16802, United States, mbf10@psu.edu, Woonghee Tim Huh, Robin Roundy, Amar Sapra

We consider a market with one agent having large capacity and other agents having small capacities. We present new results on the impact of the expansion of the big agent either by acquisition of extra capacity or merger with small agents on the auctioneer's cost and the profit of agents under various sealed bid auction mechanisms.

4 - Simulating Decision Making in Multi-Attribute Reverse Auctions
Monica Tremblay, Information Systems & Decision Sciences, University of South Florida, 4202 E Fowler Avenue, CIS1040, Tampa, FL, 33620-7800, United States, mtremblay@tampabay.rr.com

This study uses simulation to investigate multi-stage decision making in supply chain reverse auctions where the manufacturer must choose among a number of Customer RFQ's and determine the corresponding price and delivery date. Quotes are directly linked to the manufacturer's decision to accept supplier responses to material RFP's. Work in Progress

■ SB45

T-Gold (Mezzanine)

New Algorithmic and Complexity Insights into the Nash Equilibrium

Cluster: Game Theory
Invited Session

Chair: Yoav Shoham, Professor, Stanford University, Computer Science Department, Stanford, CA, 94305, United States, shoham@stanford.edu

1 - Simple Search Methods for Finding a Nash Equilibrium
Eugene Nudelman, Stanford University, 353 Serra Mall, Room 128, Stanford, CA, 94305, United States, eugnud@cs.stanford.edu, Yoav Shoham, Ryan Porter

We present two simple search methods for computing a sample Nash equilibrium in a normal-form game: one for 2-player games and one for N-player games. We test these algorithms on many classes of games, and show that they perform well against the state of the art— the Lemke-Howson algorithm for 2-player games, and Simplicial Subdivision and Govindan-Wilson for N-player games.

2 - Results about the Complexity of Solving Games
Tuomas Sandholm, Associate Professor, Carnegie Mellon University, Computer Science Department, 5000 Forbes Avenue, Pittsburgh, PA, 15213, United States, sandholm@cs.cmu.edu, Vincent Conitzer

In this talk I will discuss our results on 1) the complexity of finding good (or approximately good) Nash equilibria, finding symmetric Nash equilibria, and counting Nash equilibria in matrix games, and 2) complexity of determining existence of pure-strategy equilibria in matrix games of incomplete information, and in stochastic games. If time allows, I will also discuss new results on the complexity of iterated elimination.

3 - Computing Nash Equilibria in Compact Structured Representations
Christian Shelton, University of California, Riverside, Department of Computer Science & Enginee, 310 Surge Building, Riverside, CA, 92521, United States, cshelton@cs.ucr.edu, Ben Blum, Daphne Koller

This talk will present a method for computing exact Nash equilibria for multiagent compact representations that exploits new continuation (or homotopy) methods from the economics literature and structured representations from the computer science literature. Our method exploits the compact representation in order to reduce calculation time and can operate on any representation topology. I will demonstrate experimental results comparing our method to other approximate and exact algorithms.

■ SB46

T-Aspen (Mezzanine)

Panel: ADVANCEing Women in OR/MS

Sponsor: Women in OR/MS
Sponsored Session

Chair: Joyce W. Yen, University of Washington, Box 352650, Seattle, WA, United States, joyceyen@u.washington.edu

1 - Ga Tech's NSF ADVANCE
Panelist: Jane Ammons, Dr., Georgia Institute of Technology, Industrial and Systems Engineering, Atlanta, GA, United States, jane.ammons@isye.gatech.edu

The NSF ADVANCE program seeks to increase the participation and advancement of women faculty in science and engineering. In this panel, NSF ADVANCE Institutional Transformation Grantees will share best practices and ideas. The session will conclude with a discussion on how to take back these ideas to other institutions.

2 - Advance at the University of California, Irvine
Panelist: Amelia Regan, University of California, Irvine, Institute of Transportation Studies, Computer Science and Civil Engineering, Irvine, CA, United States, aregan@uci.edu

The goal of the ADVANCE program is to increase the participation of women in the scientific and engineering workforce through the increased representation and advancement of women in academic science and engineering careers. The speakers come from some of the campuses that have received substantial grants under the ADVANCE program. They will discuss experiences on their campuses including best practices and challenges.

3 - New Mexico State' s ADVANCE Program
Panelist: Bonnie Daily, Associate Professor, New Mexico State University, Management Dept, MSC 3DJ, Las Cruces, NM, 88003, United States, bdaily@nmsu.edu

The NSF ADVANCE program seeks to increase the participation and advancement of women faculty in science and engineering. In this panel, NSF ADVANCE Institutional Transformation Grantees will share best practices and ideas. The session will conclude with a discussion on how to take back these ideas to other institutions.

4 - ADVANCE at the University of Washington
Panelist: Joyce W. Yen, University of Washington, Box 352650, Seattle, WA, United States, joyceyen@u.washington.edu

The NSF ADVANCE program seeks to increase the participation and advancement of women faculty in science and engineering. In this panel, NSF ADVANCE Institutional Transformation Grantees will share best practices and ideas. The session will conclude with a discussion on how to take these ideas back to other institutions.

■ SB47

T-Century (Mezzanine)

Software Demonstration

Cluster: Software Demonstrations
Invited Session

1 - Decisioneering, Inc.- Spreadsheet Simulation and Modeling Using Crystal Ball Professional
Lawrence Goldman, Product Marketing Manager, Decisioneering, Inc., 1515 Arapahoe St. #1311, Denver, CO, 80202, United States, lgoldman@crystalball.com

Easily teach risk analysis to your students! Crystal Ball—a simple, reliable, and convenient software simulation tool—enhances Excel by performing Monte Carlo analysis, optimization, and time-series forecasting. This presentation uses practical examples to show how Crystal Ball helps quantify and reduce operational and financial risks.

2 - Syncopation Software- DPL 6.0 Professional
Chris Dalton, CEO, Syncopation Software, 216 Center Street, Bangor, ME, 04401, United States, cdalton@syncopationsoftware.com

From Discounted Cash Flow to Decision Analysis in Minutes See how easy it is to use DPL 6.0 to quickly develop a full decision analysis from a cash flow spreadsheet. The demonstration covers DPL's redesigned Excel interface and new Policy Summary filters as well as decision trees, influence diagrams, sensitivity, and time series percentiles. The demonstration includes a pharmaceutical R&D case.

Sunday 1:30pm-3:00pm

■ SC01

P-Ballroom F

Tutorial: Simulation Optimization

Cluster: Tutorials- Denver 2004
Invited Session

1 - Simulation Optimization
Fred Glover, Professor, University of Colorado, UCB 419, Leeds School of Business, BOULDER, CO, 80309-0419, United States, Fred.Glover@Colorado.EDU, James Kelly

This tutorial will demonstrate how these two traditional areas of OR are combined into a powerful decision-making system. Simulation models uncertainty while optimization seeks best policies. The sense in which these represent decision-making will be explained in the tutorial, which will include an example to optimize financial portfolio investments under uncertainty.

■ SC02

P-Ballroom E

Modernization of Traditional Revenue Management Tools

Sponsor: Revenue Management & Dynamic Pricing
Sponsored Session

Chair: Mark Ferguson, Assistant Professor of Operations Management, Georgia Institute of Technology, College of Management, 800 West Peachtree Street, NW, Atlanta, GA, 30332-052, United States, mark.ferguson@mgt.gatech.edu

1 - A Comparison of Unconstraining Methods to Improve Global Revenue Management Systems
Carrie Crystal, Georgia Tech, 800 W. Peachtree, NW, Atlanta, GA, 30332-0520, United States, carrie.crystal@mgt.gatech.edu, Mark Ferguson

A successful revenue management system requires accurate demand forecasts to set booking limits to ensure an adequate supply for higher fare customers. The use of booking limits constrains demand data needed for an accurate forecast. Ignoring this interaction leads to sub-optimal potential revenues. We evaluate several of the common methods used to unconstrain demand data and propose an improved method that outperforms the traditional methods in tests performed on industry data.

2 - Modeling Extensions for a Class of Business-to-business Revenue Management Problems
Nicola Secomandi, Assistant Professor, Tepper School of Business, Carnegie Mellon University, 5000 Forbes Avenue, Pittsburgh, PA, 15213, United States, ns7@andrew.cmu.edu

Recently, the business consulting and operations research communities have shown great interest in porting revenue management (RM) principles from traditional business-to-consumer (B2C) settings to the realm of business-to-business (B2B) e-commerce. The talk discusses how existing B2C RM inventory and pricing control models can be unified and extended to deal with a class of B2B RM problems.

3 - Price Guarantees in Dynamic Pricing and Revenue Management
Yuri Levin, School of Business, Queen's University, Kingston, ON, K7L3N6, Canada, ylevin@business.queensu.ca, Jeff McGill, Mikhail Nediak

We present a new model for revenue management of product sales that incorporates both dynamic pricing and a price guarantee that provides customers with compensation if the market price of the product drops below a level specified at the time of purchase. We consider the problem of simultaneously determining optimal dynamic price and guarantee policies for items from a fixed stock when demand depends both on the price and on the parameters of the price guarantee. The model can be used for pricing any items with limited availability over a fixed time horizon.

■ SC03

P-Plaza Court 1

Perspectives on Multilevel Meta-Heuristics

Cluster: Multiscale and Multilevel Methods
Invited Session

Chair: Teodor Gabriel Crainic, Professor, ESG, UQAM and Centre for Research on Transportation, CP 8888, succ. centre Ville, Montreal, QC, H3C 3P8, Canada, theo@crt.umontreal.ca

1 - Multilevel Cooperative Search
Michel Toulouse, Professor, University of Manitoba, 545 Machray Hall, Winnipeg, MB, R3T 2N2, Canada, toulouse@cs.umanitoba.ca

Typical multilevel algorithms for combinatorial optimization problems have three phases: coarsening, search and refinement. Multilevel cooperative search is a parallel algorithm consisting to iteratively execute similar phases as above in parallel at each level. Interaction operators between adjacent levels update coarsening and search at one level based on information from neighbor levels. These operators are key components of the method, they will be the main focus of this talk.

2 - Multilevel and Advanced Memory-based Search Methods
Teodor Gabriel Crainic, Professor, ESG, UQAM and Centre for Research on Transportation, CP 8888, succ. centre Ville, Montreal, QC, H3C 3P8, Canada, theo@crt.umontreal.ca, Fred Glover, Michel Toulouse

■ SC04

P-Plaza Court 2

Joint Panel Session Data Mining/ QSR: Data Mining Research, Applications, and Software

Sponsor: Data Mining and Quality, Statistics and Reliability
Sponsored Session

Chair: Jionghua (Judy) Jin, Assistant Professor, The University of Arizona, Dept. of Systems and Industrial Engineering, Systems & Industrial Engineering, Tucson, AZ, 85750, United States, jhjin@sie.arizona.edu

Co-Chair: Victoria Chen, University of Texas at Arlington, Dept. of Industrial & Manuf. Sys. Eng., Campus Box 19017, Arlington, TX, 76019-0017, United States, vchen@uta.edu

1 - Panel: Data Mining Research, Applications and Software
Moderator: Jionghua (Judy) Jin, Assistant Professor, The University of Arizona, Dept. of Systems and Industrial Engineering, Systems & Industrial Engineering, Tucson, AZ, 85750, United States, jhjin@sie.arizona.edu, Panelists: David Duling, Edward Lau, Jianjun Shi, Kwok-Leung Tsui

The objective of this panel is to provide an open discussion on data mining issues. In this session, panelists will share their expertise on methods, software, and applications in industry, manufacturing, and finance.

■ SC05

P-Plaza Court 3

Cutting Planes for Integer Programming Models

Sponsor: Optimization/ Integer Programming
Sponsored Session

Chair: Ismael de Farias, Assistant Professor, University at Buffalo, SUNY, Department of Industrial Engineering, 403 Bell Hall, Buffalo, NY, 14260, United States, defarias@buffalo.edu

1 - Strengthening Group Polyhedra-Derived Cuts for Mixed Integer Programs through Lifting
Jean-Philippe Richard, Assistant Professor, Purdue Universtiy, 315 N. Grant Street, West Lafayette, IN, 47906, United States, jprichar@ecn.purdue.edu, Yanjun Li, Lisa Miller

Since the early work of Gomory and Johnson, it is well-known how facets of the group problem can be used to generate cuts for general mixed integer programs. In this talk, we present a more intuitive procedure to derive Gomory and Johnson's cuts through lifting. We then show how this procedure can be used to obtain new facets of the group problem and to derive strengthened group-based mixed integer inequalities.

2 - Equal Capacity Lot-Sizing with Supplier Selection
Diego Klabjan, Assistant Professor, University of Illinois at Urbana-Champaign, Dept. of Mechanical and Industrial Eng., 140 Mechanical Engineering Building, Urbana, IL, 61801, United States, klabjan@uiuc.edu, Yijia Zhao

The traditional lot-sizing problem is to find least cost production lot sizes in several time periods linked together by inventory. We integrate this model and the model of selecting suppliers in each time period. We first show that the resulting problem is polynomially solvable in presence of equal capacity on production and supply. We provide valid inequalities for the uncapacitated case and we give sufficient and necessary conditions for facet defining inequalities.

3 - A Polyhedral Study of Single Machine Scheduling
Ismael de Farias, Assistant Professor, University at Buffalo, SUNY, Department of Industrial Engineering, 403 Bell Hall, Buffalo, NY, 14260, United States, defarias@buffalo.edu

We discuss the inequality description of single machine scheduling with release dates, deadlines, and sequence dependent setup times. We also discuss the robust case. We give computational results that demonstrate the usefulness of our inequalities.

■ SC06

P-Plaza Court 4

Recent Developments in Stochastic Programming

Sponsor: Optimization/Stochastic Programming
Sponsored Session

Chair: Shabbir Ahmed, Ph.D, Georgia Institute of Technology, 765 Ferst Drive NW, Atlanta, GA, 30332, United States, sahmed@isye.gatech.edu

1 - On Solution Quality and Proximal Terms in Stochastic Programming
David Morton, Associate Professor, University of Texas at Austin, Graduate Program in Operations Research, Austin, TX, 78712, United States, morton@mail.utexas.edu

We describe methods for establishing solution quality in stochastic linear programs, stochastic integer programs and models with probabilistic objective functions. Our approach employs Monte Carlo sampling to construct a confidence interval on the so-called optimality gap of a candidate solution. We examine the benefits of using a proximal term in this type of approach.

2 - Column Generation within Stochastic Programming
Mehmet Demirci, University of Pittsburgh, 1048 Benedum Hall, Pittbsurgh, PA, 15261, United States, mcd21@pitt.edu, Brady Hunsaker, Jay Rosenberger, Andrew Schaefer

Stochastic programming is a technique for optimization in the presence of uncertainty, which usually leads to very large problem sizes. We developed a method for incorporating column generation within stochastic programming framework. This method generates columns for the master problem of the L-Shaped method, while simultaneously adding feasibility and optimality cuts generated from the second-stage subproblems. We discuss convergence issues and preliminary computational results.

3 - A Derivative Free Algorithm for Stochastic Optimization
Anton Kleywegt, Associate Professor, Georgia Institute of Technology, School of Industrial and Systems Enginee, Georgia Institute of Technology, Atlanta, GA, 30332-0205, United States, anton@isye.gatech.edu, Vijay Bharadwaj

We propose an algorithm for a stochastic optimization problem that does not compute derivatives. For a given point x, the algorithm only estimates the objective value f(x), for example with a sample average approximation. Such algorithms are appealing when the approximation of the objective function is not differentiable everywhere, or when the practitioner does not want to implement the code to compute the derivatives.

4 - Heuristically Confined Dynamic Programming
Matthew Realff, Dr, Georgia Tech, School of Chemical Engineering, ES&T Building, Atlanta, GA, 30332-0100, United States, Matthew.Realff@chbe.gatech.edu, Jaein Choi, Jay H Lee

Multistage stochastic optimization leads to high dimensional state spaces for which searching for the global optimum is very time consuming. In this paper we will present a framework for combining heuristics that are effective for different realizations of a given problem and problem uncertainty through dynamic programming. This will generate policies that interleave the decisisions made by different heuristics based on estimates of the cost to go from states in which they have been tested.

■ SC07

P-Plaza Court 5

Global Optimization- Costly Functions and Multistart Methods

Sponsor: Optimization/ Global Optimization
Sponsored Session

Chair: Leon Lasdon, Professor, McCombs College of Business, MSIS Department, University of Texas, Austin, TX, 78712, United States, Leon.Lasdon@mccombs.utexas.edu

1 - MAPO: Using a Committee of Algorithm-Experts for Parallel Optimization of Costly Functions
Christine Shoemaker, Ripley Professor, Cornell University, 210 Hollister Hall, Cornell University, Ithaca, NY, 14853, United States, cas12@cornell.edu, Rommel Regis

Our new MAPO (Multi-Algorithm Parallel Optimization) algorithm iteratively uses a committee of serial response surface algorithms to find global optimum of computationally costly functions. Good numerical results for MAPO are reported for 16 and fewer processors on multiple problems (including a 12-dimensional nonlinear system of Partial Differential Equations describing groundwater).

2 - A Stochastic Radial Basis Function Method for Global Optimization
Rommel Regis, Postdoctoral Associate, Cornell Theory Center, 623 Rhodes Hall, Cornell University, Ithaca, NY, 14853, United States, rgr6@cornell.edu, Christine Shoemaker

We introduce a stochastic global optimization method for costly functions that utilizes radial basis function models. In each iteration, the evaluation point is chosen to be the best point from a set of randomly generated points which are ranked according to predicted function value and distance from previously evaluated points. We present a probabilistic convergence result for the method. We also show promising computational results on test problems and on a groundwater remediation application.

3 - Multistart Algorithms for Seeking Feasibility
Leon Lasdon, Professor, McCombs College of Business, MSIS Department, University of Texas, Austin, TX, 78712, United States, Leon.Lasdon@mccombs.utexas.edu, John Plummer, Zsolt Ugray

MSNLP is a multistart heuristic for global optimization. It uses a search method to compute candidate starting points for a local NLP solver, which is started when a point passes distance and merit filter tests. This talk describes modifications to MSNLP for finding feasible solutions to a system of nonlinear constraints.

■ SC08

P-Plaza Court 6

Auctions and Market Equilibrium

Sponsor: Optimization/ Network Optimization
Sponsored Session

Chair: Lisa Fleischer, T. J. Watson Research Center, IBM, Yorktown Heights, NY, United States, lkf@watson.ibm.com

1 - Near Optimal Online Auctions
Jason Hartline, Researcher, Microsoft Research, 1065 La Avenida, Mountain View, CA, 94043, United States, hartline@microsoft.com, Avrim Blum

Using machine learning techniques, we solve the problem of selling a digital good in an online auction (Bar-Yossef et al, 2002) optimally up to a constant factor. In this setting, bids arrive over time and must be answered immediately. Notably this problem combines the lack of information due to not knowing the future bids (need online algorithm analysis) and the lack of information due to the fact that the bidders' valuations for the good are initially private (need game theoretic analysis).

2 - A Polynomial Time Algorithm for Computing the Arrow-Debreu MarketEquilibrium for Linear Utilities
Kamal Jain, Researcher, Microsoft Research, United States, kamalj@microsoft.com

We will present a polynomial time algorithm to compute the Arrow-Debreu market equilibrium for linear utilities. If time permits we will also discuss markets with productions and non-linear utilities.

3 - Approximating Market Equilibrium - The Separable GrossSubstitutability Case
Sanjiv Kapoor, Professor, Illionis Institute of Technology, United States, kapoor@iit.edu, Rahul Garg, Vijay Vazirani

In this paper we study the problem of market equilibrium. We consider the model where there is a supply of money associated with each buyer and a quantity with each item. The market equilibrium problem is to compute a price vector which ensures market clearing each buyer maximizes his utility. Utility functions satisfying gross substitutability have been studied extensively. We design an algorithm for separable, differentiable, concave utility functions satisfying gross substitutes.

■ SC09

P-Plaza Court 7

Convex Optimization in Machine Learning II

Sponsor: Optimization/ In Data-Mining
Sponsored Session

Chair: Gert Lanckriet, Ph.D. Candidate, U.C. Berkeley, 262M Cory Hall, U.C. Berkeley, Berkeley, CA, 94720, United States, gert@cs.berkeley.edu

1 - Multi-response Modeling: Feature Construction and Prediction
Kristin Bennett, Rensselaer Polytechnic Institute, Math Sciences Dept, 110 8th Street, Troy, NY, United States, bennek@rpi.edu, Zhi Xiang

We develop a general approach, Boosted Latent Analysis (BLA) to modeling many-to-many relationships such as multiple regression and multi-class classification. The method simultaneously factorizes and predicts the input and response much like Partial Least Squares (PLS). But unlike PLS, BLA can be used with any suitable differentiable loss function.

2 - A Direct Formulation for Sparse PCA using Semidefinite Programming
Alexandre d'Aspremont, ORFE Dept., Princeton University, Princeton, NJ, 08544, United States, aspremon@princeton.edu, Laurent El Ghaoui, Gert Lanckriet, Michael Jordan

We approximate, in the Frobenius-norm sense, a positive, semidefinite symmetric matrix by a rank-one matrix, with an upper bound on the cardinality of its eigenvector, using a semidefinite programming based relaxation. This arises in the decomposition of a covariance matrix into sparse factors, and has wide applications ranging from biology to finance.

■ SC10

P-Plaza Court 8

Joint Session TSL/Aviation Applications: Air Traffic Management II

Sponsor: Transportation Science & Logistics, Aviation Applications
Sponsored Session

Chair: Michael Ball, Professor, University of MD, Robert H Smith School of Business, University of MD, College Park, MD, 20742, United States, MBall@rhsmith.umd.edu

1 - Scenario-Based Air Traffic Management in Practice: Developing and Using Capacity Scenario Trees
Mark Hansen, University of California - Berkeley, 107B McLaughlin Hall, U.C. Berkeley, Berkeley, CA, 94720, United States, mhansen@ce.berkeley.edu, Avijit Mukherjee, Pei-chen Barry Liu

A recent advance in solving the single airport ground holding problem uses a dynamic stochastic IP model that allows assigned ground delays to be revised based on updated information. A scenario tree of airport arrival capacity profiles is used as an input for this model. We present a methodology for generating scenario trees from empirical data and assess the performance of the optimization model when used in conjunction with the empirically derived tree in a real-world setting.

2 - National Airspace System Equipment Replacement Modeling: Obsolescence Problems and New-Technology
Jasenka Rakas, Researcher, University of California at Berkeley, NEXTOR, 107D McLaughlin Hall, Berkeley, CA, 94720, United States, jrakas@berkeley.edu, Huifang Yin

This research analyzes maintenance policies for the National Airspace System (NAS) and makes optimal decisions, subject to budget constraints, considering uncertainty about future technology in modeling equipment replacements. Dynamic programming is used for optimal hold-or-replace decisions at certain points in time with the objective to minimize equipment operating costs. We focus on radars, which are critical parts of the NAS that currently face obsolescence problems.

3 - Estimating Flight Departure Delay Distributions Using Statistic Models
Yufeng Tu, University of Maryland, College Park, 3300VMH, Smith School of Business, University of Maryland, College Park, 20742, United States, ytu@rhsmith.umd.edu, David Lovell, Michael Ball

The goal of this work is to develop flight departure delay distribution models for use in air traffic congestion prediction. Major factors influencing flight departure delays have been studied and both static and dynamic prediction models are being developed. Flight data of Denver airport in the year 2000 was used to establish preliminary version of the models.

4 - Optimization Models for Offloading Flow Constrained Areas
Ming Zhong, University of Maryland, College Park, 3300 Van Munching Hall, R. H. Smith School of Business, College Park, MD, 20742, United States, mzhong@rhsmith.umd.edu, Michael Ball

The FAA has begun to experiment with the use of Flow Constrained Area (FCA) advisories to address capacity/demand imbalances in the National Airspace System. In this paper, we describe and test bi-criteria network flow models with side constraints, which consider both efficiency and equity, to address the FCA demand reduction problem.

■ SC11

P-Governor's Square 9

Military Logistics Research at RAND

Sponsor: Transportation Science & Logistics
Sponsored Session

Chair: Ron McGarvey, Associate Operations Researcher, RAND, 201 N Craig St, Pittsburgh, PA, 15213, United States, ronm@rand.org

1 - Depot Capacity Assessment Tool: Workloads, Capacity and Availability
Elvira Loredo, Associate Researcher, RAND Corporation, 1700 Main Street, PO Box 2138, Santa Monica, CA, 90407, United States, loredo@rand.org, Don Snyder, Raymond Pyles

A concern arising from current Air Force aircraft replacement plans is the potential deterioration of aircraft availability as maintenance workloads grow due to age-related material deterioration. Our goal is to build is to produce a model that can be easily used to help answer questions about any fleet. Including: 1) how many aircraft will be in work at the depot if a given trend in workload growth materializes, 2) how much capacity is needed to maintain a target number of aircraft in work.

2 - Consolidating Field Repair Activities
Louis Luangkesorn, RAND Corporation, 201 N. Craig St., Suite 202, Pittsburgh, PA, 15213, United States, Louis_Luangkesorn@rand.org, Ron McGarvey, Jim Masters

When field operations depend on the availability of high-value, low-density items, it is beneficial to have spare parts and repair capacity near field operating locations. This leads to a tradeoff between the maintaining repair capacity at many locations and having spare inventory. We will present an iterative MILP/queuing model to optimize inventory allocation and repair facility location and we will discuss characteristics that lead to consolidating field repair.

3 - Maximizing Availability of Reparable Items
Adam Resnick, RAND, 1700 Main St., Santa Monica, CA, United States, Adam_Resnick@rand.org, Don Snyder, Pat Mills, Brent Fulton

We study policies for maintaining inventories of high-value reparable assets with difficult to forecast demands. These assets are expensive and may have significant holding costs. We consider the tradeoff between purchase, repair, and holding costs, to minimize costs while meeting demands.

4 - A Decision Support Tool for Overseas Positioning of U.S. Air Force Resources
Ron McGarvey, Associate Operations Researcher, RAND, 201 N Craig St, Pittsburgh, PA, 15213, United States, ronm@rand.org, Mahyar Amouzegar, Thomas Lang, Louis Luangkesorn

The U.S. Air Force envisions significant changes to its future overseas basing posture, including its storage and maintenance sites for War Reserve Materiel. This presentation will discuss ongoing efforts to build math programming decision support tools to assist the Air Force with this difficult, multi-objective problem.

■ SC12

P-Governor's Square 10

Robustness and Stochasticity in Transportation Networks

Sponsor: Transportation Science & Logistics
Sponsored Session

Chair: S. Travis Waller, University of Texas - Austin, Dept. of Civil Eng., ECJ 6.204, Austin, TX, 78712, United States, stw@mail.utexas.edu

1 - Modeling Vulnerability-Based Interdependencies Among Multiple Infrastructure Networks
Srinivas Peeta, Purdue University, School of Civil Engineering, West Lafayette, IN, 47907, United States, peeta@purdue.edu, Pengcheng Zhang

Interdependencies among various critical civil infrastructure systems introduce a key layer of vulnerability concerns. This research studies the infrastructure interdependencies using a "system of systems" approach. General equilibrium models are used to capture the reliability and cost interactions among the infrastructure networks. Simulation results will be provided to generate insights.

2 - Analytical Expressions for the Robust Traffic Assignment Problem
Satish Ukkusuri, Ph.D Candidate, University of Texas - Austin, Dept. of Civil Eng., ECJ 6.202, Austin, TX, 78712, United States, ukkusuri@mail.utexas.edu, S. Travis Waller

This research addresses the impact on the network design decisions by taking into account the long-term uncertainty in demand. We provide closed form expressions for the expected and variance of the system cost for the traffic assignment problem when the demand is assumed to be a normal random variable. The talk will also address how this methodology can be generalized to other demand distributions.

3 - Location-Relocation in Probabilistic Networks: Sensor Networks, Emergency Response, Homeland Defense
Elise Miller-Hooks, Assistant Professor, University of Maryland, Dept. of Civil & Environmental Eng., 1173 Glenn Martin Hall, College Park, MD, 20742, United States, elisemh@umd.edu, Aamod Sathe

We formulate a multi-objective probabilistic location-relocation problem as mixed integer linear programs with multiple objectives. A metaheuristic is presented based on the principles of genetic algorithms for determining the optimal location of mobile base stations (or ambulances or military units) in probabilistic networks such that the likelihood that network connectivity or coverage is maintained is maximized. Relocation decisions are provided for use when connectivity or coverage is lost.

4 - Robust Optimization with Correlated Demands
Jennifer Duthie, University of Texas at Austin, Dept. of Civil Eng., ECJ 6.202, Austin, TX, 78712, United States, jduthie@mail.utexas.edu, S. Travis Waller, Satish Ukkusuri

Previous work in this area has treated O-D demand as uncertain and explored the impact of considering both second and first order moments in evaluating network designs. In reality, these demands are likely correlated. This work gives insight into how accounting for these correlations can lead to improved models of traffic systems and may cause planners to design networks differently.

■ SC13

P-Governor's Square 11

RASIG Roundtable Conference

Sponsor: Railroad Applications
Sponsored Session

Chair: Jian Liu, Research Director, Innovative Scheduling Systems, Inc., 2153 Hawthorne Road, Gainesville, FL, 32641, United States, liu-jian@cox.net

1 - Optimization Models for Interchange Gate Analysis
Ravindra Ahuja, Professor, University of Florida, 303, Weil Hall, P O Box 116595, Gainesville, FL, 32611, United States, ahuja@ufl.edu

2 - The Interline Service Design Problem: Definition, Objectives, Constraints, and Current Practice
Carl Van Dyke, President, MultiModal Applied Systems, Princeton, NJ, United States, carl@multimodalinc.com

A large percentage of the freight traffic handled by most railways is received from, or delivered to, another railway. How these "interline movements" are structured and managed can have a major impact on both costs and service quality. A well defined methodology has evolved for analyzing these problems using computer-based analysis techniques, which will be explored in this discussion.

3 - Designing the Joint Service Product
Ron Griffith, United States, Ron.Griffith@bnsf.com

Railroads have historically routed interchange traffic according to either the gateways preferred by customers, or those specified in rate contracts. This narrative explores the industry response to the economic benefits of increasing equipment velocity as well as the need to improve service that have provided the impetus for recent joint-carrier cooperative service design initiatives.

4 - Class One Alliances as an Immediate Alternative to Merger
Natasha Zuraikat, United States, Natasha_Zuraikat@csx.com

STB has ruled to put on hold class one railroads mergers since 1999. At that time alliances were introduced to facilitate the design of the joint service products and capture benefits of a merger without an actual merger. In this talk we will discuss how railroads price their joint product, create revenue division and some other aspects of the joint operations.

■ SC14

P-Governor's Square 14

Patently Critical - Insights from Studies on the Strategic use of Patents

Sponsor: Technology Management
Sponsored Session

Chair: Robert Lowe, Carnegie Mellon University, Tepper School of Business, 5000 Forbes Avenue, Pittsburgh, PA, 15213, United States, roblowe@andrew.cmu.edu

Co-Chair: Francisco Veloso, Carnegie Mellon University, United States, fveloso@CMU.EDU

1 - Hiding in the Patent's Shadow
Stuart Graham, Georgia Tech, United States, stuart.graham@mgt.gatech.edu

This paper examines firms' uses of secrecy and patenting to explore an elementary question of firm intellectual property strategy: Is there complementarity between different types of appropriability mechanisms? I argue that the use of the "continuation" procedure affords patent applicants a strategic opportunity arising from the added term of secrecy. This paper examines continuation data in the United States from 1975-1995.

2 - Patent Enforcement through the International Trade Commission
Deepak Somaya, Assistant Professor, University of Maryland, R.H. Smith School of Business, College Park, MD, United States, dsomaya@yahoo.com, Christine McDaniel

U.S. patents can be enforced against foreign importers through either the International Trade Commission (ITC) or the federal district courts. We examine this forum choice in patent litigation by combining, for the first time, patent suit filings from the U.S. district courts with so-called section 337 case filings from the International Trade Commission. Our findings shed light on how differences in patent enforcement between forums affect forum choice.

3 - Knowledge Partitioning in Interfirm Innovation under Technology-Forcing Regulation
Jaegul Lee, Carnegie Mellon University, United States, jaegull@andrew.cmu.edu

This paper examines interfirm knowledge partitioning in development of automotive emission control technologies. Analysis of patenting activity shows that, faced with technology-forcing regulations, manufacturers increase their share of component innovation and decrease their share in architectural innovation while suppliers behave in the opposite direction. These finding support the claim that innovation under uncertainty requires knowledge domain overlap between manufacturers and suppliers.

4 - Patently Wrong? Firm Strategy and the Decision to Disband Technological Assets
Francisco Veloso, Carnegie Mellon University, United States, fveloso@CMU.EDU, Robert Lowe

We show how a firm's R&D strategy leads to discernable differences in research outputs and in turn explains why some firms abandon a greater share of their assets. Results suggest that the decision of a pharmaceutical firm to pursue an exploratory versus an exploitative R&D strategy greatly influences the likelihood of patent renewal. Our findings raise intriguing questions regarding the impact of R&D strategies on success and suggest the need for more research on asset abandonment.

■ SC15

P-Governor's Square 15

Data Mining in Biomedicine

Cluster: Data Mining and Knowledge Discovery
Invited Session

Chair: Vladimir Boginski, University of Florida, 303 Weil Hall, Gainesville, FL, 32611, United States, vb@ufl.edu

1 - Multi-Class SVM for Genes Expression Analysis
Theodor Trafalis, University of Oklahoma, School of Industrial Engineering, 202 West Boyd, Room 124, Norman, OK, 73019, United States, ttrafalis@ou.edu, Budi Santosa

This paper compares SVM, LDA and KNN on E. coli whole-genome gene expression profiles to classify the genes in response to changing pH of the growth medium and mutation of the acid tolerance response gene regulator GadX. The responses can be classified into: 1-unchanged, 2-decreased and 3-increased expression level. The labels of few genes are known. To label unknown genes, K-Means is applied in a multi-level scheme. Applying SVM, LDA and KNN shows that SVM outperforms LDA and KNN.

2 - Clique-detection Models in Genomics
Sergiy Butenko, Assistant Professor of Industrial Engineering, Texas A&M University, 236E Zachry Engineering Center, College Station, TX, 77843-3131, United States, butenko@tamu.edu, Wilbert Wilhelm

Many important data mining problems arising in genomics have been formulated in terms of underlying combinatorial optimization models. In particular, a number have been formulated as clique-detection models. This talk will discuss several such problems, including sequence alignment and comparative modeling of protein structures.

3 - Discovering Disease-relevant Genes in DNA Microarray Data
Stanislav Busygin, University of Florida, 303 Weil Hall, Gainesville, FL, 32611, United States, busygin@ufl.edu, Panos Pardalos

Due to the development of DNA microarrays it has become possible to discover and predict genetic patterns relevant for various diseases on the basis of massive datasets provided by DNA microarray probes. However, high dimensionality and uncertain accuracy of microarray datasets remain the major obstacles in revealing the most crucial genetic factors determining a particular disease. In this presentation we describe a technique based on the correspondence analysis helping to handle this issue.

4 - Data Mining Techniques for the Classification of Epileptic Activity
Wanpracha Chaovalitwongse, ExxonMobil Research & Engineering, 1545 Route 22 East, Annandale, NJ, 08801, United States, wchaoval@rci.rutgers.edu, Panos Pardalos, Oleg Prokopyev, Leonidas Iasemidis, J. Chris Sackellares, Paul Carney, Deng-Shan Shiau, Vladimir Boginski

Epilepsy is the second most common brain disorder after stroke. Our previous study in the brain dynamics based on EEG has demonstrated that the measures of chaos can unfold the state transition toward seizures. We herein propose a scheme to incorporate data mining techniques with the chaos theory to study of the brain state classification (normal, pre-seizure, and post-seizure). A statistical cross-validation is employed to demonstrate that different states of the brain can be classified.

■ SC16

P-Governor's Square 17

Presolving and Pre-solution Analysis in Nonlinear Programming

Sponsor: Computing Society
Sponsored Session

Chair: John Chinneck, Professor, Carleton University, Systems & Computer Engineering, Ottawa, ON, K1S 5B6, Canada, chinneck@sce.carleton.ca

1 - Bound Analysis of Nonlinear Optimization Problems
Dominique Orban, Adjunct professor, Ecole Polytechnique de Montreal, 2900 Boulevard Ed. Montpetit, Montreal, QC, H3T1J4, Canada, Dominique.Orban@polymtl.ca, Robert Fourer

As one aspect of its routines for attempting to prove convexity of nonlinear functions, the DrAMPL problem analyzer determines bounds on variables and subexpressions. We describe extensions to DrAMPL's bound propagation routines that may permit some variables to be fixed or constraints to be dropped, much as in current presolve routines for linear programming. We report experience with standard test problems and with collected submissions to the NEOS Server.

2 - Constraint Programming Techniques for Analyzing Nonlinear Programs
Pascal Van Hentenryck, Professor, Department of Computer Science, Brown University, Box 1910, Providence, RI, 02912, United States, pvh@cs.brown.edu

This talk gives an overview of a variety of domain reduction techniques from constraint programming and shows how they can be used to analyze nonlinear programs.

3 - Automatic Convexity Determination in the Microsoft Excel Solver
Daniel Fylstra, President, Frontline Systems Inc., P.O. Box 4288, Incline Village, NV, 89450, United States, dfylstra@frontsys.com, Ivo Nenov, Lubomir Kolev

We present algorithmic tests to determine whether smooth functions are convex over certain regions, in an algebraic modeling system embedded in the Premium Solver Platform for Microsoft Excel. The methods rely on fast and accurate computation of the 'Hessian sign' or the full interval Hessian of each problem function via automatic differentiation techniques; their effectiveness is improved by using constraint propagation techniques to narrow the intervals over which the functions are evaluated.

4 - MProbe Analysis of Nonlinear Function Shape in NEOS
John Chinneck, Professor, Carleton University, Systems & Computer Engineering, Ottawa, ON, K1S 5B6, Canada, chinneck@sce.carleton.ca

Are the constraints/objective in an NLP concave, convex, both...? Is the constrained region convex? A knowledge of nonlinear function shape is vital to selecting an appropriate solver. MProbe is an interactive software tool that provides estimates of function and region shapes. A subset of MProbe has been packaged for non-interactive use via NEOS. The sampling methods used in MProbe are a useful adjunct to analytic function shape assessment capabilities recently added to NEOS.

■ SC17

P-Directors Row E

Advances in Decision Analysis

Sponsor: Decision Analysis
Sponsored Session

Chair: Barry R. Cobb, School of Business, University of Kansas, 1300 Sunnyside Ave., Summerfield Hall, Lawrence, KS, 66045-7585, United States, brcobb@ku.edu

Co-Chair: Prakash P. Shenoy, School of Business, University of Kansas, 1300 Sunnyside Ave., Summerfield Hall, Lawrence, KS, 66045-7585, United States, pshenoy@ku.edu

1 - A Dempster-Shafer Model for Detection of Rare Signals
Arthur P. Dempster, Department of Statistics, Harvard University, Cambridge, MA, 02138, United States, dempster@stat.harvard.edu, Wai Fung Chiu

A data-base contains information on each of a large number of parallel situations most of which are of no interest, but a few of which are high value targets. Uncertain evidence for high value is extracted for each situation. We develop a simple model for characterizing uncertainty about which and how many situations have high value, and thence for deciding which to track.

2 - Team Decision Analysis
Ross Shachter, Management Science and Engineering Dept, Stanford University, 380 Panama Way, Stanford, CA, 94305-4026, United States, shachter@stanford.edu, Apiruk Detwarasiti

We introduce Team Decision Analysis, a normative framework for team decision making under uncertainty. Rational individuals agree on preferences, information, and alternatives, but each has only partial authority and knowledge. We develop a solution concept of team stability and a solution method of strategy improvement, generalizing traditional decision analysis.

3 - Decision Making with Hybrid Influence Diagrams Using Mixtures of Truncated Exponentials
Barry R. Cobb, School of Business, University of Kansas, 1300 Sunnyside Ave., Summerfield Hall, Lawrence, KS, 66045-7585, United States, brcobb@ku.edu, Prakash P. Shenoy

Mixtures of truncated exponentials (MTE) influence diagrams are models where all probability distributions and the joint utility function are represented by MTE potentials. MTE influence diagrams can represent decision problems without restrictions relationships between continuous and discrete chance variables, distributions of chance variables, or the nature of the utility function.

■ SC18

P-Directors Row H

Decision Analysis Research In Progress

Sponsor: Decision Analysis
Sponsored Session

Chair: Kara Morgan, Senior Advisor for Risk Analysis, US Food and Drug Administration, 5600 Fishers Lane, Rm 15-62, HFP-20, Rockville, MD, 20857, United States, Kara.Morgan@FDA.gov

1 - Probability Elicitation, Scoring Rules, and Competition among Forecasters
Kenneth C. Lichtendahl, Jr, Doctoral Student, Fuqua School of Business, Duke University, Box 90120, Durham, NC, 27708-0120, United States, kjl11@duke.edu, Robert L. Winkler

Probability forecasters who are rewarded via a proper scoring rule may also care about their relative performance. If a forecaster's utility is a weighted average of score and rank, the proper-scoring-rule incentive for truthful reporting no longer holds. Instead, the forecaster typically should report more extreme probabilities, hedging toward zero or one. We discuss the form of this hedging under a variety of assumptions about opponents' utilities and the distribution of opponents' probabilities given the forecaster's probability. In the case where an opponent also cares about relative performance, we find equilibrium reporting functions. We discuss implications for the design of scoring mechanisms.

2 - Myopic Agents and Interdependent Security Risks
Ashish Gupta, Graduate Student, University of Wisconsin Madison, 1932, University Avenue, #301, Madison, WI, 53726, United States, ashishgupta@wisc.edu, Vicki Bier

We present the optimal strategies in an interdependent security model in which threats occur over time. In such models, one myopic agent can make it undesirable for non-myopic agents to invest when that would otherwise be optimal. We explore the effect of different attack rates, investment costs and so on.

3 - Breast Cancer Prevention Decision Aid: A Work in Progress
Elissa Ozanne, Institute for Technology Assessment, Harvard Medical School, 101 Merrimac Street, 10th Floor, Boston, MA, 02114-4724, United States, elissa@mgh-ita.org, Laura Esserman

Investigators have developed and evaluated a pilot version of a clinical decision aid for breast cancer prevention care. The decision framework provides access to key information during consultations and allows the integration of emerging biomarkers. Version 2 is under development and will include web-based access, the ability to store data, and track decisions and outcomes. A randomized clinical trial is planned to assess the impact on the clinical process and patient decision-making.

4 - Developing a Decision Framework for Efficient Risk Management
Kara Morgan, Senior Advisor for Risk Analysis, US Food and Drug Administration, 5600 Fishers Lane, Rm 15-62, HFP-20, Rockville, MD, 20857, United States, Kara.Morgan@FDA.gov

Data, information and models used in risk assessments, within the same agency and even within the same office, can vary widely in terms of quality for the task at hand. Decisions about different risks are made sequentially, taking into account the information available for each decision independently. A decision framework for risk management could provide guidance on how to consider uncertain information and how to be systematic and consistent in decision-making about risk.

■ SC20

P-Room 3304

Healthcare Models and Evaluation

Sponsor: Health Applications
Sponsored Session

Chair: Kevin Leonard, Assoc Prof - HPME, University of Toronto, 12 Queens Park Cres West, Toronto, ON, M5S1A8, Canada, k.leonard@utoronto.ca

1 - Efficient Network-Based Models and Algorithms for Multileaf Collimator Sequencing Problem
Arvind Kumar, Graduate Student, University of Florida, 303 Weil Hall, PO Box 116595, Gainesville, FL, 32611, United States, arvind22@ufl.edu, Ravindra Ahuja

Multileaf Collimators (MLCs) are used for delivering radiation to treat cancer patients. We describe a network flow formulation that allows us to capture various practical delivery constraints (such as, tongue-and-groove and connectedness, etc.). We describe algorithms based on this formulation and present computational results of our algorithms which are very promising.

2 - Identifying the Benefits from Information Technology in Healthcare
Kevin Leonard, Assoc Prof - HPME, University of Toronto, 12 Queens Park Cres West, Toronto, ON, M5S1A8, Canada, k.leonard@utoronto.ca, Dean Sittig

There is a revolution going on in healthcare that many people believe is long overdue. This revolution involves the application of Information and Communication Technologies (ICTs) to solve healthcare delivery system issues. This paper describes the objectives of a research project that tests the hypothesis that increased ICT capabilities, availability, and use leads directly to improved clinical quality, safety, and effectiveness in the inpatient hospital setting.

3 - Applying MDPs to HIV Therapy Planning
Steven Shechter, University of Pittsburgh, 1048 Benedum Hall, Pittsburgh, PA, 15261, United States, sms13@pitt.edu, Andrew Schaefer, Scott Braithwaite, Matthew Bailey, Mark Roberts

As HIV therapy has become more effective over the years, it has also become rather complex. There is much uncertainty about the best time to start patients on antiretroviral therapy or the best time to switch them to a new therapy. These decisions are currently based on clinical judgement and guidelines policies. We propose the use of Markov decision processes as an appropriate tool for optimizing HIV therapy under certain assumptions and discuss some theoretical results for various models.

■ SC21

P-Room 3302

Globalized Operations

Contributed Session

Chair: Tan Miller, Pfizer, 201 Tabor Road, Morris Plains, NJ, 07950, United States, tan.miller@pfizer.com

1 - Economic Performance in the Era of Globalization: The Complex Effects of Social Capital and Culture
Manpreet Hora, Ph.D Student, Richard Ivey School of Business, University of Western Ontario, 1151 Richmond Street N, London, N6A3K7, Canada, mhora@ivey.uwo.ca, Arjun Bhardwaj

Building on past research on positive linkages between social capital and national economic performance, we argue, that this relationship is more complex in the era of globalization. We hypothesize that uncertainty avoidance (a national cultural variable) moderates the relationship between social capital and national economic performance such that this relationship weakens as the level of uncertainty avoidance increases. The empirical findings in a sample of 44 nations support our hypothesis.

2 - A Structural Model of Common Approaches Dealing with Changes and Uncertainty in Manufacturing System
Jian Wang, Tokyo Institute of Technology, 2-12-1 Ookayama, Meguro-ku, Tokyo, TK, Japan, wang@ie.me.titech.ac.jp, Shane J. Schvaneveldt, De-bi Cao

We analyze the relationships among four approaches for dealing with change and uncertainty in a manufacturing strategy context. By testing several hypothesizes using survey responses and AMOS software, we find an interesting relationship structure model stochastically significant. In addition, we provide some useful explanations regarding how a firm's differing emphases on the four approaches are influenced by the firm's competitive priorities, such as cost, quality, delivery and flexibility.

3 - If You Can't Beat 'Em, Join 'Em
Jim Maginnis, University of Colorado, 9865 S. Wyecliff Dr, HR, CO, 80126, United States, jmmaginnis@earthlink.net

Shortcomings with Enterprise Resource Planning (ERP) projects can often be attributed to problems with the users. Frequently, management attitude is: Nothing is impossible for the person that doesn't have to do it. Management forgets they are not the ones to adapt the most to changes imposed by a new ERP system. Rather employees typically pay this price. In this study, we suggest that many failures could be avoided if the user was at least part owner of the project.

4 - Strategic Planning for Global Operations
Tan Miller, Pfizer, 201 Tabor Road, Morris Plains, NJ, 07950, United States, tan.miller@pfizer.com, Renato de Matta

A firm's global supply chain faces periodic changes in factors such as currency exchange and tax rates. In this study, we determine a profit maximizing supply plan considering these and other factors.

■ SC22

P-Room 3312

Tutorial: Decision Analysis Tools

Sponsor: Location Analysis
Sponsored Session

Chair: H.A. Eiselt, Faculty of Administration, University of New Brunswick, PO Box 4400, Fredericton, NB, E3B 5A3, Canada, haeiselt@unb.ca

1 - Tutorial: Decision Analysis Tools
H.A. Eiselt, Faculty of Administration, University of New Brunswick, PO Box 4400, Fredericton, NB, E3B 5A3, Canada, haeiselt@unb.ca

The presentation is designed for those individuals who are interested of getting a glimpse at a variety of decision making tools, so that they can apply them in their own field of interest. The talk first presents a unified framework that includes continuous optimization tools, discrete selection problems, & games against nature. The major differences between the approaches are based on the decision space & the (un-) certainty decision makers have to deal with. The first tools to be investigated have a continuous decision space. In other words, the decision maker has the option of infinitely many combinations of activities to achieve prespecified objectives. The concept of vector optimization does not require any prespecified tradeoffs between the individual objectives, but leaves the decision about them until later. Goal Programming takes a different route. Here, the decision maker specifies target values for each objective. this concept works will with "satisficing." this is similar to ideal point programming which also specifies achievement levels the model is trying to attain. Discrete selection problems are multicriteria decision making problems that have a finite number of decisions or choices that are evaluated on a number of criteria. The problem is to find an "overall best" decision. Again, once the tradeoffs are known, a simple generic procedure can determine such a solution. Similar to the aforementioned ideal point programming, reference point methods specify an ideal point & measure the quality of a solution by the distance between the achievement of the solution under consideration & that of the ideal point. Data envelopment analysis uses internal achievement levels to determine whether or not a solution is efficient. Preference cones attempt to derive preference information from the decision maker's statements regarding his choice of one decision over another. Multiattribute utility theory, at least in its basic version, finds equivalence points in comparisons & determines weights by way of this information. Outranking methods such as ELECTRE and PROMETHEE determine a set of soft preference relations based on comparisons with each other & external standards. Finally, methods allowing inconsistent estimates are presented, such as the normalization technique & the analytic hierarchy process. Games against nature have only a single evaluation criterion, but allow uncertainty in the outcome. These are the well-known "decision analysis" scenarios taught in many introductory operations research courses. Decision rules under uncertainty & risk are presented, along with a discussion of risk. the presentation finishes with an outlook towards competitive situations & the theory of games.

■ SC23

P-Room 3354

Joint Session Military/SIM: Project Albert and Data Farming: Vision, Applications, Capabilities and Transition

Sponsor: Military Applications, Simulation
Sponsored Session
Chair: Dr. Gary Horne, The MITRE Corporation, 2750 Killarney Dr, Suite 100, Woodbridge, VA, 22192, United States, gary.horne.ctr@usmc.mil

1 - Project Albert Overview
Dr. Gary Horne, The MITRE Corporation, 2750 Killarney Dr, Suite 100, Woodbridge, VA, 22192, United States, gary.horne.ctr@usmc.mil

Project Albert is an effort at the Marine Corps Warfighting Lab that is applying distillation modeling and data farming to questions of military interest. The vision of Project Albert is to create the best data farming environment possible to collaboratively explore the vast space of possibilities inherent in the questions that our decision makers face in today's uncertain world. This presentation will provide an overview of Project Albert and a description of the data farming methodology.

2 - Project Albert Applications
Mary McDonald, The MITRE Corporation, 2750 Killarney Dr, Suite 100, Woodbridge, VA, United States, mmcdonald@mitre.org, Matthew Koehler

Over the past six years, Project Albert has been applied to various question areas in support of different military commands and analytic agencies, demonstrating the broad capabilities of the Project Albert methodology. Several will be discussed, inter alia Command and Control, Volume/Precision Fires, Seabasing, Gunslinger and Boomerang, Peacekeeping and Humanitarian Operations, Experimental History Case Studies, Future Combat Systems Analysis, and Military Operations in Urban Terrain.

3 - Project Albert Capabilities and Transition
Theodore Meyer, The MITRE Corporation, 2750 Killarney Dr, Suite 100, Woodbridge, VA, United States, tedmeyer@mitre.org

A suite of software tools and working methodologies have been developed to implement the concepts that define Project Albert and Data Farming. The status of current development and direction of future development will be presented. The Project Albert software suite includes: the agent-based modeling software, scheduling and distribution software for data farming, software for exploring parameter space, and visualization tools.

■ SC25

P-Room 3404

Presentations of Finalists #3 and #4 for the Fifth Annual INFORMS Case Competition

Sponsor: Education (INFORM-ED) SPONSORED/INVITED
Sponsored Session
Chair: Christopher J. Zappe, Bucknell University, 113 Marts Hall, Lewisburg, PA, 17837, United States, zappe@bucknell.edu

1 - Fifth Annual INFORMS Case Competition,

The four finalists for the 2004 INFORMS Case Competition will deliver final presentations of their cases to a panel of judges and the audience. All are welcome to attend and observe these presentations as well as to ask questions of the finalists. The winner of the competition will be selected by the judges at the end of the four presentations. The winner and runners-up will be announced at the INFORM-Ed Annual Business Meeting in Denver.

■ SC26

P-Room 3412

Stochastic Models for Production and Service Operations

Cluster: Stochastic Models for Manufacturing Systems
Invited Session
Chair: Eylem Tekin, Assistant Professor, University of North Carolina at Chapel Hill, 205 Smith Building UNC Campus, Chapel Hill, NC, 27599, United States, eylem@unc.edu

1 - Outsourcing Multi-Priority Warranty Services
Peter S Buczkowski, United States, buczkows@email.unc.edu, Vidyadhar Kulkarni

We consider the problem of outsourcing warranty repairs for a fixed population to outside vendors when items have priorities in service. The higher priority customers have a restriction on the expected waiting time. We provide an algorithm to solve the problem and use numerical examples to illustrate the cost benefits of a multi-priority structure.

2 - A Multi-Period Inventory Model with Censored Data
Xiangwen Lu, United States, xwlu@ust.hk, Kaijie Zhu, Jeannette Song

Departing from the literature that focuses on single-period models, we consider a multi-period inventory model for a perishable product with censored data. The Bayesian approach is used for demand updates. We develop a general class of heuristic policies and derive upper bounds on the relative optimality loss of these policies.

3 - Dynamic Revenue Management of Flexible Inventory
Tao Huang, Ph.D student, University of North Carolina-Chapel Hill, Chapel Hill, NC, 27599, United States, ht76@email.unc.edu, Eylem Tekin

We investigate dynamic control polices for allocating flexible inventory to stochastic demand from multiple classes of customers in order to maximize total expected revenues. We present structural properties of the optimal policies for the simple case of two resources satisfying demand from multiple classes of customers. We propose heuristics for more general cases. Furthermore, we study the effect of different system design scenarios and parameters on the performance of the system.

4 - Push and Pull Strategies in Automated Agile Workforce Environments
Biying Shou, Ph.D Student, Northwestern University, United States, biying@iems.nwu.edu, Wallace J. Hopp, Seyed Iravani

We consider the design and control of manufacturing cells with a mixture of manual and automated equipment staffed by a flexible operator. We characterize the structure of the optimal allocation policy under push and CONWIP protocols. Using Markov decision process and simulation models, we generate insights concerning cell design. Finally, we demonstrate that the well-known principles of efficiency and robustness for CONWIP versus push carry over to systems with agile workforce and automation.

■ SC27

P-Room 3454

Approximations and Limit Theorems in Queueing Networks

Sponsor: Applied Probability
Sponsored Session
Chair: Assaf Zeevi, Columbia University, United States, assaf@gsb.columbia.edu

1 - Validity of Steady-State Heavy Traffic Approximations in Open Queueing Networks
David Gamarnik, United States, daveg@us.ibm.com, Assaf Zeevi

A classical theorem by Reiman asserts that the sequence of normalized queue lengths in a Generalized Jackson Network (GJN) in heavy traffic converges weakly to a Reflected Brownian Motion (RBM). However, it is not known whether the stationary distribution of the RBM provides a valid approximation for the underlying steady-state of the GJN. In this talk we resolve this open problem, thus validating a so-called ``interchange-of-limits" for this class of networks.

2 - What is Burstiness?
Hernan Awad, Ph.D candidate, Stanford University, Management Science and Engineering, Terman Engineering Center Rm#321, Stanford, CA, 94305-4026, United States, hawad@stanford.edu, Peter Rabinovitch, Peter Glynn

We argue that burstiness is related to the number of packets that are dropped within a busy cycle in which loss occurs. This motivates the development of approximations for the distribution of the number of dropped packets, conditional on the occurrence of loss. We provide conditional limit theorems for the distribution of packet loss as the buffer grows in size, and study the impact of long-range dependence and heavy tails on this distribution.

3 - Uniqueness of Fluid Limits of Stochastic Networks
Kavita Ramanan, United States, kramanan@asdf5.math.cmu.edu, Rami Atar, Amarjit Budhiraja

We formulate a general condition for the existence and uniqueness of solutions to differential equations with discontinuous right-hand sides, which cannot be analyzed using classical techniques. We show that this condition can be verified for dynamical systems that characterize the fluid limits of certain classes of multi-dimensional queueing networks. We also discuss the potential usefulness of these results for obtaining diffusion and large deviations approximations.

4 - Importance Sampling and Rare Event Simulation in the Presence of Heavy-tails

Achal Bassamboo, Graduate School of Business, Stanford University, 518 Memorial Way, Stanford, CA, 94305, United States, achalb@stanford.edu, Sandeep Juneja, Assaf Zeevi

We consider importance sampling simulation-based estimation of buffer overflow probabilities in a queue with heavy-tailed service times. We show that there does not exist a state independent change of measure which is asymptotically optimal. We then discuss state dependent strategies that achieve significant variance reduction.

■ SC28

P-Room 3504

Proactive Maintenance in Reconfigurable and Flexible Manufacturing Systems

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: Dragan Djurdjanovic, Assistant Research Scientist, University of Michigan, Department of Mechanical Engineering, 2350 Hayward Street, Ann Arbor, MI, 48109-2125, United States, ddjurdja@engin.umich.edu

1 - Availability of Inspected Systems Subject to Environmental Wear and Shocks

Daniel Finkelstei, US Air Force Academy, United States, Daniel.Finkelstein@usafa.af.mil, Jeffrey Kharoufeh

We consider an inspected system with hidden failures in which the degradation of the system is governed by its ambient environment and Poisson shocks. Derived are the cumulative distribution function and mean of the first time to failure, as well as the long-run availability using an inspect-and-replace policy.

2 - Poisson Disorder Problem with Exponential Penalty for Delay

Savas Dayanik, Assistant Professor, Princeton University, ORFE, E-Quad, Princeton, NJ, 08544, United States, sdayanik@princeton.edu, Erhan Bayraktar

We solve the Poisson disorder problem when the delay is penalized exponentially. Our objective is to detect, as quickly as possible, the unobservable time of the change in the intensity of a Poisson process. The change point delimits two different regimes in which one employs distinct strategies (e.g., investment, advertising, manufacturing). We describe a stopping rule that minimizes the frequency of false alarms and an exponential cost function of the detection delay.

3 - Reliability Based Proactive Scheduling of Maintenance and Reconfiguration Operations in Reconfigurable Manufacturing Systems

Dragan Djurdjanovic, Assistant Research Scientist, University of Michigan, Department of Mechanical Engineering, 2350 Hayward Street, Ann Arbor, MI, 48109-2125, United States, ddjurdja@umich.edu, Julie Simmons Ivy

Maintenance is crucial in the Reconfigurable Manufacturing Systems that need to be responsive to fluctuations in market demand, while at the same time maintaining the highest product quality. This research aims at integrating the information about the equipment behavior, buffer status and system configuration into an optimal maintenance scheduling that includes reconfiguration as well as traditional maintenance actions of repair and replacement as possible responses to equipment degradation.

4 - Real-time Degradation Modeling forMaintenance Management and Replacement Strategies

Nagi Gebraeel, United States, gebraeel@purdue.edu

Degradation modeling uses degradation signals acquired by condition monitoring techniques to compute remaining life distributions of components being monitored. This research develops a degradation modeling methodology that combines reliability information with real-time condition monitoring information to estimate residual life distributions for partially degraded components.

■ SC29

P-Room 3502

Forestry Session - Fire Applications II

Cluster: Forestry Applications
Invited 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 - Expert Opinion Weight Elicitation Process for Wildland Fire Management Planning

Pamela Ziesler, Colorado State University, Fire Economics Lab, Dept. Forest, Rangeland and Watershed, Stewardship, Ft. Collins, CO, 80523, United States, pamela.ziesler@colostate.edu, Douglas Rideout

Land managers must often make decisions that directly or implicitly involve tradeoffs that are guided by relative comparisons. In the Fire Program Analysis system, optimal deployment for initial attack is guided by non-monetized weights applied to acres to be protected from wildfire effects. The relative weights inform the system as to which acres are more/less important to protect. This paper shows how non-monetized relative weights can be elicited and used for planning.

2 - Wildfire Budget Formation and Allocation using Operations Research

Douglas Rideout, Fire Economics Lab, Colorado State University, Dept. of Forest, Rangeland and Watershed, Stewardship, Fort Collins, CO, 80523, United States, doug@cnr.colostate.edu

Key members of the federal wildfire planning and budgeting community are revamping the nation's wildfire management and budgeting system based on performance-based economics and OR. This paper summarizes the key components of the new system, known as Fire Program Analysis (FPA) used to allocate approximately $500 million annually of the federal fire fighting budget. We show how programs can be better and more efficient using straightforward applications of economics and operations research.

3 - An Integer Programming Model to Optimize Resource Allocation

Geoffrey Donovan, USDA Forest Service, Pacific Northwest Research Station, 620 SW Main St. Suite 400, Portland, OR, 97205, United States, gdonovan@fs.fed.us

Determining the specific mix of fire-fighting resources for a given fire is formulated as a mixed-integer programming model to minimize the costs of fire fighting and fire damage subject to a fire containment constraint. The model is used to determine the effects of cost parameters and budget constraints on the optimal allocation of resources for fire containment.

4 - Positioning and Dispatching Fire Fighting Resources when Wildfire Location is Uncertain

Robert Haight, Research Forester, USDA Forest Service, North Central Research Station, 1992 Folwell Avenue, St. Paul, MN, 55108, United States, rhaight@fs.fed.us

Fire managers position fire fighting resources with knowledge of probabilities of fire occurrence in surrounding districts. When fires occur, managers dispatch those resources to contain the fires. We formulate a two-stage model with two objectives: minimize the expected cost of positioning and dispatching resources and minimize the expected area burned. Uncertainty about fire location is represented by ignition scenarios, each listing where fires occur.

■ SC30

P-Room 3512

Journal of Quality Technology

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: Joe H. Sullivan, Professor, Mississippi State University, College of Business, MSU, MS, 39762-9582, United States, jsullivan@cobilan.msstate.edu

1 - Using Control Charts to Monitor Process and Product Quality Profiles

William H. Woodall, Virginia Tech, Blacksburg, VA, 24061-0439, United States, bwoodall@vt.edu, Dan Spitzner, Douglas Montgomery, Shilpa Gupta

The quality of a process or product is often best characterized by a relationship between a response variable and one or more explanatory variables. At each sampling stage one observes several data points that can be represented by a curve (or profile). We discuss some of the general issues involved in monitoring profiles and review the SPC literature on the topic. We review applications involving linear regression, nonlinear regression, splines, and wavelets.

2 - A Change Point Model for a Shift in Variance

Douglas M. Hawkins, Professor, School of Statistics, University of Minnesota, 313 Ford Hall, 224 Church St. SE, Minneapolis, MN, 55455-0493, United States, doug@stat.umn.edu, K. D. Zamba

Variance management is now recognized as a major route to quality improvement, but monitoring tools have often-unrealistic requirements for detailed prior process knowledge. We present a variance changepoint approach that does not assume any prior process knowledge but uses the evolving data to learn and monitor simultaneously. The approach is applied to a problem in gold mine evaluation.

3 - Run-Length Performance of Regression Control Charts with Estimated Parameters
Fugee Tsung, HK University of Sci. & Tech., IEEM Dept., HKUST, Kowloon, HK, Hong Kong, season@ust.hk, Kwok-Leung Tsui, Lianjie Shu

The regression control chart is an effective statistical process control (SPC) tool in situations where the output characteristic of interest is affected by an external covariate. It has broad applications such as monitoring and diagnosing multistage processes. In practice, the regression model relating the output and the covariate is rarely known and needs to be estimated. In this research, the run length performance of various regression control charts with estimated parameters is studied.

4 - Estimating Sensitivity of Process Capability Modeled by a Transfer Function
Alan Bowman, Professor of Management, Graduate College of Union University, Lamont House, 807 Union Street, Schenectady, NY, 12308, United States, bowmana@union.edu, Josef Schmee

An output random variable (Y) is a function of a number of input random variables (X's). The probability that Y falls within its specification limits is a measure of the process capability for Y. We describe a one-pass simulation method to efficiently estimate the sensitivity of the process capability for Y to changes in each parameter of the X's. The estimates can be used to focus system improvement actions on those parameters with the most effect on capability.

■ SC31

P-Room 3545

Time-Dependent Queueing Models

Sponsor: Applied Probability
Sponsored Session

Chair: Andrew Ross, Lehigh University, 200 West Packer Ave, Bethlehem, PA, 18015, United States, amr5@lehigh.edu

1 - Managing Time-varying Queues in Web Hosting Services
Natarajan Gautam, Associate Professor, Penn State University, 310 Leonhard Building, University Park, PA, 16802, United States, ngautam@psu.edu, Sai Rajesh Mahabhashyam, Yiyu Chen

Web hosting services can be modeled as systems of parallel queues with each queue having multiple servers and multiple classes of traffic. Typically each queue represents one web application with time-varying traffic arrival pattern as well as number of servers. We evaluate several parameters that can be controlled (possibly at various time granularities), such as admitting arrivals, scheduling inside a queue, number of servers, speed of servers, resource partitioning for various classes, etc.

2 - Closed-Form Expressions for Waiting Time in Queues with Alternating Load
Alan Scheller-Wolf, Associate Professor, Tepper School of Business, Carnegie Mellon University, Pittsburgh, PA, 15213, United States, awolf@andrew.cmu.edu, Mor Harchol-Balter

We obtain simple, closed-form solutions for the mean waiting time in a single-server FIFO queue where the arrival rate fluctuates between Poisson processes with two different means, according to a Markov Modulated Poisson Process, and service times are exponential. Time permitting, we will also discuss extensions to multiple servers, Morkov Modulated service rates, and phase-type service time distributions.

3 - Time of Day Models for Geostationary and Low Earth Orbit Communications Satellites
Thomas Little, Graduate Student, Lehigh University, 200 West Packer Avenue, Industrial and Systems Engineering, Bethlehem, PA, 18015, United States, twl2@lehigh.edu, Andrew Ross

Communications satellites offer access opportunities for disparate regions located within their coverage map. Due to their vast coverage, interesting daily traffic patterns are observed. In this paper we consider instances of a daily traffic model for Geostationary and Low Earth Orbit satellites. The model is based upon a local traffic pattern with aggregate traffic weighted by regional technology penetration. For each instance, a coverage map and a plot of daily system traffic are displayed.

4 - Expected Maximum-in-system for an Mt/G/infinity System
Andrew Ross, Lehigh University, 200 West Packer Ave, Bethlehem, PA, 18015, United States, amr5@lehigh.edu

Arrivals to a modem bank have a strong daily cycle. We ask what the expected maximum number in system would be if plenty of servers were available. We compute bounds on the expected maximum using a multivariate Normal approximation, using mathematical programming to find the appropriate parameters. The method is applicable to the expected maximum of any multivariate Normal, and sometimes the bounds are very tight.

■ SC32

T-Vail (Majestic Level)

Spreadsheet Simulation and Optimization

Cluster: OR Practice
Invited Session

Chair: Lawrence Goldman, Product Marketing Manager, Decisioneering, Inc., 1515 Arapahoe St. #1311, Denver, CO, 80202, United States, lgoldman@crystalball.com

1 - Some Heuristics for using OptQuest
Stephen Powell, Faculty, Dartmouth College, Tuck School of Business, Hanover, NH, 03755, United States, Stephen.G.Powell@Dartmouth.EDU

While OptQuest can in theory be used to solve complex stochastic optimization problems, end-users in particular find it difficult to identify demonstrably superior solutions. We offer some practical guidelines for using OptQuest that can improve both the quality and robustness of the solutions found. We will illustrate these guidelines on a range of applications, from finance, marketing and operations.

2 - The Case For Tax-Loss Harvesting In January
John Charnes, Professor and Area Director for Finance, Economics, and Decision Sciences, The University of Kansas School of Business, Summerfield Hall, 1300 Sunnyside Avenue, Lawrence, KS, 66049, United States, jmc@ku.edu, Howard Marmorstein

Contrary to conventional wisdom, might it be beneficial to consider tax loss harvesting in January or any other time before the end of the year? In this talk we use simulation and optimization to specify the optimal timing of loss realization, given an investor's marginal tax rate and transaction costs.

3 - Should We Kill the Clinical Trial: A Clinical Trial Simulation
Russell Ivanhoe, Principal, RJI Co., 404 Seneca St., Palo Alto, CA, 94301, United States, rjivanhoe@rjico.com

I analyzed in process research using Monte Carlo simulation. I reviewed previous reports and the in process research data when it became available creating a simulated randomized trial using output from the initial modeling. I then developed a feasibility score for the technology and determined the probability of meeting protocol endpoints. A recommendation was made to discontinue the clinical trial and resubmit the technology under different labeling.

■ SC33

T-Savoy (Majestic Level)

JFIG Paper Competition I

Sponsor: JFIG, Junior Faculty Interest Group
Sponsored Session

Chair: Sila Cetinkaya, Associate Professor of Industrial Engineering, Texas A&M University College Station, TX, 77843-3131, United States, sila@tamu.edu

1 - Online Auction and List Price Revenue Management
Gustavo Vulcano, Assistant Professor, New York University, 44 West 4th Street, Suite 8-76, New York, NY, 10012, United States, gvulcano@stern.nyu.edu, Rene Caldentey

We analyze a revenue management problem in which a seller, facing a Poisson arriving stream of rational customers, operates an online multiunit auction. The seller announces the auction duration, the reservation price, and the number of units to offer in order to maximize revenues. Besides the auction, customers have access to an alternative list price channel to buy the product. This list price channel can be either managed by the auctioneer or by another firm.

2 - Optimal Investment Strategies for Flexible Resources, Considering Pricing and Correlated Demands
Ebru K. Bish, Assistant Professor, Grado Department of Industrial and Systems Engineering Virginia Polytechnic Institute and State University, Blacksburg, VA, 24061, United States, ebru@vt.edu, Qiong Wang

We study the resource investment decision faced by a two-product firm, which utilizes ex-post pricing in a monopolistic situation. The firm can invest in dedicated resources, which can only satisfy a specific product, and/or in a more expensive, flexible resource, which can satisfy both products. Our analysis characterizes the structure of the firm's optimal resource investment portfolio as a function of demand parameters and investment costs, and provides managerial guidelines and principles.

■ SC34

T-Columbine (Majestic Level)

Leadtime and Pricing Considerations

Sponsor: Manufacturing and Service Operations Management Sponsored Session

Chair: Pinar Keskinocak, Coca-Cola Assistant Professor, Georgia Institute of Technology, School of Industrial and Systems Enginee, 765 Ferst Drive, Atlanta, GA, 30345, United States, pinar@isye.gatech.edu

Co-Chair: Julie Swann, Georgia Institute of Technology, Industrial and Systems Engineering Dept., 765 Ferst Drive, NW, Groseclose 0205 Room 411, Atlanta, GA, 30332-0205, United States, jswann@isye.gatech.edu

1 - Realizing Market Segmentation in the Manufacturing Industry
Julie Swann, Georgia Institute of Technology, Industrial and Systems Engineering Dept., 765 Ferst Drive, NW, Groseclose 0205 Room 411, Atlanta, GA, 30332-0205, United States, jswann@isye.gatech.edu, Tieming Liu, Serhan Duran, David Simchi-Levi

We analyze market segmentation in manufacturing where customers are differentiated according to fulfillment priority and willingness to wait. We allow some orders to be promised immediately and satisfied in the next period (B), and inventory may be reserved to satisfy future profitable demand (R). We show a modified order-up-to policy (S, R, B) is optimal for various rationing strategies where S is the base stock level and values are limited by capacity; profit improvement can be significant.

2 - Quoting Customer Lead Times when the Demand Depends on Service Performance
Altan Gulcu, Georgia Institute of Technology, Atlanta, GA, United States, altan@isye.gatech.edu, Serhan Duran, Pinar Keskinocak, Julie Swann

We consider the problem of quoting lead times when the customer demand depends on the quoted lead time as well as the long run performance of the server in meeting them. We derive the optimal lead time in infinite capacity case and compare it to the case when customers ignore the long run performance and just consider the quoted lead time when placing their order. Then, we search for the optimal control policy with finite server capacity and when the arriving orders are processed FCFS order.

3 - Assuring Production Capacity During Supply Channel Selection
Holly Lutze, Assistant Professor, University of Texas at Dallas, School of Management, SM30, P. O. Box 830688, Richardson, TX, 75083-0688, United States, hlutze@utdallas.edu, Ozalp Ozer

When promising a delivery leadtime, a firm takes responsibility for acquiring enough units to fill customer orders on time. To minimize expected costs with a promised leadtime, firms seek to ensure sufficient production capacity in their upstream supply chains. Focusing on supply channel selection, we study the impact of competition and component subcontracting on supply chain capacity and profits.

4 - Demand Shaping for Differentiated Products with Limited Component Availability
Bo Zhang, Ph.D Student, University of Texas at Austin, The University of Texas at Austin, Mgmt Sci & Info Systems, Austin, TX, 78712, United States, zhangbo@mail.utexas.edu, Anant Balakrishnan, Yusen Xia

With increasing visibility of incoming component shipments, firms can use dynamic pricing strategies to match demand with anticipated supply. We develop an economic model to address these short-run demand shaping decisions for vertically differentiated products that use product-specific and common components. Using a characterization of optimal price and sales trajectories over a finite horizon, we develop a procedure to find the optimal policy.

■ SC35

T-Terrace (Terrace Level)

Operations Management and Homeland Security

Sponsor: Manufacturing and Service Operations Management Sponsored Session

Chair: Lawrence Wein, Paul E. Holden Professor of Management Science, Graduate School of Business, Stanford University, Stanford, CA, 94305-5015, United States, wein_lawrence@gsb.stanford.edu

1 - Models for Designing Response Plans to Catastrophic Events.
Richard Larson, Professor, MIT, Civil and Environmental Engineering, Room 1-170, Cambridge, MA, 02139, United States, rclarson@mit.edu

Building on OR models of urban police, fire and ambulances, we discuss modeling response to catastrophes including terrorist attacks. First responder resources are overwhelmed, so 2nd and possibly 3rd tier responders are deployed. We build from the Hypercube Queueing Model for spatial deployments, cut-off priority queues and related work. The goal is to provide a local decision tool to assess the quality of alternative emergency response plans. This is part of the DHS USC CREATE project.

2 - Tactical Prevention of Suicide Bombings in Israel
Edward H Kaplan, William N and Marie A Beach Professor of Management Sciences, Professor of Public Health, Yale University, School of Management, Yale School of Medicine, New Haven, CT, 06520-8200, United States, edward.kaplan@yale.edu, Alex Mintz, Shaul Mishal, Claudio (Dicky) Samban

We propose a terror-stock model that treats the suicide bombing attack rate as a function of the number of terrorists available to plan and execute suicide bombings. Counterterror tactics are intended to reduce the capacity of terror organizations to commit attacks. We present the results of an empirical study applying this framework to suicide bombings in Israel during 2001-2003.

3 - Using Fingerprint Image Quality to Improve the Identification Performance of the US-VISIT Program
Manas Baveja, Stanford University, Scientific Computing and Computational M, Stanford, CA, 94305, United States, manas@stanford.edu, Lawrence Wein

Motivated by the difficulty of correctly matching fingerprints of poor image quality, we solve a game-theoretic formulation of the identification problem. Our results suggest a serious but reparable vulnerability in the biometric identification system of the US-VISIT Program, which is a key tool for keeping terrorists off of US soil.

■ SC36

T-Capitol (Terrace Level)

Financial Engineering I

Cluster: Financial Engineering

Invited Session

Chair: Shi-Jie Deng, Asst. Professor, Georgia Inst. of Tech., 765 Ferst Dr, Atlanta, GA, 30332, United States, deng@isye.gatech.edu

1 - The Innovest Austrian Pension Fund Financial Planning Model InnoALM
William Ziemba, University of British Columbia, Faculty of Commerce and Business Adminis, Canada, ziemba@interchange.ubc.ca

This paper describes the financial planning model InnoALM developed by Innovest for Austrian pension funds for the Austrian employees of the electronics firm Siemens. The model is one tool in the analysis of the growing worldwide problem of ageing and the growing number of pensioners in an environment of increased demand for government services including national pensions, which uses a multiperiod stochastic linear programming framework with a flexible number of time periods of varying length.

2 - Modeling Recovery with Systematic Risk
Amnon Levy, Moody's KMV, United States, Amnon.Levy@MKMV.com

This paper proposes a pricing framework that accounts for systematic risk in recovery for the pricing of credit risky instruments. The methodology is developed within a general asset-pricing framework and allows for correlation between the firm's underlying assets and realized recovery in the event of default. An example is provided where the expected value in default under the risk neutral measure is expressed as a linear function of the expected value under the true measure.

3 - Empirical Bayes Estimation with Dynamic Portfolio Models
Leonard MacLean, Dalhousie University, School of Business Administration, Canada, lmaclean@mgmt.dal.ca, Michael Foster, William Ziemba

This paper considers the estimation of parameters in a dynamic stochastic model for securities prices, where the expected rate of return is a random variable. An empirical Bayes estimator is developed from the model structure. The estimator is an improvement on other popular estimators in terms of mean squared error. The effect of reduced estimation error on accumulated wealth is analyzed for the portfolio choice model with constant relative risk aversion utility.

4 - A Semi-dynamic Approach for Valuing and Hedging a Ratio Call Option with Continuous Payouts
Shi-Jie Deng, Asst. Professor, Georgia Inst. of Tech., 765 Ferst Dr, Atlanta, GA, 30332, United States, deng@isye.gatech.edu

We consider the problem of replicating the payoffs of a call option on the ratio of the prices of two assets with a fixed finite maturity which continuously pays the positive part of the difference between the daily price ratio and a strike ratio level. We present an alternative approach which combines dynamic trading in the underlying assets with static positions in a set of basket options of one single maturity.

■ SC37

T-Biltmore (Terrace Level)

Risk Management in Power Markets

Sponsor: Energy, Natural Resources and the Environment
Sponsored Session

Chair: Alvaro Baillo, Professor, Universidad Pontificia Comillas, Sta Cruz de Marcenado 26, Madrid, 28015, Spain, alvaro.baillo@iit.upco.es

1 - Volumetric Hedging in Electricity Procurement
Yumi Oum, Graduate Student, UC Berkeley, IEOR Department, Berkeley, CA, 94720, United States, yumi@ieor.berkeley.edu, Shmuel Oren, Shi-Jie Deng

Load serving entities (LSE) providing electricity service at regulated prices in restructured electricity markets, face price and quantity risk. We address the hedging problem of such a risk averse LSE. Exploiting the correlation between consumption quantities and spot prices, we developed an optimal, zero-cost hedging function characterized by payoff as function of spot price. We then show how such a hedging strategy can be implemented through a portfolio of call and put options.

2 - Electricity Production Planning and Portfolio Optimization with a CVaR Objective
Jordi Cabero, Ph. D. Student, Universidad Pontificia Comillas, Sta. Cruz de Marcenado 26, Madrid, 28015, Spain, jordi.cabero@iit.upco.es, Santiago Cerisola, Alvaro Baillo, Mariano Ventosa

We present a methodology to manage the market risk faced by a hydrothermal generation company in the medium-term. Our methodology includes the generation of scenarios for random parameters (fuel prices, power demand, water inflows, electricity prices), the approximation of these scenarios by a multivariate scenario tree and the optimization of the company's operational and financial hedging decision under a stochastic programming framework in which risk exposure is measured by means of CVaR.

3 - The Contract Design Problem in Retail Electric Power Markets
Steve Gabriel, Assistant Professor, University of Maryland, Dept. of Civil & Env.. Engineering, 1143 Martin Hall, College Park, MD, 20742, United States, sgabriel@umd.edu, Miguel Angel Plazas, S. Balakrishnan, Antonio Conejo

Electric power retailers set up contracts with both suppliers as well as end-users but face risks when their forecasted load to the supplier is far from the actual end-user load. They can use the spot market to either sell/purchase electricity as needed. Intentionally under- or over-forecasting the load to the supplier and using the spot market is one option. We present a new stochastic optimization model to guide marketers both operationally and contractually.

4 - Benders Decomposition for MIP Problems: Application to Multistage Stochastic Unit Commitment Problem
Santiago Cerisola, Professor, Universidad Pontificia Comillas, Sta. Cruz de Marcenado, Madrid, 28015, Spain, cerisola@iit.upco.es, Andres Ramos, Alvaro Baillo

This paper presents a modification of Benders decomposition method to deal with mixed-integer variables at any stage of the decomposition algorithm. The interest of this modification lies in that many real decision problems may be formulated as sequential optimization problems that involve mixed integer variables at any decision stage. An application to the resolution of a weekly unit commitment problem illustrates the potential of this approach.

■ SC38

T-Beverly (Terrace Level)

Simulation Output Analysis Techniques, I

Sponsor: Simulation
Sponsored Session

Chair: David Goldsman, Professor, Georgia Institute of Technology, 765 Ferst Dr., NW, Atlanta, GA, 30332, United States, sman@isye.gatech.edu

1 - Performance of a Wavelet-Based Spectral Procedure for Steady-State Simulation Analysis
Emily Lada, Postdoctoral Fellow, SAMSI, 19 T. W. Alexander Dr., P.O. Box 14006, Research Triangle Park, NC, 27709-4006, United States, eklada@eos.ncsu.edu, James Wilson, Natalie Steiger, Jeffrey Joines

We summarize the results of a performance evaluation of WASSP, a method for constructing a confidence interval on the steady-state mean of an output process. We applied WASSP to problems designed to explore its efficiency and robustness in comparison with ASAP3 and the Heidelberger-Welch algorithm. WASSP compared favorably with its competitors, delivering confidence intervals whose half-lengths and coverage probabilities were frequently closer to the user-specified nominal levels.

2 - Fully Sequential Procedures with a Parabolic Boundary
Seong-Hee Kim, Assistant Professor, Georgia Institute of Technology, 765 Ferst Drive, NW, Atlanta, GA, 30332, United States, skim@isye.gatech.edu, David Goldsman, Demet Batur

In this talk, we develop fully sequential procedures with a parabolic boundary when the goal is to find the one among a number of simulated systems with the largest or smallest expected performance. We assume that observations from each system are IID normally distributed with unknown variances. We prove that the procedure guarantees a certain probability of a correct selection, and we compare the performance of our procedure with that of Kim and Nelson.

3 - Overlapping Overlapping Batch Means - Something More for Nothing?
David Goldsman, Professor, Georgia Institute of Technology, 765 Ferst Dr., NW, Atlanta, GA, 30332, United States, sman@isye.gatech.edu, Tuba Aktaran, Wheyming Song, Bruce Schmeiser

We introduce new estimators for the variance parameter of a steady-state simulation output process. The new estimators are linear combinations of estimators formed from overlapped versions of standardized time series and/or batch means estimators utilizing different batch sizes. We find that these "overlapping overlapping" estimators have both lower bias and lower variance than their original overlapping (without linear combinations) counterparts.

■ SC39

T-Tower Court A (2nd Floor)

Retail Supply Chain Management III: Improving Supply Chain Performance

Cluster: Supply Chain Mgmt & Operations
Invited Session

Chair: Naren Agrawal, Associate Professor, Santa Clara University, OMIS Department, Santa Clara, CA, 95053, United States, NAgrawal@scu.edu

Co-Chair: Stephen Smith, Professor, Santa Clara University OMIS, 500 El Camino Real, Kenna Hall 323C, Santa Clara, CA, 95053-0382, United States, SSmith@scu.edu

1 - Linking Supply Chain Performance to Financial Metrics
Warren Hausman, Professor, Stanford University, Stanford, CA, 94305, United States, hausman@stanford.edu, Manas C. Fuloria

For fashion industries we analyze the implications of improved supply chain performance (in particular, reduced stockouts and markdowns) on both operational metrics and also financial metrics. We demonstrate a powerful linkage to Market Capitalization for 53 firms in specialty retail, department stores, wholesale brands, and athletic brands.

2 - If the Inventory Manager Knew - RFID in Retail and Distribution
Hau Lee, United States, lee_hau@gsb.stanford.edu, Ozalp Ozer, Atali Aykut

The discrepancy in inventory records, due to misplacement of items, theft and execution errors, leads to poor inventory management, such as failing to order when necessary. We propose inventory policies that account for inventory inaccuracies. By comparing these new policies to RFID-enabled inventory systems with complete inventory visibility, we quantify the true value of RFID in inventory management.

3 - Replenishment and Inspection Policies for Systems with Inventory Record Inaccuracy
Gurhan Kok, Fuqua School of Business, Duke University, Durham, NC, 27708-0120, United States, gurhan.kok@duke.edu, Kevin Shang

Most inventory models in the literature assume accurate inventory records. However, in reality, physical inventory and inventory records (nominal inventory) are seldom aligned. We consider a single stage inventory system where there is a random discrepancy between physical inventory and nominal inventory in each time period. We characterize the optimal replenishment and inspection strategies in this model.

4 - Retail Assortment Planning
Marshall Fisher, UPS Professor, The Wharton School, University of Pennsylvania, Philadelphia, PA, 19104.6366, United States, fisher@wharton.upenn.edu, Ramnath Vaidyanathan

The assortment of products that a retailer decides to carry in each store has an enormous impact on sales and gross profit. We review approaches to assortment planning from the academic literature and from industry, propose a framework for classifying approaches and describe ongoing research for localizing assortment by store.

■ SC40

T-Tower Court B (2nd Floor)

Forecasting and Information Sharing in Supply Chains

Cluster: Supply Chain Mgmt & Operations
Invited Session

Chair: Sridhar Seshadri, Associate Professor, Stern School of Business, NYU, 44 W 4th St, New York, NY, 10012, United States, sseshadr@stern.nyu.edu

1 - Deciphering Demand Signals and the Value of Information Sharing in a Supply Chain
Avi Giloni, Assistant Professor, Sy Syms School of Business, Yeshiva University, New York, NY, 10013, United States, agiloni@ymail.yu.edu, Vishal Gaur, Sridhar Seshadri

We study a supply chain in which a single retailer orders from a supplier using a periodic review policy. The demand at the retailer is an autoregressive process. We show that as demand propagates upstream in a supply chain, the autoregressive component of demand is preserved whereas the moving average component becomes larger. We provide a rule by which managers can determine when using historical orders suffices, and when there is value to sharing demand information.

2 - Modeling Approaches for Very Long-Term Forecasts
ManMohan S. Sodhi, Associate Professor, Cass Business School, 106 Bunhill Row, London, EC1Y8TZ, United Kingdom, M.Sodhi@city.ac.uk, Erik Larsen

There is a need for very long-term forecasts, e.g., those for 20-25 years for strategic supply chain planning. Sodhi (2003) has shown how OR-based models can be used in conjunction with scenario planning for strategic supply chain planning. These OR models need scenario-specific demand forecasts to determine the optimal network configuration. We review forecast-modeling approaches that could be useful for creating such demand forecasts.

3 - Collaborative Forecasting - What's in it for the Retailers?
Johanna Smaros, Researcher, Helsinki University of Technology, Otaniementie 17, Espoo, FIN-02015, Finland, johanna.smaros@hut.fi

A study from the European grocery sector identifies reasons why companies rarely collaborate, despite the suggested benefits. A central finding is that forecasting is less important to retailers than to suppliers. This often causes retailers' forecasting processes to be very basic and reduces the potential benefits of collaboration. The conclusion is that suppliers should make collaboration easy for retailers by focusing on information sharing rather than on more laborious joint forecasting.

4 - Monotone Forecasts
Cagri Haksoz, Cass Business School, City of London, 106 Bunhill Row, London, EC1Y8TZ, United Kingdom, c.haksoz@city.ac.uk, Sridhar Seshadri

In this talk, we provide necessary and sufficient conditions for the distribution of demand in the future to be stochastically increasing in the demand that has been observed in the past. We base our analysis on the multi-period inventory model examined by Eppen and Iyer (1997). In the process of establishing the necessary and sufficient conditions we develop a new property called the sequential monotone likelihood ratio property.

■ SC41

T-Tower Court C (2nd Floor)

Supply Chain Risk Analysis I

Contributed Session

Chair: John Wu, Associate Professor, Kansas State University, 237 Durland Hall, Industrial and Manufacturing Systems Eng, Manhattan, KS, 66506, United States, chw@ksu.edu

1 - Large Scale Distributed Multi-Agent Simulation For Growing Complex Adaptive Supply Networks
Surya Pathak, Ph.D Candidate, Vanderbilt University, Box 1518, Station B,, Nashville, TN, 37235, United States, surya.d.pathak@vanderbilt.edu, David Dilts

How do supply networks grow and evolve over time? To answer this, we model supply networks (SN) as a complex adaptive system and have developed an agent-based simulation framework. To ensure scalable and computationally efficient simulation, we have used a high-performance, parallel computing infrastructure for implementation purposes. The simulation results from this research will help policy makers/managers to understand the key parameters governing the growth dynamics in supply networks.

2 - NABLE: An Agent-Based Economics Model for Simulating Supply Chain and Infrastructure Disruptions
David Schoenwald, Sandia National Labs, P.O. Box 5800, MS 0318, Albuquerque, NM, 87185-0318, United States, daschoe@sandia.gov, Mark Ehlen

Sandia National Labs has developed an agent-based economic laboratory (N-ABLE) for analyzing the economic effects of supply chain and infrastructure disruptions. N-ABLE is a simulation environment in which many economic actors simulate manufacturing firms, governments, and households. N-ABLE runs on a PC supported by a GUI that allows users to change parameters and simulate shocks to the economy. The tool has studied the economic impact of disruptions to industries and regional economies.

3 - Scenario-Based Supply Contract with Options in Supply Chain Management
John Wu, Associate Professor, Kansas State University, 237 Durland Hall, Industrial and Manufacturing Systems Eng, Manhattan, KS, 66506, United States, chw@ksu.edu, Lian Li

Our presentation focus on a supply contract with options in two level supply-chain between a supplier and a buyer having periodical commitment with options, in presence of stochastic demands. We develop a multiperiod buyer and suppler model separately by scenario-based stochastic programming considering the price protection and return policy. Optimization for both sides can be achieved via exchange of information and negotiations between supplier and buyer's contract.

■ SC42

T-Tower Court D (2nd Floor)

Multi-period Models for Revenue Management

Sponsor: Revenue Management & Dynamic Pricing
Sponsored Session

Chair: Robert Shumsky, Associate Professor, Simon School, University of Rochester, Rochester, NY, 14627, United States, shumsky@simon.rochester.edu

1 - Dynamic Pricing, Admission Control, and Capacity Management for Rental Revenue Management
Dan Zhang, University of Minnesota, Department of Mechanical Engineering, Minneapolis, MN, 55455, United States, zdan@me.umn.edu

We study a rental revenue management problem with multiple customer classes. The problem is formulated in Markov decision process framework. For a special case, we show that the problem can be reduced to an MDP with one-dimensional state and action spaces. Structural properties of the problem are studied. We formulate and solve a deterministic fluid model that admits quite simple solutions. Subsequently, the impact of revenue management decisions on capacity sizing is investigated.

2 - A Robust Optimization Approach to Multi-period Oligopolistic Pricing
Georgia Perakis, Sloan Career Development Associate Professor of Operations Research, Sloan School, MIT, 50 Memorial Drive, Rm E53-359, Cambridge, MA, 02139, United States, georgiap@mit.edu, Anshul Sood

We propose a model for pricing a single perishable product in a multi-period oligopolistic market. We address the competitive aspect of the problem together with demand uncertainty through robust optimization. We establish existence and uniqueness of equilibrium policies and introduce an iterative learning algorithm for computing these policies. We illustrate our results through some numerical examples and discuss some insights.

3 - Multi-Period Resource Management With Pricing Decisions
Francis de Vericourt, Assistant Professor, Fuqua School of Business, One Towerview, Durham, Durham, NC, 27708, United States, fdv1@duke.edu, Miguel Lobo

We analyze a multi-period resource management problem with pricing decisions. In each period, the current assets are divided between consumption and investment in service capacity. Demand is stochastic and depends on the price. Revenue generated by satisfied demand determines in turn the assets in the next period. The objective is to maximize the total discounted asset consumption. Although it has broader applications, we motivate this model with applications in non-profit organizations.

4 - Dynamic Capacity Rationing for Multiple Products with Upgrades
Robert Shumsky, Associate Professor, Simon School, University of Rochester, Rochester, NY, 14627, United States, shumsky@simon.rochester.edu, Fuqiang Zhang

We examine a multi-period model in which flexible inventory satisfies demand from multiple classes of customers. While the optimal rationing policy can be characterized as a threshold policy, the thresholds are state-dependent and laborious to calculate. We explore the effectiveness of a series of simpler approximations to the optimal policy.

■ SC43

T-Denver (Mezzanine)

Examining Empirical Research Trends in OM/ New Product Development

Cluster: New Product Development
Invited Session

Chair: Anita Tucker, Assistant Professor, University of Pennsylvania, 551 Jon M. Huntsman Hall, 3730 Walnut Street, Philadelphia, PA, 19104-6340, United States, tuckera@wharton.upenn.edu

1 - Publishing Empirical OM Work Using Alternatives to Survey and Case Studies
Thomas Gattiker, Assistant Professor, Miami University, Richard T. Farmer School of Business, 307 Laws Hall, Oxford, OH, 45056, United States, gattiktf@muohio.edu, Diane Parente

There is considerable evidence that inducing practitioners to participate in survey research is increasingly difficult. Surveys are also problematic because key informant perceptions may distort the information provided. This presentation overviews some novel sources of empirical data and provides information on publishing empirical research. It also addresses some of the blind spots and limitations that various types of empirical data may create.

2 - Empirical Research in Operations Management: Past Research and Future Directions
Taylor Randall, University of Utah , David Eccles School of Business, 1654 E. Central Campus Drive, Rm 108, Salt Lake City, UT, 84112, United States, acttr@business.utah.edu, Marcelo Olivares, Christian Terwiesch

We review past empirical research in operations management. We note marked trends in quantity of publications and sophistication of methods. Using comparisons to other fields, we describe possible future directions for empirical research.

3 - Small Worlds and Innovation
Lee Fleming, Associate Professor, Harvard University, Morgan Hall T-95, Soldiers Field Road, Boston, MA, 02163, United States, lfleming@hbs.edu

Although small-world networks have attracted much theoretical attention and are widely thought to enhance creativity, fewer empirical studies of their evolution and influence on subsequent innovative productivity exist. Using patent coauthorship data, we illustrate crossovers from large- to small-world structures and the emergence and disappearance of giant components in regional collaboration networks. Based on a mix of qualitative and quantitative research, we find only qualified evidence to support the emerging consensus that small worlds improve innovation. We close with a discussion of the implications of regional collaboration networks for firms and policy makers.

■ SC44

T-Spruce (Mezzanine)

Auctions in Practice

Cluster: Auction Theory & Applications
Invited Session

Chair: Wedad Elmaghraby, Assistant Professor, ISyE, Georgia Institute of Technology, 765 Ferst Dr., Atlanta, GA, United States, wedad@isye.gatech.edu

1 - Non-convex Daily Electricity Auctions
Richard O'Neill, FERC, United States, richard.oneill@ferc.gov, Michael Rothkopf, Wedad Elmaghraby, William Stewart

Before electricity auction markets developed, vertically integrated utilities formulated a MIP and used a Lagrangean relaxation approach to decide which units to commit. When unit commitment markets developed, a dispatched unit was paid the higher of its bid cost and the market clearing prices (dual prices). This daily auction is a multiproduct, two-sided auction with discrete and continuous products (variables). We illustrate the use of efficient two-part pricing with simple examples.

2 - Auctions versus Negotiations: An Empirical Analysis
Patrick Bajari, Associate Professor, Duke University, 219B Social Science Building, Duke University, Durham, NC, 27708, United States, bajari@econ.duke.edu

Should the buyer of a customized good use competitive bidding or negotiation to select a contractor? We examine a comprehensive data set of private sector building contracts awarded in Northern California during the years 1995-2000. The analysis suggests a number of potential limitations to the use of auctions. Auctions perform poorly when projects are complex, contractual design is incomplete and there are few available bidders.

3 - Procurement Auctions for Differentiated Goods
Jason Shachat, Associate Professor, National University of Singapore, Department of Business Policy, 1 Business Link, Singapore, 117570, Singapore, ecsjs@nus.edu.sg, J. Todd Swarthout

We consider two mechanisms to procure differentiated goods: a request for quote and an English auction with bidding credits. Game theoretic models predict the request for quote is socially efficient but the English auction with bidding credits is not. In experiments, the request for quote is less efficient than the English auctions with bidding credits. Moreover, both the buyer and seller receive more surplus in the English auction with bidding credits.

4 - An Examination of Package Bidding in Transportation Auctions
Chris Caplice, Principal Research, MIT CTL, 1 Amherst Street, Bldg E40-365, Cambridge, MA, 02139, United States, caplice@MIT.edu

This paper discusses the actual bidding behavior of transportation companies in reverse combinatorial auctions. We analyze the simple and package bids submitted in over a dozen single and multiple round auctions. Metrics for classifying and characterizing package bids are developed and comparisons to auctions in other domains are drawn.

■ SC45

T-Gold (Mezzanine)

AI and Game Theory

Cluster: Game Theory
Invited Session

Chair: Gerry Tesauro, IBM Research, 19 Skyline Drive, Hawthorne, NY, 10532, United States, gtesauro@us.ibm.com

1 - Network Models for Game Theory and Economics
Sham Kakade, PostDoc, University of Pennsylvania, Suite 400A, 3401 Walnut St., Philadelphia, PA, 19103, United States, skakade@linc.cis.upenn.edu

Over the last few years, a number of authors have developed network models for large-population game theory and economics. In such models, each player or organization is a vertex in a graph, and payoffs and transactions are restricted to obey the graph topology. This allows the specification of rich structure (social, organizational, political) in strategic systems. This talk will survey these models and the attendant algorithms for computing Nash, correlated, and Arrow-Debreu equilibria.

2 - Experts Algorithms and Exploration-Exploitation Tradeoffs in Reactive Environments
Daniela de Farias, Massachusetts Institute of Technology, Cambridge, MA, United States, pucci@mit.edu, Nimrod Megiddo

A general experts method for making decisions in a reactive environment is presented along with a proper definition of value. The method is shown to asymptotically perform as well as the best available expert. Several variants are analyzed from the viewpoint of the exploration-exploitation tradeoff, including explore-then-exploit, polynomially vanishing exploration, constant-frequency exploration, and constant-size exploration phases. Complexity and performance bounds are proven.

3 - A Heuristic-Strategy Approach to Analyzing Complex Strategic Interactions
William Walsh, Research Staff Member, IBM T.J. Watson Research Center, 19 Sklyine Dr, 2S-K15, Hawthorne, NY, 10019, United States, wwalsh1@us.ibm.com

I describe an approach to analyzing complex games with repeated actions for which standard techniques are intractable. Exogenously specified, heuristic strategies, rather than the atomic actions, are treated as primitive, and a three-part analysis is applied: computation of heuristic-strategy Nash equilibrium, identification of the most plausible equilibria via replicator dynamics, and analysis with perturbed payoffs to predict the effects of unmodeled changes in the strategies.

4 - Group Probability
Itzhak Ravid, Israel, iravid@netvision.net.il

Probability rewarding score, like the quadratic, is a known operational criterion for individual probability. It is known to fail as a rewarding scheme for a combined probability assessment of a group of experts, because incomplete information (of each expert regarding his fellows' beliefs) encourages dishonesty in bargaining. I propose a formal scoring scheme that rewards each individual both for being honest and for active sharing his true information with his peers.

■ SC46

T-Aspen (Mezzanine)

Panel: Junior Faculty Responsibilities and Tenure: Balancing Teaching, Research, Service and Life

Sponsor: Women in OR/MS
Sponsored Session

Chair: Amelia Regan, University of California, Irvine, Institute of Transportation Studies, Computer Science and Civil Engineering, Irvine, CA, United States, aregan@uci.edu

1 - Junior Faculty Responsibilities and Tenure: Balancing Teaching, Research, Service and Life,

Recently tenured and advanced junior faculty share their insights and experiences on the tenure track. The format will be short introductions by each speaker followed by plenty of time for questions and answers.

■ SC47

T-Century (Mezzanine)

Software Demonstration

Cluster: Software Demonstrations
Invited Session

1 - Intelligent Automation, Inc.- CybelePro®
Goutam Satapathy, Intelligent Automation, Inc., 15400 Calhoun Dr., Ste. 400, Rockville, MD, 20855, United States, goutam@i-a-i.com, Patrick Sodre Carlos

United States government and industries have identified the need for agent-technology in modeling and simulation. Intelligent Automation offers CybelePro® (www.cybelepro.com), a robust and efficient agent infrastructure for rapid development and deployment of large-scale high performance agent-based simulation and decision support systems. We will demonstrate NASA's Airspace Concept Evaluation System (ACES) and air traffic flow control DST developed using Cybele.

Sunday 4:30pm-6:00pm

■ SD01

P-Ballroom F

Tutorial: Computational Finance

Cluster: Tutorials- Denver 2004
Invited Session

1 - Computational Finance
Stavros A. Zenios, Professor, School of Economics & Management, University of Cyprus, P.O. Box 20537, CY 1678, Nicosia, Cyprus, zenioss@ucy.ac.cy

Quantitative methods have been gaining increasing importance in finance over recent decades. Not only have the celebrated models for options pricing evolved to unprecedented levels and are used routinely in industry, but policymakers have also come to rely on quantitative models for risk management and control. Within the framework of enterprise-wide risk management methods and techniques drawn from operations research play today an important role. This tutorial will survey the current state-of-affairs.

■ SD02

P-Ballroom E

Tabu Search: Theory and Applications

Cluster: Metaheuristics (EU/ME)
Invited Session

Chair: Michel Gendreau, University of Montreal, C.P. 6128, succ. Centre-ville, Montreal, QC, H3M 2V4, Canada, michelg@crt.umontreal.ca

1 - On the Relationship Between Long-Term Memory, Pool Maintenance, and Fitness-Distance Correlation
Jean-Paul Watson, Sandia National Laboratories, P.O. Box 5800, MS 1110, Albuquerque, NM, 87185, United States, jwatson@sandia.gov

The effectiveness of long-term memory mechanisms such as reintensification and path relinking is a function of two related factors: the strength of fitness-distance correlation in the underlying search space and the composition of the pool of elite solutions. We characterize the relationship between these two factors and explore the implications of this relationship for the design of advanced tabu search algorithms. Experimental results are presented for the job-shop scheduling problem.

2 - A Tabu Search Algorithm for a Difficult Forest Machine Location Problem
Andres Weintraub, Dep of Industrial Engineering, University of Chile, POB 2777, Santiago, Me, Chile, aweintra@dii.uchile.cl, Andres Diaz, Jorge Vera, Celso Ribeiro, Jacques Ferland

The forest location problem is difficult to solve , as it involves a combination of plant location and fixed charge netwok flow problem, since access roads need to be built. We develop a Tabu search algorithm for this problem. The main feature is the use of spanning and Steiner trees to obtain network configurations. Good computational results are shown on realistic large size problems

3 - A Tabu Search Algorithm for a Dynamic Pickup and Delivery Vehicle Routing Problem
Frédéric Semet, Professor, Université de Valenciennes et du Hainaut-Cambrésis, LAMIH/ROI, 59313 Valenciennes Cedex, Le Mont Houy, ISTV 2, Valenciennes, 59313, France, frederic.semet@univ-valenciennes.fr, Fabien Malca

Recent improvements in communication and information technologies allow to carrier the management of their fleet in real-time. The associated static problem considered is the pickup and delivery problem with time windows and a fixed size fleet. A tabu search heuristic embedded in dynamic context is presented.

4 - On the Importance of Allowing Infeasible Moves in Tabu Search Heuristics
Michel Gendreau, University of Montreal, C.P. 6128, succ. Centre-ville, Montreal, QC, H3M 2V4, Canada, michelg@crt.umontreal.ca

Several of the most successful Tabu Search heuristics allow the search to consider moves to infeasible solutions. The success of these heuristics has often been attributed to the fact that this greatly improves the connectedness of the search space, thus making it easier to proceed to good solutions. In this talk, we focus on other factors and propose a different explanation for the excellent performance of Tabu Search heuristics (and other Local Search methods) that allow infeasible moves.

■ SD03

P-Plaza Court 1

Sequential and Parallel Scatter Search

Cluster: Scatter Search and Path Relinking Methods for Optimization
Invited Session

Chair: Teodor Gabriel Crainic, Professor, ESG, UQAM and Centre for Research on Transportation, CP 8888, succ. centre Ville, Montreal, QC, H3C 3P8, Canada, theo@crt.umontreal.ca

1 - Parallel Scatter Search for Solving Machine Learning Problems
José A. Moreno-Pérez, Professor, University of La Laguna, Facultad de Matemáticas, Dep. Esatdìstica, I.O. y C., La Laguna, 38271, Spain, jamoreno@ull.es, Miguel Garcia-Torres, Félix Garcìa-López, Belén Melián-Batista, J, Marcos Moreno-Vega

Usual tasks in supervised and unsupervised machine learning consist of solving optimization problems. There are several usual ways to evaluate the quality of the solution for those problems. The arising optimization problems are too hard to be solved by exact algorithms. We describe several parallelizations of the Scatter Searches metaheuristic for those problems and analyse their performance.

2 - Ejection Chain/Path Relinking Method for the Quadratic Assignment Problem
James Tabitha, Assistant Professor, Virginia Tech, 1007 Pamplin Hall, Blacksburg, VA, 24060, United States, tajames@vt.edu, Cesar Rego, Fred Glover

We propose a new method for the quadratic assignment problem that integrates ejection chains with path relinking. Design features and computational results are reported for a parallel implementation that concurrently executes key algorithmic components for enhanced speed.

3 - Scatter Search Strategies for Network Design
Teodor Gabriel Crainic, Professor, ESG, UQAM and Centre for Research on Transportation, CP 8888, succ. centre Ville, Montreal, QC, H3C 3P8, Canada, theo@crt.umontreal.ca, Michel Gendreau

We present a first analysis of a number of issues related to the definition of a scatter search meta-heuristic for capacitated multicommodity network design: solution combination mechanism to generate new solutions, number of parent solutions, the role of memories and elite set mechanisms, etc.

■ SD04

P-Plaza Court 2

Process Data Mining

Sponsor: Data Mining
Sponsored Session

Chair: George Runger, Arizona State University, Industrial Engineering, Tempe, AZ, 85287, United States, runger@asu.edu

1 - Selection of Critical Variables via Data Mining for Quality Improvement
Myeong-Soo Lee, Pohang University of Science and Technology, Division of Mechanical & Industrial Eng., Pohang, Kyungbuk, South Korea, poskit@postech.ac.kr, Kwang-Jae Kim

The selection of the critical variables, called critical-to-process (CTP), is a key factor for the success of a quality improvement initiative. A systematic procedure for selecting CTPs via data mining is proposed. The proposed procedure is illustrated using a case example from a manufacturing process.

2 - Knowledge Discovery from Observational Data for Process Control through Causal Bayesian Network
Jing Li, University of Michigan, 2385 Bishop #7, Ann Arbor, United States, jinglz@engin.umich.edu, Jianjun Shi

This paper focuses on learning causal relationships from massive manufacturing sensing data. An integrated causal discovery approach is proposed to improve the generic PC algorithm with manufacturing domain knowledge. The learned causal relationships are represented by a causal Bayesian network and can be used to facilitate process control.

3 - Features and Mining for Cycle-Time Prediction
Mani Janakiram, Intel Corporation, 5000 W. Chandler Blvd., Chandler, AZ, 85226, United States, mani.janakiram@intel.com, Darshit Parmar

An estimate of cycle time for product in a factory is useful to semiconductor manufacturers to assess customer due dates, schedule resources and to monitor the operation. For a complex process, with hundreds of steps, different product mixes, and reentrant flow, this estimate can be difficult. We mine the vast quantities of operations data to develop novel summary measures. Such measures are subsequently used to generate a model to predict cycle time. An update to previous research is presented.

4 - Mining for Multivariate SPC: Patterns, Artificial Contrasts, and Ensemble Methods
George Runger, Arizona State University, Industrial Engineering, Tempe, AZ, 85287, United States, runger@asu.edu, Wookyeon Hwang, Eugene Tuv

A control region for a process often has a characteristic pattern and one can learn to distinguish such a region from random noise. Then multivariate SPC can be converted to a supervised learning task. The effectiveness of such an approach is shown here through error rate tables and graphical illustrations. Such a computational approach is now easily accomplished with modern computing resources. Examples use random forests and a regularized least squares classifier.

■ SD05

P-Plaza Court 3

Integer/Combinatorial Optimization Under Uncertainty

Sponsor: Optimization/ Integer Programming
Sponsored Session

Chair: Shabbir Ahmed, Ph.D, Georgia Institute of Technology, 765 Ferst Drive NW, Atlanta, GA, 30332, United States, sahmed@isye.gatech.edu

1 - Robust Network Flow/Design with Uncertain Demand
Alper Atamturk, University of California, 4141 Etcheverry Hall, MC 1777, Berkeley, CA, 94720-1777, United States, atamturk@ieor.berkeley.edu, Muhong Zhang

We describe a robust optimization approach for solving the network flow and design problems with polyhedral demand uncertainty. We study complexity and algorithms. We describe polynomially solvable cases. Applications to transportation, production, distribution problems are given.

2 - Pairing Mixed 0-1 Inequalities: Applications in Stochastic Integer Programs
Shabbir Ahmed, Ph.D, Georgia Institute of Technology, 765 Ferst Drive NW, Atlanta, GA, 30332, United States, sahmed@isye.gatech.edu, Yongpei Guan, George Nemhauser

We present a new scheme for combining two valid inequalities for a mixed 0-1 set to obtain a new valid inequality. The scheme can be used to generate valid inequalities for deterministic equivalents of stochastic integer programs (SIPs). We discuss applications in two-stage SIPs and stochastic lot-sizing problems, develop conditions for the inequalities to be facet-defining, and present some preliminary numerical results.

3 - Regrets only! Online Stochastic Combinatorial Optimization under Time Constraints
Pascal Van Hentenryck, Professor, Department of Computer Science, Brown University, Box 1910, Providence, RI, 02912, United States, pvh@cs.brown.edu

We consider online stochastic optimization problems where time constraints severely limit the number of offline optimizations available at decision time and/or in between decisions. We propose a regret algorithm that provides a fast approximation of an expectation approach. The regret algorithm is evaluated on two online applications: packet scheduling in networks and multiple vehicle routing with time windows. On both applications, it produces significant benefits over prior approaches.

4 - Disjunctive Decomposition with Branch-and-Cut (D2-BAC) for Two Stage SMIP
Lewis Ntaimo, Assistant Professor, Texas A & M University, Department of Industrial Engineering, 3131 TAMU, College Station, TX, 77843, United States, ntaimo@iemail.tamu.edu, Suvrajeet Sen

In this talk we discuss computational tests associated with a branch-and-cut decomposition method for large scale Stochastic Mixed-Integer Programming (SMIP). This algorithm, based on a scheme by Sen and Sherali, decomposes the IP master program from the IP subproblems by approximating value functions of the second stage MIPs. Computational results with a variety of applications will be presented.

■ SD06

P-Plaza Court 4

Cross Entropy

Sponsor: Optimization/Stochastic Programming
Sponsored Session

Chair: Tal Raviv, University of Haifa, Haifa, Israel, talraviv@tx.technion.ac.il

1 - A Stochastic Minimum CE Method for Combinatorial Optimization and Rare-events Estimation
Reuven Rubinstein, Technion, Israel Institute of Technology, Haifa, Israel, ierrr01@ie.technion.ac.il

We present a new generic randomized algorithm, called the minimum cross-entropy (MCE) algorithm for approximating the optimal solution of NP-hard combinatorial optimization problems and estimating probabilities of rare-events. The MCE method presents an adaptive stochastic version of Kullback's cross-entropy method. We discuss the similarities and the differences between MCE and the standard cross-entropy method, prove the convergence of MCE and present supportive numerical results.

2 - Global Likelihood Optimization via the Cross-Entropy Method, with an Application to Mixture Models
Dirk Kroese, University of Queensland, Department of Mathematics, Brisbane, Australia, kroese@maths.uq.edu.au, Zdravko Botev

Global likelihood maximization is an important aspect of many statistical analyses. Often the likelihood function is highly multi-extremal. This presents a significant challenge to standard search procedures, which often settle too quickly into an inferior local maximum. We present a new approach based on the cross-entropy (CE) method, and illustrate its use for the analysis of mixture models. We show that in certain situations CE outperforms the well-known EM algorithm.

3 - Application of the Cross-Entropy Method to Clustering and Vector Quantization
Thomas Taimre, The University of Queensland, Department of Mathematics, Brisbane, Australia, ttaimre@maths.uq.edu.au, Dirk Kroese, Reuven Rubinstein

We apply the cross-entropy (CE) method to problems in clustering and vector quantization. Through various numerical experiments we demonstrate the high accuracy of the CE algorithm and show that it can generate near-optimal clusters for fairly large data sets. We compare the CE method with well-known clustering and vector quantization methods such as K-means, fuzzy K-means and linear vector quantization, and apply each method to benchmark and image analysis data.

4 - Application of CE for Management of Multi-Echelon Supply Network
Tal Raviv, University of Haifa, Haifa, Israel, talraviv@tx.technion.ac.il

A proper management of inventory is a crucial factor in firms' success. This is a challenging task in enterprises where the inventory is deployed across several locations and tiers. The quantity of items ordered at each location in each period can be determined using a polynomial function in which the inventory levels of the neighboring tiers are parameters. In this study we use a cross entropy methodology to obtain the coefficients of these polynomials.

■ SD07

P-Plaza Court 5

Global Optimization- Packing Problems

Sponsor: Optimization/ Global Optimization
Sponsored Session

Chair: János D. Pintér, Pintér Consulting Services, Inc, Halifax , NS, Canada, jdpinter@hfx.eastlink.ca

1 - Circle Packing Problems: Applications and Solution Approaches
Ignacio Castillo, Assistant Professor, University of Alberta, 3-30G Business Building, Edmonton, AB, T6G2R6, Canada, ignacio.castillo@ualberta.ca, Frank J. Kampas, János D. Pintér

In the most general setting, a circle packing is an arrangement of arbitrary circles inside a given set such that no two circles overlap. In this talk, we will present several circle packing problems, review their applications and several stategies for their solution.

2 - Solving Circle Packing Problems by Global Optimization
János D. Pintér, Pintér Consulting Services, Inc, Halifax , NS, Canada, jdpinter@hfx.eastlink.ca, Frank J. Kampas, Ignacio Castillo

General (non-overlapping, and in some sense extremal) circle packings can be viewed as global optimization problems. Illustrative numerical examples are presented and visualized using MathOptimizer and MathOptimizer Professional: both software products can be used in conjunction with the integrated technical computing system Mathematica.

3 - Maple Global Optimization Toolbox
János D. Pintér, Pintér Consulting Services, Inc, Halifax , NS, Canada, jdpinter@hfx.eastlink.ca

Maple is a fully integrated modeling and computing system for engineering and scientific applications (www.maplesoft.com). The Global Optimization Toolbox is based on the external LGO global/local solver suite that is seamlessly linked to Maple. We introduce the Toolbox, review the model setup and solution procedure, and illustrate its usage by examples.

■ SD08

P-Plaza Court 6

Data Aggregation in Sensor Networks

Sponsor: Optimization/ Network Optimization
Sponsored Session

Chair: Ashish Goel, Assistant Professor, Stanford University, Terman 311, Stanford, CA, 94305-4026, United States, ashishg@stanford.edu

1 - Power-Efficient Sensor Placement and Transmission Structure for Data-Gathering under Distortion Bounds
Deepak Ganesan, UCLA, United States, deepak@lecs.cs.ucla.edu, Baltasar Beferull-Lozano

Sensor networks are envisoned to be large scale and highly over-deployed, comprising thousands of nodes that co-ordinate to accomplish a sensing task. Yet, today, the cheapest sensor node monitoring just weather costs a few hundred dollars. While we await a future with ubiquitous cheap sensor nodes, a problem that is both immediate and necessary is to accomplish these tasks with a limited number of nodes that have stringent power constraints. In this work, we consider the joint optimization of sensor placement and transmission structure for data gathering, whereby a given number of nodes need to be placed in a field such that the sensed data can be reconstructed at a base station (sink) within specified distortion bounds while minimizing the energy consumed for communication. We assume that the nodes use joint entropy coding based on explicit communication between sensor nodes (non Slepian-Wolf coding), and consider both maximum and average distortion bounds. This optimization is very complex since it involves an interplay between the spaces of possible transmission structures given radio reachability limitations and feasible placements satisfying distortion bounds.

2 - Decentralized Aggregation in Networks
David Kempe, University of Washington, 6546 24th Ave NE, Seattle, WA, 98115, United States, kempe@cs.washington.edu, Alin Dobra, Johannes Gehrke

We present a general framework and concrete protocols for decentralized computation of aggregate function values in a network. The protocols are based on communication via randomized gossip, flooding, or similar approaches, and can be used to compute sums, moments, quantiles, and more complex aggregate functions. The analysis shows how the protocols' convergence times relate in a precise way to a notion of diffusion speed of the communication mechanism.

3 - Scale Free Aggregation in Sensor Networks
Ashish Goel, Assistant Professor, Stanford University, Terman 311, Stanford, CA, 94305-4026, United States, ashishg@stanford.edu, Mihaela Enachescu, Ramesh Govindan, Rajeev Motwani

In sensor networks, it is important to take advantage of data correlations in order to avoid transmission redundancy. We consider the case where the correlation among a set of sensors depends on the area spanned by the sensors and a scale parameter k. We present a simple randomized algorithm for routing information on a grid of sensors. Our algorithm gives a constant factor approximation to the optimum aggregation tree simultaneously for all scale parameters k.

■ SD09

P-Plaza Court 7

Product and Supply Chain Innovation

Cluster: Supply Chain Mgmt & Operations
Invited Session

Chair: Sreekumar Bhaskaran, Doctoral Candidate, University of Texas Austin, CBA 4.202, Management Department, Red McCombs School of Business, Austin, Tx, 78705, United States, Sreekumar.Bhaskaran-Nair@phd.mccombs.utexas.edu

1 - Dynamic Testing of Product Designs
Sanjiv Erat, College of Management, Georgia Institute of Technology, 800 West Peachtree St. NW, Room 4309, Atlanta, GA, 30332, United States, sanjiv.erat@mgt.gatech.edu, Stylianos Kavadias

Research in NPD has conceptualized testing as a "design-build-test-analyze" cycle to emphasize the importance of analysis of previous test results in guiding the test process. Using the notion of correlated performances, we develop a stylized model of prototype testing that explicitly accounts for "analysis phase". Analytical characterization of the optimal testing policy is shown. Further, we examine the impact of imprecise managerial knowledge on the test schedule and the net payoffs.

2 - Incentives for Design for Environment (DfE) within Producer Responsible Organizations (PROs)
Laurens Debo, Tepper School of Business, Carnegie-Mellon University, 5000 Forbes Avenue, Pittsburgh, PA, 15213, United States, laurdebo@andrew.cmu.edu, Sunder Kekre

Recently, many producers have become responsible for proper end-of-life treatment of the products that they bring to the market. Major hurdles are high collection and recycling costs. In order to take advantage of strong economies of scale, different firms in an industry may organize collection jointly via a PRO. Producers may control recycling costs by applying DfE. We discuss impact of a PRO on the incentives for DfE and obtain guidelines for companies to form consortiums.

3 - Incorporating Subjective Quality Attributes in Innovation Decision Making
Sreekumar Bhaskaran, Doctoral Candidate, University of Texas Austin, CBA 4.202, Management Department, Red McCombs School of Business, Austin, Tx, 78705, United States, Sreekumar.Bhaskaran-Nair@phd.mccombs.utexas.edu, Vish Krishnan

We examine how the presence of subjective quality attributes affect a firm's innovation decision making. Contrary to existing literature, we find that when subjective attributes are important, having a product-line based approach would enable firms to better address the market needs and generate higher profits. We find that the choice between different product development approaches depends on market structure, costs of innovation and consumer preferences.

4 - Supply Chain Disruptions Management: A Theoretic Framework with Applications
Yusen Xia, Georgia State University, Department of Managerial Sciences, Robinson College of Business, Atlanta, GA, 30303, United States, ysxia@gsu.edu, Gang Yu

In this talk, we present a theoretic framework for managing supply chain disruptions. This framework includes the definition of a disruption recovery time window, the concept of deviation penalty from the original plan and the classifications of different types of disruptions. We then talk about two models that use this framework: an EPQ (economic production quantity) model and a two-stage production and inventory model.

■ SD10

P-Plaza Court 8

Congestion Pricing and Related Models

Sponsor: Transportation Science & Logistics
Sponsored Session

Chair: Siriphong Lawphongpanich, University of Florida, Dept. of Industrial & Systems Eng., P.O. Box 11-6595, Gainesville, FL, 32611, United States, lawphong@ise.ufl.edu

1 - Relaxed Toll Sets for Toll Pricing Problems
Lihui Bai, Valparaiso University, College of Business Administration, Valparaiso, IN, 46383, United States, lbai@cao.ise.ufl.edu, Donald Hearn, Siriphong Lawphongpanich

Toll pricing problems in Hearn and Ramana [1998] require a solution to the system problem to define the toll set. In practice, it may not be possible to obtain an exact solution to the system problem and the inaccuracy in an approximate solution may render the toll set empty. This paper offers alternative toll sets based on relaxed optimality conditions. Tolls from the relaxed toll sets are shown theoretically and empirically to induce route choices that are nearly system optimal.

2 - Toll Pricing in Multi-Modal Traffic Assignment
Younes Hamdouch, United Arab Emirates University, Department of Business Administration, P.O.Box 15551, Al-Ain, United Arab Emirates, Hamdouch@ufl.edu, Siriphong Lawphongpanich, Donald Hearn, Michael Florian

We extend the toll pricing framework for traffic networks to ones that allows users to combine several modes of transportation. To determine tolls, we construct a user equilibrium and system optimal model. We assume that users adopt hyperpaths and the demand between each OD pair is fixed. The users' choice of transportation modes is based on a binomial logit function. We characterize the set of valid tolls and provide a numerical example to illustrate our approach.

3 - Dynamic Traffic Assignment with Periodic Time Horizon
Artyom Nahapetyan, University of Florida, Dept. of Industrial & Systems Eng., P.O. Box 11-6595, Gainesville, FL, 32611, United States, Artyom@ufl.edu, Siriphong Lawphongpanich

In this paper, we propose an optimal control formulation of a dynamic traffic assignment problem in which the number of cars on each arc at the beginning of the time horizon is same as the one at the end. We obtain an approximate solution to a discretized version of the problem by solving a linear mixed integer program. We also provide numerical examples to illustrate the effectiveness of our approximation scheme.

■ SD11

P-Governor's Square 9

Facility Layout Design

Sponsor: Transportation Science & Logistics
Sponsored Session

Chair: Russell Meller, Assoc. Professor, Grado Department of Industrial & Systems Engineering, Virginia Polytechnic Institute & State University, 250 Durham Hall (0118), Blacksburg, VA, 24061, United States, rmeller@vt.edu

1 - Exploring the Potential of Ant Colony Metaheuristic for Facility Layout Optimization

Benoit Montreuil, Professor, Laval University, CENTOR Research Center, Pavillon P. Prince, Office 2533, Québec, QC, G1K 7P4, Canada, benoit.montreuil@centor.ulaval.ca, Edith Brotherton, Nabil Ouazzani, Mustapha Nourelfath

We present the results of an extensive investigation of the potential of ant colony metaheuristic in optimizing facility layouts. We document the conceptual evolution we had to take in order to achieve higher performance. This implies most facets of ant colony heuristic design, including types of ants and pheromone tracing. We provide empirical evidence to illustrate the impact of the metaheuristic design evolution.

2 - New Approaches for Generating Rectangular Block Layout Designs

Brett Peters, Professor, Texas A&M University, Department of Industrial Engineering, TAMUS 3131, College Station, TX, 77843-3131, United States, bpeters@tamu.edu, Vatcharapol Sukhotu

Many approaches have been developed for determining a rectangular-block facility layout. Several meta-heuristics have been proposed, but they generally require that the layout be restricted to a certain structure, e.g., a baytype or sliceable structure. We propose a new approach to generate a rectangular block layout without any structural restrictions. An algorithm for computing dimensions and coordinates of all departments in the facility based on this representation is described.

3 - A Bottom-Up Approach to Facility Layout Design

Russell Meller, Assoc. Professor, Grado Department of Industrial & Systems Engineering, Virginia Polytechnic Institute & State University, 250 Durham Hall (0118), Blacksburg, VA, 24061, United States, rmeller@vt.edu

The facility layout problem is typically presented as a top-down process. In the first stage the block layout is produced and in the second stage the detailed layout is determined. The facility layout problem as solved in practice, however, is not approached in a top-down two-stage process, but rather a bottom-up process of detailed layout design and block layout configuration. We present a reformulated facility layout model that supports the bottom-up design process.

■ SD12

P-Governor's Square 10

Transportation Infrastructure Management

Sponsor: Transportation Science & Logistics
Sponsored Session

Chair: Pablo Durango-Cohen, Assistant Professor, Northwestern University, 2145 Sheridan Road, A335, Evanston, IL, 60208, United States, pdc@northwestern.edu

1 - Robust Maintenance Policies under Uncertainty in Asset Management

Kenneth Kuhn, Graduate Student Researcher, University of California, Berkeley, Berkeley, CA, United States, kdkuhn@uclink.berkeley.edu, Samer Madanat

Newly developed robust optimization techniques are employed to deal with epistemic uncertainty in asset management. Efficient solution algorithms are developed to solve the robust counterpart of the asset management problem. A case study is used to demonstrate the usefulness of the proposed approach in reducing maintenance and rehabilitation expenditures.

2 - Functional Interactions in Network Maintenance Optimization

Suzanne Childress, Graduate Student Researcher, Northwestern University, 2145 Sheridan Road, Evanston, IL, 60208, United States, s-childress@northwestern.edu, Pablo Durango-Cohen

We analyze the effect of facility functional network roles on optimal maintenance policies. The optimization relies on a linear control model that creates feedback between facility condition and facility demand for use. The formulation ensures that individual facility demand depends on the condition of all network facilities. We show that optimal policy structure results from the sign of individual facility correlations.

3 - Physical Security and Vulnerability at Airports

Mark Turnquist, Professor, Cornell University, Civil & Environmental Engineering, 309 Hollister Hall, Ithaca, NY, 14853, United States, mat14@cornell.edu, Linda Nozick, Dean Jones, Craig Lawton, Chad Davis

A model of malicious intrusions in an airport is developed that uses a network representation of the system structure together with Markov models of intruder progress and strategy. This structure provides an explicit mechanism to estimate the probability of successful breaches of physical security, and to evaluate potential improvements.

4 - Determination of Optimal Intervals for Preventive Maintenance of Infrastructure Systems

Zhanmin Zhang, Assistant Professor, University of Texas, Austin, Austin, TX, United States, z.zhang@mail.utexas.edu

The optimal intervals for preventive maintenance of infrastructure systems are a function of the infrastructure deterioration process and costs for preventive maintenance and failure repairs. This paper discusses a reliability-based method to determine the optimal intervals. A numerical case study was conducted for different levels of quality control and costs.

■ SD13

P-Governor's Square 11

RASIG Roundtable Conference (Continued)

Sponsor: Railroad Applications
Sponsored Session

Chair: Jian Liu, Research Director, Innovative Scheduling Systems, Inc., 2153 Hawthorne Road, Gainesville, FL, 32641, United States, liujian@cox.net

■ SD14

P-Governor's Square 14

Management of Technology: A Matter of Degree?

Sponsor: Technology Management
Sponsored Session

Chair: Sebastian Fixson, Assistant Professor, University of Michigan, 1205 Beal Avenue, IOE 2793, Ann Arbor, MI, 48109, United States, fixson@umich.edu

1 - Problem Management in Complex Product Development Projects

Phil Gouel, Ph.D. Candidate, University of Michigan, 1205 Beal Avenue, IOE, Ann Arbor, MI, 48109, United States, pgouel@umich.edu, Sebastian Fixson

In the development of complex engineering products or systems problems often become visible only late in the product development (PD) process when the design information is converted into manufacturing information. We investigate two technology management processes in this type of PD system: problem detection and problem treatment. With examples from the auto industry, we develop a categorization scheme to classify problem types and problem treatment strategies.

2 - Managing Transportation and Logistics Outsourcing in the Automotive Industry

Kingsley Reeves, University of Michigan, 1205 Beal Avenue, Ann Arbor, MI, 48109, United States, kareeves@umich.edu

This research examines two contrasting approaches to technology management in the automotive industry. The "technology", as broadly defined by Perrow, is the provision of transportation and logistics services. Two contrasting case studies are examined. In one case, an American automaker has selected an organizational model that is closer to pure, arms-length outsourcing. This is contrasted with a Japanese automaker, which has selected an organizational model that is much more integrated.

3 - Managing Risk and Uncertainty in Emerging Technology Industries

Elicia Maine, Assistant Professor, Simon Frasier University, 7272 - 515 West Hastings, Vancouver, BC, V6B 5K3, Canada, emaine@sfu.ca

The combination of risk, uncertainty, and R&D costs in the emerging technology industries of software, biotech, and advanced materials provide some unique valuation and resource allocation challenges for investors and managers. To better illustrate these challenges, real options valuation is applied to a case study in each industry.

4 - Substitutes for "Management": Practices for Complex Product Development in Free/Open Source Software
Karim Lakhani, MIT Sloan School of Management, 50 Memorial Drive, Cambridge, MA, 02138, United States, lakhani@mit.edu

In an extreme form my research question can phrased as: "Why do we need managers? And what are the substitutes for management?" To explore this matter, I focus on an empirical study of the coordination practices in Free/Open Source software (F/OSS) projects. F/OSS communities produce high quality software products without much of the direct managerial control and intervention that exists in similar firm-based software projects.

■ SD15

P-Governor's Square 15

Data Mining for Fraud Detection and Marketing

Cluster: Data Mining and Knowledge Discovery
Invited Session

Chair: Wei Jiang, Assistant Professor, Stevens Institute of Technology, Castle Point of Hudson, Hoboken, NJ, 07030, United States, wjiang@stevens.edu

1 - Timing is Everything: Aligning Available Data to Effectively Solve Business Problems Claims
Mark Richards, Analytic Innovations, LLC, United States, mark@analyticinnovations.com

Industry practitioners are often faced with problems that arise when they apply data collected for purposes unrelated to modeling. The manner in which we approach and ultimately present the data to our models has enormous implications for the success of our project. I illustrate some of the issues with examples from insurance fraud and cross-sell marketing in the banking industry.

2 - Detecting Suspicious Transactions in P&C Insurance Operations
Marty Ellingsworth, EVP & CTO, Full Capture Solutions, Inc., 330 Roberts Street, Suite 400, East Hartford, CT, 06108, United States, MartyElls@aol.com

Property & Casualty insurance currently generates about $400 Billion a year in premiums and about $300 Billion a year in claim payments. It is no wonder that with that much cashflow, many people who participate in bringing it in or paying it out might try to help themselves to either something that is not theirs or more than they are entitled to have. We will discuss the broad types of fraud and the methods of detecting them early.

3 - Market Segmentation of Time Series Data
Siu-Tong Au, United States, sau@att.com

This talk discusses the data mining approach in market segmentation when large amount of time series data are available. The complexity of industrial market and product, and the large amount of data being generated daily within any companies makes it critical for marketers to understand market structure and changing dynamics. The talk will first focus on data extraction, cleaning and engineering, and then on algorithm engineering in related to marketing applications.

■ SD16

P-Governor's Square 17

Automatic Selection of NLP Solver or Sub-Solver

Sponsor: Computing Society
Sponsored Session

Chair: Arne Drud, Dr., ARKI Cons & Developm., Bagsvaerdvej 246 A, Bagsvaerd, 2880, Denmark, adrud@arki.dk

1 - Combining Interior-Point and Active-Set Approaches for Nonlinear Optimization in KNITRO
Richard Waltz, Research Assistant Professor, Northwestern University, ECE Department, 2145 Sheridan Road, Evanston, IL, 60208, United States, rwaltz@ece.northwestern.edu, Richard Byrd, Jorge Nocedal

We will give an overview of the latest version of the KNITRO optimization software package and discuss the various algorithmic options available to the user. In particular we will investigate the use of crossover techniques for NLP barrier methods to achieve a solution with accurate sensitivities and good active-set information. We will also discuss dynamic rules for choosing good problem dependent algorithmic settings.

2 - DrAmpl — A Meta-Solver for Optimization
Dominique Orban, Adjunct professor, Ecole Polytechnique de Montreal, 2900 Boulevard Ed. Montpetit, Montreal, QC, H3T1J4, Canada, Dominique.Orban@polymtl.ca, Robert Fourer

Building upon the AMPL interface library, DrAmpl is a meta-solver for obtaining statistics on an optimization problem, for symbolically proving or numerically disproving convexity of the functions involved, and for suggesting appropriate solvers. Problem characteristics are matched with solvers available on the NEOS Server, by use of a relational database. In this presentation, we describe the design of DrAmpl along with the needs that it meets and the perspectives that it offers.

3 - Dynamic Selection of Sub-Solver inside CONOPT
Arne Drud, Dr., ARKI Cons & Developm., Bagsvaerdvej 246 A, Bagsvaerd, 2880, Denmark, adrud@arki.dk

CONOPT, a nonlinear solver based on the GRG paradigm, has SLP and SQP subsolvers. The presentation describes how the appropriate subsolver is selected dynamically based on local properties of the model, estimated from recent iteration statistics.

■ SD17

P-Directors Row E

DAS Practice Award Finalists

Sponsor: Decision Analysis
Sponsored Session

Chair: Kazuo J. Ezawa, Director, Bristol-Myers Squibb Company, Route 206 & Proviceline Road, Princeton, NJ, 08540, United States, kazuo.ezawa@bms.com

1 - Using Value of Information Techniques to Prioritize Business Process Changes at General Motors
Jeffrey Keisler, Assistant Professor, University of Massachusetts Boston, College of Management, Boston, MA, 02125, United States, Jeff.Keisler@umb.edu, Mark Brodfuehrer

In an effort to reduce frequent company-wide imbalances in parts supply and demand, we mapped a large set of related organizational processes. We identified information flows and decision points, and defined potential changes to them. We rapidly constructed a large number of decision models, and used value of information type calculations to estimate the value of various changes. This allowed us to successfully prioritize and refine change requirements which were then implemented.

2 - Reconfiguring Supply Chain Decision Making at IBM
Craig W. Kirkwood, Department of Supply Chain Management, W. P. Carey School of Business, PO Box 874706, Arizona State University, Tempe, AZ, 85287-4706, United States, craig.kirkwood@as.edu, Arnold Maltz, Matthew P. Slaven

A multiobjective decision analysis process was developed within a spreadsheet environment for the early stage analysis of global supply chain design decisions. This process is applied in facilitated workshops, and it has been applied with several different groups of analysts and managers. The process is currently being propagated for broad use within IBM's Integrated Supply Chain organization. The extended Pearson-Tukey approximation and moment methods are used to address uncertainties.

3 - Risk Evaluation and Decision Making for the Temporary Shutdown of a Pharmaceutical Plant
Daniel A Johnson, Sr. Decision Science Associate, Lilly Corporate Center, DC 2120, Indianapolis, IN, 46285, United States, johnsonda@lilly.com, Charles Persinger

We present a decision analysis used to help Eli Lilly and Company evaluate different alternatives to retrofit one of its major manufacturing facilities. Major constraints included compliance with strict FDA guidance and assurance of mandated inventories of critical medicines. The analysis drove decision-making and facilitated communication with the FDA.

4 - Asset Strategy Evaluation for a Multiple Indication Oncology Product
Erik Johnson, Bristol-Myers Squibb Company, Route 206 & Provinceline Road, Princeton, NJ, 08540, United States, erjohnson1@aol.com

Pharmaceutical R&D is a lengthy process littered with failed compounds. In order to develop a portfolio with the highest ROI in a resource-constrained environment, each compound must be evaluated probabilistically in order to make informed decisions on tradeoffs across heterogeneous products. Most oncology products typically pursue multiple indications and compendia across different tumor types and geographies to maximize the value of the product. Probabilistic modeling, correlations and a large number of scenarios benefit from decision analysis techniques, such as event trees, simulation and sensitivity analysis, to better quantify ROI

■ SD18

P-Directors Row H

Climate Change

Sponsor: Decision Analysis
Sponsored Session

Chair: Erin Baker, Department of Mechanical and Industrial Engineering, University of Massachusetts, Amherst, MA, United States, edbaker@ecs.umass.edu

1 - Using Climate Change Information to Improve Hazard Mitigation Decisions
Martin Schultz, Ph.D, Dept. of Engineering and Public Policy, Carnegie Mellon University; and EPA, United States, mschultz@andrew.cmu.edu, Mitchell Small, Paul Fischbeck

A variety of information products from research on climate change are potentially available for use in local and regional decision making. This paper describes a project to understand the prospective impacts of climate change information on hazard mitigation decisions in Cape Cod. Using modified flood insurance rate maps to describe future hazard regimes, a decision model is developed to estimate the value of that information in the decision making process and explore the conditions under which that information has value to different decision makers.

2 - Prudent Policy or Boiling Frogs: Can Standard Two-Period Decision Models Give False Justification for Waiting for Action?
Mort Webster, University of North Carolina, United States, mort@email.unc.edu

There is considerable debate about the correct policy response for global climate change. One side argues that there is still much uncertainty in the science itself (cloud effects and ocean circulation, to name just two examples), and that we would be better off to do nothing now and wait for the future to reduce abatement costs. Another side claims that, despite the uncertainty, we should take action now to avoid possibly catastrophic damage in the future. The results of standard two-period models often counsel us to do nothing or very little now and wait for more information. However, if one would construct a model in 1970 about climate change the optimal policy might have been to "wait" until 1980 to take serious action. But then in 1980, the analytical model tells you again to wait until the "future" (i.e. 1990) for more information. In 1990, the model tells you to wait until 2000. In this respect, the current situation for this issue could resemble the famous "boiled frog" problem: if one drops a frog in boiling water, it will quickly realizes the danger and hops out, saving its life. If, however, one puts the frog in cold water and slowly heats it up, the frog's nervous system will not react to the danger and the frog will die. Therefore, the questions we attempt to answer in this research are: Will repeated application of a two-period model, advancing a decade each time, yield the same recommended action as a three-period or more decision model? How will the optimal decision be affected by design parameters such as the discount rate? Will lengthening the periods change the optimal decision? We attempt to answer these questions using Nordhaus' DICE model (Nordhaus, 1994), a simple economics and climate model.

3 - A Decision Framework for Climate Change Technology Policy
Geoffrey Blanford, Department of Management Science and Engineering, Stanford University, 491 Terman Engineering Center, Stanford, CA, 94305-4026, United States, blanford@stanford.edu

While integrated assessment models and technology studies have demonstrated that R&D investment is a crucial component of an optimal greenhouse gas abatement strategy, the R&D process itself has received little analytical attention. This paper proposes a decision modeling framework to study allocation decisions for a public R&D portfolio. The approach is then applied to the trade-off between investment in carbon capture and sequestration and further development of renewable energy technologies.

4 - Climate Change Policy Under Uncertainty — R&D versus Abatement
Erin Baker, Department of Mechanical and Industrial Engineering, University of Massachusetts, Amherst, MA, United States, edbaker@ecs.umass.edu

We consider optimal abatement policy and the optimal level of R&D spending under climate uncertainty. Which increases in risk will induce an increase in abatement or in R&D? We find that the class of increases in risk that induce an increase in abatement tend to induce a decrease in R&D spending and vice versa. Our methodology is to consider the subset of mean-preserving-spreads that cause an increase in the expected value of S-shaped curves, and apply these results to the climate change problem.

■ SD19

P-Directors Row F

Machine Learning

Sponsor: Artificial Intelligence
Sponsored Session

Chair: Endre Boros, Professor of Operations Research, RUTCOR, Rutgers University, 640 Bartholomew Road, Piscataway, NJ, 08904, United States, boros@rutcor.rutgers.edu

1 - The Impact of Domain Specific Knowledge on Support Vector Machines
Enes Eryarsoy, Ph.D. Candidate, The Warrington College of Business Administration, University of Florida, Gainsville, FL, 32611, United States, eryarsoy@ufl.edu, Haldun Aytug, Gary Koehler

We derive new error bounds on the risk functional for Support Vector Machines that are based on the fat-shattering dimension for linear classifiers. These bounds utilize domain specific knowledge.

2 - Financial Kernel Methods
Mark Cecchini, Ph.D. Candidate, The Warrington College of Business Administration, University of Florida, Gainesville, FL, 32611, United States, cecchini@ufl.edu, Haldun Aytug, Gary Koehler, Praveen Pathak

We hypothesize that information necessary to determine significant financial events is available in basic financial reports. A financial event is an occurrence that significantly alters the value of a company. We develop a method of capturing this information by considering text and quantitative data utilizing information retrieval and kernel methods.

3 - On Justifiable Learning
Endre Boros, Professor of Operations Research, RUTCOR, Rutgers University, 640 Bartholomew Road, Piscataway, NJ, 08904, United States, boros@rutcor.rutgers.edu

We present an idea for enhancing standard learning processes with some sort of apriori assurances — which could be called "justifiable learning". We analyze the arising mathematical problems and propose some algorithmic solutions.

■ SD20

P-Room 3304

Pierskalla Award

Sponsor: Health Applications
Sponsored Session

Chair: Allen Holder, Trinity University, Department of Mathematics, One Trinity Place, San Antonio, TX, 78212-7200, United States, aholder@trinity.edu

1 - Seizure Warning Algorithm Based on Optimization and Nonlinear Dynamics
Wanpracha Chaovalitwongse, ExxonMobil Research & Engineering, 1545 Route 22 East, Annandale, NJ, 08801, United States, wchaoval@rci.rutgers.edu, Panos Pardalos

Epilepsy is one of the most common brain disorders, which is characterized by spontaneous recurrent seizures. We herein report the first prospective analysis of the online automated algorithm for detecting the preictal transition in ongoing EEG signals. Quadratically constrained quadratic 0-1 programming problems are formulated to select critical brain electrode sites that exhibit the preictal transition for the warning of epileptic seizures.

2 - Scheduling Start Times for Surgeries with Uncertain Durations
Brian Denton, Senior Engineer, IBM, 1000 River Road, Bld. 958A, Essex Junction, VT, 05452, United States, bdenton@us.ibm.com, Diwakar Gupta

There is evidence in the health care literature that between one third and one half of total costs in hospitals are associated with operating rooms in North America. This talk describes a stochastic programming model for determining optimal time allocation for a sequence of surgeries with uncertain durations. We describe the model formulation, structural properties, and solution methodology for solving large scale instances of the model. We also describe a specific application and present numerical results based on real surgical data.

3 - Engineering the Economic Value of Two Pediatric Combination Vaccines
Edward Sewell, Professor, Southern Illinois University Edwardsville, Department of Mathematics and Statistics, Edwardsville, IL, 62026, United States, esewell@siue.edu, Sheldon Jacobson, Tamana Karnani

This paper analyzes the value of two combination vaccines for pediatric immunization, as a function of the cost of an administering an injection and the number of doses of the vaccine administered. This analysis establishes conditions under which each vaccine provides a good value in the market place.

■ SD22

P-Room 3312

Location Modeling III

Sponsor: Location Analysis
Sponsored Session

Chair: Richard Francis, Professor, University of Florida, ISE Department, 303 Weil Hall, Gainesville, FL, 32611-6595, United States, francis@ise.ufl.edu

Co-Chair: Max Shen, University of California-Berkeley, IEOR Department, Berkeley, CA, 94720, United States, shen@ieor.berkeley.edu

1 - Approximating the Two-Level Facility Location Problem Via a Quasi-Greedy Approach
Jiawei Zhang, New York University, Stern School of Business, New York, NY, 10012, United States, jiazhang@stanford.edu

We propose a quasi-greedy algorithm for approximating the uncapacitated two-level facility location problem and study its worst case performance. The algorithm combines the technique of randomized rounding with that of dual fitting. The ideas are useful for solving several other multi-level facility location problems.

2 - Worldport: A Case Study in Facility Location Problem
Ranganath Nuggehalli, Manager, Operations Research, United Parcel Service, United States, RNuggehalli@ups.com, Keith Ware

Worldport is the largest UPS consolidation center. Its construction took seven years and cost one billion plus dollars; this 4,000,000 ft-sq. facility, with 122 miles of conveyors, can handle 304,000 packages per hour (expandable to 500,000 packages per hour). We discuss facility location and size factors.

3 - Probabilistic Analysis of Aggregation for the Euclidean p-Median Problem
Lian Qi, University of Florida, Industrial and Systems Engineering, Gainesville, FL, 32611, United States, lianqi@ufl.edu, Richard Francis, Max Shen

We interpret finding q aggregate demand points (ADPs) for the planar p- median model as a q-median model, having aggregation error bound v(q). Zemel's work provides an asymptotic formula for v(q), assuming uniformly distributed DPs. Building on Zemel's work, we obtain an insight into the problem with uniformly distributed DPs, and study more general cases where DPs have piecewise uniform distribution and arbitrary distribution.

4 - Benefits from Integrated Location/Inventory Modeling
Leyla Ozsen, Purdue University, Industrial Engineering Department, West Lafayette, IN, 47907, United States, lozsen@purdue.edu, Collette Coullard, Mark Daskin

We outline an integrated location-inventory model. We briefly present a Lagrangian-based algorithm and the results from our sensitivity analysis. The two issues we discuss are the benefits gained by integrating the location and inventory decisions and how location/allocation and ordering decisions will be affected as a company faces increased demand.

■ SD23

P-Room 3354

Military Applications of Operations Research

Sponsor: Military Applications
Sponsored Session

Chair: Alexandra Newman, Assistant Professor, Colorado School of Mines, Division of Economics and Business, Golden, CO, 80401, United States, newman@mines.edu

1 - Optimal Retasking of Air Strike Assets in Response to Time-Sensitive Targets
Richard Rosenthal, Professor, Naval Postgraduate School, Monterey, CA, 93943, United States, rosenthal@nps.edu, Anton Rowe, Paul Weaver, Tom Hoivik

Suppose a conflict is underway, strike and SEAD aircraft are on scheduled missions, and high-value targets suddenly pop up. Our IP-based automated decision aid rapidly revises air tasking orders in response to these time-sensitive targets. It aims to maximize achievement of current goals while minimizing attrition risk and disruption of current plans. The decision aid was tested and evaluated in major Marine air strike exercises, and scored very highly on all measures of operational performance.

2 - A Network Optimization Model for Career-Field Designation of U.S. Army Officers
Dan Shrimpton, Major, U.S. Army, United States Government, Pentagon, Washington D.C., United States, daniel.shrimpton@hqda.army.mil

The United States Army's career-progression pattern assigns, or "designates," Army officers to specialized roles in which the officers serve. We develop a network optimization model, the Career-Field Designation Model, that assigns officers to these roles in a matter of minutes. The Army has used this system four times since June 2001 to assign a total of approximately 10,500 officers, and will continue to use the model to designate about 1,500 officers each year.

3 - A Long Term Helicopter Maintenance Scheduling Model for the U.S. Coast Guard
R. Tony Hahn, U.S. Coast Guard, Colorado School of Mines, Division of Economics and Business, Golden, CO, 80401, United States, rhahn@mines.edu

We present a mixed integer program to schedule Coast Guard helicopters for heavy maintenance and operations at a large Coast Guard Air Station. Constraints include repair facility capacity, operational requirements and required flight hours. The results help plan missions critical to Homeland Security, and Search and Rescue.

■ SD24

P-Room 3402

Service Industry Applications

Contributed Session

Chair: Sal Agnihothri, Associate Professor, State University of New York at Binghamton, School of Management, Binghamton University, Binghamton, NY, 13902, United States, agni@binghamton.edu

1 - On the Robustness of Neural Nets for Predicting Price Abnormalities in Wholesale Power Markets
Hisham Choueiki, Senior Energy Specialist, PUCO, 180 East Broad Street,, Third Floor, Columbus, OH, 43215, United States, hisham.choueiki@puc.state.oh.us, David Wang

Recurrent Neural Nets are used in predicting the On-Peak Day-ahead wholesale price of power at the Into-Cinergy hub. We run sensitivity analyses to assess the success (accuracy) of these models for predicting abnormal prices (>$300/MWh). Preliminary results and remarks will be presented.

2 - The Airline Seat Allocation Decision Incorporating Customer Diversion
Sang-Won KIM, Ph.D Candidate, Richard Ivey School of Business, UWO, 1151 Richmond Street North, London, ON, N6A3K7, Canada, swkim@ivey.uwo.ca

This research considers the optimal booking limit determination of an airline seat inventory allocation problem focused on the influence of strategic behavior of the customers and verifies the potential benefits and losses in revenue to the airlines. Also, we verify the relationship between the optimal booking limit of each period both numerically and analytically.

3 - Is SPC(Service Profit Chain) Really Useful for Service Industry?
Kwangtae Park, Professor, Korea University, Anam-dong, Sungbuk-gu, Seoul, 136-701, South Korea, ktpark@korea.ac.kr, Minho Lee, Jeonghun Park

We apply the service profit chain to service industry to see the relationships among employ satisfaction, service quality and customer satisfaction. We show the empirical result from statistical analysis of questionaires.

4 - Multiobjective Scheduling Support for Event Coordination in a Catering Enterprise
Madhumohan Govindaluri, Doctoral Student, Clemson University, 221 B Martin Street, Clemson, SC, 29631, United States, gsmadhu80@yahoo.com, Vinay Mehendiratta

This presentation discusses a multi-objective scheduling support for the event coordinator (EC) scheduling problem in a catering firm. The EC scheduling problem is unique because of the constraints imposed due to the size of event, employee skills and seniority, customer demands, and work load balance among hourly paid supervisors. The proposed model utilizes compromise programming approach to trade-off cost and satisfaction where Pareto solutions are determined for various preferences.

5 - Inter-territory Server Sharing Decisions in Field Services
Sal Agnihothri, Associate Professor, State University of New York at Binghamton, School of Management, Binghamton University, Binghamton, NY, 13902, United States, agni@binghamton.edu, Srinivas Chakravarthy

We consider a field service system with two territories, each with a single server who repairs equipment on-site. It is a common practice to re-deploy servers between territories whenever the queue length exceeds a certain value, which is a decision variable. The objective of this paper is to investigate the impact of additional travel time due to inter-territory dispatch on server sharing decisions between the two territories by developing an appropriate queueing model.

■ SD25

P-Room 3404

Teaching Pricing and Revenue Management

Sponsor: Education (INFORM-ED) SPONSORED/INVITED
Sponsored Session

Chair: Ioana Popescu, Assistant Professor of Decision Sciences, INSEAD, Blvd. de Constance, Fontainebleau, 77300, France, ioana.popescu@insead.edu

1 - Transportation National Group: A Case Study in RM
Garrett van Ryzin, United States, gjv1@columbia.edu

Transportation National Group is a revenue management case study designed for use in MBA classes. It looks at the issues involved in evaluating and implementating RM in a new industry (trailer leasing). I will describe the case itself and my teaching plan for it.

2 - An MBA Elective on Revenue Optimization
Michael Harrison, Graduate School of Business, Stanford University, Stanford, CA, 94305-5015, United States, harrison_michael@gsb.stanford.edu

I will describe a four-unit elective course (19 class sessions of 105 minutes each) that I have taught twice at Stanford GSB, both times in collaboration with Bob Phillips. The course emphasizes OR modeling and optimization (primary), microeconomic theory related to price discrimination (secondary), and statistical methods of forecasting and estimation (tertiary).

3 - A Course in Revenue Management at Georgia Tech
Anton Kleywegt, Associate Professor, Georgia Institute of Technology, School of Industrial and Systems Enginee, Georgia Institute of Technology, Atlanta, GA, 30332-0205, United States, anton@isye.gatech.edu

In this talk I describe a course in revenue management that I have taught three times (fall 2000, spring 2002, fall 2003) to executive masters students at Georgia Tech. I describe the topics covered in the course, and the tools and exercises that have been useful in the class.

4 - Teaching Dynamic Pricing & Revenue Management to MBAs at INSEAD
Ioana Popescu, Assistant Professor of Decision Sciences, INSEAD, Blvd. de Constance, Fontainebleau, 77300, France, ioana.popescu@insead.edu

Why and how does a Revenue Management course fit in an MBA curriculum? In this presentation I will share some of my experiences in designing, positioning and delivering a full MBA elective on revenue management. I will provide a roadmap of the evolution of the course over the past five years, success dynamics and directions for improvement.

■ SD26

P-Room 3412

Dynamic Resource Allocation in Queueing Networks

Cluster: Stochastic Models for Manufacturing Systems
Invited Session

Chair: Nilay Argon, Assistant Professor, University of Wisconsin-Madison, 1513 University Avenue, Dept. of Industrial Engineering, Madison, WI, 53706, United States, nilay@engr.wisc.edu

1 - Server Assignment Policies in Splitting Systems with Cross-Trained Servers
Nilay Argon, Assistant Professor, University of Wisconsin-Madison, 1513 University Avenue, Dept. of Industrial Engineering, Madison, WI, 53706, United States, nilay@engr.wisc.edu, Yi-Chun Tsai

We consider a queueing system in which an arriving job splits into several subjobs that can be processed in parallel by multiple servers that are cross-trained and cooperative. For such a system, we seek dynamic server assignment policies that maximizes the system capacity. We characterize the optimal policy when there are two or three servers in the system and the service times are exponentially distributed.

2 - Dynamic Allocation of Resources in a Tandem Queueing System with Reliability Considerations
Cheng-Hung Wu, University of Michingan, Dept. of Industrial and Operations Eng., 1205 Beal Avenue, Ann Arbor, MI, 48109, United States, wuch@umich.edu, Mark Lewis

Consider a two stage tandem queueing system, with dedicated machines in each stage. Additional reconfigurable resources can be assigned to one of these two stations without setup cost and time. In a clearing system model (without external arrivals) both with and without failures of the dedicated machines, we show the existence of an optimal transition monotone policy. Moreover, the switching curve defined by this policy has slope greater than or equal to -1.

3 - Admission Control in the Presence of Priorities
Feng Chen, Ph.D Student, University of North Carolina at Chapel Hill, 602 Airport Rd, Northampton Terr., Apt. 205, Chapel Hill, NC, 27514, United States, chenf@email.unc.edu, Vidyadhar Kulkarni

Consider an M/M/1 queueing system serving two customer classes, where class 1 has preemptive priority over class 2. There is a class- dependent reward for accepting a customer, and a class-dependent holding cost per unit time. We obtain optimal admission policy to minimize the long run expected discounted cost and show that it is described by two downward sloping switching curves.

4 - Optimal Control of Assemble-to-Order Systems
Saif Benjaafar, University of Minnesota, Mechanical Engineering Dept., Minneapolis, MN, 55455, United States, saif@umn.edu, Mohsen ElHafsi

We consider the optimal control of an assemble-to-order (ATO) system with multiple customer classes. We formulate the problem as a Markov decision process and characterize the structure of the optimal policy. We show that the optimal production policy for each component is a state-dependent base-stock policy and the optimal inventory allocation is a state-dependent multi-level rationing policy.

■ SD27

P-Room 3454

Queueing Systems

Sponsor: Applied Probability
Sponsored Session

Chair: Mark Lewis, Assistant Professsor, University of Michigan, Industrial and Operations Engineering, 1205 Beal Avenue, Ann Arbor, MI, 48109-2111, United States, melewis@engin.umich.edu

1 - Bilingual Call Centers with Two Unilingual Servers
Stanford David, Associate Professor, University of Western Ontario, Department of Statsl & Actuarial Science, 1151 Richmond Street North, London, ON, N6A 5B7, Canada, stanford@stats.uwo.ca

2 - Corrected Asymptotics for Queues in Heavy Traffic
Jose Blanchet, Assistant Professor, Harvard University, Science Center, One Oxford Street, Cambridge, MA, 02138-2901, United States, jblanche@stanford.edu, Peter Glynn

In this talk we consider the single server queue under broad classes of distributional assumptions (including M/G/1 and Ph/G/1 among others). We develop closed form expressions for asymptotic expansions (in the heavy traffic regime) of important performance measures such as the steady-state waiting time and queue length. Numerical experiments will be discussed to compare with other types of approximations.

3 - Asymptotics of Closed Fork and Join Queues with Subexponential Service Times
Hayriye Ayhan, Associate Professor, Georgia Institute of Technology, Industrial and Systems Engineering, 765 Ferst Drive NW, Atlanta, GA, 30332-0205, United States, hayhan@isye.gatech.edu

We consider a closed fork and join queueing network where several lines feed a single assembly station. We obtain the tail asymptotics of transient cycle times, waiting times and residual service times under the assumption that at least one service time distribution is subexponential. We also discuss under which conditions these results can be generalized to the tail asymptotics of stationary characteristics.

4 - Optimality of Randomized Trunk Reservation for a Problem with a Single Constraint
Eugene Feinberg, Professor, State University of New York at Stony Brook, Department of Applied Math and Stats, Stony Brook, NY, 11794-3600, United States, efeinberg@notes.cc.sunysb.edu, Xiaofei Fan

We consider a problem of accepting arriving customers to an M/M/c/loss queue with several customer types. The system managers are paid for serving customers and penalized for rejecting them. The rewards and penalties depend on customer types. The goal is to maximize the average rewards per unit time subject to the constraint on the average penalties. We provide a solution to this problem. In particular, we optimize average rewards subject to constraints on blocking probabilities.

■ SD28

P-Room 3504

Reliability Research

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: Paul Kvam, Associate Professor, Georgia Tech, Industrial & Systems Eng., 765 Ferst Drive, Atlanta, GA, 30332-0205, United States, pkvam@isye.gatech.edu

1 - Estimating Load-Sharing Properties in a Dynamic Reliability System
Paul Kvam, Associate Professor, Georgia Tech, Industrial & Systems Eng., 765 Ferst Drive, Atlanta, GA, 30332-0205, United States, pkvam@isye.gatech.edu

In an equal load share model, after the first of components fails, failure rates for the remaining components change. An estimator for the load share parameters in an equal load-share model is derived. Based on observing i.i.d. systems, a non-parametric estimator of the component baseline cumulative hazard function is presented. Potential applications can be found in diverse areas, including materials testing, software reliability and power plant safety assessment.

2 - Modeling Approach of Spatially Clustered Defects in Semiconductor Manufacturing
Suk Joo Bae, Post-Doctoral researcher, University of Tennessee, 8215, carolina way, #1223, Knoxville, TN, 37923, United States, sbae@utk.edu, Way Kuo, Paul Kvam

Recently, as semiconductor technology evolves, the design geometries are shrinking to the extent of nanoscale, making physical failure analysis more difficult. To secure high revenues, the need for accurate yield prediction is essential. In semiconductor manufacturing, fatal defects tend to be spatially distributed over the wafer with a certain pattern. In this article, we show that yield prediction is substantially improved by incorporating spatial information of defects into the model.

■ SD29

P-Room 3502

Forestry Session - Fire Applications III

Cluster: Forestry Applications
Invited Session

Chair: Jeremy Fried, USDA Forest Service, Pacific Northwest Research Station, P.O. Box 3890, Portland, OR, 97208, United States, jeremy.fried@fs.fed.us

1 - Determining Prevention Values for Forest Fires
Cristian Palma, Facultad de Agronomìa e Ingenierìa Forestal, Departamento de Ciencias Forestales, Pontificia Universidad Católica de Chile, Casilla 306, Correo 22, Santiago, Chile, cpalmai@puc.cl, Andres Weintraub, David Martell, Wenbin Cui, Dario Robak

Harvesting high flammability forest stands may not only save the timber harvested but may also reduce the risk to other forest stands scattered across the landscape. We present a methodology for assessing protection values associated with individual stands using a fire spread model and a multiple shortest path evaluation algorithm. We describe our application of this approach to a forest management unit in the province of Alberta.

2 - The Impact of Planning Model Structure on the Management of Flammable Forests
David Martell, Faculty of Forestry, University of Toronto, 33 Willlcocks Street, Toronto, ON, Canada, martell@smokey.forestry.utoronto.ca

Forest managers often incorporate average annual fire loss estimates in deterministic timber harvest scheduling models. We embed such a planning model in a simulation model of a flammable forest to explore how the re-planning interval and other attributes of the planning model influence the structure of the forest over time.

3 - Optimization of Fuel Treatment Selection and Processing Facility Siting for Fuel Hazard Reduction
Jeremy Fried, USDA Forest Service, Pacific Northwest Research Station, P.O. Box 3890, Portland, OR, 97208, United States, jeremy.fried@fs.fed.us, P.J. Daugherty

The FIA BioSum framework was applied to a multi-state region to evaluate the feasibility and efficacy of fuel reduction at a landscape scale. Solutions are sensitive to haul costs, especially when fuel treatments generate large amounts of sub-merchantable material. Since the number and location of processing facilities for merchantable and sub-merchantable fiber controls haul costs, we develop a joint optimization approach that selects processing facilities and fuel treatments to implement.

4 - Designing a Conservation Reserve Network With Minimal Fragmentation
Hayri Onal, Associate Professor, University of Illinois, Dept. Agricultural and Consumer Economic, 305 Mumford Hall, MC-710, Urbana, IL, 61801, United States, h-onal@uiuc.edu, Yicheng Wang

When a fully connected conservation reserve network which protects a set of target species is economically infeasible, it may be desirable to construct a network with minimal spatial separation between disconnected subreserves. This paper presents an integer programming approach to the problem and computational experience in an empirical application.

■ SD30

P-Room 3512

Panel Discussion: Important Issues and Challenges on the Interface Between OR and Statistics

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: Jianjun Shi, University of Michigan, University of Michigan, Ann Arbor, MI, United States, shihang@umich.edu

1 - Panel: Important Issues and Challenges on the Interface Between OR and Statistics
Moderator: Jianjun Shi, University of Michigan, University of Michigan, Ann Arbor, MI, United States, shihang@umich.edu, Panelists: Stephen Pollock, Jim Berger, Arthur Dempster, Stephen M. Robinson

The disciplines of statistics and operations research (OR) have many similarities, with overlapping sub-disciplines and many application areas in common. Nevertheless, the two have evolved largely as distinct disciplines, with relatively little communication and very little overlap in technical training. The purpose of this panel session is to begin an effort to change this situation by inviting well respected leaders in both Stat and OR disciplines to identify opportunities, obstacles and potential ways to promote collaboration of researchers from these two communities.

■ SD31

P-Room 3545

Asymptotics and Control of Stochastic Networks

Sponsor: Applied Probability
Sponsored Session

Chair: Cathy Xia, Research Staff Member, IBM TJ Watson Research Center, 19 Skyline Drive, Hawthorne, NY, 10520, United States, cathyx@us.ibm.com

1 - Asymptotic Analysis of Queueing Networks under Time-varying Self-similar Cross Traffic
Cathy Xia, Research Staff Member, IBM TJ Watson Research Center, 19 Skyline Drive, Hawthorne, NY, 10520, United States, cathyx@us.ibm.com, Marc Lelarge, Zhen Liu

We consider a queueing network where the queues have time-varying self-similar cross traffic. This is motivated by the observation that the Internet traffic is non-stationary and exhibits different degree of self-similarity at different times. We investigate the asymptotic behavior of various performance metrics in the multicast context, including the end-to-end delay, system throughput, etc. We further support our analysis with some practical insights and illustrative examples.

2 - The Effect of Service Time Variability on Maximum Queue Lengths in Batch M/G/1 Queues
Rhonda Righter, Professor, Department of IEOR, University of California at Berkeley, Berkeley, CA, 94720, United States, rrighter@ieor.berkeley.edu, Misja Nuyens, Ger Koole

3 - Analysis of General Closed Queuing Networks with Synchronization Stations and Population Constraints
Ananth Krishnamurthy, Assistant Professor, Rensselaer Polytechnic Institute, Dept. of DSES, 110 8th Street, Troy, NY, 12180, United States, krisha@rpi.edu, Adam Petrie

Closed queuing networks with synchronization stations and population constraints find applications in models of manufacturing and computer systems. The paper discusses new performance evaluation algorithms based on parametric decomposition and two moment approximations. The algorithms are used to compare system performance under different types of population constraints.

4 - Admission Control with Finite Buffer and Partial Queue Information
Sridhar Seshadri, Associate Professor, Stern School of Business, NYU, 44 W 4th St, New York, NY, 10012, United States, sseshadr@stern.nyu.edu, Dorothee Honhon

We consider an extension to the queuing model of Lin and Ross (2003) in which a gatekeeper controls the admission to a loss queuing system by deciding whether to block or admit arriving customers. We consider the particular case of a one-server, finite buffer queue and provide new heuristics that improve on the performance relative to the methods proposed by Lin and Ross. The heuristics use state compression and solve a dynamic program for the optimal control.

■ SD32

T-Vail (Majestic Level)

OR in Industry

Cluster: OR Practice
Invited Session

Chair: Erica Klampfl, Ford Research and Advanced Engineering, 2101 Village Rd., SRL/ MD2122, Dearborn, MI, 48124, United States, eklampfl@ford.com

1 - An Empirically-Derived Agenda for Quantitative Tools to Analyze & Mitigate Supply Chain Disruptions
Debra Elkins, Research Program Manager, Enterprise Risk Modeling, General Motors R&D Center, 30500 Mound Road, Mailcode 480-106-359, Warren, MI, 48090-9055, United States, debra.elkins@gm.com, Jennifer Blackhurst, Christopher Craighead, Robert Handfield

While industry & academia agree that disruptions are present in all supply chains, there is limited information on how to deal with disruptions in both the short and long term. We present results from a major multi-industry empirical study on supply chain disruptions, and suggest a industry-academic research agenda related to quantitative tools that industry perceives as critically important for enhancing detection, analysis, and mitigation planning in response to supply chain disruptions.

2 - Optimization In The Upstream Oil and Gas Industry
Cassandra McZeal, ExxonMobil, PO Box 2189, URC-URC-C326, Houston, 77252-2189, United States, cassandra.m.mczeal@exxonmobil.com

Optimization technology can assist in maximizing economic value for exploration, development, and operations in the upstream industry. The decisions can span the entire production network from reservoirs to market options. Combining optimization technology with an integrated business model often leads to innovative and higher-value solutions. Current ExxonMobil optimization models have identified opportunities that have added significant value to project economics and capital efficiency.

3 - Navigating New Aviation Frontiers with OR
Markus Emsermann, Operations Research Analyst, Jeppesen, 55 Inverness Drive East, Englewood, CO, 80112, United States, markus.emsermann@jeppesen.com, Ralph Tiedeman

Jeppesen is recognized as the world's foremost provider of aviation information. Our legacy core competency is a subscription service that distributes flight manuals to over 250,000 pilots worldwide. The result is a complex and challenging scheduling problem with over 17 million paper sheets shipped worldwide per week. Currently, we are in the process of customizing to the customer level the content and media of our manuals.OR will play an increasingly more important role in this transition.

■ SD33

T-Savoy (Majestic Level)

JFIG Paper Competition II

Sponsor: JFIG, Junior Faculty Interest Group
Sponsored Session

Chair: Sila Cetinkaya, Associate Professor of Industrial Engineering, Texas A&M University College Station, TX, 77843-3131, United States, sila@tamu.edu

1 - Poisson Disorder Problem with Exponential Penalty for Delay
Savas Dayanik, Assistant Professor, Princeton University, ORFE, E-Quad, Princeton, NJ, 08544, United States, sdayanik@princeton.edu, Erhan Bayraktar

We solve the Poisson disorder problem when the delay is penalized exponentially. Our objective is to detect, as quickly as possible, the unobservable time of the change in the intensity of a Poisson process. The change point delimits two different regimes in which one employs distinct strategies (e.g., investment, advertising, manufacturing). We describe a stopping rule that minimizes the frequency of false alarms and an exponential cost function of the detection delay.

2 - Shipper Valuation and Hedging of Interstate Natural Gas Pipelines Transportation Contracts
Nicola Secomandi, Assistant Professor, Tepper School of Business, Carnegie Mellon University, 5000 Forbes Avenue, Pittsburgh, PA, 15213, United States, ns7@andrew.cmu.edu

In the United States, interstate natural gas pipeline companies provide transportation services by stipulating contracts with shippers. Since these contracts link natural gas production with its local distribution and consumption, they play a fundamental role in the supply chain of this industry. The talk investigates how shippers should value and hedge them, with an emphasis on producers and local distribution companies.

3 - Competition for Procurement Contracts with Service Guarantees
Francis de Vericourt, Assistant Professor, Fuqua School of Business, One Towerview, Durham, Durham, NC, 27708, United States, fdv1@duke.edu, Fernando Bernstein

A set of firms wants to establish long-term contracts with a group of suppliers. Each supplier's ability to process the firms' requests is constrained by her production capacity. When specifying the contracts, firms need to stipulate service delivery guarantees. We determine which set of contracts is allocated to each supplier.

■ SD34

T-Columbine (Majestic Level)

Pricing and Competition in Operations Management

Sponsor: Manufacturing and Service Operations Management
Sponsored Session

Chair: Hyun-Soo Ahn, Assistant Professor, Michigan Business School, University of Michigan, Ann Arbor, MI, 48109, United States, hsahn@bus.umich.edu

Chair: Yi Xu, Assistant Professor, University of Miami, 412B Jenkins Bldg, 5250 University Dr., Coral Gables, FL, 33146, United States, yxu@miami.edu

1 - Price Markdown in Competition
Fuqiang Zhang, University of California at Irvine, Irvine, CA, United States, Fuqiang@wharton.upenn.edu

This paper tries to explain the increasingly used price markdowns by proposing a price markdown game. In our model setting, we show that unilaterally using markdown in general is not profitable for a firm. However, depending on the parameter values, it is possible that both firms use markdown is the unique equilibrium.

2 - Efficient Contract Design in Multi-Principal Multi-Agent Supply Chains
Thomas A. Weber, Assistant Professor, Stanford University, Management Science and Engineering, Stanford, CA, 94305-4026, United States, webert@stanford.edu, Hongxia Xiong

We consider a multi-principal multi-agent game in a complete-information supply chain setting and determine endogenous nonlinear equilibrium transfer schedules. The resulting contracts align incentives for decentralized decision-making and can achieve first-best channel solutions. These contracts provide a benchmark to measure the efficiency of other existing parameterized contract designs.

3 - Competitive Pricing and Product Positioning in a Supply Chain with a Branded Component Supplier
Yi Xu, Assistant Professor, United States, yxu@exchange.sba.miami.edu, Haresh Gurnani, Ramarao Desiraju

We study competitive pricing and product positioning strategies in a supply chain comprising of two manufacturers with differentiated products and a supplier of a key branded component. Each manufacturer independently decides on whether to use the branded component or its own unbranded component. Implications of the nature of the equilibrium strategies will be discussed.

4 - Dynamic Competition under Supermodularity
Tava Olsen, United States, olsen@olin.wustl.edu, Hyun-Soo Ahn

We consider a general non-linear framework for competition in a stochastic multi-period setting. Unlike traditional models in the operations literature, we do not assume a linear structure for costs and state transitions. We prove the existence of a Markov perfect Nash equilibrium and demonstrate supermodular properties of this equilibrium. We show how these properties lead to insights regarding operational decisions.

■ SD35

T-Terrace (Terrace Level)

Secure Supply Chain Collaborations

Sponsor: Manufacturing and Service Operations Management
Sponsored Session

Chair: Leroy Schwarz, Professor, Krannert School of Management, Purdue University, 403 West State Street, West Lafayette, IN, 47907-2056, United States, lschwarz@mgmt.purdue.edu

Co-Chair: Mikhail Atallah, Purdue University, United States, mja@cs.purdue.edu

Co-Chair: Vinayak Deshpande, Assistant Professor of Management, Purdue University, 4024 Rawls Hall, West Lafayette, IN, 47907, United States, Vinayak@purdue.edu

1 - Collaboration and Revelation: Streamlining Supply Chain Inventories with Limited Information Disclos
Yossi Aviv, Associate Professor of Operations Management, Washington University, Campus Box 1133, 1 Brookings Drive, Saint Louis, MO, 63130, United States, aviv@wustl.edu

We discuss the potential value of collaborative forecasting in a supply chain consisting of a retailer and a supplier. A key feature of our model is that the trading partners may be privy to private streams of information that they may not be willing to share. After defining performance metrics that relate to the level of information disclosure and local inventory costs, we develop a mechanism that controls the information transfer and product replenishment at both levels of the supply chain.

2 - Secure Supply-Chain Collaboration (SSCC): A New Technology for Supply-Chain Management
Leroy Schwarz, Professor, Krannert School of Management, Purdue University, West Lafayette, IN, 47907, United States, lee@mgmt.purdue.edu

This paper will introduce and illustrate the use of secure multi-party computation (SMC), a well-established technique in computer science, to managing supply chains. SSCC protocols enable supply-chain partners to cooperatively achieve desired mutually agreed-upon goals without revealing the private information of any of the parties. This talk will introduce SMC and describe its use in several well-known supply-chain management scenarios.

3 - Identifying Beneficial Collaboration Securely in Decentralized Logistics Systems
Ananth Iyer, Professor, Purdue University, 1310 Krannert Building, Rawls 4025, West Lafayette, IN, 47907, United States, aiyer@mgmt.purdue.edu

We focus on the problem faced by independent trucking companies that have separate pickup and delivery tasks. We focus on the identification of potential efficiency enhancing task swaps between these companies that maintains the anonymity of the remaining data. We present an algorithm finds opportunities to swap loads without revealing any information except the loads swapped along with proofs of the security.

4 - Secure Protocols for Supply Chain Collaboration: Capacity Allocation and Collaborative Forecasting
Vinayak Deshpande, Assistant Professor of Management, Purdue University, 4024 Rawls Hall, West Lafayette, IN, 47907, United States, Vinayak@purdue.edu, Mikhail Atallah, Leroy Schwarz, Keith Frikken

In this talk, we present specific protocols for two types of supply-chain interactions: Capacity Allocation and Collaborative Forecasting. For the secure capacity allocation model, we show how to allocate capacity to retailers without revealing retailers actual order quantities to the supplier, or the supplier's capacity to the retailers. In secure collaborative forecasting, we develop protocols for constructing a joint forecast without revealing the retailers or suppliers forecast parameters.

■ SD36

T-Capitol (Terrace Level)

Financial Engineering Applications

Cluster: Financial Engineering
Invited Session

Chair: John Birge, University of Chicago, Graduate School of Business, Chicago, IL, United States, John.Birge@gsb.uchicago.edu

1 - Solving Impulse Control Problems for One Dimensional Diffusions via Optimal Stopping
Masahiko Egami, Ph.D. student, Princeton Univeristy, E312 Engineering Quadrangle, Princeton, NJ, 08544, United States, megami@Princeton.EDU, Savas Dayanik

We consider impulse control problems in a general setting where the driving process is one dimensional diffusions. We characterize the value function and this characterization leads to a new solution method in use of optimal stopping problem techniques. We show some examples from finanical engineering problems.

2 - Recent Developments in Pricing Discrete Barrier and Lookback Options
Steven Kou, Associate Professor, Columbia University, 312 Mudd, Dept. of IEOR, Columbia University, New York, NY, 10027, United States, sk75@columbia.edu

Barrier and lookback options are derivative contracts that depend on the extremal values of the underlying assets. We shall present new algorithms, based on Laplace transforms, to price these options (Petrella and Kou, 2003), and new continuity corrections for two dimensional and partial barrier options (Cao and Kou, 2003).

3 - Comparisons of Alternative Quasi-Monte Carlo Sequences for Option Pricing
Xuefeng Jiang, Ph.D Student, Northwestern University, 2145 Sheridan Road, Tech Building, C210, IEMS Department, Evanston, IL, 60208, United States, xfjiang@northwestern.edu, John Birge

We applied quasi-Monte Carlo sequences into a duality approach to price American options. We compared the results using different low discrepancy sequences and estimated the error bounds. The results demonstrated the value of the alpha sequence using expansions of irrationals.

4 - On the Valuation of Options in Jump-Diffusion Models by Variational Methods
Liming Feng, IEMS Department, Northwestern University, 2145 Sheridan Rd, RM C210, Evanston, IL, 60208, United States, feng@iems.northwestern.edu, Vadim Linetsky, Michael Marcozzi

We consider valuation of European and American options under jump-diffusion processes by variational methods.The value function solves a parabolic partial integro-differential variational inequality.A finite element implementation is presented.We introduce separate approximation domains for both state and jump variables.With any semi-implicit time integrator,this procedure presents a full discretization which is of optimal efficiency.Multi-dimensional computations are also presented.

■ SD37

T-Biltmore (Terrace Level)

Electric Power Transmission Markets

Sponsor: Energy, Natural Resources and the Environment
Sponsored Session

Chair: Shmuel Oren, Professor, Univ of California - Berkeley, Department of IEOR, 4135 Etcheverry Hall, Berkeley, ca, 94720, United States, oren@ieor.berkeley.edu

1 - Transmission Investment in Competitive Electricity Markets
Javier Contreras, Associate Professor, UCLM, E.T.S. de Ingenieros Industriales, Campus Universitario s/n, Ciudad Real, 13005, Spain, Javier.Contreras@uclm.es

This presentation proposes the construction of an analytic framework for the transmission network investment problem in competitive markets to address the multiple challenges that the industry is facing. We provide the description of a multi-layered analytic framework that has the capability to capture the various aspects of the transmission investment issues. The application of the framework is illustrated by a simple case study to bring to the fore the salient characteristics.

2 - Two-Settlement Cournot Equilibrium in Price-capped Electricity Markets
Jian Yao, Univ of California - Berkeley, Department of IEOR, 4135 Etcheverry Hall, berkeley, ca, 94720, United States, jyao@ieor.berkeley.edu, Shmuel Oren, Ilan Adler

We study Cournot equilibria in the two-settlement electricity markets under congestion and energy price caps. We consider spot market uncertainty of demand, generation and transmission. The model is formulated and solved as a stochastic Equilibrium Problem with Equilibrium Constraints (EPEC). Numerical test results are obtained for the 53-bus Belgian electricity network under a variety of hypothetical economic assumptions.

3 - Inefficiency of Simultaneously Feasible Congestion Revenue Rights Auctions
Shi-Jie Deng, Asst. Professor, Georgia Inst. of Tech., 765 Ferst Dr, Atlanta, GA, 30332, United States, deng@isye.gatech.edu, Shmuel Oren, Sakis Meliopoulos

Empirical evidence shows that the clearing prices for financial transmission rights (FTRs) resulting from centralized auctions conducted by a System Operator differ significantly from the realized congestion revenues. We show that such deviations are due to certain inherent inefficiencies in the auction structure. Even with perfect foresight of average congestion rents the auction clearing prices for the FTRs depend on the bid quantity and thus may not be priced correctly in the FTR auction.

■ SD38

T-Beverly (Terrace Level)

Simulation Applications to Healthcare and Aircraft Design

Sponsor: Simulation
Sponsored Session

Chair: Andrew Ganti, Sr. Consultant/MBB, General Electric, 300 Winged Ter. Dr., San Ramon, CA, 94583, United States, Andy.Ganti@med.ge.com

1 - Queueing Theory, Markov Chains, and Optimum Facility Size — Hospital Obstetric Services Application
Dave LaCourse, President, HealthCare Management Engineering, Inc., 13505 Marquette Blvd, Fort Meyers, FL, 33905, United States, davelacourse@earthlink.net

Case study: Healthcare application of Queueing Theory (M/M/c + more) & Markov Chains to determine optimum number of patient rooms for OB services (antepartum, labor/delivery, and postpartum, including high-risk patients). In addition to the O.R. models, supplementary methods include Hypothesis testing, Interactive graphics, Sensitivity analyses & "Data mining." Excel spreadsheets models will be made available to attendees free of charge.

2 - Role of Monte Carlo Simulation in Design For Six Sigma
Narendra Soman, Researcher, General Electric Global Research Center, 1 Research Circle, Building KW Room D236, Niskayuna, NY, 12309, United States, narendra.soman@research.ge.com

Design For Six Sigma (DFSS) is a methodology to enable design of products and processes that meet customer expectations to a Six Sigma quality level. Monte Carlo analysis can be applied effectively in DFSS to quantify the uncertainty in the system response due to uncertainty in input parameters, noise variables, and computational model parameters. The talk also demonstrates examples of solving difficult mechanical assembly problems (previously deemed unsolvable) using Monte Carlo Analysis.

■ SD39

T-Tower Court A (2nd Floor)

Contracting in Supply Chains and Markets

Cluster: Supply Chain Mgmt & Operations
Invited Session

Chair: Erica Plambeck, Assistant Professor, Stanford Graduate School of Business, 518 Memorial Way, Stanford, CA, 94305, United States, elp@stanford.edu

1 - Competitive Customization
Ali Kemal Parlakturk, Stanford University, 1300 Oak Creek Dr #308, Palo Alto, CA, 94304, United States, pturk@stanford.edu, Haim Mendelson

We study customization under competition. We consider asymmetric customization capabilities and production costs and compare their effects on market structure. This determines the relation between a firm's strategic investments and its current market position.

2 - Relational Contracts for Dynamic, Joint Production
Terry Taylor, Associate Professor, Columbia University, Graduate School of Business, 3022 Broadway, New York, NY, 10027, United States, tat2002@columbia.edu, Erica Plambeck

The success of a buyer-supplier relationship in producing quality products depends importantly on the actions of both parties. For example, a buyer may provide input materials and/or assistance in the production process. Because it is difficult for a third party to assess who is at fault if the production process fails, firms may rely on informal agreements (relational contracts). We characterize optimal relational contracts and consider implications for sharing process information.

3 - Renegotiation of Supply Contracts
Erica Plambeck, Assistant Professor, Stanford Graduate School of Business, 518 Memorial Way, Stanford, CA, 94305, United States, elp@stanford.edu, Terry Taylor

The potential for renegotiation of supply contract affects incentives for information-sharing and investment. Ideally, contracts should be designed in anticipation of the potential for renegotiation. Simple contracts with renegotiation can perform as well as complex, complete contingent contracts.

■ SD40

T-Tower Court B (2nd Floor)

Managing Demand under Multiple Products or Retailers

Cluster: Supply Chain Mgmt & Operations
Invited Session

Chair: David Simchi-Levi, Professor, MIT, 77 Massachusetts Ave., 1-171, Cambridge, MA, 02139, United States, dslevi@mit.edu

Co-Chair: Julie Swann, Georgia Institute of Technology, Industrial and Systems Engineering Dept., 765 Ferst Drive, NW, Groseclose 0205 Room 411, Atlanta, GA, 30332-0205, United States, jswann@isye.gatech.edu

1 - Dynamic Retail Assortment with Demand Learning for Short Life-Cycle Consumer Goods
Felipe Caro, MIT Sloan School of Management, 50 Memorial Drive, Room E53-356A, Cambridge, MA, 02142, United States, fcaro@mit.edu, Jeremie Gallien

We present a dynamic assortment model with demand learning for a retailer with short design-to-shelf lead-times (e.g. Zara) seeking to maximize total season profits. Our analysis involves the Lagrangian relaxation of weakly coupled dynamic programs; it yields explicit near-optimal policies capturing the key exploration vs. exploitation trade-off, and associated suboptimality bounds. We report their numerical performance under various scenarios for the type of demand and inventory data available.

2 - Optimal Production and Admission Policies in Make-To-Stock/Make-To-Order Manufacturing Systems
Tieming Liu, Massachusetts Institute of Technology, 77 Massachusetts Avenue, Room 5-012, Cambridge, MA, 02139, United States, tmliu@mit.edu, 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.

3 - A Non-Parametric Approach to Multi-Product Pricing
Paat Rusmevichientong, Cornell University, 206 Rhodes Hall, Cornell University, Ithaca, NY, 14853, United States, paatrus@orie.cornell.edu, Peter Glynn, Benjamin Van Roy

Motivated by the availability of consumer preference data from e-commerce websites, we consider models of consumer purchasing behavior, each of which relates observed data to subsequent purchasing tendencies. Although computing optimal prices is NP-complete, when prices are constrained by a price ladder, the problem becomes one of maximizing a supermodular function. We provide a heuristic for our price-ladder constrained problem together with encouraging computational results on real dataset.

4 - Hybrid Push-Pull Inventory to Trade-off Information Flow and Risk Pooling with Multiple Dealers
Xiaohui Xu, University of Texas at Austin, Mccombs School of Business, Austin, TX, United States, xiaohui.xu@phd.mccombs.utexas.edu, Yusen Xia, Steve Gilbert

We consider a supply chain in which a manufacturer serves multiple dealers whose demands are correlated. Dealers can operate in either push or pull relationships with the manufacturer, depending upon whether it is the dealer or the manufacturer who holds the inventory. We analyze how a manufacturer can induce an appropriate mix of push and pull relationships to balance the information-flow advantages associated with push dealers against the risk-pooling benefits associated with pull dealers.

■ SD41

T-Tower Court C (2nd Floor)

Supply Chain Remanufacturing

Contributed Session

Chair: Kris Lieckens, University of Antwerp, Prinsstraat 13, Antwerp, 2000, Belgium, kris.lieckens@ua.ac.be

1 - Effects of Random Yield in Reverse Supply Chains with Price-sensitive Supply and Demand
Ismail Serdar Bakal, University of Florida, Dept. of Industrial and Systems Engi., Gainesville, FL, 32611, United States, ismailsb@ufl.edu, Elif Akcali

We explore effects of random yield to pricing decisions in reverse supply chains. Yield of the remanufacturing process is random and depends on the acquisition fee offered. We develop models to determine the optimal acquisition fee for the used product and the sales price for remanufactured parts and analyze the effects of yield variation to the profitability of remanufacturing, benefits of delaying pricing decisions until after yield realization and value of perfect yield rate information.

2 - Customer vs. Firm Selection of Sales Contract Parameters in Remanufacturing
Baris Yalabik, University of Illinois at Urbana-Champaign, 350 Wohlers Hall, 1206 S Sixth St., Champaign, IL, 61820, United States, yalabik@uiuc.edu, Dilip Chhajed, Nicholas Petruzzi

We model and solve for a remanufacturer's sales contract and product design decisions in two different settings. First, we consider the case in which the firm offers the market a deal consisting of a lease price and duration. Second, we re-solve the model assuming each customer can select her own lease duration. We conclude by comparing the optimal behavior of the firm and the associated profits for the two cases.

3 - Effect of Environmental Policies on Remanufacturing Competition
Supriya Mitra, Syracuse University, Suite 400,, Crouse-Hinds School of Mangement Bldg.,, Syracuse, NY, 13244-2130, United States, smitra@syr.edu, Scott Webster

We examine a 2 period model of a manufacturer who produces and sells a new product (for period 1 and 2) and a remanufacturer who procures the end-of-life returns of the product and then remanufactures and sells them in the 2nd period. We analyze how evolving environmental policies such as product take-back laws affect the competitive behavior of the two players.

4 - Reverse Logistics Network Design: Uncertainty at Multiple Levels
Kris Lieckens, University of Antwerp, Prinsstraat 13, Antwerp, 2000, Belgium, kris.lieckens@ua.ac.be, Nico Vandaele

Concerning the efficient design of reverse logistics networks, we show that traditional models can be improved when they are combined with a queueing model that can incorporate both lead times and system variabilities. We solve a single product-multiple level network with the technique of differential evolution.

■ SD42

T-Tower Court D (2nd Floor)

Assorted Topics in Revenue Management

Sponsor: Revenue Management & Dynamic Pricing
Sponsored Session

Chair: Warren Lieberman, President, Veritec Solutions, 824 Miramar Terrace, Belmont, CA, 94002, United States, warren@veritecsolutions.com

1 - Dynamic Competitive Revenue Management with Forward and Spot Markets
Srinivas Krishnamoorthy, Doctoral Candidate, Columbia Business School, Uris Hall, 3022 Broadway, New York, NY, 10027, United States, sk711@columbia.edu, Guillermo Gallego, Robert Phillips

We study dynamic games between two capacity providers - an entrant and an incumbent - who compete to sell in both a forward market and a spot market. Subgame-perfect Nash equilibria are identified under different assumptions about market structure, demand, and available capacity. The study has implications for revenue management markets where providers have dynamic competitive interactions rather then a single static interaction.

2 - Monetizing Risk in Managed Care Contracting
Jin Liu, PROS Revenue Management, 3100 Main St., Suite 900, Houston, TX, 77002, United States, JLiu@prosrm.com, Kirk Abbott

Managed care contracts are the means by which hospitals are reimbursed for services rendered to patients. The design of the structure and parameters of these contracts is a pricing optimization problem. A risk minimization pricing model has been used successfully for pricing these contracts. However, the communication of the value of lower risk to clients has been challenging. We present new techniques for monetizing this risk and show its utility in contract optimization.

3 - Manufacturing Schedule Optimization at General Motors: A Revenue Management Approach
Charles Rosa, General Motors, R&D and Planning, Mail Code 480-106-359; 30500 Mound Road, Warren, MI, 48090-9055, United States, charles.rosa@gm.com, Slaven Sljivar

General Motors Corp has developed an optimization based Revenue Management application that helps its business analysts quickly understand the impact of pricing and incentives on sales of GM and non-GM vehicles. Using this tool, GM is starting to improve its profit position by better balancing its production schedules against its automotive pricing policies while, at the same time, adhering to a variety of business constraints.

4 - A New Framework for Revenue Management Decision Making
Warren Lieberman, President, Veritec Solutions, 824 Miramar Terrace, Belmont, CA, 94002, United States, warren@veritecsolutions.com

Traditional revenue management decision making is based on transaction level forecasts. This can break down in industries where transaction volume is small and variable. This talk describes the research we have undertaken to base revenue management decisions on state changes in a system, rather than relying on transaction volume forecasting. Approaches similar to the one we explore have been successfully applied in other areas.

■ SD43

T-Denver (Mezzanine)

Empirical Research in New Product Development II

Cluster: New Product Development
Invited Session

Chair: Anita Tucker, Assistant Professor, University of Pennsylvania, 551 Jon M. Huntsman Hall, 3730 Walnut Street, Philadelphia, PA, 19104-6340, United States, tuckera@wharton.upenn.edu

1 - Methodological Fit in Empirical Operations Management Research
Anita Tucker, Assistant Professor, University of Pennsylvania, 551 Jon M. Huntsman Hall, 3730 Walnut Street, Philadelphia, PA, 19104-6340, United States, tuckera@wharton.upenn.edu, Amy Edmondson, Stacy McManus

Methodological fit is an attribute of high-quality research that receives little explicit attention in the OM literature. Fit refers to internal consistency among elements of a research project -question, prior work, design, and contribution. We offer a contingency framework that relates prior work - the state of theory and research - to the design of a new research project, and discuss implications for educating OM researchers who wish to study and collect data from real organizations.

2 - Innovation in Operations Management: An Empirical Investigation
Aleda Roth, Professor, University of North Carolina, Kenan-Flagler Business School, McColl 4708, Chapel Hill, NC, 27599, United States, Aleda_Roth@unc.edu

3 - Empirical Research in Software Development: Lessons from the Field
Alan MacCormack, Associate Professor, Harvard University, Morgan Hall Terrace, Soldiers Field Road, Boston, MA, 02163, United States, amaccormack@hbs.edu

Over the past 6 years I have embarked on a research trajectory that seeks to explore how firms should respond to the presence of uncertainty in their innovation processes. The work has employed a variety of empirical methods at multiple levels of analysis. In this talk, I will describe my overall trajectory, the logic behind the methods chosen and results to date. I will also discuss some personal lessons on the way to gather data on complex processes and ambiguous outcomes in the real world.

4 - Value Added Services, Product Innovation and Switching Inertia
Rohit Verma, Associate Professor and Thayne Robson Fellow, University of Utah, David Eccles School of Business, 1645 Camcus Center Drive, Salt Lake City, UT, 84112, United States, rohit.verma@business.utah.edu, Gerhard Plaschka

This study presents an econometric framework for assessing the relative impact of value-added services and technical innovation on new product development in industrial automation industry. Based on discrete choice modeling framework, empirical data for this multi-year study was collected from about 200 European and 500 US-based manufacturing organizations using individually customized computer-based survey of Sr. Executives. The results illustrate the role of value-added services and technical innovation in overcoming switching inertia in the product development process.

■ SD44

T-Spruce (Mezzanine)

Bidding Mechanisms for Time-Sensitive Markets

Cluster: Auction Theory & Applications
Invited Session

Chair: Jeremie Gallien, MIT Sloan School of Management, 30, Wadsworth Street, E53-389, Cambridge, MA, 02142, United States, jgallien@MIT.EDU

1 - Competition in the Supply Option Market
Victor Martinez de Albeniz, Assistant Professor, IESE, Av Pearson 21, Barcelona, 08034, Spain, valbeniz@iese.edu, David Simchi-Levi

We propose a competition model where a buyer purchases some commodity component from a pool of suppliers, through option contracts. The suppliers compete for capacity allocation and supply deliveries by submitting reservation and execution prices to the buyer. We characterize the suppliers' Nash equilibria in pure strategies. We show that in equilibrium, suppliers tend to be clustered in small groups of two or three suppliers each, and that supply chain inefficiencies are bounded.

2 - Online Auction and List Price Revenue Management
Gustavo Vulcano, Assistant Professor, New York University, 44 West 4th Street, Suite 8-76, New York, NY, 10012, United States, gvulcano@stern.nyu.edu, Rene Caldentey

We analyze a revenue management problem in which a seller, facing a Poisson arriving stream of rational customers, operates an online multiunit auction. The seller announces the auction duration, the reservation price, and the number of units to offer in order to maximize revenues. Besides the auction, customers have access to an alternative list price channel to buy the product. This list price channel can be either managed by the auctioneer or by another firm.

3 - Models for Buyout Option in Online Auctions
Shobhit Gupta, Graduate Student, MIT Operations Research Center, 305 Memorial Drive, Ashdown House, Cambridge, MA, 02139, United States, shobhit@mit.edu, Jeremie Gallien

Increasingly used in online auctions, buyout prices allow bidders to instantly purchase the item listed. In a model featuring time-sensitive bidders with uniform valuations and Poisson arrivals (but endogenous bidding times), we focus on finding temporary and permanent, static and dynamic buyout prices maximizing the seller's discounted revenue. We present approximate closed-form solutions and provide insights on the relative benefits of using all types of buyout prices in various environments.

■ SD45

T-Gold (Mezzanine)

Algorithms for Market Equilibria

Cluster: Game Theory
Invited Session

Chair: Vijay Vazirani, Professor, Georgia Tech, 801 Atlantic Drive, Atlanta, GA, 30332, United States, vazirani@cc.gatech.edu

1 - Auction Algorithms for Market Equilibrium
Sanjiv Kapoor, Professor, Illionis Institute of Technology, United States, kapoor@iit.edu

In this paper we study computing market equilibrium in markets with linear utility functions. The buyers in the market have an initial endowment given by a portfolio of items. The market equilibrium problem is to compute a price vector which ensures market clearing, each buyer maximizing its utility. We formulate the market equilibrium problem as a parameterized linear program. We then define an auction mechanism which computes prices such that approximate market clearing is achieved.

2 - The Spending Constraint Model for Market Equilibrium
Nikhil Devanur, Student, Georgia Tech, 801 Atlantic Drive, Atlanta, GA, 30332, United States, nikhil@cc.gatech.edu, Vijay Vazirani

The traditional model of market equilibrium supports impressive existence results, including the celebrated Arrow-Debreu Theorem. However, in this model, polynomial time algorithms for computing (or approximating) equilibria are known only for linear utility functions. We present a new, and natural, model of market equilibrium that not only admits existence and uniqueness results paralleling those for the traditional model but is also amenable to efficient algorithms.

3 - Market Equilibria for Quasi-Concave Homothetic Utilities and Economies of Scale in Production
Kamal Jain, Researcher, Microsoft Research, United States, kamalj@microsoft.com, Vijay Vazirani, Yinyu Ye

Eisenberg and Gale (1959) gave a convex program for computing market equilibrium for Fisher's model for linear utility functions Eisenberg (1961) generalized this to homogeneous, concave function. We further generalize to: 1. Homothetic, quasi-concave utilities. 2. We introduce the notion of a trading cone which enables us to compute market equilibrium in the presence of economies of scale in production provided differential pricing is allowed. Applications to network pricing are provided.

4 - Economic Properties of Social Networks
Sham Kakade, PostDoc, University of Pennsylvania, Suite 400A, 3401 Walnut St., Philadelphia, PA, 19103, United States, skakade@linc.cis.upenn.edu

We examine the marriage of recent probabilistic generative models for social networks with classical frameworks from mathematical economics. We are particularly interested in how the statistical structure of such networks influences global economic quantities such as price variation. Our findings are a mixture of formal analysis, simulation, and experiments on a foreign trade data set from the United Nations, which have been made possible only by algorithmic advances of the last two years.

■ SD46

T-Aspen (Mezzanine)

Panel: Careers in Academia, Industry and the Public Sector: Opportunities and Challenges for OR/OR/MS Professionals

Sponsor: Women in OR/MS
Sponsored Session

Chair: Amelia Regan, University of California, Irvine, Institute of Transportation Studies, Computer Science and Civil Engineering, Irvine, CA, United States, aregan@uci.edu

1 - Careers in Academia, Industry and the Public Sector: Opportunities and Challenges for OR/OR/MS Professionals

Professionals from each of these sectors will discuss their career paths and the relevant decision variables and utility functions. Of particular Interest will be opportunities for advancement, balancing work and family and long term job satisfaction.

■ SD47

T-Century (Mezzanine)

Software Demonstration

Cluster: Software Demonstrations
Invited Session

1 - GAMS Development Corp.- GAMS: A High Performance Modeling System for Large-Scale Modeling Applications
Alex Meeraus, President, GAMS Development Corporation, 1217 Potomac St. NW, Washington, DC, 20007, United States, AMeeraus@gams.com, Armin Pruessner

The General Algebraic Modeling System (GAMS) is a high-level modeling environment for mathematical programming problems. It consists of a language compiler and a stable of integrated high-performance solvers. GAMS is tailored for complex, large scale modeling applications. We show how to build large maintainable models that can be adapted quickly to new situations. Furthermore, we illustrate how easily GAMS can be interfaced with other applications such as Excel or embedded in user applications for solving real world problems.

2 - Interpretive Simulations- Active Learning Through Business Simulations
Tony Naidu, Interpretive Simulations, 1421 Sachem Pl., Ste. 2, Charlottesville, VA, 22901, United States, tony@interpretive.com

An overview of our broad range of fully administered business simulations, used by some of the leading business schools in the world, including Michigan, Wharton and Darden. Each simulation is designed with specific pedagogical objectives in mind, yet provides a realistic setting to challenge students. Whether your class size is 15 or 1500, undergraduate or MBA, domestic or international, marketing, management or operations, let one of our simulations become the cornerstone of your course.

Monday 8:00am-9:30am

■ MA01

P-Ballroom F

Tutorial: Constraint Languages for Combinatorial Optimization

Cluster: Tutorials- Denver 2004
Invited Session

1 - Constraint Languages for Combinatorial Optimization
Pascal Van Hentenryck, Professor, Department of Computer Science, Brown University, Box 1910, Providence, RI, 02912, United States, pvh@cs.brown.edu, Laurent Michel

This tutorial reviews recent developments in the design and implementation of constraint languages for combinatorial optimization. In particular, it argues that constraint-based languages are a unifying technology to express combinatorial optimization problems, supporting a variety of solvers including constraint programming, local search, and mathematical programming.

■ MA02

P-Ballroom E

Genetic Algorithms

Cluster: Metaheuristics (EU/ME)
Invited Session

Chair: Franz Rothlauf, University of Mannheim, Schloss, Mannheim, 68131, Germany, rothlauf@uni-mannheim.de

Co-Chair: Martin Pellikan, United States, pelikan@cs.umsl.edu

1 - Automatic Design of Neighborhood Operators Via Probabilistic Model Building
Kumara Sastry, University of Illinois at Urbana-Champaign, 104 S. Mathews Ave, 117 Transportation Bldg, Urbana, IL, 61801, United States, kumara@illigal.ge.uiuc.edu

This study presents a methodlogy for inducing neighborhood operators that automatically identify problem decomposition via probabilistic model building of a population of candidate solutions. The local-search operator uses the probabilistic model of the problem decomposition to find the best among competing subproblems. The results show that for deterministic additively separable problem the genetic local-search method scales-up as O(2^k m^1.5), where k is the BB size and m number of BBs.

2 - Topology Design of Wireless Local Area Networks Using Genetic Algorithms
Chao-Hsien Chu, Associate Professor, Pennsylvania State University, 301K IST Building, University Park, PA, 16802, United States, chu@ist.psu.edu, Tao Yang

Over the past few years, there has been a rapid growth in wireless industry. How to design efficient topology for wireless networks is a key issue. In this paper, we formulate the problem into a dual 0-1 integer-programming model. A new approach using GAs is proposed to solve the problem. We explore the major research issues that are critical to a GA implementation. Our experiments show that the proposed GA approach is efficient and can often find optimal or near optimal solutions.

3 - Experiments with Hybrid Genetic Algorithms for the QAP
Zvi Drezner, Professor, California State University-Fullerton, Dept of Info. Systems and Decision Sci., Langsdorf Hall 540, Fullerton, CA, 92834, United States, zdrezner@fullerton.edu

We perform extensive computational experiments solving quadratic assignment problems using various variants of an hybrid genetic algorithm. We propose a new metaheuristic algorithm (ESH) that combines features from genetic algorithms, scatter search, and an improvement heuristic, such as tabu search. We tested the new approach and compared it with other proposed modifications on the quadratic assignment problem with excellent results.

4 - Feature Subset Selection with Genetic and Evolutionary Algorithms
Erick Cantu-Paz, Lawrence Livermore National Laboratory, 7000 East Avenue, L-561, Livermore, ca, 94550, United States, cantupaz@llnl.gov

The problem of supervised classification is concerned with using labeled examples to induce a model that classifies objects into a finite set of known classes. The examples are described by a vector of numeric or nominal features. Some of these features may be irrelevant or redundant and avoiding them is important because they may have a negative effect on the accuracy of the classifier. This talk will describe recent results on the feature subset selection problem with GAs.

■ MA03

P-Plaza Court 1

Scatter Search and Path Relinking for Timetabling and Scheduling

Cluster: Scatter Search and Path Relinking Methods for Optimization
Invited Session

Chair: Dario Landa Silva, University of Nottingham, School of Computer Science and IT, Wollaton Road, Nottingham, NG8 1BB, United Kingdom, jds@Cs.Nott.AC.UK

1 - Scatter Search for Project Scheduling with Resource Availability Cost
Vinìcius Armentano, Professor, Universidade de Campinas, FEEC-Av. Albert Einstein, 400, Campinas, SP, 13083-970, Brazil, vinicius@densis.fee.unicamp.br, Denise Yamashita, Manuel Laguna

We consider a project scheduling problem with a deadline and with the objective of minimizing resource availability costs. The solution for several deadlines provides time/cost tradeoffs, which is a valuable information for negotiating the project's price . An implementation of scatter search that incorporates advanced strategies, such as path relinking to combine solutions and the use of frequency-based memory for the diversification generator, is proposed. Computational tests are reported.

2 - A Hybrid Scatter Search / Electromagnetism Meta-Heuristic for Project Scheduling
Bert De Reyck, Associate Professor, London Business School, Regent's Park, London, NW1 4SA, United Kingdom, bdereyck@london.edu, Mario Vanhoucke, Dieter Debels, Roel Leus

We present a new meta-heuristic for the resource-constrained project scheduling problem, combining elements from scatter search and a recently introduced heuristic method for the optimisation of unconstrained continuous functions based on an analogy with electromagnetism theory. Computational experiments on standard benchmark datasets show that the procedure is capable of producing consistently good results for challenging problem instances, and outperforms state-of-the-art existing heuristics.

3 - Scatter Search and Path Relinking in the Robust Coloring Problem
Pedro Lara-Velazquez, Universidad Nacional Autonoma de Mexico, Circuito Exterior CP 04510, Ciudad Universitaria, Mexico, D.F., MX, Mexico, pelara@graef.fciencias.unam.mx, Miguel Angel Gutierrez-Andrade, Sergio de los Cobos Silva

Let G be a graph and G' its weighted complementary graph. The Robust Coloring Problem is the search of a valid k-coloring in G, with a minimal sum of the penalties in the edges of G', that join vertex with the same color. For big instances of this NP-Hard problem we're developed a Scatter Search Algorithm with random and deterministic kinds of path relinking. Compared with previously developed algorithms such as Simulated Annealing, Tabu, and Partial Enumeration, our algorithm is the best.

■ MA04

P-Plaza Court 2

Tutorial: Introduction to Manifold Based Methods in Dimension Reduction and Model Estimation

Sponsor: Data Mining
Sponsored Session

Chair: T. Warren Liao, Louisiana State University, Industrial & Manufacturing Systems Engin, Baton Rouge, LA, 70803, United States, ieliao@lsu.edu

1 - Introduction to Manifold Based methods in Dimension Reduction and Model Estimation
Xiaoming Huo, Asst. Professor, Georgia Institute of Tech., 765 Ferst Dr., Atlanta, GA, 30332, United States, xiaoming@isye.gatech.edu

In the recent years, manifold-based methods are gaining its momentum in both computational sciences and statistics. In this talk, I will review some basic principles in these methods, and describe its potential applications in problems in data analysis and data mining. Some exemplary problems are dimension reduction and clustering.

■ MA05

P-Plaza Court 3

Integer Programming Applications

Sponsor: Optimization/ Integer Programming
Sponsored Session

Chair: Anuj Mehrotra, Leslie O Barnes Associate Professor and Chairman, University of Miami, Department of Management Science, School of Business, Coral Gables, FL, 33124, United States, anuj@miami.edu

1 - Scheduling an Air Taxi Service
Daniel Espinoza, Georgia Institute of Technology, School of ISyE, Atlanta, GA, 30332, United States, despinoz@isye.gatech.edu, Mokhtar Bazaraa, Martin Savelsbergh, Marcos Goycoolea, George Nemhauser, Renan Garcia, Alex Khmelnitsky, Eugene Taits

Air taxi services will use a new class of small, relatively inexpensive, jets that can fly from small or midsize U.S. airports on 4-8 seat planes at a much lower cost than chartering. Scheduling such a service is a 2-stage problem. In the first stage requests for service are either accepted or rejected, and in the second stage the accepted requests are scheduled by minimizing cost. This talk focuses on the cost optimization problem.

2 - Optimal Supplier Selection and Assignment in Multi-division Firms
Hari Natarajan, Assistant Professor, University of Miami, Coral Gables, FL, 33134, United States, hari@miami.edu, Anant Balakrishnan

For a context where suppliers offer business volume discounts, we formulate a mixed-integer program to select and assign suppliers to individual divisions to meet divisional requirements and preferences, considering the total cost of procurement including purchasing, inventory and transportation costs. We present results from an LP-based approach that generates near-optimal solutions.

3 - Traffic Grooming in Optical Communication Networks
Amr Farahat, Assistant Professor, Cornell University, Johnson Graduate School of Management, Ithaca, NY, United States, afarahat@mit.edu, Cynthia Barnhart

A mixed-integer formulation is presented for the traffic grooming problem in optical communication networks which is an extension of the routing and wavelength assignment problem. We propose a tractable decomposition of the problem and report numerical results based on a practical-size test instance drawn from a major network provider. We discuss similarities between this problem and others arising in logistics and highlight its relaxation as a network loading problem.

■ MA06

P-Plaza Court 4

Validation and Approximation in Stochastic Programming

Sponsor: Optimization/Stochastic Programming
Sponsored Session

Chair: Tito Homem-de-Mello, Northwestern University, Department of Ind. Eng. & Mgmt. Sci., 2145 Sheridan Rd., Evanston, IL, 60208, United States, tito@northwestern.edu

1 - Assessing Solution Quality in Stochastic Programming
Guzin Bayraksan, Ph.D Candidate, University of Texas - Austin, Operations Research and Industrial Eng, 1 University Station, C2200, Austin, TX, 78712, United States, guzinb@mail.utexas.edu, David Morton

We present Monte Carlo simulation-based procedures for assessing solution quality in stochastic programming. Quality is defined via the optimality gap and the procedures' output is a confidence interval on this gap. In comparison with an earlier multiple-replication procedure, new procedures are computationally less demanding. Empirical coverage results are compared.

2 - Towards Developing New Methods for Stochastic Integer Programming
Sanjay Mehrotra, Northwestern University, IEMS Dept, 2145 North Sheridan Road, Evanston, IL, 60208, United States, mehrotra@iems.nwu.edu, Huanyuan Sheng

We will describe our experiences to date of developing methods for stochastic integer programming. We will present a simple branching scheme that has solve previously solved problems with significantly fewer branching nodes. We will also discuss possible incorporation of generalized branching schemes in the context of stochastic integer programming.

3 - Approximation Strategies for Resource Allocation under Uncertainty
Huseyin Topaloglu, Cornell University, United States, huseyin@orie.cornell.edu

We consider a solution strategy for two-stage stochastic programs that is based on approximating the recourse function with a separable approximation. The proposed strategy is fast, scales well with the problem size, and can easily be used in multi-stage contexts (albeit heuristically). We provide numerical results in logistics, telecommunications capacity planning and fleet sizing.

4 - Multi-Stage Stochastic Programming Models in Revenue Management
Tito Homem-de-Mello, Northwestern University, Department of Ind. Eng. & Mgmt. Sci., 2145 Sheridan Rd., Evanston, IL, 60208, United States, tito@northwestern.edu, Lijian Chen

We discuss the use of stochastic programming models in revenue management, focusing on the classical seat allocation problem. We first show how such models can improve upon more traditional LP-based methods. We then present a nonlinear multi-stage stochastic program and describe some characteristics of it (notably lack of convexity). Finally, we discuss some strategies for obtaining approximating solutions to the problem.

■ MA07

P-Plaza Court 5

Global Mixed-Integer Optimization

Sponsor: Optimization/ Global Optimization
Sponsored Session

Chair: Kenneth Holmstrom, Sweden, hkh@tomlab.biz

1 - A Polyhedral Branch-and-cut Algorithm for Global Optimization
Nick Sahinidis, Professor, University of Illinois, Dept. of Chemical and Biomolecular Eng., 600 South Mathews Avenue, Urbana, IL, 61801, United States, nikos@uiuc.edu, Mohit Tawarmalani

We develop a general-purpose, primal, branch-and-cut approach to global optimization. Our algorithm exploits convexity in order to generate cutting planes and polyhedral relaxations for multivariate nonconvex problems. Extensive computational results with problems from globallib and minlplib demonstrate that the proposed techniques reduce relaxation gaps by up to 100% and significantly expedite the solution process, often by several orders of magnitude.

2 - Mixed-Integer Expensive Global Optimization with TOMLAB
Kenneth Holmstrom, Sweden, hkh@tomlab.biz

A mixed-integer constrained extension of the RBF algorithm for computationally costly global optimization is presented. Implementation in TOMLAB (http://tomlab.biz) solver rbfSolve is discussed. The algorithm relies on MINLP sub solvers in TOMLAB, currently OQNLP or DIRECT (glcFast or glcSolve). Results for real-life and artificial test problems are presented.

■ MA08

P-Plaza Court 6

Network Games and Multicommodity Flows

Sponsor: Optimization/ Network Optimization
Sponsored Session

Chair: Garud Iyengar, Columbia University, United States, garud@ieor.columbia.edu

1 - Convergence Issues in Competitive Games
Vahab Mirrokni, MIT Computer Science and AI Lab, The Stata Center, Bldg 32, 32 Vassar St., Cambridge, MA, 02139, United States, mirrokni@theory.lcs.mit.edu, Adrian Vetta

We study the value of the social function after multiple rounds of best response behaviors in iterative games. We consider non-cooperative games with a submodular social function; known as valid and basic games and market sharing games. We show that for basic games and market sharing games this convergence happens very fast, but for valid games in which all Nash equilibria has high social value, iterative selfish behavior may ``converge" to a set of poor solutions.

2 - Multicommodity Flow with Holding Cost
Barbara Anthony, Graduate Student, Carnegie Mellon University, Math Dept, Wean Hall, 5000 Forbes Ave, Pittsburgh, PA, 15213, United States, banthony@andrew.cmu.edu, Lisa Fleischer

Consider a directed network with edge capacities and per-unit-time holding costs at each node. We seek flows over time that drain all flow to the sink, obey capacity constraints and minimize the total holding cost incurred. This problem is motivated by job-shop scheduling problems, whose relaxations can be viewed as continuous fluid flow problems. We give new results about the structure of optimal solutions and discuss computational results on factory-level data sets for the motivating problem.

3 - Fractional Packing Problems in O*(1/epsilon) Iterations
Garud Iyengar, Columbia University, United States, garud@ieor.columbia.edu, Daniel Bienstock

We adapt a method proposed by Nesterov to design an algorithm that computes epsilon-optimal solutions to fractional packing problems by solving O*(1/epsilon) separable convex quadratic programs. In contrast, previous algorithms required Omega(\epsilon {-2}) iterations. We show that the techniques extend to yield efficient algorithms for maximum multi-commodity flow and mixed packing-covering problems.

■ MA09

P-Plaza Court 7

Network Optimization

Cluster: Honoring Pete Veinott
Invited Session

Chair: James Orlin, Professor, MIT, E40-147, Cambridge, MA, 02139, United States, jorlin@mit.edu

1 - Linear Programming and the Fifth Sin
Alan Hoffman, IBM, IBM Watson Research Center, P.O.Box 218, Yorktown Heights, NY, 10598, United States, ajh@us.ibm.com

Our aim is to classify those linear programming problem classes where a greedy algorithm (i.e., successive maximization of variables in some given order) produces an optimum answer. Such classes are rare and precious, and we will summarize what is known about them.

2 - A Topology Problem Solved via Network Flow Theory
Margarida Mello, Department of Applied Mathematics, University of Campinas, São Paulo, Brazil, margarid@ime.unicamp.br

The question of whether an abstract Lyapunov graph may be continued to one of the Morse type is formulated as an integer program feasibility problem. The latter is modeled as a network-flow problem with added constraints. Using the concept of cut tree of a graph, this flow problem is decomposed into a collection of smaller ones. Applying the Fourier-Motzkin method, the feasibility problem is seen to be equivalent to a collection of linear inequalities, the famous Poincare-Hopf inequalities.

3 - Monotone Comparative Statics: A Geometric Approach
Bruno H. Strulovici, Stanford University, 397 Terman Engineering Center, Stanford, CA, 94305-4026, United States, bstrulovici@stanford.edu, Thomas A. Weber

We consider comparative statics of solutions to parameterized optimization problems. We provide a geometric method for finding a reparameterization of the problem under which monotone comparative statics may be achieved in the absence of the standard supermodularity assumptions on the objective function.

4 - Convex Combinatorial Optimization
Uriel G. Rothblum, Professor, Technion, Faculty of Industrial Eng. and Mgt., Haifa, 32000, Israel, rothblum@ie.technion.ac.il, Shmuel Onn

We introduce the convex combinatorial optimization problem, a far reaching generalization of the standard combinatorial optimization problem. We show that it is strongly polynomial time solvable over any edge-guaranteed family and discuss several applications.

■ MA10

P-Plaza Court 8

Vehicle Routing

Sponsor: Transportation Science & Logistics
Sponsored Session

Chair: Maciek Nowak, Assistant Professor, Georgia Southern University, Dept. of Mngment., Mrkt. and Logistics, P.O. Box 8154, Statesboro, GA, 30460, United States, mnowak@georgiasouthern.edu

1 - Pickup and Delivery Problem with Split Loads
Maciek Nowak, Assistant Professor, Georgia Southern University, Dept. of Mngment., Mrkt. and Logistics, P.O. Box 8154, Statesboro, GA, 30460, United States, mnowak@georgiasouthern.edu, Chip White, Ozlem Ergun

We present a heuristic for the PDP with Split Loads, where multiple vehicles service one load, and compare it with an exact solution method. Structural characteristics of the problem that aid in its solution are described. The benefit of using split loads is quantified and the heuristic is tested on real data from a large LTL company.

2 - Approximate Procedures for the Probabilistic Traveling Salesperson Problem
Hao Tang, Senior Operations Research Analyst, FedEx Express Corporation, 3680 Hacks Cross Rd., Memphis, TN, 38125, United States, htang@fedex.com, Elise Miller-Hooks

Approximate expressions for evaluating a priori PTSP solutions are introduced and are incorporated in heuristic improvement procedures. A progressive approximation extension is also provided. Results of numerical experiments indicate that the proposed methodologies can provide high quality solutions with significantly reduced computational complexity as compared to identical improvement procedures incorporating exact solution evaluation.

3 - The Probabilistic Traveling Salesman Problem with Time Windows
Ann Campbell, Assistant Professor, Department of Management Sciences, Henry B. Tippie College of Business, University of Iowa, Iowa City, IA, 52242, United States, ann-campbell@uiowa.edu, Barrett Thomas

We look at how to include a time window constraint in models for the probabilistic traveling salesman problem. We consider both a chance-constrained approach and a series of recourse models which account for different ways of penalizing for lateness at customers. We also highlight special cases that keep the problems tractable.

4 - Period Vehicle Routing Problem with Service Level Choice
Peter Francis, Northwestern University, 2145 Sheridan Road, Evanston, IL, United States, ksmilowitz@northwestern.edu, Michal Tzur, Karen Smilowitz

We present a variant of the Period Vehicle Routing Problem in which routes must be designed over a time horizon and a minimum frequency of visits has been stipulated for the nodes. The service frequency becomes a decision in our model, considering demand volume as well as routing efficiency.

■ MA11

P-Governor's Square 9

Dynamic Traffic Assignment and Applications

Sponsor: Transportation Science & Logistics
Sponsored Session

Chair: James Moore, Professor and Chair, Daniel J. Epstein Department of Industrial and Systems Engineering, GER 240, MC 0193, USC, University of Southern California, Los Angeles, CA, 90089-0193, United States, jmoore@almaak.usc.edu

1 - A Multi-Resolution Traffic Simulation Assignment Approach for Analyzing CBD Flow Configuration
Yi-Chang Chiu, Assistant Professor, Department of Civil Engineering, 500 W. University Ave., University of Texas at El Paso, El Paso, TX, 79968, United States, chiu@utep.edu, Jessica Hernandez, Xuesong Zhou

The developing trend to change the flow configuration in central business districts (CBD) from one-way to two-way has presented several technical challenges. This paper presents a Multiple Resolution Simulation and Assignment (MRSA) framework to address these issues. The proposed framework is an integration of a microscopic traffic simulation model and the mesoscopic dynamic traffic assignment model in conjunction with a dynamic origin-destination (OD) estimation using link traffic counts.

2 - Projected Dynamical Systems and Evolutionary Variational Inequalities with Applications to Traffic
Anna Nagurney, John F. Smith Memorial Professor, Isenberg School of Management, University of Massachusetts, Amherst, MA, 01003, United States, nagurney@gbfin.umass.edu, Monica Gabriela Cojocaru, Patrizia Daniele

In this paper we make explicit the connection between projected dynamical systems on Hilbert spaces and evolutionary variational inequalities. We give a novel formulation that unifies the underlying constraint sets for such inequalities, which arise in time-dependent traffic network and spatial price equilibrium problems. We provide a traffic network numerical exmaple in which we compute the curve of equilibria.

3 - Studying Dynamic User Equilibrium and Traffic Assignment in a Road Network
Wenlong Jin, Post Doctoral Researcher, Institute of Transportation Studies, University of California, 522 Social Science Tower, Irvine, CA, 92697-200, United States, wjin@uci.edu, Michael Zhang

We present some studies on asymptotic equilibrium states and traffic assignment with a Kinematic Wave simulation model for a simple network of one O-D pair and two alternative routes. We first examine the asymptotic equilibrium states given fixed proportions of two path flows. Then for different assignment proportions, we study the average travel time on each route and show dynamic user equilibrium state between two routes. We further compare the results with static ones.

4 - CoSIGN: A Fictitious Play Algorithm for Coordinated Traffic Signal Control
Shih-Fen Cheng, Department of Industrial and Operations Engineering, The University of Michigan, 1101 Beal Avenue, Ann Arbor, MI, 48109-2110, United States, chengsf@umich.edu, Marina Epelman, Robert Smith

In this paper, the challenging problem of finding efficient signal timing plans for a group of signals is investigated. We employ the game-theoretic paradigm of fictitious play to iteratively converge to a locally optimal coordinated timing plan. The algorithm is robustly scalable to realistic size networks modeled with high fidelity simulations such as city of Troy, Michigan. More then 10 percent savings in delay and throughput is experienced for a network of 75 intersections.

■ MA12

P-Governor's Square 10

Warehouse Design & Operations

Sponsor: Transportation Science & Logistics
Sponsored Session

Chair: Kevin Gue, Associate Professor, Department of Industrial & Systems Engineering, Auburn University, Auburn, AL, 36849, United States, kevin.gue@auburn.edu

1 - A Mathematical Model for Warehouse Design and Product Allocation
Sunderesh Heragu, Professor, Rensselaer Polytechnic Institute, DSES Dept., CII 5015, 110, Eighth St, Troy, NY, 12180-3590, United States, herags@rpi.edu, Pieter Schuur, Ronald Mantel, Lili Du

In this presentation, we develop an integer programming model to determine product allocation to four 'flows' - forward, reserve, forward-reserve and cross-docking, in a warehouse. As a by-product, the model also determines the space required for each 'flow' or area. Efficiency of the model as well as a heuristic algorithmare demonstrated using very large problems with upto 150,000 products.

2 - A Queuing Model for an Automated Workstation Receiving Arrivals from an Automated Workstation
David Kim, Associate Professor, Oregon State University, 121 Covell Hall, Dept. of IME, Corvallis, OR, 97331, United States, david.kim@orst.edu

In this research we develop a queuing model for a single "automated" workstation that receives arrivals from another automated workstation. An automated workstation is a server with deterministic processing times that experiences random operating times between failures, and then subsequent random repair times. We develop analytical expressions for the queue size distribution, as well as the average number in system for a discrete model of this queuing system.

3 - A Storage System Based on the 15-Puzzle
Kevin Gue, Associate Professor, Department of Industrial & Systems Engineering, Auburn University, Auburn, AL, 36849, United States, kevin.gue@auburn.edu

We describe a Very High Density (VHD) storage system based on a classic children's game, the 15-puzzle, in which tiles slide within a square to change the arrangement. We describe a model of a physical goods storage systems based on this concept, and show how performance compares with other high density storage systems. We close with discussion of a "puzzle storage" system currently under development for the U.S. Navy.

4 - ASRS Design for Consolidating Orders
Anshu Jalora, Texas A&M University, United States, anshu@tamu.edu, Brett Peters

ASRS design models reported in the literature assume that the storage volume is known in advance. However, when ASRS is used for order consolidation, the storage volume requirement also depends on the ASRS operation (single command or dual command) cycle times, which depend on the ASRS configuration. In the current work, a model has been developed to find an optimal ASRS configuration that meets the storage volume and throughput requirements in order consolidation applications.

■ MA13

P-Governor's Square 11

OR Applied to Railroads II

Sponsor: Railroad Applications
Sponsored Session

Chair: Edwin R "Chip" Kraft, Director, Operations Planning, Transporation Economics + Management Systems, Inc., 116 Record St, Frederick, Md, 21701, United States, ckraft@temsinc.com

1 - A Rail Car Distribution Model with Multiple Information Streams
Warren Powell, Princeton University, Engineering Quad, Princeton University, Princeton, NJ, United States, powell@Princeton.EDU

The classical car distribution problem assigns known (and possibly forecasted) cars and orders. In real applications, information about order quantities and attributes such as the destination of the order do not arrive at the same time. We present the results of a model that captures these information streams.

2 - Utilizing Operations Research Tools at CSX
Dharma Acharya, United States, dharma_acharya@csx.com

The advancements in operations research techniques and the improvements in data quality have enabled railroads to improve railroad operations. The author will discuss his experience in utilizing various operations research techniques and tools in improving the operating plan and resource assignments at CSX

3 - A Decision Support System for Yard Closure Analysis
Jian Liu, Research Director, Innovative Scheduling Systems, Inc., 2153 Hawthorne Road, Gainesville, FL, 32641, United States, liujian@cox.net

■ MA14

P-Governor's Square 14

Innovation and Entrepreneurship

Sponsor: Technology Management
Sponsored Session

Chair: Moren Levesque, Case Western Reserve University, 10900 Euclid Avenue, Cleveland, OH, 44106, United States, moren.levesque@weatherhead.cwru.edu

1 - IT Does Matter: An Empirical Analysis of e-business, Innovation, and Financial Performance
Philipp Koellinger, DIW Berlin, Koenigin-Luise-Str. 5, Berlin, 14195, Germany, pkoellinger@diw.de

The study analyses two questions: (1) How much innovative activity can be attributed to Internet-based technologies? (2) Do Internet-enabled innovations translate into financial success of a company? The analysis is based on a recent cross-sectional survey of more than 7,000 enterprises in Europe. A fixed-effects error component model is used to control for unobserved heterogeneity of firms.

2 - One of These Things Is Not Like the Others: Novelty versus Imitation in Market Entry
Steven Michael, Associate Professor of Business Administration, University of Illinois, 1206 S. Sixth St., College of Business, Champaign, IL, 61820, United States, smichael@uiuc.edu

Establishing why ventures succeed and fail is central to entrepreneurship research. Existing research asserts novelty is the heart of entrepreneurship. By contrast, being different exposes firms to the risk of being perceived as illegitimate. To test these ideas, we examine entry into industries marked by discretion. As a result, theoretical richness is added to our existing studies, as well as practical advice for the entrepreneur. He or she does not want to be just like the others.

3 - Competition and Collaboration in New Ventures
John Angelis, Case Western Reserve University, 10900 Euclid Avenue, Cleveland, OH, 44106, United States, jna@cwru.edu, Moren Levesque

Entrepreneurs invest in awareness advertising because new products may face a lack of reputation and trust in the market place. Under certain conditions, investing in awareness advertising and market expansion for the entire industry can yield greater profit than taking away some of the competition's market share. This paper will investigate financial investment strategies and tradeoffs between increasing market share and size of a potential market for substitutable/innovative products.

4 - Institutions and Mechanisms for Nurturing Knowledge-Based Firms: A Study of the Selected US Regional
Sarfraz Mian, SUNY Oswego, NY, United States, mian@oswego.edu

The author presents results of his recent national survey of selected regional institutional mechanisms in the form of science parks, technology incubators, and related incubation support programs. The study reveals some unique characteristics of the regional innovation systems and their planned nurturing environments providing insights for entrepreneurs and benchmarking data for regional policy makers.

■ MA15

P-Governor's Square 15

Clustering Applications and Evaluation

Cluster: Data Mining and Knowledge Discovery
Invited Session

Chair: Sigurdur Olafsson, Iowa State University, 2019 Black Engineering, Ames, IA, 50011, United States, olafsson@iastate.edu

1 - Understanding Usage Patterns in Document Access
Piyamart Kumsaikaew, Student, Iowa State University, 1300 Coconino RD APT#236, Ames, IA, 50014, United States, piyamart@iastate.edu, John Jackman

Web usage mining uses data mining technologies to extract valuable knowledge from a web server log to improve system performance and enhance the quality and delivery of information content to the end user. The goal is to understand the underlying usage patterns for document access and determine the objectives of user classes in terms of information content. An evaluation of methods for web usage mining is presented based on web server log and the implementation of a web-usage mining tool.

2 - A Hybrid Clustering Algorithm for Non-Sequential Datasets
Kweku-Muata Osei-Bryson, Professor, Virginia Commonwealth University, 1015 Floyd Avenue, Richmond, VA, United States, kweku.muata@isy.vcu.edu, Tasha Inniss

Clustering attempts to partition a dataset into a meaningful set of mutually exclusive clusters. It is known that sequential clustering algorithms can give optimal partitions when applied to sequential data. In this paper we focus on the use of modified sequential clustering techniques for clustering datasets in which there no natural sequential ordering of the objects and the clusters have admissibility criteria (e.g. page size restrictions).

3 - Reducing Demand Forecast Error in Retail Merchandising using Clustering
Mahesh Kumar, Assistant Professor, Rutgers Business School, 305 Memorial Drive, Cambridge, MA, 02139, United States, maheshk@mit.edu, Nitin Patel

A common drawback of most forecasting methods is that the forecast will be inaccurate if only small amounts of past sales data are available for analysis. We overcome this limitation by pooling data from similar items using clustering. We present a new model that suggests that early in a season, when there is little data, clustering improves forecast accuracy, while later in the season, it is better to treat each item separately. Results from empirical studies on real data support our model.

4 - Data Mining of Student Explanations in a Web-Based Learning Environment
Sigurdur Olafsson, Iowa State University, 2019 Black Engineering, Ames, IA, 50011, United States, olafsson@iastate.edu

We report on results obtained from data mining explanations students provide in a web-based learning environment. In this environment, students solve engineering problems in guided manner that asks them to explain and justify key steps in the process. These explanations provide a rich source of information for how the students are progressing, and using clustering tools we identify different groups of students some of which are progressing towards a good solution, whereas others are off course.

■ MA16

P-Governor's Square 17

Some New Results on Cuts and Cutting Planes

Sponsor: Computing Society
Sponsored Session

Chair: David Gay, Sandia National Labs, P.O. Box 5800, MS 0370, Albuquerque, NM, 87185-0370, United States, dmgay@sandia.gov

1 - A New LP formulation of Global Min-Cut
Venkatesh Natarajan, Carnegie Mellon University, United States, vn@andrew.cmu.edu, Robert Carr

In this talk we present a Linear Programming formulation of Global Min-Cut that requires only O(n≤) variables and O(n≥) constraints. Until this point, the best known formulation required O(n≥) variables and O(n≥) constraints.

2 - New Cutting Plane Approaches
Erik Lauer, Sandia National Labs, P.O. Box 5800, MS 1110, Albuquerque, NM, 87185-1110, United States, elauer@sandia.gov, Robert Carr, Cynthia A. Phillips

There is a trivial cuttting plane when the objective function value is fractional for the LP relaxation of an integer program. Using dual variable values we can find considerably stronger cutting planes when the objective function is fractional and in some cases when this value is integer.

3 - LP Relaxations for a class of Non-linear Programs
Robert Carr, Sandia National Laboratories, Mail Stop 1110, P.O. Box 5800, Albuquerque, NM, 87185-1110, United States, rdcarr@sandia.gov

When the objective function has a certain quadratic form, we get tight upper and lower bounds from our linear programming relaxation. We also show that cutting planes can in some cases improve the solution of a semi-definite programming problem.

■ MA17

P-Directors Row E

Decision Analysis Arcade

Sponsor: Decision Analysis
Sponsored Session

Chair: James E. Smith, Fuqua School of Business, Duke University, Durham, NC, 27708-0120, United States, jes9@mail.duke.edu

1 - Bayesianism Without Consequences
Robert Nau, Fuqua School of Business, Duke University, Box 90120, Durham, NC, 27708-0120, United States, rnau@mail.duke.edu

A generalization of subjective expected utility is developed in which the primitives are states of the world, feasible strategies of the decision maker, and money: there are no abstract "consequences" in the tradition of Savage. The model provides a foundation for Bayesian decision analysis and game theory in which the decision maker's risk neutral probabilities and preferences among strategies are updated by Bayes' rule without the need to identify "true" prior probabilities.

2 - Multiple Objective Decision Analysis for Potassium Iodide Distribution in Nuclear Incidents
L. Robin Keller, Professor, Operations & Decision Technologies, Graduate School of Management, University of California, Irvine, GSM 350, Irvine, CA, 92697, United States, LRKeller@uci.edu

A National Academy of Sciences book advises states to use a multiple objective decision analysis process to evaluate plans for distribution of potassium iodide (to protect against thyroid cancer) when there will be radioactive iodine exposure due to an accident or terrorism at a US nuclear power plant. The decision process features were proposed following public hearings involving multiple stakeholders with divergent political perspectives and varying assumptions about scientific evidence.

3 - Real Options without Bushy Trees: Practical Techniques for Multi-Period Decision Analysis
Chris Dalton, CEO, Syncopation Software, 216 Center Street, Bangor, ME, 04401, United States, cdalton@syncopationsoftware.com

A decision tree is often the most natural way of expressing a "real options" problem with a recurring pattern of uncertainties and downstream decisions. Unfortunately, the exponential nature of decision trees makes it difficult to solve such a tree for more than a few time periods. This talk discusses modelling techniques which blend decision tree analysis with dynamic programming to efficiently solve these problems. Examples and results will be shown using DPL, a commercial DA software package.

4 - Skepticism and Post-decision Surprise in Decision Analysis
James E. Smith, Fuqua School of Business, Duke University, Durham, NC, 27708-0120, United States, jes9@mail.duke.edu, Robert L. Winkler

We consider the impact of errors in estimates of value when coupled with optimization-based processes and show that this leads to values that are biased high. We argue that this phenomenon is prevalent and underappreciated and model it to understand its nature and extent. Remedies involve skepticism in doses proportional to the magnitude of the potential errors.

■ MA18

P-Directors Row H

Expert Opinion: Overconfidence, Dependency and Aggregation

Sponsor: Decision Analysis
Sponsored Session

Chair: Jason Merrick, Associate Professor, Virginia Commonwealth Univeristy, PO Box 843083, 1001 W. Main St., Richmond, VA, 23284, United States, jrmerric@vcu.edu

1 - Bayesian Nonparametric Combination of Multivariate Expert Judgments
Kenneth C. Lichtendahl, Jr, Doctoral Student, Fuqua School of Business, Duke University, Box 90120, Durham, NC, 27708-0120, United States, kjl11@duke.edu, Robert T. Clemen

We present a Bayesian nonparametric model for combining expert probability judgments. Although a typical Bayesian nonparametric model assigns a prior on a space of sampling distributions, we reverse this approach to create a likelihood function on a space of continuous expert judgments given the uncertain quantities of interest. The advantage of doing so is that we can consider arbitrary expert probability distributions, whereas previous combination models focused on parametric families.

2 - A Study of Expert Overconfidence

Vicki Bier, Professor, University of Wisconsin-Madison, 451 Mechanical Engineering Building, 1513 University Avenue, Madison, WI, 53706, United States, bier@engr.wisc.edu, Shi-Woei Lin

We analyzed a large data set on expert opinion compiled by Cooke and colleagues at the Technical University of Delft, which contains roughly 5,000 90% confidence intervals of uncertain quantities for which the true values are now known. The analysis assesses the overall extent of overconfidence in the data set, and differences among studies, experts, and questions within a study. Significant differences were found among studies, among experts, and among questions. Implications are discussed.

3 - Analysis of Correlated Expert Judgments from Pairwise Comparisons

Jason Merrick, Associate Professor, Virginia Commonwealth Univeristy, PO Box 843083, 1001 W. Main St., Richmond, VA, 23284, United States, jrmerric@vcu.edu, J. Rene van Dorp

We develop a Bayesian multivariate analysis of expert judgment elicited using an extended form of pairwise comparisons. The analysis developed allows the examination of correlations between experts and gives a more complete estimate of the variance of predictions. The analysis is applied to a data set of expert judgments elicited during the Washington State Ferries Risk Assessment.

■ MA19

P-Directors Row F

Tutorial on Agent-based Modeling and Simulation

Sponsor: Artificial Intelligence
Sponsored Session

Chair: Charles Macal, Director, Center for Complex Adaptive Agent Systems Simulation, Argonne National Laboratory, 9700 S. Cass Ave., DIS-Bldg 900, Chicago, IL, 60439, United States, macal@anl.gov

1 - Tutorial on Agent-based Modeling and Simulation

Charles Macal, Director, Center for Complex Adaptive Agent Systems Simulation, Argonne National Laboratory, 9700 S. Cass Ave., DIS-Bldg 900, Chicago, 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 thoughts on its relationship to OR.

■ MA20

P-Room 3304

Handheld Computers in Patient Care Delivery: Organizational and Physician Issues

Sponsor: Health Applications
Sponsored Session

Chair: Sharon Schweikhart, Chair and Associate Professor, The Ohio State University, School of Public Health, 1583 Perry Street, Columbus, OH, 43210, United States, schweikhart.1@osu.edu

1 - Physician Needs with Regard to Handheld Computer Adoption

Sarah Hoshaw, Graduate Student, The Ohio State University, School of Public Health, 1583 Perry Street, Columbus, OH, 43210-1234, United States, hoshaw.1@osu.edu, Ann Scheck McAlearney, Sharon Schweikhart, Mitchell Medow

Organizational decisions regarding clinical information technology adoption and implementation will be improved when physicians' needs from both the organization and device are considered. Our qualitative study identified physician needs with regard to adopting handheld computers for the purposes of increasing productivity, enhancing patient care, improving communication, and facilitating administrative tasks.

2 - Operational Implications of PDA Adoption: Implementation Challenges and Facilitators

Sharon Schweikhart, Chair and Associate Professor, The Ohio State University, School of Public Health, 1583 Perry Street, Columbus, OH, 43210, United States, schweikhart.1@osu.edu, Mitchell Medow, Ann Scheck McAlearney, Sarah Hoshaw

Results of a multiple site case study analysis of organizational strategies for the adoption of handheld computers in clinical care settings are presented. Operational challenges and facilitators associated with the implementation of PDA technology, as identified by IT professionals as well as various types of clinicians, are discussed.

3 - Promoting Best Practices Using Information Technology: Computerized Order Sets

Deena Chisolm, Clinical Assistant Professor, The Ohio State University, 700 Children's Drive, Room J1412, Columbus, OH, 43205, United States, chisolm.1111@osu.edu, Ann Scheck McAlearney, Kelly Kelleher, David Fisher

Computerized order sets are designed to improve clinical processes by streamlining the process of entering orders for specific conditions and by providing evidence-based treatment guidance at the point of care. Results of two projects assessing implementation and quality impact of order sets are presented here. Our results suggest that order sets can have a meaningful impact on health care quality but that care must be taken in designing implementation plans to maximize utilization.

■ MA21

P-Room 3302

Challenges to OR from the Public Policy Sector

Sponsor: Public Programs and Processes
Sponsored Session

Chair: John Hollywood, RAND Corporation, 1200 South Hayes Street, Arlington, VA, 22202, United States, johnsh@rand.org

1 - Some Opportunities for Further OR Successes Within the Air Force

Bart Bennett, RAND, 1700 Main Street, Santa Monica, CA, 90407, United States, Bart_Bennett@rand.org

The Air Force has been supported by a wide-range of OR-related research from analysts both within the Air Force and from a whole variety of contractors and universities. OR is used in different ways within the different communities in the Air Force. This talk will consider two of these areas, force structure/modernization and manpower. Some successes and challenges will discussed. Thoughts on some possible next great steps ahead will be shared.

2 - The Gambler, the Gangster and the Rabbi: Why Policy-Makers Don't Value OR

Douglas Samuelson, InfoLogix, Inc., United States, dsamuel@seas.upenn.edu

OR analysts who support public policy decisions face special challenges in getting recognition for the value of their work. These include the difficulty of explaining recommendations clearly to non-technical policy-makers without obscuring the technical basis for the recommendations, and minimizing the risk of embarrassment from decisions that turn out badly. I will provide some illustrations from actual Federal policy decisions, and perhaps a parable or two.

3 - Emergency Response Logistics

Edward Chan, RAND, 1700 Main Street, Santa Monica, CA, 90407, United States, Edward_Chan@rand.org

Emergency responder operations in the United States are highly decentralized, with equipment, operations, and management decisions made largely at the local municipal level. Lessons from large disasters, most recently illustrated by the September 11, 2001 terrorist attacks, indicate that this decentralization hinders efficient response to very large events. We propose to evaluate different options for providing emergency response capabilities to large incidents.

4 - Observations on OR in Defense Policy

John Hollywood, RAND Corporation, 1200 South Hayes Street, Arlington, VA, 22202, United States, johnsh@rand.org

We present a series of observations on what it is like to be an operations researcher working on defense policy, and the types of challenges we've faced. Among other observations, we discusss how the bulk of the work is understanding what the problem really is, and how the problem is most often structural rather than a straightforward OR problem; and how OR is alive and well in the public sector provided one is willing to go beyond classic optimization and stochastic optmization.

■ MA22

P-Room 3312

Location Modeling IV

Sponsor: Location Analysis
Sponsored Session

Chair: Trevor Hale, Assistant Professor, Ohio University, Dept. of Mgmt. Sys., 275 Stocker Center, Athens, OH, 45701, United States, thale@bobcat.ent.ohiou.edu

1 - Finding Rectilinear Least Cost Paths with Convex Polygonal Congested Regions
Avijit Sarkar, University at Buffalo (SUNY), 342 Bell Hall, Department of Industrial Engineering, Buffalo, NY, 14260, United States, sarkar@eng.buffalo.edu, Rajan Batta, Rakesh Nagi

This research considers the problem of finding the least cost path between an origin and a destination in the presence of convex polygonal congested regions using the rectilinear distance metric. We show that exponential number of potential least cost paths are possible. A memory based probing algorithm is developed to determine these. Discussion of heuristic approaches will be provided with computational tests.

2 - Scatter Search for the Production-Distribution System Design Problem
Halit Uster, Assistant Professor, Texas A&M University, Department of Industrial Engineering, College Station, TX, 77843, United States, uster@tamu.edu, Burcu Baris Keskin

We consider a production-distribution system design problem with additional constaints for service level requirements. We present an efficient scatter search heuristic approach hybridized with single-solution based metaheuristics. We also provide numerical results and comparisons with existing solution methodologies.

3 - Optimizing the Location of Base Stations in Wireless Networks
Robert Aboolian, Assistant Professor, California State University San Marcos, College of Business Administration, San Marcos, CA, 92096, United States, raboolia@csusm.edu, Sheldon Lou

Location of base stations in a wireless network, have a significant role on the performance of the network. We will formulate a set of models which will optimize the location of base stations for cellular radio networks assuming a continuous and stochastic demand. We formulate models both for TDMA and CDMA mutiple access enabling technologies.

4 - Dwell Point Locations for Overhead Bridge Cranes
Trevor Hale, Assistant Professor, Ohio University, Dept. of Mgmt. Systems, 275 Stocker Center, Athens, OH, 45701, United States, halet@ohio.edu, Jennifer Blackhurst, Faizul Huq, Ken Cutright

This research presents a methodology for determining the optimal dwell point location for overhead bridge cranes to minimize the expected response time for material movement requests. The problem is modeled as a minisum location problem with two dimensional demands. These demands come in three forms: move material from the I/O, move material to the I/O; and, move material across the area. The result is a non-trivial solution to where the overhead bridge crane should wait when it is idle.

■ MA23

P-Room 3354

Maritime Military Applications

Sponsor: Military Applications
Sponsored Session

Chair: Marc Thibault, Research Assistant Professor, School of Public Policy, George Mason University, Mail Stop 3C6, 4400 University Drive, Fairfax, Virginia, 22030-4444, United States, mthibau1@gmu.edu

1 - Coast Guard Framework for Alignment of Planning & Decision-Making
Patrick Ryan, President, MicroSystems Integration, Inc., 181 S. Broad St., Suite 103, Pawcatuck, CT, 06378, United States, patr@msi-ct.com, James Passarelli, Todd Watanabe

The Coast Guard has a number of initiatives to support enterprise planning and decision-making by aligning and providing enterprise access to analysis tools and models, data and measurement systems, and knowledge management repositories. The Unified Performance Logic Model (UPLM), a cognitive mapping tool that relates operational purpose/risk management to requirements/capabilities to support/readiness, is providing the primary construct for enterprise alignment, focus and refinement.

2 - Using a Systems Thinking Approach to Examine Personnel Issues
Jim Frank, CALIBRE, 6354 Walker Lane, Suite 300, Metro Park, Alexandria, VA, 22310, United States, Jim.Frank@calibresys.com, Steven Deveau, Kevin Ryan, Robert Montcalm

The United States Coast Guard experienced an undesirable rate of flow through their personnel system, which they termed “turbulence.” Rather than focusing on one specific part of the personnel system, such as advancements or training, the Coast Guard sought to gain an understanding of the interactions among processes within the system that caused this turbulence. The authors used a Systems Thinking methodology as a conceptual framework for this problem. The Systems Thinking approach enabled the Coast Guard to gain a better understanding of system intricacies in their personnel system and improved their ability to evaluate different policy options. An anticipated outcome of this approach was the insight and mutual understanding among personnel policy-makers of how the enlisted personnel system actually worked. It was believed that this insight would be gained by bringing Coast Guard personnel experts together to discuss this turbulence and how their respective pieces of the personnel system work and interact.

3 - A Multivariate Analysis of U.S. Coast Guard and Department of Defense Enlistment Propensity
Marc Thibault, Research Assistant Professor, School of Public Policy, George Mason University, Mail Stop 3C6, 4400 University Drive, Fairfax, Virginia, 22030-4444, United States, mthibau1@gmu.edu

The U.S. Coast Guard (USCG) is a U.S. military service but it is not a part of the U.S. Department of Defense. The USCG has not been included in the research on America’s military manpower system. This presentation reports the findings of a research effort that compares youth who express a preference for USCG service with youth who express a preference for DOD service. The military manpower policy implications of the differences between these two military preference groups are discussed.

4 - A Stochastic Salvo Model for Naval Surface Combat
Michael Armstrong, Associate Professor, Sprott School of Business, Carleton University, Ottawa, ON, K1S 5B6, Canada, michael_armstrong@carleton.ca

We propose a stochastic version of the salvo model for modern naval surface combat. Expressions are derived for the mean and variance of surviving force strengths and for the probabilities of possible salvo outcomes, all in forms simple enough to be implemented in spreadsheet software. We find that focusing just on the average outcome of a battle can be highly misleading. The model also provides guidance about a navy’s preferences for risk and for weapons mix.

5 - The U.S. Coast Guard’s Deepwater Force Modernization Plan
Brien Alkire, Associate Operations Researcher, RAND Corporation, 1776 Main Street, Santa Monica, CA, 90407, United States, brien@rand.org, John Birkler

Explores whether the pace at which the U.S. Coast Guard can acquire surface and air assets that it will operate in the deepwater environment (50 or more nautical miles from shore) can be accelerated and whether the original Integrated Deepwater System program to modernize its aging ships and aircraft will provide the Coast Guard with a force structure to meet the demands of its traditional missions and emerging responsibilities as part of the new Department of Homeland Security.

■ MA24

P-Room 3402

Optimization in Financial Services I

Sponsor: Financial Services
Sponsored Session

Chair: Sud Mallya, Bank of America, United States, Sudhakar.K.Mallya@bankofamerica.com

1 - Modeling the Transportation Network and Estimating Transportation Costs In Check Processing
Sud Mallya, Bank of America, United States, Sudhakar.K.Mallya@bankofamerica.com, Debraj Mallick, Olga Bagatourova

Transportation of checks from the point of receipt such as Banking Centers, ATMs and other sources to the processing facilities constitutes a significant part of the total check processing costs. The proposed approach utilizes a set-covering algorithm to model the transportation network. Factors such as route density; proximity of banking centers to each other; distance to the destination etc. are incorporated.

2 - Modeling Fraud Cases and Agent Staffing to Improve Recovery on Fraud

Russell Walker, Capital One, United States, russell.walker@capitalone.com, Dan Swanson, Gene Burke, Michelle Mitchell, Kurt Thearling, Chitra Jain, Harland Mason

Potential fraud cases are identified daily using a fraud detection system. Many cases need manual investigation which are time consuming. In the event that a case is actual fraud, it is important to begin the investigation as soon as possible, suggesting a priority for newer and higher value fraud cases. A simulation model was developed that looked at the operations of the fraud investigation staff and the impact of changes to and variability in the value of cases and their arrivals.

3 - Further Results on Modeling Banks' Dynamic Reserve Demand

Richard Anderson, Federal Reserve of St. Louis, United States, Richard.G.Anderson@stls.frb.org

This paper presents further results on modeling a bank's demand for statutory reserves (vault cash plus deposits at Federal Reserve Banks). A bank's management is modeled as having a number of tools available, including manipulating the amount of reservable deposits via retail-deposit sweep programs. Preliminary results are presented regarding solving an approximation to the problem via collation methods for the objective functions based on analytic functions.

■ MA25

P-Room 3404

INFORMS Case and Teaching Materials: Dialog with Prospective Authors and Case Teachers

Sponsor: Education (INFORM-ED) SPONSORED/INVITED
Sponsored Session

Chair: Thomas Grossman, Associate Professor, University of San Francisco, Masagung School of Management, San Francisco, CA, 94117-1045, United States, tagrossman@usfca.edu

1 - INFORMS Case and Teaching Materials

Thomas Grossman, Associate Professor, University of San Francisco, Masagung School of Management, San Francisco, CA, 94117-1045, United States, tagrossman@usfca.edu

The Editorial Staff of INFORMS Case and Teaching Materials will discuss the rapid change and growth in the past year. We'll give a status report on our new distribution channels, present existing cases on Strategic OR and recently accepted new cases, discuss the submission and review process, and provide suggestions for faculty considering submitting cases or other teaching materials.

■ MA26

P-Room 3412

Stochastic Models for Process Industries and Supply Chains

Cluster: Stochastic Models for Manufacturing Systems
Invited Session

Chair: Ananth Krishnamurthy, Assistant Professor, Rensselaer Polytechnic Institute, Dept. of DSES, 110 8th Street, Troy, NY, 12180, United States, krisha@rpi.edu

1 - Joint Inventory Control and Pricing Optimization for Continuous Review System

Xiuli Chao, professor, NCSU, Operations Research, Raleigh, NC, 27695, United States, xchao@ncsu.edu, Sean Xiang Zhou

We analyze an infinite horizon, single product continuous review inventory system in which the decision of selling price and inventory replenishment are made simultaneously. The objective is to maximize the long run average profit. The demand arrival is poisson process with price dependent arrival rate. Ordering cost includes both setup cost and a unit purchasing cost. We characterize the structure of optimal strategies and develop an efficient algorithm to compute those control parameters.

2 - Manufacturing Capacity Revenue Management through Supply Contracts

Diwakar Gupta, Department of Mechanical Engineering, University of Minnesota, United States, guptad@me.umn.edu, Lei Wang

Manufacturers in process industries typically produce to order on account of the custom nature of end products. However, the presence of both contractual and transactional customers have created situations in which different price- and delivery-time sensitivity of buyers can be exploited to extract more of the consumer surplus by using a delivery-time based discriminatory pricing strategy. This talk will describe new challenges that arise and some modeling efforts aimed at resolving them.

3 - Modelling Blocking Systems with Zero Buffers in Semi-process Industries

Nico Goossens, University of Antwerp, Prinsstraat 13, Antwerp, 2000, Belgium, nico.goossens@ua.ac.be, Nico Vandaele

Blocking systems with zero buffers are typical for (semi-)process industries. It has not only the characteristics of limited buffer systems, but if buffer sizes are zero, the equipment is often used as temporary storage. Methodologically, analytical models to model these systems are not wide spread. Based on simulation results, the performance of a kanban analytical model applied to the blocking system is studied.

4 - Performance Modeling of Supply Chain Networks

Manjunath Kamath, Professor, Oklahoma State University, School of IE&M, 322 EN, Stillwater, OK, 74078, United States, mkamath@okstate.edu, Sandeep Srivathsan

We present queueing network models of supply chains that extend previous work on queueing models of production-inventory networks by modeling supply, transportation and distribution operations. We develop models of "building block" configurations, which can then be combined to model larger supply chain networks. The models are solved using the parametric decomposition approach that is based on a two-moment framework.

■ MA27

P-Room 3454

Queueing Systems with Applications

Sponsor: Applied Probability
Sponsored Session

Chair: Victor Araman, New York University, Stern School of Business, New York, NY, 10012, United States, varaman@stern.nyu.edu

1 - Asymptotic Analysis of a Stylized Model of an Electronic Marketplace

Costis Maglaras, United States, c.maglaras@columbia.edu, Ying-Ju Chen, Gustavo Vulcano

We study a marketplace where buyers arrive and submit orders, and n independent suppliers modelled as ./GI/1 queues compete for these orders by submitting bids that comprise of a price and target leadtime. Orders get awarded to the "cheapest" supplier. We characterize the asymptotic behavior of this system, and subsequently extract insights about the equilibrium behavior of the suppliers as well as the efficiency of this market.

2 - Corrected Heavy Traffic Approximations for Queues with Infinite Variance Processing Times

Jose Blanchet, Assistant Professor, Harvard University, Science Center, One Oxford Street, Cambridge, MA, 02138-2901, United States, jblanche@stanford.edu, Peter Glynn

If service times and interarrival times have finite variance, the steady-state waiting time can be approximated, in heavy-traffic, by an exponential law. Subsequent corrections to this approximation can be obtained in the spirit of so-called Edgeworth expansions (in which the exponential law replaces the Gaussian distribution). This talk focuses on corrections to the heavy-traffic approximation for the case of infinite variance input in which the exponential law is replaced by the Kovalenko law.

3 - Two Queueing Systems Related to the Lost Sales Inventory Model

Marty Reiman, Bell Labs, Lucent Technologies, 600 Mountain Ave., Room 2C-315, Murray Hill, NJ, 07974, United States, marty@research.bell-labs.com

We consider the single item, single location, continuous review inventory model with lost sales, where demand arrives in a Poisson process and lead times are fixed. The optimal policy for this model is not known. The standard base-stock policy leads to an Erlang loss system. We introduce a new policy that places orders at fixed intervals. This gives rise to a D/M/1 queue. We compare these policies numerically and asymptotically (as the lost sales penalty and lead time grow large.)

4 - Maximum of Random Walk with Medium-Tailed Distribution

Victor Araman, New York University, Stern School of Business, New York, NY, 10012, United States, varaman@stern.nyu.edu

In this work we study tail asymptotics and related properties of the maximum of a random walk that has a negative drift and which increments have medium-tailed distributions.

■ MA28

P-Room 3504

Advanced SPC for Autocorrelated / Multivariate Data

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: Jionghua (Judy) Jin, Assistant Professor, The University of Arizona, Dept. of Systems and Industrial Engineering, Systems & Industrial Engineering, Tucson, AZ, 85750, United States, jhjin@sie.arizona.edu

1 - Monitoring a Functional Profile of a Quality Characteristic
Amit Mitra, College of Business, Auburn University, Auburn, AL, 36849, United States, mitra@business.auburn.edu, Kaustubh-ulhas Kulkarni

Instead of controlling a quality characteristic, measured at a certain operational phase of the product, one could be interested in monitoring a desired functional relationship of that characteristic as measured over a certain parameter, for example time. Approaches for monitoring such profiles on a characteristic are presented.

2 - Multivariate Process Control: Correlation Shift Detection and Diagnosis
Hang Zhang, Dept of Industrial and Systems Engineering, Rutgers University, Piscataway, NJ, 08854, United States, zhangh@eden.rutgers.edu, Susan Albin

To compliment the methods available to detect mean shifts in multivariate manufacturing processes, we propose a new method to detect correlation shifts online. Further, we provide a diagnosis method to indicate which variables are responsible for the shift. Simulations of petroleum processing illustrate the performance of the methods.

3 - Statistical Process Adjustment of a Multiple Input/Output Semiconductor Manufacturing Process
Nirmal Govind, Intel Corporation, 5000 W. Chandler Blvd., Chandler, AZ, 85226, United States, nirmal.govind@intel.com, Mani Janakiram, George Runger, Russell Barton

Multiple Input Multiple Output (MIMO) processes are frequently encountered in practical applications. We consider methods for statistical adjustment of a semiconductor process with two inputs and two outputs. Process based controllers are constructed using polynomial models obtained from a designed experiment. These controllers are compared with data based controllers constructed using real-time process data.

4 - New Model-Free CuSum Charts For Autocorrelated Data
Seong-Hee Kim, Assistant Professor, Georgia Institute of Technology, 765 Ferst Drive, NW, Atlanta, GA, 30332, United States, skim@isye.gatech.edu, David Goldsman, Kwok-Leung Tsui, Christos Alexopoulos

We present new CuSum charts for monitoring a change in mean of auto-correlated data. Our method is a CuSum-type chart in the sense that we monitor a cumulative sum. However, our statistic is the plain cumulative sum of differences between obtained observations and a target value, and the derivation of control charts is from a different perspective. It is model-free and can use batch means of any size (batch size of one is possible).

■ MA29

P-Room 3502

Forestry Applications II

Cluster: Forestry Applications
Invited Session

Chair: Marc McDill, Associate Professor, Pennsylvania State University, School of Forest Resources, 214B Ferguson Building, University Park, PA, 16802, United States, mem14@psu.edu

1 - Promoting Large, Compact Mature Forest Patches through Harvest Scheduling Models
Sandor Toth, Pennsylvania State University, School of Forest Resources, 214B Ferguson Bldg, University Park, PA, 16802, United States, sft108@psu.edu, Marc McDill

A linear integer programming formulation is proposed that allows one to constrain or minimize the total perimeter of mature forest patches that meet prespecified minimum area requirements within a spatially explicit harvest scheduling framework. This promotes the development of interior mature forest habitat. Potential uses of the formulation, as well as a possible way of acquiring the total boundary targets, are demonstrated by analyzing the trade-offs of a three criteria planning problem.

2 - Modeling Tradeoffs Between Adjacency-type Constraints and Biodiversity
Darek Nalle, Assistant Professor, University of Nevada, Dept. of Resource Economics, Reno, NV, 89557, United States, nalle@cabnr.unr.edu, Jeffrey Arthur

Harvest and haul costs are often not explicitly taken into account during the formulation of environmental regulations. This work develops tradeoff curves between costs absorbed by the ownership and a biodiversity measure for selected adjacency-type constraints.

3 - Modeling Shelterwood Treatments in Spatially Explicit Forest Planning
Sonney George, Pennsylvania State University, School of Forest Resources, 214B Ferguson Bldg, University Park, PA, 16802, United States, sgp113@psu.edu, Marc McDill

Shelterwood treatments are a prerequisite before final harvesting in many forest districts in Pennsylvania. In the districts where it is practiced, only a subset of the stands require shelterwood treatments. A spatially explicit forest planning model that allows harvests of stands with and without shelterwood treatments is presented and discussed. Solutions based on actual data from a forest district are also presented.

4 - Temporal Connectivity of Large Mature Forest Patches
Babu Rajasekaran, Pennsylvania State University, 214B Ferguson Bldg, University Park, PA, 16802, United States, bxr908@psu.edu, Marc McDill

Mature patches are important habitat for wildlife. An area-based planning model has previously been developed that maintains habitat. However, that model does not ensure that mature patches are spatially connected across the different periods of a planning horizon. Two sets of MILP formulations are proposed that ensure mature patch connectivity over different periods of a planning horizon. The formulations can be used alone or in combination to explore management alternatives.

5 - Strengthening Cover Inequalities for Area-Based Adjacency Formulations of Harvest Scheduling Models
Marc McDill, Associate Professor, Pennsylvania State University, School of Forest Resources, 214B Ferguson Building, University Park, PA, 16802, United States, mem14@psu.edu, Sandor Toth, Sonney George

This work proposes a procedure to strengthen the area-restriction adjacency constraints (ARM) generated by the McDill-Rebain-Braze Path Algorithm (2002) for harvest scheduling problems. We analyze, both theoretically and empirically, how this formulation performs relative to the original Path formulation and to the maximal clique formulation of the generalized management units approach of Goycoolea et al (2002).

■ MA30

P-Room 3512

Directed Process Monitoring

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: Harriet Black Nembhard, Associate Professor and Emmert H. Bashore Career Professor, Marcus Department of Industrial & Manufacturing Engineering , Penn State University, 310 Leonhard Building, University Park, PA, 16802, United States, hbn2@psu.edu

1 - Recent Advances in Statistical Process Control
Fugee Tsung, HK University of Sci. & Tech., IEEM Dept., HKUST, Kowloon, HK, Hong Kong, season@ust.hk

With advances in information, sensing, and data capture technology, large volumes of data are being routinely collected and shared over multiple-stage processes, which have growing impacts on the existing Statistical process control (SPC) techniques. This talk will review the technical challenges and some recent extensions in SPC for profile monitoring, multistage monitoring, and dynamic system monitoring.

2 - A Modeling Strategy for Multidimensional Non-linear Problems
Murat Kulahci, Arizona State University, United States, Murat.Kulahci@asu.edu, Spencer Graves, Søren Bisgaard

In this article we present a flexible modeling strategy for multidimensional non-linear problems that extends the approach of Box and Hunter (1962). The idea is to use a base model derived from theoretical considerations, typically a non-linear model, where certain conditions are assumed to be fixed. To extend the range of applicability of the base model, the conditions that originally were held constant in the theoretical derivation are allowed to vary according to a carefully planned experimental design. The constants in the original theoretical expression are re-estimated from data obtained under each of these changed conditions. Hence the "constants" typically vary in a systematic fashion. Next the estimated "constants" are considered "data" and fitted to empirical equations, mostly but not necessarily

lower order polynomials, as functions of the conditions. As an illustration, we develop a model for the average run length (ARL) of the Cusum. This new model has wider applicability than the already existing tools to Δ104 obtain the ARL.

3 - Quantile-Control Charting Normal Left-Censored Data
Rene Valverde-Ventura, Research Scientist, Eli Lilly, 836 Warrick St, West Lafayette, IN, 47906, United States, VALVERDE-VENTURA_RENE@Lilly.com

The pharmaceutical industry works with compounds whose impurities are at very low levels and so those values are below the limit of detection. The monitoring of processes where the majority of the values are undetectable presents challenges due to the difficulty to estimate their mean and variance. Specifically, we propose control charts for normal left-censored processes using the distribution of the non-censored individual observations.

4 - Cuscore Statistics for Monitoring a Seasonal Time Series Process
Pannapa Changpetch, Penn State University, United States, puc121@psu.edu, Harriet Black Nembhard

The Cuscore chart is especially well suited for detecting special causes that can be modeled in advance. Motivated by an application involving blood platelet orders placed with the Red Cross, we develop the appropriate Cuscore statistic and the required control limits to detect a mean shift in a seasonal time series process. We find that the detection capability of the Cuscore is better than the Cusum. This result holds even when there is a mismatch between the actual and expected signal time.

■ MA31

P-Room 3545

Economics of Information Technology and Supply Chains

Sponsor: Information Systems
Sponsored Session

Chair: Ram Bala, Health Products Research, 3498 US Route 22 West, Whitehouse, NJ, 08888, United States, ram.bala@anderson.ucla.edu

1 - Towards Disruption Free Supply Chains
Nitin Bakshi, Wharton School, University of Pennsylvania, United States, nbakshi@wharton.upenn.edu

Disruptions in supply chain activity viz. terrorist strikes, natural disasters,give rise to a risk which hasn't been well studied in literature. Investment in disruption risk mitigation in global supply chains calls for a cooperative approach,to maximize the gains of supply chain participants. We model the situation as a two person bargaining game with incomplete information to determine how the costs of the risk management exercise would be shared amongst the participants in the supply chain.

2 - Inferring Service Quality from Queue Lengths in a Multiserver Setting
Senthil Veeraraghavan, Assistant Professor, The Wharton School, University of Pennsylvania, United States, senthilv@wharton.upenn.edu, Laurens Debo, Alan Scheller-Wolf

We consider two service centers with exponentially distributed service rates competing with each other. The customers, arriving according to a Poisson Process, observe the queue length and a private, but imperfect signal of which center is better. Based on this information, customers choose from which center to purchase the service. We analyze the equilibrium consumer behavior and comment how queue length information complements the private information about service quality.

3 - Equilibrium Analysis of a Tiered Supply Chain Network
Deming Zhou, Ph.D student, UCLA, 110 Westwood plaza, Suite B512, los angeles, ca, 90095, United States, dzhou@anderson.ucla.edu, Uday Karmarkar

We analyze a decentralized supply chain network in which firms compete in quantity and aggregate demand at the lower tiers forms a derived demand function for upper tier suppliers. We define and examine the equilibrium state of a given network under conditions of linear demand for the final markets and rational behavior by each firm. We discuss situations when such conditions do not hold. In such cases, there could be multiple equilibria or no equilibrium at all.

4 - Renting of Software Services Under Competition
Ram Bala, Health Products Research, 3498 US Route 22 West, Whitehouse, NJ, 08888, United States, ram.bala@anderson.ucla.edu, Scott Carr

We examine the equilibrium outcome of a duopoly in which a software vendor with the product of higher value chooses to sell her product while a service provider offers a subscription. We characterize the equilibrium based on the level of product differentiation between the two firms and the discount factor attached to future time periods. This reveals insights on the generalization of the Coase conjecture for durable goods in a competitive setting.

■ MA32

T-Vail (Majestic Level)

OR in Telecommunications

Cluster: OR Practice
Invited Session

Chair: Mark Reynolds, Director, Level(3) Communications, 1025 Eldorado Blvd., Broomfield, CO, 80021, United States, Mark.Reynolds@Level3.com

1 - Optimization Modeling for IP Capacity Planning in Telecommunications Industries
Mikael Weigelt, Sr. Engineer, Level(3) Communications, 1025 Eldorado Blvd., Broomfield, CO, 80021, United States, mikael.weigelt@level3.com

The presentation will describe a framework for a series of models that facilitate planning of the IP network at Level 3 Communications. This framework incorporates demand forecasting, capacity planning and traffic engineering.

2 - Next Generation Optical Network Analysis
Dennis Dietz, Qwest Communications, 1855 S. Flatiron Ct., Boulder, CO, 80301, United States, dennis.dietz@qwest.com

A cogent modeling approach is developed to explore the relationship between key network attributes and overall efficiency. The approach is implemented using a reference topology and traffic distribution that represent a typical North American long-haul network. Specific attributes examined include transparency, core speed, line system reach, and protection strategy.

3 - Analytical Models for Internet Protocol Networks
John Shortle, George Mason University, 4400 University Dr., MS 4A6, Fairfax, VA, 22030, United States, jshortle@gmu.edu, Denise Masi, Martin Fischer

This talk presents an analytical network model of queues for Internet Protocol networks. We discuss computational complexity issues with evaluating performance metrics using this model. Finally, we compare speed and accuracy with existing network simulators such as OPNET.

■ MA33

T-Savoy (Majestic Level)

Panel: Is There a "Theory of Practice"?

Sponsor: CPMS, The Practice Section of INFORMS
Sponsored Session

Chair: Donald Smith, Associate Professor, Monmouth University, School of Business Administration, Monmouth University, West Long Branch, NJ, 07764-1898, United States, dsmith@monmouth.edu

1 - Is There a "Theory of Practice"?
Moderator: Donald Smith, Associate Professor, Monmouth University, School of Business Administration, Monmouth University, West Long Branch, NJ, 07764-1898, United States, dsmith@monmouth.edu, Panelists: Jeffrey D. Camm, Terry Harrison, Fred Murphy, Michael Rothkopf

"Theory" implies widely applicable concepts, whereas "practice" usually pertains to unique circumstances. Is there a "theory of practice" apart from the general (usually mathematical) theory that is in the standard curriculum? Come see what several former and present Editors-in-Chief of Interfaces have to say on the subject.

■ MA34

T-Columbine (Majestic Level)

Capacity Reservation and Coordination

Sponsor: Manufacturing and Service Operations Management
Sponsored Session

Chair: Izak Duenyas, University of Michigan, 701 Tappan St., Ann Arbor, MI, 48108, United States, duenyas@bus.umich.edu

1 - Quantity Reservation and Capacity Investment with Bargaining
Dimitris Kostamis, University of Michigan, IOE Department, 1205 Beal Ave, Ann Arbor, MI, 48109-2117, United States, dkostami@umich.edu, Izak Duenyas

We consider a situation where an OEM can build its own capacity to manufacture a product, but also reserve a quantity of the product at a supplier. The supplier decides how much capacity to build in expectation that the OEM demand may exceed the reserved quantity. Once demand is realized, renegotation takes place. We characterize this game, especially focusing on the effect of bargaining power on equilibrium quantities reserved and capacities built.

2 - Supply Chain Sourcing under Asymmetric Cost Information
Ozalp Ozer, Professor, Stanford University, Terman Engineering Center, Room 314, Stanford, CA, 94305-4026, United States, oozer@stanford.edu, Gal Raz

We study a supply chain in which a manufacturer is facing a supplier selection decision from two sourcing options: a large and powerful supplier or a starting small supplier. We examine strategies the big supplier should follow to win the sourcing contract and the effect of information asymmetry about the cost of the small supplier and manufacturer on these strategies.

3 - Collaboration in Complementary Capacity with Information Asymmetry
Jun Zhang, A.B. Freeman School of Business, Tulane University, New Orleans, LA, 70118, United States, jzhang4@tulane.edu, Amiya Chakravarty

We study the optimal contracting problem between two firms collaborating on capacity investment with information asymmetry. System efficiency is lost due to the margin difference between the two firms. When the cost information of the lower-margin firm is private, optimal contracts cannot achieve the first-best capacity investment level in general. For a special case, we demonstrate that a profit-sharing contract can achieve the first best solution.

4 - On the Role of a Contingent Purchase Opportunity in a Two-Echelon Decentralized Supply Chain
Shiming Deng, Braincess, Inc., 1000 Ellwell Ct. Suite 220, Palo Alto, CA, 94303, United States, shiming.deng@braincess.com, Candace Yano

We study a contract that combines a contingent purchase opportunity with an advance purchase, and show that contingent purchase opportunity may degrade the performance of the supply chain. The manufacturer (supplier), however, may use a price cap (floor) to reduce the adverse effects and make both parties better off.

■ MA35

T-Terrace (Terrace Level)

Supply Chain Risk and Flexibility Management Industry Implementations

Sponsor: Manufacturing and Service Operations Management
Sponsored Session

Chair: Blake Johnson, Stanford University, Management Science & Engineering, Terman Engineering Center, Stanford, CA, 94025, United States, blakej@stanford.edu

1 - Product Transitions Research
Jay Hopman, Strategic Analyst / Researcher, Intel Corporation, 1900 Prairie City Rd. FM1-56, Folsom, CA, 95630, United States, jay.hopman@intel.com

Intel and research partners have completed case studies on major product transitions, focusing on organizational management of demand and supply alignment for current and next generation products. Findings have led to development and application of new approaches such as the Product Transition Index and Playbook. The team is now developing diffusion and system dynamics models to improve forecasting, planning, and management of current and upcoming transitions.

2 - Overall Value of Manufacturing Flexibility Including Part Commonality and Supply Capacity Levels
Mark Everson, Technical Expert, Ford Motor Company, SRL Bldg, MD # 2122, 2101 Village Rd., Dearborn, MI, 48124, United States, meverson@ford.com, Janis Grabis, Charu Chandra, David Ostrowski

An enterprise-level flexible manufacturing approach for a multi-product manufacturer like an automotive company requires a cost-effective mix of many key enablers, including flexible assembly plants, part commonality between products, and supply base flexibility. This talk will overview a strategic planning model that determines the overall business value of flexible manufacturing systems.

3 - Valuing Real Options at Boeing - Modeling Uncertainty and Calculating Risk-adjusted Benefits
Scott Mathews, Computational Finance Technical Lead, Boeing Corporation, P.O. Box 3707, MC 45-93, Seattle, WA, 98124-2207, United States, scott.h.mathews@boeing.com

Boeing has developed a set of straightforward strategic decision-modeling methods and tools based on techniques used in the capital markets. These methods and tools appropriately value investment and risk of opportunities while assessing the likelihood of future events. Boeing's intuitive and transparent real option technology facilitates strategic planning. The methods are easily integrated into spreadsheets with simulation methods extending NPV analysis to incorporate risk and decision points.

4 - Risk and Flexibility Management at Dell and Zara: Historical Factors and Evolving Principles
Blake Johnson, Stanford University, Management Science & Engineering, Terman Engineering Center, Stanford, CA, 94025, United States, blakej@stanford.edu

The operating models of Dell and Zara have transformed their industries by cost-effectively reducing risk and increasing flexibility, delivering both greater customer responsiveness and larger, more predictable margins. In addition to management quality, analysis of the evolution of both business suggestions 1) important roles for historical coincidence, and 2) generalizable and transferable supply chain engineering principles currently only partly developed and actively evolving at both firms.

■ MA36

T-Capitol (Terrace Level)

Financial Engineering II

Cluster: Financial Engineering
Invited Session

Chair: Jaya Bishwal, University of California, Santa Barbara, Department of Statistics and App. Prob., Santa Barbara, CA, 93106, United States, bishwal@pstat.ucsb.edu

1 - Higher Order Simulated Maximum Likelihood Estimation of Diffusions
Robert Kimmel, Princeton University, Princeton, NJ, 08544, United States, rkimmel@princeton.edu, Jaya Bishwal

We study the estimation of discretely observed homogeneous ergodic diffusions through the simulated maximum likelihood (SML) method. Simulation of inter-observation points is made by several higher order discretization schemes. We consider both bias reduction and variance reduction schemes, and obtain several SML estimators with higher order accuracy. The new estimators are applied to several well known models in finance.

2 - Revisiting the Standard Poisson Disorder Problem
Erhan Bayraktar, Research Assistant Professor, University of Michigan, Department of Mathematics, Ann Arbor, MI, 48109, United States, erhan@umich.edu, Savas Dayanik, Ioannis Karatzas

A change in the arrival rate of a Poisson process delimits two different regimes in which one employs distinct strategies (e.g.,investment, advertising, manufacturing). The change time is unobservable and it is of interest to do an online detection. Here we solve the standard Poisson disorder problem which addresses the tradeoff between false alarms and detection delay costs and describe efficient numerical methods to calculate the optimal policy parameters.

3 - Asset Pricing Using Possibly Misspecified Models
Jialin Yu, Columbia University, 421 Uris Hall, 3022 Broadway, New York, NY, 10027, United States, jy2167@columbia.edu

To implement financial models, parametric method is efficient and nonparametric method is robust against misspecification. What if a model is misspecified yet approximates reality, as in many cases? This paper proposes an estimator that, with correct models, achieves the parametric convergence rate. When a model is a "total disaster", it retains the nonparametric robustness. It can outperform the (non)parametric estimators when a model is an approximation. Applications are provided.

4 - Comparing Multi-Period Hedging Strategies
Katharyn Boyle, Cornell University, 657 Rhodes Hall, Cornell University, Ithaca, NY, 14850, United States, katharyn@cam.cornell.edu, Thomas F. Coleman, Yuying Li

We consider discrete dynamic hedging strategies for complex options using the underlying and more liquid options. We illustrate that this hedging problem can become ill-posed when the universe of hedging instruments include liquid options. We propose to regularize the ill-posedness through cost modeling or total risk minimization. We compare the proposed techniques with existing hedging strategies and illustrate their potential applications.

■ MA37

T-Biltmore (Terrace Level)

Agent-based Modelling in Energy Markets

Sponsor: Energy, Natural Resources and the Environment
Sponsored Session

Chair: Augusto Ruperez Micola, London Business School, Sussex Place, Regent's Park, London, United Kingdom, aruperezmicola@london.edu

1 - A Computational Laboratory for Pre-Testing the Reliability of Restructured Wholesale Power Markets
Deddy Koesrindartoto, Graduate Assistant - Ph.D Candidate, Department of Economics, Iowa State University, 260 Heady Hall, Ames, IA, 50011, United States, deddypri@iastate.edu, Leigh Tesfatsion

This talk will discuss a collaborative project with the Los Alamos National Laboratory to test the economic reliability of the Wholesale Power Market Platform (WPMP), a market design proposed in April 2003 by the U.S. Federal Energy Regulatory Commission for common adoption by U.S. wholesale electricity markets. The WPMP is a complicated market design encompassing a real-time market, a day-ahead market, and a financial transmission rights markets. Variants of the WPMP design have been adopted or submitted for adoption by various regions of the United States, but it is being resisted in other regions on the grounds that its reliability has not yet been sufficiently established. The key issue addressed in our project is the extent to which the WPMP design is capable of sustaining efficient, orderly, and fair market outcomes over time despite attempts by market participants to gain advantage through strategic pricing, capacity withholding, and/or induced transmission grid congestion. To carry out this reliability study, we are developing an agent-based computational laboratory that captures the salient aspects of the WPMP design. A computational laboratory is a computational framework with a graphical user interface that permits the systematic exploration of complex system behaviors by means of controlled and replicable experiments. Resources related to ACE electricity research (readings, software, and pointers to individuals, groups, and websites) can be accessed online at http://www.econ.iastate.edu/tesfatsi/aelect.htm

2 - Analysis of the Russian Wholesale Electricity Market Performance using Computational Learning

Yevgeniy Pogrebnyak, Head of Research, Institute for Complex Strategic Studies (Moscow), Kotelnicheskaya nab., 17, Moscow, Russian Federation, ypogrebnyak@london.edu, Derek Bunn

A limited competitive day-ahead wholesale electricity market has been operating in Russia since 2003. The full reforms are expected to be finalised upon the assessment of the transitional market. We develop a stylized agent-based model of the Russian wholesale market and perform a series of computational experiments to assess issues in market concentration, trading arrangements, bilateral contracts, and capacity commitment. We analyse several policy options from the results of these experiments.

3 - Coordination and Incentives in Vertically Related Energy Markets

Augusto Ruperez Micola, London Business School, Sussex Place, Regent's Park, London, United Kingdom, aruperezmicola@london.edu, Derek Bunn

Energy firms can normally choose between selling the commodity in-house to its supply arm or to specialised retailers via the market. In this paper, we contribute to solve two issues: What incentive schemes optimise the alignment of the overall firm's interest and that of the vertically integrated individual SBUs? Is it more profitable to take part in the market or trade in-house? The method consists of simulations in which agents interact through a simple reinforcement algorithm.

■ MA38

T-Beverly (Terrace Level)

Simulation Applications

Sponsor: Simulation
Sponsored Session

Chair: Douglas Morrice, Professor, The University of Texas at Austin, Management Department, Red McCombs School of Business, Austin, TX, 78712-0210, United States, morrice@mail.utexas.edu

1 - NUDRT: A Simulation Software Tool for Planning Demand-Responsive Transit Services

Barry L. Nelson, James N. and Margie M. Krebs Professor, Department of IEMS, Northwestern University, 2145 Sheridan Road, Room C250, Evanston, IL, 60208, United States, nelsonb@northwestern.edu, Hong Wan

The Americans with Disabilities Act mandates equal access to public transportation services for all Americans. For the elderly or disabled, demand-responsive transit (DRT) is often superior to fixed-route bus service. We describe a simulation software tool developed for the Transit Cooperative Research Program that helps communities plan DRT service.

2 - Implementation of a Simulation-Based Scheduling System for a Two-Plant Textile Operation

Jeffrey Joines, Assistant Professor, North Carolina State University, P.O. Box 8301, North Carolina State University, Raleigh, NC, 27695-8301, United States, jeffjoines@ncsu.edu, Kristin Thoney

Scheduling any complicated job shop becomes increasingly more difficult when the cycle time is reduced. We will discuss the implementation of a simulation-based scheduling system that properly schedules parts in a two-plant textile operation. The system has allowed the company to reduce the cycle time by at least a week.

3 - Simulating the Behavior of Large Software Applications

Herb Schwetman, Senior Staff Engineer, Sun MicroSystems, Inc., SunLabs, Austin, TX, United States, Herb.Schwetman@Sun.COM

Large, software applications are critical to the operation of many commercial computer systems today. These applications typically integrate one or more software components such as web-servers, application servers, directory servers and database management systems to create the application. This talk discusses the development of simulation models of such applications, focusing on models of the components. A model of the Sun JES Directory Server illustrates important features of these models.

4 - A Simulation of Land Seismic Surveying Operations in Oilfield Services

Douglas Morrice, Professor, The University of Texas at Austin, Management Department, Red McCombs School of Business, Austin, TX, 78712-0210, United States, morrice@mail.utexas.edu, Peter Mullarkey, Srinagesh Gavirneni, Grant Butler

Seismic survey, the process of mapping subterranean rock formations using reflection of sound waves, is an important first step in oil and gas exploration. It is a complex operation lasting many months, covering hundreds of square miles, employing scores of people, and utilizing a large variety of equipment. Oilfield services companies must win surveys in a closed bidding process organized by oil companies. To support biding, we developed a simulation tool to estimate survey cost and duration.

■ MA39

T-Tower Court A (2nd Floor)

Supply Chain Management and Incentives

Cluster: Supply Chain Mgmt & Operations
Invited Session

Chair: Ananth Raman, Professor, Harvard Business School, Morgan Hall T11, Soldiers Field, Boston, MA, 02163, United States, araman@hbs.edu

1 - Supply Chain Coordination and Competition - Coordination is not all it is Cracked up to be

Gerard Cachon, The Wharton School, 543 JMHH, Philadelphia, PA, 19104, United States, cachon@wharton.upenn.edu

Suppose one supply chain competes against another supply chain, each with one supplier and one retailer. Many contracts have been identified to coordinate each supply chain, i.e., to align incentives so that each supply chain's profit is maximized. But those contracts do not explicitly account for competitive action. Do they still coordinate with competition? Would a sophisticated supply chain adopt those contracts?

2 - Incentives to Forecast with Multiple Retailers

Martin Lariviere, Kellogg School of Management, Northwestern University, Evanston, IL, 60208, United States, m-lariviere@northwestern.edu

Suppose retailer effort in one market can improve the precision of a supply chain's forecast for several markets. We consider the incentives to forecast and the number of retailers a supplier should induce to forecast.

3 - Strategic Perils of Delayed Differentiation under Competition

Krishnan S. Anand, The Wharton School, University of Pennsylvania, Philadelphia, PA, 19104, United States, anandk@wharton.upenn.edu, Karan Girotra

Delayed Differentiation (ëPostponement') has been extensively studied in the Operations literature as a method for risk pooling by a monopolist under demand uncertainty. We extend the analysis to imperfectly competitive markets, and find that purely strategic considerations not identified previously in the literature play a pivotal role in determining the value of postponement.

4 - Impact of Supply Chain Contracts on Incentives for Leadtime Reduction

Santiago Kraiselburd, Harvard Business School, Sherman Hall, Soldiers Field Road, Boston, MA, 02163, United States, skraiselburd@hbs.edu, Ananth Raman

We show that in supply chains where retailer effort can substantially affect sales, the retailer exerts effort after choosing stocking quantity and observing demand, and where the manufacturer and retailer have a wholesale price only contract, longer leadtimes can result in higher sales for the manufacturer. We define and study a "safety stock effect" and an "effort effect" that accounts for this, and propose contract forms to overcome this problem.

■ MA40

T-Tower Court B (2nd Floor)

Newsvendor Pricing Models in Supply Chain Management

Cluster: Supply Chain Mgmt & Operations
Invited Session

Chair: Nicholas Petruzzi, Assistant Professor, University of Illinois, 350 Wohlers Hall, 1206 S. Sixth Street, Champaign, IL, 61820, United States, petruzzi@uiuc.edu

1 - Joint Pricing-Production Decisions in Supply Chains of Complementary Products with Uncertain Demand

Yunzeng Wang, Associate Professor, Case Western Reserve University, Cleveland, OH, 44106, United States, yunzeng.Wang@case.edu

Consider n manufacturers, each producing a different product and selling it to a market. The n products are perfectly complementary to each other, and their demand is both price-sensitive and uncertain. We explore how channel structure affects firms' individual price-production decision and profitability. Channel structure is parameterized by the number of firms involved, the sequence of decision-making among the firms, and the involvement of a retailer, etc.

2 - Tailored Supply Chain Decision Making

Saibal Ray, McGill University, 1001 Sherbrooke Street (West), Montreal, Qu, Canada, saibal.ray@mcgill.ca, Yuyue Song, Shanling Li

In this paper we analytically determine the optimal pricing and inventory decisions in two-echelon supply chains, where both echelons can make these decisions in presence of stochastic price-sensitive demand and delivery uncertainty. We provide managerial insights regarding customization of the optimal actions with changes in business environment. Specifically, we illustrate the importance of stochasticity of delivery time in such models, an issue largely ignored in the previous literature.

3 - Vertical Control of Inventory and Pricing Decisions

Harish Krishnan, Assistant Professor, University of British Columbia, 2053 Main Mall, Henry Angus 455, Vancouver, BC, Canada, harish.krishnan@sauder.ubc.ca, Ralph Winter

This paper examines vertical contracts when downstream outlets compete on price and face uncertain demand. Can the manufacturer rely on retailers to make efficient decisions, or should the manufacturer control downstream inventory and price decisions? We characterize the contracts with downstream agents that will elicit efficient inventory and pricing decisions.

4 - Newsvendor Pricing, Purchasing, and Consignment: Supply Chain Modeling Implications and Insights

Nicholas Petruzzi, Assistant Professor, University of Illinois, 350 Wohlers Hall, 1206 S. Sixth Street, Champaign, IL, 61820, United States, petruzzi@uiuc.edu

A price-setting newsvendor model is applied in the context of a supplier-retailer supply chain to compare a wholesale price contract (supplier sets a cost for each unit purchased by retailer) with a consignment contract (retailer sets a percentage fee for each unit sold on behalf of supplier). The idea is to understand when one contract is preferred to the other, and how that answer depends on whether the perspective is centered on the overall chain, the market, the supplier, or the retailer.

■ MA41

T-Tower Court C (2nd Floor)

Supply Chain Networks

Contributed Session

Chair: Youxu Tjader, University of Pittsburgh, 9123 Willoughby Rd, Pittsburhg, PA, 15237, United States, yotst1@katz.pitt.edu

1 - Power Indices for Supply Chain Structures

Jayavel Sounderpandian, Professor, University of Wisconsin-Parkside, Department of Business, 900 Wood Road, Kenosha, WI, 53141-2000, United States, sounderp@uwp.edu

A supply chain structure is a set of links with a clutter, or antichain, of the links declared as the set of possible chains. One or more of the subsets in the clutter may materialize as the supply chains. Depending upon the possible chains and cuts in which a link may be included, a power index can be defined and computed for that link. The relative merits of different definitions of power indices are examined.

2 - Defining the Role of Supply Networks within the Supply Chain

George Kenyon, Assistant Professor, Lamar University, P. O. Box 10025, Beaumont, TX, 77710, United States, kenyongn@hal.lamar.edu, Kabir Sen

There is inconsistent evidence that any of the SCM can be effectively integrated into industry or provide sustainable performance improvements. Few companies actively manage their supply chain from suppliers' supplier to customer's customer. There is a gap between SCM theories and industry practices. The primary reason for this gap between practice and theory is the ambiguity of the definition of SCM. This paper offers an explanation for the gap, and proposes new definitions for SCM.

3 - The Impact of the Supply Chain Network Dynamics

Youxu Tjader, University of Pittsburgh, 9123 Willoughby Rd, Pittsburhg, PA, 15237, United States, yotst1@katz.pitt.edu

We examine the impact of supply chain network (SCN) dynamics by studying different structures of networks. We found that network structure has a significant effect on the standing (importance) of members in a SCN. Changes of member's standing in the network directly contribute to the rapport among SC members, which in turn influence the SCN performance.

■ MA42

T-Tower Court D (2nd Floor)

Optimal Pricing Policies

Sponsor: Revenue Management & Dynamic Pricing
Sponsored Session

Chair: Julie Swann, Georgia Institute of Technology, Industrial and Systems Engineering Dept., 765 Ferst Drive, NW, Groseclose 0205 Room 411, Atlanta, GA, 30332-0205, United States, jswann@isye.gatech.edu

Co-Chair: David Simchi-Levi, Professor, MIT, 77 Massachusetts Ave., 1-171, Cambridge, MA, 02139, United States, dslevi@mit.edu

1 - A Robust Nonlinear Fluid Model of Dynamic Pricing and Inventory Control with no Backorders

Elodie Adida, Ph.D candidate, Massachusetts Institute of Technology, Room E40-139, 77 Massachusetts Ave., Cambridge, MA, 02139, United States, eadida@mit.edu, Georgia Perakis

We study a fluid model for dynamic pricing and inventory control in a make-to-stock system. First demand is deterministic and subsequently demand is uncertain. We consider a multi-product capacitated, dynamic setting with no backorders. We introduce an algorithm that computes the optimal production and pricing policy on a finite time horizon. When demand is uncertain we consider the additive demand case. We use ideas from robust optimization. We give numerical examples and discuss some insights.

2 - Strategic Response to Wait-or-Buy: Revenue Management via Last-Minute Deals with Customer Learning

Anton Ovchinnikov, Ph.D Candidate in Operations Management, Joseph L. Rotman School of Management, University of Toronto, 105 St. George street, Toronto, ON, M5S 3E6, Canada, anton@rotman.utoronto.ca, Joseph Milner

We study the inter-temporal revenue management problem of a service provider whose customers' behavior depends on the observed pricing history. We present a model and show that the resulting optimal policy is of a "Bang-Bang" type. We show that firms can use pricing policy to effectively reduce strategic customer response.

3 - Dynamic Pricing and Inventory Control with Demand Substitution: The Value of Pricing Flexibility

Xiaowei Xu, Ph.D Student, Northwestern University, 2145 Sheridan Road, Room C223, Evanston, IL, 60208, United States, xuxiaowe@northwestern.edu, Wallace Hopp

This paper studies a one-shot inventory replenishment problem with dynamic pricing. The customer arrival process is assumed either to be piecewise deterministic or to follow a geometric Brownian motion. Homogeneous customers have an iso-elastic demand function. We find a closed form optimal pricing policy. We establish a WPBE for the price and inventory game. The pricing equilibrium is cooperative, but that inventory competition results in overstock and damages profits.

4 - Dynamic Pricing Strategies with Reference Price Effects

Yaozhong Wu, INSEAD, Blvd de Constance, Fontainebleau, France, yaozhong.wu@insead.edu, Ioana Popescu

We consider the long term pricing problem of a monopolist selling goods to a market of repeated customers. We specifically consider the influence of customers' purchase experience, in terms of observed past prices, on demand. This is modeled as a general reference price mechanism. We characterize the optimal dynamic pricing strategy under various demand dynamics, and compare it to the corresponding myopic policy.

■ MA43

T-Denver (Mezzanine)

Supply Chain Issues in Product Design

Cluster: New Product Development
Invited Session

Chair: H. Sebastian Heese, Assistant Professor, Kelley School of Business, Indiana University, Bloomington, IN, 47401, United States, hheese@indiana.edu

1 - Bundling Profitability under Customer Demand Correlation and Variability
Jamison Day, University of Houston, 401 E Allen St, Bloomington, IN, 47401, United States, jday@indiana.edu

In this presentation, we examine several properties of a simple pricing and bundling problem. Although it has been shown that negative correlation in reservation prices leads to profitable bundling opportunities, no information concerning how much profitability varies with different levels of correlation is given. We investigate the relationship between optimal mixed bundling profitability and reservation price correlation and variability.

2 - Should Multiple Points of Product Differentiation Coexist?
Aydin Alptekinoglu, Assistant Professor, University of Florida, Warrington College of Business, Decision and Information Sciences, Gainesville, FL, 32611-7169, United States, aalp@ufl.edu, Christopher S. Tang

The main benefit of postponement comes from a demand pooling effect due to delayed allocation of generic parts into end-products. But, there could be an important downside: The longer the delay (in differentiating the product) the narrower is the breadth of product variety that can be produced from the generic part. We propose a model that allows multiple points of product differentiation in order to explore this tradeoff.

3 - Developing New Technologies for Industrial Customers: More Functionality, More Performance or Both?
Sanjiv Erat, College of Management, Georgia Institute of Technology, 800 West Peachtree St. NW, Room 4309, Atlanta, GA, 30332, United States, sanjiv.erat@mgt.gatech.edu, Stylianos Kavadias

We develop a model of technology introduction to a market of competing industrial customers. Motivated by examples from the electronics industry, such as the introduction of the Digital Signal Processor (DSP) based solutions, where the technology providers can offer components with enhanced performance, or with rich functionality (e.g. bare-bones components with emphasis on performance, or a feature-rich component that combines multiple systems), we examine the drivers for the two approaches.

4 - The Private Label Threat: Manufacturer-Retailer Interactions in Product Line Design
H. Sebastian Heese, Assistant Professor, Kelley School of Business, Indiana University, Bloomington, IN, 47401, United States, hheese@indiana.edu

In a simple supply chain setting with one manufacturer and one retailer, we examine how the retailer should position a private label product vis-à-vis a competing national brand product, when positioning takes place on a quality-type dimension. We focus on how a strategic manufacturer could mitigate losses associated with such an entry by choosing the appropriate product positioning and wholesale pricing strategy.

■ MA44

T-Spruce (Mezzanine)

Field Studies of Online Auctions

Cluster: Auction Theory & Applications
Invited Session

Chair: Otto Koppius, Erasmus University Rotterdam, Dept. of Decision and Information Scienc, Rotterdam School of Management, Rotterdam, Netherlands, O.Koppius@fbk.eur.nl

1 - Modeling Consumer Surplus in Online Auctions
Galit Shmueli, Assistant Professor, Smith School of Business, University of Maryland, 4361 Van Munching Hall, College Park, MD, 20742, United States, gshmueli@rhsmith.umd.edu, Wolfgang Jank, Ravi Bapna

We present a model for quantifying and understanding drivers of consumer surplus from eBay auctions. Since eBay does not disclose winning bids there is no publicly available measure of auction surplus. To overcome this we design a field experiment that allows bidders to bid on eBay via our bidding agent, and record the surplus for auctions where our agent won. The data pose statistical challenges in specifying the surplus distribution and modeling it as a function of relevant economic measures.

2 - Regret, Learning and Desire to Win in Auctions
Richard Engelbrecht-Wiggans, Professor, University of Illinois, College of Business, Champaign, IL, United States, eplus17@uiuc.edu, Elena Katok

We consider a sealed-bid first-price auction model in which bidders desire to win auctions and to avoid regret in addition to making profit. Our experimental data is consistent with this model, and providing laboratory subjects with appropriate additional information reduces the effect of regret and desire to win.

3 - Factors Influencing the Outcome of Electronic Reverse Auctions for IT Services
Uladzimir Radkevitch, Department of Information and Decision Sciences, Rotterdam School of Management, Erasmus University, F1-2, Postbox 1738, 3000 DR Rotterdam, Rotterdam, Netherlands, uradkevitch@fbk.eur.nl, Eric van Heck

Companies increasingly turn to electronic markets to outsource IT-related tasks. Reverse auctions serve to select the best suppliers at these markets. This paper investigates outcomes of electronic reverse auctions (i.e. whether a contract is made between buyer and supplier) and their relationships with buyer's pre-bidding costs. These costs include search costs and communication costs. Empirical research is based on the analysis of 570 reverse auctions for IT services.

4 - Bidding Dynamics: Antecedents, Processes and Outcomes
Otto Koppius, Erasmus University Rotterdam, Dept. of Decision and Information Scienc, Rotterdam School of Management, Rotterdam, Netherlands, O.Koppius@fbk.eur.nl

In many studies on English auctions that link design parameters to auction outcomes, the actual bidding process tends to remain unspecified, thus limiting our understanding. Using a database of the complete bid history of nearly 200 reverse auctions in the utilities industry, I find that seemingly small variations of auction design parameters, in particular the information architecture of the auction, can produce large differences in bidding dynamics and subsequently auction outcome.

■ MA45

T-Gold (Mezzanine)

Vaccination Strategies

Cluster: Medicine and OR
Invited Session

Chair: Eva Lee, Associate Professor & Director, Center for Operations Research in Medicine, Georgia Institute of Technology, Industrial & Systems Engineering, Atlanta, GA, 30332-0205, United States, evakylee@isye.gatech.edu

1 - The Effect of Vaccination Policies in Bi-Level "Small World" Social Structures
Moshe Kress, Professor, Naval Postgraduate School, Operations Research Management, Monterey, CA, 93943, United States, mkress@nps.navy.mil

A common assumption in biodefense modeling is that of homogeneous mixing, which implies that the graph of the social network that represents contacts between individuals is a random graph. Such a mixing pattern is hardly typical to population interaction in a modern urban environment. In this paper we develop a two-level small-world network structure and evaluate the effectiveness of alternative vaccination strategies within that structure.

2 - Large-Scale Clinic Design — CDC experience
Jacquelyn Mason, Centers for Disease Control and Prevention, Emergency and Environmental Health Servi, National Center for Environmental Health, Atlanta, GA, United States, zao4@cdc.gov

We provide an overview of a large-scale clinic design, and discuss commonalities and differences between dispensing centers and small pox vaccination centers. We explain the use of simulation in clinic design and discuss the development of Maxi-Vac, a protocol we developed at CDC. We illustrate the limitation of Maxi-Vac, and this leads to the third talk on a practical large-scale simulation/optimization system, RealOpt.

3 - Emergency Treatment Response and Real-Time Staff Allocation for Bioterrorism & Infectious Disease
Eva Lee, Associate Professor & Director, Center for Operations Research in Medicine, Georgia Institute of Technology, Industrial & Systems Engineering, Atlanta, GA, 30332-0205, United States, evakylee@isye.gatech.edu, Siddhartha Maheshwary, Jacquelyn Mason

We describe a large-scale simulation-optimization decision support system designed for resource allocation in emergency treatment centers. The system weaves the simulation of patient inflows with an optimization algorithm to dynamically optimize the assignment of healthcare workers within the treatment centers. Scenarios based on different patient flow patterns will be analyzed, and comparisons with Maxi-Vac —- a protocol system developed at CDC —- will be reported.

■ MA46

T-Aspen (Mezzanine)

Optimization and Graph Problems

Sponsor: Minority Issues
Sponsored Session
Chair: Earl Barnes, Professor, Georgia Tech, Ferst Drive, Atlanta, GA, 30332, United States, ebarnes@isye.gatech.edu

1 - Exploring the Application of Genetic Algorithms to Solve the Hub Scheduling Problem

Douglas McWilliams, Purdue University, 401 N. Grant Street, West Lafayette, IN, 47907-2021, United States, dmcwilli@purdue.edu

Ever since the Motor Carrier Act of 1980, companies operating in the trucking industry have been faced with the challenge of providing shippers with high-quality service at low cost. To maintain survivability in the trucking industry, the management team in each company has focused on providing lean delivery service to their customers. This research focuses on the production planning and scheduling operations at hub terminals in the parcel delivery industry, such companies as United States Postal Service, UPS, FedEx, and DHL. The scheduling function in a hub terminal consists of releasing a set of inbound trailers to a fixed number of unload docks. Parcels in the inbound trailers are unloaded and cross docked to load docks. At the load docks, parcels are placed on outbound trailers, which deliver the parcels to other points in the delivery system. The order wherein the set of inbound trailers is unloaded for the most part determines the productivity of the transfer operation. This research explores the application of genetic algorithms (GA) in solving the hub scheduling problem (HSP). The computational experiment shows that the proposed GA based approach is effective in solving the HSP compared to current industry practice.

2 - Optimization and the Classification Problem

Pamela Williams, Senior Member of Technical Staff, Sandia National Laboratories, PO Box 969, MS 9159, Livermore, CA, 94551-0969, United States, pwillia@sandia.gov

The essence of data mining is the ability to extract knowledge from seemingly inconclusive data. Data mining applications include problems in engineering, environment, and medicine where it is important to classify an underlying state of nature based on analysis of a relevant set of data. The term support vector machine is applied to an algorithmic approach to solving the classification problem. We introduce a decomposition method with a novel shrinking strategy to train support vector machines.

3 - A Solver for the Maximum Weight Independent Set Problem

Jeffrey Warren, student, Texas A&M University, TAMUS 3131, College Station, TX, United States, j-warren@tamu.edu

We use a clique-cover approach to solve the maximum weight independent set (MWIS) problem in a branch-and-bound framework. Following the methods of Balas and Xue, we find subgraphs for which the MWIS problem is easily solved and branch on inclusion of the remaining vertices. We attempt to produce superior child nodes by constructing our subgraphs in a more general fashion than do Balas and Xue. We also investigate intelligent means of expanding the search for branch sets at each node.

4 - Linear Programming and Maximum Cliques

Earl Barnes, Professor, Georgia Tech, Ferst Drive, Atlanta, GA, 30332, United States, ebarnes@isye.gatech.edu

The maximum clique problem is polynomially solvable for perfect graphs. We formulate a linear programming model whose solution also gives a maximum clique for a certain class of non-perfect graphs.

■ MA47

T-Century (Mezzanine)

Software Demonstration

Cluster: Software Demonstrations
Invited Session

1 - Frontline Systems, Inc.- Premium Solver

Daniel Fylstra, President, Frontline Systems Inc., P.O. Box 4288, Incline Village, NV, 89450, United States, dfylstra@frontsys.com

See how Premium Solver handles the full spectrum of optimization problems, from linear programming to genetic algorithms. Our Solver DLL products supply easy-to-use optimization for your applications. Learn how to "do more with less," and how working with Excel can cut down the cost and complexity of using optimization technology.

2 - Imagine That, Inc.- Simulation with Extend

Anthony Nastasi, Imagine That, Inc., 6830 Via Del Oro, Ste. 230, San Jose, CA, 95119, United States, anthonyn@imaginethatinc.com

This presentation provides an introduction to modeling with Extend by Imagine That Inc., an innovative leader in the simulation industry since 1987. Extend offers an unmatched suite of features along with a unique combination of power and ease of use. Consequently, Extend spans the full spectrum of simulation modeling applications from the classroom to Fortune 500 companies.

Monday 10:00am-11:30am

■ MB01

P-Ballroom F

Tutorial: Nonlinear Programming and Engineering Applications

Cluster: Tutorials- Denver 2004
Invited Session

1 - Nonlinear Programming and Engineering Applications
Robert J. Vanderbei, ACE-42 Engineering Quad, Princeton University, Princeton, NJ, 08544, United States, rvdb@princeton.edu

Interior-point methods for nonlinear programming make it possible to solve realistic- size models of engineering problems. After a brief review of interior-point methods for nonlinear programming, he will devote much of the tutorial to a consideration of various applications drawn from such areas as FIR filter design, antenna array design, high-contrast imaging, new orbits in the n-body problem, trajectory planning, and others.

■ MB02

P-Ballroom E

New Advances in Algorithm Design and Search Strategies

Cluster: Metaheuristics (EU/ME)
Invited Session

Chair: Cesar Rego, Associate Professor, University of Mississippi, School of Business Administration, Oxford, MS, 38677, United States, crego@bus.olemiss.edu

Co-Chair: Dorabela Gamboa, Escola Superior de Tecnologia e Gestäo de Felgueiras, Instituto Politécnico do Porto, R. do Curral, Apt. 205, 4610-156, Felgueiras, Portugal, dgamboa@estgf.ipp.pt

1 - Advances on the Implementation of TSP Algorithms
Colin Osterman, University of Mississippi, Hearin Center for Enterprise Science, School of Business Administration, Oxford, MS, 38677, United States, costerman@bus.olemiss.edu, Cesar Rego

We advance the state of the art in heuristic search algorithm performance for the Traveling Salesman Problem. General improvement in algorithm speed is achieved with the use of a new data structure, the k-level satellite tree. The data structure is presented and comparisons offered with previous structures.

2 - Advances on Filter-and-Fan Search for Job Shop Scheduling
Dorabela Gamboa, Escola Superior de Tecnologia e Gestäo de Felgueiras, Instituto Politécnico do Porto, R. do Curral, Apt. 205, 4610-156, Felgueiras, Portugal, dgamboa@estgf.ipp.pt, Cesar Rego, Renato Duarte

Filter and Fan (F&F) is a method to create dynamic and adaptive neighborhoods for local search and meta-heuristic algorithms. In this paper we discuss algorithm designs that are critical for performance and present computational results for our new developments on the application of the F&F approach to the job shop scheduling problem.

3 - Two-Level Tabu Search for 3-D Orthogonal Bin Packing
Teodor Gabriel Crainic, Professor, ESG, UQAM and Centre for Research on Transportation, CP 8888, succ. centre Ville, Montreal, QC, H3C 3P8, Canada, theo@crt.umontreal.ca, Guido Perboli, Roberto Tadei

One must orthogonally pack a set of boxes into a minimum set of bins (strongly NP-Hard problem). The first-level tabu search modifies the assignment of the boxes to the bins to reduce the number of bins. For each assignment, the boxes in each bin are arranged by means of a second tabu search based on an interval graph representation of the packing. We present the neighborhoods, search strategies, implementation details, and computational results obtained on literature benchmark instances

4 - Adaptive Memory Search for Multidemand Multidimensional Knapsack Problems
Arne Løkketangen, Molde College, 6411, Molde, Norway, arne.lokketangen@hiMolde.no, Halvard Arntzen, Lars Magnus Hvattum

We describe a simple adaptive memory search method for the 0/1 Multidemand Multidimensional Knapsack Problem (0/1 MDMKP). The search balances the level of infeasibility against the quality of the solution, and uses a simple dynamic tabu search mechanism. A weighting scheme to balance out the differences in the tightness of the constraints is also implemented. Computational results on a portfolio of test problems are reported, showing very favorable results.

■ MB03

P-Plaza Court 1

Scatter Search and Path Relinking Applications

Cluster: Scatter Search and Path Relinking Methods for Optimization
Invited Session

Chair: Rafael Martì, University of Valencia, C/ Dr Moliner 50, Burjassot (Valencia), VL, 46100, Spain, rafael.marti@uv.es

1 - Solving the 3D Image Registration Problem by Scatter Search with Path-Relinking
Sergio Damas, Assistant Profesor, University of Granada, Periodista Daniel Saucedo Aranda, Granada, GR, 18071, Spain, sdamas@ugr.es, Jose Santamaria, Oscar Cordon

Image registration has been a very active research area in computer vision. There is an increasing interest on the application of metaheuristics in this field. In this contribution we introduce the use of Scatter Search with Path Relinking to solve the problem. The new proposal will be validated considering different shapes and transformations, and testing its performance with a Basic Memetic Algorithm and a classical, deterministic algorithm, ICP.

2 - SSPMO: A Scatter Search Procedure for Non-Linear Multiobjective Optimization
Julian Molina, Associate Professor, University of Malaga, campus El Ejido s./n. Fac. de CC. EE., Malaga, Ma, 29071, Spain, julian.molina@uma.es, Manuel Laguna, Rafael Martì, Rafael Caballero

We describe the development and testing of a metaheuristic procedure, base on the scatter search methodology, for the problem of approximating the efficiency frontier of nonlinear multiobjective optimization problems on continuous variables. The application of scatter search to multiobjective optimization problems has not been explored fully in the literature. We test the proposed procedure on a suite of extensively used problems in multiobjective optimization.

3 - A Scatter Search Algorithm for the Capacitated Vehicle Routing Problem
Vicente Campos, University of Valencia (Spain), C/Dr. Moliner,k 50, Burjassot, Sp, 46100, Spain, vicente.campos@uv.es, Angel Corberan

In this work a Scatter Search Algorithm for the CVRP is presented. It is based on a new procedure for combining solutions. This procedure handles the routes as items and combine them using a Path Relinking strategy. Computational results on several sets of instances are given.

4 - Controlled Pool Maintenance for Metaheuristics - An Update of Research
Peter Greistorfer, Assist. Professor, Karl-Franzens-Universität Graz, Institute of Industrial Management, Universitätsstrafle 15/G2, Graz, 8010, Austria, peter.greistorfer@kfunigraz.ac.at, Stefan Voss

Pool-oriented metaheuristics maintain reference sets of high quality solutions which are repeatedly used to guarantee a balance between diversification and intensification. We analyze major pool components and present a review of the literature. New numerical results provide strong arguments in favor of diversity of solutions over other criteria.

5 - Approximating Functions with Neural Networks and Statistics
Rafael Martì, University of Valencia, C/ Dr Moliner 50, Burjassot (Valencia), VL, 46100, Spain, rafael.marti@uv.es, Francisco Montes

Artificial neural networks (NN) have been widely used for prediction, in which an unknown function is approximated. We propose a path relinking implementation (PR) that uses GRG2 as an improvement phase for NN training. An empirical comparison of PR with previous training methods (including tabu and scatter search), and also with the more recent statistic techniques (nonlinear and local regression, GAM and splines) shows its merit.

■ MB04

P-Plaza Court 2

Clustering Algorithms and Applications

Sponsor: Data Mining
Sponsored Session

Chair: T. Warren Liao, Louisiana State University, Industrial & Manufacturing Systems Engin, Baton Rouge, LA, 70803, United States, ieliao@lsu.edu

1 - Performance of Clustering Algorithms in Dynamic Scheduling
Kaushik Gune, Purdue University, School of Industrial Engineering, West Lafayette, IN, 47907, United States, kgune@purdue.edu, Yuehwern Yih

This paper focuses on performance of two clustering algorithms in scheduling of semiconductor wafer fab. Data clustering methods are used to extract scheduling knowledge that can be used real-time to make decisions on shop floor control. Competitive Neural Network and Self Organized Maps are compared by testing on a simulation model. Simulation results show that SOM works better than CNN in terms of over all performance based on cycle time, throughput and the number of tardy jobs.

2 - Finding Fuzzy Sets for Quantitative Attributes for the Mining of Fuzzy Association Rules
P.N.A. Huy, Louisiana State University, Department of Industrial Engineering, 3128 CEBA Building, Baton Rouge, LA, 70803-6409, United States, hpham15@lsu.edu, T. Warren Liao, Evangelos Triantaphyllou

The paper proposes an approach for finding fuzzy sets for the quantitative attributes in a database by using clustering techniques. Next we employ techniques for the mining of fuzzy association rules and perform a comparative study on the derived results. We discuss these algorithms and the results of our analyses.

3 - Distributed Clustering of Multivariate Time Series Data
Arun Nayar, Louisiana State University, Industrial & Manufacturing Systems Engin, Baton Rouge, LA, 70803, United States, anayar1@cct.lsu.edu, T. Warren Liao

In this paper, we present a method for parallel clustering of multivariate time series in a distributed computing environment and report some results obtained based on model-generated data.

■ MB05

P-Plaza Court 3

Polyhedral Techniques for Integer Programming

Sponsor: Optimization/ Integer Programming
Sponsored Session

Chair: Lisa Miller, University of Minnesota, 1100 Mechanical Engineering, 111 Church St. SE, Minneapolis, MN, 55113, United States, lmiller@me.umn.edu

1 - A Branch-and-cut Algorithm for a Single Machine Scheduling Problem
Ahmet Keha, Assistant Professor, Arizona State University, PO Box 875906, Tempe, AZ, 85287, United States, ahmet.keha@asu.edu

We compare computational performances of four formulations that are used to formulate single machine scheduling problems for a variety of performance measures and machine restrictions. We also introduce two families of valid inequalities for single machine scheduling problems. We conclude our presentation with computational results that represent the effectiveness of our valid inequalities.

2 - Approximate Superlinear Lifting of Continuous Variables
Jean-Philippe Richard, Assistant Professor, Purdue Universtiy, 315 N. Grant Street, West Lafayette, IN, 47906, United States, jprichar@ecn.purdue.edu

In this talk, we introduce a scheme to generate valid and facet-defining inequalities for general mixed integer polyhedra through the lifting of continuous variables. We show that this procedure is simple if the inequality to be lifted is superlinear and introduce the concept of approximate superlinear lifting. Finally, we discuss the relevance of this approximate approach in obtaining new strong inequalities for mixed integer programs.

3 - Early Estimates of the Size of Branch-and-Bound Trees
Miroslav Karamanov, Ph.D. student, Tepper School of Business at Carnegie Mellon, 5000 Forbes Ave, Pittsburgh, PA, 15213, United States, miroslav@andrew.cmu.edu, Gerard Cornuejols, Yanjun Li

We show that the time needed to solve mixed integer programming problems by branch and bound can be roughly predicted early in the solution process. We construct a procedure that can be implemented as part of an MIP solver. It is based on analyzing the partial tree resulting from running the algorithm for a short period of time, and predicting the shape of the whole tree. The procedure is tested on instances from the literature.

■ MB06

P-Plaza Court 4

Approximate Dynamic Programming

Sponsor: Optimization/Stochastic Programming
Sponsored Session

Chair: Dan Adelman, Associate Professor, University of Chicago, Graduate School of Business, 1101 East 58th Street, Chicago, IL, 60637, United States, dan.adelman@gsb.uchicago.edu

1 - Optimal Stepsizes for Approximate Dynamic Programming
Warren Powell, Princeton University, Engineering Quad, Princeton University, Princeton, NJ, United States, powell@Princeton.EDU, Abraham George

Most approximate dynamic programming algorithms obtain Monte Carlo estimates of the value function and smooth these into the current estimate using a stepsize. Stochastic stepsize formulas can be erratic, and most deterministic formulas decline too quickly producing "apparent convergence." We present an optimal stochastic formula that minimizes mean squared errors. Numerical experiments demonstrate more robust and rapid convergence than deterministic formulas.

2 - Performance Loss Bounds for Approximate Value Iteration with State Aggregation
Benjamin Van Roy, Stanford University, Terman 315, Stanford, CA, 94305, United States, bvr@stanford.edu

Sharp performance loss bounds for approximate value iteration with state aggregation exhibit an undesirable dependence on the discount factor: the performance loss can grow undbounded as the discount factor approaches one. We establish that this dependence on the discount factor vanishes if the projections used are defined with respect to the invariant distribution associated with the resulting suboptimal policy. Such a projection is motivated by temporal difference learning.

3 - Approximate DP for Networks using Constraint Reduction
Mike Veatch, Gordon College, Dept. of Mathematics, Wenham, MA, 01923, United States, veatch@gordon.edu

After formulating some approximate LPs for stochastic network control problems, we demostrate that the large or infinite set of constraints reduces to a small equivalent set. Piece-wise quadratic value functions (from fluid models) and other terms designed to capture stochastic effects near boundaries are considered. These methods give promising LP bounds on average cost.

4 - Relaxations of Weakly Coupled Dynamic Programs
Adam Mersereau, Assistant Professor, University of Chicago, Graduate School of Business, 1101 E 58th Street, Chicago, IL, 60637, United States, adam.mersereau@gsb.uchicago.edu, Dan Adelman

We consider a class of dynamic programming problems that are amenable to decomposition/relaxation. We compare two such techniques, namely Langrangian relaxation and the linear programming approach to approximate dynamic programming.

■ MB07

P-Plaza Court 5

Panel: Advanced Global Optimization - Scientific and Engineering Applications

Sponsor: Optimization/ Global Optimization
Sponsored Session

Chair: János D. Pintér, Pintér Consulting Services, Inc, Halifax , NS, Canada, jdpinter@hfx.eastlink.ca

1 - Advanced Global Optimization - Scientific and Engineering Applications
Kenneth Holmstrom, Sweden, hkh@tomlab.biz, Leon Lasdon, Christine Shoemaker, János D. Pintér, Zelda B. Zabinsky

In many applications, it is necessary to evaluate special functions or integrals, solve differential equations, etc. in order to find best model parameters. We review several such applications, and illustrate their solution using global optimization tools in the integrated modeling environments Mathematica and Maple.

■ MB08

P-Plaza Court 6

Graph Cuts and Connectivity

Sponsor: Optimization/ Network Optimization
Sponsored Session

Chair: Lisa Fleischer, T. J. Watson Research Center, IBM, Yorktown Heights, NY, United States, lkf@watson.ibm.com

1 - Approximating Metrics by Tree Metrics
Kunal Talwar, University of California, Berkeley, 581 Soda Hall #1776, Berkeley, CA, 94720, United States, kunal@cs.berkeley.edu, Jittat Fakcharoenphol, Satish Rao

We say a metric (X,d) is probabilistically approximated by a distribution over tree metrics with distortion α if for every pair of points, the expected tree distance is no more than α times the original distance. We show how to achieve this with distortoin $O(\log n)$ for any n point metric. This improves upon the result of Bartal who gave a bound of $O(\log n \log\log n)$ and matches the lower bound. This has applications to many approximation and online algorithms.

2 - On Polyhedral Relaxations for the Maximum Cut Problem
Alantha Newman, student, MIT, 32 Vassar St., 32-626, Cambridge, MA, 02139, United States, alantha@theory.lcs.mit.edu

We consider three polyhedral relaxations for the maximum cut problem. We give a new, simple proof of a theorem of Barahona that states that the metric polytope of a general graph is a projection of the metric polytope of the complete graph. We then give a new, simple proof of a theorem of Poljak that states that, for any non-negative cost function, the optimal objective value over the relaxation of the bipartite subgraph polytope equals the optimal objective value over the metric polytope.

3 - Algorithms for Approximating the Smallest k-Edge Connected Spanning Subgraph
Harold Gabow, United States, hal@cs.colorado.edu

The smallest k-ECSS problem is to start with a given graph and an integer k, and find a spanning subgraph that is k-edge connected and contains the fewest possible number of edges. We examine combinatorial and LP-based approximation algorithms, achieving the best-known approximation ratios in both cases. The LP-based algorithms achieve approximation ratio approaching 1 as k tends to infinity, at the expense of greater computation time.

■ MB09

P-Plaza Court 7

Honoring Pete Veinott: Dynamic Programming

Cluster: Honoring Pete Veinott
Invited Session

Chair: Martin L. Puterman, Professor, Sauder School of Business, University of British Columbia, 2053 Main Mall, Vancouver, BC, V6T1Z2, Canada, marty@coe.ubc.ca

1 - On the Robustness of the Holmstrom-Milgrom Intertemporal Linear Contract Result
Bruce Miller, UCLA, Anderson Graduate School of Management, Los Angeles, CA, 90095, United States, bruce.miller@anderson.ucla.edu, Joseph Chen

Holmstrom and Milgrom (1987) show that a linear contract is optimal when (1) the agent makes decisions continuously over the time interval [0,1], (2) output is described by Brownian motion and (3) the agent has an exponential utility function. To examine the robustness of their linear contract result we discretize the interval [0,1] into I equal intervals. Numerical simulations suggest that their result is highly robust to the first two assumptions but only modestly robust to the third.

2 - Optimal Exit from a Deteriorating Project with Noisy Returns
Steven Lippman, Professor, Anderson School of Business, UCLA, 110 Westwood Plaza, Suite D517, PO Box 951481, Los Angeles, CA, 90095, United States, steven.lippman@anderson.ucla.edu

We determine when to terminate/exit an investment whose cumulative return follows a Brownian motion with drift mu and volatility sigma^2. After an unobserved exponential amount of time, the drift drops to mu_Low < 0. Using SDE, we show that it is optimal to exit as soon as the posterior probability of being in the "low" state falls to a given critical number. Applications to technological improvement are given.

3 - Harmonic Dynamic Programs
Matthew J. Sobel, Professor, Weatherhead School of Management, Case Western Reserve University, 10900 Euclid Ave., Cleveland, OH, 44106-7235, United States, matthew.sobel@case.edu, Wei Wei

We identify new sufficient conditions for dynamic programs to have myopic optima. One set of conditions includes a reward function that is homogeneous of degree m. The results are prompted by work of Veinott and others.

4 - Understanding Bias Optimality in MDPs
Martin L. Puterman, Professor, Sauder School of Business, University of British Columbia, 2053 Main Mall, Vancouver, BC, V6T1Z2, Canada, marty@coe.ubc.ca, Mark Lewis

This talk will survey research on bias optimality with the objective of providing insight into what this important concept means and why it is useful.

■ MB10

P-Plaza Court 8

Stochastic Models

Sponsor: Transportation Science & Logistics
Sponsored Session

Chair: Jeffrey Ohlmann, Assistant Professor, University of Iowa, 108 John Pappajohn Business Building, 21 E. Market Street, Iowa City, IA, 52246, United States, jeffrey-ohlmann@uiowa.edu

1 - An Approximate Dynamic Programming Approach for the Vehicle Routing Problem with Stochastic Demands
Clara Novoa, Ph.D.Student, Lehigh University, Industrial and Systems Engineering, Bethlehem, PA, 18015, United States, cmr5@lehigh.edu, Robert Storer

We develop new rollout-based approximate DP's for the dynamic single-vehicle routing problem with stochastic demands. We study the rollout algorithm under different a priori solutions, look-ahead policies, and fast pruning schemes. We investigate estimating the cost-to-go with simulation and stratified sampling in addition to direct approaches. We compare our solutions to the perfect information case (averages of exact a posteriori solutions for sampled VRP's), and to previous methods.

2 - Dynamic Waiting Strategies when Customer Locations are Known
Barrett Thomas, Asst. Professor, Dept. of Management Sciences, University of Iowa, 108 Pappajohn Business Building, University of Iowa, Iowa City, IA, 52240-1000, United States, barrett-thomas@uiowa.edu

Consider a driver leaving a depot and knowing only a subset of the customers who will be served. Customers who request service while the vehicle is enroute are inserted into a preexisting route. At any decision epoch, the driver can choose to wait for a prespecified period of time or to travel to the next customer. The objective is to maximize the expected number of customers served. We present results on the structure of the optimal policy and explore the performance of heuristics.

3 - A Dynamic, Time-Dependent and Stochastic Evacuation Problem
Sathaporn Opasanon, University of Maryland, Dept. of Civil & Environmental Eng., 1173 Glenn Martin Hall, College Park, MD, 20742, United States, opasanon@umd.edu, Elise Miller-Hooks

A conceptual framework and algorithmic steps are proposed for determining optimal evacuation paths in capacitated dynamic networks, where arc traversal times are time-dependent and arc capacities are discrete random variables with time-varying distributions. The proposed algorithm can facilitate safer evacuation of a building in the event of military attack, fire, natural disaster, or other circumstances warranting quick escape.

4 - Fleet Management with Stochastic Deterioration and Budget Constraints
Jeffrey Ohlmann, Assistant Professor, University of Iowa, 108 John Pappajohn Business Building, 21 E. Market Street, Iowa City, IA, 52246, United States, jeffrey-ohlmann@uiowa.edu, James Bean

We present a fleet replacement model considering stochastic deterioration and budget limits. We formulate the problem as a nonlinear mixed integer program and utilize maintenance data from trucking companies to estimate problem parameters. We develop a penalty-based heuristic method to determine near-optimal replacement policies over a finite planning horizon.

■ MB11

P-Governor's Square 9

Integrated Urban Transportation Modeling Approaches

Sponsor: Transportation Science & Logistics
Sponsored Session

Chair: James Moore, Professor and Chair, Daniel J. Epstein Department of Industrial and Systems Engineering, GER 240, MC 0193, USC, University of Southern California, Los Angeles, CA, 90089-0193, United States, jmoore@almaak.usc.edu

1 - Selecting Traffic Counting Locations in a Transportation Network for O-D Trip Table Estimation
Piya Chootinan, Dept. of Civil & Environmental Engineering, Utah State University, Logan, UT, 84322-4110, United States, piyachoo@cc.usu.edu, Anthony Chen

One application of the traffic counting location problem is to optimize the selection of traffic counts in a transportation network to improve the quality of origin-destination (O-D) trip table estimates. In this talk, we present an integer programming formulation based on the O-D interception rule. Variants of the basic model are also discussed.

2 - Detailed Convergence Properties of the Traffic Assignment Problem
David Boyce, Professor, Department of Civil and Environmental Engineering, Northwestern University, 2149 Grey Avenue, Evanston, IL, 60201, United States, dboyce@uic.edu, Biljana Dekic, Hillel Bar-Gera

We investigate detailed convergence properties of solutions to the Traffic Assignment Problem for the cases of fixed and variable origin-destination flows. Our aim is to identify practical criteria for the desired precision of the solution. Using case studies, network-specific, spatial convergence characteristics are identified and guidelines for practice proposed.

3 - Solving the Non-additive Traffic Equilibrium Problem with Capacity Constraints

Zhong Zhou, Dept. of Civil & Environmental Engineering, Utah State University, Logan, UT, 84322-4110, United States, zhongzhou@cc.usu.edu, Anthony Chen

In this talk, we present a modified alternating direction method for solving the non-additive traffic equilibrium problem with capacity constraints. Route cost structure is non-additive. That is, the cost incurred on each route is not simply the sum of the link costs on it. Capacity constraints are also considered when solving the traffic assignment problem. Numerical results for a congestion pricing application will be presented.

4 - Modeling Urban Taxi Services on Stochastic and Dynamic Transportation Network

Jun-Seok Oh, Assistant Professor, Western Michigan University, Department of Civil and Construction Eng, Kalamazoo, MI, 49008-5316, United States, jun.oh@wmich.edu, Hyungmyung Kim, R. Jayakrishnan

This study models a taxi service system in urban area considering taxi drivers' day-to-day experience on the transportation network. The model considers the stochastic and dynamic transportation network and various levels of drivers' network knowledge. This study analyzes the optimal size of taxi service systems and effects of taxi company's information systems by considering quality and operational efficiency of taxi services from both passengers and taxi operator's point of view.

5 - Estimating Link Travel Times in Stochastic Networks

Yueyue Fan, Department of Civil and Environmental Engineering, University of California, Davis, CA, 95616, United States, yyfan@ucdavis.edu, James Moore

The problem of estimating the probability distribution functions (PDF) of link travel times based on field data collected by point detectors is discussed in this paper. Car occurrence at each point detector is treated as a time series. Given the auto-correlation and cross-correlation function of the two time series of car occurrence at the starting and ending nodes of the studied link, the problem is formulated as a Fredholm integral equation if only one link is considered, or a matrix integral equation in the network context where multiple links are studied simultaneously. Simple numerical examples are provided to demonstrate the feasibility of the solution scheme of solving the integral equation through linear algebra.

■ MB13

P-Governor's Square 11

OR Applied to Railroads III

Sponsor: Railroad Applications
Sponsored Session

Chair: Michael Gorman, Professor, Univerisity of Dayton, School of Business, Dept of MIS/OM/DSC, 300 College Park, Dayton, OH, 45469, United States, Michael.Gorman@notes.udayton.edu

1 - Maintenance Gang Scheduling

Michael Gorman, Professor, Univerisity of Dayton, School of Business, Dept of MIS/OM/DSC, 300 College Park, Dayton, OH, 45469, United States, Michael.Gorman@notes.udayton.edu

We explore the annual planning of rail maintenance gang scheduling at BNSF railway. The problem is akin to job scheduling and allocation on parallel machines with sequence-dependent setup times. The problem is further complicated through various precedence, sequencing, and simultaneity constraints between jobs. We consider a number of formulations and solution methodologies to this problem, and make recommendations as to the most appropriate approach to solving the problem.

2 - Stage-wise Approach to Solve Train Scheduling Problem

Krishna Jha, Research Director, Innovative Scheduling Systems, 2153 SE Hawthorne Rd, Suite 128, Gainesville, FL, 32641, United States, kcjha@ufl.edu

For a typical US railroad, the train scheduling problem is extremely large and complex combinatorial optimization problem. We decompose the problem in four stages, which makes the size of sub-problems manageable in every stage. We have developed network flow based heuristics to solve the sub-problems. We also present the computational results for a real life problem instance.

3 - Railroad Line Capacity Simulation Modeling

Edwin R "Chip" Kraft, Director, Operations Planning, Transporation Economics + Management Systems, Inc., 116 Record St, Frederick, Md, 21701, United States, ckraft@temsinc.com

MISS-IT is a new event-based line capacity model for testing the effects of additional infrastructure, signaling systems, or revised operating and dispatch practices. The presentation will focus on how MISS-IT simulates a moving-block PTC environment, as well as recent installation of "backtracking" logic to ensure development of feasible train dispatching plans.

■ MB14

P-Governor's Square 14

Dissertation Award

Sponsor: Technology Management
Sponsored Session

Chair: Diane Bailey, United States, debailey@leland.stanford.edu

1 - Allocating Favorable Work Contexts in Industrial R&D: The Role of Race/Ethnicity, Gender, Family Characteristics, and Organizational Setting

Corinne Post, Assistant Professor of Management, Lubin School of Business, PACE University, 861 Bedford Road, Pleasantville, NY, 10570, United States, cpost@pace.edu

Meritocratic factors have not fully explained why women and minorities perform less well and are promoted less quickly than men and whites. I examine what work contexts help differentiating low- and high-performers; whether inequalities in access to work contexts help explain those differences; and whether inequalities are pervasive across companies.

■ MB15

P-Governor's Square 15

Data Analysis via Combinatorics, Optimization and Logic

Cluster: Data Mining and Knowledge Discovery
Invited Session

Chair: Peter L. Hammer, Director of RUTCOR, Rutgers University, 640 Bartholomew Road, Piscataway, NJ, 08854, United States, hammer@rutcor.rutgers.edu

1 - Pattern-based Feature Selection in Genomics and Proteomics

Gabriela Alexe, RUTCOR - Rutgers University Center for Operations Research, 640 Bartholomew Road, Piscataway, NJ, 08854, United States, alexe@rutcor.rutgers.edu, Sorin Alexe, Peter L. Hammer, B. Vizvari

We describe an iterative feature selection procedure. The iterative application of a filtering stage (which uses combinatorial, statistical and information-theoretical criteria) with an evaluation of variables based on the frequency of their participation in patterns, leads to a Pareto-optimal "support set", which balances the conflicting criteria of simplicity and accuracy.

2 - A Boolean Measure of Similarity for Data Mining

Martin Anthony, London School of Economics & Political Science, London, WC2A 2AE, United Kingdom, m.anthony@lse.ac.uk

We propose a way of measuring the similarity of a Boolean vector to a set of Boolean vectors, motivated in part by data mining problems. We relate the similarity measure to one based on Hamming distance and develop from this similarity measure ways of quantifying the `quality' of a dataset.

3 - Maximum Patterns in Logical Analysis of Data

Tiberius Bonates, RUTCOR - Rutgers Center for Operations Research, 640 Bartholomew Road, Piscataway, NJ, 08854, United States, tbonates@rutcor.rutgers.edu, Peter L. Hammer, Alex Kogan

The problem of finding patterns of maximum prevalence is formulated as an integer linear program and solved by using a new type of heuristics. The effectiveness of the proposed heuristic and the accuracy of maximum pattern-based models are shown through numerical experiments on benchmark machine learning datasets.

4 - Identification of Plausibly Misclassified Observations

Irina Lozina, RUTCOR - Rutgers University Center for Operations Research, 640 Bartholomew Road, Piscataway, NJ, 08854, United States, ilozina@rutcor.rutgers.edu, Tiberius Bonates, Peter L. Hammer, Alex Kogan

Plausibly misclassified observations appearing in classification datasets are identified using a combinatorial algorithm, and suspected misclassifications are checked using Logical Analysis of Data (LAD) methods. Empirical evaluation on benchmark machine learning datasets and on real-life problems strongly confirms the correctness of the conclusions.

■ MB16

P-Governor's Square 17

Tutorial: Logic-based Techniques for Linear and Nonlinear Discrete/ContinuousOptimization

Sponsor: Computing Society
Sponsored Session

Chair: Ignacio Grossmann, R.R. Dean University Professor, Carnegie Mellon University, Department of Chemical Engineering, Pittsburgh, PA, 15213, United States, grossmann@cmu.edu

1 - Logic-based Techniques for Linear and Nonlinear Discrete/Continuous Optimization
Ignacio Grossmann, R.R. Dean University Professor, Carnegie Mellon University, Department of Chemical Engineering, Pittsburgh, PA, 15213, United States, grossmann@cmu.edu

We review MI(N)LP techniques, and describe Generalized Disjunctive Programming (GDP) for representing discrete decisions with disjunctions and logic propositions. We present relaxations for branch and cut and decomposition methods, and establish their properties. The global solution of nonconvex GDPs is discussed, as well as the integration with constraint programming.

■ MB17

P-Directors Row E

Duncan Luce's 2003 Ramsey Award Session

Sponsor: Decision Analysis
Sponsored Session

Chair: Ralph Keeney, Fuqua School of Business, Duke University, Durham, NC, 27708, United States, keeney@duke.edu

1 - Duncan Luce's Contributions to Decision Analysis
Detlof von Winterfeldt, University of Southern California, School of Policy, Planning, and Development, Lewis Hall, 312 D, Los Angeles, CA, 90089, United States, winterfe@usc.edu

This presentation will review Duncan Luce's contributions to decision analysis in four areas: game theory, probabilistic choice theory, conjoint measurement theory, and generalized expected utility theory. These contributions influenced individuals and the whole field in many important ways, as illustrated by several examples in each of the four areas. (30 minutes)

2 - Was Savage's Formulation of the Decision Problem Too Limiting?
R. Duncan Luce, University of California, School of Social Sciences, Irvine, CA, United States, rdluce@uci.edu

Savage's neat formulation, acts over "states of nature" ordered by preference, forces SEU given suitable monotonicity assumptions. Moreover, it lacks a natural zero, ways to compare local gambles and to discuss having two (or more) gambles, and a principled meaning for utility differences. I sketch attempts to overcome these limitations. (60 minutes)

■ MB18

P-Directors Row H

Multicriteria Decision Making

Contributed Session

Chair: Eugene Hahn, Salisbury University, 1101 Camden Ave, Salisbury, MD, 21801, United States, edhahn@salisbury.edu

1 - Research and Development Project Selection Based on Multicriteria Decision Analysis
Adiel Teixeira de Almeida, Professor, Federal University of Pernambuco, Caixa Postal 7462, Recife, PE, 50.630-970, Brazil, aalmeida@ufpe.br, Ana Paula C. S. Costa, Caroline M. G. Miranda

The paper presents a multicriteria decision model for research and development (R&D) project selection. The criteria considered are: project cost, success probability, impact on the quality of product, impact on the productivity of the system, and impact on strategic issues. The choice of the multicriteria method is treated as a modelling issue. Several approaches have been considered, including MAUT, VIP Analysis and ELECTRE. Modelling considerations and numerical results are presented.

2 - An Enumerative Cutting Plane Algorithm for Integer Linear Vector Optimization
Walter Habenicht, Professor Dr., University of Hohenheim, Industriebetriebslehre (510A), Stuttgart, 70593, Germany, habenicht@uni-hohenheim.de

In this paper we present a new algorithm for integer linear vector optimization. It is a hybrid interactive approach which combines the use of cuttingplanes with enumeration. We outline the algorithm and present computational results.

3 - A Survey of Approximation Methods in Multiobjective Programming
Margaret Wiecek, Professor, Clemson University, Department of Mathematical Sciences, Clemson, SC, 29631, United States, wmalgor@clemson.edu, Stefan Ruzika

Deterministic approaches to approximate the efficient and Pareto sets of multiobjective programs are reviewed. Special attention is given to approximating structures, methods generating Pareto points, and approximation quality. The survey covers 50 articles published since 1975.

4 - Some Ranking Irregularities when ELECTRE Methods are used to Solve MCDM Problems
Xiaoting Wang, Louisiana State University, 3550 Nicholson Dr. Apt. 2118, Baton Rouge, LA, 70802, United States, xwang8@lsu.edu, Evangelos Triantaphyllou

Recent research revealed that some types of ranking irregularities might happen when some ELECTRE methods are used to solve MCDM problems. It was already known that similar irregularities happen with some other well-known MCDM methods, such as the AHP and its additive variants. In this presentation we explore in depth why these irregularities occur.

5 - Coming to Consensus in Multiple-expert Stochastic Multicriteria Decision Making
Eugene Hahn, Salisbury University, 1101 Camden Ave, Salisbury, MD, 21801, United States, edhahn@salisbury.edu

In multiple-expert stochastic multicriteria decision making scenarios, it is typically necessary to reconcile different opinions regarding the alternatives and criteria. Before such activities can take place, it is important to understand the nature of the differences in opinion. We describe some measures for identifying similarity and dissimilarity in opinion under uncertain judgments. The measures are illustrated using judgments regarding quality improvement initiatives.

■ MB19

P-Directors Row F

Semiconductor Industry

Contributed Session

Chair: Frank Bass, McDermott Professor of Management, University of Texas at Dallas, P.O. Box 830688 SM32, Richardson, TX, 75083-0688, United States, mzjb@utdallas.edu

1 - Moore's Law and The Experience Curve: The Economics of Bits and Chips
Frank Bass, McDermott Professor of Management, University of Texas at Dallas, P.O. Box 830688 SM32, Richardson, TX, 75083-0688, United States, mzjb@utdallas.edu, Portia Bass

Digital products and technologies differ in fundamental ways from traditional products. The economic consequences of Moore's Law and learning have not been extensively analyzed. In this paper we show that it is possible to derive economic relationships based on learning with profound implications on the basis of properties of digital technologies. Based on these relationships we develop an econometric analysis of demand, supply and price relationships for DRAM (dynamic random access memory).

■ MB20

P-Room 3304

Joint Session Health Applications/ Computing: Computational Biology and Bioinformatics

Sponsor: Health Applications, Computing
Sponsored Session

Chair: J. Macgregor Smith, Professor, University of Massachusetts, Dept. of MIE, Elab Building, Amherst, MA, 01003, United States, jmsmith@snail.ecs.umass.edu

1 - Protein Tertiary Structure Characterization using Topology
Bala Krishnamoorthy, Assistant Professor, Washington State University, Dept. of Mathematics, Pullmann, WA, 99164, United States, kbala@wsu.edu, Scott Provan, Alexander Tropsha

Proteins are represented by a series of subcomplexes of the Delaunay complex, called alpha complexes, whose vertices are the alpha-carbon atoms of residues. Boundaries of neighborhoods of contiguous strands of varying lengths are defined as subcomplexes of subdivided alpha complexes. Topologically persistent features of boundary complexes and their relative persistences characterize tertiary structural motifs. Initial results of protein classification using these motifs will be presented.

2 - Haplotyping and Minimum Diversity Graphs
Allen Holder, Trinity University, Department of Mathematics, One Trinity Place, San Antonio, TX, 78212-7200, United States, aholder@trinity.edu, Courtney Davis

Haplotyping is the process of reconstructing the genetic information from prior generations. We cast the haplotyping problem into the realm of graph theory by studying a mathematical construct, called a diversity graph, that describes the problem. In particular, we investigate the problem of finding the minimum number of haplotypes that can reconstruct a population. The graph theory representation provides significant insight if the number of mates is restricted.

3 - Steiner Minimal Trees and Folded and Misfolded Protein Structures

J. Macgregor Smith, Professor, University of Massachusetts, Dept. of MIE, Elab Building, Amherst, MA, 01003, United States, jmsmith@ecs.umass.edu

The Steiner Minimal Tree (SMT) problem determines the minimal length network for connecting a given set of terminals in 3-dimensional space. SMTs are also useful in modeling minimum energy configurations. We demonstrate the use of SMTs for predicting and evaluating low energy confirmation structures for folded and misfolded proteins in the protein folding problem.

■ MB21

P-Room 3302

Threats To Life and Limb

Sponsor: Public Programs and Processes
Sponsored Session

Chair: Arnold Barnett, George Eastman Professor of Management Science, MIT, E53-379, 77 Massachusetts Ave, Cambridge, MA, 02139, United States, abarnett@mit.edu

1 - Vaccinating Children Against Drug Abuse: Safe and Effective but a Lousy ROI?

Jonathan Caulkins, Professor, CMU Heinz, 5000 Forbes Ave, Pittsburgh, PA, 15213, United States, caulkins@cmu.edu

Immunotherapies are being developed against cocaine, nicotine, and other drugs. What could be better than vaccinating children against drug abuse with an FDA-approved safe and effective immunotherapy? From a societal benefit-cost analysis, doing nothing or even vaccinating after people become addicted might be. This talk explains why.

2 - Performance Assessment of a Two-Level Security Screening System for Air Travelers

Alfred Blumstein, The Heinz School, Carnegie Mellon University, Pittsburgh, PA, 15213, United States, ab0q@andrew.cmu.edu

TSA is implementing and evaluating a Registered Traveler (RT) System at five airports. We analyze a SWIFT (Short-Wait Integrated Flight Travel) design based on RT principles. We estimate demand, time savings to registered and non-registered travelers, and other airport processing enhancements. The system has considerable potential, especially at airports like Pittsburgh.

3 - Is There a Doctor in the House?

Linda Green, Columbia University Graduate School of B, New York, NY, 10027, United States, lvg1@columbia.edu

Recent media reports have called attention to the problem of emergency room overcrowding and the resulting delays for inpatient beds. However, the most critical component of delay is the wait for initial treatment by a physician. Using the example of a major urban hospital, this talk examines the major reasons for this delay, including the complexities of staffing in the face of arrivals that vary substantially over the day and the week.

4 - Airlines as Baseball Players: Another Approach to Evaluating Air Carrier Safety Records

Arnold Barnett, George Eastman Professor of Management Science, MIT, E53-379, 77 Massachusetts Ave, Cambridge, MA, 02139, United States, abarnett@mit.edu

Within the First World, observed differences across airlines in passenger death risk are almost never statistically significant. But, given the rarity of fatal crashes, even a large difference is unlikely to achieve significance. We discuss an approach to analyzing airline safety records that was inspired by the way the Oakland A's evaluate individual baseball players. Is it crazy? We report; you decide.

■ MB22

P-Room 3312

Joint Session Location Analysis/Minority Isues/ Public Programs and Processes: Location Modeling V

Sponsor: Location Analysis, Minority Issues, Public Programs and Processes
Sponsored Session

Chair: Michael Johnson, Associate Professor of Management Science and Urban Affairs, H. John Heinz III School of Public Policy and Management, Carnegie Mellon University, 5000 Forbes Ave., Pittsburgh, PA, 15213-3890, United States, johnson2@andrew.cmu.edu

1 - On Feasibility of Maximal Diameter Zone Design

Anton Ovchinnikov, Ph.D Candidate in Operations Management, Joseph L. Rotman School of Management, University of Toronto, 105 St. George street, Toronto, ON, M5S 3E6, Canada, anton@rotman.utoronto.ca, Oded Berman, Dmitry Krass

We address the problem of whether a graph can be partitioned into sub-graphs (zones), so that the diameter of each zone is bounded by a specified upper bound. This problem arises in many zoning and clustering contexts. Results for exact and heuristic approaches to this problem are presented.

2 - Covering Planar Trees with Discs

Pitu Mirchandani, Professor, University of Arizona, Dept. of Systems and Industrial Eng., PO Box 210020, Tucson, AZ, 85721-0020, United States, pitu@sie.arizona.edu, Andrea Pacifici, Mariagrazia Meconi, Alessandro Agnetis

A set of radar antennae are to be located to cover all points on a river. Assume there are p different radar types, location costs include fixed and variable components, and the river is represented by a tree network over a Euclidean plane. We show that the problem of selecting and locating a set of antennae at minimum cost is NP-hard even on a single link network with a quadratic cost function. Special polynomially-solvable cases and heuristics are illustrated.

3 - Community Values Regarding Location of Community Corrections Centers

Lacy Vong, Master's Candidate, Heinz School of Public Policy and Management, Carnegie Mellon University, 5000 Forbes Ave., Pittsburgh, PA, 15213-3890, United States, lvong@andrew.cmu.edu, Michael Johnson

Community corrections centers are facilities that assist in the reintegration of offenders into civil society. Location of CCCs in residential neighborhoods is a controversial and difficult task. This paper presents results from field research into stakeholder values that may result in OR-based planning models that are more realistic and politically feasible than those based solely on a social planner's perspective.

4 - Evaluation of Multi-Criteria Decision Models for Computer-Assisted Housing Search

Michael Johnson, Associate Professor of Management Science and Urban Affairs, H. John Heinz III School of Public Policy and Management, Carnegie Mellon University, 5000 Forbes Ave., Pittsburgh, PA, 15213-3890, United States, johnson2@andrew.cmu.edu

Tenant-based housing vouchers enable low-income clients to choose private-market rental housing that best suits their needs. Cuts in housing subsidies have resulted in an increased need for clients to successfully use housing vouchers. This paper presents results from field research regarding the ability of clients to productively use different multi-criteria decision models to identify and rank destination alternatives for computer-assisted housing mobility counseling.

■ MB23

P-Room 3354

Strategic Airlift Transportation - Recent Analyses and Current Insights

Sponsor: Military Applications
Sponsored Session

Chair: Robert Brigantic, Assistant Professor of Operations Research, US Air Force, AFIT/ENS, WPAFB, OH, 45433, United States, robert.brigantic@afit.edu

1 - Examination of Optimal Range/Payload Metrics for Strategic Airlift Aircraft

Robert Brigantic, Assistant Professor of Operations Research, US Air Force, AFIT/ENS, WPAFB, OH, 45433, United States, rbrigant@sbcglobal.net, Kenneth Greenstreet

The U.S. Air Force uses range/payload charts to compute strategic airlift aircraft payloads over set distances. However, these charts do not account for potential weather patterns affecting an aircraft at cruise altitude nor required reserve fuel. This research examines fuel requirements for the C-5 and C-17 operating at various flight levels and subject to historical winds and temperature deviations. A methodology is presented to compute maximum C-5 and C-17 payloads under realistic conditions.

2 - Probability Distribution Analysis of Air Mobility Planning Factors

Robert Brigantic, Assistant Professor of Operations Research, US Air Force, AFIT/ENS, WPAFB, OH, 45433, United States, robert.brigantic@afit.edu, Dana Pelletier

Air mobility planning factors are used by the U.S. Air Force to estimate force closure and to determine force mix requirements. Current planning factors are historical averages from Operation Desert Storm/Shield. Payload and ground time data from Operations Enduring Freedom/Iraqi Freedom were analyzed determine if published planning factors accurately portray experience from these recent operations. Theoretical probability distributions were also fitted to these data and will be presented.

3 - Airport Simulation Tool Assessment of Aerial Port Capability to Support the Global War on Terror
Phil Collins, Director, Modeling & Simulation, Sumaria Systems, Inc., 1728 Corporate Crossing, Suite 1, O'Fallon, IL, 62269, United States, pcollins@sumaria.net, Norm Drabek, Andrea Drabek

In the Global War on Terrorism the DOD is looking to extend the reach of the defense transportation system. The air transportation network in particular is crucial since it often provides the only means to project power early in a scenario. The potential of many locations are being analyzed using the Airport Simulation Tool for use in future operations documenting limiting factors, sizing of transportation enablers, and the potential for capital improvements to improve overall throughput.

4 - Strategic Airlift Munitions Planning Factors
Alan Johnson, Associate Professor, US Air Force, AFIT/ENS, WPAFB, OH, 45434, United States, tamnalan@earthlink.net, John Bulldis

Our research identifies possible improvements for the strategic airlift movements of munitions from the continental United States through en route air bases to locations worldwide. We specifically examine the airlift issues associated with hot cargo pad scheduling, logistics information systems capabilities, host nation coordination at en route bases, emerging operational capabilities such as the Army's Stryker Brigade, and standardization of related publications.

5 - Stryker Brigade Airlift Deployment
Alan Johnson, Associate Professor, US Air Force, AFIT/ENS, WPAFB, OH, 45433, United States, alan.johnson@afit.edu, Matt Gill

We investigate the closure time necessary to deploy an Army Stryker Brigade via strategic airlift for 56 origin-destination scenarios—a relook at a related 2002 study by US Transportation Command analysts. We use a Monte Carlo-based spreadsheet approach coupled with updated planning factors and Stryker information as inputs. This presentation reviews our purpose, methodology, and progress to date.

■ MB24

P-Room 3402

Student Research Paper Competition

Sponsor: Financial Services
Sponsored Session

Chair: Suresh Nair, Professor, University of Connecticut, School of Business, Storrs, CT, 06269, United States, suresh.nair@uconn.edu

1 - Claim Strategy, Market Signal and (under)Development of Cyber Insurance Market
Tridib Bandyopadhyay, University of Texas at Dallas, United States, tridib@utdallas.edu

Despite the increasing dependence of firms on information assets, a mature market for cyber insurance is yet to emerge. We argue that financial reporting of cyber insurance claims should send an adverse signal to the stock market and give rise to an interesting phenomenon wherein a firm, under certain circumstances, could "under claim" the loss due to a cyber attack. We develop a control theoretic model that attempts to explain the observed lack of a developed cyber insurance market.

2 - Optimal Static-Dynamic Hedges for Exotic Options
Aytac Ilhan, The University of Oxford, 24-29 St. Giles', The Mathematical Institute, Oxford, OX1 3LB, United Kingdom, ilhan@maths.ox.ac.uk

We study optimal hedging of exotic options using a combination of a static position in standard options and dynamic trading of the underlying asset. In a general market model, the investor is assumed to maximize her expected utility given the market prices of options. We give conditions that guarantee the existence and uniqueness of a solution to the problem by studying the convexity of the value function, and discuss computational approaches within the context of stochastic volatility models.

3 - Does Market Risk Capital Requirement Affect Bank Behavior?
Leonard Kofman, Ph.D Candidate, Industrial and Operations Engineering - University of Michigan, 1205 Beal Ave, Ann Arbor, MI, 48105, United States, lkofman@umich.edu

The Basel Accord sets minimum capital requirements on both credit and market risk. In this paper we analyze the effect of market risk on banks' behavior. We find that the main effect of the market risk requirement is to curtail excessive investment when banks are doing well and there is almost zero effect on companies that are close to bankruptcy. Therefore, the market risk requirement has only a small effect on banks' default probabilities and in this sense the requirement is inefficient

4 - Joint Production and Financing Decisions: Modeling and Analysis
Xiaodong Xu, Northwestern University, United States, xdxu@northwestern.edu

We develop models to make production and financing decisions simultaneously in the presence of demand uncertainty and market imperfections. We find firms' investment and leverage decisions are negative correlated. Sensitivity analysis indicates that a traditional all equity manufacture company can improve its performance significantly by making real and financial decisions together.

5 - Behavioral Modeling in Optimal Investment-Consumption Decisions for Long-term Financial Planning
Lepeng Li, Rensselaer Polytechnic Institute, 110 8th Street, Troy, NY, 12180, United States, lepeng@alum.rpi.edu

This paper develops a modeling framework that incorporates behavioral aspects for an individual planner's consumption, saving and investment decisions for long-term financial planning. Some well-observed behavioral aspects in preferences are discussed and incorporated in an optimization framework for the creation of more robust decision-aid systems for long-term financial planning. Computational results are demonstrated for the tradeoff between immediate consumption and retirement savings.

■ MB25

P-Room 3404

Joint Session Education/OR in Sports: SpORts in the OR Classroom I

Sponsor: Education (INFORM-ED) SPONSORED/INVITED, OR in Sports
Sponsored Session

Chair: James Cochran, Assistant Professor, Louisiana Tech University, P. O. Box 10318, Ruston, LA, 71272, United States, jcochran@cab.latech.edu

1 - Teaching Markov Chains Using Baseball
Joel Sokol, Assistant Professor, Georgia Institute of Technology, School of ISyE, Georgia Institute of Technology, Atlanta, GA, 30332-0205, United States, jsokol@isye.gatech.edu

We show how baseball can be used to provide an intuitive wrap-up of the Markov chain module in introductory OR courses. The baseball example provides an opportunity to discuss issues of modeling, interpretation, relevance, and implementation.

2 - How Many Games Should a Playoff Series Have?
David Goldsman, Professor, Georgia Institute of Technology, 765 Ferst Dr., NW, Atlanta, GA, 30332, United States, sman@isye.gatech.edu, Seong-Hee Kim

Suppose that two teams enter a playoff series such as the NBA Finals or the World Series. The goal of the series is to determine which of the two teams is better. How long should the series be in order to make the correct determination with a high, pre-specified probability? We formulate and discuss an indifference-zone selection procedure to answer this question.

3 - Simulating the NHL Regular Season and Playoffs to Motivate Student Interest in OR/MS
Armann Ingolfsson, University of Alberta, School of Business, Edmonton, AB, T6G 2R6, Canada, armann.ingolfsson@ualberta.ca

Monte Carlo simulation models of regular season and playoff games in the National Hockey League can be used to motivate students who are sports fans to study OR/MS models. I describe how such models can be implemented in a spreadsheet, how we have used them in our courses, and how students have reacted to them.

4 - Using Strat-O-Matic Board Games to Teach Basic Probability for Statistics
James Cochran, Assistant Professor, Louisiana Tech University, P. O. Box 10318, Ruston, LA, 71272, United States, jcochran@cab.latech.edu

We demonstrate how to use the popular Strat-O-Matic board games to explain various basic probability concepts. Concepts illustrated include classical vs. relative frequency approach to assigning probabilities, discrete probability distributions (especially the discrete uniform distribution), transformations and sample spaces, the laws Of multiplication and addition, conditional probability, randomization and independence, and Bayes' theorem.

■ MB26

P-Room 3412

Analytical Approaches for Manufacturing Systems

Cluster: Stochastic Models for Manufacturing Systems
Invited Session

Chair: Ananth Krishnamurthy, Assistant Professor, Rensselaer Polytechnic Institute, Dept. of DSES, 110 8th Street, Troy, NY, 12180, United States, krisha@rpi.edu

1 - A Customer Threshold Property for Closed Finite Queueing Networks

Mustafa Yuzukirmizi, Ph.D Student, Department of Mechanical and Industrial Engineering, University of Massachusetts, Elab Building, Amherst, MA, 01003, United States, myuzukir@ecs.umass.edu, J. Macgregor Smith

We present a new class of finite queues in cyclic networks with production blocking. We show that with a threshold related to the number of customers in the network, these queues are insensitive to the allocation of buffers and the order of the stations. We also illustrate that, the problem can be reducible in the number of customers with an equivalent finite queue. In addition, some simple and practical, yet effective approximations are presented.

2 - Solving Semi-open Queuing Networks Via Matrix-Geometric Methods

Sunderesh Heragu, Professor, Rensselaer Polytechnic Institute, DSES Dept., CII 5015, 110, Eighth St, Troy, NY, 12180-3590, United States, herags@rpi.edu, Jing Jia

In this paper, we present a semi-open queuing network modeling approach to estimate performance measures of a manufacturing system. The model is solved via analytical matrix-geometric methods. Several variations of the single-product network are solved exactly. Computational results are shown.

3 - Incentives and Flexibility in a Decentralized Multi-product Assemble-to-Order System

Yulan Wang, Duke University, 1 Towerview Dr., Durham, NC, 27708, United States, yulan.wang@duke.edu, Gregory DeCroix, Fernando Bernstein

We consider a multi-product assemble-to-order system in which a firm buys components from several independent suppliers and controls the assembly operations. The assembler sets prices to pay for the components and the suppliers choose how much capacity to install. We analyze equilibrium properties of this system and study the value of component flexibility for the assembler.

4 - Impact of Product Variety and Heterogeneity on Kitting Process in Assembly Systems

Ananth Krishnamurthy, Assistant Professor, Rensselaer Polytechnic Institute, Dept. of DSES, 110 8th Street, Troy, NY, 12180, United States, krisha@rpi.edu, Ram Ramakrishnan

We develop efficient analytical models for the kitting process in assembly systems. We assume that a kit consists of two or more components and that components are replenished based on a kanban policy. The models are used to quantify the impact of product variety, heterogeneity and component commonality on the performance trade-offs with respect to the kitting process.

■ MB27

P-Room 3454

Staffing Large-Scale Service Systems

Sponsor: Applied Probability
Sponsored Session

Chair: Mor Armony, Assistant Professor, NYU, 44 West 4th Street #8-66, New York, NY, 10012, United States, marmony@stern.nyu.edu

1 - An LP-based Method for Staffing and Routing in Large Call Centers

Achal Bassamboo, Stanford University, 518 Memorial Way, Stanford, CA, 94305, United States, bassamboo_achal@gsb.stanford.edu, Assaf Zeevi, Michael Harrison

We consider two levels of system management in a call center with multiple customer classes and multiple agent pools: setting staffing levels, and dynamically routing calls to agents. We propose a method for staffing and routing that is based on linear programming, and show that this method is asymptotically optimal in a certain limiting parameter regime.

2 - Service Level and Service Quality: Scheduling with Multiple Objectives

Tarja Joro, Assistant Professor, University of Alberta, 3-40F Business Building, Edmonton, AB, T6G2R6, Canada, Tarja.Joro@ualberta.ca, Ignacio Castillo, Yongyue Li

In workforce scheduling, staffing cost and service quality are the central drivers. We discuss the multidimensional nature of service quality and the use of Service Level as a measurement of service quality in call center setting. Furthermore, we discuss the use of SIPP assumptions in scheduling.

3 - Intelligent Intra-Week and Intra-Day Updating of Call Forecasts

Vijay Mehrotra, Assistant Professor, San Francisco State University, College of Business, 1600 Holloway Avenue, San Francisco, CA, 94132, United States, vjm@sfsu.edu

While actual call volumes early in the week clearly impact the distribution of calls later in the week, the challenge is to understand how to best make use of this information. In this paper, we utilize historical data from several centers to examine the variability of call arrival patterns, develop a model for updating forecasts based on new information, and test this model empirically.

4 - Staffing and Control of Large Service Systems with Heterogeneous Servers

Mor Armony, Assistant Professor, NYU, 44 West 4th Street #8-66, New York, NY, 10012, United States, marmony@stern.nyu.edu, Avi Mandelbaum

Motivated by modern call centers, we consider large-scale service systems with heterogeneous servers. For such systems, we propose a joint staffing and routing rule which asymptotically minimizes staffing costs, subject to constraints on the waiting probability, as demand grows large. The proposed staffing rule adds a square-root safety service capacity to the minimum stability capacity. The resulting asymptotic regime is the so called the Quality and Efficiency Driven (QED) regime.

■ MB28

P-Room 3504

Opportunities in Bioinformatics, Drug Development and Logistics

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: Jye-Chyi Lu, Professor, Georgia Institute of Technology, 765 Ferst Drive, Campus Box 0205, Atlanta, GA, 30332, United States, jclu@isye.gatech.edu

1 - ICI: A New Approach to Explore Between-Cluster Relationships with Applications

C. F. Jeff Wu, Coca-Cola Chair in Engineering Statistics, Georgia Institute of Technology, 765 Ferst Drive NW, Atlanta, GA, 30332, United States, jeffwu@isye.gatech.edu

For gene expression data, the amount of co-regulation between clustered sets of genes will be established. This analysis will yield an alternative way of characterizing the between-gene relationship that builds upon the existing structure obtained from clustering. A procedure, dubbed ICI (Inter-Cluster Investigator), is proposed to allow the identification of negatively and positively correlated sets of objects, which may be an indication of repression or regulation in gene expression data.

2 - Visualizing Brain Function and Connectivity with Magnetic Resonance Imaging

Xiaoping Hu, Professor, Director of Biomedical Imaging Technology Center, Emory University, 531 Asbury Circle, Suite N305, Atlanta, GA, 30332-4600, United States, xhu@bme.emory.edu

Tremendous progress has been made in MRI-based methods for studying the brain. Functional MRI allows the noninvasive mapping of brain function and provides information regarding brain connectivity relevant to brain function while diffusion-tensor imaging measures neuroanatomic microstructure and connectivity. fMRI, DTI and other techniques are making MR brain imaging a rapidly growing field. This talk will provide an overview of the field and describe representative work from our lab.

3 - Opportunities of Systems Engineering in Bioinformatics

Hyoungtae Kim, Postdoctoral Fellow, Georgia Institute of Technology, School of Industrial and Systems Eng, Campus Box 0205, Atlanta, GA, 30332, United States, htkim@isye.isye.gatech.edu, Jye-Chyi Lu, Shu-Chuan Lin

This presentation provides an overview of possible opportunities for systems engineers in bioinformatics research. Several examples will be given from our on-going research with various partners in computational biology and cancer research. Grant opportunities in NIH and other agencies will be presented.

■ MB29

P-Room 3502

Forestry Applications III

Cluster: Forestry Applications
Invited Session

Chair: Stephanie Snyder, Operations Research Analyst, USDA Forest Service, North Central Research Station, 1992 Folwell Ave, St. Paul, MN, 55108, United States, stephaniesnyder@fs.fed.us

1 - Operational Forestry Harvest Scheduling
Stuart Mitchell, Lecturer, Dept of Engineering Science, University of Auckland, Private Bag 92019, Auckland, New Zealand, s.mitchell@auckland.ac.nz, David Ryan

This paper considers the Operational Forest Harvest Scheduling Problem. Over the short-term (4-8 weeks), this problem allocates harvesting crews and distributes production within a forest to satisfy customer demand. We use a novel formulation and solve this problem using column generation and constraint branching. A feature of our approach involves the interpretation of some fractional solutions of the linear relaxation. We report the results from two case studies.

2 - The Cost of Achieving Old Forest Structural Criteria on Private Land in Western Oregon
Claire Montgomery, Associate Professor, Oregon State University, Department of Forest Resources, Corvallis, OR, 97331, United States, claire.montgomery@oregonstate.edu, Greg Latta, Darius Adams

We derive stand-level prescriptions to minimize cost of managing for old growth structural attributes. We incorporate these and maximum timber value prescriptions into a timber supply model to solve for timber supply from private land in western Oregon subject to meeting forest area targets that achieve old growth structural criteria. We compute opportunity cost for several targets and time horizons. This active management approach is compared to a reserve approach.

3 - An Approach to Stochastic Ecology
Eldon Gunn, Professor and Department Head, Dept. of Industrial Engineering, Dalhousie University, P.O. Box 1000, Halifax, NS, B3J 2X4, Canada, Eldon.Gunn@dal.ca, Larry Davis

How can we make progress on understanding what it means to manage an ecosystem? Any management process results in a spatial time series of forest vegetation. Assessing the habitat implications for various species at each point in time, produces a set of (nonspatial) habitat time series. These time series have few nice properties. This paper attempts to put this ecosystem management problem in a stochastic framework as a way of discussing what it means to make good management decisions.

4 - Existence Value and Optimal Timber-wildlife Management: Impacts of Climate Change
Daniel Spring, Faculty of Science, Monash University, School of Biological Science, Victoria, 3800, Australia, daniel.spring@sci.monash.edu.au

Dynamic programming is used to determine optimal tree harvest ages on multiple stands that maximise the expected returns from timber and the expected value of an endangered possum species. The sensitivity of optimal cutting policies to possum existence values and the increased risk of fire under climate change is investigated

■ MB30

P-Room 3512

Technometrics-Sponsored session

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: Bill Notz, Professor, United States, win@stat.ohio-state.edu

1 - A Statistical Process Control Framework for the Characterization of Variation in Batch Profiles
Mary Leitnaker, Professor, University of Tennessee, Knoxville, TN, 37996, United States, leitnake@utk.edu, Nitin Kaistha

We discuss an SPC framework for characterizing systematic variability in historical databases of batch profiles. Scaling methods are used to obtain scale parameters characterizing systematic time and measurement axis variability. Profile scaling is proposed so each parameter has a specific meaning in terms of the type of variability explained. Multivariate SPC charts on scale parameters and the residuals after scaling are developed. Simulation examples are used to demonstrate the methodology.

2 - A Dual-Response Approach to the Multivariate Robust Parameter Design Problem
Guillermo Miro Quesada, Research Scientist, Eli Lilly and Company, Bioprocess Research and Development, Lilly Technical Center-North, Indianapolis, IN, 46221, United States, MIROQUESADA_GUILLERMO@Lilly.com, Enrique del Castillo

We discuss an extension to the dual-response approach to robust parameter design for multiple responses. We provide unbiased estimates of the process covariance matrix and vector of expected values using parameter estimates from a multivariate regression. We give conditions for zeroing-out the variance contribution of the noise factors for an unconstrained problem. For the constrained case, we discuss possible scalar optimization criteria of the covariance matrix. Examples will be given.

3 - Control Charts and the Efficient Allocation of Sampling Resources
Zachary G. Stoumbos, Professor, Rutgers University, Department of Management Science & Information Systems, The Janis H. Levin Building, 94 Rockafeller Road, Piscataway,, NJ, 08854-8054, United States, stoumbos@andromeda.rutgers.edu, Marion R. Reynolds, Jr.

We discuss whether better statistical performance is achieved using samples of size 1 or greater than 1 for monitoring the process mean and standard deviation. Shewhart, EWMA, and CUSUM charts are considered. For each, a combination of two charts is studied; one to monitor the mean and one the standard deviation. We evaluate control chart combinations for various types of process changes. The overall conclusion is that it is best to take samples of size 1and use an EWMA or CUSUM combination.

4 - Phase I Analysis of Linear Profiles with Calibration Applications
William H. Woodall, Virginia Tech, Blacksburg, VA, 24061-0439, United States, bwoodall@vt.edu, Mahmoud Mahmoud

We study the Phase I analysis of data when the quality of a process is characterized by a linear function. We assume simple linear regression data are available for a fixed number of samples collected over time. Using simulation, we compare the performance of some recommended approaches used to assess the stability of the process. We also propose a method using indicator variables in a multiple regression model. This method is shown to have competitive performance relative to other methods.

■ MB31

P-Room 3545

Collaborative Technology

Sponsor: Information Systems
Sponsored Session

Chair: Astrid Lipp, Assistant Professor, Georgia State University, CIS Department, P.O. Box 4015, Atlanta, GA, 30302-4015, United States, alipp@gsu.edu

1 - Experiencing vClass in an IT Graduate Course: A Case Study
Astrid Lipp, Assistant Professor, Georgia State University, CIS Department, P.O. Box 4015, Atlanta, GA, 30302-4015, United States, astridlippgsu@yahoo.com, Yide Shen

The computer conferencing system named vClass from Elluminate was used to teach a graduate course on information technology and collaborative work. Students evaluated each class, whether it was taught using vClass or face-to-face by filling out questionnaires consisting of both TAM items and open-ended questions. A final validated questionnaire (Webster, 1997) was administered at the end of the semester. Some implications for practice are discussed.

2 - DoD Enterprise Collaboration: The Way Ahead
Keith Dean, Collaboration Lead, OASD(NII), Department of Defense, United States, Keith.Dean@osd.mil

3 - Teaching Cognitive Mapping And Evaluating Cognitive Mapping Skills
Astrid Lipp, Assistant Professor, Georgia State University, CIS Department, P.O. Box 4015, Atlanta, GA, 30302-4015, United States, alipp@gsu.edu, Roy Johnson

This paper discusses how cognitive mapping using Decision Explorer can be taught and evaluated. Maps of individual cognitive mapping sessions produced by the more experienced facilitator and novice facilitators are compared using Decision Explorer analysis tools. Evaluations of the cognitive mapping process and the resulting maps by the people being mapped are also compared.

■ MB32

T-Vail (Majestic Level)

Supply Chain Simulation Optimization, SimFlex Group - Flextronics

Cluster: OR Practice
Invited Session

Chair: John Sedej, Vice President, Flextronics, 17075 Camino San Bernardo, San Diego, CA, 92127, United States, john.sedej@flextronics.com

1 - Supply Chain Simulation-Optimization with SimFlex
John Sedej, Vice President, Flextronics, 17075 Camino San Bernardo, San Diego, CA, 92127, United States, john.sedej@flextronics.com

The SimFlex Group within Flextronics has developed a supply chain simulation technology known as SimFlex. This supply chain simulation software enables companies to simulate supply chain dynamics, evaluate multiple planning criteria and real-world variations. We give an overview of the SimFlex software and how it is used within Flextronics, and we report on some customer projects and the impact SimFlex has had on the supply chain design.

2 - Intel Case Study for Network Optimization Integrated with SimFlex
Carsten Jordan, Flextronics - SimFlex Group, 17075 Camino San Bernardo, San Diego, CA, 92127, United States, carsten.jordan@flextronics.com, Cem Vardar

Interpreting a supply chain as a generalized network flow problem, we show how the input data for a mixed-integer linear program is derived from the generic data for the supply chain simulation tool—and, how we can use simulation to adjust for good optimization input data. We show the integration of optimization and simulation with ILOG CPLEX/ OPL. Cem Vardar, Intel corporation, will show how this method is used to optimize the worldwide Retail CPU supply chain within Intel.

3 - Simulation-Optimization with OptQuest integrated in SimFlex
Rost Misyutin, Flextronics, 17075 Camino San Bernardo, San Diego, CA, 92127, United States, rost.misyutin@flextronics.com

Integrating Simulation with the OptQuest allows to search over dynamic supply chain parameters which cannot be modeled in mixed integer programming models. The OptQuest integration complements SimFlex's capabilities to fine-tune a supply chain and to search for a best solution among a large number of potential what-if scenarios. We cover some technical aspects of the integration and show the application of simulation-optimization in a project for a printer supply chain.

■ MB33

T-Savoy (Majestic Level)

Daniel H. Wagner Prize Competition

Sponsor: The Daniel H. Wagner Prize for Excellence in Operations Research
Sponsored Session

Chair: Joseph H. Discenza, SmartCrane, LLC, 2 Eaton Street Suite 500, Hampton, VA, 23669, United States, joeh@discenza.com

1 - Providing Dial Tone in the Presence of Circuit Congestion due to Long Holding Time Internet Dial-Up Calls — Assuring Emergency Services Access
Vaidyanathan Ramaswami, AT&T Labs - Research, E-233, 180 Park Avenue, Florham Park, NJ, 07932, United States, vramaswami@att.com, Soohan Ahn, Alan E. Kaplan, David Poole, Simon Byers

Telephone availability is critical, particularly in emergency situations where immediate help is needed. This work describes how Operations Research models and techniques were used to identify the root cause of dial tone unavailability in significant parts of the AT&T network and to develop remedies restoring quality service protecting the AT&T brand name and assuring the safety of its customers. The work has much wider implications than to the specific application considered, and particularly so to current areas of research related to the Internet and broadband technologies. An off-shoot of this work is also a significant reduction in access charges incurred by AT&T to the tune of $5M in 2004 and $18M per year going forward.

2 - Reinventing Crew Scheduling at Netherlands Railways
Leo Kroon, NS Reizigers, Department of Logistics, HGB IV, 9.09 P.O. Box 2025, 3500 HA Utrecht, Netherlands, L.Kroon@fbk.eur.nl, Erwin Abbink, Matteo Fischetti, Michiel Vromans

Sophisticated Operations Research models and techniques were applied succssfully for scheduling the 6,500+ drivers and conductors of the Dutch railway operator NS Reizigers. The schedules were generated according to new rules aiming at increasing the punctuality and efficiency of the services, together with the satisfaction of the drivers and conductors. The produced plans trimmed personnel costs by about $4.8 million per year. However, the application of the model showed that cost reductions of over $7 million per year are also conceivable.

■ MB34

T-Columbine (Majestic Level)

Managing Capacity: Pricing, Competition and No-Shows

Sponsor: Manufacturing and Service Operations Management
Sponsored Session

Chair: Candace Yano, Professor, University of California, IEOR Department, Berkeley, CA, 94720-1777, United States, yano@queue.ieor.berkeley.edu

1 - Value of Information in a Two-Echelon Supply Chain with Limited Capacity
Nesim Erkip, Middle East Technical University, METU, Dept. of IE, Ankara, 06531, Turkey, erkipn@metu.edu.tr, Ismail Serdar Bakal, Refik Gullu

We analyze a supply chain of a supplier and retailers where the capacity of the supplier is limited. Retailers are independent agents possessing different levels of information regarding the supply. Embedding this asymmetry on the capacity of the supplier, we analyze the response of retailers using game theoretic tools.

2 - Air Cargo Overbooking using a Discrete Show-up Rate Distribution
Andreea Popescu, Ph.D Student, School of Industrial and Systems Engineering, Georgia Institute of Technology, 765 Ferst Drive NW, Atlanta, GA, 30332-0205, United States, andreeap@isye.gatech.edu, Pinar Keskinocak, Ellis Johnson, Mariana LaDue, Raja Kasilingam

The differences between the passenger and the cargo business, multi-dimensionality, smallest booking period, higher data variability, suggest different approaches for estimating the cargo show-up rate. We show that the normal distribution, widely used for estimating the passenger show-up rate, does not always provide a good fit for cargo. We propose a discrete estimator and analyze its behavior.

3 - Demand Management through Decentralized Capacity Allocation in Sea Cargo
Ozgun Caliskan Demirag, Ph.D Sudent, Georgia Institute of Technology, Industrial and Systems Engineering Dept., 765 Ferst Drive, NW, Groseclose 0205 Room 437, Atlanta, GA, 30332-0205, United States, gtg501c@mail.gatech.edu, Julie Swann

Sea cargo logistics and transportation companies lacking a central booking/reservation system allocate aggregate ship capacity to decentralized sales agents who manage individual bookings. We model the problem of dynamically allocating capacity and analyze sales incentives and transfer pricing schemes with the objective of making the decentralized system profits as close as possible to the centralized system profits.

4 - Day-of-week Pricing for Express Package Delivery Services
Alexandra Newman, Assistant Professor, Colorado School of Mines, Division of Economics and Business, Golden, CO, 80401, United States, newman@mines.edu, Candace Yano

We present preliminary results for the problem faced by a package delivery company of selecting day-of-week prices by speed of service for its contract customers. Such prices may induce these customers to ship counter-cyclically to the overall demand pattern, thereby allowing lower contract prices and reduced transportation capacity requirements.

■ MB35

T-Terrace (Terrace Level)

The Value of Collaborative Processes in the Supply Chain

Sponsor: Manufacturing and Service Operations Management
Sponsored Session

Chair: Yossi Aviv, Associate Professor of Operations Management, Washington University, Campus Box 1133, 1 Brookings Drive, Saint Louis, MO, 63130, United States, aviv@wustl.edu

1 - Supply Chain Collaboration at US Coast Guard using Part Age Information
Vinayak Deshpande, Assistant Professor of Management, Purdue University, 4024 Rawls Hall, West Lafayette, IN, 47907, United States, Vinayak@purdue.edu, Ananth Iyer

We demonstrate the value of information collaboration across different divisions within the US Coast Guard. The key step involved merging aircraft maintenance information with a demand database using Math Programming, to improve the management of service parts at the USCG. We then developed a state dependent supply replenishment policy that uses part age information. Computational results on actual demand data suggest that our proposed policy can lead to significant reduction in inventory cost.

2 - The Value of Supplier-Retailer Collaboration: Category Management and Category Captainship
Mumin Kurtulus, INSEAD, Boulevard de Constance, Fontainebleau, 77305, France, mumin.kurtulus@insead.edu, Beril Toktay

Category management is a supplier-retailer process for managing retail categories in a collaborative manner. Category captainship is a form of category management in which retailers rely on one of the leading manufacturers in the category for strategic recommendations regarding that category. We introduce a framework in which manufacturers of competing brands each negotiate with a retailer over wholesale prices. We study the effectiveness of different strategies in managing the category.

3 - Implementing Collaborative Forecasting Through Buy Back Contracts
Julia Miyaoka, San Francisco State University, 1600 Holloway Ave., San Francisco, CA, 94022, United States, jmiyaoka@sfsu.edu

Collaborative forecasting is a process where supply chain members jointly develop a single forecast of demand. We address the incentive issues associated with implementing collaborative forecasting. We find that buy back contracts that align the incentives can also coordinate the channel.

4 - Collaborative Forecasting and Inventory Management: Capacity Considerations
Yossi Aviv, Associate Professor of Operations Management, Washington University, Campus Box 1133, 1 Brookings Drive, Saint Louis, MO, 63130, United States, aviv@wustl.edu

We develop a stylized model framework to study potential values of collaborative forecasting partnerships in a supply chain, and how they are affected by two important characteristics of the manufacturing capacity: (i) cost of production and (ii) the flexibility of capacity scheduling. We thus extend the quantitative research on collaborative forecasting, that to date has only focused on traditional inventory cost performance measures.

■ MB36

T-Capitol (Terrace Level)

Risk Management in Engineering Applications I

Cluster: Financial Engineering
Invited Session

Chair: Stanislav Uryasev, Professor, University of Florida, PO Box 116595, 303 Weil Hall, Gainesville, FL, 32611, United States, uryasev@ufl.edu

1 - Analysis of Stock Market Data Using Network-Based Approaches
Vladimir Boginski, University of Florida, 303 Weil Hall, Gainesville, FL, 32611, United States, vb@ufl.edu, Sergiy Butenko, Panos Pardalos

We consider a network representation of the stock market data referred to as the market graph, which is constructed by calculating cross-correlations between pairs of stocks based on the opening prices data over a certain period of time. We study the evolution of the structural properties of the market graph over time and draw conclusions regarding the dynamics of the stock market development based on the interpretation of the obtained results.

2 - On Risk Measures in Stochastic Programming
Pavlo Krokhmal, University of Florida, Graduate Research & Engineering Center, Shalimar, FL, 32579, United States, krokhmal@ufl.edu

We consider a generalization of the two-stage stochastic programming model that captures the risk of the second-stage (recourse) action. The properties of the formulated stochastic programming problem are discussed. We introduce general representation forms for coherent risk measures that facilitate incorporation of risk measures into stochastic programs. Applicability of the existing algorithms for solving the formulated SP problem is discussed, and numerical examples are presented.

3 - Pricing European Options in Incomplete Market: Regression with Constraints
Stanislav Uryasev, Professor, University of Florida, PO Box 116595, 303 Weil Hall, Gainesville, FL, 32611, United States, uryasev@ufl.edu, Sergey Sarykalin

We consider a new approach to pricing European options in incomplete market. The method replicates an option by a portfolio consisting of a stock and a bond and simultaneously calculates prices of options with all strikes. We apply linear regression with constraints that can accommodate various assumptions on stochastic processes of the underlying security. We directly calibrate the model with historical prices of the underlying security using assumptions on the class of replication policies.

■ MB37

T-Biltmore (Terrace Level)

Electricity Pricing and Risk Management

Sponsor: Energy, Natural Resources and the Environment
Sponsored Session

Chair: Shi-Jie Deng, Asst. Professor, Georgia Inst. of Tech., 765 Ferst Dr, Atlanta, GA, 30332, United States, deng@isye.gatech.edu

1 - Analysis of Electric Grid Security Under Terrorist Threat
Javier Salmeron, Research Assistant Professor, Naval Postgraduate School, 1411 Cunningham Road, Monterey, CA, 93943, United States, jsalmero@nps.edu, Ross Baldick, Kevin Wood

We describe new analytical techniques to help mitigate the disruptions to electric power grids caused by terrorist attacks. New bilevel mathematical models and algorithms identify critical system components by creating maximally disruptive attack plans for terrorists assumed to have limited offensive resources. We report results for standard reliability test networks to show that the techniques identify critical components with modest computational effort.

2 - Investment Dynamics in Electricity Markets
Alfredo Garcia, Systems & Information Engineering Department, University of Virginia, Charlottesville, VA, 22904, United States, ag7s@virginia.edu, Ennio Stacchetti

We study the long run reliability (or security of supply) of electricity markets under price caps by constructing a dynamic game model of investment. We develop a full characterization of equilibrium investment and show that excess capacity is a natural feature of Markov Perfect Equilibrium. We also give conditions on the primitives of the model (risk free interest rate, price cap, demand growth rate, investment cost) to obtain a given (equilibrium) average level of excess capacity in the long-run.

3 - An Interior Sampling Algorithm for the Solution of Stochastic Nash Games
Uday Shanbhag, Ph.D Candidate, Dept. of Mgmt. Science and Engg., Stanford University, Stanford, CA, 94305, United States, udaybag@stanford.edu, Peter Glynn, Gerd Infanger

We consider a class of equilibrium problems in which agents solve stochastic convex quadratic programs(QPs). By using a novel reformulation, we may solve this class of problems by an interior sampling algorithm. The second part of the paper considers the problem of electricity pricing in imperfect markets under uncertainty. By extending the ideas of Hobbs et al., we discuss the efficient solution of large stochastic Nash Cournot problems.

4 - Pricing and Hedging of Energy Supply Contracts with Quantity Risk
Shi-Jie Deng, Asst. Professor, Georgia Inst. of Tech., 765 Ferst Dr, Atlanta, GA, 30332, United States, deng@isye.gatech.edu, Youyi Feng

We examine the problem of pricing and hedging an full-requirement power supply contract in which a power marketer is obligated to fulfill an end user's total electricity usage request at a predetermined fixed price per unit of consumption. We propose a revenue management formulation to analyze this problem and obtain the structure properties of the optimal policy in selling and risk managing such contracts.

■ MB38

T-Beverly (Terrace Level)

Optimal Simulations and Simulation for Optimization

Sponsor: Simulation
Sponsored Session

Chair: Jeremy Staum, Northwestern University, 2145 Sheridan Road, Evanston, IL, United States, j-staum@northwestern.edu

1 - Discrete Optimization via Simulation using COMPASS
L. Jeff Hong, Assistant Professor, Hong Kong University of Science and Technology, IEEM Dept., HKUST, Clear Water Bay, Kowloon, Hong Kong, hongl@iems.northwestern.edu, Barry L. Nelson

We propose an optimization-via-simulation algorithm, called COMPASS, for use when the performance measure is estimated via a stochastic, discrete-event simulation, and the decision variables are integer ordered. We prove that COMPASS converges to the set of local optimal solutions with probability 1 for both terminating and steady-state simulation, and for both fully constrained problems and partially constrained or unconstrained problems under very mild conditions.

2 - Recent Results for Optimal Allocation of Simulation Replications under Correlated Sampling
Xiaoping Xiong, University of Maryland, Smith School of Business, Van Munching Hall, College park, MD, 20742-1815, United States, xxiong@rhsmith.umd.edu, Michael Fu

For the correlated setting of the optimal computing budget allocation (OCBA) problem, we show asymptotic optimality for a recently proposed approximation and report on results in the non-Gaussian setting.

3 - A Probabilistic Branch-and-bound Scheme for Simulation Optimization
Yanto Prasetio, Industrial Engineering, Box 352650, Seattle, WA, United States, prasetio@u.washington.edu, Joyce W. Yen, Zelda B. Zabinsky

We propose a probabilistic branch-and-bound scheme for simulation optimization. To determine how the simulation resources should be spent, a statistical analysis is used to guide the branching scheme and the number of replications within a sub-region. Numerical experiments on stochastic test functions are given.

4 - Simulation of Coherent Risk Measures
Jeremy Staum, Northwestern University, 2145 Sheridan Road, Evanston, IL, United States, j-staum@northwestern.edu, Barry L. Nelson, Vadim Lesnevski

In financial risk management, a coherent risk measure equals the maximum expected loss under several different probability measures, which are analogous to systems in ranking-and-selection. Here it is the best system's value and not identity that is of interest. We explore the correctness and computational efficiency of simulation estimates and confidence intervals for a maximum of several expectations.

■ MB39

T-Tower Court A (2nd Floor)

Sourcing and Procurement Strategies

Cluster: Supply Chain Mgmt & Operations
Invited Session

Chair: Serguei Netessine, Assistant Professor, The Wharton School, University of Pennsylvania, 3730 Walnut St. Suite 500, Philadelphia, PA, 19104, United States, netessin@wharton.upenn.edu

1 - Procurement Auctions and Eroding Price Contracts in the Presence of Learning by Doing
Se-Kyoung Oh, Goergia Institute of Technology, United States, tweetiee@isye.gatech.edu, Wedad Elmaghraby

Under an erosion rate policy in the presence of learning by doing, the buyer initially awards production to the lowest-bid supplier via an auction, and the supplier should reduce prices in subsequent periods. We study the design of the optimal eroding price schedule and compare the performance of it against two different auctions. We find that a buyer is always better off running short-term auctions, rather than limiting competition and contracting with a single supplier.

2 - Private Information and Performance in Oligopolistic Markets for Procurement
Tunay Tunca, Asst. Professor, GSB, Stanford University, 518 Memorial Way, Stanford University, Stanford, CA, 94305, United States, tunca_tunay@gsb.stanford.edu

We examine the role of private information in an imperfectly competitive market for procurement. We find the Bayesian equilibrium and explore a market performance measure that can be more informative than fragmentation by itself. We also examine how market performance and surplus distribution get affected when market performance is near its theoretical limits and derive policy implications.

3 - Strategic Interaction between Channel Structure and Distribution Strategy for Durable Goods
Steve Gilbert, Associate Professor, University of Texas at Austin, McCombs School of Business, 1 University Station, Austin, TX, 78712, United States, Steve.Gilbert@mccombs.utexas.edu, Sreekumar Bhaskaran

We consider a supply chain in which a durable goods manufacturer (DGM) uses an intermediary(s) to reach its consumers and examine how the DGM's decision to lease/sell the products interacts with the market and channel structure. Among other results, we show that greater intensity of competition makes leasing more attractive to the DGM relative to selling. This contrasts with existing results that do not consider channel structure.

4 - An Incentive Effect of Multiple Sourcing
Serguei Netessine, Assistant Professor, The Wharton School, University of Pennsylvania, 3730 Walnut St. Suite 500, Philadelphia, PA, 19104, United States, netessin@wharton.upenn.edu, Stanley Baiman

We consider a supply chain with one manufacturer who assembles an end-product consisting of two components purchased from outside suppliers. Each supplier is privately informed as to his marginal cost of production. We demonstrate that increasing the number of suppliers mitigates (but does not entirely eliminate) the coordination costs arising from the supplier-incentive problems which is contrary to the standard assertion that increasing the number of suppliers increases coordination costs.

■ MB40

T-Tower Court B (2nd Floor)

Supply Chain and Pricing

Cluster: Supply Chain Mgmt & Operations
Invited Session

Chair: Georgia Perakis, Sloan Career Development Associate Professor of Operations Research, Sloan School, MIT, 50 Memorial Drive, Rm E53-359, Cambridge, MA, 02139, United States, georgiap@mit.edu

1 - Inter-temporal Choice Model
Guillermo Gallego, Columbia University, New York, NY, United States, gmg2@columbia.edu, Ozge Sahin

We study inter-temporal risk neutral and risk averse choice models with stochastic prices and valuations. We show that low-to-high and high-to-low price behavior in revenue and markdown management is consequence of these factors. We propose new products, including options that exploit the differences in the uncertainties of valuations.

2 - Pricing, Ordering and Capacitated Production in a Single-Retailer, Two-Supplier System
Candace Yano, Professor, University of California Berkeley, Industrial Engineering & Operations Res., Haas School of Business, Berkeley, CA, United States, yano@ieor.berkeley.edu, Richard Steinberg

We analyze a supply chain with two capacity-constrained suppliers of partially-substitutable products selling to a major retailer. The retailer chooses prices and order quantities; the suppliers choose wholesale prices and production quantities under capacity constraints. We show how the existence and form of equilibria are affected by supplier capacity constraints.

3 - Data-Driven Inventory Management
Aurelie Thiele, Assistant Professor, Lehigh University, Dept of Industrial Engineering, Bethlehem, PA, 18015, United States, aurelie@mit.edu, Dimitris Bertsimas

We propose an approach to inventory management that (a) works directly with data, i.e., combines historical data and optimization in a single framework, (b) leads to tractable algorithms and closed-form solutions, (c) incorporates risk aversion using a single scalar parameter, and (d) leads to strong empirical performance.

4 - Price-Only Contracts
Guillaume Roels, Ph.D student, MIT - Operations Research Center, 77 Mass. Ave, E40-149, Cambridge, MA, 02139, United States, roels@mit.edu, Georgia Perakis

Despite their popularity, price-only contracts do not coordinate the supply chain. This talk analyzes a single supplier-single manufacturer supply chain where the supplier builds capacity before observing the demand. We provide a bound for the loss of efficiency in the decentralized supply chain in comparison with the centralized supply chain. Moreover, we show how bargaining or long-term supply relationships can improve the efficiency of the chain.

■ MB41

T-Tower Court C (2nd Floor)

Supply Chain Contracts and Games I

Contributed Session

Chair: Shankar Sundaresan, Assistant Professor, Penn State University, BAB 509Q, University Park, PA, 16802, United States, shankar-s@psu.edu

1 - Supply Chain Coordination Through Adjustment Contracts
Rong Li, School of Industrial Engineering, Purdue University, 315 N. Grant Street, West Lafayette, United States, joannali77@yahoo.com, Jennifer Ryan

We study a single-period Stackelberg game between a buyer and its supplier under a portfolio of supply contracts: a wholesale-price contract and an adjustment contract, which allows both upward and downward adjustments during the period. Optimal policies for both parties are characterized. Pareto-improvement

and coordination can be achieved simultaneously.

2 - Supply Chain Coordination Models for Multiple Products
Ajay Mishra, Assistant Professor, SUNY Binghamton, School of Management, Binghamton, NY, 13902, United States, amishra@binghamton.edu

We study channel coordination for a single buyer purchasing multiple price-sensitive products from a single supplier, in a deterministic environment. The buyer incurs ordering cost and holding cost. The supplier incurs joint ordering cost, product-specific ordering and delivery cost, and holding cost for each product. We develop the supplier's contracts using volume discounts and quantity discounts for multiple products with decentralized decision making.

3 - A 'Performance Comparison Tool' for Achieving Compatibility among Players in a Supply Chain
Gangaraju Vanteddu, Ph.D Candidate, Industrial & mfg Engineering Department Wayne State University, 4815 4th Street #1073, Detroit, MI, 48202, United States

In this paper we are presenting a 'Performance comparison tool' in the context of a supply chain that will enable us to find the gaps between the business strategy of different players and the supply chain strategy and we also suggest some remedial measures to rectify the same.

4 - Supply Chain Structures and Contracts for Managing Multi-tiered Suppliers
Moti Levi, Assistant Professor, Penn State University, 509 BAB, Smeal College of Business, University Park, PA, 16802, United States, mlevi@psu.edu, Shankar Sundaresan

We investigate a three-tiered supply-chain in which the quality of product at each tier is influenced by the quality of constituent components and effort level of the producer. We find that under different information regimes of each tier's knowledge about others' cost and engineering functions, different forms of optimal supply chain contracts and structures are recommended, some of which are quite surprising.

■ MB42

T-Tower Court D (2nd Floor)

New Trends on Stochastic Revenue Management

Sponsor: Revenue Management & Dynamic Pricing
Sponsored Session

Chair: Rene Caldentey, Assistant Professor, New York University, 44 West 4th Street, Suite 8-77, New York, NY, 10012, United States, rcaldent@stern.nyu.edu

1 - Dynamic Pricing and Leadtime Quotation Strategies for a Make-to-order System
Costis Maglaras, United States, c.maglaras@columbia.edu, Sabri Celik

This talk considers a model of a multi-product make-to-order firm, where each product is offered at a variety of different leadtimes. We formulate an approximating diffusion control problem that admits a closed-form solution and provides several insights about practical strategies for the problem of dynamic pricing and leadtime quotation in make-to-order systems.

2 - Dynamic Pricing for Non-Perishable Products with Demand Learning
Victor Araman, New York University, Stern School of Business, New York, NY, 10012, United States, varaman@stern.nyu.edu, Rene Caldentey

We consider the long-term operations of a retailer selling non-perishable products. Continuously, the retailer observes his inventory, learns about demand, and dynamically chooses the price to maximize the total discounted revenues. Demand is a Poisson process with a price sensitive intensity parameterized by an unknown parameter. We formulate the HJB equation and solve numerically for the optimal value function and obtain approximations of the solution.

3 - Relative Entropy, Exponential Utility, and Robust Dynamic Pricing
Andrew Lim, Assistant Professor, University of California, IEOR Department, Berkeley, CA, 94720-1777, United States, lim@ieor.berkeley.edu, George Shanthikumar

Standard formulations of the dynamic pricing problem assume a known relationship between price and demand rate. In the real world, however, there is ambiguity in this relationship, and for this reason, "robust" pricing policies are of value. In this talk, we show how "robust solutions" can be derived when relative entropy is used as a measure of model ambiguity. Interesting connections with the exponential utility function will also be discussed.

■ MB43

T-Denver (Mezzanine)

Role of Technology in New Product Development

Cluster: New Product Development
Invited Session

Chair: Vish Krishnan, University of Texas at Austin, Department of Management, Austin, TX, 78712, United States, Vish.Krishnan@mccombs.utexas.edu

1 - Are all Forms of Modularity Equally Effective in Improving the Development Process?
Nitin Joglekar, Asst. Professor, Boston University, 595 Commonwealth Avenue, Boston, MA, 02215, United States, joglekar@bu.edu, Paulo Gomes

Some organizations have been mandating the use modular technologies in order to improve development process performance. We introduce a series of measures for observing task level modularity. These measures are used to explore the relationship between engineering design decisions and the drivers of transaction costs in a distributed software development environment.

2 - Virtual Customer Environments: Technology-based Forums for Customer Co-innovation and Value Creation
Satish Nambisan, Associate Professor, Rensselaer Polytechic Inst., Lally School of Management, 110 & 8th Street, Troy, NY, 12180, United States, nambis@rpi.edu

Organizations have employed virtual customer environments (VCEs) to facilitate customer-firm partnering for product innovation and value creation. In this presentation, I draw on my research on VCEs conducted over the past four years and focus on the following issues: customers' value creation roles in VCEs, customers' interaction experience in VCEs and its impact on their value co-creation behavior, and strategies for the effective appropriation of the value created externally by customers.

3 - Impact of Technology on Project and Product Management
Vish Krishnan, University of Texas at Austin, Department of Management, Austin, TX, 78712, United States, Vish.Krishnan@mccombs.utexas.edu, Indranil Bardhan

Technology's impact on improving productivity in new product development has been mixed. While some firms have realized gains, many others have found the benefits to be elusive. We propose that firms focusing on the operatinal benefits of information technology are associated with greater gains from the deployment of technology. An index is proposed and tested for the operational benefits of technology in project and product management.

■ MB44

T-Spruce (Mezzanine)

Multi-Attribute Auctions & Experiments

Cluster: Auction Theory & Applications
Invited Session

Chair: Elena Katok, Associate Professor, Penn State, Smeal College of Business, 509H Business Administration Bldg, University Park, PA, 16802, United States, ekatok@psu.edu

1 - Optimality and Equilibrium in Scoring Auctions
John Asker, Assistant Professor, Stern School of Business, NYU, Henry Kaufman Management Center, 44 West 4th Street, New York, NY, 10012, United States, asker@post.harvard.edu, Estelle Cantillon

We study multi-attribute auctions in which suppliers have private information about their costs, which is summarized by a multi-dimensional type. We obtain two kinds of equilibrium result: First, we characterize the set of equilibria in quasi-linear scoring auctions; Second, we prove a new utility equivalence theorem for quasi-linear scoring auctions. We then investigate the design of the optimal auction with both discrete and continuous types and discuss implementation via a scoring auction.

2 - Entry Decisions and Bidding Behavior in Sequential First-Price Procurement Auctions
Jeannette Brosig, Visiting Research Scholar, Penn State University, Smeal College of Business Administration, 310 Business Administration Building, University Park, PA, 16802, United States, yeb2@psu.edu, Philipp Reiss

Though many real life auctions are run independently of each other, from the bidders' point of view they often form sequences of auctions. We investigate how behavior responds to the additional incentives that are present in such auction sequences. Our results on first-price procurement auctions reveal that subjects' entry and bidding behavior is crucially affected by the opportunity cost of early bid submission. Though, decisions systematically deviate from the equilibrium prediction.

3 - Noncompetitive Sales and Procurement Auctions
Elena Katok, Associate Professor, Penn State, Smeal College of Business, 509H Business Administration Bldg, University Park, PA, 16802, United States, ekatok@psu.edu,
Richard Engelbrecht-Wiggans

Noncompetitive sales are often used in procurement settings in conjunction with auctions to help preserve long-term relationships, while simultaneously introducing an element of market competition into the procurement process. We present a theoretical and laboratory comparison of ascending auctions with and without noncompetitive sales and fin that noncompetitive sales decrease costs in the laboratory by over 10 percent.

4 - Reputation Mechanisms for Information Goods - The Market for Product Evaluations
Carsten Schmidt, Max Planck Institute for Research into Economic Systems, Kahlaische Str. 10, Jena, 07745, Germany, cschmidt@mpiew-jena.mpg.de

Reputation mechanisms for the provision of information goods and the successful interaction between strangers are described and compared to known mechanisms for retail goods. It is shown that in the reputation mechanism of the opinion portal Ciao.com investment in reputation pays-off monetarily. Surprisingly, the member provided ratings of the product evaluations do not contain information. In addition, free riding opportunities for new members are observed.

■ MB45

T-Gold (Mezzanine)

Cancer Therapeutics

Cluster: Medicine and OR
Invited Session

Chair: Eva Lee, Associate Professor & Director, Center for Operations Research in Medicine, Georgia Institute of Technology, Industrial & Systems Engineering, Atlanta, GA, 30332-0205, United States, evakylee@isye.gatech.edu

1 - Treatment Planning for Radiofrequency Ablation of Hepatic Cancer
Ariela Sofer, Professor and Chair, Systems Engineering & Operations Research, George Mason University, MS4A6, Fairfax, VA, 22030, United States, asofer@gmu.edu, Bradford Wood, MD

Radiofrequency ablation is a minimally invasive technique for killing tumors. A needle is placed near the tumor and heat is applied. Temperatures above 50C kill tissue. The treatment plan is to determine the number of needles and their positions to guarantee that the entire tumor is killed while damage to vital healthy tissue is minimized. Since the spread of heat is governed by the bio-heat equation, this is a PDE-constrained problem. We present the problem and initial solution approaches.

2 - Optimization and Decision Support in IMRT Cancer Treatment
Eva Lee, Associate Professor & Director, Center for Operations Research in Medicine, Georgia Institute of Technology, Industrial & Systems Engineering, Atlanta, GA, 30332-0205, United States, evakylee@isye.gatech.edu

In this talk, we present an optimization decision support system for designing treatment plans in intensity-modulated radiation therapy. Plan designs involve optimization of beam geometries, radiation energies and beam intensity. Several MIP-based optimization models and computational strategies will be presented. Clinical qualities of resulting plans on real cancer patient cases will be discussed.

3 - Models for Radiation Therapy Treatment Planning
Edwin Romeijn, Associate Professor, ISE Department, University of Florida, 303 Weil Hall, PO Box 116595, Gainesville, FL, 32607, United States, romeijn@ise.ufl.edu, James F. Dempsey, Jonathan G. Li

Optimization models for radiation therapy treatment planning are based on criteria that evaluate the dose distribution in individual structures. Using results from the area of risk management, we will discuss the relationship between dose distribution dominance and criteria that are separable in the dose received by individual points in the patient. We also show that many other criteria that have been proposed to date are equivalent to separable criteria in a multi-criteria optimization setting.

■ MB46

T-Aspen (Mezzanine)

Trade Policy Models and How They Are Used

Cluster: Agricultural Economics
Invited Session

Chair: Suchada Langley, Chief, Global Agricultural Markets Branch, ERS-USDA, 1800 M Street, N.W., Room S5186, Washington, DC, 20036, United States, SLANGLEY@ers.usda.gov

1 - The ERS/Penn State Trade Model
David Abler, United States, d-abler@psu.edu

The ERS/Penn State trade model builds on best practices in previous agricultural trade models while at the same time incorporating a much wider range of domestic and border policies than most previous models. This paper describes the development and structure of the ERS/Penn State trade model, and contains an illustrative set of results on trade liberalization in international markets for dairy products.

2 - How do Policy Makers use Trade Policy Models and Economic Analysis?
William H. Meyers, Co-Director, FAPRI, University of Missouri-Columbia, 101 Park de Ville Drive, Columbia, Mo, 65203, United States, meyersw@missouri.edu

Why and how do policy-makers use economic analysis? This presentation looks at trade policy analysis from the policy-makers perspective. It delves into the types of issues policy-makers need analyzed, how they use results, and the impact that analysis has on trade policy.

3 - Agricultural Trade Policy in a Changing World
Suchada Langley, Chief, Global Agricultural Markets Branch, ERS-USDA, 1800 M Street, N.W., Room S5186, Washington, DC, 20036, United States, SLANGLEY@ers.usda.gov

Many changes in the agricultural business landscape in recent decades will have a lasting impact on the way economists analyze policy and how policymakers make policy. Changes related to globalization, consumer preferences, and income growth have called into question the role of public policy in agricultural trade analysis. This session looks at how changes in global markets affect trade policy analysis.

■ MB47

T-Century (Mezzanine)

Software Demonstration

Cluster: Software Demonstrations
Invited Session

1 - MINITAB, Inc.- Introduction to MINITAB Release 14
David McClelland, MINITAB, Inc., 1829 Pine Hall Rd., State College, PA, 16801, United States, dmcclelland@minitab.com

MINITAB® Release 14 is the leading statistical software package used in education. More than 4,000 colleges, universities, and high schools worldwide choose MINITAB because it: contains all the methods students need and is easy to learn and use; parallels the approach used in virtually all the leading textbooks, making it compatible with any curriculum; produces stunning graphs that are simple to make, edit, and update; is used by thousands of distinguished companies students will want to work for, including GE, 3M, Toshiba, Bank of America and the Ford Motor Company.

2 - Resampling Stats- Excel as a Platform for Data Mining
Peter Bruce, Resampling Stats, Inc., 612 N Jackson St, Arlington, VA, 22201, United States, pbruce@resample.com

New tools make Excel an attractive platform for prototyping data mining solutions (teaching too). The topics and methods available in a comprehensive data mining add-in for Excel (XLMiner) are reviewed. These include neural nets, CART, K-nearest-neighbors, logistic and linear regression, Bayesian classifier, clustering, more. The key steps in the data mining process will be demonstrated in XLMiner for several methods.

Monday 1:30pm-3:00pm

■ MC01

P-Ballroom F

Tutorial: Computer-Aided Design for Electrical and Computer Engineering

Cluster: Tutorials- Denver 2004
Invited Session

1 - Computer-Aided Design for Electrical and Computer Engineering
John Chinneck, Professor, Carleton University, Systems & Computer Engineering, Ottawa, ON, K1S 5B6, Canada, chinneck@sce.carleton.ca, Michel Nakhla, Q.J. Zhang

This tutorial will provide an overview of applications of OR methods to solve and analyze complex problems in this growing area. The speakers will show how OR applies to the design of computer chips composed of millions of interconnected microscopic devices. Problems include how to pack the devices into the smallest possible area, how to route the interconnections, and how to simulate the behavior of a proposed design. They will also describe difficult design and optimization problems in other CAD areas, such as antenna design, radio- and microwave-frequency circuit design.

■ MC02

P-Ballroom E

Coupling OR Techniques and Metaheuristics

Cluster: Metaheuristics (EU/ME)
Invited Session

Chair: Erwin Pesch, Professor, University of Siegen, FB 5, Faculty of Economics, Institute of Information Systems, Siegen, 57068, Germany, pesch@fb5.uni-siegen.de

1 - Combining Genetic Algorithm with Constraint Programming for a Scheduling Problem
Ceyda Oguz, Professor, The Hong Kong Polytechnic University, Department of Logistics, Hung Hom, Kowloon, Hong Kong SAR, Hong Kong, lgtceyda@polyu.edu.hk, Antoine Jouglet, Marc Sevaux

We developed a genetic algorithm and a constraint programming based branch-and-bound algorithm to solve multiprocessor task scheduling problem in hybrid flow-shop environments. We then combined these two approaches to benefit from their different aspects. We will present our computational results which are very encouraging.

2 - Heuristics for the Response Time Variability Problem
Wieslaw Kubiak, Professor, Faculty of Business Administration, Memorial University of Newfoundland, St. John's, NL, A1B 3X5, Canada, wkubiak@mun.ca, Albert Corominas, Natalia Moreno Palli

The response time variability (RTV) problem occurs whenever jobs need to be sequenced so as to minimize the variability of time they wait for their next turn in obtaining resources. We study its computational complexity and present polynomial algorithms for special cases. We propose a position exchange heuristic to improve the RTV of an initial sequence. The latter is bottleneck sequence, the Webster and Jefferson sequences of the apportionment, and a random sequence.

3 - A Comparison of Solution Procedures for the Flow Shop Scheduling with Late Work Criterion
Erwin Pesch, Professor, University of Siegen, FB 5, Faculty of Economics, Institute of Information Systems, Siegen, 57068, Germany, pesch@fb5.uni-siegen.de, Jacek Blazewicz, Malgorzata Sterna, Frank Werner

We analyze different solution procedures for the two-machine flow shop scheduling problem with a common due date and weighted late work criterion, i.e. for problem F2 | dj = d | Yw, which is known to be binary NP-hard. Binary NP-hardness has been proved by presenting a transformation from the partition problem and proposing an extensive pseudo-polynomial time dynamic programming method (DP) of complexity O(n2d4).

■ MC04

P-Plaza Court 2

Data Mining in Biomedical Applications

Sponsor: Data Mining
Sponsored Session

Chair: Shital Shah, University of Iowa, 3131 Seamans Center, Iowa City, IA, 52242-1527, United States, scshah@engineering.uiowa.edu

1 - Data Mining Models for Effective Bladder Cancer Immunotherapy
Shital Shah, University of Iowa, 3131 Seamans Center, Iowa City, IA, 52242-1527, United States, scshah@engineering.uiowa.edu, Michael O'Donnell, Andrew Kusiak

Bladder cancer is the fifth most common malignant disease in the United States with a high treatment cost. In this research, data from a nationwide BCG plus interferon-alpha immunotherapy clinical trial is considered. Data mining algorithms are used to analyze the effectiveness of immunotherapy treatment and understanding clinically relevant parameters and their interactions.

2 - Application of Data Mining to Nurse Activity and Patient Diagnosis
Duraikannan Sundaramoorthi, University of Texas at Arlington, Industrial and Manufacturing Sys. Eng., Campus Box 19017, Arlington, TX, 76019-0017, United States, dxs7400@omega.uta.edu, Jay Rosenberger

A methodology for mining Nurse Activity and Patient Diagnosis Data in hospital environment is presented. Data was collected from Baylor Regional Medical Center and encrypted for mining to preserve the privacy of nurses and patients.We describe statistical techniques to explore patterns among shifts,care units,and patient types.

3 - Simultaneous Hypothesis Testing in Large Scale Contingency Tables
Seoung Bum Kim, United States, sbkim@isye.gatech.edu, Mark Borodovsky, Kwok-Leung Tsui

We propose an approach to statistical inference of an individual cell in contingency tables within the framework of simultaneous testing procedures. We apply the proposed methodology to identify the patterns of non-local interactions in beta- strands. We found a number of non-local pairs having either strong or weak interactions.

4 - Study the Relationship Between Disease and Risk Factors through Casual Discovery and Data Mining
Jing Li, University of Michigan, 2385 Bishop #7, Ann Arbor, United States, jinglz@engin.umich.edu, Jianjun Shi

This research makes efforts in studying the causal relationship between disease and risk factors using statistical and data mining approaches. Focuses are especially placed on two risk factors including the occupations the patient used to undertake, the regions he/she used to visit, the interaction between these two factors, and how the relationship between occupation/region and disease changes temporally.

■ MC05

P-Plaza Court 3

Computational Approaches for Integer Programs

Sponsor: Optimization/ Integer Programming
Sponsored Session

Chair: Jeff Linderoth, Lehigh University, 200 W. Packer Ave, Bethlehem, PA, 18015, United States, jtl3@lehigh.edu

1 - Heuristics for Big Bucket Production Planning Problems
Kerem Akartunali, University of Wisconsin-Madison, Dept. of Industrial Engineering, Madison, WI, United States, kerema@cae.wisc.edu, Andrew Miller

We discuss heuristics for lot-sizing problems in which multiple product categories or items share a limited capacity in each planning period, and which often involve multiple machines, a complex bill-of-material structure, and other complicating factors. Our heuristics use strong formulations, a relax-and-fix approach, and other ideas to build high quality production plans. They are competitive with the best known methods in terms of both the feasible solutions and lower bounds produced.

2 - Solving Lift-and-Project Relaxations of Binary Integer Programs
Dieter Vandenbussche, University of Illinois at Urbana-Champaign, 140 Mechanical Engineering Building, MC, 1206 West Green Street, Urbana, IL, 61801, United States, dieterv@uiuc.edu, Samuel Burer

We propose a method for optimizing the lift-and-project relaxations of binary integer programs introduced by Lovasz and Schrijver. In particular, we study both linear and semidefinite relaxations. The key idea is a restructuring of the relaxations, which isolates the complicating constraints and allows for a Lagrangian approach. Computational results illustrate that our algorithm produces tight bounds much more quickly than state-of-the-art linear and semidefinite solvers.

3 - A Set-Partitioning-Based Model and Solution Procedure for the SVRP
Rosemary T. Berger, Lehigh University, Industrial and Systems Engineering, 200 W. Packer Ave., Bethlehem, PA, 18015, United States, rtb3@lehigh.edu, Jeff Linderoth, Clara Novoa, Robert Storer

We present a set-partitioning-based formulation for the stochastic vehicle routing problem (SVRP) with stochastic demands. The model is equivalent to a two-stage stochastic program with integer recourse. Demand is revealed only when a vehicle arrives at a customer. We discuss several different recourse policies in response to failures (exceeding vehicle capacity) of planned routes. We describe a column generation-based solution procedure and present computational results.

■ MC06

P-Plaza Court 4

Portfolio Optimization

Sponsor: Optimization/Stochastic Programming
Sponsored Session

Chair: Victor DeMiguel, Assistant Professor, London Business School, Regent's Park, London, NW1 4SA, United Kingdom, avmiguel@london.edu

1 - Tax Management Strategies with Multiple Risky Assets
Stathis Tompaidis, Assistant Professor, University of Texas at Austin, MSIS Dpt., McCombs School of Business, Austin, TX, 78712, United States, Stathis.Tompaidis@mccombs.utexas.edu, Ron Kaniel, Michael Gallmeyer

We study the consumption-portfolio problem of a capital gain taxed investor who has access to multiple risky stocks and uncover two different scenarios where it is optimal to short sell. The first - a trading flexibility strategy - is an ex ante way of minimizing future tax-induced trading costs, when the investor shorts a stock even when no stock has an embedded gain. The second incentive to short is an imperfect form of shorting the box used to ex-post reduce aggregate equity exposure.

2 - Portfolio Investment with the Exact Tax Basis via Nonlinear Programming
Raman Uppal, Professor, London Business School, Regents Park, London, NW14SA, United Kingdom, ruppal@london.edu, Victor DeMiguel

Computing the optimal portfolio policy of an investor facing capital gains tax is a challenging problem: because the tax to be paid depends on the purchase price, the optimal policy is path dependent and the size of the problem grows exponentially with the number of time periods. We show how the structure of the problem can be exploited to compute the optimal policy via nonlinear programming. We also characterize the optimal policy and compare it to approximate policies in the literature.

■ MC07

P-Plaza Court 5

Stochastic Adaptive Search in Global Optimization

Sponsor: Optimization/ Global Optimization
Sponsored Session

Chair: Zelda B. Zabinsky, Professor, University of Washington, Box 352650, Seattle, WA, 98195, United States, zelda@u.washington.edu

1 - Implementing Annealing Adaptive Search for Global Optimization Using Hit-and-Run Sampler
Yanfang Shen, Industrial Engineering, Box 352650, University of Washington, Seattle, WA, 98195, United States, shyf@u.washington.edu, Zelda B. Zabinsky

The expected number of records of Annealing Adaptive Search (AAS) for global optimization grows linearly in dimension. A specific cooling schedule maintains linearity for the expected number of function evaluations. We analyze the complexity of AAS with a Markov Chain Monte Carlo sampler. When the sampler is Discrete Hit-and-Run, we provide an upper bound on convergence rate to the global optimum. An empirical study is presented using AAS with Hit-and-Run for discrete and continuous domains.

2 - Convergence of Simulated Annealing for Noisy Objective Function Evaluation over a Continuous Domain
Archis Ghate, Ph.D Student, University of Michigan, Dept of Ind. & Oper. Engg., 1205 Beal Avenue, Ann Arbor, MI, 48109, United States, archis@umich.edu, Robert Smith

In this talk, we give conditions under which continuous domain Simulated Annealing with noisy objective function evaluation con- verges in probability. In particular, we prove that if the estimation errors go to zero in probability asymptotically faster than the temperature, then Simulated Annealing with noisy objective function evaluations converges in probability to a global optimum. This result can be used for extending Simulated Annealing to problems in simulation optimization.

3 - Stopping Strategy for Multistart Stochastic Global Optimization Algorithms on Lipschitz Problems
Charoenchai Khompatraporn, Industrial Engineering, Box 352650, University of Washington, Seattle, WA, 98195, United States, ckhom@u.washington.edu, Zelda B. Zabinsky

A strategy to stop multistart stochastic global optimization is developed and demonstrated on some Lipschitz optimization test problems. A parameter that reflects how the algorithm obtains records is estimated through experiments, and then used to determine the best number of restarts of sequential stochastic search while ensuring a statistical confidence on the optimum.

■ MC08

P-Plaza Court 6

Networks and Scheduling

Sponsor: Optimization/ Network Optimization
Sponsored Session

Chair: Lisa Fleischer, T. J. Watson Research Center, IBM, Yorktown Heights, NY, United States, lkf@watson.ibm.com

1 - On the Spread of Viruses in Scale-free Networks
Amin Saberi, Microsoft Research, One Microsoft Way, Redmond, WA, United States, saberi@cc.gatech.edu, Noam Berger, Christopher Borgs, Jennifer Chayes

We will use epidemic models to analyze the spread of viruses in networks of computers. In particular, we will analyze the contact process on random graphs generated according to the preferential attachment scheme as a model for the spread of viruses in the Internet. We show that any virus with a positive rate of spread from a node to its neighbors has a non-vanishing chance of becoming epidemic.

2 - Mechanism Design for Policy Routing
Rahul Sami, MIT, 77 Massachusetts Ave., Building 32-G582, Cambridge, MA, 02143, United States, rsami@mit.edu, Joan Feigenbaum, Scott Shenker

We study mechanisms for interdomain routing in which Autonomous Systems have policy preferences over alternative routes. We focus on "next-hop" preferences, and present a strategyproof mechanism for welfare-maximizing routing. However, we show that, in contrast to earlier results on lowest-cost routing, this mechanism cannot be implemented with a distributed algorithm compatible with the Border Gateway Protocol used for interdomain routing. Joint work with Joan Feigenbaum and Scott Shenker.

3 - Improvements in Competitive Guarantees for Quality of Service Buffer Management
Lisa Fleischer, T. J. Watson Research Center, IBM, Yorktown Heights, NY, United States, lkf@watson.ibm.com, Nikhil Bansal, Tracy Kimbrel, Mohammad Mahdian, Baruch Schieber, Maxim Sviridenko

We study the behavior of algorithms for buffering packets weighted by different levels of Quality of Service (QoS) guarantees in a single queue with FIFO policy. Buffer space is limited, and packet loss occurs when the buffer overflows. The goal is to maximize weighted throughput. For this problem, a simple greedy algorithm has competitive ratio of 2. We show that a simple preemptive greedy algorithm has a competitive ratio of at most 1.75.

■ MC09

P-Plaza Court 7

Honoring Pete Veinott: Inventory and Operations Management. To Honor Pete Veinott's Illustrious Career, a Group of Students and Associates will Present 3-5 Talks on Inventory and Operations Management

Cluster: Honoring Pete Veinott
Invited Session

Chair: Robin Roundy, Professor, Cornell University, 216 Rhodes Hall, Ithaca, NY, 14850, United States, robin@orie.cornell.edu

1 - Callable and Flexible Revenue Management
Guillermo Gallego, Columbia University, New York, NY, United States, gmg2@columbia.edu, Steven Kou, Garud Iyengar

Revenues management systems can be enhanced if low-fare sales can be recalled to satisfy high-fare demands. We present mechanisms so low fare customers can self select and participate in the recall program for both single leg and network models and show that the program can result in higher consumer surplus and higher expected profits.

2 - On the Structure of Optimal Policies for Stochastic Inventory Systems with Minimum Order Quantity

Michael Katehakis, Professor, Rutgers, Management Sc ience and Information Syst, Piscataway, NJ, United States, mnk@andromeda.rutgers.edu, Yao Zhao

We analyze a single product, periodic-review inventory model in which the ordering cost is linear, but the ordering quantity must be larger than or equal to an minimum order size. We introduce a new concept, the M-increasing functions; which allows us to characterize the optimal inventory policies everywhere in the state space outside of a known interval for each time period. Bounds are provided for these intervals.

3 - Efficient Selection of Components for System Order Revenue Coverage

Julie Ward, Project Scientist, Hewlett-Packard Laboratories, 1501 Page Mill Road, MS 1140, Palo Alto, CA, 9430, United States, jward@hp.com, Bin Zhang, Qi Feng, Krishna Venkatraman

Each order for a PC consists of a set of components. An order is covered by a component set if every component in the order is included in the set. We consider the NP-hard problem of selecting a set of at most S components to maximize the revenue of orders covered. We show how to generate a nested series of solutions along the efficient frontier of revenue coverage and set size in polynomial time. We also present efficient heuristics for this problem. This problem arises in HP's PC business.

4 - Joint Replenishment with Container Costs: An Efficient Algorithm and Performance Guarantee

Robin Roundy, Professor, Cornell University, 216 Rhodes Hall, Ithaca, NY, 14850, United States, robin@orie.cornell.edu, Chung-Yee Lee, Wikrom Jaruphongsa

We consider the classical joint replenishment problem for N items with constant demand in continuous time. Joint inventory replenishments are shipped using containers with a fixed capacity. There are fixed costs for placing a joint order, for each item included in the order (item-specific), and for each container used, as well as traditional holding costs. We obtain an efficient heuristic for this NP-hard problem, and prove that its cost is always within 62% of optimal.

■ MC10

P-Plaza Court 8

Intermodal Freight Transportation

Sponsor: Transportation Science & Logistics
Sponsored Session

Chair: Jeff Day, Schneider National, Inc., United States, dayj@schneider.com

1 - Using Distributed Computing to Solve Large Transportation Networks

Jeff Day, Schneider National, Inc., United States, dayj@schneider.com, Hugo Simao, Warren Powell, Belgacem Bouzaiene-Ayari

We use an optimizing simulator, based on informational decomposition and approximate dynamic programming, to perform tactical and strategic studies on large transportation networks. We further explore the decomposition aspect of the approach by distributing the computation of the subproblems among several processors, using Java interprocess communication to flow information among them.

2 - Planning Container Drayage Operations at Congested Seaports

Alan Erera, Georgia Institute of Technology, School of Ind and Sys Engineering, Atlanta, GA, 30332-0205, United States, alerera@isye.gatech.edu, Rajeev Namboothiri

We consider managing operations for a fleet of drayage vehicles providing container pickup and delivery service to a seaport. We develop optimization models that explicitly consider time-dependent congestion delays at the port, and develop heuristic solution methods based on set partitioning. The framework is used to develop an understanding of the potential impact of congestion delays on drayage operational efficiency.

3 - Improved Modeling and Solution Methods for the Multi-Resource Routing Problem

Guangming Zhang, Northwestern University, United States, g-zhang@northwestern.edu, Karen Smilowitz, Peter Francis

We propose method to effectively manage the number of options considered for flexible tasks in the Multi-Resource Routing Problem. This modeling change generates sufficient options to allow for low-cost solutions while maintaining reasonable computational effort. We also propose a new solution method that uses randomized column generation. Computational results from test cases show that these changes improve the quality of solutions by at least 5% as compared to methods from previous studies.

4 - Floating Stocks in fMCG Supply Chains

Rommert Dekker, Erasmus University Rotterdam, PO Box 1738, 3000 DR Rotterdam, Rotterdam, NL, Netherlands, rdekker@few.eur.nl

In this paper we present a new distribution concept called ëfloating stocks', which uses intermodal transport to deploy inventories in a supply chain in advance of retailer demand. Supplying part of the demand directly by road compensates the longer transit time of this transport. First an analytical comparison is made which shows that this concept has advantages in inventories over pure road and intermodal transport.

■ MC11

P-Governor's Square 9

Optimization for Decison Support

Sponsor: Transportation Science & Logistics
Sponsored Session

Chair: James Moore, Professor and Chair, Daniel J. Epstein Department of Industrial and Systems Engineering, GER 240, MC 0193, USC, University of Southern California, Los Angeles, CA, 90089-0193, United States, jmoore@almaak.usc.edu

1 - Optimization on Traffic Operations at the Toll Plaza

Seongmoon Kim, Assistant Professor, Industrial & Systems Engineering, 10555 W. Flagler Street / (EC 3100), Florida International University, Miami, FL, 33178, United States, Seongmoon.Kim@FIU.edu

The objective in this research is how to dynamically determine the optimal lane-type configuration which minimizes the total waiting time at the toll plaza. We use a queueing model to examine traffic operations at the toll plaza and integrate optimization methods to achieve the optimal configuration.

2 - Evaluating Speed Post-processors for Regional Mobile Emissions Estimation

Song Bai, Grad. Res. Asst., University of California, Dept. of Civil and Env. Engrg, One Shields Ave., Davis, CA, 96515, United States, sbai@ucdavis.edu, Deb Niemeier

The use of speed post-processors improves travel demand model speed estimates. We analyze five speed post-processors, characterizing impacts on regional emissions inventories using a case study with field observations and simulation. Selection guidelines are proposed for balancing between accuracy of speed estimates, simplicity of method and availability of required post-processing calibration parameters. This study improves our understanding of the effects of speed post-processor choice.

3 - An Integer Programming Approach to Alleviate the Parking Problem in Schedule-Based Demand Systems

Luis Otero, University of South Florida, 4202 E. Fowler Ave., Tampa, FL, United States, ldotero@eng.usf.edu, Grisselle Centeno, Aldo Fabregas

Parking availability is directly affected by the drivers' activities schedule i.e., work shift, appointments, classes, flights, or production. Typically, the schedulers of these activities overlook parking capacity, creating peak periods for parking space demand. In this study, an integer programming approach that will optimize the schedule during the planning phase is presented in order to alleviate the parking problem. The methodology is tested in a university parking scenario.

4 - Bridge Reconstruction Strategy

Hamid Pourmohammadi, Doctoral Candidate, Daniel J. Epstein Department of Industrial and Systems Engineering, GER 240, MC 0193, USC, University of Southern California, Los Angeles, CA, 90089-0193, United States, pourmoha@usc.edu

After an earthquake, reconstructing the transportation network is crucial. Clustering is a suitable strategy for effective bridge reconstruction. Mathematical programming is applied to define the number, size of clusters, and location of maintenance centers. A mathematical model is developed to prioritize the reconstruction of bridge clusters. Based on TOPSIS (Technique for Order Preference by Similarity to Ideal Solution), we obtain the acceptable solution in a reasonable time.

■ MC12

P-Governor's Square 10

Service Parts Logistics Network Design with Inventory Management

Sponsor: Transportation Science & Logistics
Sponsored Session

Chair: Erhan Kutanoglu, The University of Texas at Austin, 1 University Station C2200, Austin, TX, 78712, United States, erhank@mail.utexas.edu

1 - Logistics Network Design with Inventory Stocking, Time-based Service Levels, and Part Commonality
Vishv Jeet, The University of Texas at Austin, 1 University Station C2200, Austin, TX, 78712, United States, vjeet_a@mail.utexas.edu, Erhan Kutanoglu

We consider a network design problem motivated by challenges in service parts logistics (SPL). A SPL network delivers parts for after-sales services to dispersed customers. As service contracts promise time-based service levels, the network should designed so target percentages of demand are satisfied within specified windows. Our model locates facilities and determines the stock levels at open locations, considering multiple products with part commonality, which introduces non-linearity.

2 - Solving Integrated Logistics Network Design and Stocking Problems with Time-Based Services
Mehmet Candas, Ph.D student, The University of Texas at Austin, 1 University Station C2200, Austin, TX, 78712, United States, mfcandas@mail.utexas.edu

Inspired by the service parts logistics challenges, we investigate exact and heuristic ways to solve problems where location/allocation and stocking decisions are considered simultaneously. These problems are characterized by product-based tiered time-based service levels, and multiple products and parts, each with low demand. The overall model is a nonlinear integer program, which can be linearized for special cases. We present efficient solution techniques to solve this version.

3 - Multi-Echelon Logistics Network Design with Time-Based Service Coverage Constraints
Erhan Kutanoglu, The University of Texas at Austin, 1 University Station C2200, Austin, TX, 78712, United States, erhank@mail.utexas.edu, J. Wesley Barnes

We study a tabu search-based method to solve multi-echelon logistics network design problems with time-based service constraints. The problems are motivated by similar applications in service parts logistics. We present the tabu search results and compare them to the optimal solutions for small problems and to other heuristics for larger problems.

■ MC13

P-Governor's Square 11

Joint Session Railroad Applications/ TSL: Scheduled Railroading: New Operating Strategies for Freight Trains

Sponsor: Railroad Applications, Transportation Science and Logistics
Sponsored Session

Chair: David Hunt, Cambridge Systematics, Inc., P.O. Box 816, Pennington, NJ, United States, dhunt@camsys.com

1 - Current Directions in Model-Driven Freight Railway Service Design
Carl Van Dyke, President, MultiModal Applied Systems, Princeton, NJ, United States, carl@multimodalinc.com

The design of freight railway operating plans is increasingly influenced by the use of computer-based design tools. For many railways, this use of computers has become a well defined and structured process, which now presents opportunities to extend the role of OR techniques to the next level. We will explore the both current state-of-the art, and the emerging uses of OR by freight railways.

2 - New Advances in Solving Large-Scale Railroad Scheduling Problems
Ravindra Ahuja, Professor, University of Florida, 303, Weil Hall, P O Box 116595, Gainesville, FL, 32611, United States, ahuja@ufl.edu

In the past two years, we have developed state-of-the-art optimization methods for solving several railroad scheduling problems: the railroad blocking problem, the yard closure problem, and the train scheduling problem. In this talk, we will give an overview of the algorithms, and present computational results for data provided by several US railroads.

3 - Synchronization of intermodal trains
Teodor Gabriel Crainic, Professor, ESG, UQAM and Centre for Research on Transportation, CP 8888, Succ. Centre Ville, Montreal, QC, H3C 3P8, Canada, theo@crt.umontreal.ca, Michael Berline Pedersen, Allan Larsen

For intermodal trains to compete with road transportation, the transit time of the intermodal trip chains need to be reduced. Synchronising trains in terminals and removing connection delays can achieve this. We present a model that considers the trade-off between value of time of freight and the operational cost.

■ MC14

P-Governor's Square 14

Joint TMS/NPD Panel: Editors' Views on Multidisciplinary Research

Sponsor: Technology Management, New Product Development
Sponsored Session

Chair: Vish Krishnan, University of Texas at Austin, Department of Management, Austin, TX, 78712, United States, Vish.Krishnan@mccombs.utexas.edu

1 - Panel: Editors' Views on Multidisciplinary Research
Moderator: Vish Krishnan, University of Texas at Austin, Department of Management, Austin, TX, 78712, United States, Vish.Krishnan@mccombs.utexas.edu, Panelists: Anthony DiBenedetto, Jeffrey Liker, Scott Shane, Michael Badawy

This presentation will explore some of the issues relating to publishing scholarly research articles in technology management and product development journals. It will draw on the experience of the Editors at major journals.

■ MC15

P-Governor's Square 15

Logistics and Scheduling

Cluster: Scheduling
Invited Session

Chair: Xiaoqiang Cai, Professor, The Chinese University of Hong Kong, Dept of SEEM, Shatin, N.T., Hong Kong, xqcai@se.cuhk.edu.hk

Co-Chair: Chung-Yee Lee, The Hong Kong University of Science and Technology, Department of Industrial Engineering and, Kowloon, Hong Kong, cylee@ust.hk

1 - Dynamic Policies for Stochastic Scheduling Subject to Preemptive-Repeat Machine Breakdowns
Xiaoqiang Cai, Professor, The Chinese University of Hong Kong, Dept of SEEM, Shatin, N.T., Hong Kong, xqcai@se.cuhk.edu.hk, Xianyi Wu, Xian Zhou

We consider the problem where a number of jobs are processed on a single machine subject to stochastic, preemptive-repeat breakdowns. Two cases for the processing time of a job interrupted by a breakdown are examined: (a) it may be re-sampled according to its probability distribution; or(b) it may remain a same (but unknown) amount as that before the breakdown. We allow general uptimes and downtimes distributions and arbitrary processing distributions, and find policies that are optimal dynamically. We also reveal an interesting distinction between the optimal dynamic policies for the cases with and without processing time re-sampling.

2 - Models for Third Party Scheduling Operations
George Vairaktarakis, Case Western Reserve University, Weatherhead School of Management, Cleveland, OH, 44106, United States, gxv5@case.edu, Xiaoqiang Cai

A manufacturer(M) outsources work to a third party(3P) who leases its daily capacity at regular or peak cost. If M books a day, (s)he can purchase limited overtime at additional cost. M minimizes booking+ overtime+ tardiness penalty for jobs delivered after their due date. Models and solutions are presented.

3 - Machine Scheduling with Deliveries to Multiple Customer Locations
Chung-Lun Li, The Hong Kong Polytechnic University, Faculty of Business, Kowloon, Hong Kong, lgtclli@polyu.edu.hk, George Vairaktarakis, Chung-Yee Lee

We analyze a single-machine scheduling model that incorporates routing decisions of a delivery vehicle which serves customers at different locations. The objective is to minimize the sum of job arrival times. The problem is NP-hard in the strong sense in general. We develop polynomial-time algorithms for various special cases of the problem.

4 - Jobs and Identical Resource Allocation
Hui-Chih Hung, The Ohio State University, Industrial Engineering, 1971 Neil Avenue, Columbus, OH, 43210, United States, hung.63@osu.edu, Marc Posner

Consider a queueing system where jobs have distinct weights and arrival rates. The problem is to minimize WIP cost by grouping identical servers and allocating job types to server groups. The problem is NP-hard. For two servers, a heuristic is constructed that has an upper bound on the relative error of 4/3. Except for special instances, the heuristic finds an optimal solution. For multiple servers, a class of heuristics are constructed where the relative error is bounded above by 1+e.

■ MC16

P-Governor's Square 17

Linear Programming

Sponsor: Computing Society
Sponsored Session

Chair: Nick Sahinidis, Professor, University of Illinois, Dept. of Chemical and Biomolecular Eng., 600 South Mathews Avenue, Urbana, IL, 61801, United States, nikos@uiuc.edu

1 - On Solving the Colorful Linear Programming Problem
Tamas Terlaky, Professor, McMaster University, Department of Computing and Software, 1280 Main St. W. Hamilton, Hamilton, ON, L8S 4L7, Canada, terlaky@mcmaster.ca, Antoine Deza, Sui Huang

Colorful Linear Programming Problem (Bárány and Onn) in dimension d asks for a colorful simplex of d+1 colored points from d+1 colored sets of point such that the colorful simplex contains a given point from the core of the colorful sets. We show that a pivot algorithms provides a powerful tool to solve the colorful LP problem.

2 - Improving the Efficiency of the Simplex Algorithm Based on a Geometric Explanation of Phase 1
Daniel Solow, Case Western Reserve University, Weatherhead School of Management, Cleveland, OH, 44106, United States, dxs8@weatherhead.cwru.edu, Hans Halim

Computer simulations are shown to support the conjecture that phase 1 of the simplex algorithm terminates at a feasible point of an LP that is geometrically close to the starting point. A coordinate transformation is then proposed and time-savings benefits are demonstrated when CPLEX solves the Netlib problems.

3 - Additional Experimentation of the Cosine Simplex Method (CSM)
Federico Trigos, Professor, Tecnologico de Monterrey, Campus Toluca., Eduardo Monroy Cárdenas 2000, Toluca, ME, 50110, Mexico, ftrigos@itesm.mx, Jenny Dìaz, Juan Frausto

New results obtained by additional experimentation of the Cosine Simplex Method endorse the goodness of this approach that find initial points which can be both primal and dual unfeasible ones and get them ready to apply simplex methods for solving linear programming problems. Experimentation on network problems and Klee-Minty problems leads to establish two theorems about the effectiveness of the CSM.

■ MC17

P-Directors Row E

Panel Discussion: Perspectives on Corporate Risk Attitudes

Sponsor: Decision Analysis
Sponsored Session

Chair: Michael R. Walls, Colorado School of Mines, Golden, CO, 80401, United States, mwalls@mines.edu

Co-Chair: James E. Smith, Fuqua School of Business, Duke University, Durham, NC, 27708-0120, United States, jes9@mail.duke.edu

Co-Chair: James Dyer, University of Texas at Austin, United States

Co-Chair: Carl Spetzler, Strategic Decisions Group, United States

Co-Chair: Eric Bickel, Assistant Professor, Department of Industrial Engineering, Texas A&M University, 236B Zachry Engineering Center, 3131 TAMU, College Station, TX, 77843-3131, United States, bickel@iemail.tamu.edu

1 - A Panel Discussion: Perspectives on Corporate Risk Attitudes
Moderator: Michael R. Walls, Colorado School of Mines, Golden, CO, 80401, United States, mwalls@mines.edu, Panelists: James Dyer, Eric Bickel, Carl Spetzler, James E. Smith

Over the last 35 years, there has been considerable discussion in the field of decision analysis about the appropriate way to think about and model risk attitudes in the corporate setting. This ongoing discussion and some resulting publications have included both descriptive and normative perspectives. The panelists will discuss some of these alternative perspectives in light of their notional and practical implications for corporate decision making. The panelists will also present their viewpoints on how managers might leverage the contributions to this area in the context of their own strategic decision making challenges.

■ MC18

P-Directors Row H

Behavioral Decision Theory

Sponsor: Decision Analysis
Sponsored Session

Chair: Karen Jenni, Principal, Geomatrix Consultants, 1401 17th Street, Suite 600, Denver, CO, 80202, United States, kjenni@geomatrix.com

1 - Four Score and Seven Years from Now: The Date/Delay Effect in Intertemporal Choice
Daniel Read, Reader, Operational Research, London School of Economics, Houghton Street, London, LD, WC2A 2AE, United Kingdom, D.Read@lse.ac.uk, Shane Frederick

We describe a new anomaly in intertemporal choice: the "date/delay effect:" Future outcomes are discounted more when time is referred to as a delay (e.g., 'in 6 months') than as a calendar date (e.g. on October 17th). The effect is demonstrated in four experiments, using both choice and matching response modes. Moreover, hyperbolic discounting is found only when time is referred to as a delay discount rates are constant when time is referred to in terms of calendar dates).

2 - Judgment and Choice in the NFL Draft
Cade Massey, Fuqua School of Business, Duke University, Durham, NC, 27708-0120, United States, cade.massey@duke.edu, Richard Thaler

We argue that NFL teams are overconfident in their ability to assess the professional prospects of college football players, leading them to over-value early draft picks relative to late ones. We use draft-day trades and the long-term performance of drafted players to evaluate this hypothesis, finding evidence consistent with over-valuation. The results suggest that psychological biases can persist in "real world" environments, despite strong incentives, the presence of a market, and the opportunity to learn

3 - Modeling the Effects of Reference Point Dependence on Supplier Selection
Tianjun Feng, Graduate School of Management, University of California, Irvine GSM 335, Irvine, CA, 92697-3125, United States, tfeng02@gsm.uci.edu, L. Robin Keller

The primary goal of this paper is to develop an analytical framework for a buyer to understand the impact of reference level and loss aversion on supplier selection and make smart choices among her suppliers. A mathematical reference-dependent model is proposed to explore the effect on supplier selection by evaluating the suppliers relative to multi-attribute reference points characterized by price, delivery time guarantee and capacity level.

■ MC19

P-Directors Row F

Topics in Reverse Supply Chain Management

Cluster: Reverse Supply Chains
Invited Session

Chair: Elif Akcali, Assistant Professor, University of Florida, Dept. of Industrial & Systems Eng., Gainesville, FL, 32611-6595, United States, akcali@ise.ufl.edu

1 - Collection Strategy Choice and Network Design with Financial Incentives for Product Returns
Tamer Boyaci, Assistant Professor, McGill University, 1001 Sherbrooke Street (West),, Montreal, Qu, Canada, tamer.boyaci@mcgill.ca, Vedat Verter

We present an integrated, analytical framework for selecting collection strategies by simultaneously optimizing the service area of each collection facility and the financial incentive provided by a collector for each returned product. We analyze both drop-off and pick-up collection strategies. We establish the impact of various cost, product and market characteristics on the optimal decisions, and identify the key drivers of the firm's preference over the two collection strategies.

2 - Acquisition and Sales Pricing for the Recovery and Recycling of End-of-life Products
Ibrahim Karakayali, University of Florida, 303 Weil Hall, PO Box 116595, Gainesville, FL, 32611, United States, ibrahimk@ufl.edu, Elif Akcali, Hulya Emir

We consider a product that can be purchased from a final user market, and some or all of its parts can be recovered and remanufactured for sale in a secondary parts market, and determine the optimal buy-back prices for the end-of-life product, the recovery fractions of the remanufacturable parts, and the sales prices for the remanufactured parts. We also provide insight on how manufacturers can promote the recovery and recycling of their end-of-life products.

3 - Time Value of Commercial Product Returns
Gilvan C. Souza, Assistant Professor, University of Maryland, The Robert H. Smith School of Business, 4311 Van Munching Hall, College Park, MD, 20742-1815, United States, gsouza@umd.edu, Daniel Guide, Joseph Blackburn, Luk Van Wassenhove

There are significant opportunities to build competitive advantage from the appropriate reverse supply chain design for commercial product returns. We use a simple queuing network model to provide managerial insights into the marginal value of time in the product returns stream. We illustrate our approach with actual examples from two companies in different industries and show how industry clockspeed affects the choice between an efficient and a responsive returns network.

4 - Planning Reverse Production Systems under Uncertainty with Full Factorial Scenario Design
Tiravat Assavapokee, Dr., University of Houston, Industrial Engineering, Houston, Tx, United States, Tiravat.Assavapokee@mail.uh.edu, Jane Ammons, Matthew Realff

We develop a new three-stage min-max regret robust algorithm for making robust strategic decisions for forward and reverse production systems under uncertainty when uncertain parameters' values are classified into a finitely large set of full factorial designed scenarios. A case study on planning e-scrap reverse production systems is presented and demonstrates the significant improvement in computational time of this new algorithm over the traditional robust optimization algorithm.

■ MC20

P-Room 3304

Demand Management in Healthcare

Sponsor: Health Applications
Sponsored Session

Chair: Julie Swann, Georgia Institute of Technology, Industrial and Systems Engineering Dept., 765 Ferst Drive, NW, Groseclose 0205 Room 411, Atlanta, GA, 30332-0205, United States, jswann@isye.gatech.edu

1 - Healthcare Appointment Scheduling: Perceptions of Patient Wait, and the Impact of Limited Capacity
Peter Salzarulo, Indiana University, 3960 Whitewood Way, Bloomington, IN, 47404, United States, psalzaru@indiana.edu, Kurt Bretthauer, Kenneth Schultz, Murray Cote

In the appointment scheduling literature, the cost of patient wait is calculated whereby each minute of patient wait increases cost by one unit. The true cost of patient wait, however, is the patient's perception of the time spent waiting. Using nonlinear cost functions, we examine the impact that consideration of patient perceptions of wait has on the selection of appointment rules. We also consider the impact on scheduling rule performance of limiting the capacity of several key resources.

2 - Appointment Scheduling under Revenue Consideration: Simulation Study of a Single Physician Clinic
Vikram Tiwari, Indiana University Bloomington, BU570, ODT, 1309 E 10th Street, Bloomington, IN, 47405, United States, vtiwari@indiana.edu

Doctors are forced to employ some form of revenue management. In this appointment scheduling simulation study, we evaluate possible techniques for enhancing revenues and the trade-offs involved. Preliminary findings suggest that classifying patients based on their expected revenue potential and treatment severity redistributes patients' appointments so that the average waiting time decreases without any significant loss or gain in the revenues.

3 - Optimal Location of Community Healthcare Centers
Sebastian Urbina, Georgia Institute of Technology, 1004 Summit North Dr, Atlanta, GA, 30324, United States, gte765y@mail.gatech.edu, Julie Swann, Paul Griffin

Recently the US government has increased funding for a network of community healthcare centers distributed over a wide geographical area, but rarely is a systems approach considered in locating the centers or determining what services to provide in each. We develop models of demand (need) for free healthcare based on publicly available data and build cost and service models to optimize location of these centers and services within the state of Georgia.

4 - Public Policy for Improved Dental Health in the US Market
Julie Swann, Georgia Institute of Technology, Industrial and Systems Engineering Dept., 765 Ferst Drive, NW, Groseclose 0205 Room 411, Atlanta, GA, 30332-0205, United States, jswann@isye.gatech.edu, Paul Griffin, Susan Griffin, Natalya Zlobin

Due to a larger number of elderly persons who have kept more teeth, rising dental costs have led to a crisis of dental care for this high-risk group. We apply economic theory to identify factors affecting insurance coverage and dental care utilization in the US and compare these factors for the medical and dental markets. We develop theory and test with data to predict the future dental demand in the US, and we design financing mechanisms to improve overall dental health at reasonable costs."

■ MC21

P-Room 3302

Public Processes and Industry Applications

Sponsor: Public Programs and Processes
Sponsored Session

Chair: Michael Pidd, Professor of Management Science, Lancaster University, The Management School, Bailrigg, Lancaster, LA1 4YX, United Kingdom, M.Pidd@lancaster.ac.uk

1 - Airline Baggage Holds: A Probabilistic Analysis of Three Security Dilemmas
Susan Martonosi, Graduate Student, MIT, E40-130, 77 Massachusetts Ave, Cambridge, MA, 02139, United States, sem18@mit.edu, Arnold Barnett

Three years after 9/11, certain security measures imposed to protect aircraft baggage holds from explosive devices have been relaxed. Other measures have yet to be implemented. We consider some recent policy dilemmas involving checked passenger luggage, US mail and general cargo. We find that a specific security measure, such as bomb-sniffing dogs, might be highly beneficial in one context but unacceptably risky in another.

2 - Spillover Effects of MNC's R&D Activities in China: Some Facts and Open Questions
Sien Shen, National University of Singapore, Vice Dean Office, Business School,, 1Business Link, NUS, Singapore, 117592, Singapore, g0301022@nus.edu.sg

Foreign R&D activities can have beneficial effects to innovation capacity in host country.This paper provides empirical evidence by examining the foreign R&D activities in China and analyzes the spillover channels.It concludes that MNC's R&D activities have positive spillover effects on China's innovation capacity.In addition, open questions are discussed:the spillover effect in China is limited and geographically uneven; there exists reverse spillovers in China.

3 - OR/MS and Performance Measurement in the Public Sector
Michael Pidd, Professor of Management Science, Lancaster University, The Management School, Bailrigg, Lancaster, LA1 4YX, United Kingdom, M.Pidd@lancaster.ac.uk

Most countries wish to ensure that public programmes are run effectively and efficiently and they use performance indicators (PIs) to assess their success. PIs are models, rather like those used in OR/MS, but very simple. Performance measurement systems often produce dysfunctional behaviour despite the good intentions of everyone involved. This paper considers why this occurs and suggests the contributions that OR/MS might make to better performance measurement in the public sector.

■ MC22

P-Room 3312

Location Modeling VI

Sponsor: Location Analysis
Sponsored Session

Chair: Michael Johnson, Associate Professor of Management Science and Urban Affairs, H. John Heinz III School of Public Policy and Management, Carnegie Mellon University, 5000 Forbes Ave., Pittsburgh, PA, 15213-3890, United States, johnson2@andrew.cmu.edu

1 - Stochastic Location of Facilities on a Line
Opher Baron, Rotman School of Management, University of Toronto, 105 St. George St., Toronto, ON, M5S 3E6, Canada, Opher.Baron@rotman.utoronto.ca, Oded Berman, Dmitry Krass

We consider locating M single server facilities on the unit line with an upper bound constraint on the probability that customers waiting times be longer than a threshold. We show that when feasible, a fair location is optimal; we also provide approximate solutions for M and the service capacity.

2 - Multiple Facilities Location in the Plane Using the Gravity Model
Tammy Drezner, Part-time Faculty, Information Systems and Decision Sciences Department, California State University, Fullerton, P.O. Box 34080, Fullerton, CA, 92834, United States, tdrezner@fullerton.edu, Zvi Drezner

We consider two problems for location of p facilities. The first is the p-median problem in which the total distance traveled by customers is minimized, and the second one minimizes the variance of the demands attracted to each facility. In each case we use the gravity rule to allocate demands to facilities rather than assuming that each customer selects the closest facility.

3 - A Branch-and-Price Algorithm for Large-scale Planar Location Problems
Giovanni Righini, Associate Professor in Operations Research, Universit‡ degli Studi di Milano, Dipartimento di Tecnologie dell'Informaz, Via Bramante 65, Crema, I-26013, Italy, righini@dti.unimi.it, Luca Zaniboni

We present a branch-and-price algorithm for the exact solution of multi-source location problems in the Euclidean plane. This approach allows to confine the non-linear part of the problem in the pricing subproblem, where weighted single-source problems are repeatedly solved. We discuss the effectiveness of stabilization techniques for column generation and we report on computational results obtained on large-scale instances.

■ MC23

P-Room 3354

Mobility Applications I

Sponsor: Military Applications
Sponsored Session

Chair: Andy Armacost, Associate Professor, US Air Force Academy, 2354 Fairchild Drive, 6J100, Colorado Springs, CO, 80840, United States, andy.armacost@usafa.af.mil

1 - A Combined Adaptive Tabu Search and Set Partitioning Approach for the Crew Scheduling Problem
Jim Moore, AF Institute of Technology, AFIT/ENS, Building 641, 2950 Hobson Way, Wright Patterson AFB, OH, 45433-7765, United States, James.Moore@afit.edu, Todd Combs, J. Wesley Barnes, Victor Wiley

Air refueling is an integral part of U.S. air power across a wide range of military operations. The planning, tasking, and scheduling of aerial refueling require solution of two major problems: assigning and scheduling of tankers to refueling points and efficiently assigning crews to each tanker. A hybrid adaptive tabu search/set partitioning scheme combines the metaheuristic tabu search with a classical optimization approach.

2 - The Characteristic Neighborhood Equation for an AR(2) Landscape
Boryana Dimova, Ph.D Student, University of Texas, 2501 Lake Austin Blvd. M201, Austin, TX, 78703, United States, boryana_dimova@mail.utexas.edu, Elmira Popova, J. Wesley Barnes

Elementary landscape has favorable properties for direct search methods. For the special case of symmetric-regular neighborhood, is prove that the autocorrelation function associated with an elementary landscape is consistent with an AR(1). We extended this property to arbitrary elementary landscape. Here we develop the characteristic neighborhood equation for an AR(2)Landscape and extend the concept for favorable neighborhood for a local search.

3 - An Adaptive Tabu Search Approach for 2-Dimensional Orthogonal Packing Problems
John Harwig, Operations Research Analyst, U.S. Army Operational Test Command, ATTN: CSTE-OTC-MA-M, 91012 Station Avenue, Fort Hood, TX, 76544, United States, john.m.harwig@otc.army.mil, J. Wesley Barnes, Jim Moore

The research presented implements an adaptive tabu search procedure for bin packing, ATS-BP, that controls the partitioning, ordering and orientation features of the solution to the two-dimensional orthogonal bin packing problem. The method uses a new fine-grained objective function and an efficient dynamic move neighborhood strategy. ATS-BP results meet or exceed all other techniques a common 500 problem test set. The technique has potential applications for shipment of military equipment.

4 - A Tabu Search Approach to the Strategic Airlift Problem
Garry Lambert, LTC, Department of Mathematics, United States Military Academy, West Point, NY, 10996, United States, garry.lambert@us.army.mil, J. Wesley Barnes

Air Mobility Command (AMC) planners use simulation systems or large-scale LP models in studying the strategic airlift problem (SAP). AMC needs a tool which prescribes good solutions while maintaining the operational level detail necessary to produce flight schedules. This presentation outlines a tabu search algorithm that obtains excellent solutions to the SAP with the operational level detail necessary for AMC planners to develop the detailed routing and scheduling of strategic airlift.

■ MC224

P-Room 3402

Optimization in Financial Services II

Sponsor: Financial Services
Sponsored Session

Chair: Dessislava Pachamanova, Babson College, United States, dpachamanova@babson.edu

1 - Optimizing Workforce Planning within a Consumer Credit Originations Environment
Charles Reichenbach, Wells Fargo, Consumer Credit Group, 11601 N. Black Canyon Highway, MAC S3626-020, Phoenix, AZ, United States, Charles.Reichenbach@wellsfargo.com, Jihong Jin, Hung-Nan Chen, Geetha Rajavelu

The Originations Division of Wells Fargo's Consumer Credit Group (CCG) determines staffing and facilities plans for its U.S. operations based on the results of a stochastic optimization model that predicts resource levels required to meet competing imperatives, such as increasing production, minimizing expense, and maintaining service levels. The model utilizes Monte Carlo simulation and math programming to evaluate two stochastic factors: demand uncertainty and process variation.

2 - Simulation for Long- and Short-Term Scheduling under Uncertainty
Olga Bagatourova, Bank of America, United States, Olga.Bagatourova@bankofamerica.com, Sud Mallya

Workforce scheduling for check proofing and encoding operations in a bank where uncertainties include both volume and arrival pattern of the work is a challenging task. A shop floor simulation model and a heuristic for workforce schedule optimization using simulation to estimate objective function are presented. The proposed approach results in a robust work schedule that can be easily adjusted "on the fly" in response to environmental changes, such as volume and throughput fluctuations.

3 - Modeling when and which Customers Purchase and Terminate their Insurance Products
Lyn Thomas, Professor of Management Science, University of Southampton, School of Management, University of Southampton, Southampton, SO516DB, United Kingdom, l.thomas@soton.ac.uk, leilei Tang

In the insurance industry customer relationships can last over several years if not decades. Thus modeling who will purchase another product or who will terminate a product and when these events may happen must involve economic factors as well as socio-demographic ones. Developing ideas first used in credit scoring this paper looks at two approaches to estimating these propensities -survival analysis and Markov chains.

4 - The Profitability of Home Equity Protection
Michael Allietta, Babson College, United States, mallietta@babson.edu, Thomas Malloy, Dessislava Pachamanova

Home Equity Protection (HEP) contracts are a relatively new financial tool that helps homeowners hedge the risk of a potential downturn in the real estate market. There are currently no for-profit HEP providers in the United States; however, non-profit organizations have made HEP available to selected regions such as Syracuse and New York. We discuss approaches for determining appropriate premia for HEP plans and assessing the viability of such plans for different real estate markets.

■ MC25

P-Room 3404

Joint Session Education/OR in Sports: SpORts in the OR Classroom II

Sponsor: Education (INFORM-ED) SPONSORED/INVITED, OR in Sports
Sponsored Session

Chair: James Cochran, Assistant Professor, Louisiana Tech University, P. O. Box 10318, Ruston, LA, 71272, United States, jcochran@cab.latech.edu

1 - Scheduling a Professional Sports League (Optimally!) in Microsoft® Excel
John Birge, University of Chicago, Graduate School of Business, Chicago, IL, United States, John.Birge@gsb.uchicago.edu

Scheduling a sports league to minimize travel is a notoriously difficult task involving the coordinated solutions of multiple traveling salesperson problems (TSP) with additional constraints. Good modeling techniques can, however, sometimes reduce these problems to manageable sizes. This paper describes the use of a case based on Major League Soccer. The case illustrates TSP solution methodology, column generation techniques, and integer programming formulations.

2 - Teaching Statistics With Sports Examples
Paul Kvam, Associate Professor, Georgia Tech, Industrial & Systems Eng., 765 Ferst Drive, Atlanta, GA, 30332-0205, United States, pkvam@isye.gatech.edu, Joel Sokol

Introductory statistics lends itself to endless applications of sports examples. The goal of this article is to show different ways sports examples can be used to illustrate statistical methods or to motivate project work in an introductory class. We use NBA lottery statistics for lessons on probability and novel graphical methods, MLB salary data to showcase statistical graphics and linear regression, and college basketball to illustrate a logistic regression procedure.

3 - Optimizing Travel Considerations for the NCAA Basketball Tournament
Cole Smith, University of Arizona, PO Box 210020, Tucson, AZ, 85721, United States, cole@sie.arizona.edu, Barbara Fraticelli

65 teams participate in the Men's NCAA Basketball Tournament each March, a tournament that garners much attention, but requires substantial travel for these teams. Given the selection and seedings of these teams, we minimize travel to the first and second round sites, plus expected travel cost to the third/fourth round sites. We adjust the seeding of some teams with some penalty cost, and ensure that NCAA matchup rules are not violated. We illustrate our model on recent tournament data.

4 - It Ain't Over Till It's Over: Playoff Races and Optimization Modeling Exercises
Eli Olinick, SMU, EMIS Department, PO Box 750123, Dallas, TX, 75275-0123, United States, olinick@engr.smu.edu

Sports fans love to speculate about which teams will advance to the post season and whether their favorite team is still in contention for the playoffs. Sports elimination problems - determining when teams have been "mathematically eliminated" from the playoffs - are useful for teaching basic ideas in optimization since students can intuitively relate to them and find the results interesting. We present a series of optimization modeling exercises concerning sports elimination problems.

■ MC26

P-Room 3412

Consumer-Designed Solutions and Recommendation Agents

Sponsor: Marketing
Sponsored Session

Chair: Page Moreau, Assistant Professor of Marketing, Leeds School of Business, University of Colorado, UCB 419, Boulder, CO, 80302, United States, Page.Moreau@Colorado.EDU

1 - Designing the Solution: The Effect of Constraints on Consumer Creativity
Page Moreau, Assistant Professor of Marketing, Leeds School of Business, University of Colorado, UCB 419, Boulder, CO, 80302, United States, Page.Moreau@Colorado.EDU

Across a variety of domains, consumers often choose to act as the designer of their own solution, sourcing the necessary components and assembling the parts to meet their specific goals. While thinking creatively is an integral part in the daily life of every consumer, surprisingly little research in marketing has examined the factors influencing such processes.

2 - Feedback Control Design for Website Effectiveness
Anjala Krishen, Doctoral Student, Virginia Tech, 2016 Pamplin Hall, Virginia Tech, Blacksburg, VA, 24061, United States, anjala@vt.edu, Kent Nakamoto, Pushkin Kachroo

We present a methodology that shows a step-wise mathematical framework for feedback control based optimal design of a website. We apply it to a sample problem by creating a feedback controller for a web-design problem that involves dynamic feedback based creation of advertising popup windows. We present various dynamic models using optimal and standard feedback control settings for the various models. We also provide a software simulation package developed in Matlab for web-designers.

3 - Computing Optimal Recommendation Sets for E-commerce and Retailing
Bob Price, Postdoctoral Fellow, University of Alberta, Edmonton, AB, T6G 2E8, Canada, price@cs.ualberta.ca, Paul Messinger

We point out the sub-optimality of the common practice of generating recommendation sets from rankings of expected market utility. Instead, we propose an algorithm, which we call "recursive Leaps and Bounds," that relatively quickly finds the optimal cover set from all possible subsets. We show how this algorithm applies for e-commerce and retail assortment selection, and sketch other possible applications in management and computing science.

■ MC27

P-Room 3454

Queues with Flexible Servers

Sponsor: Applied Probability
Sponsored Session

Chair: Hayriye Ayhan, Associate Professor, Georgia Institute of Technology, Industrial and Systems Engineering, 765 Ferst Drive NW, Atlanta, GA, 30332-0205, United States, hayhan@isye.gatech.edu

1 - On the Introduction of Agile, Temporary Workers into a Tandem Queueing System
David Kaufman, Ph.D. student, University of Michigan, Industrial and Operations Engineering, 1205 Beal Avenue, Ann Arbor, MI, 48109-2117, United States, davidlk@umich.edu, Mark Lewis, Hyun-Soo Ahn

We consider a 2-stage tandem queueing system where agile workers serve both stations, but the workforce level may fluctuate by hiring, firing, or turnover. We present multiple workforce fluctuation scenarios where staffing decisions are made at different random epochs. We show for all cases that it is optimal to assign all workers to the same queue independent of the workforce level. We then characterize the optimal workforce policy in an unrestricted case and discuss intricacies of other cases.

2 - Pooling in Queueing Networks with Cooperation and Blocking
Nilay Argon, Assistant Professor, University of Wisconsin-Madison, 1513 University Avenue, Dept. of Industrial Engineering, Madison, WI, 53706, United States, nilay@engr.wisc.edu, Sigrun Andradottir

For a tandem line of finite queues with cross-trained and cooperative servers, we provide sufficient conditions under which pooling several adjacent stations will decrease the departure time of each job from the system. We extend our results to closed tandem lines and to queueing networks with either a general blocking mechanism (including communication, kanban, and production blocking mechanisms) or probabilistic routing.

3 - Scheduling Failure Prone Networks with Flexible Servers
Douglas Down, Associate Professor, McMaster University, Department of Computing and Software, 1280 Main Street West, Hamilton, ON, L8S 4K1, Canada, downd@mcmaster.ca, Hayriye Ayhan, Sigrun Andradottir

We examine maximizing capacity in a network with flexible servers, where classes and servers may fail. We assume i.i.d. interarrival and service times, Bernoulli routing, and the failure state follows a Markov process. The maximal capacity is found by solving an LP. We identify scheduling policies that arbitrarily approach this value. We give several structural results, including identifying when flexibility can completely compensate for failures and when scheduling policies may be simplified."

■ MC28

P-Room 3504

Variability Modeling and Classification

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: Kailash Kapur, Professor, University of Washington, Industrial Engineering, Box 352650, Seattle, WA, 98195-2650, United States, kkapur@u.washington.edu

1 - Development of Variance Transmission Equation For the Six Sigma Process
Qianmei Feng, Industrial Engineering, University of Washington, Seattle, WA, 98195-2650, United States, fengqm@u.washington.edu, Kailash Kapur

Six Sigma methodology strives to improve process by reducing the variability. One of the efforts for variability reduction is to find the relationship between the variances of input variables and the variances of output variables, which can be expressed as a variance transmission equation (VTE).

2 - A Comparative Study of Optimizing Process Settings Using PLS Model versus Multiple Regression Model
Di Xu, American Express, 1802 W. Maryland Ave, #2013, Phoenix, AZ, United States, dixu@att.net, Susan Albin

Partial Least Squares (PLS) method has provided a powerful approach to model a process with multiple variables. Optimization methods then can be applied to some goodness-of-fit measure defined in the PLS model to identify optimal settings for the process. This paper compares the PLS method to the more established multiple regression approach in optimizing process settings. We provide some evidence to support the effectiveness of the PLS method.

3 - Multi-Sensor Based Grinding Wheel Condition Monitoring by Clustering
T. Warren Liao, Louisiana State University, Industrial & Manufacturing Systems Engin, Baton Rouge, LA, 70803, United States, ieliao@lsu.edu, Fengming Tang

We study grinding wheel condition monitoring using multiple sensors. Individual sensory signals are first processed to extract relevant features, which in turn forms a feature vector to a clustering algorithm that groups signals reflecting similar wheel conditions into the same cluster and signals reflecting dissimilar conditions into different clusters.

4 - Monitoring Multiple Nonconformities: Improvements on the Demerit Control Chart
Robin Wurl, United States, RobinWurl@psu.edu

An Edgeworth Expansion is used to compute the distribution of a statistic to monitor multiple nonconformities. The method yields a considerably better approximation to the true distribution of the statistic than typical procedures. A constraint on the statistic is removed, expanding the functionality and flexibility of the control chart.

■ MC29

P-Room 3502

GRID Simulation and Supply Chain Analysis

Sponsor: E-Business
Sponsored Session

Chair: Heng Cao, Advisory Engineer, IBM T.J. Watson Research Center, Route 134,, Kitchawan Road, Yorktown Heights, NY, 10598, United States, hengcao@us.ibm.com

1 - Global Dynamic Response Optimization Model (GD-ROM) for Value Chain Management
Roger Gung, Research Staff Member, IBM T.J. Watson Research Center, PO Box 218, Yorktown Heights, NY, 10598, United States, rgung@us.ibm.com, Teresa Wu, Darshit Parmar

In today's value chains, there has been a shift towards more collaborative model enabling integration of processes and competencies. Due to this trend, it has become difficult to effectively manage the customer collaboration, support business processes, business core and derived data, and supplier collaboration. Our on-going research aims at developing a Global Dynamic Response Optimization Model that performs dynamic optimization to meet customer orders while reducing value chain cost.

2 - Providing High Performance Supply Chain Simulation Through Web Sservices on GRID
Heng Cao, Advisory Engineer, IBM T.J. Watson Research Center, Route 134,, Kitchawan Road, Yorktown Heights, NY, 10598, United States, hengcao@us.ibm.com, Haifeng Xi, David Jensen, Leonard Berman

For supply chain simulation that involves aggregating results from multiple runs of the same underlying model, simulation iterations can be distributed to networked computing resources to achieve significant speedup. Web Services based OGSA provides an attractive network computing mechanism for distributed computing. This presentation introduces a generic distributed job running framework that facilitates such high performance supply chain simulation utilizing IBM MathGrid environment.

3 - Performance Analysis of Grid Computing Infrastructure using Discrete-Event Simulation
Sugato Bagchi, Research Staff Member, IBM T.J. Watson Research Center, Route 134,, Kitchawan Road, Yorktown Heights, NY, 10598, United States, bagchi@us.ibm.com

Recent advances in middleware technologies that enable grid and on-demand computing environments have outpaced the state of art capabilities of IT infrastructure design and analysis tools. We have developed IBM Grid Value at Work, an infrastructure modeling environment that supports an extensible set of analysis tools. This presentation focuses on one of the tools, a discrete-event simulator for analyzing the performance of computational workloads on a grid.

■ MC30

P-Room 3512

Panel Discussion: Directors' Message — Funding Trend and Opportunities at Federal Agencies

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: Yu Ding, Assistant Professor, Texas A&M University, Dept of Industrial Engineering, College Station, TX, 77843-3131, United States, YuDing@iemail.tamu.edu

1 - Directors' Message
Moderator: Harry Chang, U. S. Army Research Office, United States, mouhsiung.chang@us.army.mil. Panelists: Alan Feiveson, Wendy L. Martinez, Abhijit Deshmukh, Delcie Durham, Suvrajeet Sen

Several program directors from federal agencies will talk about general funding interest and trend, current funding opportunities, as well as review processes and criteria.

■ MC31

P-Room 3545

Data Mining and Security

Sponsor: Information Systems
Sponsored Session

Chair: Syam Menon, University of Texas at Dallas, MS 33, School of Management, Richardson, Tx, 75083, United States, syam@utdallas.edu

1 - A Pricing Model for Database Queries Under Security Constraints
Manuel Nunez, University of Connecticut, Dept of Operations and Information Mgmt, 2100 Hillside Road Unit 1041, Storrs, CT, 06269, United States, Manuel.Nunez@business.uconn.edu

We study a market consisting of a data provider (DP) and a group of database users. The users want the answers to as many queries as possible from a target set of queries. The DP will provide answers to the queries for a price as long as the confidentiality of the data is preserved. We formulate mathematical models to determine an optimal safe bundle of queries to answer and its corresponding price. Our models incorporate insider threat and the expected risk of disclosure.

2 - Protecting Confidentiality in Data Mining — Some Perspectives
Rathindra Sarathy, Professor, Oklahoma State University, 408 Business, Department of MSIS, Stillwater, OK, 74078, United States, sarathy@okstate.edu, Mohammad Al-Ahmadi, Krish Muralidhar

Data mining of confidential, numeric data is an important area of research. Current data masking methods focus on making the protected data useful for statistical analysis involving linear models. Data mining, on the other hand, entails exploration of more complicated relationships. We explore some of the challenges in protecting the confidentiality of numeric data in the data mining context, and discuss possible solution approaches.

3 - Hiding Sensitive Itemsets: Exact and Approximate Approaches
Syam Menon, University of Texas at Dallas, MS 33, School of Management, Richardson, Tx, 75083, United States, syam@utdallas.edu, Sumit Sarkar

Sharing databases among firms comes with the risk of revealing relationships of potential strategic importance. This can be avoided by hiding these relationships before sharing. The identification of frequent itemsets is the first step in many data mining tasks. We present exact & heuristic approaches to solve different versions of the frequent itemset hiding problem. While some exact approaches have difficulty tackling large databases, the heuristics are observed to be efficient & effective.

■ MC32

T-Vail (Majestic Level)

Demand Forecasting and Demand Management

Cluster: OR Practice
Invited Session

Chair: Roger Tsai, IBM T. J. Watson Research Center, Rt 134, Yorktown Heights, NY, 10598, United States, rtsai@us.ibm.com

1 - Forecasting Demand using Dynamic Shipment and Orders Information
Roger Tsai, IBM T. J. Watson Research Center, Rt 134, Yorktown Heights, NY, 10598, United States, rtsai@us.ibm.com

This talk discusses the methodology and the applications of using the rich information contained in the shipment and customer orders to forecast future demand from the customers. The inter-relationship between the shipment, orders and future demand are exploited. Methodology in dealing with order lumpiness or large bids/spikes is utilized. The system is enveloped with a parametric optimization framework. The application results are discussed.

2 - Order Trend Analysis for Demand Conditioning in a Sense and Response Environment

Roger Tsai, IBM T. J. Watson Research Center, Rt 134, Yorktown Heights, NY, 10598, United States, rtsai@us.ibm.com, Markus Ettl, Edwin Pednault, Bianca Zadrozny, Lianjun An, Kelly Bowles, Pawan Chowdhary, Shubir Kapoor, Saharon Rosset, Paul Huang

This talk discusses the methodology and the applications of forecasting future orders for demand conditioning in a Sense and Response Environment. The focus will be on the specific techniques and application results for Order Trend Analysis. The forecasting algorithm makes use of the rich information contained in the dynamic behavior of the orders and shipment to project the future order. The application and deployment results will be shown.

3 - Demand Management and Optimization of Available to Promise in IBM's Microelectronics Division

Rahul Nahar, IBM, 1000 River Road, Essex Junction, VT, 05452, United States, rnahar@us.ibm.com, Samik Raychaudhuri

Operations Research methodology underpins demand management and available to promise systems in IBM's Semiconductor supply chain. This talk describes the business challenge to the industry, use of operations research techniques like forecasting and how they have been successfully implemented within a supply chain optimization process. We also describe future goals and challenges in this area.

4 - Demand Forecasting Challenges in High Technology Environments

John Konopka, Program Manager IBM Integrated Supply Chain Strategy, IBM, 2929 North Central Ave., Phoenix, AZ, 85012, United States, Konopka@us.ibm.com, Sarah Santo

This research identifies some underlying issues that make forecasting in a High Technology Environment complex. This study identifies and discusses the impact of these issues on the accuracy of the forecast. We also suggest some methods on how one may want to adjust the forecast when some of these issues are present.

5 - Forecast Account Balances by a Dynamic Model

Sheng-Pen (Ben) Wang, Associate Professor, Chang Gung University, Dept of Business Administration, Taoyuan, 333, Taiwan, wangsp@mail.cgu.edu.tw

Going beyond traditional regression techniques, this paper built a dynamic model of the banks deposits. The model incorporates transfers between accounts as well as withdraws and new deposits, and how each of these is influenced by bank policies and outside influences. While providing greater accuracy than previous models, the model also provides greater insight into why events are occurring. Empirical study applies to a local bank in Taiwan.

■ MC33

T-Savoy (Majestic Level)

Daniel H. Wagner Prize Competition

Sponsor: The Daniel H. Wagner Prize for Excellence in Operations Research

Sponsored Session

Chair: Joseph H. Discenza, SmartCrane, LLC, 2 Eaton Street Suite 500, Hampton, VA, 23669, United States, joeh@discenza.com

1 - Scheduling Employees in Quebec's Liquor Stores with Integer Programming

Bernard Gendron, Université de Montréal, C.P. 6128, Succursale Centre-Ville, Montréal, Québec, Canada, bernard@crt.umontreal.ca

The SAQ (in French, "Société des alcools du Québec") is a government's society responsible for distributing and selling alcohol-based products all across the Province of Quebec, Canada, through a large network of more than 400 stores. Every week, the SAQ has to generate the working schedules of more than 3000 employees. Until 2002, this process was handled manually, incurring estimated annual salary expenses of almost 1,000,000$ (CAN). This manual process was generating a great number of errors, because of the inability of the human beings to produce solutions that would respect all the complex rules of the union agreement. As a result of having to deal with the complaints filed by the employees, the company estimates it had to pay an annual cost of approximately 300,000$ (CAN). After a careful examination of the available computer-based workforce scheduling products, the company realized that none of them would properly handle their specific union agreement rules. It is in this context that the author of this project was approached to develop a solution engine that would interact with a homemade Web-based database/graphical system to produce the desired schedules.

2 - A Sequential Linear Programming Approach to Portfolio Optimization

Srinivas Bollapragada, General Electric Global Research Center, K1-5C22A, 1 Research Circle, Schenectady, NY, 12309, United States, Srnivas.Bollapragada@research.ge.com, Kete Charles Chalermkraivuth

General Electric Company (GE) owns several insurance businesses that offer a range of insurance, reinsurance and financial products for consumer and commercial customers. The assets supporting GE's insurance businesses are generated mainly through insurance premiums and contract payments. These assets are invested primarily in low-risk fixed income instruments, including corporate and government bonds, in accordance with statutory requirements. A major objective in selecting particular investments is to maximize the return on investment within risk parameters with which the business is comfortable. In addition, the business must ensure that there is sufficient cash flow to meet the liabilities associated with its products. Because a majority of the investments are in bonds, a major source of risk is from interest rate fluctuations.

■ MC34

T-Columbine (Majestic Level)

Issues in Supply Chain Management

Sponsor: Manufacturing and Service Operations Management

Sponsored Session

Chair: Haresh Gurnani, University of Miami, Dept of Management, 417B Jenkins Building, Coral Gables, FL, 33124, United States, hgurnani@exchange.sba.miami.edu

Co-Chair: Yunzeng Wang, Associate Professor, Case Western Reserve University, Cleveland, OH, 44106, United States, yunzeng.Wang@case.edu

1 - Modeling the Evolution of Demand Forecasts for Individual Products

Vickii Shu Zhou, Cornell University, Johnson Graduate School of Management, Ithaca, NY, 14853, United States, sz44@cornell.edu, Peter Jackson, Robin Roundy, Rachel Zhang

The Martingale Model of Forecast Evolution (MMFE) has been used extensively to model the behavior of forecasts over time of a given product family. In this paper, we extend the MMFE model and develop several estimation methods that allow us to model the behavior of forecast disaggregation systems..

2 - Scheduled Ordering Policies with Information Sharing in Capacitated Supply Chains

Srinagesh Gavirneni, Indiana University, Kelley School of Business, Bloomington, IN, 47405, United States, sgavirne@indiana.edu

For a supply chain with one capacitated supplier and many retailers, scheduled ordering policies have been proposed, with limited success, for reducing costs. We show that, when the retailers are willing to share information, these policies are beneficial in a larger variety of settings and determine conditions under which these strategies are especially effective.

3 - Pricing and Production Strategies in Decentralized Assemble-to-Order Systems with Leadtimes

Xiang Fang, Doctoral Student, Weatherhead School of Management, Case Western Reserve University, 10900 Euclid Ave, Cleveland, OH, 44106, United States, xxf6@case.edu, Kut C. So, Yunzeng Wang

An assembler needs components from independent suppliers. Demand for the assembled product is uncertain and its price decreases with delivery delay. The assembler sets a price schedule to suppliers, based on the timing of their component deliveries. We study the assembler's pricing strategy and suppliers' production decisions.

4 - Competitive Pricing and Capacity Investment Decisions for Substitute/Complementary Products

Saibal Ray, McGill University, 1001 Sherbrooke Street (West), Montreal, Qu, Canada, saibal.ray@mcgill.ca, Haresh Gurnani, Tamer Boyaci

We determine competitive pricing and capacity investment decisions for two firms selling different products in a deterministic but price-sensitive market. We explore the effects of presence of competition (centralized or decentralized), nature of competition (Nash or Stackelberg), relationship between products (complements or substitutes), and capacity costs on the optimal decisions and profits.

■ MC35

T-Terrace (Terrace Level)

Recognizing MSOM Fellows 2004 Research Accomplishments

Sponsor: Manufacturing and Service Operations Management
Sponsored Session

Chair: Panos Kouvelis, Professor, John M. Olin School of Business, Washington University in St. Louis, Saint Louis, MO, 63105, United States, kouvelis@wustl.edu

1 - Recognizing MSOM Fellows 2004 Research Accomplishments, Awi Federgruen, Morris Cohen

In this session we celebrate the scholarly accomplishments of the winners of the MSOM FELLOW AWARD for 2004, Professors Morris Cohen, Wharton, and Awi Federgruen,Columbia business school. Professors Cohen and Federgruen will present 45 minute talks summarizing their research interests, significant contributions to our field, and suggested future research directions.

■ MC36

T-Capitol (Terrace Level)

Risk Management in Engineering Applications II

Cluster: Financial Engineering
Invited Session

Chair: Stanislav Uryasev, Professor, University of Florida, PO Box 116595, 303 Weil Hall, Gainesville, FL, 32611, United States, uryasev@ufl.edu

1 - Hedging the Natural Gas Spot Price: Optimization Approach
Mattias Letmark, University of Florida, 303 Weil Hall, Gainesville, FL, 32611, United States, letmark@ufl.edu, Stanislav Uryasev

The paper considers the problem of hedging the Natural Gas spot price by constructing an optimal hedging strategy subject to risk constraints and non-speculative constraints. The hedging portfolio includes NYMEX Gas futures and options based on these futures. We compare in-sample and out-of-sample performance of the algorithm.

2 - Best Execution in Secondary Mortgage Markets
Chung-Jui Wang, University of Florida, 303 Weil Hall, Gainesville, FL, 32611, United States, cjwang@ufl.edu, Stanislav Uryasev

In this paper, we build a model that supports mortgage bankers to perform a thorough, precise best execution analysis. The model offers secondary marketing functionality including the loan-level best execution for MBS/whole loan, guarantee fee buy-up and buy-down grids, and excess servicing plans.

■ MC37

T-Biltmore (Terrace Level)

Electricity Market Modeling

Sponsor: Energy, Natural Resources and the Environment
Sponsored Session

Chair: Benjamin Hobbs, Professor, The Johns Hopkins University, Dept. Geography & Environ. Engineering, 313 Ames Hall, 3400 N. Charles, Baltimore, MD, 21218, United States, bhobbs@jhu.edu

1 - Multi-Period Equilibrium in a Pool-Based Electricity Market
Raquel Garcìa-Bertrand, Ph.D Student, E.T.S. de Ingenieros Industriales, Universidad de Castilla - La Mancha, E. Politécnico,Campus Universitario s/n, Ciudad Real, 13071, Spain, Raquel.Garcia@uclm.es, Antonio J. Conejo

Based on the well-known concept of single-period equilibrium in an electricity market, this paper defines, analyzes and illustrates the concept of multi-period equilibrium. The conditions to attain such equilibrium are formulated using Benders decomposition which requires the iterative solution of a mixed-integer linear programming master problem and a quadratic programming subproblem. This multi-period equilibrium is illustrated through a realistic case study based on the IEEE RTS system.

2 - Dynamic Oligopolistic Competition in Electric Power Network Markets
Reetabrata Mookherjee, Ph.D student, The Pennsylvania State University, Department of Industrial Engineering, 355 Leonhard Building, University Park, PA, 16802, United States, reeto@psu.edu, Terry L. Friesz

In this paper we construct, analyze and compute solutions to a model of electric power production and distribution that treats producers as game-theoretic agents competing via a network. We employ a self-regulating differential variational inequality formulation of the dynamic, non-zero sum game that describes competition among electric power producers for shares of the total demand for electric power. We provide a practical algorithm that may be implemented with off-the-shelf software.

3 - Conjectural Variation Equilibrium Computation via Optimization: Dual Info & Generation Operation
Efraim Centeno Hernaez, Universidad Pontificia Comillas, IIT, Departamento de Electrotecnia y Sistemas, c/ Santa Cruz de Marcenado 26, 28015 Madrid, Spain, efraim.centeno@iit.upco.es

This presentation introduces an optimization-based method to solve market equilibrium problem to be used in medium-term electricity markets analysis. This problem can be solved by using LP. The value of dual variables can be interpreted and used as interesting economic information for the company to determinate its strategy. The most relevant of this variables is price, that is obtained from the dual variable of the constraint that represents generation-demand balance.

4 - Modeling Collusive Games in Transmission-Constrained Electricity Markets
Andrew Liu, Ph.D Student, Johns Hopkins University, Dept. of Applied Math & Statistics, 3400 N. Charles Street, 211F, Whitehead Hall, Baltimore, MD, 21218, United States, lliu@jhu.edu, Joseph Harrington, Benjamin Hobbs, Jong-Shi Pang

We study a bilevel programming formulation of a collusive game in electricity markets. In the upper level, electric generators collectively maximize the Nash bargaining objective function, subject to incentive compatibility constraints; in the lower level, an Independent System Operator (ISO) acts as a Stackelberg follower with respect to the collusive generators. We will present some theories and numerical examples.

■ MC38

T-Beverly (Terrace Level)

Simulation I

Contributed Session

Chair: David Bandy, Associate Professor, University of Wisconsin Oshkosh, College of Business Administartion, University of Wisconsin Oshkosh, Oshkosh, WI, 54901, United States, bandy@uwosh.edu

1 - Pricing a Product Line of Upgradeable Contracts: The eBusiness Service Providers Case
Sarit Markovich, Tel-Aviv University, 307 Recanati, Faculty of Management, Tel-Aviv Universi, Ramat-Aviv, Tel-Aviv, 69978, Israel, saritm@post.tau.ac.il, Shane Greenstein

We analyze a differentiated oligopoly, where firms compete in product lines and consumers incur costs when switching from one firm to another. We look at the following questions: How should a firm price its product line? What is the effect of the number of different contracts the firm offers on the prices it charges? Should firms take advantage of consumers' switching costs to lock them in? And finally what is the effect of competition on the pricing strategy of price discriminating firms.

2 - R&D Portfolio Strategy and Performance: A Behavioral Model
Francesca Gino, Post Doctoral Fellow, Harvard Business School, Morgan Hall T86, Soldiers Field, Boston, MA, 02163, United States, fgino@hbs.edu, Gary Pisano

The paper explores the underlying causes of volatility in R&D performance over time at the firm level, using a simulation approach. We argue that the swings in performance we observe in different industries (e.g. pharmaceutical), while rooted in uncertainty, are exacerbated by the behavioral influences in how decision-makers deal with risk and uncertainty in R&D. We also look at firms' behavior towards the information that becomes available during the different phases of the R&D process.

3 - Analyzing Warrior Systems Using the Infantry Warrior Simulation
Alicia Borgman, OR Analyst, Simulation Technologies, Inc., 209 West Central Street, Suite 229, Natick, MA, 01760, United States, aborgman@stiusa.com, Robert Auer

Infantry Warrior Simulation is a constructive force-on-force simulation for assessing warrior systems in support of research, development, and acquisition. Its focus is the individual combatant and small unit. Challenges include modeling complex human systems and their integration with warrior systems, a lack of accurate models of critical elements of the human system, and representing the many varied and interdependent capabilities of the systems within an integrated simulation environment.

4 - Simulation of a Whey Processing Facility
Erv Ziese, Production Supervisor, Foremost Farms USA, E10889A Penny Lane, P. O. Box 111, Baraboo, WI, 53913-0111, United States, jezmund@charter.net, David Bandy

ProModel was used to simulate a whey processing facility for a plant capacity improvement study. The simulation investigated how upgrading equipment to increase the output of edible lactose would affect input, storage and other operations. The approach involved increasing capacity of the lactose refinery to improve throughput of the plant. The simulation identified bottlenecks that might occur in other parts of the plant. Two models were created to demonstrate before and after effects.

5 - Performance Evaluation of Large-Scale Assemble-to-Order Systems With Batch Ordering
Yao Zhao, Rutgers University, 180 University Ave, Newark, NJ, 07102, United States, yaozhao@andromeda.rutgers.edu

We design efficient methods based-on Monte Carlo simulation to estimate the statistics of batch-ordering Assemble-to-Order systems with stochastic sequential lead-times. It is well known that these statistics can be expressed as the average of the counter-parts of the base-stock systems. However, the number of the base-stock systems is exponential in the number of components. Our methods can take every base-stock system into account without sampling each one of them individually.

■ MC39

T-Tower Court A (2nd Floor)

Competition and Cooperation in Supply Chains

Cluster: Supply Chain Mgmt & Operations
Invited Session

Chair: Greys Sosic, Assistant Professor, University of Southern California, Marshall School of Business, Los Angeles, CA, United States, sosic@marshall.usc.edu

1 - Inventory Assortment and Substitution Problems
Yehuda Bassok, Professor, U.S.C., ca, United States, bassok@marshall.usc.edu, Feng Chen

We consider general substitution problem. We assume that the demand for each product is random, and that there is a cost for managing variety. Consumers have preferences for products, that is in case that the preferred product is not available some consumers are willing to purchase a different product. We concentrate in developing simple approximations to identify the optimal stocking levels and the optimal assortment.

2 - Contract Negotiations and Risk Preference
Mahesh Nagarajan, Assistant Professor, University of British Columbia, 2053 Main Mall, Vancouver, BC, v6t1z2, Canada, mahesh.nagarajan@sauder.ubc.ca, Yehuda Bassok

We present some new results on contracting between supply chain partners. Players' risk preferences are modeled using risk aversion and value functions proposed by Kahneman and Tversky. We consider various scenarios: Players adopting leader follower roles; players negotiating over the parameters of the contract etc. We show the equilibrium contract's dependence on risk preferences, the type of negotiatons between players and the structure of the suoply chain.

3 - Transshipment of Inventories Among the Retailers: Myopic vs. Farsighted Stability
Greys Sosic, Assistant Professor, University of Southern California, Marshall School of Business, Los Angeles, CA, United States, sosic@marshall.usc.edu

In a model with independent retailers facing stochastic demand, each retailer makes his stocking decision, and after demand realization may be left with some residual demand/inventory. Inventory may be transshipped to fulfill unsatisfied demand, and the additional profit is allocated to the retailers. Some allocation rules may induce the retailers to form subcoalitions within which inventory will be shared. We analyze stable coalition structures with respect to myopic and farsighted stability.

4 - Price and Order Postponement in a Decentralized Newsvendor Model with Price-Dependent Demand
Shuya Yin, University of British Columbia, Sauder School of Business, 419-2053 Main Mall, Vancouver, BC, V6T1Z2, Canada, shuya.yin@sauder.ubc.ca, Daniel Granot

We analyze the effect of postponement in a decentralized price-dependent newsvendor model. The postponement strategies differ in the timing of the retailer's operational decisions relative to demand realization. We show how vertical competition, demand models, contract types, and the timing of the operational decisions influence the equilibrium values.

■ MC40

T-Tower Court B (2nd Floor)

Topics in Supply Chain Management

Cluster: Supply Chain Mgmt & Operations
Invited Session

Chair: Baris Ata, Kellogg School of Management, Northwestern University, 2001 Sheridan Road, Evanston, IL, United States, b-ata@kellogg.northwestern.edu

1 - A Single-Product Inventory Model for Multiple Demand Classes
Hasan Arslan, Ph.D. Candidate, MIT Sloan School of Management, MIT Sloan School of Management, E53-388, Cambridge, MA, 02142, United States, harslan@mit.edu, Stephen Graves, Thomas Roemer

We consider a single-product inventory system that serves multiple demand classes, which differ in their backlog costs or service level requirements. We develop a model for cost evaluation and optimization, under the assumptions of Poisson demand, deterministic replenishment lead-time, and a continuous-review (Q, R) policy with rationing. We show the value from a rationing policy and how to incorporate into a multi-echelon setting the single-item model with multiple demand classes.

2 - Experimental Investigation of Supplier-Retailer Contracts
Giuseppe Paleologo, Mathematical Sciences, IBM T.J. Watson Research Center, United States, gappy@us.ibm.com, Claudia Keser

In the past 15 years, research on supply chain contracts has established itself as one of the most active areas in OM. Most research in this area has been normative, and studies that analyze the actions or real human beings are only handful. We present the results of a laboratory experiment conducted at NYU. We show that, although inefficiencies are present, they are not occurring in the form predicted by the expected utility theory, and formulate hypotheses explaining the observed behavior.

3 - Dynamic Sourcing from Competitive Suppliers with Relationship
Cuihong Li, Ph.D. Candidate, Tepper School of Business at CMU, United States, cuihong@andrew.cmu.edu, Laurens Debo

We model a two period dynamic sourcing problem for a buyer who faces uncertain demand in each period, where suppliers' capabilities change over time. The buyer can build a long-term relationship with a single supplier over both periods, or a short-term relationship which allows flexible switching between suppliers. Based on optimal auction models we analyze the optimal sourcing strategy in each relationship, and provide managerial insights on environments where either relationship is better.

4 - Stock Rationing Policy for a Make-to-Stock System with Two Priority Classes and Tagged Orders
Sean Willems, Shool of Management, Boston University, United States, willems@bu.edu, Feng Tian

■ MC41

T-Tower Court C (2nd Floor)

Supply Chain Risk Analysis II

Contributed Session

Chair: Brian Lewis, Ph.D Candidate, Georgia Institute of Technology, 765 Ferst Drive NW, Atlanta, GA, 30332-0205, United States, blewis@isye.gatech.edu

1 - Dual Supply Options as a Risk Management Tool
Ozgur Yazlali, Stanford University, Terman Engineering Center, 3rd Floor, Stanford University, Stanford, CA, 94305-4026, United States, oyazlali@stanford.edu, Feryal Erhun

We assume a downstream party, manufacturer, receiving supply from two upstream parties, suppliers, with consecutive lead times and limited capacity. The manufacturer faces a two-stage problem: first, choosing the best contract pair; and second, ordering given the contract terms of the previous stage problem. We show the optimality of so-called two-level modified base-stock policy for the second stage problem, and provide a methodology for the analysis of the first stage problem.

2 - Vulnerability Measurement and Mitigation for Water Supply System under Intentional Attacks
Jianhong Qiao, Purdue University, 315 N. Grant Street, West Lafayette, IN, 47906, United States, qiaoj@purdue.edu, Jean-Philippe Richard, Mark Lawley

Water Supply Systems, mainly Water Distribution Networks, are one of the key critical infrastructure of modern societies. Our research provides a methodology for measuring the vulnerability of a water distribution network under intentional attacks. Based on this measure, a large-scale non-linear programming model is formed to efficiently distribute limited security resources in the system. A constraint generation solution methodology is then proposed to solve the model.

3 - Risk Optimization in the Pharmaceutical Supply Chain
Eleni Pratsini, IBM Zurich Research Lab, Saeumerstrasse 4, Rueschlikon, CH, 8803, Switzerland, pra@zurich.ibm.com, Chris Kenyon, Walter Van Dyck, Hugh Browne, Frances Bruttin, Doug Dean

In dealing with ever increasing regulatory requirements, pharmaceutical companies must develop supply chain strategies that consider those elements of risk that affect the reliability of their products. Risk interactions also need to be addressed. Considering possible actions a company can take, a non-convex minlp was developed with the objective of minimizing a company's exposure to risk while maximizing profitability. Solution approaches are presented and the results are discussed.

4 - An Inventory Control Model with Border Security Considerations
Brian Lewis, Ph.D Candidate, Georgia Institute of Technology, 765 Ferst Drive NW, Atlanta, GA, 30332-0205, United States, blewis@isye.gatech.edu, Alan Erera, Chip White

We apply the results in Song and Zipkin (1996) to a periodic review, single commodity inventory system whose order leadtimes are dependent on an exogenous two-state Markov process. The exogenous system models a security threat condition system that determines when outstanding orders are able to pass through the border. We provide parameterized results in the Markov process' transition probabilities, since these are difficult to determine in practice. A computational study is presented.

■ MC42

T-Tower Court D (2nd Floor)

Revenue Management Application

Sponsor: Revenue Management & Dynamic Pricing
Sponsored Session

Chair: Montgomery Blair, Director of Science, Dollar Thrfity Automotive Group, 5330 East 31st Street, CIMS 7155, Tulsa, OK, 74133, United States, montgomery.blair@DTAG.Com

1 - Revenue Management in the Multi-Family Housing Industry
Donald Davidoff, Group Vice President, Pricing & Rev Mgmt, Archstone-Smith, 9200 East Panorama Circle, Suite 400, Englewood, CO, 80112, United States, ddavidoff@archstonesmith.com

Multi-family housing is an emerging indusry for revenue management. This presentation discusses the similarities and differences between multi-family housing and hospitality with an emphasis on key drivers for application of revenue management. The presentation concludes with an overview of approaches for dealing with key RM challenges (e.g. lower transaction density, longer lengths of stay, ...)

2 - Operations Research Opportunities
Montgomery Blair, Director of Science, Dollar Thrfity Automotive Group, 5330 East 31st Street, CIMS 7155, Tulsa, OK, 74133, United States, montgomery.blair@DTAG.Com

As RM grows from its infancy of availability controls into a more dynamic pricing environment, it presents new challenges and opportunities for operations research application. Applying the science of economics via mathematical modeling in a systematic fashion holds great profit potential for companies. Although, this talk will outline specific areas of keen interest in the car rental sector it contains many elements that are common in many industries that apply RM.

3 - Revenue Management for Low Cost Carriers
Chis Anderson, Assistant Professor, Richard Ivey School of Business, University of Western Ontario, London, ON, N6A 3K7, Canada, canderson@ivey.uwo.ca, Benjamin Marcus

Low-cost carriers, or discount carriers, have emerged as important players in many service industries. We present preliminary work toward understanding revenue management for a discount pricing firm in the airline industry. We formulate an optimal pricing control model for a firm that must underprice to capture a segment of exogenous, perhaps time dependent demand.

■ MC43

T-Denver (Mezzanine)

Session on NPD Research

Cluster: New Product Development
Invited Session

Chair: Debasish Mallick, Assistant Professor, University of Minnesota, Carlson School of Management, 321-19th Avenue South, Minneapolis, MN, 55455, United States, Dmallick@csom.umn.edu

1 - A Learning Model for New Product Introduction
Debasish Mallick, Assistant Professor, University of Minnesota, Carlson School of Management, 321-19th Avenue South, Minneapolis, MN, 55455, United States, Dmallick@csom.umn.edu

We focus on the comparative treatment given to two factors: knowledge and skill in managing new product introduction and capture insights obtained from the technology S-curve and manufacturing learning curve literature into a comprehensive framework. Using optimal control theory, we explore how new product introduction affects competitive advantage and business performance of firms.

2 - Coordinating New Product Development Projects
Thomas Roemer, MIT Sloan, E53-387, Cambridge, MA, 02142, United States, troemer@mit.edu

This research addresses challenges arising from inter-project and intra-project planning and scheduling during product development. In particular, to structure the front end activities and to minimize the makespan for development activities, we provide a structured, graph-based approach to forming conceptual design teams. A mathematical model assigns experts to projects and coordinates multiple concurrent projects. Research motivation, setting and application are from the aerospace industry.

3 - Product Development in a Supply Chain Network
Changyue Luo, Doctoral Student, University of Minnesota, United States, cluo@csom.umn.edu

This study reflects an effort in extending current literature on Inter-firm collaborative product development from individual dyadic level to a supply chain level. We study the relationship between manufacturer-customer collaboration and manufacturer-customer collaboration, as well as how these collaborations affect the duration of different CPD stages. The refutable hypotheses are empirically tested using the data of Sixty-two projects.

4 - Simultaneous Channel and Quality Design for Channel Discriminating Customers
Dilip Chhajed, University of Illinois at Urbana-Champaign, 350 Wohlers Hall, Champaign, IL, 61820, United States, chhajed@uiuc.edu, Chongqi Wu

We study simultaneous channel and quality design problem when both direct and indirect channels belong to the manufacturer. The market has two types of customers. Customers' direct channel preference has uniform distribution. Results show that the target customers, prices and quality depend on the channel strategy and the market conditions characterized by the size of the two market segments and the amount of customers who prefer direct channel to indirect channel.

■ MC44

T-Spruce (Mezzanine)

Multi-item Auction Mechanisms for Operations Research

Cluster: Auction Theory & Applications
Invited Session

Chair: Roy Kwon, Assistant Professor, University of Toronto, 5 King's College Road, Toronto, ON, M5S 3G8, Canada, rkwon@mie.utoronto.ca

1 - Bidding Behavior in Combinatorial auctions
Srinivas Nandiraju, University of California, Irvine, 6417, Adobe Circle Rd. South, Irvine, CA, 92612, United States, snandira@uci.edu, Amelia Regan

We model carrier behavior in combinatorial auctions for transportation service procurement. We study the impact of existing demand commitments, asymmetric information on bidding and efficiency of auctions. Repeated auctions are conducted to model the learning and evolution of bidding strategies. We further investigate if a game theoretic equilibrium is reached.

2 - Generation and Selcetion of Core Outcomes in Sealed-bid Combinatorial Auctions
Robert Day, Professor, Univerity of Connecticut School of Business, Storrs, CT, United States, rwday@math.umd.edu, S. Raghavan

We introduce a constraint generation approach for determining bidder-Pareto-optimal core outcomes in a one-sided combinatorial auction for distinct goods. Starting with a set of winners and corresponding VCG payments, we present a technique for achieving a core outcome which minimizes total bidder payments. A comparison to the minimax payment rules of Parkes is given, and comments on the relationship to the works of Ausubel and Milgrom, and Hoffman et al are provided.

3 - Bid Generation Models for Transportation Combinatorial Auctions
Chi-Guhn Lee, Assistant Professor, University of Toronto, 5 King's College Road, Toronto, ON, M5S 3G8, Canada, chi@mie.utoronto.ca, Roy Kwon, Zhong Ma

Combinatorial auctions are promising frameworks by which shippers procure truckload capacity from 3rd party carriers. In this research we focus on the carrier's optimal bid generation problem in combinatorial auctions for transportation procurement. Bidders employ vehicle routing models to identify sets of lanes based on the actual routes that optimally trade off repositioning costs of vehicles and the rewards associated with servicing lanes.

4 - Multi-Unit Auction Mechanisms: Analysis, Risk, Markets, and Beliefs
Amar Sapra, Cornell University, ORIE Department, 2nd floor, Rhodes Hall, Ithaca, NY, 14850, United States, sapra@orie.cornell.edu, Mike Freimer, Tim Huh, Robin Roundy,
We present multi-unit auction mechanisms.

5 - Greedy Bounds for Winner Determination
Roy Kwon, Assistant Professor, University of Toronto, 5 King's College Road, Toronto, ON, M5S 3G8, Canada, rkwon@mie.utoronto.ca

We present new optimality bounds for several greedy methods for the winner determination problem in combinatorial auctions e.g. set packing. We present both ex-ante and ex-post bounds that can reveal considerable optimality by taking into account problem dependent data.The bounds can be competitive with duality gap information without the need to solve an LP. We illustrate the utility of the bounds.

■ MC45

T-Gold (Mezzanine)

Medical Diagnosis and Prediction

Cluster: Medicine and OR
Invited Session

Chair: Eva Lee, Associate Professor & Director, Center for Operations Research in Medicine, Georgia Institute of Technology, Industrial & Systems Engineering, Atlanta, GA, 30332-0205, United States, evakylee@isye.gatech.edu

1 - Large-Scale Genomic Pattern Recognition and Classification of CpG Loci in Human Cancer
Eva Lee, Associate Professor & Director, Center for Operations Research in Medicine, Georgia Institute of Technology, Industrial & Systems Engineering, Atlanta, GA, 30332-0205, United States, evakylee@isye.gatech.edu

A pattern recognition/discriminant analysis approach is described for genomic classification in human cancer. The algorithm first identifies hidden patterns in DNA sequences. These patterns are then used as attributes for an optimization-based predictive model. The model maximizes the total number of correct classifications while constraining the rate of misclassifications. It also allows a reserved judgement region. Prediction of DNA sequences related to human breast cancer will be presented.

2 - Optimization in Data Mining for the Study of Brain Disorders
Wanpracha Chaovalitwongse, ExxonMobil Research & Engineering, 1545 Route 22 East, Annandale, NJ, 08801, United States, wchaoval@rci.rutgers.edu, Panos Pardalos

At least 40 million people worldwide currently suffer from epilepsy, brain disorder. Herein, we employ various measures of chaos to mine hidden signatures of epileptic activity in EEG. Optimization plays an important role in the extraction of the features that show tendency toward seizures. Data mining techniques are proposed to the study of the prediction of epileptic activity. The results of this study demonstrate that the normal and epileptic activities are distinctive and distinguishable.

3 - LEAD: A Methodology for Learning Efficient Approaches to Medical Diagnosis
Tapas Das, Professor, University of South Florida, 4102 E. Fowler Avenue, ENB118, Tampa, FL, 33620, United States, das@eng.usf.edu, Saif Fakih

This paper develops a learning based methodology that, based on the patient information, recommends test(s) that optimizes a suitable measure of diagnostic performance. The methodology combines tools from the fields of data mining (rough set theory, in particular), utility theory, Markov decision processes (MDP), and reinforcement learning (RL). The methodology is implemented on a sample problem of diagnosing solitary pulmonary nodule (SPN).

4 - Logical Analysis of Breast Cancer Data from Gene Expression Microarrays
Gabriela Alexe, RUTCOR — Rutgers University Center for Operations Research, 640 Bartholomew Road, Piscataway, NJ, 08854, United States, alexe@rutcor.rutgers.edu, David Axelrod, Sorin Alexe, Endre Boros, Peter L. Hammer, Michael Reiss

After extracting a "support set" of 16 genes from the 25,000 gene prognostic breast cancer dataset of van't Veer, a model consisting of 132 combinatorial patterns predictive of metastases built on these genes was constructed, yielding accuracies of 100% and 94.7%, respectively, on the training and the test sets.

■ MC46

T-Aspen (Mezzanine)

Economic Modelling Over Space or Time

Cluster: Agricultural Economics
Invited Session

Chair: Ken Foster, Professor, Purdue University, 403 W. State Street, West Lafayette, IN, 47907-2056, United States, kfoster@purdue.edu

1 - Price Discovery in and Around the Sahel: A Milian Case Study
David Bessler, Professor, Texas A&M University, Department of Agricultural Economics, College Station, TX, 77843, United States, d-bessler@tamu.edu

The functioning of basic food markets is examined in Mali. Directed Acyclic Graphs (DAGs) are used to analyze the causal flow of price information in contemporaneous time among several surplus and deficit production areas. The DAG induced structure is married with a dynamic structure via an error correction model to offer insights into pricing which cohere with the Marshallian idea that price is discovered at the margin of cultivation.

2 - Spatial Spillover Effects of Local Growth Controls in California Housing Markets
Brigitte Waldorf, Professor, University of Arizona, Tucson, Az, United States, bwaldorf@email.arizona.edu, Pillsung Byun, Raymond Florax

Studies on price effects of growth controls yield ambiguous empirical results. This ambiguity is not surprising given that housing price changes are outcomes of a nexus of effects, including spatial and temporal dependencies. We investigate spillovers in a spatial econometric set-up. Results suggest global spillover effects for new housing supply whereas market orientation of new home building is affected by local spillovers only.

3 - Measuring Market Power in the US Livestock Industry with Trend and Cycle Decompositions
Ken Foster, Professor, Purdue University, 403 W. State Street, West Lafayette, IN, 47907-2056, United States, kfoster@purdue.edu, Chowdhury Mahmoud

Using several models of cointegration we estimate the market power exercised in the U.S. pork and beef markets. We estimate the long run relationship between different stakeholder prices and also the short run dynamics for any deviation in prices from equilibrium, associated with Engle Granger error correction model and a Linear Systems State Space model following Foster and Havenner. These results from different approaches are then compared.

■ MC47

T-Century (Mezzanine)

Software Demonstration

Cluster: Software Demonstrations
Invited Session

1 - LINDO Systems, Inc.- Efficient Tools for Optimization Modeling
Mark Wiley, LINDO Systems, Inc., 1415 North Dayton, Chicago, IL, 60622, United States, 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, and seamlessly embed optimization into your own applications.

2 - Maximal Software, Inc.- Introducing New Release of the MPL Modeling System for Optimization with New and Enhanced Features
Bjarni Kristjansson, President, Maximal Software, Inc., 2111 Wilson Boulevard, Arlington, VA, 22201, United States, bjarni@maximalsoftware.com

We will demonstrate the newest release of MPL with many new enhancements to help solve real-world optimization problems. 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 (COIN, GLPK, LGO) have been added and existing solvers updated (CPLEX, XPRESS, XA, CONOPT). Data access has been improved with new native drivers (ORACLE, ADO) and offers now full XML/SOAP support for Internet connectivity.

Monday 4:30pm-6:00pm

■ MD01

P-Ballroom F

Tutorial: Markov Decision Chains

Cluster: Tutorials- Denver 2004
Invited Session

1 - Markov Decision Chains

Arthur F. Veinott, Department of Management Science and Engineering, Stanford University, Terman Engineering Center Rm 309, Stanford, CA, 94305-4026, United States, veinott@stanford.edu

This topic has a rich history in OR. For finitely many states and actions, he will give a unified development of optimality concepts over long time horizons and discuss why they are important. The focus will be on the relations among the concepts as well as the existence, characterization and efficient computation of stationary optimal policies for them. The optimality concepts include maximum value and stopping value; maximum present value for fixed and for small interest rates; maximum reward rate; Ces‡ro overtaking and future-value optimality. Recent results show how to decompose each of these problems into a sequence of problems of two types, viz., maximum stopping value and maximum reward rate. Both types can be solved in polynomial time by reduction to linear programs and use of interior-point methods. For deterministic systems, both types can be solved in strongly polynomial time by combinatorial methods.

■ MD02

P-Ballroom E

Issues in Metaheuristics Design, Comparison and Testing

Cluster: Metaheuristics (EU/ME)
Invited Session

Chair: Kenneth Sørensen, University of Antwerp - EU/ME, Information Systems & Operations and Log, Antwerp, Belgium, kenneth.sorensen@ua.ac.be

1 - Software Engineering Concepts Applied to the Design of Meta-heuristics: The EasyLocal++ Project

Luca Di Gaspero, Ph.D, DIEGM - University of Udine, via delle Scienze 208, Udine, UD, 33100, Italy, l.digaspero@uniud.it, Andrea Schaerf

EasyLocal++ is an O-O framework for the design and the analysis of local search algorithms. The framework is grounded on firm software engineering concepts and aims at easing the reuse of code. The control structures of the algorithms are provided by means of abstract classes that implement the abstract meta-heuristics. They are meant to be specialized by concrete classes that supply the problem-dependent part. Some additional tools help the user in the analyses/comparisons of the algorithms.

2 - libOR: Library for OR data sets

Kenneth Sørensen, University of Antwerp - EU/ME, Information Systems & Operations and Log, Antwerp, Belgium, kenneth.sorensen@ua.ac.be, Marc Sevaux

libOR can be described as a comprehensive database of OR problem data sets, similar to the OR library. * Although libOR consists of a central database, it is decentrally updateable. * Unlike other similar databases, libOR also contains a database of results. * libOR uses XML technology to validate data sets. libOR has a number of responsibles that make sure that the problems and results are up to date, it largely depends on the co-operation of the research community.

3 - MOAMP - A Generic Multiobjective Metaheuristic using an Adaptative Memory

Julian Molina, Associate Professor, University of Malaga, campus El Ejido s./n. Fac. de CC. EE., Malaga, Ma, 29071, Spain, julian.molina@uma.es, Xavier Gandibleux, Rafael Caballero

MOAMP is a MultiObjective MetaHeuristic using an Adaptative Memory inspirated from the tabu search principles. The procedure is able to compute a good approximation of the efficient solution set for optimization problems with multiple objectives,in particular, for MOCO problems. MOAMP is not designed for a particular type of MOCO problem, but rather as an generic solving method able to offer a good performance for a wide variety of problems without requiring a strong customization.

■ MD03

P-Plaza Court 1

Biomedical Applications of Operations Research

Cluster: Science & OR
Invited Session

Chair: Peter L. Hammer, Director of RUTCOR, Rutgers University, 640 Bartholomew Road, Piscataway, NJ, 08854, United States, hammer@rutcor.rutgers.edu

1 - O.R. Applications to the Analysis of Human Polymorphisms

Giuseppe Lancia, Associate Professor of O.R., University of Udine, Dipartimento di Matematica e Informatica, Udine, Italy, lancia@dimi.uniud.it

The most common human polymorphism consists in the variation of a single nucleotide, called SNP. Determining the values for a set of SNPs gives rise to several nice and challenging combinatorial problems, called “haplotyping” problems. We will illustrate many important haplotyping problems and the results obtained for their solution.

2 - Fingerprinting Native & Angiogenic Microvascular Networks via Pattern Recognition and Classification

Eva Lee, Associate Professor & Director, Center for Operations Research in Medicine, Georgia Institute of Technology, Industrial & Systems Engineering, Atlanta, GA, 30332-0205, United States, 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.

3 - Having A BLAST with BlastQuest: Where Do We Go From Here?

Li Liu, University of Florida, ICBR Molecular Service Division, Interdisciplinary Center for Biotechnolo, Gainesville, FL, 32610, United States, liliu@biotech.ufl.edu, Joachim Hammer, Michael Popp, William Farmerie, Markus Schneider, Anuj Sahni

The computational challenges of data analysis workflow from large-scale gene sequencing to customized microarray projects is discussed. To meet the informatics workflow challenge our interdisciplinary team developed a new database tool called BlastQuest along with a suite of integrated bioinformatics tools. Remaining unsolved problems are presented for further research discussion.

4 - From Diagnosis to Therapy via LAD

Peter L. Hammer, Director of RUTCOR, Rutgers University, 640 Bartholomew Road, Piscataway, NJ, 08854, United States, hammer@rutcor.rutgers.edu, David Axelrod, Tiberius Bonates, Irina Lozina

The Logical Analysis of Data (LAD) has been shown to be an effective tool for developing accurate diagnostic and prognostic tools. In this paper, we show how these results can be extended to the design of an integer programming-based tool for therapy selection.

■ MD04

P-Plaza Court 2

Data Mining in Practice

Sponsor: Data Mining
Sponsored Session

Chair: Di Xu, American Express, 1802 W. Maryland Ave, #2013, Phoenix, AZ, United States, dixu@worldnet.att.net

1 - Mining and Tracking Useful Features in Massive Text Data with Applications to Risk Management

Daniel Jeske, University of California at Riverside, Department of Statistics, Riverside, CA, United States, daniel.jeske@ucr.edu, Regina Liu

We describe a systematic data mining procedure for exploring large free-style text datasets to discover useful features and develop tracking statistics, often referred to as performance measures or risk indicators. The procedure includes text classification, inference under error measurements, and risk analysis. An aviation safety report repository from the FAA is used to illustrate applications of our research to aviation risk management and general decision-support systems.

2 - Some Practical Issues in Consumer Credit Risk Management

Di Xu, American Express, 1802 W. Maryland Ave, #2013, Phoenix, AZ, United States, dixu@att.net

Data mining provides an important tool for consumer lenders to assess, manage and control the credit risk of millions of customer. This paper discusses some practical issues in using data mining in risk management and presents some innovative ways to meet the challenge of day-to-day risk operations.

3 - Solving Cheminformatics Problems using Boosted Latent Analysis

Kristin Bennett, Rensselaer Polytechnic Institute, Math Sciences Dept, 110 8th Street, Troy, NY, United States, bennek@rpi.edu, Michi Momma, Zhi Xiang

The problem of construction features targeted to specific learning tasks is solved by ``Boosted Latent Analysis." For a given data set and loss function, the method produces orthogonal linear and/or nonlinear features that are suitable for data visualization, dimensionality reduction, and improving predictive models. The method is used to successfully address challenging problems in cheminformatics.

4 - Clustering Methods In Statistical Quality Control

Susan Albin, professor, Dept of Industrial and Systems Engineering, Rutgers University, Piscataway, NJ, 08854, United States, salbin@rci.rutgers.edu, Hang Zhang

We compare techniques for detecting outliers, determining the number of clusters, and for assigning data points to clusters in order to identify methods suitable for analyzing baseline data in statistical quality control. In particular, we compare methods developed for image processing and those developed for other types of data analysis.

■ MD05

P-Plaza Court 3

Integer Programming

Sponsor: Optimization/ Integer Programming
Sponsored Session

Chair: Gabor Pataki, Department of Statistics and OR, University of North Carolina, Chapel Hill, NC 27599, www.or.unc.edu/~pataki, Chapel Hill, NC, United States, pataki@email.unc.edu

1 - Simple Lifted Cover Inequalities and Hard Knapsack Problems

Brady Hunsaker, Assistant Professor, University of Pittsburgh, 1036 Benedum Hall, Pittsburgh, PA, 15261, United States, hunsaker@engr.pitt.edu, Craig Tovey

We consider a class of random knapsack instances described by Chvatal, who showed that with probability going to 1, such instances require an exponential number of branch-and-bound nodes. We show that even with the use of simple lifted cover inequalities, an exponential number of nodes is required with probability going to 1.

2 - Valid Inequalities Based on the Interpolation Procedure

Oktay Gunluk, IBM T.J. Watson Research, United States, oktay@watson.ibm.com, Sanjeeb Dash

We study the interpolation procedure of Gomory and Johnson (1972), which generates cutting planes for general integer programs from facets of cyclic group polyhedra. This idea has recently been re-considered by Evans (2002) and Gomory, Johnson and Evans (2003). We compare inequalities generated by this procedure with mixed-integer rounding (MIR) based inequalities.

3 - On Nearly Orthogonal Lattice Bases

Sanjeeb Dash, IBM Research, Yorktown Heights, NY, United States, sanjeebd@us.ibm.com, Richard Baraniuk, Ramesh Neelamani

We show that lattice bases which satisfy some simple angle properties always contain the shortest lattice vector. The lattice bases we study are "nearly orthogonal" in the sense that the angle between any basis vector and the linear space spanned by the other basis vectors is at least 60 degrees, and arise in an application involving JPEG image decompression.

■ MD06

P-Plaza Court 4

Modeling and Computation in Stochastic Programming

Sponsor: Optimization/Stochastic Programming
Sponsored Session

Chair: Jeff Linderoth, Lehigh University, 200 W. Packer Ave, Bethlehem, PA, 18015, United States, jtl3@lehigh.edu

1 - Computational Experience with a decomposition based interior method for two stage stochastic prog.

Sanjay Mehrotra, Northwestern University, IEMS Dept, 2145 North Sheridan Road, Evanston, IL, 60208, United States, mehrotra@iems.nwu.edu, Muhittin Gokhan Ozevin

We showed that the log barrier associated with the recourse function acts as a self-concordant barrier. This lead to the development of a decomposition based method for two stage stochastic convex quadratic, conic, and semidefinite programs. In this talk we will describe our implementation strategies and computational experiences with this method. Among other things we find that the method naturally allows us to progressively add scenarios, which leads to significant efficiency gains.

2 - Mean-risk Models in Stochastic Programming

Shabbir Ahmed, Ph.D, Georgia Institute of Technology, 765 Ferst Drive NW, Atlanta, GA, 30332, United States, sahmed@isye.gatech.edu

We investigate the computational suitability of various mean-risk objective functions for addressing risk in stochastic programming models. We propose a parametric cutting plane algorithm to generate the entire mean-risk efficient frontier for the mean-absolute semideviation objective.

3 - A Distributed Decision-Making Structure for Dynamic Resource Allocation

Huseyin Topaloglu, Cornell University, 223 Rhodes Hall, Ithaca, NY, 14853, United States, topaloglu@orie.cornell.edu, Warren Powell

We describe a multi-agent solution approach for dynamic resoure allocation. Our approach is based on a dynamic programming-based learning and communication mechanism among the decision agents. Agents managing different sets of resources coordinate their actions through nonlinear functions, which correspond to value function approximations in the dynamic programming setting. Our approach replicates the behavior of geographically-dispersed dispatchers that manage "parts" of the same vehicle fleet.

4 - Multistage Stochastic Linear Programming on a Computational Grid

Jeff Linderoth, Lehigh University, 200 W. Packer Ave, Bethlehem, PA, 18015, United States, jtl3@lehigh.edu

We will describe an implementation of a nested-decomposition-based, multistage stochastic linear programming solver running on a computing platform known as a computational grid. Computational results revealing the power of the approach and the platform will be presented.

■ MD07

P-Plaza Court 5

Algorithms for Complementarity Problems in Engineering Applications

Sponsor: Optimization/Linear Programming and Complementarity
Sponsored Session

Chair: Mihai Anitescu, Computer Scientist, Argonne National Laboratory, 9700 South Cass Ave., MCS, building 221, Argonne, IL, 60637, United States, anitescu@mcs.anl.gov

1 - Optimal Control Problems with Complementarity Constraints

Mihai Anitescu, Computer Scientist, Argonne National Laboratory, 9700 South Cass Ave., MCS, building 221, Argonne, IL, 60637, United States, anitescu@mcs.anl.gov, David Stewart

We show that the discretize and optimize approach for optimal problems with complementarity constraints may exhibit spectacular failures. This can be remedied by using a smoothing method where the smoothing parameter is corelated with the time step. We present several numerical examples to validate our theoretical findings.

2 - Computational Experience with Contact Problems with Friction

Michael Kostreva, Professor, Ph.D., Clemson University, Mathematical Sciences Department, Martin Hall, Clemson, SC, 29634, United States, flstgla@clemson.edu, Darius Wlodarczyk

We consider the problems of multi-body contact with Coulomb friction, in which an LCP is solved at each time step. The numerical solutions of such LCPs by different approaches will be described and compared with the Lemke algorithm as suggested by Anitescu and Potra.

3 - Complementarity Formulation of Rigid Multibody Nonsmooth Dynamics

Gary Hart, Graduate student, University of Pittsburgh, Department of Mathematics, Thackeray 301, Pittsburgh, PA, 15260, United States, gdhart@pitt.edu, Mihai Anitescu

We present issues connected to the efficient computation of the trajectories of rigid multibody dynamics with contact, joins and friction. We will particularly emphasize the efficient setup of the complementarity subproblems. The benefits of our approach are illustrated by several numerical examples

■ MD08

P-Plaza Court 6

Network Optimization

Sponsor: Optimization/ Network Optimization
Sponsored Session

Chair: Tim Roughgarden, Assistant Professor, Stanford University, Gates Building, 353 Serra Mall, Stanford, CA, 94305, United States, timr@cs.berkeley.edu

1 - Semidefinite Programming and a Sparsest Cut Approximation
Satish Rao, Professor, UC Berkeley, CS Division, Soda Hall, Berkeley, CA, 94720, United States, satishr@cs.berkeley.edu

We show how to use a well-known semidefinite programming relaxation of the balanced cut problem to produce a solution that is within $O(\sqrt{\log n})$ of the optimal. We do this by proving a theorem regarding point sets in Euclidean space, where all the angles are less than ninety degrees. In particular, we show how to find two large sets that are far apart. This work is joint with Arora and Vazirani.

2 - Bypassing the Embedding: Algorithms for Low Dimensional Metrics
Kunal Talwar, University of California, Berkeley, 581 Soda Hall #1776, Berkeley, CA, 94720, United States, kunal@cs.berkeley.edu

The doubling dimension of a metric is the smallest k such that any ball of radius 2r can be covered using 2^k balls of radius r. We show that metrics with small doubling dimension share several properties of low dimensional Euclidean spaces. In particular, we show a quasi-polynomial approximation scheme for TSP and other optimization problems on such metrics. We also give compact distance labels, shortest path oracles and efficient routing schemes using well-separated pair decompositions.

3 - Tolls for Heterogeneous Selfish Users in a Multicommodity Network
Mohammad Mahdian, Microsoft Research, 1 Microsoft Way, Redmond, WA, 98052, United States, mahdian@theory.lcs.mit.edu

We prove the existence of tolls to induce multicommodity, heterogeneous network users that independently choose routes minimizing their own linear function of tolls versus latency to collectively form the traffic pattern of a minimum average latency flow. Our proof is constructive and gives an algorithm for computing tolls by solving a simple LP. Our result extends to handle general nonatomic congestion games, and gives a complete characterization of flows that are enforceable by tolls.

4 - Bounding Braess's Paradox
Tim Roughgarden, Assistant Professor, Stanford University, Gates Building, 353 Serra Mall, Stanford, CA, 94305, United States, tim@cs.stanford.edu

Braess's Paradox is the counterintuitive fact that adding links to a congested network with selfish traffic can degrade network performance. While numerous papers have been written about the paradox since its discovery in 1968, little was known about its worst-case severity. In this talk, we will describe recent work that precisely determines the worst-possible magnitude of Braess's Paradox. Includes joint work with Henry Lin, Eva Tardos, and Asher Walkover.

■ MD09

P-Plaza Court 7

Interior Methods for Mathematical Programs with Equilibrium Constraints

Sponsor: Optimization/ Nonlinear Programming
Sponsored Session

Chair: Michael P. Friedlander, Computer Science, UBC, 2366 Main Mall, Vancouver, BC, V6T1Z4, Canada, mpf@cs.ubc.ca

1 - How to Keep your MPECs Relaxed
Michael P. Friedlander, Computer Science, UBC, 2366 Main Mall, Vancouver, BC, V6T1Z4, Canada, mpf@cs.ubc.ca, Victor DeMiguel, Javier Nogales, Stefan Scholtes

An interior method for solving mathematical programs with equilibrium constraints (MPECs) is proposed. At each iteration a single primal-dual step is computed from a relaxed subproblem; each subproblem is defined as a relaxation of the MPEC with a nonempty strictly feasible region. In constrast to previous approaches, the proposed relaxation scheme preserves the nonempty strict feasibility of each subproblem even in the limit. Convergence properties and numerical results are described.

2 - Interior Methods for MPCCs
Gabriel Lopez-Calva, Grad. Student, Northwestern University, 2145 Sheridan Road, Tech C 210, Evanston, IL, 60208, United States, g-lopez-calva@northwestern.edu, Sven Leyffer, Jorge Nocedal

We review alternative techniques for solving MPCCs with interior methods. We focus on a L1-penalty reformulation, discuss first and second order conditions of it, and results on speed of convergence and distance to the solution. We prove convergence of the inexact barrier scheme to strongly-stationary points and derive relationships between alternative interior methods for MPCCs. We discuss updating strategies for the penalty parameter and present extensive numerical results.

3 - Solving Dynamic Games as MPECs
David Shanno, Professor, Rutgers University, RUTCOR, 640 Bartholomew Road, Piscataway, NJ, 08854, United States, shanno@rutcor.rutgers.edu, Arun Sen

Dynamic games can be used to model a variety of applications, such as duopoly pricing or auctions. For some simple models, it is shown that current MPEC codes, for example LOQO or FilterSQP find equilibria efficiently. For more complex models, however, the codes generally fail. The talk discusses a hybrid method based on dynamical systems, and demonstrates convergence to equilibria on several models where standard codes failed.

4 - A Gradient-flow Based Interior Point Method for Stochastic MPCCs
Uday Shanbhag, Ph.D Candidate, Dept. of Mgmt. Science and Engg., Stanford University, Stanford, CA, 94305, United States, udaybag@stanford.edu, Walter Murray, Michael Saunders

Gradient flows were first discussed by Courant and have been recently been revisited by Behrman and others. We propose an interior point method for MPCCs in which gradient-flow directions are combined with the more conventional Newton step and the negative curvature direction. By the use of Schur-complement factorization, we discuss how a stochastic MPCC may be solved efficiently. Computational results of the algorithm on the macMpec test problem set are provided.

■ MD10

P-Plaza Court 8

Logistics and Routing

Sponsor: Transportation Science & Logistics
Sponsored Session

Chair: Ozlem Ergun, Assistant Professor, Georgia Tech, 765 Ferst Drive, Atlanta, GA, 30332, United States, oergun@isye.gatech.edu

1 - Strategies for the Online Inventory Routing Problem under Real-time Information
Ricardo Giesen, Maryland Transportation Initiative, University of Maryland, Dept. of Civil and Env. Engineering, 1173 Glenn L. Martin Hall, College Park, MD, 20742, United States, giesen@umd.edu, Hani S. Mahmassani, Patrick Jaillet

We study strategies for the online inventory routing problem under real-time information. A set of retailers facing stochastic demands is served from a central depot by a single truck, with the objective of minimizing both transportation and inventory costs. We propose a mixed integer programming formulation for the off-line version and introduce different rolling horizon strategies for the real-time version. We examine potential benefits of updating plans based on real-time information.

2 - Column Generation Combined with Constraint Programming to Solve a Technician Dispatch Problem
Sebastián Souyris, Researcher, Universidad de Chile, Republica 701, Santiago, Chile, ssouyris@dii.uchile.cl, Andres Weintraub, Cristián Cortés

We deal with a scheduling problem for Xerox technicians, which need to visit about 400 customers daily for repairs. The problem is how to schedule the itineraries given travel and repair times and promised time windows. The problem is approached via Dantzig-Wolfe decomposition and constraint programming to solve the subproblems. Good Computational results on real problems are presented.

3 - The Impact of Road Traffic Congestion and JIT Replenishment on Distribution Costs
Jay Sankaran, Associate Professor, University of Auckland, D/o ISOM, U. of Auckland, P.B. 92019, Auckland, New Zealand, j.sankaran@auckland.ac.nz, Lincoln Wood

We report the use of continuous approximation models to quantify the relative impact of (1) JIT replenishment by resellers and (2) rising levels of traffic congestion, on distribution costs. We use approximation formulae in the manner of Daganzo and others. A real-world problem is used to clarify the approach.

4 - Collaborative Logistics: The Shipper Collaboration Problem
Ozlem Ergun, Assistant Professor, Georgia Tech, 765 Ferst Drive, Atlanta, GA, 30332, United States, oergun@isye.gatech.edu, Guletkin Kuyzu, Martin Savelsbergh

We discuss an application of collaboration in logistics from the trucking industry where a buyers' collaboration is established by a group of shippers pooling together their shipment requests. We explore two directions: how to solve the underlying optimization problem when the timing of shipments is important, and how to allocate the benefits/costs of collaboration.

■ MD11

P-Governor's Square 9

Choice Models

Sponsor: Transportation Science & Logistics
Sponsored Session

Chair: James Moore, Professor and Chair, Daniel J. Epstein Department of Industrial and Systems Engineering, GER 240, MC 0193, USC, University of Southern California, Los Angeles, CA, 90089-0193, United States, jmoore@almaak.usc.edu

1 - Mixed Generalized Extreme Value Models
Laurie Garrow, Ph.D. student, Northwestern University, Dept of Civil &Environmental Engineering, Evanston, IL, United States, l-bowler@northwestern.edu, Frank Koppelman

We compare methods of representing correlation and random taste variation in choice models. We provide a motivation for integrating complex closed-form models to represent correlation among alternatives with random coefficients. Using the nested logit (NL) as an example, we demonstrate that while a mixed model can approximate a NL model theoretically, empirically the NL model may not be well approximated by its mixture analog.

2 - Reoptimization Algorithms for the Shortest Path Problem with Stochastic Value of Time: Application to Dynamic Road Pricing Evaluation in Urban Transportation Networks
Hani S. Mahmassani, Director, Maryland Transportation Initiative, University of Maryland, Dept. of Civil and Env. Engineering, 1173 Glenn L. Martin Hall, College Park, MD, 20742, United States, masmah@umd.edu, Xuesong Zhou, Chung-Cheng Jas Lu

Several recent studies consider the value of time in the route choice model as a stochastic distribution rather than a constant value across tripmakers. We formulate the corresponding shortest path problem with stochastic value of time as a link cost change problem and present an efficient reoptimization-based solution algorithm.

3 - Experimental Comparison of Neural Network and Logit Models in Disaggregate Discrete Choice Behavior
Aldo Fabregas, Ph.D. Student, University of South Florida, 4202 E. Fowler Ave. ENB118, Tampa, FL, United States, alfabreg@yahoo.com, Luis Otero, Ram Pendyala, Grisselle Centeno

In this study, a neural network approach is compared to logit models for the forecasting of individual discrete choice behavior of travel demand. Different network architectures and training strategies are used to avoid drawbacks of the backpropagation algorithm. Results from the neural network approach are compared to different settings of multinomial logit and nested logit models on different performance measures. The experiments are tested with both artificially generated and real data.

4 - Developing a Consistent Data Set from an Inconsistent Data Set
Shinya Kikuchi, Professor, Transportation Engineering, Department of Civil and Environmental Engineering, University of Delaware, Newark, DE, 19716, United States, kikuchi@ce.udel.edu, Anuj Gupta

This paper deals with adjusting the values of data. It reviews the available methods for their mathematical structure, and proposes a fuzzy optimization approach that adjusts the inconsistent set of data values to the one that is consistent with the general knowledge of the analyst. It shows examples that adjust the observed trip generation rates that are not consistent with the general knowledge of trip characteristics, so that the adjusted data can be used for travel forecasting steps.

■ MD12

P-Governor's Square 10

Transportation Network Optimization Problems in Complex Environments

Sponsor: Transportation Science & Logistics
Sponsored Session

Chair: Elise Miller-Hooks, Assistant Professor, University of Maryland, Dept. of Civil & Environmental Eng., 1173 Glenn Martin Hall, College Park, MD, 20742, United States, elisemh@umd.edu

1 - Constrained Stochastic and Dynamic Shortest Path Problems in Transportation Networks
Deepak Kumar, University of Texas at Austin, Dept. of Civil Engg., Austin, TX, 78705, United States, dkumar@mail.utexas.edu, Steven Travis Waller

This paper develops algorithms for several new variations of the constrained stochastic dynamic shortest path problems where the objective is to minimize the expected cost subject to some specified constraint on the travel time of the path. The constraint can be placed on the expected travel time of the path, or on the cumulative probability of experiencing a travel time or less on the path. The correctness of the proposed algorithm will be proved and results from the model will be presented.

2 - Shortest Path Updating in Time-Varying Networks: Algorithms and Findings
Baiyu Yang, Sr. Operations Research Analyst, American Airlines, 4333 Amon Carter Blvd., MD 5358, Fort Worth, TX, 76155, United States, baiyu.yang@aa.com, Elise Miller-Hooks

Significant savings in computation time can often be achieved through the use of a reoptimization algorithm that would begin from the prior solution in determining the updated optimal solution for the given arc travel time changes. We present reoptimization algorithms for updating paths in time-varying networks given simultaneous and arbitrary changes in any number of network arcs and compare their computational performance.

3 - Robust Network Design Evaluation using Evolutionary Algorithms
Satish Ukkusuri, Ph.D Candidate, University of Texas - Austin, Dept. of Civil Eng., ECJ 6.202, Austin, TX, 78712, United States, ukkusuri@mail.utexas.edu, S. Travis Waller, Tom V M

This presentation will address the problem of network design decisions under O-D uncertainty in the static network design problem (NDP). We solve the network design evaluations accounting for both the expected value and variance of the system cost. The most important contribution of this work would be to comparing the deterministic NDP; stochastic NDP and robust NDP. In short the value of robustness will be demonstrated.

4 - Competitive Analysis of Online Routing Problems
Michael Wagner, MIT, 77 Massachsuetts Ave, Cambridge, MA, 02139, United States, Patrick Jaillet

An online problem is one that must be solved under uncertainty with no stochastic nor robustness assumptions about the uncertainty. We present recent results on online versions of the Traveling Salesman Problem (TSP), Traveling Repairman Problem (TRP) and other vehicle routing problems (VRPs). Our results also introduce a relaxation of classical competitive analysis.

■ MD13

P-Governor's Square 11

RASIG Student Paper Contest Presentation

Sponsor: Railroad Applications
Sponsored Session

Chair: Pooja Dewan, United States, Pooja.Dewan@bnsf.com

1 - RASIG Student Paper Contest,

RASIG (Rail Applications Special Interest Group) a subdivision of INFORMS and Railway Age are sponsoring a student research paper contest on Management Science in Railroad Applications.

2 - Heterogeneity and Reliability of Railway Services
Michiel J.C.M. Vromans, Department of decision and Information Management, School of Management, Erasmus University Rotterdam, Room F1-76, P.O.Box 1738, 3000 DR Rotterdam, The Netherlands, MVromans@fbk.eur.nl, Dekker Rommert, Leo Kroon

Reliability is one of the key factors in transportation. This paper examines reliability in public railway systems. To reduce the propagation of delays between the trains we attempt to decrease the interdependencies by reducing the running time differences per track section and by thus creating more homogeneous timetables. We use network wide simulation for the analysis of the alternative timetables. We report on both theoretical and practical cases. Besides a comparison of different timetables, also general timetabling principles are deduced.

3 - New Approaches for the Train Dispatching Problem
Guvenc Sahin, Department of Industrial and Systems Engineering, University of Florida, 303 Weil Hall, Gainesville, FL, United States, guvencs@ufl.edu

Running freight trains on time and reducing travel times are becoming increasingly important as railroads face the challenge of truck competition in an environment in which quick response and just-in-time requirements to fulfill demand are establishing as an industry standard. Most freight railroads operate over extensive lengths of single line tracks, in which a train has to be pulled over to cross or overtake another train. The train dispatching problem aims to determine detailed train movements and timetables over a rail network, under various operational constraints and restrictions, in order to minimize train deviations from the planned schedule. Our motivation is in real-time scheduling to help dispatchers that are controlling the traffic in real time make the right decisions on which train will stop in train conflicts, as new data about updated train positions becomes available. In this paper we give a new integer programming formulation

of this problem based on a space-time network, propose some exact and heuristic algorithm to solve it and present some computational results. Our approach also includes some realistic constraints like maximal allowed delays and restricted stopping stations for each train individually that have not been considered before.

4 - A Network Flow Approach for Railroad Crew Scheduling

Balachandran Vaidyanathan, Doctoral Student, Industrial & Systems Engineering, University of Florida, Gainesville, FL, United States, vbala@ufl.edu

In this paper, we study one of the most important railroad optimization problems, the crew scheduling problem, and develop network flow based approaches to solve this problem. The crew scheduling problem is to assign crew (train operators) to scheduled trains over a time period (generally for a week), so that the crew cost is minimum and the schedule honors many operational and contractual requirements. The cost of a crew consists of wages, accommodation cost, and deadheading cost. This problem is a very large-scale optimization problem and is highly constrained due to various labor union contracts and federal labor laws. Fortunately, the problem can be decomposed into separate problems, one for each or a set of crew districts. We have developed network flow based models which can be used to solve the crew scheduling problem in real-time. We formulate the crew scheduling problem as a minimum cost flow problem (for non-overlapping crew districts), and as a multicommodity flow problem (for overlapping crew districts) and solve them using network flow algorithms. We present preliminary computational results of our algorithms on the data provided by a major US railroad.

5 - An Optimization Model for Assignment of Empty Cars in Railroad Networks

Amar Kumar Narisetty, Purdue University, 110 East Columbia Street, Apt #202, West Lafayette, IN, United States, anariset@purdue.edu

An important problem faced by large railroad companies is how to best assign supply of empty freight cars to customers demand. The assignment decision needs to be based on the location of empty cars, type of empty cars and urgency of demand. Given the large size of the problem (i.e., the number of customers and supply locations) manual solutions will often be di±cult to obtain and very suboptimal. In this paper we present a Simple Optimization Model (SOM) for the assignment of empty freight cars with the goals of (i) reducing transportation time and miles travelled by empty cars (ii) improving on-time performance and (iii) improving customer satisfaction. The model is embedded within a simulation tool that enables the evaluation of (i) new operating policies (ii) the importance of precise demand and supply forecast, etc. Currently SOM is in an advanced development and implementation stage and will be part of a major railroad's empty car management system in which real time assignments are made. An intelligent empty freight car assignment model is an indispensable tool to keep railroads operating costs low and help them stay competitive, while providing satisfactory service to the customers.

■ MD14

P-Governor's Square 14

Technology Management Section Distinguished Speaker

Sponsor: Technology Management
Sponsored Session

Chair: Sarfraz Mian, SUNY Oswego, NY, United States, mian@oswego.edu

1 - Academic Entrepreneurship: University Spinoffs and Wealth Creation

Scott Shane, Case Western Reserve University, 10900 Euclid Avenue, Cleveland, OH, 44106, United States, sas46@cwru.edu

This presentation will explain the formation of university spinoff companies and their role in the commercialization of university technology and wealth creation in the United States and elsewhere.

■ MD15

P-Governor's Square 15

Integrated Production and Distribution Scheduling

Cluster: Scheduling
Invited Session

Chair: Zhi-Long Chen, University of Maryland, College Park, MD, 20742, United States, zchen@rhsmith.umd.edu

1 - On the Integrated Production, Inventory and Transportation Problem with Bi-directional Flows

Lei Lei, Rutgers University, Rutgers Business School, Newark and New Brunswick, NJ, United States, llei@andromeda.rutgers.edu, Hua Zhong

We study the integrated production, inventory and transportation problem in a reverse logistics environment to minimize the total operational cost. A LP relaxation based local optimization algorithm is proposed, special case solutions are analyzed, and empirical results are reported.

2 - On the Flow Shop Scheduling with Time Delays

Djama Rebaine, Professor, Departement d'Informatique et de Mathematique, Universite du Quebec a Chicoutimi, Chicoutimi, Qu, G7H 2B1, Canada, drebaine@uqac.ca

In the literature of flow shop models, it is usually assumed that once an operation is completed, the corresponding job immediately becomes available for further processing. In practice, however, there might be a significant time delay between the completion of an operation on one machine and the start of the next operation of the same job on another machine. In this presentation, we review complexity aspects of flow shop problems with time delays, mainly with respect to the makespan criterion.

3 - Supply Chain Scheduling: Distribution Systems

H. Neil Geismar, Professor, Prairie View A&M University, United States, ngeismar@yahoo.com, Milind Dawande, Nicholas G. Hall, Chelliah Sriskandarajah

We study conflict and cooperation issues arising in a supply chain where a manufacturer makes products which are shipped to customers by a distributor. The manufacturer and the distributor have differing ideal schedules. We demonstrate that the cost savings provided by cooperation between the decision makers is usually significant.

4 - Joint Cyclic Production and Delivery Scheduling in a Two-Stage Supply Chain

Guruprasad Pundoor, Ph.D. student, Robert H. Smith School of Business, University of Maryland, College Park, MD, 20742-1815, United States, pundoor@umd.edu, Zhi-Long Chen

We present an integrated production and distribution scheduling model in a two-stage supply chain consisting of one or more suppliers, a warehouse, and a customer. Each supplier produces a different product at a constant rate. Completed products are delivered from the suppliers to the warehouse first and then from the warehouse to the customer. We study the problem under various production and delivery scheduling policies. We derive either an exact or a heuristic solution algorithm.

■ MD16

P-Governor's Square 17

Simulation-Based Optimization

Sponsor: Computing Society
Sponsored Session

Chair: Abhijit Gosavi, Assistant Professor, SUNY, Buffalo, 317 Bell Hall, Buffalo, NY, 14228, United States, agosavi@buffalo.edu

1 - Efficient Simulation-based Stochastic Optimization

Chun-Hung Chen, Associate Professor, George Mason University, 4400 University Drive, MS 4A6, SEOR Dept, Fairfax, VA, 22030, United States, cchen9@gmu.edu

We present a new simulation-based optimization methodology which can significantly improve computational efficiency for decision making under uncertainty. Our new approach is developed based on a very efficient technique called Optimal Computing Budget Allocation, which intelligently determines the most efficient way of simulation budget allocation. With integration with the method of Design of Experiments, our new approach is highly effective for stochastic optimization problems.

2 - Fully Sequential Procedures for Comparing Constrained Systems via Simulation

Seong-Hee Kim, Assistant Professor, Georgia Institute of Technology, 765 Ferst Drive, NW, Atlanta, GA, 30332, United States, skim@isye.gatech.edu, David Goldsman, Sigrun Andradottir

We consider the problem of finding the system with the largest or smallest primary performance measure among a finite number of simulated systems in the presence of a constraint on a secondary performance measure. We present a fully-sequential procedure that solves this problem and present numerical results documenting its performance.

3 - A Learning Automata Approach to Simulation-based Optimization

Abhijit Gosavi, Assistant Professor, SUNY, Buffalo, 317 Bell Hall, Buffalo, NY, 14228, United States, agosavi@buffalo.edu

We present a meta-heuristic, called learning automata, for simulation-based optimization. We will discuss asymptotic convergence properties of the procedure along with some numerical results.

■ MD17

P-Directors Row E

DAS 2004 Awards Session

Sponsor: Decision Analysis
Sponsored Session

Chair: Gregory Parnell, Professor of Systems Engineering, United Stated Military Academy, Department of Systems Engineering, West Point, NY, 10996, United States, gregory.parnell@usma.edu

1 - Decision Analysis Society Awards
Gregory Parnell, Professor of Systems Engineering, United Stated Military Academy, Department of Systems Engineering, West Point, NY, 10996, United States, gregory.parnell@usma.edu

The Decision Analysis Society of INFORMs will announce the recipients of the 2004 Ramsey Medal for lifetime contributions to decision analysis, the 2004 publications award for best publication in the year 2002, and the 2004 Student Paper Award. Each winner will speak briefly. The winner of the Decision Analysis Practice Award will also be announced. The practice award finalists will make their presentations in an earlier session.

■ MD18

P-Directors Row H

Network Design

Sponsor: Telecommunications
Sponsored Session

Chair: Luis Gouveia, CIO and DEIO, Faculdade de Ciencias da Universidade de Lisboa, BLOCO C6, Piso 4, Portugal, legouveia@fc.ul.pt

1 - Models and Heuristics for the Minimum Cost Tree Problem
Luis Gouveia, CIO and DEIO, Faculdade de Ciencias da Universidade de Lisboa, BLOCO C6, Piso 4, Portugal, legouveia@fc.ul.pt, Christophe Duhamel, Pedro Moura, Mauricio de Sousa

In a directed graph where arc costs are real-valued - not only positive - the Minimum Cost Tree (MCT) problem consists in finding a tree whose value is the lowest possible. This problem is a generalization of both the Minimum Spanning Tree (MST) problem and the Steiner Tree (ST) problem. It is NP-hard as well. Starting from the MST, we will show the changes induced by the removal of the spanning property on the polyedral structure of the problem. Three formulations for the MST (including a new one, which includes the so called "eliminating disconnected components" constraints) give a description of the convex hull of the incidence vectors of directed trees. Only one (the new one) can easily be adapted to the MCT. We then describe a multicommodity flow reformulation that is valid for the MCT. It differes from well known multicommodity flow reformulations in the sense that the source and destination equalities are replaced by inequalities. We show that the linear programming relaxation of this formulation strictly dominates the linear programming relaxation of the previous formulation. We will also propose two lagrangean relaxations based on the multicommodity flow reformulation. Results will be shown on small-to-medium instances. For medium-to-large instances, we will also propose an upper bound based on a local search procedure involving the the concept of key path developped for the ST. Two movements are proposed: the first one tries to extend the current tree while the second tries to reduce it. Both are relying on the computation of a shortest path in the graph with modified costs. Numerical experiments will illustrate the interest of this approach.

2 - Applications of the Pilot Method to Hard Modifications of the Minimum Spanning Tree Problem
Stefan Voss, University of Hamburg, United States, Raffaele Cerulli, Cees Duin, Manuela Fernandes, Andreas Fink, Monica Gentili, Luis Gouveia

The pilot method as a meta-heuristic is a tempered greedy method aimed at obtaining high-quality solutions by looking ahead for each possible choice. Repeatedly a master solution is modified accounting for best choices, which are judged by separate heuristic results. Excellent results are obtained, e.g., for the hop-constrained minimum spanning tree and the labelling spanning tree problem.

3 - A Branch-and-Price-and-Cut Algorithm for Multifacility Nonbifurcated Network Loading
Bernard Gendron, Université de Montréal, C.P. 6128, Succursale Centre-Ville, Montréal, Québec, Canada, bernard@crt.umontreal.ca, Jean-Yves Potvin, Patrick Soriano

We study a variant of the network loading problem where multiple facilities can be installed on each edge of the network and where each commodity must flow though a single path. We propose a branch-and-price-and-cut algorithm for the problem, where path flow variables are generated dynamically and cuts based on cutsets of the network and linking constraints are added at every node of the tree.

4 - Multi-Period Traffic Routing in Satellite Networks
Ioannis Gamvros, The Robert H. Smith School of Business, University of Maryland, College Park, MD, 20742, United States, S. Raghavan

Satellite communication networks consist of a set of geostationary satellites at specific longitudes each one offering different region coverage and different up-beam, down-beam connectivity between regions at each time period. These networks are dynamic and their configuration can significantly change from one time period to the next. We consider a complex multi-period traffic routing problem that arises in satellite networks. We develop a (multi-period) path-based multi-commodity integer programming formulation and develop a branch-and-price-and-cut solution procedure. Computational results for large-scale problems will be presented.

■ MD19

P-Directors Row F

Return Flows: Management, Network Design, Forecasting Value

Cluster: Reverse Supply Chains
Invited Session

Chair: Beril Toktay, Associate Professor of Operations Management, INSEAD, Boulevard de Constance, Fontainebleau, 77305, France, beril.toktay@insead.edu

1 - The Returns Routing Problem
Ronald Tibben-Lembke, Assoc. Prof, SCM, University of Nevada, Reno, MGRS / 028, Reno, NV, 89557, United States, rtl@unr.edu

We study the problem of minimizing the transportation and holding costs of collecting customer returns from retail stores and transporting them to a centralized returns center. The problem is an inventory routing problem (IRP) in reverse, but the physical nature of returns causes differences from the traditional IRP.

2 - Inventory and Sales Planning for Products with Warranty
Wei Huang, UNC-CH, Dept. of Statistics and Operations Research, 210 Smith Building, CB#3180, UNC-CH, Chapel Hill, NC, 27599, United States, whuang@email.unc.edu, Vidyadhar Kulkarni, Jayashankar Swaminathan

Manufacturers often have to plan for production of new products as well as the warranty parts. In this paper, we study inventory and sales planning when both new and products under warranty are taken into consideration.

3 - Reverse Supply Chain Management and Electronic Waste
Anna Nagurney, John F. Smith Memorial Professor, Isenberg School of Management, University of Massachusetts, Amherst, MA, 01003, United States, nagurney@gbfin.umass.edu, Fuminori Toyasaki

This paper presents an integrated multitiered network equilibrium framework with different decision-makers for the modeling of reverse supply chain management of electronic waste with recycling and hazardous waste disposal. The model is supported by theoretical results and numerical examples.

4 - Using Forecast Information from Early Returns of Used Products to Set Remanufacturing Capacity
Sarah Ryan, United States, smryan@iastate.edu, Suphalat Chittamvanich

The capacity for remanufacturing perishable products must be set before full knowledge of their return times is available. Future return times are predicted using maximum likelihood estimates obtained from early returns. A simple newsvendor-like model shows that as the time to obsolescence decreases and more returns arrive, the reduction in discounting of future profits and the increasing quality of return time estimates may influence capacity decisions in different directions.

5 - Managing New and Remanufactured Products
Jayashankar Swaminathan, UNC Chapel Hill, CB# 3490, McColl 4717, UNC- Chapel Hill, Chapel Hill, NC, 27599, United States, msj@unc.edu, Geraldo Ferrer

We study a firm that makes new products in first period and uses returned cores to offer remanufactured products and new products in future periods. In a duopoly environment an imitator intercepts cores from OEM products and remanufactures them in future periods. If remanufacturing is very profitable, the OEM may forgo some of the first-period margin by lowering the price and selling additional units to increase the number of cores available for remanufacturing in future periods.

■ MD20

P-Room 3304

Applications in Patient Safety and Screening

Sponsor: Health Applications
Sponsored Session

Chair: Amy R. Wilson, Assistant Professor, Division of Health Services Research and Policy, University of Minnesota, 420 Delaware St. SE, MMC 729, Minneapolis, MN, 55455, United States, arwilson@umn.edu

1 - Rapid Cycle Improvement for Patient Safety
Sandra Potthoff, University of Minnesota, 321 19th Avenue South, Minneapolis, MN, United States, Sandra.J.Potthoff-1@tc.umn.edu

A consortium of healthcare organizations in the Twin Cities and surrounding area is participating in a collaborative to reduce ventilator-associated pneumonias and central line blood stream infections in their ICUs. This paper will describe the collaborative and present results from a qualitative study of four hospitals that are participating in the collaborative.

2 - Breast Cancer Screening Policy Characterization
Julie Ivy, Assistant Professor, University of Michigan, 701 Tappan Street, Ann Arbor, MI, 48109-1234, United States, jsimmons@bus.umich.edu

We use efficient frontiers to characterize breast cancer screening policy and mammography cost-effectiveness as a function of patient history, age and the decision maker's belief about the patient's condition. We utilize POMDPs to represent patient and payer preferences and incorporate the uncertainty associated with the partial observability of the disease and the treatment outcome in determining the effectiveness of screening.

3 - A Model of Screening for a Disease: Quality Decision Under Competition
Evrim Didem Gunes, Assistant Professor, Koc University, Rumeli Feneri Yolu, Sariyer, Istanbul, 34450, Turkey, egunes@ku.edu.tr, Stephen Chick, Luk Van Wassenhove

A model of screening for a disease is proposed where willingness of target population for the test depends on sensitivity of the test. Two organizational choices are considered. Optimal quality investment and participation levels to screening as well as total costs are investigated for a duopoly competition. Sensitivity analysis explores performance improvement opportunities.

4 - If You Must Screen for Depression, Use the Best Test
Amy R. Wilson, Assistant Professor, Division of Health Services Research and Policy, University of Minnesota, 420 Delaware St. SE, MMC 729, Minneapolis, MN, 55455, United States, arwilson@umn.edu, Donna D. McAlpine

The US Preventive Services Task Force has recommended that all adults be screened for depression in primary care. Several screening instruments exist, and the task force has stated that insufficient evidence exists to recommend one over another. The instruments are all fairly sensitive but vary in length and specificity. We suggest that in this case, it is appropriate to use a minimum cost per detection criterion. Under that criterion, we show that several tests would never be desirable.

■ MD21

P-Room 3302

Inventory Modeling I

Contributed Session

Chair: Shailesh Kulkarni, Assistant Professor, University of North Texas, 321 Avenue A, Room 336, College of Business Administration, Denton, TX, 76203-5249, United States, kulkarni@unt.edu

1 - Optimal Inventory Policy with Limited Order Opportunities
Jian Li, Krannert School of Management, Purdue University, 1310 Krannert Building, West Lafayette, IN, 47907-1310, United States, Li53@mgmt.purdue.edu, Suresh Chand, Maqbool Dada

We consider a stochastic multi-period problem. A decision maker decides at the beginning of each period whether or not to place an order. The decision maker is allowed to place at most N orders in T periods. We analyze the form of the optimal policy.

2 - Batch Sizing under Learning and Forgetting: Steady State Results
Sunantha Teyarachakul, School of Business, Minnesota State University, Moorhead, MI, United States, teyarach@mnstate.edu, Suresh Chand, James Ward

We consider steady-state characteristics of lot-sizing when learning and forgetting are present. Assuming constant lot-size and constant demand-rate, we examined the convergence properties of the batch production time as the number of batches grows. We found a new type of convergence, alternating convergence; that is as the number of lots produced goes to infinity, the batch production time alternates between two different values. We investigated the behavior of the average cost per time in our problem and considered policies with lower costs than the best ESCLS (Equal-spaced and constant lot-size) policy.

3 - Direct Fulfillment Performance in Internet Retailing: Emergency Transshipments and Demand Dispersion
Elliot Rabinovich, Assistant Professor, Arizona State University, PO Box 874706, Tempe, AZ, 85287, United States, elliot.rabinovich@asu.edu

An empirical simulation model evaluates avenues through which Internet retailers and wholesalers engaged in direct fulfillment arrangements (i.e., drop shipping) can jointly improve their logistical performance. Focusing on online CD retailing, the model assesses the effects that emergency transshipments and demand dispersion have on inventory and product-release performance, as well as on transportation costs, in direct fulfillment operations.

4 - On the Incorporation of Quality Loss Costs in a Generalized Lot-Sizing Model with Yield Uncertainty
Shailesh Kulkarni, Assistant Professor, University of North Texas, 321 Avenue A, Room 336, College of Business Administration, Denton, TX, 76203-5249, United States, kulkarni@unt.edu

We examine a joint lot-sizing and process investment problem with uncertain yield, backlogging and inspection. The process quality loss profile around the target is captured via a modification of the Reflected Normal loss function. We develop distribution-free closed-form solutions which allow us to examine the nature of optimal policies. Overall, our models and analysis provide some interesting insights into this reasonably complex inventory problem.

■ MD22

P-Room 3312

Network Centric Warfare

Sponsor: Military Applications
Sponsored Session

Chair: John M. Andrew, Col USAFA/DFMS, Department of Math Sciences, HQ USAFA/DFMS, 2354 Fairchild Dr #6D2A, US Air Force Academy, CO, 80908, United States, john.andrew@usafa.af.mil

1 - Dynamic Sensor Network Topolgy Managament in Network Centric Warfare
Rajan Batta, University at Buffalo (SUNY), 410 Bell Hall, Dept of Industrial Engg, Buffalo, NY, 14260, United States, batta@eng.buffalo.edu, Rakesh Nagi

In this talk we will describe the modeling and implementation of a sensor network topology management scheme in a threat environment. This implementation is embeded in a testbed that has a target tracking and visualization capability.

2 - Network Interdiction Under Asymmetric Information
Matthew Bailey, Assistant Professor, University of Pittsburgh, 1032 Benedum Hall, Pittsburgh, PA, 15261, United States, mdbailey@pitt.edu, Halil Bayrak

We consider the problem of allocating sensors for detection of an adversary on a large-scale communication or transportation system represented by a network of nodes and links. Ideally, resources would be allocated to guarantee detection; however, due to budgetary constraints or network structure this may not be feasible. We explore a scenario where the adversary has imperfect intelligence about the system features and explore the development of robust sensor allocation decisions.

3 - Resource Allocation for Integrative Technologies
Oren Setter, Tel Aviv University, Faculty of Management, Tel Aviv, 69978, Israel, settero@post.tau.ac.il, Asher Tishler

Integrative technologies are information and communication technologies that enable separate individual systems to work as a single holistic system. This study explores the optimal budget allocation for to the development of integrative technologies. We develop an optimization framework that captures the main characteristics of the problem. We then use it to derive the optimal allocation, and to analyze it. To demonstrate the viability of the model, we apply it to the US military.

■ MD23

P-Room 3354

Resource Allocation for Military Applications

Sponsor: Military Applications
Sponsored Session

Chair: Sharon Arroyo, The Boeing Company, PO Box 3707, MC 7L-20, Seattle, WA, United States, sharon.f.arroyo@boeing.com

1 - Sensor Deployment for Area Coverage and Targeting under Imprecise Placement
Steven Charbonneau, LTC, HQDA G8 PAED, Pentagon, Washington, DC, 20301, United States, Steven.Charbonneau@hqda.army.mil, Karla Hoffman, Andrew Loerch

Unattended Ground Sensors (UGS) will play a vital role in information dominance for the Army. Developing a sensor deployment plan that incorporates probability of detection, line of bearing errors, minimum number of sensors required, and imprecise sensor delivery, involves the formulation and solution of stochastic mixed integer non linear programming problem (S-MINLP). We propose a method based on integer programming for approximating the solution of the stochastic sensor placement problem.

2 - Rapid Improvement of Stochastic Networks Using Two-Moment Approximations
Julien Granger, Graduate Student, Industrial Engineering Department, University of Wisconsin, 1513 University Avenue, Madison, WI, 53706, United States, granger@cae.wisc.edu, Stephen M. Robinson, Ananth Krishnamurthy

This talk investigates a method for rapidly improving the performance of stochastic networks by substituting two-moment approximations for the usual repetitive simulation runs. The technique employs some recently devised improvements to the approximations and appears to offer a very substantial advantage in speed. We present an example from airfield operations, in which the technique identifies bottleneck problems and shows how to invest in capacity to improve performance.

3 - A Target Visitation Problem
Don Grundel, AFRL/MNGN, 101 W Eglin Blvd, Ste 331, Eglin AFB, FL, United States, don.grundel@eglin.af.mil, David Jeffcoat

We present the Target Visitation Problem (TVP) for a single unmanned agent. The ability to effectively plan paths for agents to visit multiple targets is an increasingly important capability in a variety of applications, including surveillance, attack, assessment, search and rescue, disaster relief, and environmental cleanup. We formulate the target visitation problem for a single agent and then describe and compare some solution procedures.

■ MD24

P-Room 3402

Optimization in Financial Services III

Sponsor: Financial Services
Sponsored Session

Chair: Russell Walker, Capital One, United States, russell.walker@capitalone.com

1 - Managing IT Resources for Improving Time to Market
Russell Walker, Capital One, United States, russell.walker@capitalone.com, Michelle Mitchell, Roy Lowrance, Chitra Jain, Kurt Thearling, Dan Swanson, Scott Sykes

In this study, we looked to improve the time to market of key IT projects. Recognizing that modeling knowledge-worker environments with classic OR tools would be novel, a model was developed that prioritized work across the IT resources, using an optimization approach. Additionally, a simulation was developed to consider changes to the processes that drive project completion. With these models, the IT decision makers can consider various scenarios the impact of time to market.

2 - Using Discrete Event Simulation to Design the Image Exchange Process under Check 21
Atul Modi, Process Design Engineer, Bank of America, 1401 Elm St, Dallas, TX, 75202, United States, Atul.Modi@bankofamerica.com, Sud Mallya

The check processing industry, including Bank of America's Transaction Services faces a significant change brought about by the passage of the Check 21 legislation. This legislation, which confers legal status on the Image Replacement Document (IRD), serves as a catalyst for check settlement using Images. To analyze the complexity and the changes, a discrete event simulation model has been developed. Specifically, the model analyzes the design of the 'Send' and 'Receive' processes.

3 - The Potential of Optimization Models in Capital Management
Richard Hamilton, Senior Vice President, National City Corporation, United States, Richard.Hamilton@nationalcity.com

Capital Management optimizes the deployment of a firm's capital and uses economic capital allocation. It involves linking risk with capital adequacy and can alter the process of making investment decisions since it ties the returns on individual investment decisions directly to the returns on shareholder equity. However, the optimization of the capital allocated to individual portfolios does not necessarily mean the firm's capital allocation is optimized. We discuss the challenges involved.

4 - A Multi-Period Model For Bank Of America Transaction Services In The Post-Check21 Era
Gang Chen, Bank of America, R & D, Dallas, TX, United States, gang.chen@bankofamerica.com, Debraj Mallick, Mark Hutchins, Fred Hale, Olga Bagatourova, Atul Modi, Sud Mallya

As the Check 21 Act goes to effect on October 28, 2004, the check payment system in the US will reach a whole new level of truly electronic clearing and settlement. We employ large-scale integer programming in conjunction with Lagrangean Relaxation to optimize the network and develop a multi-period geographic footprint for Bank of America's Transaction Services in the post-Check21 era.

■ MD25

P-Room 3404

Joint Session Education/OR in Sports: SpORts in the OR Classroom III

Sponsor: Education (INFORM-ED) SPONSORED/INVITED, OR in Sports
Sponsored Session

Chair: James Cochran, Assistant Professor, Louisiana Tech University, P. O. Box 10318, Ruston, LA, 71272, United States, jcochran@cab.latech.edu

1 - Using Sports Scheduling to Teach Integer and Constraint Programming
Michael Trick, Carnegie Mellon, Tepper School of Business, Carnegie Mellon, Pittsburgh, PA, 15213, United States, trick@cmu.edu

Sports scheduling provides a number of examples that can be used to illustrate important concepts in integer and constraint programming. I outline how I use sports scheduling in the MBA classroom as part of my course on the application of OR methods.

2 - Teaching Decision Making with Baseball Examples
Eric Bickel, Assistant Professor, Texas A&M University, Department of Industrial Engineering, 236B Zachry Engineering Center, College Station, TX, 77843-3131, United States, ebickel@sdg.com

Sports examples can be wonderful vehicle for teaching OR/MS concepts. Baseball is particularly well suited to teaching statistics/probability, Markov decision processes, and decision analysis. This talk details a baseball example I developed to teach fundamental decision making skills. This example has been used successfully to teach undergraduates and graduates in technical and non-technical disciplines.

3 - Bowie Kuhn's Worst Nightmare - A Case in Integer Programming & Simpson's Paradox
James Cochran, Assistant Professor, Louisiana Tech University, P. O. Box 10318, Ruston, LA, 71272, United States, jcochran@cab.latech.edu

We provide a narrative case describing the contentious negotiations between the Major League Baseball Player's Association and franchise owners over a collective bargaining agreement in the early 1980s. Details of the strike, ensuing agreement, and plan for resuming the season and facilitating the playoffs are provided. Prestrike records and number of scheduled poststrike games are provided for each team. Students must evaluate the plan for resuming the season and the revised playoff structure.

■ MD26

P-Room 3412

Strategic Models of E-commerce and Pricing

Sponsor: Marketing
Sponsored Session

Chair: Chuan He, University of Colorado at Boulder, 419 UCB, Boulder, CO, 80309, United States, chuan.he@colorado.edu

1 - Managing E-marketplace: A Strategic Analysis of Non-price Advertising
Chuan He, University of Colorado at Boulder, 419 UCB, Boulder, CO, 80309, United States, chuan.he@colorado.edu, Yuxin Chen

We investigate an E-marketplace with competing on-line stores. We find that in a commission-based business model such as the E-marketplace, featuring tends to be associated with price premium and serves as a mechanism to mitigate competition among online stores. We also show that when the market coverage of the E-marketplace is high or when consumers incur substantial search costs, it is more beneficial for the E-marketplace to feature the high-price store for free.

2 - Online Competition via Several Internet Shopping Agents
Amit Pazgal, Associate Professor, Washington University, St. Louis, MO, 63130, United States, pazgal@olin.wustl.edu, Ganesh Iyer

We investigate the pricing strategies of firms selling homogenous goods through several Internet Shopping Agents (ISAs). We characterize the equilibrium strategies when firms can not utilize all the ISA's. We show that even with homogenous price sensitive consumers firms get positive expected profits. We demonstrate the equivalence of the problem to an auction setting where limited resource firms simultaneously bid on a subset of the offered projects. We end with some experimental results.

3 - Strategic Self-Restraint and Retail Online Expansion
Yunchuan Liu, University of California, Riverside, 125 Anderson Hall, AGSM, 900 University Ave, Riverside, CA, 92507, United States, yunchuan.liu@ucr.edu, Sunil Gupta, Z. John Zhang

We develop a game-theoretical model in this paper to study the optimal channel expansion and management strategies for a brick-and-mortar retailer facing the possible entry of a pure-play E-tailer. We find that an incumbent brick-and-mortar retailer's decision to enter online can have the strategic ramification of deterring a pure-play E-tailer from entering a market. However, entry deterrence is executed through a self-restraint strategy. This strategy calls on a brick-and-mortar retailer to strategically refrain from entering online even when doing so is expected on the cost justification. We further find that entering online with an independent operation helps the incumbent brick-and-mortar retailer to credibly deter the E-tailer's entry. The credibility comes from the retailer's willingness to cannibalize its own brick-and-mortar business. We also discuss some consumer welfare implications of retail online entry and also the managerial insights of our analysis.

4 - Edgeworth Cycles and Fairness in Competitive Promotional Strategies: An Experimental Study
Sungchul Choi, Assistant Professor, University of Northern British Columbia, Prince George, BC, Canada, schoi@unbc.ca, Paul Messinger

We conduct experiments to test various aspects of Narasimhan's (1988) mixed-strategy equilibrium relating to the cumulative price distribution and predictions of promotional depth and frequency. While the cumulative price distributions for symmetric cases are not far from predictions, the presence of serial correlation is not predicted by the mixed-strategy equilibrium. We accordingly consider alternative explanations of behavior including the Edgeworth Price Cycle and the fairness hypothesis.

■ MD27

P-Room 3454

Applied Probability in Financial Engineering

Sponsor: Applied Probability
Sponsored Session

Chair: Shi-Jie Deng, Asst. Professor, Georgia Inst. of Tech., 765 Ferst Dr, Atlanta, GA, 30332, United States, deng@isye.gatech.edu

1 - Recent Developments in the Double Exponential Jump Diffusion Model
Steven Kou, Associate Professor, Columbia University, 312 Mudd, Dept. of IEOR, Columbia University, New York, NY, 10027, United States, sk75@columbia.edu

Analytical tractability is one of the challenges faced by many alternative models that try to generalize the Black-Scholes option pricing model to incorporate more empirical features. We demonstrate a double exponential jump diffusion model can lead to an analytic solution/approximation for finite horizon American options (Kou and Wang, 2004) and analytical solutions for popular two dimensional path-dependent options (Huang and Kou, 2004).

2 - Optimal Multiple-stopping of Linear Diffusions and Swing Options
Savas Dayanik, Assistant Professor, Princeton University, ORFE, E-Quad, Princeton, NJ, 08544, United States, sdayanik@princeton.edu, Rene Carmona

Traded in energy markets, swing options give the holder multiple-exercise rights of American type. The unique feature of these options is that, after every exercise, at least a contractually-determined amount of time must pass before the next right is exercised. Motivated by the pricing of such options, we formulate optimal multiple-stopping problems for general linear regular diffusion processes. We describe a novel solution method and illustrate it on several examples.

3 - American-style Options Pricing by Adaptive Simulation
Shi-Jie Deng, Asst. Professor, Georgia Inst. of Tech., 765 Ferst Dr, Atlanta, GA, 30332, United States, deng@isye.gatech.edu, Sungjoo Lee

We propose a novel simulation approach for pricing American-style derivative securities. We develop an adaptive policy search algorithm for searching the optimal policy in exercising an American-style option. The option price is obtained by first estimating the optimal exercising policy and then evaluating the option with the estimated policy through simulation. We show that the proposed algorithm leads to the convergence to the true optimal policy with probability one.

■ MD28

P-Room 3504

Maintenance Optimization

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: Lisa Maillart, Assistant Professor of Operations, Weatherhead School of Management, Case Western Reserve University, 10900 Euclid Avenue, Cleveland, OH, 44118, United States, lisa.maillart@case.edu

1 - Considering the Bottleneck in Multi-Machine Maintenance Optimization
Xiang Fang, Doctoral Student, Weatherhead School of Management, Case Western Reserve University, 10900 Euclid Ave, Cleveland, OH, 44106, United States, xxf6@case.edu, Lisa Maillart

We consider a system of n failure-independent, but non-identical machines in series. The objective is to find an age-replacement policy for each machine, such that the throughput of the entire system is maximized, subject to a budget constraint. Both the structure of the optimal policy as well as numerical results are discussed.

2 - Deterioration Modelling and Decision Support for Painting Maintenance
Rommert Dekker, Erasmus University Rotterdam, PO Box 1738, 3000 DR Rotterdam, Rotterdam, NL, Netherlands, rdekker@few.eur.nl

In this presentation we consider the modeling of deterioration of protective painting. We compare three models, viz. a Brownian motion, a gamma process and a detailed simulation model with respect to adherence to expert judgment and assessments. Next we briefly discuss how these will be used in a decision support system for planning and scheduling the maintenance (inspection, spot painting and repainting) in a large-scale system.

3 - Availability Analysis for the Quasi-Renewal Process
Joel Nachlas, Associate Professor of Industrial and Systems Engineering, Virginia Tech, 215 Durham Hall, Blacksburg, VA, 24061, United States, nachlas@vt.edu, Ian Rehmert

For most repairable equipment, repair actions take time and the condition following repair is not strictly "as good as new" or "as bad as it was". Using quasi-renewal processes to model the operations and repair intervals, we construct two expressions for point availability and use them to bound the approximated point availability.

4 - Selective Maintenance Modeling for Extended Planning Horizons
Richard Cassady, Associate Professor of Industrial Engineering, University of Arkansas, 4207 Bell Engineering Center, Fayetteville, AR, 72701, United States, cassady@engr.uark.edu, Lisa Maillart

Established selective maintenance models for repairable systems address between-mission maintenance decisions under limited resources. These optimization models are most often designed to maximize system reliability for the next future mission. If the system is expected to complete a sequence of future missions, planning horizons of more than one future mission can be considered. An optimization-based framework for selective maintenance under extended planning horizons is presented and analyzed.

■ MD29

P-Room 3502

"Marketing on the Internet: What's New and What Isn't?"

Sponsor: E-Business
Sponsored Session

Chair: Dipankar Chakravarti, The Ortloff Professor of Business, University of Colorado, Boulder, Leeds School of Business, UCB 419, Boulder, CO, 80309, U.S., Dipankar.Chakravarti@colorado.edu

1 -Panel: "Marketing on the Internet: What's New and What Isn't?"

Moderator:Dipankar Chakravarti, The Ortloff Professor of Business, University of Colorado, Boulder, Leeds School of Business, UCB 419, Boulder, CO, 80309, U.S., Dipankar.Chakravarti@colorado.edu, Panelists: Ramiro Montealegre, John Anderson, Steve Harris, Paul Imbierowicz, Rick Robinson.

This panel of academics and practitioners will address how the Internet is currently shaping marketing practice in contemporary business environments. The practitioner panelists will share their own/client experiences with current and emerging uses of the Internet as a marketing medium, in both B2B and B2C

environments. They will work jointly with the academic panelists to identify what has been learned from past experience and identify issues and questions to develop a marketing-oriented e-business research agenda that is sensitive to practitioner needs. The panel format is designed to encourage significant audience participation.

■ MD30

P-Room 3512

QSR Best Student Paper

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: Shwu-Tzy Jiang, Postdoctoral Research Associate, University of Oklahoma, 202 West Boyd St., Carson Engineering Center, Rm., 107, Norman, OK, 73019, United States, Shwu-Tzy.Jiang-3@ou.edu

1 - Optimal Filter Design Approach to Statistical Process Control

Chang-Ho Chin, Texas A&M, United States, chchin@tamu.edu

Many control charting methods for both i.i.d and autocorrelated data can be viewed as charting the output of a linear filter applied to the process data. We propose a generalization of this concept, in which the filter parameters are optimally selected to minimize the out-of-control ARL while constraining the in-control ARL to some desired value. A number of interesting characteristics of the optimal filters are discussed.

2 - Proportional Intensity Model Robustness for Right-censored Failure Data

Kai Jiang, United States, kaijiang@stanford.edu

This paper reports the robustness of the Prentice- Williams-Peterson-gap time (PWP-GT) model, for right-censored failure data. The results are beneficial to practitioners in anticipating the more favorable application domains for using the PWP-GT model. At sample size of 60, PWP-GT proves to perform well when 80% of the units have some censoring.

3 - Setup Error Adjustment of Multiple Lots using a Sequential Monte Carlo Method

Z. Lian, The Pennsylvania State University, United States, zilong@psu.edu

Traditional multi-lot setup adjustment procedures are based on the assumptions of known process parameters. In the case that process parameters are unknown, adjustment procedures based on a Bayesian model using Markov Chain Monte Carlo techniques have been proposed but they are very time-consuming. In this paper we present a faster adjustment procedure also based on a Bayesian model using a Sequential Monte Carlo (SMC) method for computing posterior distributions of the unknown process parameters.

4 - SELC : Sequential Elimination of Level Combinations by Means of Modified Genetic Algorithms

Abhyuday Mandal, Industrial and Systems Engineering, Georgia Institute of Technology, 765 Ferst Drive NW, Atlanta, GA, 30332, United States, amandal@isye.gatech.edu

To search for an optimal design in a large search space, Wu, Mao, Ma (1990) suggested the SEL-method. Genetic algorithms (GA) can be used to improve upon this method. New ideas of forbidden array and weighted mutation are introduced. Relaxing the condition of orthogonality, GA is able to accommodate a variety of design points and enhances the chance of getting the best setting in fewer runs, particularly in the presence of interactions.

■ MD31

P-Room 3545

Info-System

Sponsor: Information Systems
Sponsored Session

Chair: Barin Nag, Professor, Towson University, Department of Management, Towson, MD, 21252, United States, bnag@towson.edu

1 - Characteristics and Performance of Agents in Supply Chain Management

Barin Nag, Professor, Towson University, Department of Management, Towson, MD, 21252, United States, bnag@towson.edu, Songchul Hong, Dong Yao

Intelligent software agents perform supply chain transactions over the Internet. We examine the characteristics of the buyer and seller agents and the structure of the community to optimize the goal-driven performance in a two-tier auction environment.

■ MD32

T-Vail (Majestic Level)

OR Models for the Automotive Industry

Cluster: OR Practice
Invited Session

Chair: Kenneth Chelst, Chair, Wayne State University, Dept. of Industrial & Manuf., 4815 Fourth St., Detroit, MI, 48201, United States, kchelst@wayne.edu

1 - Vehicle Shipping Facilities Optimizer for Manufacturing Plant Dwell Time Reduction

Ramakrishna Govindu, Ph.D. Candidate, Wayne State University, Industrial and Manufacturing Engg, 4815 Fourth St, Detroit, MI, 48202, United States, ah0776@wayne.edu, Leslie Monplaisir

We present the development and implementation of a decision support system that reduces dwell time. The model provides, through a series of spreadsheet functions, a consistent method of identifying facility constraints in order to improve vehicle shipping on-time performance. The system was designed for implementation in 21 Assembly plants in North America. It was projected to reduce the several million dollars of excess dwell time costs in Ford Motor Company.

2 - Risk Management in Sourcing to Emerging Markets

Yavuz Canbolat, Wayne State University, IME Department, 4815 Fourth St., Detroit, MI, 48201, United States, canbolat@wayne.edu, Kenneth Chelst

This paper presents a risk assessment and management model for sourcing an automotive component to emerging market. We used a PFMEA structure to characterize a comprehensive list of risk factors and built an @Risk model that quantifies risk factors in terms of dollars. The model enables decision makers to develop and evaluate risk mitigation plans. We demonstrate the model with a real world case study involving a North American auto company considering sourcing a component to China.

3 - Global Optimization Sourcing Strategy for Microprocessors

Bimal Nepal, Ph.D. Candidate, Wayne State University, Dept. of Industrial & Manufacturing Engg, 4815 Fourth Street, Detroit, MI, 48202, United States, bnepal@wayne.edu, Kenneth Chelst

The sourcing decision of critical components in automotive industries is complex due to rigorous product requirements, multiple suppliers and dynamic pricing structures. We present a set-covering model for selecting the most economical set of microcontrollers that meets product requirements. Lot size constraints are used to handle a piecewise linear pricing structure. A corporate case study is used to demonstrate the model's potential for saving two million dollars over a 4-year planning horizon.

4 - Product Line Optimization Model for Quoting New Business

Ibrahim Dogan, United States, aq9742@wayne.edu, Leslie Monplaisir

Uncertainty of internal and external factors, limitation of resources, complexity of product development and manufacturing necessitates the need for a comprehensive mathematical modeling in determining the best strategies bidding for different product lines of a multi-national OEM supplier. This model provides the management with better understanding about utilization of their facilities and skill sets, best allocation of new product lines and the perspectives for quoting new business.

■ MD33

T-Savoy (Majestic Level)

Daniel H. Wagner Prize Competition

Sponsor: The Daniel H. Wagner Prize for Excellence in Operations Research
Sponsored Session

1 - Maximizing Federal Natural Gas Royalties

Major Steven A. Stoddard, Center for Army Analysis, Fort Belvoir, VA, 22060, United States, steven.stoddard@us.army.mil

The United States has substantial natural gas reserves. Commercial entities produce natural gas from these reserves under authority of leases from the Federal government. The U.S. Department of the Interior's Mineral Management Service (MMS) manages the mineral rights on behalf of American citizens and collects royalties on gas taken from Federal properties. MMS collects two different methods of payment on royalty obligations - royalty in value (RIV) and royalty in kind (RIK). Statute allows that "The Federal Government may take all or part of its Ô gas royalties in kind (a volume of the commodity) as opposed to in value (cash)." Historically, most leaseholders have paid their royalties in value. The alternative, RIK, was initiated as a formal program in 1995 and has been a growing entity for MMS. In this case, instead of paying cash, leaseholders pay royalties in the form of physical molecules of natural gas. MMS then sells the gas commercially. When MMS takes natural gas royalties in kind, it also contracts for the most profitable transportation, processing, and sales arrangements that it can

find. This research enables MMS to accomplish the goal of maximizing royalties from natural gas production on Federal properties. We do so by implementing new tools that manage data, developing an improved pricing methodology, and creating an optimization technique that provides rapid solutions to complex problems.

2 - Liquidity Risk of Revolving Credit Lines
Russ Labe, Director, Management Science, Merrill Lynch, P.O. Box 9065, Princeton, NJ, 08543-9065, United States, russ_labe@ml.com, Tom Duffy, Wenyue Hsu, Manos Hatzakis, Bonnie Liao, Adeesh Setya, Lihua Yang, Xiangdong Luo

Merrill Lynch Bank USA has a portfolio of revolving credit lines to help corporations meet short-term funding needs. We developed a Monte Carlo simulation model to analyze the liquidity risk of the portfolio. The model also incorporates other OR/MS techniques including Markov transitions, expert sytems, and generating industry correlated random numbers. The model enabled the Bank to free $3 billion of liquidity from a portfolio of $11 billion. The model is used on a regular monthly basis.

■ MD34

T-Columbine (Majestic Level)

Pricing and Revenue Management in Operations

Sponsor: Manufacturing and Service Operations Management
Sponsored Session

Chair: Philipp Afeche, Kellogg School of Management / Northwestern University, 2001 Sheridan Road, Evanston, IL, 60208, United States, p-afeche@kellogg.northwestern.edu

Co-Chair: Assaf Zeevi, Columbia University, United States, assaf@gsb.columbia.edu

Co-Chair: Costis Maglaras, United States, c.maglaras@columbia.edu

1 - Coordinating Price and Capacity Decisions in Inventory Systems
Gad Allon, Columbia University, Graduate School of Business, NY, NY, United States, ga2003@columbia.edu, Assaf Zeevi

We address the simultaneous determination of pricing and capacity investment strategies in a multi-period setting under demand uncertainty. In our model a monopolistic firm makes three decisions: capacity investment (or disinvestment); production (inventory); and pricing; all of which can be specified as a function of the state of the system. We analyze the optimal joint strategy and investigate the relationships between the main strategic decision variables, price and capacity.

2 - Robust Controls for Revenue Management Problems
Serkan Eren, Columbia Business School, 3022 Broadway, NY, NY, 10027, United States, se2027@columbia.edu, Costis Maglaras

This talk focuses on the single-resource capacity control problem in a setting with imperfect knowledge about the market conditions. We study and compare two formulations that either model the parameter ambiguity probabilistically or through a max-min criterion over the range of possible parameter values.

3 - A Model for Make-To-Order Revenue Management
Jeremie Gallien, MIT Sloan School of Management, 30, Wadsworth Street, E53-389, Cambridge, MA, 02142, United States, jgallien@MIT.EDU, Yann Le Tallec, Tor Schoenmeyr

We seek to identify quantitative and dynamic sales guidelines for a capacity-constrained, make-to-order manufacturer when negotiating contracts along the dimensions of price, quantity and delivery lead-time. We formulate accordingly an admission control problem, and derive a computationally efficient policy using a fluid approximation. Simulation experiments reveal that its performance is superior to that of static policies and close to optimal over an important range of market environments.

4 - Revenue Management and Delaying Tactics for Competing Providers
Philipp Afeche, Kellogg School of Management / Northwestern University, 2001 Sheridan Road, Evanston, IL, 60208, United States, p-afeche@kellogg.northwestern.edu

Consider the problem of two providers who compete for heterogeneous and delay sensitive customers with private information about their delay tolerance. How should the firms choose their price-delay menus and schedule their resources? We characterize the possible price-delay equilibria and discuss how they emerge from a tradeoff between competitive and service differentiation effects.

■ MD35

T-Terrace (Terrace Level)

Managing Supply Chains in e-tailing and e-procurement

Sponsor: Manufacturing and Service Operations Management
Sponsored Session

Chair: Srinagesh Gavirneni, Indiana University, Kelley School of Business, Bloomington, IN, 47405, United States, sgavirne@indiana.edu

1 - The Dynamic Assignment of Online Fulfillment Responsibilities in Retail/E-Tail Systems
Stephen Mahar, Department of Operations and Decision Technologies, Kelley School of Business, Indiana University, Bloomington, IN, 47405, United States, smahar@indiana.edu, Kurt Bretthauer, M.A. Venkataramanan

Recently many traditional offline retailers have extended their brands online. This paper examines how such firms can benefit by investing in continuous monitoring of online demands and inventory positions (versus periodic monitoring). We develop and evaluate two dynamic assignment policies that leverage real time information. Computational results indicate that dynamically specifying e-fulfillment responsibilities can significantly reduce system cost over the optimal static policy.

2 - An Exploratory Study of Bundling in B2B Online Procurement Auctions
Tobias Schoenherr, Doctoral Candidate, Indiana University, Operations and Decision Technologies, Kelley School of Business, 1309 E. 10th, Bloomington, IN, 47405, United States, tschoenh@indiana.edu, Vincent A. Mabert

A request for quotation order lot may consist of a single stock keeping unit, but will more often contain a bundle of different items that is attractive to one or more potential bidders. The way a bundle is set up can influence purchasing performance and competition. This research identifies factors that influence the performance of bundled purchases in B2B online procurement auctions. The results will aid purchasers to make the decision how and what to bundle in a more informed way.

3 - Supply Chain Procurement with Inventory and Backordering Options
Pinar Keskinocak, Coca-Cola Assistant Professor, Georgia Institute of Technology, School of Industrial and Systems Enginee, 765 Ferst Drive, Atlanta, GA, 30345, United States, pinar@isye.gatech.edu, Paul Griffin, Kasarin Charnsirisakskul

We study the strategic behavior of a supplier and retailer in a two-period setting, where the supplier has limited capacity, the retailer can carry inventory, and the supplier and the retailer can backorder demand. We show that the supplier prefers the backordering option, while the retailer may or may not depending on the holding/backordering costs, and capacity level. We also show that under the backordering option, both the supplier and retailer are better off with limited capacity.

4 - The Optimal Competitive Pricing and Cooperative Advertising in a Manufacturer-Retailer Supply Chain
Xiaohang Yue, University of Wisconsin_Milwaukee, United States, xyue@uwm.edu

We study the strategies of competitive pricing and cooperative advertising in a manufacturer-retailer supply chain with an e-tail distribution channel. We obtain some optimal policies of pricing and advertising under the Bertrand and Stackelberg settings.

■ MD36

T-Capitol (Terrace Level)

Computational Finance

Cluster: Financial Engineering
Invited Session

Chair: Benjamin Van Roy, Stanford University, Terman 315, Stanford, CA, 94305, United States, bvr@stanford.edu

1 - Cumulants in Option Pricing
James Primbs, United States, japrimbs@stanford.edu, Yuji Yamada

Cumulants provide a natural characterization of certain random processes, especially in the context of option pricing. They are particularly suited to the description of Levy processes, which include geometric Brownian motion and jump diffusion models. We show that a generalized Black-Scholes equation can be written in term of cumulants, and use this to create numerical approaches that incorporate the effects of skewness and kurtosis that appear in the underlying asset.

2 - Approximate Dynamic Programming for Portfolio Optimization
Martin Haugh, United States, martin.haugh@columbia.edu, Leonid Kogan, Zhen Wu

We use approximate dynamic programming (ADP) methods to solve some high-dimensional portfolio optimization problems. Dual-based methods are then used to evaluate the quality of these ADP solutions. We also compare the performance of the ADP solutions to the performances of other heuristic solutions.

3 - Dynamic Portfolio Optimization via Approximate Dynamic Programming
Benjamin Van Roy, Stanford University, Terman 315, Stanford, CA, 94305, United States, bvr@stanford.edu, Jiarui (Jared) Han

We discuss an approximate dynamic programming algorithm that addresses the problem of dynamic portfolio selection for an investor with constant relative risk aversion, when returns are modulated by an observable Markov process. As an example, consider management of a fixed income portfolio with returns modulated by the forward rate curve, which is modeled as a Markov process, possibly with an infinite number of state variables.

4 - Matrix Decomposition in Sparse Factors
Laurent El Ghaoui, United States, elghaoui@eecs.berkeley.edu, Alexandre d'Aspremont, Gert Lanckriet

We examine the problem of approximating, in the Frobenius-norm sense, a positive semidefinite matrix by a rank-one matrix, with an upper bound on the cardinality of its eigenvector. We provide a link with a modification of the classical representation of the largest eigenvalue of a symmetric matrix, where cardinality is constrained, and derive an SDP relaxation for our problem. We discuss applications of this technique in portfolio management with fixed transaction costs.

■ MD37

T-Biltmore (Terrace Level)

Pricing Issues in Electricity Markets

Sponsor: Energy, Natural Resources and the Environment
Sponsored Session

Chair: Tapas K. Das, University of South Florida, 4202 E. Fowler Avenue, Tampa, FL, 33620, United States, das@latte.eng.usf.edu

1 - A Stochastic Model for Market Price of Electricity and a Firm's Profit under Oligopoly
Mainak Mazumdar, Professor, University of Pittsburgh, 1048 Benedum Hall, Pittsburgh, PA, 15261, United States, mmazumd@engr.pitt.edu, Lizhi Wang, Matthew Bailey, Jorge Valenzuela

Under a model that accounts for the stochastic behavior of load and generator availabilities, the paper develops a procedure for estimating the mean and variances of market prices and a firm's profits under perfect competition and oligopoly.

2 - Multi-Period Electric Transmission Expansion Using AC Power Flow Equations
Ronald Rardin, Professor of Industrial Engineering, Purdue University, Purdue Energy Modeling Research Groups, West Lafayette, IN, 47907-2022, United States, rardin@purdue.edu, Ramu Naidoo, Chee-Mun Ong, F Thomas Sparrow, Douglas Gotham, Zuwei Yu

We consider multi-period minimum cost expansion of electric transmission networks with both real and reactive power requirements. A Benders decomposition with combinatorial expansion master problem decisions and sub-problems reducing to modified AC power flow optimizations leads to approximate solutions superior to prior sequential heuristics on IEEE standard tests.

3 - An OPF Framework for Assessing Auction Strategies in Deregulated Electricity Markets
Tapas Das, Professor, University of South Florida, 4102 E. Fowler Avenue, ENB118, Tampa, FL, 33620, United States, das@eng.usf.edu, Balaji Rajan, Vishnuteja Nanduri

Deregulated power markets across the world use different auction strategies for pricing electricity. We develop an OPF based methodology for assessing the impact of existing auction mechanisms on the performance of energy markets. The methodology is tested using sample networks available in MATPOWER.

■ MD38

T-Beverly (Terrace Level)

Simulation-Optimization

Contributed Session

Chair: Deng Huang, Ph. D. Student, Ohio State University, 210 Baker Systems Building, 1971 Neil Avenue, Columbus, OH, 43210, United States, huang.262@osu.edu

1 - A Decision Support Tool for Efficient Shipboard Equipment Maintenance
Abelardo Mayoral, Project Analyst, Centre for Operations Excellence/ University of British Columbia, 2053 Main Mall, Vancouver, BC, V6T1Z2, Canada, abelardo.mayoral@coe.ubc.ca, Mehmet Atilla Begen, Martin L. Puterman, Shuyu Fan

Equipment on large vessels may be managed by several different maintenance strategies. Choosing a good strategy for each piece of equipment involves a trade off between reliability and cost. We developed a decision support tool to enable management to evaluate different maintenance strategies. The tool uses stochastic dynamic programming to find an optimal solution and a simulation to evaluate recommended and user defined strategies.

2 - Global Optimization of Stochastic Black-Box Systems via Sequential Kriging Meta-Models
Deng Huang, Ph. D. Student, Ohio State University, 210 Baker Systems Building, 1971 Neil Avenue, Columbus, OH, 43210, United States, huang.262@osu.edu, Theodore Allen

Efficient Global Optimization is extended to address stochastic black-box systems. The method is based on a Kriging meta-model that provides global approximation and uncertainty of the objective. The in-fill samples are selected by maximizing an augmented Expected Improvement function with desirable properties for stochastic responses. Performance of the method is empirically compared with Nelder-Mead and Simultaneous Perturbation Stochastic Approximation methods using test functions.

3 - Integrated Risk Management Approach: Dynamic Risk Measures
George Birbilis, Brunel University, Department of Mathematical Sciences, Kingston Lane, Uxbridge, UB8 3PH, United Kingdom, george.birbilis@brunel.ac.uk

The principle contribution of this research is to provide a methodology for the Enterprize Risk Management called Integrated Risk Management Approach (IRMA).IRMA addresses the following issues: - The requirements from a simulation and software agent perspective - Dynamic adaptation of the system in general and the simulation in particular over time.

4 - Material Design for Semiconductor Alloys and Nanocrystals with Specific Electronic Properties
Peter Graf, National Renewable Energy Laboratory, 1617 Cole Blvd, Golden, CO, 80401, United States, peter_graf@nrel.gov, Kwiseon Kim, Wesley Jones

Material design for electronic applications involves exploring vast numbers of possible atomic configurations of semiconductors. We discuss global optimization problems including 1) The composition-constrained semiconductor alloy problem, 2) The random-alloy superlattice problem and 3) The atomistic-morphology problem of nanocrystals. We will describe our optimization approach using a parallel genetic algorithm with modified fitness schemes and specialized crossover and mutation operations.

5 - Investing in the Links of a Stochastic Network to Minimize Expected Shortest Path Length
Kannan Viswanath, Graduate Student, Purdue University, 434 Krannert Building, West Lafayette, IN, 47906, United States, viswanak@mgmt.purdue.edu, Srinivas Peeta, Sibel Salman

This type of problem arises in disaster-related strategic planning, where a decision-maker seeks to reduce the vulnerability of a transportation network to disasters, by upgrading its weakest elements. We model it as a two-stage stochastic program in which the probability distribution is dependent on the first stage decisions. We derive its equivalent deterministic program which enables us to derive structural results for the objective function. We present an approximate solution procedure.

■ MD39

T-Tower Court A (2nd Floor)

Decentralized Supply Chains: Quality Risk, Information Acquisition and Project Management

Cluster: Supply Chain Mgmt & Operations
Invited Session

Chair: Ozalp Ozer, Assistant Professor, Stanford University, Stanford, CA, United States, ozalp@stanford.edu

1 - Salesforce Incentives, Information Acquisition, and Production Planning
Fangruo Chen, Professor, Columbia University, New York, NY, United States, fc26@columbia.edu, Wen-Qiang Xiao

We consider the problem of providing incentives for a salesperson to increase sales and to gather and share information about the market condition. The firm can use the market information to improve its production planning. We find that linear contracts offer no incentives for information acquisition, whereas a menu of nonlinear contracts motivates the salesperson to both gather market information and share it with the firm.

2 - Risk Averseness and Supply Chain Coordination
David Simchi-Levi, Professor, MIT, 77 Massachusetts Ave., 1-171, Cambridge, MA, 02139, United States, dslevi@mit.edu, Xin Chen, Stephen Shum

We propose a risk averse model to study supply contracts between a retailer and its multiple suppliers. We identify coordinating contracts depending on the level of risk averseness of the different suppliers and the retailer.

3 - Incentive Contracting in Project Management
Murat Bayiz, Ph.D. Candidate, The Anderson School of Management at UCLA, 110 Westwood Plz. B501, Los Angeles, CA, 90095, United States, murat.bayiz@anderson.ucla.edu, Charles Corbett

We study incentive contracting in project management. We characterize the model in which the project manager (principal) gives incentives to the sub-contractors (agents) to encourage them to exert more effort. We discuss how the optimal payment scheme changes with information asymmetry, variability in task durations, project network and contract type.

4 - Contract Manufacturing with Unverifiable Product Quality and Hidden Information on Quality Costs
Ozalp Ozer, Professor, Stanford University, Terman Engineering Center, Room 314, Stanford, CA, 94305-4026, United States, oozer@stanford.edu, Murat Kaya

Original equipment manufacturers (OEMs) continue to outsource more functions, including design and strategic procurement, to contract manufacturers (CMs). As a result, OEM's product quality is largely determined by CM's effort. We consider the incentives an OEM must provide to encourage a CM to exert costly effort in achieving high quality. We find optimal two-part linear contracts depending on whether the quality is verifiable and the CM's quality cost is public.

■ MD40

T-Tower Court B (2nd Floor)

Stochastic Inventory Theory

Cluster: Supply Chain Mgmt & Operations
Invited Session

Chair: Ganesh Janakiraman, Assistant Professor, Stern School of Business, NYU, 44 West 4th St., New York, NY, 10012, United States, gjanakir@stern.nyu.edu

1 - Alternate Approaches to Important Results in Inventory and Pricing Control
Ganesh Janakiraman, Assistant Professor, Stern School of Business, NYU, 44 West 4th St., New York, NY, 10012, States, gjanakir@stern.nyu.edu, Tim Huh

We derive the structure of optimal policies in some well known stochastic inventory problems, including problems in which prices are also decision variables. Our proofs are more direct and easier to understand than traditional, induction based proofs.

2 - A Simple Heuristic for Optimal Policies in Serial Inventory Systems with Fixed Order Costs
Kevin Shang, Assistant Professor, Fuqua School of Business, Duke University, Durham, NC, United States, khshang@duke.edu

We develop a simple procedure to calculate near-optimal control parameters for both deterministic and stochastic serial inventory systems with fixed order costs. Numerical studies show that this simple heuristic outperforms those developed in Chen and Zheng (1998).

3 - A Dynamic Assortment Problem
Mahesh Nagarajan, Assistant Professor, University of British Columbia, 2053 Main Mall, Vancouver, BC, v6t1z2, Canada, mahesh.nagarajan@sauder.ubc.ca, Jay Ghosh

Demand distribution for N products in each of T periods is known. A retailer can order from M types of assortments of these N products in each period. Excess inventory is carried over and unsatisfied demand is lost. This problem is NP hard. In this study, we explore approximation algorithms and heuristics to solve this problem and evaluate performance bounds.

4 - Integrated Real-Time Capacity and Inventory Allocation for Reparable Service Parts
Kathryn Caggiano, UW-Madison, 975 University Avenue, Madison, WI, 53706, United States, kcaggiano@bus.wisc.edu, James Rappold, John Muckstadt

We develop an integrated model for making repair and inventory allocation decisions in a two-echelon reparable service parts system. We formulate the decision problem as a finite-horizon, periodic-review mathematical program and develop practical heuristic methods for solving the problem. We demonstrate the quality and computational efficiency of the heuristic approaches, as well as the value of employing this type of integrated decision model in practice.

■ MD41

T-Tower Court C (2nd Floor)

Supply Chain Inventory Management I

Contributed Session

Chair: Wei-yu Kevin Chiang, Assistant Professor, University of Maryland, Baltimore County, 1000 Hilltop Circle, ITE 450, Baltimore, MD, 21250, United States, wchiang@umbc.edu

1 - The Use of a Premium-payment Scheme in a Supply-chain Game Involving Acquirable Capacity
Jian Yang, Assistant Professor, New Jersey Institute of Technology, Department of IME, Newark, NJ, 07102, United States, yang@adm.njit.edu, Shitao Yang

We study a practice whereby a downstream firm pays to its supplier a premium payment for a certain quantity of products. Under a simple setting which involves only one downstream firm with symmetric information, we show that the adoption of this practice can induce the supplier to build a higher capacity level. The higher capacity level enables the supplier to satisfy a larger portion of demands from the downstream firm, and this leads to higher payoffs for both parties in the supply chain.

2 - Inventory Competition and Capacity Allocation in a Multiple-Channel Distribution System
Qin Geng, Univeristy of Illinois at Urbana-Champaign, 302 W. locust , Apt1, Urbana, IL, 61801, United States, qingeng@uiuc.edu, Suman Mallik

Consider a multi-channel distribution system where a manufacturer is simultaneously a supplier to and a competitor of a retailer. How should a manufacturer allocate scarce capacity between itself and the retailer? When is it optimal for the manufacturer to offer no product to the retailer even without a capacity constraint? What is the impact of manufacturer's allocation decision on the total supply chain profit? Using a game theoretic model we seek answers to these questions.

3 - Pricing Management for Two Distribution Channels under Brand Competition
Hisashi Kurata, Univ of Wisconsin-Milwaukee, 3202 N. Maryland Ave., BUS S325, Milwaukee, WI, 53201, United States, hkurata@uwm.edu, John Liu, Dong Yao

We analyze pricing for two distribution channels under competition between a national brand (NB) and a store brand (SB), where a NB can be distributed through both online and local stores and the SB is distributed only through local stores. Formulating the problem as a manufacturer-leader Stackelberg game, we find several essential channel management issues, including brand positioning, EDLP selection for a chain store, necessity for coordination between channels, and SB pricing.

4 - Inventory Competition in a Multi-Channel Supply Chain
Wei-yu Kevin Chiang, Assistant Professor, University of Maryland, Baltimore County, 1000 Hilltop Circle, ITE 450, Baltimore, MD, 21250, United States, wchiang@umbc.edu

We develop a game-theoretical model to investigate the competitive and cooperative stocking behavior in a two-echelon supply chain in which a supplier uses both its wholly owned direct channel and an independent retailer to distribute its products to customers with heterogeneous channel preference. The customers may dynamically substitute between the two sales channels. We analyze the channel inefficiencies induced by inventory competition and explore some supply chain coordination contracts.

■ MD42

T-Tower Court D (2nd Floor)

Dynamic Pricing and Revenue Management

Sponsor: Revenue Management & Dynamic Pricing
Sponsored Session

Chair: Guillermo Gallego, Columbia University, New York, NY, United States, gmg2@columbia.edu

1 - Revenue Management with Repeated Interactions
Ioana Popescu, Assistant Professor of Decision Sciences, INSEAD, Blvd. de Constance, Fontainebleau, 77300, France, ioana.popescu@insead.edu, Yaozhong Wu, Itir Karaesmen

We investigate a capacity allocation problem under repeated interactions between a monopolistic firm and a perfectly segmented market of customers. Our model generalizes the short-term revenue management problem by incorporating demand dynamics, which capture the impact of current availability on future demand. We provide insights into the structure of the optimal policy and compare it to the myopic one, that ignores such demand dynamics.

2 - Strategic Capacity Rationing to Induce Early Purchases
Garrett van Ryzin, United States, gjv1@columbia.edu, Qian Liu

We study a model of selling over time in which consumers strategize over the timing of their purchases. By stocking to deliberately create shortages in later periods, the seller is able to induce high-valuation customers to purchase early at a higher price. We analyze how the seller's optimal stocking quantity is affected by the risk preferences of consumers, competition from other suppliers and aggregate demand uncertainty.

3 - Dynamic Pricing for Parallel Flights
William L. Cooper, University of Minnesota, Department of Mechanical Engineering, Minneapolis, MN, 55455, United States, billcoop@me.umn.edu, Dan Zhang

We describe a Markov decision process model for dynamically pricing multiple flights between a common origin and destination. Consumers decide what, if anything, to purchase based upon the prices of all the flights as well as their own preferences. We describe analytical properties of the problem as well as computational techniques. The work is motivated by a situation faced by low-fare carriers who sell tickets on their own websites over the Internet.

4 - Martingale Bid Prices for Network Revenue Management
Baris Ata, Kellogg School of Management, Northwestern University, 2001 Sheridan Road, Evanston, IL, United States, b-ata@kellogg.northwestern.edu, Robert Philipps, Michael J. Harrison

In a network revenue management model where demand is continuous, there exist optimal bid prices that form a martingale. Moreover, by taking conditional expectations appropriately, one can construct a martingale bid-price sequence that is piecewise constant over time intervals of length L, and is asymptotically optimal as L->0.

■ MD43

T-Denver (Mezzanine)

Product Development Deep Dive

Cluster: New Product Development
Invited Session

Chair: Vish Krishnan, University of Texas at Austin, Department of Management, Austin, TX, 78712, United States, Vish.Krishnan@mccombs.utexas.edu

1 - Introduction of New Technologies to Competing Industrial Customers
Stylianos Kavadias, Assistant Professor of OM, College of Management, Georgia Institute of Technology, 800 West Peachtree Street NW, Atlanta, GA, 30332, United States, stylianos.kavadias@mgt.gatech.edu, Sanjiv Erat

Motivated by several examples from industry, we consider a technology supplier that develops and introduces an innovation to a market of OEMs. The employed technology impacts the end-product quality, and the end-product market demand is allocated based on the quality. T We examine the impact of downstream competition on technology introduction and pricing strategies when multiple technologies are introduced sequentially.

2 - A Product Architecture-Based Solution to Rapid Sequential Innovation
Vish Krishnan, University of Texas at Austin, Department of Management, Austin, TX, 78712, United States, Vish.Krishnan@mccombs.utexas.edu, Karthik Ramachandran

Managing rapid sequential innovation presents challenges to profit-maximizing firms because the seller's choices make buyers reconsider their purchase timing, with some customers possibly regretting their purchase timing decisions at a later time. We find that by following an architectural approach called Modular Upgradability and by localizing performance improvements, a firm can maximize profits without causing customer regret.

■ MD44

T-Spruce (Mezzanine)

Designing Auction Mechanisms: From Theory To Computing

Cluster: Auction Theory & Applications
Invited Session

Chair: David Wu, Lee A. Iacocca Professor, Lehigh University, Dept. of Ind. Sys. Eng., 200 W. Packer Ave., Bethlehem, PA, 18015, United States, david.wu@lehigh.edu

1 - Computational Aspects of Preference Aggregation using the Kemeny Rule
Jayant Kalagnanam, IBM T J Watson Research Ctr., 1101 Kitchawan Rd, Yorktown Hts, NY, 10598, United States, jayant@us.ibm.com, Andrew Davenport

We consider from a computational perspective the problem of how to aggregate the ranking preferences of a number of alternatives by a number of different voters into a single consensus ranking, following the majority voting rule. The Kemeny order has been designed to tackle the presence of cycles in the majority preference relation. However computing a Kemeny order is known to be NP-hard.

2 - Designing Multi-Item Ascending Price Vickrey Auctions
David C. Parkes, Harvard University, Div. of Engineering and Appl. Sciences, 33 Oxford Street, Cambridge, MA, 02138, United States, parkes@eecs.harvard.edu, Debasis Mishra

The direct Vickrey-Clarke-Groves (VCG) mechanism requires solving underlying optimization problems of the main economy and of every ``marginal" economy. We show that VCG outcome can be implemented using a competitive equilibrium (CE) of the main economy iff that CE price is also a CE price of every marginal economy. We call such a CE price a universal competitive equilibrium (UCE) price. We use UCE price concept to design ascending price Vickrey auctions for any valuation profile of buyers.

3 - A Bidder Aid Tool for Dynamic Package Creation in the FCC Spectrum Auctions
Karla Hoffman, Professor and Chair, Geroge Mason University, Systems Eng. and OR Dept., Mail Stop 4A6, Fairfax, VA, 22030, United States, khoffman@gmu.edu, Dinesh Menon, Susara VanDenHeever

We present a bidder aid tool that will helps bidders more effectively participate in combinatorial FCC spectrum auctions by enabling concise expression of preferences. In addition to logical relationships between items, bidders may express spectrum-specific preferences such as those related to minimum population coverage, bandwidth, and budget. The tool generates the optimal set of biddable packages dynamically. We will present our preliminary testing of this tool.

4 - Dominant Strategy Double Auction Mechanisms with Application in Supply Chain Formation Problems
Max Shen, University of California-Berkeley, IEOR Department, Berkeley, CA, 94720, United States, shen@ieor.berkeley.edu, Leon Chu

We propose two double auction mechanisms, the buyer competition mechanism and the modified buyer competition mechanism, for a broad class of supply chain formation problems. Both mechanisms are strategy-proof, individual-rational, weakly budget-balanced, and highly efficient. The buyer competition mechanism is also computationally efficient, since it only requires solving an underlying linear programming problem.

■ MD45

T-Gold (Mezzanine)

Operations Research and Data Mining for Healthcare Systems and Medical Applications

Cluster: Medicine and OR
Invited Session

Chair: Wanpracha Chaovalitwongse, ExxonMobil Research & Engineering, 1545 Route 22 East, Annandale, NJ, 08801, United States, wchaoval@rci.rutgers.edu

1 - Study of Hospital Evacuation and Surge Capacity
Mohsen Jafari, Professor, Rutgers University, 96 Frelinghuysen Rd., CORE Bldg., Piscataway, NJ, 08855, United States, jafari@rci.rutgers.edu

We study hospital evacuation and surge capacity in New Jersey hospitals. Two levels of analysis are being conducted - at micro level individual units within the hospital and their interaction are considered. At micro level, the interaction between a hospital and its community is analyzed.

2 - Network-Based Techniques in EEG Data Analysis and Epileptic Brain Modeling
Vladimir Boginski, University of Florida, 303 Weil Hall, Gainesville, FL, 32611, United States, vb@ufl.edu, Oleg Prokopyev, Panos Pardalos, Wanpracha Chaovalitwongse, J. Chris Sackellares, Paul Carney

We discuss a novel approach of modeling the behavior of the epileptic human brain, utilizing network-based techniques and statistical preprocessing of the EEG data from the electrodes located in different parts of the brain. In the constructed graphs, the vertices represent the "functional units" of the brain. Studying the dynamics of the properties of these graphs provides valuable information about the patterns characterizing the behavior of the brain prior to, during, and after a seizure.

3 - Wisconsin Breast Cancer Diagnosis via Global Optimization
Hong Ryoo, Assistant Professor, Korea University, Industrial Systems & Information Eng., 1, 5-Ka, Anam-Dong, Sungbuk-Ku, Seoul, 136-701, South Korea, hsryoo@korea.ac.kr, Nick Sahinidis

We develop a breast cancer diagnostic tool based upon our recent global optimization algorithms. The global optimization capability allows us to prove that the famous Wisconsin Breast Cancer Diagnostic Database is bilinearly inseparable. Furthermore, when trained on Group 1 this database, our discriminant correctly diagnoses 327 of the 330 patients in Groups 2-8, yielding 99.09% diagnostic accuracy. This represents a new record of diagnostic accuracy for this database.

■ MD46

T-Aspen (Mezzanine)

Agroterrorism: Economic Considerations and Supply Chain Management

Cluster: Agricultural Economics
Invited Session

Chair: Calum Turvey, Professor, Rutgers University, Dept of Agric., Food and Res. Econ, 55 Dudley Road, New Brunswick, NJ, 08901, United States, turvey@aesop.rutgers.edu

1 - Consumer Risk Perceptions of Agroterrorism with Implications for Food Systems Management
William Hallman, Associate Professor, Rutgers University, Dept of Human Ecology, 55 Dudley Road, New Brunswick, NJ, 08901, United States, hallman@aesop.rutgers.edu, Brian Schilling, Calum Turvey

This paper reports the results of a detailed national poll on consumer attitudes and risk perceptions of a potential agroterrorsim attack on the U.S. food system. The poll results will be used to identify key aspects of supply-chain risk from a consumer point of view, and will also be used to identify key perceptions of risk across the supply chain. By understanding consumer perceptions, methods can be developed to communicate supply-chain risks.

2 - Food System Traceability and RFID Technologies
Yifen Wang, Research Associate, Washington State University, Dept of Food Science, Pullman, WA, 99164-6376, United States, wyf@wsu.edu, Barbara Rasco, Eliza Mojduszka

Food Traceability Systems (active) and Food Fast Detection Systems (passive) have been developed to ensure food quality and safety and to deter intentional (agroterrorist) contamination of the food supply. This paper reports on the use of Radio Frequency Identification Devices (RFID) for tracing food across the supply chain. Pros and cons of the RFID system are stated, applications of the system are described and economics and trade models are used to examine and evaluate the system.

3 - Agroterrorosim, Trade, and the Value of Risk Mitigation
Calum Turvey, Professor, Rutgers University, Dept of Agric., Food and Res. Econ, 55 Dudley Road, New Brunswick, NJ, 08901, United States, turvey@aesop.rutgers.edu, Karl Meilke, John Cranfield

This paper reports on a method to model the value of preparedness from an agroterrorism attack on the food system. The first step involves using a computeable general equilibrium model to compute net economic losses from a simulated attack of Foot and Mouth Disease in the U.S. Mid West. The results of the trade model are then used to simulate the net benefits of preparedness under a number of response rates.

4 - Bringing Food Supply Chain StakeholdersTogether: A Case Study of TableTop Agroterrorism Simulation
Paul DeVito, Professor, St. Joseph's University, 5600 City Avenue, Philadelphia, PA, 19131-1395, United States, pdevito@sju.edu, Thomas Kennedy, Thomas Tavantzis

With potential terrorist attacks on the food system, it is vital that food firms understand their roles. This paper describes how Table Top exercises can be used to achieve this goal. An exercise that includes food supply chain members, government officials, law enforcement, and the media is reported. The Table Top exercise can identify shortcomings in response by all parties, while providing the food industry with a reality-check on what can be expected should such an occurrence take place.

■ MD47

T-Century (Mezzanine)

Software Demonstration

Cluster: Software Demonstrations
Invited Session

1 - ILOG, Inc. - Bridging the Gap Between Model and User: Introducing New Optimization Technology That Helps Users Become Self Sufficient and Reduces the Support Needed by the OR Model Developer
Greg Glockner, ILOG, Inc., 889 Alder Ave., Ste. 200, Incline Village, NV, 89451, United States, gglockner@ilog.com

Most business managers view optimization as a tool to inspire better decisions, not a replacement for human experience. Here, we will introduce innovative new technology from ILOG that combines business rules and optimization. This technology guides managers towards better decisions by empowering them to maintain, update and execute optimization models developed by operations researchers.

2 - Paragon Decision Technology BV- AIMMS' Analytical Tools and Extensive Algorithmic Capabilities
Gertjan de Lange, Paragon Decision Technology BV, PO Box 3277, 2001 DG Haarlem, Netherlands, g.de.lange@paragon.nl, Koos Heerink

See the power and extended capabilities of AIMMS: the solver independent and intuitive modeling environment. AIMMS provides a single medium in which to develop and turn advanced prototypes into robust and large-scale operational end-user systems. The AIMMS 3.5 release (Oct. 2004) includes new functionality that extends AIMMS' unique development tools and algorithmic capabilities. We will demonstrate: the graphical Math Program Inspector, a unique collection of tools to visually inspect and analyze linear mathematical programs; and the possibility of working with multiple mathematical programs simultaneously, and so opening up the possibility of constructing advanced and more efficient customized solution algorithms.

Tuesday 8:00am-9:30am

■ TA01

P-Ballroom F

Tutorial: Parallel Algorithm Design for Branch and Bound

Cluster: Tutorials- Denver 2004
Invited Session

1 - Parallel Algorithm Design for Branch and Bound
David Bader, Associate Professor and Regents' Lecturer, Electrical and Computer Engineering Department, University of New Mexico, Albuquerque, MN, 87131, United States, dbader@ece.unm.edu, William E. Hart, Cynthia A. Phillips

Large and/or computationally expensive optimization problems sometimes require parallel or high-performance computing systems to achieve reasonable running times. This tutorial will present techniques to assist the porting of serial optimization codes to parallel systems and discuss more fundamentally parallel approaches to optimization. The speakers will survey the state-of-the-art in distributed- and shared-memory architectures and give an overview of the programming models appropriate for efficient algorithms on these platforms. As a concrete example, they will discuss the design of parallel branch-and-bound algorithms for the problem of maximum parsimony in evolutionary trees.

■ TA02

P-Ballroom E

Heuristic Programming

Contributed Session

Chair: Alan Rao, Senior ORA, Volpe Center/USDOT-RSPA, 55 Broadway, Cambridge, MA, 02142, United States, rao@volpe.dot.gov

1 - Algorithm for Multiple Tasks and Multiple Resources Assignment Problem
Joon-Yeoul Oh, Assistant Professor, Texas A&M University-Kingsville, 700 University Blvd., MSC 184, Kingsville, TX, 78363, United States, kfjo000@tamuk.edu, Eunjin Lee

The traditional assignment problem assigns one task per one employee, and it is usually solved in polynomial time. However, if an employee is assigned to multiple tasks, and/or a task requires multiple employees, the assignment problem becomes NP-complete. Due to the complexity of the problem, a heuristic method, called Heuristic Search Algorithm (HSA), is developed to find an optimal or near optimal solution within polynomial time. This paper also shows various findings using the method.

2 - Collaborative Planning and Synchronization of the Operations of Two Business Partners
Chafik Abid, Ph.D student, Laval University, Ste-Foy, Quebec, QC, G1K7P4, Canada, chafik.abid@centor.ulaval.ca, Benoit Montreuil, Sophie D'Amours

The proposed approach is building on available-to-promise technology. It uses a three-stage procedure for: the main operation strategy, the tactical and the operational planning. A mixed linear mathematical model and a heuristic are developed. Comparisons with others approaches, for an organization that manufactures coaches, show significant advantages of the suggested model. All these approaches were implemented using the Delphi programming environment and the Cplex optimization software.

3 - An Upper Bound for the Number of Matching Schemata in a Binary Coded Genetic Algorithm
David Lovell, Associate Professor, University of Maryland, Department of Civil Engineering, 1173 Martin Hall, College Park, MD, 20742, United States, lovell@eng.umd.edu, Manoj Jha

In this paper we derive a hard upper bound on the number of matching schemata in a binary-coded genetic algorithm for a population of a given size and string length. A loose upper bound is reported in the published literature, but does not take into account redundancies that are inevitable for certain values of the population size. In this paper, this over-counting is rectified. A special case when the string length is small compared to the population size has a particularly elegant solution.

4 - Heuristic Techniques Developed for Geospatial Data Fusion
Alan Rao, Senior ORA, Volpe Center/USDOT-RSPA, 55 Broadway, Cambridge, MA, 02142, United States, rao@volpe.dot.gov

The applications of Geospatial Technology require an automated "conflation" between multiple sources (or versions) of geospatial data. "Data fusion" is a new term developed to apply many old techniques in rubber-sheeting, pattern recognition, spatial partitioning, feature match and transfer. This visualized problem presents a challenge to test the effectiveness of tabu search, simulated annealing, and other heuristic techniques - for the combination of local and global optimizations.

■ TA03

P-Plaza Court 1

Operations Research in Biology

Cluster: Science & OR
Invited Session

Chair: Stephen Billups, Director, Center for Computational Biology, University of Colorado at Denver, PO Box 173354, Campus Box 160, Denver, CO, 80217, United States, Stephen.Billups@cudenver.edu

1 - A Kernel-based Framework for Integration of Genome-wide Data
Gert Lanckriet, Department of Electrical Engineering and Computer Science, University of California, Berkeley, CA, 94720, United States, gert@eecs.berkeley.edu, Michael Jordan, Nello Cristianini, William Noble

Kernel methods provide a principled framework in which to repre- sent many types of data, including vectors, strings, trees and graphs. These methods are useful for drawing inferences about biological phenomena, that are described by diverse sources of information. We show a method for combining multiple kernel representations in an optimal fashion, and apply it to predict yeast protein functional classications using a support vector machine (SVM) trained on different types of data.

2 - Why we Need [near-] Alternative Optima
Harvey Greenberg, Professor, Mathematics Dept, University of Colorado at Denver, Campus Box 170, PO Box 1723364, Denver, CO, 80217-3364, United States, Harvey.Greenberg@cudenver.edu

This will describe case studies using constraint-based analysis and extreme pathways in metabolic networks that need to obtain alternative optima to linear programs. The problem is #-P hard, but it is possible to obtain complete success in some cases and partial success in larger problems. Methods will be described, the major focus of this talk is on the models and questions put to them.

3 - Optimization Techniques for Genomic Comparison Problems
Carlos A.S. Oliveira, Assistant Professor, Oklahoma State University, School of Industrial Engineering and Management, 322 Engineering North, Stillwater, OK, 74078, United States, coliv@okstate.edu

Genomic data comparison and analysis represents nowadays an important new field of application for optimization techniques. Mathematical programming and optimization methods can be employed with success to solve some of the genomic comparison problems, leveraging the large amount of optimization tools available. We present theoretical and experimental results that support the use of integer and linear programming for genomic comparison problems.

4 - A Decomposition Strategy for Peptide Design
William E. Hart, Sandia National Laboratories, PO Box 5800, MS 1110, Albuquerque, NM, 87185, United States, wehart@sandia.gov, Harvey Greenberg, Diana Roe

We consider the problem of designing a peptide with a given backbone structure that is docked with a nearby protein. A solution to this problem is a peptide sequence and set of amino acid structures that has minimal energy. We discuss how the peptide design and structure selection can be solved seperately, which enables the practical solution of this problem.

■ TA04

P-Plaza Court 2

Teaching Data Mining

Sponsor: Data Mining
Sponsored Session

Chair: Marietta Tretter, Professor, Texas A&M University, 325Q Wehner BLDG, TAMUS 4217, College Station, TX, 77843-4217, United States, MTretter@CGSB.TAMU.EDU

1 - SAS Support for Data Mining Training
Jerry Oglesby, Director, Higher Education Consulting, SAS Institute Inc., SAS Campus Drive, Cary, NC, 27513, United States, Jerry.Oglesby@sas.com

In 2001 the Education Division of SAS established the Higher Education Consulting group. It's purpose is to work with higher education institutions to help incorporate SAS software into their curriculum. A focus area has been to support data mining programs. This presentation will discuss the support SAS has in place for institutions teaching data mining including: guest speakers; training materials; data mining certificates; free summer data mining training program for educators.

2 - Excel as a Platform for Data Mining
Peter Bruce, Resampling Stats, Inc., 612 N Jackson St, Arlington, VA, 22201, United States, pbruce@resample.com

While Excel is not the first thing that leaps to mind when one thinks of data mining, new tools make it an attractive platform for teaching data mining. The pros and cons of working in Excel are discussed, and the topics and methods available in a comprehensive data mining add-in for Excel (XLMiner) are reviewed. These include classification , prediction , affinity analysis, among others. The key steps in the data mining process will be demonstrated in XLMiner for several methods.

3 - A Thousand Things That Do and Do Not Work in Teaching Data Mining

Marietta Tretter, Professor, Texas A&M University, 325Q Wehner BLDG, TAMUS 4217, College Station, TX, 77843-4217, United States, MTretter@CGSB.TAMU.EDU

This talk will disseminate some useful information about teaching data mining to graduate and undergraduate students from applied disciplines. Material content, software packages and text material will be discussed and summarized based on five years of experience.

■ TA05

P-Plaza Court 3

Recent Progress in MIP

Sponsor: Optimization/ Integer Programming
Sponsored Session

Chair: Oktay Gunluk, IBM T.J. Watson Research, United States, oktay@watson.ibm.com

1 - Preconditioning integer programs via column basis reduction

Gabor Pataki, Department of Statistics and OR, University of North Carolina, Chapel Hill, NC 27599, www.or.unc.edu/~pataki, Chapel Hill, NC, United States, pataki@email.unc.edu, Bala Krishnamoorthy

We propose a simplification and generalization of a reformulation technique for IPs proposed by Aardal and others, and analyze it on several classes of hard integer programs.

2 - On Reformulation of Mixed Integer Linear Programs

Kent Andersen, CMU, United States, kha@andrew.cmu.edu

Given a constraint of a mixed integer linear program, we examine the set of valid inequalities, which dominate the constraint on the LP relaxation. We show that, if such an improving inequality exists, then there is also a coefficient which can improved. We compare our improvements on the MIPLIB 3.0 problems to the pre-processor of CPLEX 8.0. We also demonstrate that mixed integer Gomory cuts often can be improved similarly.

3 - Metric-type Inequalities for Survivable Network Design using Directed Cycles

Deepak Rajan, UC Berkeley, United States, deepak@queue.IEOR.Berkeley.EDU

We first review the metric inequalities described for the network design problem, and discuss various techniques for generating them effectively. Some of these techniques use our earlier results on the general integer knapsack set. These ideas are also implemented in a branch-and-cut algorithm for designing survivable networks using directed cycles.

■ TA06

P-Plaza Court 4

Stochastic Network Planning

Sponsor: Optimization/Stochastic Programming
Sponsored Session

Chair: Feng Pan, Los Alamos National Laboratory, Mail Stop F604, Los Alamos, NM, 87545, United States, fpan@lanl.gov

1 - Solution Techniques For Network Interdiction Model on Generalized Network

Feng Pan, Los Alamos National Laboratory, Mail Stop F604, Los Alamos, NM, 87545, United States, fpan@lanl.gov, David Morton

We describe a stochastic network interdiction problem on a generalized network. We propose different models which differ in assumptions on the adversaries' perceptions and on regions of interest. We describe several preprocessing techniques and present a type of valid inequalities. We focus on the facet property of the valid inequality and different ways of implementations. We talk about the possible extension of this valid inequality to other models.

2 - Several Real World Applications of Network Planning

Kevin Sager, Los Alamos National Laboratory, United States, saeger@lanl.gov

We discuss several real world applications of network planning in LANL.

3 - Solution Techniques for Stochastic Network Interdiction

Dimitri Papageorgiou, Operations Analyst, Raytheon, Woburn, MA, United States, djpapag@mail.utexas.edu

We present solution techniques used to solve large-scale instances of a stochastic network interdiction model for deterring and preventing the smuggling of nuclear material. Our decomposition algorithms involve appending Benders' cuts and structure-dependent facet-defining inequalities to the master problem. Computational results reveal orders-of-magnitude improvements of the decomposition algorithms over direct solution of the deterministic equivalent MIP.

■ TA07

P-Plaza Court 5

New Algorithms for Mathematical Problems with Equilibrium Constraints.

Sponsor: Optimization/Linear Programming and Complementarity
Sponsored Session

Chair: Mihai Anitescu, Computer Scientist, Argonne National Laboratory, 9700 South Cass Ave., MCS, building 221, Argonne, IL, 60637, United States, anitescu@mcs.anl.gov

1 - An Averaging Method for Nash Games with Shared Decision Variables

Todd Munson, Assistant Scientist, Argonne National Laboratory, 9700 S. Cass Ave, Argonne, IL, 60439, United States, tmunson@mcs.anl.gov

This talk concerns a class of Nash games in which the participants share some of the decision variables. An averaging method is developed in order to transform these games into standard Nash games. This technique is successfully applied to solve an example multi-leader, single-follower game for an electricity market.

2 - Exploiting Convergence of Multipliers in a Trust-region Decomposition Method for MPECs

Daniel Ralph, Cambridge University, Judge Institute of Management, Trumpington St, Cambridge, CB2 1AG, United Kingdom, d.ralph@jims.cam.ac.uk, Giovanni Giallombardo

The feasible set of a math program with equilibrium constraints (MPEC) has many pieces, each of which a standard NLP feasible set. At each iteration of a decomposition method, one step of an NLP method in the current piece updates the iterate, and the piece is updated using Lagrange multiplier info. We study decomposition applied to linearly-constrained MPECs with a trust region NLP solver. A new multiplier convergence result for the latter strengthens the convergence analysis for the former.

3 - A Sequential Complementarity Algorithm for Solving Equilibrium Problems with Equilibrium Constraints

Che-Lin Su, Stanford University, Management Science and Engineering, Stanford, CA, 94305, United States, clsu@stanford.edu

This work studies algorithms for equilibrium problems with equilibrium constraints (EPECs). We present a new relaxation method for MPECs and extend Scholtes's convergence results on regularization scheme to our approach. We propose a sequential complementarity (SCP) algorithm for solving EPECs and establish the convergence of this algorithm. We present numerical results on randomly generated EPEC test problems.

■ TA08

P-Plaza Court 6

Network Design, Facility Location, and Cost Sharing

Sponsor: Optimization/ Network Optimization
Sponsored Session

Chair: Lisa Fleischer, T. J. Watson Research Center, IBM, Yorktown Heights, NY, United States, lkf@watson.ibm.com

1 - Price of Anarchy, Locality Gap, and a Network ServiceProvider Game

Nikhil Devanur, Student, Georgia Tech, 801 Atlantic Drive, Atlanta, GA, 30332, United States, nikhil@cc.gatech.edu, Amin Saberi, Vijay Vazirani, Naveen Garg, Rohit Khandekar, Vinayaka Pandit

In this paper, we define a network service provider game that is natural in the context of the Internet and we raise the question of upper bounding the price of anarchy for this game. Our answer is obtained in two steps. In the first step, we show that the price of anarchy of this game is precisely the locality gap of the k-facility location problem under a certain neighborhood structure. Our second step is to show that the locality gap of the k-facility location problem is at most 5.

2 - Lower Bounds on Cost-sharing Schemes for Facility Location & other Combinatorial Optimization Games
Nicole Immorlica, MIT Computer Science and AI Lab, The Stata Center, Bldg 32, 32 Vassar Street, Cambridge, MA, 02139, United States, nickle@mit.edu, Mohammad Mahdian, Vahab Mirrokni

A cost-sharing scheme is a set of rules defining how to share the cost of a service amongst serviced customers. It is cross-monotonic if it guarantees everyone is better off when the set of serviced customers expands. We develop a novel technique to prove lower bounds on the budget-balance factor of cross-monotonic cost-sharing schemes, thereby obtaining tight bounds for combinatorial optimization games such as facility location. We also discuss implications for group-strategyproof mechanisms.

3 - Stochastic Network Design
Amitabh Sinha, Assistant Professor, Michigan Business School, 701 Tappan St, Ann Arbor, MI, 48109, United States, amitabh@umich.edu, Anupam Gupta, R. Ravi

We study the problem of constructing single-source networks in a two-stage stochastic optimization model with finite scenarios and recourse. We use linear programming and combinatorial optimization tools to provide a robust constant-factor approximation algorithm.

■ TA09

P-Plaza Court 7

Large-Scale Nonlinear Programming

Sponsor: Optimization/ Nonlinear Programming
Sponsored Session

Chair: Zhaosong Lu, Georgia Institue of Technology, School of ISyE, 765 Ferst Drive NW, Atlanta, GA, 30332, United States, zhaosong@isye.gatech.edu

1 - Multigrid Methods in Optimization Solvers
Steven Benson, Assistant Scientist, Argonne National Laboratory, Building 221, 9700 S. Cass Avenue, Argonne, IL, 60439, United States, benson@mcs.anl.gov

Although mesh sequencing techniques and multigrid preconditioners have been used extensively in PDE solvers, their use in optimization solvers has been rare. I will introduce several applications of constrained optimization where these techniques can be applied. The enormous benefits of these techniques and the requirements they impose on the optimization solvers will be presented.

2 - Large-Scale Semidefinite Programming via Saddle Point Prox-Method
Zhaosong Lu, Georgia Institue of Technology, School of ISyE, 765 Ferst Drive NW, Atlanta, GA, 30332, United States, zhaosong@isye.gatech.edu, Renato Monteiro, Arkadi Nemirovski

The representations of positive semidefiniteness and positive definite completion for well-structured sparse symmetric matrices are firstly developed. Using these representations, we then apply Saddle Point Prox-Method to solve some well structured semidefinite programming such as MAXCUT and Lovasz capacity problems, etc. Some computational results are finally presented.

3 - A Semidefinite Optimization Approach for the Single-Row Layout Problem with Unequal Dimensions
Miguel Anjos, Assistant Professor, Dept of Management Sciences, University of Waterloo, 200 University Avenue West, Waterloo, ON, N2L 3G1, Canada, anjos@stanfordalumni.org, Andrew Kennings, Anthony Vannelli

We consider the single-row facility layout problem which consists in finding an optimal linear placement of facilities with varying dimensions. A new semidefinite programming relaxation provides the first non-trivial global lower bounds for this problem, and a heuristic procedure extracts a placement from the optimal solution to the relaxation. Computational results show that this approach is consistently within a few percentage points of global optimality.

■ TA10

P-Plaza Court 8

Applications in Public Transport

Sponsor: Transportation Science & Logistics
Sponsored Session

Chair: Mark Hickman, University of Arizona, P.O. Box 210072, Tucson, AZ, United States, mhickman@email.arizona.edu

1 - Mobility Allowance Shuttle Transit (MAST) Services: Description, Formulation, Heuristic, Simulation
Luca Quadrifoglio, University of Southern California, Industrial and Systems Engineering dept., Los Angeles, CA, 90089-0193, United States, quadrifo@usc.edu, Maged Dessouky

The MAST system is an innovative concept that merges flexibility with low cost operability. The problem is NP-Hard and we need approximation methods to solve it. We use an insertion heuristic with a proper use of control parameters that prevent the "wild" consumption of slack time. A sensitivity analysis shows that narrower service areas are more appropriate. MAST services are competitive with conventional fixed-bus route ones and perform much better under certain demand distributions.

2 - Design of a Demand-Responsive Transit System
Yuwei Li, University of California, Berkeley, Institute of Transportation Studies, 416G McLaughlin Hall, Berkeley, CA, 94720, United States, yuwei@newton.berkeley.edu, Michael Cassidy

This research studies efficient transit service strategies under reduced budget. We first develop a methodology of using boarding/alighting data to derive the OD matrix for transit use in the study region, taking into account existing knowledge about the travel pattern in the region. Performance measures are developed to identify corridors for which fixed-route scheduled service should be maintained, and a system of demand-responsive transit are proposed to serve passengers in low-density areas.

3 - The Real-Time Stop-Skipping Problem in Transit Operations
Mark Hickman, University of Arizona, P.O. Box 210072, Tucson, AZ, United States, mhickman@email.arizona.edu, Aichong Sun

This study investigates two stop-skipping policies for operations control on a public transit route, implemented in a real-time manner in response to a service disruption on the route. Both a basic stop-skipping policy and an adaptive policy alternative are formulated as nonlinear integer programming problems that can be solved quickly using explicit enumeration. A simulation study is conducted to examine the performance of the two stop-skipping policies.

■ TA11

P-Governor's Square 9

Modeling Advances in Dynamic Traffic Assignment

Sponsor: Transportation Science & Logistics
Sponsored Session

Chair: Srinivas Peeta, Purdue University, School of Civil engineering, West Lafayette, IN, 47907, United States, peeta@purdue.edu

1 - Improved Speed-Density Relationship Based Traffic Simulation Method for Large Network Applications
Yi-Chang Chiu, Assistant Professor, Department of Civil Engineering, 500 W. University Ave., University of Texas at El Paso, El Paso, TX, 79968, United States, chiu@utep.edu, Liang Zhou

We present an improved mesoscopic simulation model that integrates the speed-density-relationship-based and flow-density-relationship-based models. The proposed model has shown to reasonably simulate regular traffic and flow discontinuity under various traffic conditions for large network applications. Theoretical foundation and simulation experiment results will be discussed.

2 - Mesoscopic Simulation of Roundabouts in Dynamic Network Assignment Applications
Stacy Eisenman, University of Maryland, Maryland Transportation Initiative, Department of Civil and Environmental Engineering, College Park, MD, 20742-3021, United States, eisens@umd.edu, Hani S. Mahmassani

Roundabouts are common traffic control facilities that present unique operational and safety characteristics, and produce complex interactions between approaching vehicles. We discuss development of a roundabout module for a dynamic traffic simulation-assignment model, including modeling assumptions made, the mesoscopic simulation procedure and results from the evaluation and calibration.

3 - A Bi-level Linear Programming Approach for the Dynamic Network Design Problem
Ampol Karoonsoontawong, Graduate Research Assistant, University of Texas, ECJ 6.202, Austin, TX, 78712, United States, ampolk@mail.utexas.edu, S. Travis Waller

We present the formulation and solution algorithm for the traffic network design problem employing two known analytical LP models for UO and SO DTA. We discuss different solution methods for the bilevel linear programming problems and show that the Kth Best algorithm, which guarantees the exact solution in a finite number of iterations, appears highly applicable. We demonstrate the proposed technique and discuss numerical results for the UO and SO network design solutions.

4 - Behavior-Consistent Deployable Traffic Routing under Advanced Information Systems
Srinivas Peeta, Purdue University, School of Civil engineering, West Lafayette, IN, 47907, United States, peeta@purdue.edu, Alexander Paz, Pengcheng Zhang

Vehicular traffic networks under advanced information systems are dynamic systems with drivers as self-interested agents seeking to reach their destinations and a transportation authority as a controller agent trying to improve the system performance through information provision. We model the problem through a combination of stochastic games that enable a robust study of dynamic systems composed of multiple self-interested agents.

■ TA12

P-Governor's Square 10

Supply Chain Design

Sponsor: Transportation Science & Logistics
Sponsored Session

Chair: Marc Goetschalckx, Georgia Institute of Technology, School of Industrial and Systems Engi, 765 Ferst Drive, Atlanta, GA, 30332, United States, marc.goetschalckx@isye.gatech.edu

1 - Evaluation of Global System Design Alternatives
Ronald Askin, Professor and Department Head, Arizona, Dept. of Systems and Industrial Eng., University of Arizona, Tucson, AZ, 85721, United States, ron@sie.arizona.edu, Shishir Shenoy

The location of facilities for a multistage global production and distribution network affords many opportunities for minimizing costs and risks. In this talk we report the results of a large experiment to determine the optimal facility location strategy for fabrication, assembly, and distribution across multiple countries and markets. Results are obtained for various levels of demand, cost ratios, and economies of scale.

2 - Integrated Location and Sizing of Distribution Centers on a Plane
Rakesh Nagi, University at Buffalo (SUNY), 342 Bell Hall, Dept. of Industrial Engineering, Buffalo, NY, 14260, United States, nagi@buffalo.edu, Rajan Batta, Simin Huang

We study an integrated location and sizing of distribution centers (DCs) problem on a plane. The problem minimizes the total transportation cost and DC sizing costs. We consider the following three types of sizing cost functions: (i) the proportional sizing cost function, (ii) the fixed charge linear cost sizing function, and (iii) the concave cost sizing function. Solution methods are provided for each case.

3 - Assessing Truckload Shipment Service Costs in an Online Procurement Market
Miguel Andres Figliozzi, University of Sydney, Institute of Transport Studies, Faculty of Economics and Business, University of Sydney, NSW 2006, Australia, miguel@its.usyd.edu.au, Hani S. Mahmassani, Patrick Jaillet

Real-time freight transportation marketplaces create an environment characterized by high uncertainty and complex service cost estimation. In a competitive 2nd price auction market the accurate estimation of service costs has a significant impact on a carrier's profit level. We propose a new methodology to evaluate shipment service costs. Simulation is used to compare different costing approaches (dynamic and static).

4 - Acceleration Techniques for Benders Decomposition for Robust Strategic Supply Chain Design
Marc Goetschalckx, Georgia Institute of Technology, School of Industrial and Systems Engi, 765 Ferst Drive, Atlanta, GA, 30332, United States, marc.goetschalckx@isye.gatech.edu, Gonzalo Cordova

The robust strategic supply chain design problem creates very large mixed integer programming problems for which the time to converge of standard Benders decomposition is not acceptable. Several acceleration techniques will be discussed. Their relative effectiveness will be analyzed based on the statistical analysis of the running times for an industrial case study.

■ TA13

P-Governor's Square 11

Airport Customer Service

Sponsor: Aviation Applications
Sponsored Session

Chair: Menkes van den Briel, Arizona State University, 1207 East 8th Street #215, Tempe, AZ, 85281, United States, menkes@asu.edu

1 - Improved Group Configurations for Zone/Group Boarding
Menkes van den Briel, Arizona State University, 1207 East 8th Street #215, Tempe, AZ, 85281, United States, menkes@asu.edu, Rene Villalobos, Ahmet Keha

More and more commercial airlines have adopted zone or group boarding in order to speed up the boarding process. Group boarding has an advantage over boarding by row because it allows for many more group configurations, but determining a group configuration that optimizes the boarding process is difficult. We use passenger interferences as a surrogate measure of boarding time, and present a mathematical programming model that minimizes expected passenger interferences.

2 - Airport Acceptance Rate Allocation for Miles-in-Trail Decisions
Orcun Molvalioglu, Industrial Engineering, University of Washington, Seattle, WA, 98195, United States, orcun@u.washington.edu, Zelda B. Zabinsky, Joyce W. Yen

We study the allocation of Airport Acceptance Rate for incoming flight streams. The problem is analyzed as capacity allocation that minimizes the cost of flow in a dynamic network. The optimal solutions are used to derive simple rules that could assist traffic controllers in miles-in-trail and meter-fix reassignment decisions.

3 - Extent and Impact of Future NAS Capacity Shortfalls
David Ballard, Senior Economist, GRA, Inc, 115 West Avenue, Suite 201, Jenkintown, PA, 19046, United States, bdballard@grainc.com, Earl Wingrove

While OR methods and algorithms are frequently used to model alternative approaches for allocating airport or airspace capacity, these applications sometimes occur in an abstract setting, free from the actual history of capacity growth and constraint. In this paper, OR and econometric methods are used to estimate the economic effects of future capacity shortfalls in the US National Airspace System (NAS). This assessment of NAS capacity challenges between the years 2015 and 2025 is conducted for an environment built up from explicit assumptions about capacity enhancements that are already "in the pipeline" for future years and about the characteristics of future airline fleets and operations in the future. The modeling procedure also proceeds from explicit assumptions about the figures of merit for future allocations of airspace access when rationing is required. The economic cost of future capacity shortfalls is estimated by calculating losses in consumer surplus that would be caused by the disruption of normal growth in demand for air transport services.

■ TA14

P-Governor's Square 14

Technology and Strategy

Sponsor: Technology Management
Sponsored Session

Chair: Pedro Oliveira, School of Economics and Management, Catholic University of Portugal, Palma de Cima, Lisbon, PT, 1649-023, Portugal, poliveira@fcee.ucp.pt

Co-Chair: Aleda Roth, Professor, University of North Carolina, Kenan-Flagler Business School, McColl 4708, Chapel Hill, NC, 27599, United States, Aleda_Roth@unc.edu

1 - ERP Adoption, First Mover Advantage and Business Process Differentiation
Andrea Masini, Assistant Professor, London Business School, Regent's Park, London, NW1 4SA, United Kingdom, amasini@london.edu

This paper discusses the mechanisms through which ERP adoption determines changes in productivity at the industry level. It suggests that the increased process standardization resulting from ERP adoption cause two main effects: i) an increase of average industry productivity over time and ii) a decrease of productivity differences across firms within the same sector. Operational and strategic implications are also discussed.

2 - Realizing Benefits from Enterprise Resource Planning: Does Strategic Configuration Matter?
Jeff Stratman, Assistant Professor, Georgia Tech, 800 West Peachtree Street NW, Atlanta, GA, 30332-0520, United States, jeff.stratman@mgt.gatech.edu

A key driver of the recent wave of ERP implementations was the assumption that benefits would accrue from the integration of business information, yet realized benefits have varied widely. Survey data from North American manufacturing firms are used to evaluate the proposition that firms with different strategic configurations will realize different operational benefits from the adoption of ERP systems.

3 - Knowledge Sharing among Employees
Enno Siemsen, University of North Carolina at Chapel Hill, Kenan Flagler Business School, McColl Building, CB 3490, Chapel Hill, NC, 27599-3490, United States, siemsene@kenan-flagler.unc.edu, Aleda Roth, Sridhar Balasubramanian

This research investigates how employees learn from each other through sharing work related knowledge. Our specific research questions are: What drives employees to share their knowledge with each other or alternatively, to hoard it? What can management do to increase knowledge sharing among employees? We empirically test the antecedents of employee knowledge sharing and their effect on successful sharing.

4 - B2B E-Service Capacility: The
Pedro Oliveira, Catholic University of Portugal, School of Economics and Management, Palma de Cima, Lisbon, PT, 1649-023, Portugal, oliveirp@bschool.unc.edu, Aleda Roth

This research investigates the following questions: How can the business-to-business (B2B) e-service capability construct be operationally defined? What are the operational antecedents that influence B2B e-service capability? To what extent does e-service capability influence business performance? A model is empirically tested using data gathered from 181 service companies that have deployed B2B e-services.

■ TA15

P-Governor's Square 15

Probabilistic Analysis and Supply Chain Scheduling and Due Date Quotation

Cluster: Scheduling
Invited Session

Chair: Phil Kaminsky, UC Berkeley, IEOR Dept., Berkeley, CA, United States, kaminsky@ieor.berkeley.edu

1 - Probabilistic Asymptotic Analysis On Stochastic Online Scheduling Problems
Gang Chen, Bank of America, R & D, Dallas, TX, United States, gang.chen@bankofamerica.com, Max Shen

We consider a scheduling environment where jobs with stochastic processing requirements arrive over time and the objective is to minimize the total weighted completion time. We show that a large class of nondelay algorithms is asymptotically optimal for the single machine, flow shop and uniform parallel machine problems under some probabilistic assumptions.

2 - Dynamic Due-date Quotation for Basestock Inventory Systems
Pinar Keskinocak, Coca-Cola Assistant Professor, Georgia Institute of Technology, School of Industrial and Systems Enginee, 765 Ferst Drive, Atlanta, GA, 30345, United States, pinar@isye.gatech.edu, Paul Griffin, Secil Savasaneril

An important means for a company to differentiate itself is by being responsive in demand fullfillment while satisfying delivery commitments. We analyze due-date quotation decisions where demand is lead-time sensitive and unmet due-dates are penalized. We present results for dynamic quotation of leadtime under basestock inventory holding.

3 - Job Shop Scheduling with Earliness, Tardiness and Intermediate Inventory Holding Costs
Kerem Bulbul, Assistant Professor, Sabanci University, Manufacturing Systems & Industrial Eng., Faculty of Eng.&Natural Sciences, Orhanli, Tuzla, Istanbul, 34956, Turkey, bulbul@sabanciuniv.edu

Motivated by the problem of scheduling customer orders in a make-to-order supply chain with relatively expensive intermediates, 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 scheduling heuristics to minimize the total cost and demonstrate the effectiveness of these heuristics computationally.

4 - Scheduling and Due-date Quotation in a Make-To-Order Supply Chain
Onur Kaya, University of California, IEOR Dept, Berkeley, CA, 94720, United States, okaya@ieor.berkeley.edu, Phil Kaminsky

We consider a manufacturer with a single supplier that has to quote due dates to arriving customers in a make-to-order production environment. The manufacturer is penalized for long lead times, and for missing due dates. In order to meet due dates, the manufacturer has to obtain components from the supplier. We consider several variations of this problem, and design effective due-date quotation and scheduling rules for centralized and decentralized versions of the model.

■ TA16

P-Governor's Square 17

COIN-OR: Open-Source Software for OR

Sponsor: Computing Society
Sponsored Session

Chair: Robin Lougee-Heimer, Research Staff Member, IBM Research, IBM T.J. Watson Research Center, 1101 Kitchawan Road, Yorktown Heights, NY, 10598, United States, robinlh@us.ibm.com

1 - The COIN-OR Foundation, Inc: A Nonprofit Corporation for OR Software Resources
Matthew Saltzman, Clemson University, Clemson, SC, United States, mjs@math.clemson.edu, Robin Lougee-Heimer

The COIN-OR Foundation, Inc (est. 2004) is a nonprofit corporation dedicated to the development, maintenance, and distribution of open-source resources for the computational OR community (e.g., data, models, open interfaces, algorithmic frameworks, component libraries). The COIN-OR Foundation builds on the accomplishments of the COIN-OR project (est. 2000), and is hosted by INFORMS at www.coin-or.org. We will present a status report on the COIN-OR resources and describe the new organization.

2 - Linking GAMS to Solvers using the COIN-OR Open Solver Interface
Steven Dirkse, GAMS Development Corp., United States, steve@gams.com, Michael Bussieck

The General Algebraic Modeling System (GAMS) is a commercial modeling system for mathematical programming problems. In this talk, we describe our experience developing the GAMS/COIN-OR link. This recently developed link allows GAMS users to connect their customized algorithms to a variety of solvers using one interface — the COIN-OR Open Solver Interface (OSI). This work illustrates the potential of open-source software and open standards to speed the deployment of research into practice.

3 - Mixed-Integer Rounding Inequalities for COIN-OR
Joao Goncalves, Lehigh University, Bethlehem, PA, United States, jog7@lehigh.edu, Laszlo Ladanyi

Mixed-Integer Rounding (MIR) inequalities play a central role in the development of strong cutting planes for mixed-integer programs. In this talk, we present our experience in developing a reference implementation of MIR Inequalities for the COIN-OR Cut Generation Library. The new implementation is available for reuse, research, and enhancements under an open-source license at www.coin-or.org.

■ TA17

P-Directors Row E

Portfolio Decision Analysis

Sponsor: Decision Analysis
Sponsored Session

Chair: Jeffrey Keisler, Assistant Professor, University of Massachusetts Boston, College of Management, Boston, MA, 02125, United States, Jeff.Keisler@umb.edu

1 - Portfolio Analysis of Countermeasures and Design Options for Information System Risk Assessments
Don Buckshaw, Sr. Decision Analyst, Innovative Decisions Inc, 1945 Old Gallows Road, Suite 215, Vienna, VA, 22182, United States, dbuckshaw@innovativedecisions.com, Gregory Parnell

This paper details a methodology for analyzing a portfolio of candidate information system (IS) countermeasures or design options using the Mission-Oriented Risk and Design Analysis (MORDA) process. MORDA is a quantitative risk assessment and design model based on Multiple Objective Decision Analysis that integrates traditional system security techniques with the field of Decision Analysis. MORDA determines the best investment strategy for designing a secure and functional information system.

2 - Corporate Realities of Pharmaceutical Portfolio Management
Jack Kloeber, Director, J&J Pharma Group Portfolio Management, JJPS Bldg 700 Rte 202 South, Raritan, NJ, 08869, United States, jkloeber@prdus.jnj.com

Pressures from budget(s)and with many quality projects, the company must decide which projects to fund. Using straight-forward IP to solve funding questions within an R&D Portfolio seems to be a natural solution. But optimization can be a hard product to sell to senior management. We will discuss the realities in R&D portfolio management and how we, as Decision Analysts, can embrace these realities and help management solve this seemingly already-solved problem.

3 - Selecting Portfolios of R&D Projects
Roger Burk, Associate Professor, Dept of Systems Engineering, US Military Academy, West Point, NY, 10996, United States, roger-burk@usma.edu

We present a unified treatment of the problem of selecting the best portfolio of R&D projects under a budget limit, drawing on both the OR and the engineering management literature. The greatest benefit to clients seems to come from structuring the problem and presenting scores in well-designed graphics, rather than from optimization, which tends to be of interest primarily to analysts. This among other considerations leads us to recommend a value modeling approach followed by MCDA.

4 - The Value of Assessing Weights in Multi-criteria Portfolio Decision Analysis
Jeffrey Keisler, Assistant Professor, University of Massachusetts Boston, College of Management, Boston, MA, 02125, United States, Jeff.Keisler@umb.edu

We simulate a portfolio of potential projects each scored with respect to several attributes in a linear additive value model. We consider for several analytic strategies the value added to the portfolio above that from a baseline process in which projects are funded at random, as well as the portfolios' stability. Strategies include: equal weights, picking one attribute at random, assessing weights from a single randomly selected stakeholder, and the gold standard of using correct weights.

■ TA18

P-Directors Row H

Inventory Modeling II

Contributed Session

Chair: Zhouyan Wang, Ph.D Student, Univ of Pitt, 1048 Benedum Hall, Pittsburgh, PA, 15261, United States, zhw12@pitt.edu

1 - A Fully Polynomial-time Approximation Scheme for Capacitated Requirements Planning with Pricing Flexibility

F. Zeynep Alisan, ISE Department, University of Florida, 303 Weil Hall, PO Box 116595, Gainesville, FL, 32611-6595, United States, zeynep@ufl.edu, Edwin Romeijn

Models for requirements planning with pricing generalize classical lot-sizing problems by integrating the problem of how much demand to satisfy with production and inventory planning to maximize revenue. Using a reformulation of such a problem as a capacitated single level lot-sizing problem we derive conditions on the cost and revenue functions under which a fully polynomial approximation scheme for exists.

2 - A Continuous Review Inventory Model with Two Freight Modes

Aditya Jain, Ph.D Student, University of Rochester, 60 Crittenden Blvd, 536, Rochester, NY, 14620, United States, jaina1@simon.rochester.edu, Harry Groenevelt, Nils Rudi

We analyze a continuous review stochastic inventory model, where the manager can control the lead time by choosing two freight modes differing in per unit and fixed cost. A demand reactive dynamic optimal policy is derived for combining the two freight modes for each order. Next we find the optimal reorder point and the optimal order quantity, when this policy is used. We compare this model with single freight models and provide managerial insights into the problem using geometry.

3 - Theoretical Classification and Empirical Assessment of Inventory Strategies for Supermarkets

Tom van Woensel, Eindhoven University of Technology, Den Dolech 2, Eindhoven, ee, Netherlands, t.v.woensel@tm.tue.nl, Karel van Donselaar, Jan Fransoo, Rob Broekmeulen

This paper focuses on inventory replenishment strategies for fast-moving-consumer-goods in supermarkets. The primary hypothesis in this research project is that different products or stores need different replenishment strategies. Based on a data analysis at multiple Dutch supermarkets, the potential relevance of different streams in inventory control theory for Dutch supermarkets is determined. Moreover the classification of replenishment strategies is compared with current best practices.

4 - Design and Operation Policy for Remnant Inventory Supply Chains

Zhouyan Wang, Ph.D Student, Univ of Pitt, 1048 Benedum Hall, Pittsburgh, PA, 15261, United States, zhw12@pitt.edu, Andrew Schaefer, Jayant Rajgopal

We consider a remnant inventory allocation and distribution problem with dynamic demands. We extend our previous results by including the processing cost and a new perturbation method that ensures non-degenerate dual prices. We also present new distribution properties as well as large computational and simulation results.

■ TA19

P-Directors Row F

Analytical Modeling of Remanufacturing and Recycling Systems

Cluster: Reverse Supply Chains

Invited Session

Chair: Xiuli Qu, Purdue University, 315 N. Grant Street, West Lafayette, IN, 47907, United States, qu@ecn.purdue.edu

1 - Optimal Strategic Product Returns using Mathematical Programming

Chi-Guhn Lee, Assistant Professor, University of Toronto, 5 King's College Road, Toronto, ON, M5S 3G8, Canada, chi@mie.utoronto.ca, William El-Khouri

We propose mathematical programming models for maximization of revenue generated from product returns. We address strategic product returns, which are initiated as marketing decisions. Two different scenarios are considered: store returns whole inventory, and store return part of inventory. The mathematical programming formulations are efficient enough to solve practically sized problems with up to many hundreds retail stores.

2 - Modeling Municipal and Commercial Recycling Networks

Manbir Sodhi, University of RhodeIsland, 103 Gilbreth Hall, Kingston, RI, 02881, United States, sodhi@uri.edu, Natalie Mohanty, Vaidy Jayaraman

The viability of recycling efforts depends on the value of materials recovered and the cost of recovering the material (including transportation costs). This talk considers the cost components in the setup, operation and maintenance of municipal and commercial recycling services. A variant of the Vehicle Routing Problem (VRP), the Partioned Vehicle Routing Problem (PVRP) is developed. This models fleet configuration decisions for recycling pickups.

3 - Vehicle Replacement Decisions Under National Policy Change

Darby Grande, University of Michigan, 1205 Beal Avenue, Ann Arbor, MI, 48109, United States, dgrande@engin.umich.edu, James Bean

We evaluate the impact of potential changes in national passenger vehicle policy on the environmental and economic profiles of the vehicle population. Our multiobjective, agent-based decision support system allows us to consider the effect of policies such as increased fuel cost and subsidized introduction of new technology on several household categories.

4 - Analytical Modeling for Automotive Recycling

Sudaratana Wongweragiat, Purdue University, 315 N. Grant Street, West Lafayette, IN, 47906, United States, sw72@hotmail.com, Xiuli Qu, Winston Bonawi-tan, Julie Stuart

The automotive recycling infrastructure successfully recovers 75% of the material weight in end-of-life vehicles through ferrous metals separation. However, this industry faces significant challenges as automotive manufacturers increase the use of non-ferrous materials. A planning model for automotive shredders is proposed to make short-term tactical decisions regarding to what extent to process and to reprocess materials through multiple passes, and whether to combine materials for shipment.

■ TA20

P-Room 3304

Modeling and Optimizing Issues in Health Care

Sponsor: Health Applications

Sponsored Session

Chair: Andrew Schaefer, University of Pittsburgh, 1048 Benedum Hall, Pittsburgh, PA, 15261, United States, schaefer@ie.pitt.edu

1 - A Response Surface Approach to Beam Orientation Optimization for IMRT Treatment Planning

Dionne Aleman, University of Florida, 303 Weil Hall, PO Box 116595, Gainesville, FL, 32611, United States, daleman1@ufl.edu, Edwin Romeijn, James F. Dempsey

We present a response surface (RS) based algorithm to integrate beam-orientation optimization (BOO) with fluence-map optimization (FMO) in intensity modulated radiation therapy (IMRT). BOO is computationally expensive. To reduce the number of FMO evaluations, we use the RS method, which models the FMO function as a stochastic process and estimates the FMO function by evaluating for only selectively chosen beam sets. The speed and accuracy of our algorithm show promise for clinical use.

2 - Optimizing Regions in the Liver Allocation System

Nan Kong, University of Pittsburgh, 1070 Benedum Hall, Pittsburgh, PA, United States, nak11@pitt.edu, Andrew Schaefer, Brady Hunsaker, Mark Roberts

Organ allocation in the U.S. has been a contentious issue for decades. Our primary objective is to group the service areas of 59 Organ Procurement Organizations (OPOs) into regions so that the quality of donor-recipient matches across the country is maximized. We focus on the allocation of livers. We model this problem as a set partitioning problem and consider several techniques for large-scale combinatorial optimization problems, such as column generation.

3 - Simulating the Clinical Course of Severe Community-acquired Pneumonia and Sepsis

Gorkem Saka, Department of Industrial Engineering, United States, gos2@pitt.edu, Jennifer Kreke, Mark Roberts, Andrew Schaefer, Derek Angus

We present a biologically based simulation model of pneumonia-induced sepsis, a leading cause of death in the U.S. We present the patient generation and disease-progression components of the simulation. We model disease-progression using SOFA scores, which measure the severity of sepsis. In addition to these components, we discuss model validation and present initial results. We propose future expansions to the model such as incorporating diagnostic and therapeutic decisions.

■ TA21

P-Room 3302

Research on Spreadsheet Engineering

Sponsor: Spreadsheet Productivity Research
Sponsored Session

Chair: Janet Wagner, Associate Dean, UMASS Boston, CM Dean's Office, 100 Morrissey Blvd, Boston, MA, 02125, United States, janet.wagner@umb.edu

1 - Spreadsheet Research Literature Survey
Thomas Grossman, Associate Professor, University of San Francisco, Masagung School of Management, San Francisco, CA, 94117-1045, United States, tagrossman@usfca.edu, Özgür Özlük

Spreadsheets are the most widely-used platform for Operations Research. The spreadsheet literature is scattered across academic and professional journals in many disciplines. We use the paradigm of spreadsheet engineering to organize and interpret existing knowledge, identifying opportunities for further research and providing a starting point for researchers interested in spreadsheets.

2 - Empirical Research on Industrial Practices in the use of Spreadsheets
Stephen Powell, Faculty, Dartmouth College, Tuck School of Business, Hanover, NH, 03755, United States, Stephen.G.Powell@Dartmouth.EDU, Ken Baker

We will describe the design of a three-year research project into how companies create and use spreadsheets. This research is designed to provide survey and interview data on spreadsheet practices and problems in a variety of companies, and eventually to help us design a training program based on best practices.

3 - Do Spreadsheet Errors Harm Executive Decision-Making? New Evidence from Interviews
Jonathan Caulkins, Professor, CMU Heinz, 5000 Forbes Ave, Pittsburgh, PA, 15213, United States, caulkins@cmu.edu, Tim Weidemann

Spreadsheets are ubiquitous but error-prone. Interviews with ~30 CEOs, COOs, and other leaders suggest that many errors are caught before they affect decisions, even though formal quality-control processes are rare. Nevertheless, most leaders can describe instances in which spreadsheet errors have led to bad decisions.

4 - A Survey of Spreadsheet Practices
Özgür Özlük, Assistant Professor, University of San Francisco, School of Business, 1600 Holloway St., San Francisco, CA, 94132, United States, ozgur@sfsu.edu, Thomas Grossman, Vijay Mehrotra

We present the results of a scoping survey of non-anecdotal data on spreadsheet usage. This survey interviews people who develop spreadsheets. We investigate the determinants of spreadsheet importance, identify current industry practices, and document existing standards for creation and use of spreadsheets. Our goal is to provide insight into user attributes, spreadsheet importance, and current practices.

■ TA22

P-Room 3312

VFT in the Military - Metrics and Sensitivity Analysis

Sponsor: Military Applications
Sponsored Session

Chair: Jeffery Weir, Assistant Professor, Air Force Institute of Technology, AFIT/ENS Bldg 641, 2950 Hobson Way, Wright-Patterson AFB, OH, 45433, United States, jeffery.weir@afit.edu

1 - Using Value-Focused Thinking to Evaluate the Effectiveness of Air Force Utility Privatization
Carlos Braziel, Air Force Materiel Command, Wright Patterson AFB, OH, United States, Carlos.Braziel@wpafb.af.mil

The Air Force is using the efficiencies produced by privatization as a means to improve the quality, reliability, and responsiveness of its utility systems. However, critics believe that newly privatized entities of government will cost more money and provide a lower level of service. This research attempts to build a model to capture the majority of the Air Force's utility privatization objectives, and concerns in order to facilitate the evaluation of its privatized utility systems.

2 - Robust Sensitivity Analysis For Multi-Attribute Deterministic Hierarchical Value Models
Stephen Chambal, United States, Stephen.Chambal@nro.mil

The methodology proposed in this research builds mathematical foundations for a robust sensitivity analysis approach and extends the current methodology to a more powerful form. The new methodology is easy to implement into complex hierarchical value models and provides consistency and a common standard for the decision analysis community for sensitivity analysis of multi-attribute deterministic hierarchical value models.

3 - Modeling Science Technology Selection Using Value Focused Thinking
Greg Mayer, Cheif, Quality Assurance, 13 Space Warning Squadron, Clear AFB, AK, United States, Gregory.Mayer@CLEAR.af.mil

Value-Focused Thinking was used to develop an objective R&D selection model for the Warfighter Interface Division of the Human Effectiveness Directorate, Air Force Research Laboratory (AFRL/HEC). This value-focused model incorporates United States Air Force CONOPS capabilities and AFRL/HEC strategic objectives, and is used to compare current and future R&D projects against one another. The model evaluated four sample alternatives, on which deterministic and sensitivity analysis were conducted.

■ TA23

P-Room 3354

New Supply Chain Case Studies

Sponsor: Education (INFORM-ED) SPONSORED/INVITED
Sponsored Session

Chair: Eric Johnson, Tuck School of Business, Dartmouth College, Hanover, NH, 03768, United States, m.eric.johnson@Dartmouth.EDU

1 - The mi adidas Mass Customization Initiative
Ralf Seifert, Professor, IMD and EPFL, Switzerland, Seifertaimd.ch

Many companies are exploring mass customization as a way to demonstrate market leadership, capture price premiums and manage complexity related to product variety. This case provides insights into adidas' recent "mi adidas" initiative, aimed at delivering customized athletic footwear to retail customers. The case focuses on practical implications associated with expanding the initiative.

2 - System-to-System Integration at Nokia Mobile Phones
Barchi Peleg, Stanford University, Dept. of MS&E, Terman Center #350, Stanford, CA, 94305-4026, United States, barchi@stanford.edu, Seungjin (Jin) Whang

The case describes the transformation Nokia has gone through in recent years, in response to changes in market environment. The transformation included internal reorganization, tighter collaboration with suppliers to avoid obsolescence in the network, closer relationship with customers to better understand demand, and restructuring of the distribution network.

3 - Woolworths "Chips" Away at Inventory Shrinkage through RFID Initiative
Eric Johnson, Tuck School of Business, Dartmouth College, Hanover, NH, 03768, United States, m.eric.johnson@Dartmouth.EDU

The case examines cost and benefits of a full-scale rollout of a new supply chain IT tracking system at Woolworths. Through the novel use of RFID and GPS technologies, the £2.7 billion UK retailers worked to reduce supply chain theft and improve inventory accuracy.

■ TA24

P-Room 3402

Beyond the Traditional First OR Course: Design and Implementation

Cluster: Undergraduate OR Education
Invited Session

Chair: Dick Forrester, Assistant Professor of Mathematics, Dickinson College, College and Louther Streets, Carlisle, PA, 17013, United States, forrestr@dickinson.edu

1 - Designing a First Course in Operations Research for Mathematics and Computer Science Majors
Kevin Hutson, Assistant Professor, Denison University, Dept. of Mathematics-Box M, Granville, OH, 43023, United States, hutsonk@denison.edu

Students at liberal arts (and other non-research/engineering) schools usually have a limited opportunity to see operations research. O.R. is mentioned in some economics or computer science courses, but it is not always targeted toward the sometimes applications-starved mathematics audience. This talk focuses on designing an introductory O.R. course for math/computer science majors at these schools. We will discuss topics, text book, and software options. Sample assignments will be given.

2 - Tools for Outside-the-Classroom Enhancement of an OR Course
Paul Hadavas, Armstrong Atlantic State University, 11935 Abercorn Street, Savannah, GA, 31419, United States, hadavapa@mail.armstrong.edu

During this talk we will discuss some effective tools for use outside the classroom setting. These include computer implementations of linear programming problems, simulations of queues and classic network flow problems, and journal readings and their subsequent classroom presentations. The pros and cons will be brought forth in how each goes beyond the standard classroom environment.

3 - A Capstone Course in Optimization
Allen Holder, Trinity University, Department of Mathematics, One Trinity Place, San Antonio, TX, 78212-7200, United States, aholder@trinity.edu

Many undergraduate curriculums include a capstone experience that synthesizes earlier course work. The area of optimization is well-suited for this purpose, and we show that the underpinnings of this field lie in linear and modern algebra and real analysis. The course objective is not technique or problem driven but is instead to show how topics from different disciplines combine to form a new branch of science.

■ TA25

P-Room 3404

MBA Education: Experiences from UMUC Online

Sponsor: Education (INFORM-ED) SPONSORED/INVITED
Sponsored Session

Chair: Jane Ross, Professor and Director, MBA & Executive Programs, Graduate School, University of Maryland University College, 3501 University Boulevard East, Adelphi, MD, 209857200, United States, jross@umuc.edu

1 - Collaboration as a Model for Online MBA Education
Jane Ross, Professor and Director, MBA & Executive Programs, Graduate School, University of Maryland University College, 3501 University Boulevard East, Adelphi, MD, 209857200, United States, jross@umuc.edu

A collaborative teaching model has been an important development in the online global business course of the UMUC MBA program. This presentation will focus on the UMUC MBA Model, discuss ways in which we have been influenced by selected other management models, and present the collaborative teaching model which has emerged in the UMUC MBA global business course. Course design, course methods, and lessons learned in collaborative teaching will be explored and shared.

2 - Models for Delivering Complex Concepts in Online MBA Education
Joe D'Mello, Collegiate Associate Professor, MBA & Executive Programs, Graduate School, University of Maryland University College, 3501 University Boulevard East, Adelphi, MD, 20783-8030, United States, joedmello@timaxys.com

Quantitative techniques, even when taught F-2-F, generally tend to challenge and even intimidate many MBA students. We will show how we leveraged a simple low-tech combination of synchronous (two conference calls!) and asynchronous (PowerPoint & Excel examples, posted ahead of the call) learning modes to raise scores in various MBA assignments requiring the application of quantitative techniques (probability & statistics, normal distributions, regression, and linear optimization) in business.

3 - An Administrative Model for Delivering MBA Education Anywhere, Any Place and Any Time Title
Mike Evanchik, Professor and Program Chair, Graduate School, University of Maryland University College, 3501 University Boulevard East, Adelphi, MD, 20783-8030, United States, mevanchik@umuc.edu

This session features the key administrative processes employed to develop and deliver a 42-credit online MBA program. The strategic application of multimedia technologies to develop learning objectives to enhance the presentation of program content will be discussed. In addition, the synchronous and asynchronous communication technologies necessary to coordinate the activities of administrators, faculty and students located around the world will be highlighted.

■ TA26

P-Room 3412

Price Adjustments in E-Commerce and Bricks and Mortar Retail

Sponsor: Marketing
Sponsored Session

Chair: Sourav Ray, Assistant Professor, Marketing, McMaster University, Michael G. DeGroote School of Business, 1280 Main Street, Hamilton, ON, L8S4M4, Canada, sray@mcmaster.ca

1 - Discovering Price Rigidity and Price Adjustment Patterns on the Internet
Dongwon Lee, Doctoral Candidate, Information and Decision Sciences, University of Minnesota, Carlson School of Management, Minneapolis, MN, 55455, United States, dlee@csom.umn.edu, Robert Kauffman, Mark Bergen

We explore price adjustment patterns for two major Internet book retailers: Amazon.com and BarnesandNoble.com. The data cover 449 days in 2003-04 for 377 books. We find that price adjustments: occur any day of the week; occur less frequently than daily; vary by category for books, and Amazon changes prices significantly less frequently than BN. Our findings suggest that while the Internet changes the way firms adjust prices, market forces also come into play—even for Internet retailers.

2 - Holidays and the Costs of Price Adjustment
Georg M¸ller, Strategic Pricing Group, Waltham, MA, United States, muller.georg@comcast.net, Mark Bergen, Shantanu Dutta, Daniel Levy

Most existing literature on pricing during holiday period focuses on how retailers can leverage the benefits of demand shifts. However, we argue that the opportunity cost of price adjustment also increases during such periods, thereby predicting high price rigidity. We find evidence consistent with this hypothesis using retail price data for 4,532 products carried by a major grocer retailer. Prices are more rigid in the Thanksgiving to Christmas holiday period relative to the rest of the year.

3 - Leadership in Price Changes
Chuck Wood, Assistant Professor, University of Notre Dame, 230 Mendoza College of Business, Notre Dame, IN, 46556-5646, United States, cwood1@nd.edu, Robert Kauffman

Using a customized data-collecting Internet agent and VAR we examine the timing of online price changes in two industries. While conventional wisdom predicts intense price competition, we find Bertrand competition is insufficient to explain competitive interaction in online markets. We note evidence of both tacitly collusive behavior and Edgeworth competition. As price changes are more easily detectable in online markets, tacitly collusive strategies can emerge.

4 - Asymmetric Wholesale Pricing
Sourav Ray, Assistant Professor, Marketing, McMaster University, Michael G. DeGroote School of Business, 1280 Main Street, Hamilton, ON, L8S4M4, Canada, sray@mcmaster.ca, Mark Bergen, Daniel Levy, Haipeng Chen

Asymmetric pricing, where prices rise readily but fall slowly, is of great interest to managers and academics. Unfortunately, our ability to explain this phenomenon is limited. In this paper we articulate, and provide empirical support for, a theory of asymmetric pricing in upstream prices. We combine insights from the literatures on channels of distribution and costs of price adjustment to suggest that retail costs of price adjustment may result in asymmetric pricing by manufacturers.

■ TA27

P-Room 3454

Financial Models and Analysis

Sponsor: Applied Probability
Sponsored Session

Chair: Xin Guo, Assistant Professor, Cornell University, School of ORIE, Cornell University, Ithaca, NY, 14853, United States, xinguo@orie.cornell.edu

1 - Optimal Investment and Consumption with Discontinuous Prices and Multiple Regimes
Andrew Lim, Assistant Professor, University of California, IEOR Department, Berkeley, CA, 94720-1777, United States, lim@ieor.berkeley.edu, Thaisiri Watewai

This paper concerns the problem of optimal investment and consumption with regime switching. Unlike traditional regime switching models, however, changes in regime may be accompanied by discontinuities in asset prices at the instant of transition. Closed form solutions have been obtained, and are significantly different to those of traditional regime switching models. Applications including the problem of investment in defaultable bonds will be discussed.

2 - Regular Variation and Financial Time Series Models
Richard Davis, Professor and Chair, Colorado State University, Department of Statistics, Ft. Collins, CO, 80523, United States, rdavis@stat.colostate.edu

An equivalence between multivariate regular variation of a random vector and regular variation of all finite linear combinations of the vector will be given which is then applied to a large class of financial time series models, including those arising from a stochastic recurrence equation such as GARCH, and stochastic volatility (SV) models. The various implications of this result will be described. (This is joint work with Thomas Mikosch and Bojan Basrak.)

3 - On the Controversy over Tailweight of Distributions
Steven Kou, Associate Professor, Columbia University, 312 Mudd, Dept. of IEOR, Columbia University, New York, NY, 10027, United States, sk75@columbia.edu, Chris Heyde

Although understanding tail behavior of distributions is important in many areas, such as telecommunications network analysis and finance, there is considerable controversy about distinctions between exponential type and power type tails. This paper explains why the distinctions are surprisingly difficult for popular methods in the literature, and why particularly large samples are needed for clear discrimination.

4 - Convenience Yield Model with Partial Observations and Exponential Utility
Mike Ludkovski, Princeton University, ORFE, E-Quad, Princeton, NJ, 08544, United States, mludkovs@princeton.edu, Rene Carmona

We consider the problem of hedging natural gas claims at a given location. We work with a 3-factor model for the asset spot, the convenience yield and the location basis. The conv. yield is taken to be unobserved and must be filtered. Under exponential utility, the partially observed stochastic control problem reduces to computing a closed-form expectation. The latter can be efficiently evaluated using a Kalman or particle filter. The basic model may be generalized to include nonlinear dynamics.

■ TA28

P-Room 3504

Distributed Sensing I

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: Yu Ding, Assistant Professor, Texas A&M University, Dept of Industrial Engineering, College Station, TX, 77843-3131, United States, YuDing@iemail.tamu.edu

1 - Energy Efficiency and Inference Accuracy in Distributed Sensor Networks
Abhijit Deshmukh, Associate Professor, University of Massachusetts, Mech & Industrial Eng Dept, Amherst, MA, 01003, United States, deshmukh@ecs.umass.edu, Robert Gao

Communication activities consume significant fraction of energy used by individual sensors embedded in a sensor network. This paper presents approaches to minimize communication energy usage in large-scale sensor networks by decomposing the overall network in several sub-networks with local communication capabilities, while guaranteeing the accuracy of inferences made by the network.

2 - Process Monitoring based on Multivariate Functional Sensing Data
Qiang Huang, Assistant Professor, University of South Florida, 4202 E. Fowler Ave. ENB118, Tampa, FL, United States, huangq@eng.usf.edu, Vuslat Nazilli, Hani Kababji

In the multi-sensor system, the observed characteristics are often in the form of multiple continuous curves or multivariate functional data (MFD). Statistical process control (SPC) are not directly applicable for MFD. This study develops principal curve regression methodology for process monitoring and process condition discrimination based on MFD. The proposed methodologies are illustrated with multi-channel tonnage signals from a real forging process.

3 - Reliability Prediction and Threshold Determination Using Sensors Data
Elsayed Elsayed, Professor, Rutgers, The State University of New Jersey, Department of Industrial and Systems Eng, 96 Frelinghuysen Road, Piscataway, NJ, 08854-8018, United States, elsayed@rci.rutgers.edu, Hao Zhang

Sensors observations of the degradation criterion of a system are utilized to obtain the optimum threshold degradation level that achieved desired predicted reliability estimates of the system. The effect of the number of sensors and their accuracies on the reliability estimates is investigated.

4 - A Sensor Fusion Methodology for Multi-sensor Monitoring and Diagnosis
David He, Associate Professor, Department of Mechanical and Industrial Engineering, The University of Illinois at Chicago, 842 West Taylor Street, 3049 ERF, Chicago, IL, 60607, United States, davidhe@uic.edu

A sensor fusion methodology for multi-sensor monitoring and diagnosis developed based hidden semi-Markov models (HSMMs) will be presented. In HSMMs, the input variables are implicitly treated equally important. Therefore, proper weighting schemes are needed for improving the confidence and accuracy of the sensor fusion process. In our research, this problem is tackled by estimating the appropriate weights for each of the sensor measurements using discriminant analysis techniques.

■ TA29

P-Room 3502

Real-Time Supply Chain Optimization and Execution

Sponsor: E-Business
Sponsored Session

Chair: Chien-Yu Chen, Assistant Professor, George Mason University, School of Management, 4400 University Dr., Fairfax, VA, 22030, United States, cchen8@gmu.edu

Chair: Zhenying Zhao, Faculty Research Professor, University of Maryland, R. H. Smith School of Business, College Park, MD, 20742, United States, zzhao@rhsmith.umd.edu

1 - Towards Real-Time Customized Management of Supply and Demand Chains
Ananth Krishnamurthy, Assistant Professor, Rensselaer Polytechnic Institute, Dept. of DSES, 110 8th Street, Troy, NY, 12180, United States, krisha@rpi.edu, Ali Yasar, James M. Tien

We develop an effective taxonomy for the simultaneous and real-time management of supply and demand chains. Our taxonomic approach highlights a very critical research area at which both supply and demand are flexible, thus manageable. Simultaneous and real-time management of supply and demand chains, set the stage for real-time mass customization wherein, products and services become indistinguishable and are co-produced in real-time, resulting in an overwhelming competitive economic advantage.

2 - An Available-to-Promise Model for Real-Time Multi-Channel Order Promising
Chien-Yu Chen, Assistant Professor, George Mason University, School of Management, 4400 University Dr., Fairfax, VA, 22030, United States, cchen8@gmu.edu, Zhenying Zhao, Michael Ball

To achieve real-time order promising, we propose an optimization-based Available-to-Promise (ATP) model to pre-allocate critical resources into strategic resource-availability piles for serving multi-channel customers. The ATP model has two levels of resource availability: local piles for individual sales channels and a global pile for emergency distribution. A stochastic linear-programming formulation is modeled to address future demand uncertainty. Simulation experiments will be discussed.

3 - Two-Stage Available-to-Promise (ATP)
Zhenying Zhao, Faculty Research Professor, University of Maryland, R. H. Smith School of Business, College Park, MD, 20742, United States, zzhao@rhsmith.umd.edu, Chien-Yu Chen, Michael Ball

Under assembly to order (ATO)/configuration to order (CTO) business setting, order promising and fulfillment becomes complicated due to large variety of product offerings. We propose a two-stage order promising approach, which gives initial “soft” order confirmation near real-time based on pre-allocated resource availability, and then generates “hard” order shipment dates after checking detailed resource availability. We present concepts, models, and preliminary results of this approach.

■ TA30

P-Room 3512

Reliability Research

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: David Coit, Associate Professor, Rutgers University, Industrial & Systems Engineering, 96 Frelinghuysen Rd., Piscataway, NJ, 08854, United States, coit@rutgers.edu

1 - Reliability of Weighted-k-out-of-n Systems with Applications in Fault Diagnosis Systems
Yong Chen, Assistant Professor, The University of Iowa, Dept. of Mechanical & Industrial Eng., Iowa City, IA, 52242-1527, United States, yong-chen@uiowa.edu, Qingyu Yang

Based on engineering process models developed by integrating the product and process design information, a weighted-k-out-of-n model can be used to evaluate reliability of manufacturing fault diagnosis systems. Approximation techniques are needed to efficiently evaluate system reliability and address statistical dependence of component failures in real manufacturing environment.

2 - Comparisons of Heuristics for the Redundancy Allocation Problem
David Coit, Associate Professor, Rutgers University, Industrial & Systems Engineering, 96 Frelinghuysen Rd., Piscataway, NJ, 08854, United States, coit@rutgers.edu, Abdullah Konak

The redundancy allocation problem is a well-known combinatorial optimization problem. The objective is to maximize system reliability by determining redundancy levels and selecting from among available components. Often heurustics are required because of the problem complexity. Recently, there have been two newly developed heuristics; max-min, and multiple objectives optimization. The performance of these heuristics are compared to other exisiting heuristics and to other optimization methods.

3 - Prioritized Pareto Optimal Solutions to the System Redundancy Allocation Problem

Sadan Kulturel-Konak, Assistant Professor, Penn State- Berks, Tulpehocken Rd. PO Box 7009, Reading, PA, 19610, United States, sadan@psu.edu, David W. Coit, Fatema Baheranwala

Unlike a traditional approach, which combines different objectives into an equivalent single objective problem using user-defined weights, a new methodology is presented to solve multiple objective system redundancy allocation problems with three objectives. A tabu search meta-heuristic approach is used to initially find whole Pareto front, then a Monte-Carlo simulation is used to provide a decision maker with prioritized Pareto optimal solutions.

■ TA31

P-Room 3545

Managing Information and Knowledge

Sponsor: Information Systems
Sponsored Session

Chair: Zuopeng Zhang, Ph.D Candidate, Penn State University, 324 Beam Building, University Park, PA, 16802, United States, zoz102@psu.edu

1 - Beyond Information Sharing: The Value and Learning Process of Vendor Managed Inventory

Yuliang(Oliver) Yao, Assistant Professor, Lehigh University, 621 Taylor Street, Bethlehem, PA, 19446, United States, yuy3@lehigh.edu, Martin Dresner, Yan Dong

This research empirically examines the value of VMI to the downstream partners, above and beyond information sharing, the effects of demand parameters on the value, and the learning process of implementing VMI, using EDI transaction data from the distributors (downstream) who have been conducting businesses with a manufacturer in the electronic component industry.

2 - Advertising, Spam and Anti-spam—An Equilibrium Analysis

Jane Feng, Assistant Professor, University of Florida, United States, jane.feng@cba.ufl.edu

This paper tries to provide a framework studying the problem of spam. We analyze the cause of spam, discuss the effectiveness of different anti-spam measures through a game theoretic approach. We find that when there is no perfect technology tracking down the true source address of a spammer, it is hard to stop spammng without changing the cost structure of spammers. Two approach were proposed to achieve this change, and the associated social welfare were discussed, too.

3 - Incentives for Knowledge Discovery and Diffusion in the Firm

Zuopeng Zhang, Ph.D Candidate, Penn State University, 324 Beam Building, University Park, PA, 16802, United States, zoz102@psu.edu, Shankar Sundaresan

We study the role of incentives, including wage contracts and additional rewards, in motivating workers to exert the best efforts in creating, retaining, and sharing knowledge discoveries. We demonstrate the existence and design of an incentive structure wherein all researchers exert the same optimal effort for knowledge discoveries in the first period and the discovery is shared by the successful worker and adopted by all workers in the second period.

■ TA32

T-Vail (Majestic Level)

Business Process Simulation and Optimization

Cluster: OR Practice
Invited Session

Chair: Feng Cheng, Research Staff Member, IBM Research, 1101 Kitchawan Road, Yorktown Heights, NY, 10598, United States, fcheng@us.ibm.com

1 - Simulation of Business Process and Supply Chain for an Availability Management Process

Young M. Lee, IBM Research, 1101 Kitchawan Road, Yorktown Heights, NY, 10598, United States, ymlee@us.ibm.com

We have developed a simulation model for a computer sales business process by modeling multiple, discrete events such as customer order arrival, replenishment planning and availability data refresh, and uncertainty of demand forecast, order size and customer preference of product feature. Using the model we were able to predict dynamics of availability, lead time to shipment and other business performance metrics.

2 - Finding Business Optimal IT Configuration Using Simulation and Optimization

Segev Wasserkrug, IBM, Haifa Research Labs, Haifa University, Haifa, 31905, Israel, segevw@il.ibm.com, Sarel Aiber, Dagan Gilat, Ariel Landau, Aviad Sela, Natalia Razinkov

Traditionally, IT related optimization efforts set IT configuration parameters so as to optimize IT related metrics such as response time. However, currently, enterprises are focusing on setting IT configuration so as to optimize complex business objectives. Therefore, we present a framework that incorporates simulation and optimization techniques that enable such business objective based optimization. In addition, a case study demonstrating the applicability of this approach is described.

3 - Supply Chain Coordination with Setup Costs

Lei Xie, The Department of Systems Engineering and Engineering Management,, The Chinese University of Hong Kong, Shatin, NT,, Hong Kong, lxie@se.cuhk.edu.hk, Houmin Yan

Unlike the existing coordination literature in which the supply chain involves with variable cost only, in this paper, we investigate the supply chain coordination issues for supply chains with both variable and setup costs. We found that these well-documented contracts such as buy-back contract can not coordinate the supply chain for the cases where at least one of the supply chain players can not ignore the setup cost. We demonstrate that the coordi- nation can be achieved by providing a variable whole-sale price that depends on the order quantity, or by adding an additional linear payment term in the classical buy-back contract.

4 - Simulation of RFID Impact on Retail Store Inventory Management

Feng Cheng, Research Staff Member, IBM Research, 1101 Kitchawan Road, Yorktown Heights, NY, 10598, United States, fcheng@us.ibm.com, Young M. Lee, Ying Tat Leung

RFID technology can provide accurate and real time inventory information throughout supply chain, promoting better supply chain decisions and performance. In particular, the potential performance improvement in retail store operations has generated a lot of interest in the industry. We developed a simulation model to study how RFID can improve inventory management operations at retail stores.

■ TA33

T-Savoy (Majestic Level)

Daniel H. Wagner Prize Competition Awards

Sponsor: The Daniel H. Wagner Prize for Excellence in Operations Research
Sponsored Session

Chair: Joseph H. Discenza, SmartCrane, LLC, 2 Eaton Street Suite 500, Hampton, VA, 23669, United States, joeh@discenza.com

1 - Daniel H. Wagner Prize Competition Awards,

In 1997, CPMS, the Practice Section of INFORMS, established and has since sponsored the Daniel H. Wagner Prize for Excellence in Operations Research. This prize emphasizes the quality and coherence of the analysis used in practice. Dr. Wagner strove for strong mathematics applied to practical problems, supported by clear and intelligible writing. The prize recognizes those principles by emphasizing good writing, strong analytical content, and verifiable practice successes. The fund for the prize was established after Dan's passing in 1997 by $51,000 in contributions from Metron, Inc., Daniel H. Wagner Associates, Inc., and Applied Mathematics, Inc., all of which companies are well represented in INFORMS membership. The first competition was held at the INFORMS Fall Annual Meeting in 1998 and this is the fifth competition since then. Six finalists will present papers on successful and innovative practice projects at three Monday sessions. The winning entry will be announced Tuesday morning and the $1,000 first prize will be presented at the INFORMS Spring Practice Conference 2005. Dr. Joseph H. Discenza, Prize Chair

■ TA34

T-Columbine (Majestic Level)

Strategic Operations

Sponsor: Manufacturing and Service Operations Management
Sponsored Session

Chair: Gerard Cachon, The Wharton School, 543 JMHH, Philadelphia, PA, 19104, United States, cachon@wharton.upenn.edu

1 - A Sales Contest with Forecasts
Fangruo Chen, Professor, Columbia University, New York, NY, United States, fc26@columbia.edu, Wenqiang Xiao

We consider a salesforce compensation problem with two sales territories sharing a common market condition. There are two sales people, one for each territory. They have private information about the market condition, and this information, if revealed truthfully to the firm, is beneficial for its production planning. To motivate the salesforce to work hard and to share their market information with the firm, we propose a sales contest that requires them to first submit a sales forecast.

2 - Strategic Technology Choice and Capacity Investment under Demand Uncertainty
Manu Goyal, The Wharton School, 500 JMHH, Philadelphia, PA, 19104, United States, Goyalm@wharton.upenn.edu, Serguei Netessine

The goal of this paper is to study the impact of competition on a firm's technology choice (product-flexible or product-dedicated) and capacity investment decisions. We formally characterize a subgame-perfect Nash equilibrium in the capacity and production games and compare how a monopolist and a duopolist respond to a given flexibility premium.

3 - Supply Auctions and Relational Contracts for Procurement
Tunay Tunca, Asst. Professor, GSB, Stanford University, 518 Memorial Way, Stanford University, Stanford, CA, 94305, United States, tunca_tunay@gsb.stanford.edu, Stefanos Zenios

We examine the competition between procurement auctions and long-term relational contracts. Suppliers of an industrial part with non-verifiable quality trade with several manufacturers that use that part in the production of an end-product. Through a formal model of the competition between the two procurement models with quality differentiation we examine the emerging market structure and equilibrium characteristics.

4 - Price Volatility and Lead Times
Gerard Cachon, The Wharton School, 543 JMHH, Philadelphia, PA, 19104, United States, cachon@wharton.upenn.edu, Marcelo Olivares

What is the impact of lead time on price volatility of spot markets? In many spot pricing equilibrium models price volatility increases when there is less inventory/storage. Faster lead times are often associated with lower inventory, which suggests that more responsive supply chains could lead to higher price volatility. But intuition also suggests that faster supply chains should better match supply to demand, hence lower volatility. We try to resolve these conflictly arguments.

■ TA35

T-Terrace (Terrace Level)

Mass Customization I

Cluster: Mass Customization in Mfg
Invited Session

Chair: Jose Luis Gonzalez-Velarde, Professor, ITESM (Monterrey Tech), Garza Sada Sur 2501, Monterrey, NL, 64849, Mexico, gonzalez.velarde@itesm.mx

1 - Strategic Price Optimization
Jorge Limon-Robles, Professor, Monterrey Tech, Garza Sada Sur 2501, Monterrey, NL, 64849, Mexico, jorge.limon@itesm.mx, Neale R. Smith

We present a model for strategic price optimization useful to mass customizers with direct sales and demanding customers. We formulate a multi-period model and provide an analytic solution for the single-period case. For the multi-period case, computational experiments based on realistic market behaviors are performed and the results are reported.

2 - Standard versus Custom Products: Monopoly and Competitive Models
Nan Xia, University of Southern California, Marshall School of Business, Los Angeles, CA, 90089, United States, Nan.Xia.2008@marshall.usc.edu, Raj Rajagopalan

Standard products are offered in limited variants in terms of an attribute. Custom products match the customer's attribute specification exactly but require a finite lead time. We study variety, customization and lead time decisions of a monopolist offering both standard and custom products and a duopoly where one firm offers standard products and the other custom products.

3 - Optimization Of Modular Products Manufacturing
Jose Luis Gonzalez-Velarde, Professor, ITESM (Monterrey Tech), Garza Sada Sur 2501, Monterrey, NL, 64849, Mexico, gonzalez.velarde@itesm.mx, Gerardo Treviño, Elías Olivares

Modular products owe their variety to the number of instances available for each module. However there is a tradeoff between this number and the flexibility costs implied. The problem of optimizing the selection of module instances in a reconfigurable manufacturing system is addressed. A Scatter Search meta-heuristics is used to select the minimum number of instances for each module to be manufactured considering variety and performance of the product.

4 - Mass Customization versus Mass Production: Variety and Price Competition
Aydin Alptekinoglu, Assistant Professor, University of Florida, Warrington College of Business, Decision and Information Sciences, Gainesville, FL, 32611-7169, United States, aalp@ufl.edu, Charles Corbett

Consider two multi-product firms with distinct production technologies: the mass customizer (MC) has a perfectly flexible technology (offers infinite variety); while the mass producer (MP) has a focused technology (offers finite variety). A la Hotelling, we model their competition for heterogeneous customers as a three-stage game: both firms decide whether to enter; MP designs its product line; both firms set prices. We find that MP offers less product variety under duopoly than under monopoly.

■ TA36

T-Capitol (Terrace Level)

Finance - Risk Management

Contributed Session

Chair: Georgios Dalakouras, Quantitative Research, Susquehanna, George's Dock House, 4th floor, IFSC, Dublin 1, Ireland, gbdalako@umich.edu

1 - On the Estimation of Commodity Market Risk Premium under Price Limits
Kamal Smimou, Ph.D. Candidate, University of Manitoba, I. H. Asper School of Business, Winnipeg, MB, R3T-5V4, Canada, umsmimou@cc.umanitoba.ca

This paper extends the estimation of market risk premium under price limits in two important directions. The first is to provide estimates of systematic risk for Canadian commodities futures (western barley, canola, flaxseed, feed wheat) using a market portfolio based on a similar weighting scheme suggested by Marcus (1984). The second is to estimate systematic risk with the induction of price limits in the Capital Asset Pricing Model (CAPM) and the deployment of a fuzzy regression method.

2 - Optimal Timing of Mark-to-Market in Collateral Risk Control
Jiali Liao, Drexel University, 105 N 35th Street, Philadelphia, PA, 19104, United States, jl327@drexel.edu, Theodore Theodosopoulos

The issue of risky collateral is important and complex considering mark-to-market. Little research has addressed quantitative analysis of mark-to-market timing. This paper is to propose a framework for optimal mark-to-market timing of collateral. We derived the probability of potential future exposure exceeding the acceptable level as a function of the relevant decision variables. We then used numerical methods to approximate the optimal timing under different scenarios.

3 - Replacement and Capacity Planning Strategies using Option Pricing Theory
Luke Miller, Assistant Professor, University of San Diego, School of Business Administration, 5998 Alcala Park, San Diego, CA, 92110, United States, millelt@auburn.edu

This work compares selection versus parallel strategies for replacement and capacity planning scenarios. Given market uncertainty, costs, upfront premiums, and project dependencies, a real options framework is used to guide decision-making. In general it is shown that parallel replacement is preferred under instances of high uncertainty, low upfront premiums, and inversely-related replacement/capacity alternatives.

4 - Simple Unified Pricing of Vanilla and Asian Options: Monte-Carlo and PDEs
Georgios Dalakouras, Quantitative Research, Susquehanna, George's Dock House, 4th floor, IFSC, Dublin 1, Ireland, gbdalako@umich.edu

Asian options or options on the average are contracts essential for the well-being of our financial markets. We propose a simple framework that simplifies the derivation, as well as the final form, of the celebrated Black-Scholes-Merton PDE for the price of the vanilla call and put options. Our derivation covers all Asian options and provides fast and efficient ways for pricing including high order Monte-Carlo, finite difference & moments methods, and semidefinite programming.

5 - Development of a Process for Extending the Analysis of Credit Risk to the Sub-Prime Loan Market
Shanshan Wang, Graduate Sudent & Project Analyst, Centre for Operations Excellence, University of British Columbia, University of British Columbia, 2053 Main Mall, Vancouver, BC, V6T 1Z2, Canada, shanshan.wang@coe.ubc.ca, Martin Puterman, Michael Mueller

This project is about extending a canadian financial institution's analysis of credit risk to the sub-prime market. The objective of the project is to consistently identify profitable loans, and to grant credit at an interest rate that appropriately reflects the risk involved in the loan, which can assist the financial institution to enter the sub-prime market and generate profits based on the risk-based pricing.

■ TA37

T-Biltmore (Terrace Level)

Modeling of Climate Change and Energy Markets

Sponsor: Energy, Natural Resources and the Environment
Sponsored Session

Chair: Erin Baker, Department of Mechanical and Industrial Engineering, University of Massachusetts, Amherst, MA, United States, edbaker@ecs.umass.edu

1 - Energy Demand and Climate Change: A Neural Network-based Simulation
Christian Crowley, Department of Economics, George Washington University, Washington, DC, United States, crow@gwu.edu

A standard feedforward neural network model is developed to model electricity demand in Baltimore, MD for each hour of the day. Input variables include hourly temperature, lagged loads, and trading day variation for holidays and weekends. The model is used to conduct a simulation of a 2^{o}F increase in daily temperature on hourly peak loads. The results show an increase over baseline demand forecasts, of a similar magnitude to the results reported for California by Baxter and Calandri (1992).

2 - Simulation of the Effect of Climate Change on Electricity Emissions and Tropospheric Ozone
Benjamin Hobbs, Professor, The Johns Hopkins University, Dept. Geography & Environ. Engineering, 313 Ames Hall, 3400 N. Charles, Baltimore, MD, 21218, United States, bhobbs@jhu.edu, Yihsu Chen, Hugh Ellis

3 - Optimal Technology R&D Under Uncertainties
Kwame Adu-Bonnah, Graduate Student, University of Massachusetts, 345 Lincoln Ave., #126, Amherst, MA, 01002, United States, kadubonn@ecs.umass.edu

This paper explores optimal R&D, from a social planner's perspective, in response to uncertain climate change damages caused by the buildup of greenhouse emissions. In particular, we investigate how uncertain returns on R&D investments interact with uncertain climatic damages to impact optimal R&D investment. We focus on uncertainty about the magnitude of the returns to R&D, rather than on the timing, in order to get at the idea of a possible breakthrough in technology.

4 - The Value of Modeling Uncertainty in Climate Change
Erin Baker, Department of Mechanical and Industrial Engineering, University of Massachusetts, Amherst, MA, United States, edbaker@ecs.umass.edu

There are alternate ways to contend with uncertainty in policy modeling. One way is to explicitly model uncertainty and choose the best alternative, given that the future is uncertain. An alternate way is to model the world as deterministic, and use "best estimates" to parameterize the model. We compare these two approaches in the context of climate change, by comparing the value of modeling uncertainty with the value of collecting better information for a deterministic model.

■ TA38

T-Beverly (Terrace Level)

Stochastic Processes I

Contributed Session

Chair: Kumar Muthuraman, Asst. Professor, Purdue University, 1307 E, Michael Goldon Lab.,, Purdue University,, West Lafayette, 47906, United States, kumar@purdue.edu

1 - DMAP Modeling for Multiple Words Search Problem in a Markov Sequence
Yonil Park, Research Fellow, NIH, 8600 Rockville Pike, Bethesda, MD, 20894, United States, park@ncbi.nlm.nih.gov, John Spouge

The theory of the discrete time Markovian arrival process is applied to word searches problem in a Markov sequence. Such word searches are often emphasized in studies of the human genome. The advantages of the DMAP approach are that its derivations are transparent, and they readily unify disparate results about the exact distributions of overlapping and non-overlapping word counts. We present several examples and numerical study using a random DNA dataset from the human genome.

2 - Testing Multivariate Gaussianity by Hermitian Polynomials Transformation
Nobuhiko Terui, Professor, Tohoku University, Graduate School of Economics, Kawauchi, Aoba-ku, Sendai, Japan, terui@econ.tohoku.ac.jp

Based on a characterization of orthogonality of Gaussian random variates after Hermitian polynomials transformation, we develop a Gaussianity test for multivariate stationary time series. Our simulation study shows that the proposed test has reasonable power and it has a situation which outperforms multivariate bispectrum test. Some modification of tests is proposed to examine inter-relationship between marginal time series for multivariate time series with common non-Gaussian component.

3 - Stability Region Identification for Non-Linear Stochastic Systems Using Moment Closure Methods
Ivan Guardiola, GR, NMSU Dept. of Industrial Engineering, P.O. Box 30001 MSC4230, Las Cruces, MN, 88003-8001, United States, iguardio@nmsu.edu, Timothy Matis

This presentation highlights preliminary investigations into the instability of moment approximations generated via Moments Closure Methods. We show that the instability of this method for various systems may be attributed to the underlying statistical distribution assumption. A direct interpretation of the behavior of the generated system of differential equations will identify instability regions in which finite solutions become unattainable.

4 - Stochastic Programming with Xpress-SP
Nitin Verma, Sr Consultant, Dash Optimization Inc, 560 Sylvan Ave, Englewood Cliffs, NJ, 07632, United States, nitin.verma@dashoptimization.com, Alkis Vazacopoulos

We introduce Xpress-SP — a tool for modeling, solving and analyzing stochastic problems. Xpress-SP can be used for building multi-stage mixed integer linear models involving periodic uncertainty and decision-making. It is integrated with Xpress' solver, visualization tool, and random distribution library for developing stochastic applications rapidly and easily. We demonstrate its modeling, visualization and analysis capabilities using simple examples.

5 - A Diffusion Control Problem Based on the Criss-Cross Queueing Network
Kumar Muthuraman, Asst. Professor, Purdue University, 1307 E, Michael Goldon Lab.,, Purdue University,, West Lafayette, 47906, United States, kumar@purdue.edu, Sunil Kumar

We study the diffusion control problem arising from the so-called criss-cross queueing network. Solution of the diffusion control problem involves solving a so-called free boundary problem in partial differential equations, under most parameter choices. We provide exhaustive computational results for this problem, and use the computational results to provide insight about the nature of the value function and the free boundaries.

■ TA39

T-Tower Court A (2nd Floor)

Capacity and Inventory Management

Cluster: Supply Chain Mgmt & Operations
Invited Session

Chair: Alp Muharremoglu, Columbia Business School, 3022 Broadway, 410 Uris Hall, New York, NY, 10027, United States, alp2101@columbia.edu

1 - Capacitated Multi-item Inventory Systems with Markov Modulated Demands
Ozalp Ozer, Assistant Professor, Stanford University, Stanford, CA, United States, ozalp@stanford.edu

We consider a capacitated, periodic review, multi-item production system with Markov modulated demands and minimum production requirements. We propose lower bounds and close-to-optimal heuristics to manage a two level production system. We investigate the effect of production system design strategies, such as delayed differentiation, on system's performance and the inventory at risk.

2 - The Benefits of Capacity Pooling in Decentralized Service Industries
Awi Federgruen, Columbia Business School, 3022 Broadway, New York, NY, United States, af7@columbia.edu, Gad Allon

Competing service providers often outsource the service process to a common supplier so as to benefit from pooling efficiencies. We show how the service supply chain can be optimally coordinated, when the providers compete in terms of prices, waiting time standards or both. The single server supplier chooses a service rate to accommodate the providers' promised waiting times under their demand volumes. These in turn depend on the price and waiting time standard offered by all providers.

3 - Matching Supply and Demand Using Market Signals
Rene Caldentey, Assistant Professor, New York University, 44 West 4th Street, Suite 8-77, New York, NY, 10012, United States, rcaldent@stern.nyu.edu, Vladimir Krasik

We consider a manufacturer solving a newsboy problem with stochastic demand and limited production capacity. The manufacturer's objective is to select a production strategy that minimizes a cost functional that penalizes the gap between demand and supply. A distinguishing feature of our model is the existence of a stochastically evolving market signal that is partially correlated to the demand. The manufacturer has access to this signal which he uses to control production.

4 - Order Crossing in Multi-Echelon Inventory Systems
Alp Muharremoglu, Columbia Business School, 3022 Broadway, 410 Uris Hall, New York, NY, 10027, United States, alp2101@columbia.edu, Nan Yang

We study a multi-echelon inventory system with stochastic i.i.d. leadtimes. In such a setting, all but the most primitive leadtime distributions will result in order crossing. We develop and test a method to determine base-stock levels by explicitly taking order crossing into account. We show that ignoring order crossing may be quite costly.

■ TA40

T-Tower Court B (2nd Floor)

Incentives in Firms and Supply Chains

Cluster: Supply Chain Mgmt & Operations
Invited Session

Chair: Anton Kleywegt, Georgia Institute of Technology, Department of Industrial and Systems Engineering, 765 Ferst Drive, Atlanta, GA, United States, anton.kleywegt@isye.gatech.edu

1 - Facilitating the Sharing of Demand Risk in Truckload Transportation
Matt Drake, Graduate Student, Georgia Institute of Technology, School of Industrial and Sys Engineering, 765 Ferst Drive NW, Atlanta, GA, 30332, United States, mdrake@isye.gatech.edu, Julie Swann

We analyze the structure of a currently-utilized truckload transportation contract that encourages information and demand risk sharing between the parties. The shipper is allowed to order within a percentage deviation of its original order without incurring a penalty. We characterize the optimal decisions for each party that induce a coordinated channel under a variety of compliance scenarios and consider the premium that a shipper would require to endorse this contract over a traditional one.

2 - The Strategic Role of Stock Options in Mitigating Hold-up with Respect to Suppliers
Steve Gilbert, Associate Professor, University of Texas at Austin, McCombs School of Business, 1 University Station, Austin, TX, 78712, United States, Steve.Gilbert@mccombs.utexas.edu, Xiaohui Xu

The use of stock options in managerial compensation has received a lot of attention recently, particularly in the high-tech industries. In this paper, we identify the role that stock options can play in removing the incentives that managers of a firm will have to behave opportunistically with respect to suppliers. Because the threat of opportunistic behavior can discourage suppliers from making ideosyncratic investments, the use of stock options in managerial compensation can lead to greater supplier investment and higher firm profits.

3 - The Impact of Production Technology on Price Discrimination Under Information Asymmetry
Serguei Netessine, The Wharton School, 3730, Walnut Street, Suite 500, JMHH, Philadelphia, PA, 19104, United States, netessine@wharton.upenn.edu, Terry Taylor

We consider a price-discrimination problem traditional in economics: a firm offers several versions of the same product in order to satisfy customers who are privately informed about their preferences. We show that explicitly accounting for production technology alters some of the well-known results in economics literature by affecting the number of products offered as well as their quality and prices.

4 - Coordination of Marketing and Production for Price and Lead-time Decisions
Pelin Pekgun, School of Industrial and Systems Enginee, Georgia Institute of Technology, United States, ppekgun@isye.gatech.edu, Paul Griffin, Pinar Keskinocak

We study the lead-time and price decisions of a firm, which serves customers that are sensitive to quoted price and lead-time. Pricing decisions are made primarily by the marketing department, while lead-time decisions are made by the production department. We analyze the inefficiencies that result from the decentralization of these two decisions and explore coordination mechanisms.

■ TA41

T-Tower Court C (2nd Floor)

Supply Chain Coordination I

Contributed Session

Chair: ManMohan S. Sodhi, Associate Professor, Cass Business School, 106 Bunhill Row, London, EC1Y8TZ, United Kingdom, M.Sodhi@city.ac.uk

1 - A 'Complexity' Based Approach for Supply Chain Modeling and Coordination
Gangaraju Vanteddu, Ph.D Candidate, Industrial & Mfg Engineering Department Wayne State University, 4815 4th Street #1073, Detroit, MI, 48202, United States

In this paper we provide a methodology that enables the characterization of the 'key processes' uniformly throughout the supply chain so that ,Cause & effect relationships among the players are properly understood w.r.t all the major supply chain drivers namely facilities, inventories, transportation and information.

2 - Forecast Updating and Supplier Coordination for Complementary Component Purchases
Donald Warsing, North Carolina State University, Campus Box 7229, Nelson Hall, Raleigh, NC, 27695, United States, don_warsing@ncsu.edu, Douglas Thomas, Xueyi Zhang

We model a supply chain coordination problem where a manufacturer must procure two complementary components of an OEM product. We obtain closed-form expressions for the ordering decisions with a uniform-demand model and present a normal-demand model for additional insights about varying levels of between-order information updates. Finally, we compare the performance effects of improved between-order information versus an OEM-specified contract that offsets the manufacturer's overage cost.

3 - The Value of Information in a Serial Supply Chain with Markov Modulated Demand
Dmitriy Shaltayev, University of Alabama, Box 870226, 300 Alston Hall, Tuscaloosa, United States, dshaltay@cba.ua.edu, Charles Sox

This research investigates the value of information in a serial supply chain with Markov modulated customer demand. A discrete approximation is used to approximate the cost for the case of partially observed Markov demand process. We derive the expression for the induced penalty cost for the supplier in a serial supply chain. The value of information is quantified by comparing the cost of optimal policy under fully observed demand with the optimal policy cost under partially observed demand.

4 - The Transporter's Impact on Supply Chain Coordination
Fatih Mutlu, Industrial Engineering Department, Texas A&M University, College Station, TX, 77843-3131, United States, Sila Cetinkaya

We study the impact of integrating the transporter in supply chain coordination using two-stage stylistic models. We analyze infinite horizon problems with both constant and price sensitive deterministic demand as well as single-period problems with stochastic demand. We study the corresponding centralized models for a single-supplier, -buyer, and -transporter setting. We also investigate the counterpart decentralized models in cooperative and non-cooperative game theoretic settings. We test the performance of widely used coordination mechanisms, i.e. freight discounts, and show that they are not insufficient to coordinate the system, and, hence, we develop other coordination mechanisms that can always coordinate the system.

5 - An Exact Quantification of the Bullwhip Effect
ManMohan S. Sodhi, Associate Professor, Cass Business School, 106 Bunhill Row, London, EC1Y8TZ, United Kingdom, M.Sodhi@city.ac.uk

We quantify the impact of various causes of the bullwhip effect on order and inventory variance in a supply chain. Among the causes we quantify exactly are managerial misperception (Sterman 1989), batching, price fluctuations, and shortage gaming (Lee et al. 1997). We generalize the AR(1) demand to take into account seasonality, etc. and obtain results for a K-node linear supply chain.

■ TA42

T-Tower Court D (2nd Floor)

Revenue Management and Dynamic Pricing II

Sponsor: Revenue Management & Dynamic Pricing
Sponsored Session

Chair: Darius Walczak, Scientist, PROS RM, 3100 Main St., Suite 900, Houston, TX, 77002, United States, dwalczak@prosrm.com

1 - An Efficient Approximate Solution to Revenue Management Pricing Networks
Darius Walczak, Scientist, PROS RM, 3100 Main St., Suite 900, Houston, TX, 77002, United States, dwalczak@prosrm.com

We show an intuitive way to decompose value function of a popular dynamic network problem and how to apply this decomposition to generate approximate dynamic solutions fast. Network problems arise naturally in many RM and Pricing applications with the airline Origin and Destination network (of flights) being a well-known example. We present numerical results for a small (but relevant) network with products that can be offered at a number of price points.

2 - Multistage Revenue Management with Correlated Demand
Stefanos Zenios, Graduate School of Business, Stanford University, Stanford, CA, 94305, United States, stefzen@stanford.edu, Kristin Fridgeirsdottir, Catalina Stefanescu, Victor DeMiguel, Nishant Mishra

We propose a revenue-management methodology with two innovative features. First, we develop a forecasting model taking into account correlation between demand across different products and time periods. Second, we determine bid prices using an optimization algorithm based on multistage stochastic programming. We test the methodology with real airline booking data.

3 - Real-World Combinatorial Procurement Auctions
Tuomas Sandholm, CombineNet, Inc., Fifteen 27th St., Pittsburgh, PA, 15222, United States, sandholm+@cs.cmu.edu, David Levine, Tuomas Sandholm, Subhash Suri, Yuri Smirnov, Robert Shields, Tom Kuhn, Sam Hoda, Andrew Fuqua, Bryan Bailey, Andrew Gilpin, David C. Parkes

CombineNet has gained substantial experience hosting procurement auctions over the past three years. Our auctions allow the bidders and bid taker to express their preferences in a host of novel ways, thereby increasing economic efficiency, but begetting combinatorial complexity. The size and complexity of the auctions have increased over the past year as users take advantage of our technology's capabilities. We summarize our experiences with clearing and analyzing these markets.

4 - A Practical Upgrading Algorithm
Neil Biehn, PROS Revenue Management, Houston, TX, 77002, United States, nbiehn@prosrm.com, Darius Walczak

In the travel industry, upgrading customers can increase revenue substantially. For example, a hotel can purposely oversell a standard room type knowing that unused rooms will be available in a more expensive room type. This talk describes a practical algorithm that can be used to determine optimal, proactive upgrades. A short proof of optimality will be given for two inventory classes. Furthermore, we will expose why an algorithm based solely on two inventory classes can produce poor results when used for three or more inventory classes. We conclude by describing a Linear Programming solution which handles multiple classes.

■ TA43

T-Denver (Mezzanine)

Supply Chains for Product Design

Cluster: New Product Development
Invited Session

Chair: Sezer Ulku, Visiting Assistant Professor, Georgetown University, United States, SU8@georgetown.edu

Co-Chair: Glen Schmidt, Professor, Georgetown University, McDonough School of Business, Washington, DC, 20057, United States, schmidtg@georgetown.edu

1 - A Framework for Hierarchical Product Development Planning
Nitin Joglekar, Asst. Professor, Boston University, 595 Commonwealth Avenue, Boston, MA, 02215, United States, joglekar@bu.edu, Edward Anderson

Product development has shifted towards distributed and decentralized levels of management across the supply chain. To coordinate these networks, we propose a hierarchical product development planning (HPDP) framework using integrated stochastic programming models for portfolio selection, development resource allocation, and project execution in order to maximize firm profit.

2 - Diffusion of Innovations Under High-End and Low-End Encroachment
Glen Schmidt, Professor, Georgetown University, McDonough School of Business, Washington, DC, 20057, United States, schmidtg@georgetown.edu, Cheryl Druehl

Diffusion theory has typically focused on communication effects. We show how progressive product improvements and/or cost reduction might also impact diffusion. In our model diffusion progress as either high-end encroachment (starting with high-end customers), or low-end encroachment of the fringe-market or detached-market type. We fit our model to data for microprocessors, disk drives, and digital cameras, and discuss how our encroachment types map to disruptive and sustaining technologies.

3 - Matching Product Architecture with Supply Chain Configuration
Sezer Ulku, Visiting Assistant Professor, Georgetown University, United States, SU8@georgetown.edu, Glen Schmidt

While a modular product may reduce the need for collaboration and lead to more product variety, it may sacrifice performance and cost as compared to an integral design. We investigate whether a product should be more or less modular as a function of the degree of outsourcing, the buyer/supplier contract structure, the firms' capabilities, and inter-firm coordination costs.

■ TA44

T-Spruce (Mezzanine)

DEA Applications in IT Software and Finance Industries

Cluster: Data Envelopment Analysis
Invited Session

Chair: Shanling Li, Associate Professor, Faculty of Management, McGill Univ, 1001 Sherbrooke Street West, Montreal, QC, H3G1A5, Canada, shanling.li@mcgill.ca

1 - Operating Efficiency, Economies of Scale and Stock Returns in Software Industry (1995-2002)
Jen S. Shang, Associate Professor, The Joseph M. Katz Graduate School of, 254 Mervis Hall, University of Pittsburg, Pittsburgh, PA, 15260, United States, shang@katz.pitt.edu, Shanling Li

Operating efficiency and stock returns in software industry are the major concerns for managers and investors. In this study we investigate the impact of economies of scale, growth patterns and stock returns on operating efficiencies. We use both Data Envelopment Analysis and statistical methodologies to derive implications.

2 - An Application of the DEA Approach on Mergers and Acquisitions
Menxin Zhao, Assistant Professor, McCallum Graduate School of Business, Bently College, Waltham, MA, 02452, United States, mzhao@bentley.edu

We use DEA to investigate the efficiency hypothesis regarding M&A and to understand if M&A is a market mechanism to transfer resources from inefficient firms to efficient ones. Two industries are studied: Telecommunications and Pharmaceutical/Biotech. Based on a sample of 181 and 241 respectively, we document what is consistent with target underperformance hypothesis.

3 - A Multicriteria Approach to Mutual Funds Selection
Wen-Chyuan Chiang, Professor, The University of Tulsa, College of, The University of Tulsa, Tulsa, OK, 74104, United States, wen-chiang@utulsa.edu, Jen S. Shang, Komil Tolib-ogl Ahmetov

A unified framework is proposed to facilitate decision making in mutual fund selection. We use AHP model to examine the subjective criteria associated with individual investor's preference and long-term objectives, while tangible benefits and investments costs collected from financial database are included to make objective decision. Both subjective and objective concerns are unified through DEA.

4 - Input Congestions in DEA with Stochastic Considerations
Zhimin Huang Huang, Professor, Marketing and Decision Sciences, School of Business, Adelphi University, Garden City, New York, 11530, United States, Zhiming Huang, huang@adelphi.edu, Susan X. Li

The models described in this paper for treating congestion in DEA are extended by according them chance constrained programming formulations. The usual route leads to a class of nonlinear problems. However, it is shown to be possible to avoid some of the need for dealing with these nonlinear problems by identifying conditions under which they can be replaced by ordinary (deterministic) DEA models.

■ TA45

T-Gold (Mezzanine)

Clinical OR Applications in Radiation Oncology

Cluster: Oncology and OR
Invited Session

Chair: Bill Salter, Cancer Therapy Research Center, UTHSCSA, San Antonio, TX, United States, bsalter@saci.org

1 - Optimization in Radiation Oncology
Bill Salter, Cancer Therapy Research Center, UTHSCSA, San Antonio, TX, United States, bsalter@saci.org

This session is intended to familiarize the optimization community with relevant clinical problems typically encountered in the field of Radiation Oncology, and potential pitfalls that stand in the way of meaningful optimization research. A broad overview of currently meaningful problems will be presented.

2 - An Optimization Based Comparison of Three Radiosurgical Approaches for Treatment of Brain Cancer
Dennis Cheek, Cancer Therapy Treatment Center, UTHSCSA, San Antonio, TX, United States, dcheek@ctrc.net

A unified simulated annealing optimization platform, using a novel conformity index-based rational binary objective function, has been used to compare three different radiosurgical methods for treating lesions of the brain. Results for actual patient cases will be presented.

3 - Image Guidance and Registration in Radiation Oncology
Francis Newman, University of Colorado, Health Science Center, Denver, CO, United States, Francis.Newman@UCHSC.edu

Image guidance and registration have become crucial technologies in patient alignment and treatment verification. Image based methods combined with pattern recognition techniques may ultimately provide results satisfying the clinician's and patient's need for precision and comfort. The proliferation of electronic portal imaging further advances the possibility of simultaneous verification and correction of patient treatment fields.

■ TA46

T-Aspen (Mezzanine)

Inventory Modeling III

Contributed Session

Chair: Johan Marklund, Leeds School of Business, University of Colorado, Boulder, CO, 80309, United States, johan.marklund@colorado.edu

1 - Inventory Allocation and Shipping in a Capacitated Manufacturing System
Wooseung Jang, Associate Professor, University of Missouri-Columbia, E3437 EBE, Columbia, MO, 65211, United States, jangw@missouri.edu, Cerry Klein

We address the concept of an integrated inventory allocation and shipping model in a two-echelon supply chain system. The higher echelon is a manufacturer with limited production capacity, who operates in a make-to-stock environment. The lower echelon consists of multiple types of customers who have different backorder/waiting and delivery costs. Our analytical model provides optimally coordinated allocation and delivery policies from the manufacturer's viewpoint.

2 - Heuristic Coordination of Decentralized Inventory Systems Using Induced Backorder Costs
Peter Berling, Lund University. Dep. Industrial Logistics and Management, Box 118, Lund, 22100, Sweden, peter.berling@iml.lth.se, Johan Marklund

We consider a one-warehouse multiple-retailer system where the inventory control decisions are coordinated using a near optimal induced backorder cost, b*. The contributions include insights as to how the system parameters influences b*, and a simple closed form b* estimates, offering practical means to achieve coordinated control of large size problems. The analysis focus on systems with identical retailers, but the results are extended to heterogonous retailers via a simple weighting approach.

3 - A Perishable Inventory Problem with Fixed Lifetime and Backlogging
Fredrik Olsson, Industrial Management and Logistics, Lund University, Box 118, Lund, Sweden, fredrik.olsson@iml.lth.se, Patrik Tydesjö

In this paper we analyze a single echelon, perishable goods model. Items are monitored continuously, and an S-policy is applied for stock replenishments. The lifetime and leadtime are fixed. A paper by Schmidt and Nahmias (1985) consider a perishable inventory model with fixed lifetime and leadtime with lost sales (finite statespace). In this paper we shall allow backorders. The resulting model is no longer exact, but seems to provide a very good approximation.

4 - Reservation Policies for Improved Inventory Control in Divergent Supply Chains with Advance Demand Information
Johan Marklund, Leeds School of Business, University of Colorado, Boulder, CO, 80309, United States, johan.marklund@colorado.edu

The presence of advance-order/advance-demand information raises important questions regarding how to use this information to improve the replenishment and allocation of inventories throughout the supply chain. Focusing on a one-warehouse multiple-retailer system operating in a continuous review environment, we present methods for exact and approximate cost evaluation for three warehouse reservation policies when all installations use order-base-stock policies to replenish their inventories. A numerical study illustrates the performance of the proposed policies and provides insights as to the value of carefully using reservation times as a means for warehouse inventory allocation.

■ TA47

T-Century (Mezzanine)

Software Demonstration

Cluster: Software Demonstrations
Invited Session

1 - CreateASoft- Simcad Process Simulator
Hosni Adra, CreateASoft, 1212 S. Naper Blvd. Ste. 119, Naperville, IL, 60540, United States, hadra@createasoft.com

Still working with code to build simulation models? Check out the new and intuitive approach to model building and simulation with Simcad Pro. Apply the value stream-mapping engine to your model to view process efficiencies and utilizations in real time.

2 - Micro Analysis & Design- Introduction to Micro Saint Sharp
Ben Archer, Micro Analysis & Design, 4949 Pearl East Circle, Ste. 300, Boulder, CO, 80301, United States, barcher@maad.com

Micro Saint Sharp is a general-purpose simulation tool designed to be fast, modular and powerful. It can be used to simulate the complexities of systems within a variety of industries ranging from the military to healthcare. This presentation will provide an overview of Micro Saint Sharp and some of its new modeling capabilities.

Tuesday 10:00am-11:30am

■ TB01

P-Ballroom F

Tutorial: Multiple Criteria Decision Making

Cluster: Tutorials- Denver 2004
Invited Session

1 - Multiple Criteria Decision Making
Pekka Korhonen, Dept. of Quantitative Methods in Economics and Management Science, Helsinki School of Economics, Runeberginkatu 22-24, 00100 Helsinki, Finland, Pekka.Korhonen@Hkkk.fi

This tutorial will provide a brief introduction into the main principles of Multiple Criteria Decision Making (MCDM). We will overview basic concepts, formulations, and principles of solving multiple objective programming problems. To solve those problems requires the intervention of a decision-maker. That is why behavioral assumptions play an important role in multiple objective programming. Which assumptions are made affects which kind of support is given to a decision maker. We also discuss differences between Multiple Criteria Evaluation and Multiple Objective Programming Problems. The main tasks of computer programs are to prevent a decision maker from making "stupid" decisions and to help to find the most preferred solution. There are several common misunderstandings and pitfalls in MCDM. We provide some suggestions for avoiding them. We demonstrate how MCDM may bring some additional ingredients to other research areas like Data Envelopment Analysis (DEA).

■ TB02

P-Ballroom E

Metaheuristics I

Contributed Session

Chair: Edgar Possani, Mexican Institute of Petroleum, PIMAyC, Eje Central Làzaro Càrdenas 152, Colonia San Bartola Atepehuacan, D.F. Mexico City, C.P. 07730, Mexico, epossani@imp.mx

1 - Meta-heuristic Enabled Multiple Agent Optimization for Dynamic Transportation Planning
Kaizhi Tang, Penn State University, 310 Leonhard Building, University Park, PA, 16802, United States, tangkz@yahoo.com, Jeffrey Tew, Soundar R. T. Kumara, Shang-Tae Yee, Jindae Kim, Seogchan Oh, Xuequn Ding

Dynamic optimization with Multi-agent System (MAS) has been proposed for transportation planning in dynamic and contingency environments. However, agent-based heuristics easily converge to local optimality. To improve solution quality, we introduce a new optimization architecture where meta-heuristic strategies control the myopic distributed heuristic in an upper and abstract level. Meta-heuristics are required to be adaptive to MAS for improving almost optimal solutions with dynamic changes.

2 - Heuristic Approaches for Experimentation in Catalyst Optimization
Edgar Possani, Mexican Institute of Petroleum, PIMAyC, Eje Central Làzaro Càrdenas 152, Colonia San Bartola Atepehuacan, D.F. Mexico City, C.P. 07730, Mexico, epossani@imp.mx, Carlos E Valencia Oleta, Margarita Viniegra

We give an overview of algorithms developed to aid catalyst optimization at the Mexican Institute of Petroleum. We present a methodology that uses an evolutionary approach and ideas from simulated annealing to guide the search for optimum catalytic materials based on previous experimentation. We give results on butane isomerization in ZrO2/Al2O3, and compare the approach with other theoretical models. The method leads to higher efficiency and reduction in the number of tested materials.

■ TB04

P-Plaza Court 2

Data Mining in Environmental Modeling

Sponsor: Data Mining
Sponsored Session

Chair: Eva Regnier, Assistant Professor, Naval Postgraduate School, Code 6400, 1522 Cunningham Circle, Monterey, CA, 93943, United States, eregnier@nps.edu

1 - Mining Atlanta Ozone Pollution Data
Julia Tsai, Research Lead, Information Resources Inc., 150 N. Clinton St., Chicago, IL, 60661, United States, Julia.Tsai@infores.com, Victoria Chen

An analysis of 1996 Atlanta ozone pollution data is presented. In particular, the effect of the 1996 Olympic Games in Atlanta was tested, and an exploration of critical emissions locations was conducted. Complicating analysis issues will also be discussed.

2 - An Ozone Pollution Decision-Making Framework
Zehua Yang, University of Texas at Arlington, Dept. of Industrial & Manuf. Sys. Eng., Arlington, TX, 76019, United States, zxy7348@uta.edu, Michael Chang, Victoria Chen

In order to design more sustainable urban environments, a method for evaluating the possibilities must be developed. A decision-making framework (DMF) for studying ground-level ozone pollution in urban Atlanta will be presented. The DMF is based on continuous-state stochastic dynamic programming and utilizes the EPA's Urban Airshed Model to construct the transition of ozone and nitrogen oxide concentrations over time.

3 - Weather Economics: The Business of Weather Uncertainty
Auroop Ganguly, Visiting Research Faculty, University of South Florida, Mail Stop: ENB 118, 4202 East Fowler Avenue, Tampa, FL, 33620, United States, argangul@eng.usf.edu, Shiraj Khan, Amar Gupta

Improved business forecasts can lead to reduced inventory, efficient customer service and better promotions. The demand for products ranging from cold beverage to lawn mowers depends strongly on weather variability. However, weather systems are chaotic, implying limits to predictability. This study focuses on the statistical and data related challenges involved in harnessing weather uncertainties for generating better business forecasts.

4 - Expedient Methods in Environmental Indexing
Kobi Abayomi, Graduate Student, Columbia University, 842 A Seeley Mudd Building, Manhattan, NY, 11225, United States, kabayomi@ciesin.columbia.edu, Andrew Gelman, Upmanu Lall, Greg Yetman

We call an Environmental Index an agglomeration of data compiled to provide a relative measure of environmental conditions. Environmental data is often sparse or non-random missing; many concepts, such as environmental risk or sustainability, are still being defined; indexers must balance modeling sophistication with modeling facility and model interpretability. We review our approaches to these constraints in the construction of the 2002 ESI and the UN Development Programme risk report.

■ TB05

P-Plaza Court 3

Integer Programming Software

Sponsor: Optimization/ Integer Programming
Sponsored Session

Chair: Ted Ralphs, Lehigh University, 200 West Packer Avenue, Bethlehem, PA, 18045, United States, tkralphs@lehigh.edu

1 - DECOMP: A Framework for Decomposition and Dynamic Cut Generation in Integer Programming
Matthew Galati, Optimization Developer, SAS Institute, SAS Campus Drive, Cary, NC, 27603, 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.

2 - A Framework for Implementing Parallel Tree Search Algorithms
Yan Xu, SAS Institute Inc., SAS Campus Drive, R4115, Cary, NC, 27513, United States, Yan.Xu@sas.com, Ted Ralphs, Matt Saltzman, Laszlo Ladanyi

ALPS is a framework for implementing and parallelizing tree search algorithms. It employs a number of features to improve scalability and support the implementation of data intensive algorithms. Implementing such algorithms in a scalable manner is challenging. We describe the design of ALPS and how the design addresses these challenges. We present two sample applications built with ALPS and preliminary computational results.

3 - The New COIN-OR Open Solver Interface
Matthew Saltzman, Assoc. Professor, Clemson University, Mathematical Sciences, Martin Hall, Box 340975, Clemson, SC, 29631, United States, mjs@clemson.edu

The new COIN-OR Open Solver Interface (OSI) is a flexible, extensible C++ class library for building and managing optimization models and for using callable solver libraries. We will describe the new OSI architecture, user calls for building and solving models, and solver interface construction.

■ TB06

P-Plaza Court 4

Stochastic Integer Programming Algorithms

Sponsor: Optimization/Stochastic Programming
Sponsored Session

Chair: Andrew Schaefer, University of Pittsburgh, 1048 Benedum Hall, Pittsburgh, PA, 15261, United States, schaefer@ie.pitt.edu

1 - A Multi-Stage Approach for Stochastic Capacity Planning Problems
Kai Huang, Georgia Institute of Technology, 765 Ferst Drive NW, Atlanta, GA, 30332, United States, kaih@isye.gatech.edu, Shabbir Ahmed

We study a general class of strategic capacity planning problems under uncertainty. A multi-stage mixed integer stochastic program is formulated and useful bounds are developed to justify the Value of Multi-stage Stochastic Program. By decomposition, an efficient heuristic is proposed, where the simple stochastic lot-sizing problem is identified as a key sub structure and solved optimally. The heuristic solution is shown to be asymptotically optimal.

2 - Two-Stage Integer Programs with Stochastic Right-Hand Sides
Nan Kong, University of Pittsburgh, 1070 Benedum Hall, Pittsburgh, PA, United States, nak11@pitt.edu, Brady Hunsaker, Andrew Schaefer

We consider two-stage pure integer programs with discretely distributed stochastic right-hand sides. We present an equivalent superadditive dual formulation that obtains value functions in both stages. We give two algorithms for finding the value functions. Once value functions are obtained, we apply two search strategies to find an optimal tender. We show that our method can solve randomly generated instances that are several orders of magnitude larger than those found in the literature.

3 - Integrated Models for Airline Planning Under Uncertainty
Anne C. Johnson, Dept. of Systems and Industrial Engineering, The University of Arizona, Tucson, AZ, United States, annej@email.arizona.edu, J.L. Higle

Airline planning models often yield problem instances that are computationally challenging. This results in a need to develop sequential planning models. We present an integrated planning scheme that uses “surrogate models” for more complicated subproblems. Results based on preliminary models and computations will be discussed.

■ TB07

P-Plaza Court 5

Advances in Linear and Quadratic Programming

Sponsor: Optimization/Linear Programming and Complementarity
Sponsored Session

Chair: Florian Potra, University of Maryland Baltimore County, Dept. of Math. & Stat., 1000 Hilltop Circle, Baltimore, MD, 21250, United States, potra@math.umbc.edu

1 - Revenue Optimization via Alternating Linear Programming
Florian Potra, University of Maryland Baltimore County, Dept. of Math. & Stat., 1000 Hilltop Circle, Baltimore, MD, 21250, United States, potra@math.umbc.edu, Paul Gorman, Ionut Bebu

The revenue optimization problem (ROP) consists in finding the unit prices of some given commodities and the quantities to be sold from those commodities such that the revenue realized from sales is maximized. If the prices are fixed then the problem reduces to a linear programming problem (LP) in the quantities, and if the quantities are fixed then the problem reduces to an LP in the prices. By alternately fixing the prices or the quantities, we obtain a sequence of linear programs. We study the convergence of the corresponding solutions to the solution of ROP, and present numerical results for some large scale ROPs arising in the cable television industry.

2 - A High Level Parallel Algorithm for Large Scale Quadratic Programming Problems Arising in Support Vector Machines
F. Gurtuna, Department of Mathematics and Statistics, UMBC, 1000 Hilltop Circle, Baltimore, MD, 21250, United States, gurtuna1@umbc.edu, A. Urmanov

We propose a high level parallel decomposition algorithm for solving large scale convex quadratic programming problems with bound constraints on the variables and an equality constraint. This large and dense problem arises in training support vector machines. Decomposition algorithms based on active set approach such as SVM^light may not handle very large problems. Our approach can be seen as a multi-active set approach where we can update more than one group of variables at the same time to obtain some speed-up. This is done by defining independent subproblems and solving each of them in parallel. Considering the local information such as KKT violation or steepest descent direction, each group is given some priority and subproblems are defined accordingly. Preliminary numerical experiments show that this algorithm is promising and these results are presented.

3 - The Central Path Visits all the 2^n Vertices of the Klee-Minty Cube
Tamas Terlaky, Professor, McMaster University, Department of Computing and Software, 1280 Main St. W. Hamilton, Hamilton, ON, L8S 4L7, Canada, terlaky@mcmaster.ca, Antoine Deza, Eissa Nematollahi, Reza Peyghami

It’s known that simplex methods may visit all 2^n vertices of the Klee-Minty cube. We show that, by adding redundant inequalities, the central path can be bended along the edges of the KM-cube and thus the central-path visits all vertices of the KM-cube in the same order as the simplex method does.

■ TB08

P-Plaza Court 6

Optimization and Approximation Algorithms

Sponsor: Optimization/ Network Optimization
Sponsored Session

Chair: Yinyu Ye, Department of Management Science and Engineering, Stanford University, Stanford, CA, 94305, United States, yinyu-ye@stanford.edu

1 - Cycle Covers with Short Cycles
Mohammad Mahdian, Microsoft Research, 1 Microsoft Way, Redmond, WA, 98052, United States, mahdian@theory.lcs.mit.edu, Nicole Immorlica, Vahab Mirrokni

We study a variant of the cycle covering problem in which the objective is to cover a given set of arcs in a weighted complete graph with a collection of cycles, each consisting of at most a given number of edges, to minimize the total weight. This problem was considered by Ergun et. al as a model for the problem faced by collaborative shippers. In this talk, I will describe a simple greedy algorithm proposed by Ergun et al., and will show that the approximation ratio of this algorithm is 1+ln2.

2 - Optimization Algorithms for Multicast Routing in the Internet
Carlos A.S. Oliveira, Assistant Professor, Oklahoma State University, School of Industrial Engineering and Management, 322 Engineering North, Stillwater, OK, 74078, United States, coliv@okstate.edu, Panos Pardalos

Multicast routing is a technique for data communication capable of transmitting data from one source to multiple destinations. We study the problem of minimizing the number of servers necessary for multicast data transmission, known as the streaming cache placement problem (SCPP). We present novel algorithms for different versions of this problem, based on flow techniques. Computational results show that these techniques provide near optimal solutions for a large number of instances of the SCPP

3 - A Multi-Exchange Local Search Algorithm for the Capacitated Facility Location Problem
Jiawei Zhang, New York University, Stern School of Business, New York, NY, 10012, United States, jiazhang@stanford.edu, Bo Chen, Yinyu Ye

We present a multi-exchange local search algorithm for approximating the CFLP, where a new local improvement operation is introduced that possibly exchanges multiple facilities simultaneously. We give a tight analysis for our algorithm and show that the performance guarantee of the algorithm is 5.83. In order to obtain the tight bound of our new algorithm, we make interesting use of techniques from the area of parallel machine scheduling.

■ TB09

P-Plaza Court 7

Emerging Techniques and Applications for Nonlinear Programming

Sponsor: Optimization/ Nonlinear Programming
Sponsored Session

Chair: Mihai Anitescu, Computer Scientist, Argonne National Laboratory, 9700 South Cass Ave., MCS, building 221, Argonne, IL, 60637, United States, anitescu@mcs.anl.gov

1 - Interior-Point Algorithms, Penalty Methods and Equilibrium Problems
Hande Benson, Drexel University, Dept. of Decision Sciences, 3141 Chestnut Street, Philadelphia, PA, 19104, United States, benson@drexel.edu, Arun Sen, David Shanno, Robert Vanderbei

In this talk, we consider the question of solving mathematical programs with equilibrium constraints as nonlinear programs, using an interior-point approach. These problems pose theoretical difficulties for nonlinear solvers, including interior-point methods. We examine the use of penalty methods to get around these difficulties, and present substantial numerical results. We go on to show that penalty methods can resolve some problems that interior-point algorithms encounter in general.

2 - An Inexact Newton Path-Following Interior-Point Algorithm for Nonlinear Programming
Leticia Velazquez, Assistant Professor, University of Texas at El Paso, 500 W. University Ave., El Paso, TX, 79968-0514, United States, leti@math.utep.edu, Miguel Argaez, Jaime Hernandez, Jr.

We present a path-following algorithm suited for solving large scale and/or degenerate nonlinear programs. We use interior-point methodology, a linesearch strategy within a trust region globalization strategy, and the conjugate gradient method with Steihaug's termination tests. The algorithm's path-following strategy makes use of the quasicentral path, the modified augmented Lagrangian, and weighted proximity measures. Some promising numerical results are reported.

3 - Global Convergence for an Elastic Mode Approach for NLP with Complementarity Constraints
Mihai Anitescu, Computer Scientist, Argonne National Laboratory, 9700 South Cass Ave., MCS, building 221, Argonne, IL, 60637, United States, anitescu@mcs.anl.gov, Paul Tseng, Stephen Wright

We present a globally convergent algorithm for a special class of mathematical programs with complementarity constraints. This class is a broad enough to include any instance of the obstacle problem. We show that convergence to C stationary points is in short without any other assumption on the accumulation points, and convergence to strongly stationary points is achieved under stronger assumptions. Numerical simulations demonstrate our findings.

■ TB10

P-Plaza Court 8

Freight Transportation Systems

Sponsor: Transportation Science & Logistics
Sponsored Session

Chair: David Hunt, Cambridge Systematics, Inc., P.O. Box 816, Pennington, NJ, United States, dhunt@camsys.com

1 - Integrated Capacity Management for Transportation Services
Yuwei Li, University of California Berkeley, 416 McLaughlin Hall, Berkeley, CA, United States, yuli@uclink.berkeley.edu

Low demand density, high demand variations and inflexible labor contracts often make time-differentiated transportation services with dedicated capacities expensive to provide. This research establishes a simulation framework for studying the use of shared capacity and temporary help (subcontracting) to meet fluctuating demands, and quatifies the value of deferral flexibility. Applications in parcel delivery are discussed.

2 - Capacity Modeling for Multimodal Freight Transportation Systems
Minyoung Park, University of California, Irvine, Institute of Transportation Studies, Irvine, CA, 92697, United States, mypark@uci.edu, Amelia Regan

We briefly review the evolution of capacity models for use in transportation systems planning and investment. We provide an in-depth discussion of recent advances towards an integrated, system-oriented capacity model and their applicability in the multimodal freight transportation context and discuss our current research on this topic.

3 - Concept for a Freight Model Improvement Program
David Hunt, Cambridge Systematics, Inc., P.O. Box 816, Pennington, NJ, United States, dhunt@camsys.com

State and local planners use travel demand models to allocate public money to transportation projects. Because these models were designed for passengers, freight projects are often underrepresented and underfunded. The Travel Model Improvement Program (TMIP) provides funding for the next generation of travel demand models, but the focus is again on passengers. We will review a Freight Model Improvement Program (FMIP) proposed at TRB, and discuss the primary modeling issues.

■ TB11

P-Governor's Square 9

Public Transit

Sponsor: Transportation Science & Logistics
Sponsored Session

Chair: Aichong Sun, the University of Arizona, 1209 E. 2nd St., P.O.BOX 210072, Tucson, AZ, 85721-0072, United States, suna@email.arizona.edu

1 - Design and Realization of a Multi-modal/Multi-Agency Transit Management and Information System
Daniel J. Dailey, Professor, University of Washington, Box 352500, Dept. of Electrical Engineering, Seattle, WA, 98155, United States, dan@its.washington.edu, Frederick Cathy, Stuart Maclean

In this paper we describe an ongoing project that uses the component architecture described in earlier work to combine maps, schedules, and AVL information from four transit agencies. The result is a set of web applications suitable for both transit management and traveler information. We describe both the technical and administrative challenges to be overcome in building a regional (10,000 square miles) transit AVL and information system.

2 - The Holding Problem at Multiple Holding Stations
Aichong Sun, the University of Arizona, 1209 E. 2nd St., P.O.BOX 210072, Tucson, AZ, 85721-0072, United States, suna@email.arizona.edu, Mark Hickman

Holding problem at multiple holding stations are formulated within a deterministic transit service model context. Also, a simulation based study is conducted to compare the performance of the strategies of holding vehicles at multiple holding stations and at a selected single holding station.

3 - An Equilibrium Transit Assignment Model with Capacity Constraints
Michael Florian, Professor, University of Montreal, Centre for Research on Transportation, Montreal, QB, H3C 3J7, Canada, mike@crt.umontreal.ca, Roberto Cominetti, Manuel Cepeda

This new transit assignment algorithm is based on the work of Cominetti and Correa who studied a transit assignment model with capacity constraints for a simple single O-D pair network with non overlapping common lines. The model is based on the minimization of a gap function. Every transit flow pattern that yields a gap of value zeo is an equilibrium flow that satisfies the capacity constraints. Several applications on networks originating from practice are presented.

4 - Tabu Search for the Transit Route Network Design Problem
Wei Fan, Ph.D Student, Department of Civil Engineering , The University of Texas at Austin, 1 University Station, C1761, ECJ 6.908, Austin, TX, 78712, United States, weifan@mail.utexas.edu, Randy Machemehl

A Tabu search (TS)-based heuristic method, for the first time, is applied to solve the optimal transit route network design problem (TRNDP). A multi-objective nonlinear mixed integer model is formulated. Comprehensive example networks are successfully tested. Sensitivity analyses are performed and related characteristics for the TRNDP are identified. Numerical results clearly indicate that the preferred Tabu search method outperforms the genetic algorithm used as a benchmark.

■ TB12

P-Governor's Square 10

Transportation I

Contributed Session

Chair: German Riano, Assistant Profesor, Universidad de los Andes, Ingenieria Industrial, Cra 1Este #18A-70, Bogota, DC, N/A, Colombia, griano@uniandes.edu.co

1 - Economic Indicators for the U.S. Transportation Sector
Vincent Yao, Research Assistant Professor, UALR, 2801 S University Avenue, UALR-IEA, Little Rock, AR, 72204-1099, United States, wxyao@ualr.edu

Since the transportation sector plays an important role in business cycle analysis due to its pervasive connections with different stages of the economy, I have undertaken to develop indicators for this sector and shed light on its current and future states. Indexes of coincident indicators are created for this sector using both conventional NBER method and dynamic factor models. Then several leading indicators are selected under rigorous statistical procedures to forecast them.

2 - An Application of Markov Chains to Timetable Buffer Allocation
Steven Harrod, Student, University of Cincinnati, 828 Summerville Dr., Lexington, KY, 40504, United States, harrodss@email.uc.edu

Train delays can be modeled as a Markov chain, and useful results can be accomplished using matrix methods within Microsoft Excel. Timetable planners frequently have a choice in the allocation of slack time in a railway timetable. The quantity and allocation of this slack time among multiple station stops or travel segments affects both mean travel time and the quality of customer service (on time performance). These results are comparable with previous analysis using simulation.

3 - A Multiclass Simultaneous Transportation Equilibrium Model
M. K. Hasan, Associate Professor, Kuwait University, P.O. Box 5486, Safat, Kuwait, 13055, Kuwait, mkamal@cba.edu.kw

The Simultaneous Transportation Equilibrium Model (STEM) that developed by Safwat and Magnanti in 1988 is developed to a multiclass model in term of socio-economic group, trip purpose, pure and combined transportation modes, as well as departure time, all interacting over a physically unique multimodal network. The MSTEM is formulated as a Variational Inequality problem and a diagonalization algorithm is developed to solve it.

4 - Vehicle Routing, Congestion and Queueing Theory
Laoucine Kerbache, HEC, P, Paris, France, kerbach@hec.fr, Tom van Woensel, Nico Vandaele, Herbert PEremans

Transportation is an important component of supply chain competitiveness since it plays a major role in the inbound, inter-facility, and outbound logistics. In this context, assigning and scheduling vehicle routing is a crucial management problem. Here, routing problems with time-dependent travel times due to traffic congestion are considered. The approach developed introduces the congestion component modeled through a queueing model combined with an Ant Colony Optimization heuristic.

5 - An Optimal City Buses Dispatching Stochastic LP Model
German Riano, Assistant Profesor, Universidad de los Andes, Ingenieria Industrial, Cra 1Este #18A-70, Bogota, DC, N/A, Colombia, griano@uniandes.edu.co

We present a single route optimal dispatching model. The model is linear, yet it considers important issues like random travel times and random, dynamic demand. The same model can be used for other modes of massive transit where the frequency is high enough so that users do not need to know the schedule in advance. The solution technique is based on a novel Transient Little Law.

■ TB13

P-Governor's Square 11

Joint Session Aviation/TSL: Integrated Airline Planning

Sponsor: Aviation Applications, Transportation Science & Logistics
Sponsored Session

Chair: Diego Klabjan, Assistant Professor, University of Illinois at Urbana-Champaign, Dept. of Mechanical and Industrial Eng., 140 Mechanical Engineering Building, Urbana, IL, 61801, United States, klabjan@uiuc.edu

1 - A Scheduling Problem in Fractional Ownership Airlines
Ozlem Ergun, Assistant Professor, Georgia Tech, 765 Ferst Drive, Atlanta, GA, 30332, United States, oergun@isye.gatech.edu, Ellis Johnson, Kathe Yao

A fractional jet owner is entitled to a certain number of flight hours per year and the management company is responsible for all the operational considerations of the aircrafts and serving all customer demand. We present a scheduling approach for the management company which considers: crew transportation and overtime costs, scheduled and unscheduled maintenance effects, crew rules, and the presence of a non-crew-compatible fleets. We present the results of a computational study on real data.

2 - Integrated Airline Planning
Diego Klabjan, Assistant Professor, University of Illinois at Urbana-Champaign, Dept. of Mechanical and Industrial Eng., 140 Mechanical Engineering Building, Urbana, IL, 61801, United States, klabjan@uiuc.edu, Rivi Sandhu

Strategic planning of an airline is typically performed sequentially. First an equipment type is assigned to each flight, next an aircraft is found for each flight, and at the end a crew assigned to each flight. These methodology produces suboptimal solutions since the solution to fleeting decomposes the problem for the remaining two problems. We propose a model that simultaneously produces a solution to all three problems. We study two solution methodologies for solving the model. The first one is based on a combination of Lagrangian decomposition and column generation. The second one hinges on Benders' decomposition. We present computational experiments.

3 - Fleeting with Passenger and Cargo Origin-destination Booking Control
Diego Klabjan, Assistant Professor, University of Illinois at Urbana-Champaign, Dept. of Mechanical and Industrial Eng., 140 Mechanical Engineering Building, Urbana, IL, 61801, United States, klabjan@uiuc.edu, Rivi Sandhu

Passenger revenue is on decline. Most airlines realized that there is potential in squeezing additional revenue from cargo. Particularly in the US, where combination airlines were oblivious to cargo, there is a sudden shift on focusing more on the cargo component of the revenue. Traditionally, the assignment of equipment types or fleets to flights is based solely on the passenger demand and their revenue. We study how to incorporate cargo revenue into fleeting. We propose a model that captures origin-destination passenger traffic and origin-destination cargo traffic. We solve the underlying problem by Benders' decomposition. Computational experiments are presented.

4 - Solving Larger Pairing Problems
Curt Hjorring, Carmen Systems, Odinsgatan 9, Gothenburg, SE-411 03, Sweden, curt.hjorring@carmensystems.com

Column generation has been applied successfully to solve airline crew pairing problems. However, there is a desire to solve larger problems in order to give further improvements in the airline planning process, and to solve problems originating from the railway market. We present algorithmic techniques that are useful to solve such problems. For instance, Lagrangian relaxation, along with a subgradient solver, gives much better dual feedback than an LP based approach, and has much lower computational overhead. With these techniques we are able to find high quality solutions to daily railway pairing problems with over 7,000 legs.

■ TB14

P-Governor's Square 14

Modern Technical and Professional Work

Sponsor: Technology Management
Sponsored Session

Chair: Diane Bailey, Stanford University, 428 Terman, Stanford, CA, 94305-4026, United States, diane.bailey@stanford.edu

1 - GM Work Systems: Improving White-Collar Work
William Jordan, GM R&D Center, MC 480-106-256, 30500 Mound Road, Warren, MI, 48090-9055, United States, william.c.jordan@gm.com, Susan Owen, Jan Benson

From Adam Smith's division of labor principles to lean manufacturing principles, work principles have been very effective for improving manufacturing productivity. Different principles are needed, however, for improving white-collar work system performance. This talk defines what we mean by work systems and principles, proposes work system dimensions that require different principles for effective performance, and describes our proposed approach to improving work system performance.

2 - GM Work Systems: Defining and Measuring Dimensions of Work
Jan Benson, GM R&D Center, MC 480-106-256, 30500 Mound Road, Warren, MI, 48090-9055, United States, jan.benson@gm.com, Susan Owen, William Jordan

We identify important dimensions of work that have been studied in the psychological and social science literatures and have a relationship with performance. We also describe dimensions of work important to the industrial engineering/operations research literature. We will discuss the development of a survey to assess the fourteen identified dimensions of work, ten of which have measurement scales of previously demonstrated reliability and validity.

3 - GM Work Systems: Applying Principles to Improve IE Work
Susan Owen, GM R&D Center, MC 480-106-256, 30500 Mound Road, Warren, MI, 48090-9055, United States, susan.owen@gm.com, William Jordan, Jan Benson

We review a case study focused on the work performed by a group of Industrial Engineers (IEs). Specifically, we describe efforts to understand the content of their work, to identify principles for improving that work, and to develop and deliver a workshop for teaching those principles. In addition to generating initiatives to improve the IEs' work, the workshop provided valuable lessons on methods for applying principles to improve work performance.

4 - What Engineers Do: A Close Study of Engineering Tasks and Activities
Hallie Kintner, GM R&D Center, MC 480-106-359, 30500 Mound Road, Warren, MI, 48090-9055, United States, hallie.kintner@gm.com, Diane Bailey

In this observational study of engineers at work, we examine engineers' tasks and activities to develop a rich description of engineering work. In particular, we go beyond broad generalizations as reflected in terms like "design" and "analysis" by detailing the types of activities that engineers engage in when carrying out these higher-order purposes. We comment upon the time engineers spend working alone and with others as well as the nature of their interactions with people and technology.

■ TB15

P-Governor's Square 15

Supply Chain Optimization and Scheduling

Cluster: Scheduling
Invited Session

Chair: Lei Lei, Rutgers University, Rutgers Business School, Newark and New Brunswick, NJ, United States, llei@andromeda.rutgers.edu

1 - Disruption Management in Production Planning
Jian Yang, Assistant Professor, New Jersey Institute of Technology, Department of IME, Newark, NJ, 07102, United States, yang@adm.njit.edu, Xiangtong Qi, Gang Yu

We study the problem of recovering a production plan after a disruption. For the general-cost case, we propose a dynamic programming method for the problem. For the convex-cost case, we propose a greedy method which is provably efficient.

2 - Order Assignment and Scheduling in a Supply Chain
Zhi-Long Chen, University of Maryland, College Park, MD, 20742, United States, zchen@rhsmith.umd.edu, Guruprasad Pundoor

We consider an order assignment and scheduling problem in a make-to-order supply chain consisting of several plants and a distribution center. Orders received need to be assigned to the plants and the detailed scheduling of orders needs to be determined at each plant. The objective is to minimize a weighted sum of the production cost and order delivery lead time. We study various cases of the problem and analyze the worst-case and asymptotic performance of several heuristics

3 - Coordinating Inventory Policies in Supply Chains with Stochastic Lead Times
Yao Zhao, Rutgers University, 180 University Ave, Newark, NJ, 07102, United States, yaozhao@andromeda.rutgers.edu, David Simchi-Levi

We address the question of how to optimally coordinate simple inventory policies in multi-stage supply chains with stochastic sequential lead-times. The theory of the exogenous, sequential supply systems is extended to a framework that provides exact characterization of the performance of various supply chain topologies including the intricate correlations in multi-stage multi-product assembly systems. An numerical example is used to develop managerial insights

4 - On the Zero-Inventory Production and Distribution Problem with Time Window Constraints
Lei Lei, Rutgers University, Rutgers Business School, Newark and New Brunswick, NJ, United States, llei@andromeda.rutgers.edu

We study the production and distribution problem involving a short shelf-life product, a single delivery truck, and time window constraints on delivery times. The objective is to minimize unsatisfied demand. We analyze the properties of optimality of the solution and propose a local optimization algorithm based on these properties

■ TB16

P-Governor's Square 17

Algorithms and Software for Linear Programming

Sponsor: Computing Society
Sponsored Session

Chair: Nick Sahinidis, Professor, University of Illinois, Dept. of Chemical and Biomolecular Eng., 600 South Mathews Avenue, Urbana, IL, 61801, United States, nikos@uiuc.edu

1 - Implementing a Generalized Dual Pivoting Scheme
Lou Hafer, Simon Fraser University, School of Computing Science, Burnaby, BC, V5A 1S6, Canada, lou@cs.sfu.ca

Generalized dual pivoting attempts to use primal bound-to-bound flips to increase the allowable dual motion for a pivot. This talk will describe the implementation of this idea in dylp: what worked, what didn't, and some serendipitous benefits. Computational experience with netlib and miplib problems will be provided.

2 - The LP Dual Active Set Algorithm
William Hager, Professor, University of Florida, Department of Mathematics, 358 Little Hall, Gainesville, FL, 32611-8105, United States, hager@math.ufl.edu, Timothy Davis

We present a factorization-based implementation of the LP Dual Active Set Algorithm. This implementation exploits a proximal approximation to the dual function, a strategy for dropping inactive equations from the constraints, and recently developed algorithms for updating a sparse Cholesky factorization after a small rank change. We compare solution times to those of simplex and barrier algorithms, as implemented in CPLEX, using the Netlib LP Test Problems.

3 - A Solver for Dense LP Problems
Richard Van Slyke, Professor of Computer Science, Polytechnic University, 6 Metrotech Center, Brooklyn, NY, 11201, United States, rvslyke@poly.edu, Gavriel Yarmish

We discuss a LP solver, retroLP, based on the standard form of the simplex method that is freely available for non-commercial research applications. It is effective for dense problems and can easily be modified to make a scalable, coarse grained, distributed solver using clusters. We will address at a high level: (1) How dense does a problem need to be for retroLP to offer benefits; (2) what applications tend to lead to dense LPs; and (3) how scalable can the distributed extension be?

4 - An Independent Evaluation of Continuous LP Codes
Hans Mittelmann, Professor, Arizona State University, Box 871804, Tempe, AZ, 85287-1804, United States, beck@plato.asu.edu

We will report on the performance of continuous LP programs for medium and larger size problems. Both simplex-based and interior point codes will be considered. The comparison includes several free codes and contrasts their performance with that of a few commercial products.

■ TB17

P-Directors Row E

Dynamic Programming Models

Sponsor: Decision Analysis
Sponsored Session

Chair: Laura Kornish, Assistant Professor, Fuqua School of Business, Duke University, Box 90120, Durham, NC, 27708-0120, United States, kornish@mail.duke.edu

1 - Policies for Flexible Production Systems
Canan Ulu, The Fuqua School of Business, Duke University, Durham, NC, 27708, United States, canan.ulu@duke.edu, James E. Smith

We consider a dynamic programming model of a flexible production system where one can switch from one process to another (say, from an oil-fired to a gas-fired process) or suspend production. The rewards of each process are stochastic and switching is costly. We characterize the optimal policy and value function.

2 - Optimal Dynamic Strategies in Salesforce Compensation
Ayse Kocabiyikoglu, INSEAD, Boulevard de Constance, Fontainebleau, France, ayse.kocabiyikoglu@insead.edu, Ioana Popescu

We investigate the problem of a sales agent deciding among different costly sales strategies over a multi-period sales horizon. The objective of the agent is to optimize the final utility of his sales-dependent compensation, minus the cost of the sales strategies. Our work extends the sales force compensation literature by considering a dynamic model, and providing conditions for a monotone policy to be optimal.

3 - Optimal Investment Scale-up With Noisy Returns
Neda Farzinnia, The Anderson School at UCLA, 110 Westwood Plaza, Box 951481, Los Angeles, CA, 90095-1481, United States, neda@stat.ucla.edu, Kevin McCardle

The investment strategy of a firm depends in part on its resources that pertain to an investment. There are different types of resources with various levels of specificity; we examine a firm's decision to scale up its general investment, scale up its specialized investment, or cease investment. The firm invests and observes the return on general and specific assets. However, these observations are noisy and so the optimal investment policy is obtained through sequential decision-making.

4 - Search and the Adoption of Improved Technologies
Laura Kornish, Assistant Professor, Fuqua School of Business, Duke University, Box 90120, Durham, NC, 27708-0120, United States, kornish@mail.duke.edu, Steven Lippman, John Mamer

We consider a model of search for improved technology, allowing for the adoption of interim solutions: the monopolist earns revenue on his installed technology while he searches for an even better one. We show that the optimal policy is characterized by thresholds and examine the effects of experience.

■ TB18

P-Directors Row H

Communications Service Models

Sponsor: Telecommunications
Sponsored Session

Chair: Neil Keon, Assistant Professor, Cox School of Business, SMU, P.O. Box 750333, Dallas, TX, 75275, United States, nkeon@mail.cox.smu.edu

1 - Optimal Loading of Generalized Demands over Various Network Topologies
Steven Cosares, Hofstra University, Hempstead, NY, 11549, United States, acsstc@hofstra.edu

Loading problems seek to find routes for demands that minimize the level of the most trafficked link. For problems arising in network survivability, the "demands" may be generalized to be satisfiable using a set of alternative paths, some of which may have different endpoints. We investigate this more general problem, which models a great variety of well-known network applications, and its behavior over some specific network topologies.

2 - Strategic Management in the Telecommunications Industry
Steven Powell, California State Polytechnic University, Pomona 3801 W. Temple Ave, Pomona, CA, 91768, United States, srpowell@csupomona.edu

Strategic management is now a well-developed discipline with widespread applicability. This paper examines some of the current thinking in strategic management, illustrating it with examples drawn from the telecommunications industry.

3 - Economics of VoD Infrastructure
Joakim Kalvenes, Assistant Professor, Cox School of Business, SMU, P.O. Box 750333, Dallas, TX, 75275, United States, kalvenes@smu.edu, Neil Keon

We examine the market for video on demand considering technically feasibility and financially viability. We treat quality of service as a threshold factor for consumers purchasing decisions for video on demand. We derive the economic conditions under which the network infrastructure will be provided and a viable market can exist.

4 - A Communications Revenue Management Scheme
Neil Keon, Assistant Professor, Cox School of BUsiness, SMU, P.O. Box 750333, Dallas, TX, 75275, United States, nkeon@mail.cox.smu.edu, Joakim Kalvenes

We study a revenue management scheme that increases potential capacity, where the network offers a generic communications service. The scheme is implemented at the time scale of connections (not packets) and smoothes demand allowing higher utilization and thus increased revenue.

■ TB19

P-Directors Row F

Industrial Applications

Cluster: Reverse Supply Chains
Invited Session

Chair: Elif Akcali, Assistant Professor, University of Florida, Dept. of Industrial & Systems Eng., Gainesville, FL, 32611-6595, United States, akcali@ise.ufl.edu

1 - Logistical and Legislative Uncertainties in Closed-Loop Asset Management
Manu Sharma, Ph.D. Candidate, Georgia Tech, ISyE, 755 Ferst Drive, NW, Atlanta, GA, 30332-0205, United States, manu@isye.gatech.edu, Jane Ammons

We investigate the effects of logistical and legislative uncertainties on asset management decisions faced by a U.S. national electronic equipment leasing company. Our approach captures uncertainty with discrete-scenarios and performs analysis using a mixed integer linear programming model. Results highlight the implications of uncertainties in transportation costs and environmental legislation, and the interactions between them, for end-of-life product flows and lease length decisions.

2 - Georgia Computer Equipment Disposal and Recycling Council
Jane Ammons, Professor, Georgia Institute of Technology, ISyE, 755 Ferst Drive, Atlanta, GA, 30332-0205, United States, jammons@isye.gatech.edu

Created by the Georgia Legislature in 2002, the Computer Equipment Disposal and Recycling Council (CEDRC) advises the governor and legislature to improve the state's collection and processing of used electronics. In this talk, the CEDRC chair will overview the way the council works with recyclers, OEMs, waste management firms, federal and state agencies, municipal and local governments, non-profits, and other entities and uses operations research models for comprehensive analyses.

3 - Hewlett-Packard's Implementation Social and Environmental Responsibility Programs
Andre Kuper, Hewlett-Packard Co, United States, andre.kuper@hp.com, Steven Rockhold

Hewlett-Packard's long history of environmental responsibility has resulted in a comprehensive Supply Chain Social and Environmental Responsibility Program. HP has initiated product take-back programs to recycle computers and related products. HP has also developed collaborations with suppliers to perform self assessments and audits to improve the recyclability of the product. In this talk, we will discuss the supply chain issues, challenges, and opportunities associated with these programs.

4 - Challenges and Opportunities in Creating a Remanufacturing Strategy for OEM in Automotive Industry
Devadatta Kulkarni, Staff Research Scientist, General Motors R&D, 30500 Mound Road, MC: 480-106-359, Warren, MI, United States, datta.kulkarni@gm.com, Jeffrey Tew, Elif Akcali

In this talk, we first give a current outlook of the automotive parts remanufacturing. We then examine the opportunities for the original equipment manufacturer (OEM) to create a competitive advantage and provide improved service support for its customers through remanufacturing. We also discuss the current and expected operational and organizational challenges faced by the OEM, and conclude the talk discussing automotive experiences and vision for the future of its remanufacturing business.

■ TB20

P-Room 3304

Optimization in Healthcare

Sponsor: Health Applications
Sponsored Session

Chair: Michael Carter, Professor, University of Toronto, Mechanical & Industrial Engg, 5 Kings College Rd, Toronto, ON, M5S 3G8, Canada, carter@mie.utoronto.ca

1 - Optimizing the Management of Severe Community-acquired Pneumonia and Sepsis: A MDP Approach
Jennifer Kreke, University of Pittsburgh, 1048 Benedum Hall, Pittsburgh, PA, 15261, United States, jekst11@pitt.edu, Andrew Schaefer, Matthew Bailey, Mark Roberts, Derek Angus

We introduce a Markov decision process (MDP) model to determine the optimal conditions under which to discharge a patient from the intensive care unit. Our model considers the patient's life expectancy in addition to quality of life issues and economic factors such as cost of care.

2 - Screening for BRCA Genetic Mutations - A Policy Analysis
Elissa Ozanne, Institute for Technology Assessment, Harvard Medical School, 101 Merrimac Street, 10th Floor, Boston, MA, 02114-4724, United States, elissa@mgh-ita.org, Laura Esserman, Michelle Cameron, Thomas Newman

A Markov model was developed to estimate the cost-effectiveness of using genetic testing to identify women at increased risk for breast cancer. The developed model serves as a platform to evaluate the impact of risk assessment efforts in combination with prevention interventions. Insights from the model can be used to determine risk thresholds for use and inform policy regarding risk assessment tools and prevention interventions.

3 - A Decision Support Framework for Modelling Patient Flow
Christos Vasilakis, Post-doctoral Fellow, University of British Columbia, C.C.E.E. 828 West 10th, VGH Research Pavilion, Vancouver, BC, V5Z 1L8, Canada, C.M.Vasilakis@wmin.ac.uk, Elia El-Darzi

Traditionally, patient flow models have been developed from clinical and operational perspectives. However, the former are not suitable while the latter are costly to develop and not easily replicated. A third category, compartmental models of patient flow may offer a practical level of simplification and abstraction. In this paper, we present a framework that is designed to identify the different streams of patient flow and to investigate the effects of the interaction between them.

■ TB21

P-Room 3302

Panel Discussion on Spreadsheet Research

Sponsor: Spreadsheet Productivity Research
Sponsored Session

Chair: Thomas Grossman, Associate Professor, University of San Francisco, Masagung School of Management, San Francisco, CA, 94117-1045, United States, tagrossman@usfca.edu

1 - Panel Discussion on Spreadsheet Research
Moderator: Thomas Grossman, Associate Professor, University of San Francisco, Masagung School of Management, San Francisco, CA, 94117-1045, United States, tagrossman@usfca.edu

Spreadsheets are the dominant tool for business analytics, and the most widely used platform for Operations Research. Surprisingly little is known about them. In this interactive session, experienced researchers discuss what we know, and what we don't know, about how spreadsheets are created and used. With the audience, we'll explore opportunities to do impactful research with the potential to influence business practice.

■ TB22

P-Room 3312

Mobility Applications II

Sponsor: Military Applications
Sponsored Session

Chair: Andy Armacost, Associate Professor, US Air Force Academy, 2354 Fairchild Drive, 6J100, Colorado Springs, CO, 80840, United States, andy.armacost@usafa.af.mil

1 - The Optimizing Simulator for the Military Airlift Problem with MOG
Warren Powell, Princeton University, Engineering Quad, Princeton University, Princeton, NJ, United States, powell@Princeton.EDU, Tony Wu, Alan Whisman

The optimizing simulator is an adaptive learning technology for dynamic resource management under uncertainty. We describe the adaptation of this technology to the airlift mobility problem. In this talk, we also describe how we handle airbase capacity constraints which we model using a soft congestion function. We show how we overcome the "long haul bias" implicit in myopic policies.

2 - Mathematically Modeling Pre-Positioning and Movement of Munitions

Ray Hill, Associate Professor, Wright State University, 232 Russ Engineering Center, 3640 Colonel Glenn Hwy, Dayton, OH, 45435, United States, ray.hill@wright.edu

The Air Force uses pre-positioning as to deploy forces rapidly without requiring an increased overseas presence. This research defines and develops a mathematical model to aid decision makers with a strategy for positioning and configuring pre-positioned assets. The resulting Pre-Po model developed is a mixed integer program and was tested against a realistically stressing planning scenario. Analytical results and insights are presented along with avenues for further work.

3 - Optimization Models to Support Air Mobility Command's Channel Route Execution

Andy Armacost, Associate Professor, US Air Force Academy, 2354 Fairchild Drive, 6J100, Colorado Springs, CO, 80840, United States, andy.armacost@usafa.af.mil, Steve Kolitz, Corbin Koepke, Cynthia Barnhart

Air Mobility Command operates a worldwide network of cargo planes to move material in both peacetime and during war. The peacetime routes are known as Channel Routes. In this work, we present two optimization models to support the execution of these routes. The first helps planners respond to real-time disruptions in the channel route network by rerouting cargo and/or aircraft. The second helps planners resolve on-ground capacity issues that arise from these disruptions.

4 - Group Theoretic Tabu Search (GTTS) for the Group Minimization Problem

Gary Kinney, Univ of Texas, 1043 Running River, New Braunfels, TX, 78130, United States, gkinney@mail.utexas.edu, J. Wesley Barnes

The Group Minimization Problem (GMP), developed by Gomory, is the problem of deriving the optimal integer solution for an integer program (IP) from the optimal solution to its linear relaxation. Any integer program can be solved by first solving its linear relaxation then solving the resulting GMP. We develop a group theoretic based tabu search algorithm to solve the GMP and thus develop an effective algorithm to solve the general IP.

■ TB23

P-Room 3354

Systems of Systems Analysis

Sponsor: Military Applications
Sponsored Session

Chair: Hoa Generazio, Executive Officer and Senior Military Assistant, US Army, 102 Army Pentagon, Washington, DC, 10310, United States, hoa.generazio@us.army.mil

1 - Information Reliability & Uncertainty in NCO Systems

Patrick Driscoll, Professor, U.S. Military Academy, Dept of Systems Engineering, West Point, NY, 10996, United States, pat-driscoll@usma.edu, Edward Pohl, Michael Tortorella

In this session we present our current framework for examining issues of system quality associated with Network Centric Operations for the US military that involve service reliability, information quality and classical reliability. We will discuss select preliminary findings and comment on the implications for system of systems analysis as well.

2 - Missions and Means Framework (MMF) based Evaluation

Jack Sheehan, DOTE, 4850 Mark Center Drive, Alexandria, VA, 22311, United States, jack.sheehan@osd.mil, Paul Deitz

Problem: The essence of military art is to disrupt key interdependencies so that the opposing force "whole" is less than "the remaining parts". Method: MMF assesses how parts contribute to the whole using four iterative (layered and recursive) procedures: 1) top-down decomposition to identify interdependencies, 2) Execution to determine capabilities/limitations, 3) bottom-up effects traceability to estimate mission impact, and 4) planning/re-planning to adapt behavior to warfare outcomes. By whatever name (maneuver warfare, effects-based operationsÖ) the essence of military art is to disrupt key interdependencies so that the opposing force "whole" is profoundly less than "the remaining parts". Similarly, the vision of net-centric warfare is that pervasive situation understanding generates synergies that enable the own force "whole" to be substantially greater than "the sum of the parts". A disciplined, repeatable procedure is required to translate measured capabilities and limitations into a mission-based evaluation of effectiveness, suitability, and survivability. This framework should explicitly account for how "the parts" do and do not "sum to the whole" in the "slings and arrows of outrageous fortune" of military operations. The mission decomposition and assessment procedure should account for the tangible, physical objectively measurable factors (traditional T&E) as well as the intangible, cognitive (ultimately) subjective factors (traditional warfighter expertise) that constitute mission success. The Missions and Means Framework assesses how parts contribute to the whole using four iterative (layered and recursive) procedures: 1) top-down decomposition (mission, task, capability, solution) to identify interdependencies, 2) Execution and adjudication to determine capabilities/limitations, 3) bottom-up effects traceability to estimate mission impact, and 4) planning/re-planning to adapt behavior to warfare outcomes. These procedures are extensions of the military decision making process, systems engineering functional decomposition, field testing and wargaming methods, and degraded-states fault-tree assessments. This paper demonstrates MMF-based evaluation using a US Army Future Combat Systems (FCS) example.

3 - Maritime Dominance in the Littorals: A System of Systems Analysis by NPS Students

Dave Olwell, Ph.D, Associate Director, Meyer Institute of Systems Engineering, Naval Postgraduate School, United States, dholwell@nps.edu

The spring 2004 integrated campus research project at NPS was a design of a system of systems for maritime dominance in the littorals and involved 40 students and a dozen faculty members. Students developed and compared three architectures. They selected a balanced hybrid architecture of manned and unmanned systems over architectures consisting of primarily manned or primarily unmanned systems, based on a hierarchical value needs analysis. This presentation describes their process and summarizes the results.

■ TB24

P-Room 3402

Successes and Innovations in the Teaching of Introductory OR Courses

Cluster: Undergraduate OR Education
Invited Session

Chair: Dale Peterson, US Air Force Academy, HQ USAFA/DFMS, 2354 Fairchild Dr #6D2A, USAF Academy, CO, 90840-6252, United States, Dale.Peterson@USAFA.af.mil

1 - Objectives and Evaluation in a Deterministic OR Course

Dale Peterson, US Air Force Academy, HQ USAFA/DFMS, 2354 Fairchild Dr #6D2A, USAF Academy, CO, 90840-6252, United States, Dale.Peterson@USAFA.af.mil

After teaching LP many times, I have found that students do not internalize the material and assessment is reduced to mechanical operations. In my latest offering I reduced the number of objectives and the amount of time spent on the matrix view. Instead, I emphasize formulation, algorithm understanding, and the economic interpretation that suggests many classical results. I have also instituted writing assignments and oral evaluations to assess the students' thinking processes.

2 - The Impact on Group Size and Project Duration on Capstone Design

Donna Llewellyn, Georgia Tech, CETL, Atlanta, GA, 30332-0383, United States, donna.llewellyn@cetl.gatech.edu, Paul Griffin, Susan Griffin

This work discusses how group size and project duration impact capstone design in terms of learning objectives for the student, value to industry sponsors, and faculty resources. The analysis is based on survey results and an external faculty evaluation comparing a one-semester offering with a two-semester offering of capstone design in the School of Industrial and Systems Engineering at the Georgia Institute of Technology.

3 - Using Technology to Enhance the Teaching of LP and IP Algorithms

David Rader, Rose-Hulman Institute of Technology, 5500 Wabash Ave, Terre Haute, IN, 47803, United States, david.rader@rose-hulman.edu

Most uses of technology in introductory OR courses involve the student iterating through various LP algorithms or branch-and-bound for IP. We will discuss other uses for technology, including demonstrating how "performance tweaks" of the algorithms can make a difference computationally.

■ TB25

P-Room 3404

Success Strategies for Learning, Mentoring, and Ethics

Sponsor: Education (INFORM-ED) SPONSORED/INVITED Sponsored Session

Chair: Julie Swann, Georgia Institute of Technology, Industrial and Systems Engineering Dept., 765 Ferst Drive, NW, Groseclose 0205 Room 411, Atlanta, GA, 30332-0205, United States, jswann@isye.gatech.edu

1 - Predictors of Success in Management Science Courses

Susan Palocsay, Professor, James Madison University, Info Tech & Mgt Program, MSC 0202, Harrisonburg, VA, 22807, United States, palocssw@jmu.edu, Robert Brookshire

Multiple regression was used to examine the factors that contribute to the success of business students in an introductory management science course at the undergraduate level. The strongest predictive variable was a student's college grade point average, indicating that overall academic performance to date has more influence than mathematical skills on the outcomes in management science classes.

2 - Mentoring at a Distance

Ruth Maurer, Walden University, P.O. Box 60100, Grand Junction, CO, 81506, United States, drruth1@earthlink.net, Maria Malayter

Walden University's doctoral program is completely online. Each student is required to write a dissertation and works with a mentor. The process requires a special kind of mentoring as students work on the dissertation; it can be intense at times and the question is whether that intense relationship can happen at a distance. The coauthor earned her doctorate at Walden with the first author as mentor. The focus of the paper is the lessons learned in the process by both sides of the relationship.

3 - Improving and Assessing Ethics Education

Julie Swann, Georgia Institute of Technology, Industrial and Systems Engineering Dept., 765 Ferst Drive, NW, Groseclose 0205 Room 411, Atlanta, GA, 30332-0205, United States, jswann@isye.gatech.edu, Matt Drake, Paul Griffin, Bob Kirkman

We implement new ethics curricula in an undergraduate Industrial Engineering modeling course. To assess the impact of the discipline-specific approach, we evaluate students' ethical reasoning using the Defining Issues Test (DIT) of moral theory with pre and post testing of the students. We compare this with the impact of an entire course in professional ethics as well as an Industrial Engineering control group with no ethical instruction.

4 - Responsible Authorship and Peer Review

James Wilson, Professor and Head, North Carolina State University, Department of Industrial Engineering, Campus Box 7906, Raleigh, NC, 27695, United States, jwilson@eos.ncsu.edu

Extending an article in SCIENCE AND ENGINEERING ETHICS (2002, pp. 155-174), we survey the basic principles of responsible authorship and peer review, with special emphasis on (a) guidelines for refereeing archival journal articles; and (b) how these guidelines should be taken into account at all stages of writing.

■ TB26

P-Room 3412

Channels and Auctions

Sponsor: Marketing
Sponsored Session

Chair: Peter Popkowski Leszczyc, Associate Professor Marketing, University of Alberta, 4-20F School of Business, Edmonton, AB, Canada, ppopkows@ualberta.ca

1 - Asymmetric Information and Manufacturer-Optimal Wholesale Pricing

Chuck Ingene, Professor, University of Mississippi, PO Box 1848, 220 Holman Hall, University, MS, 38677, United States, cingene@bus.olemiss.edu, Mark Parry

A bilateral-monopoly channel model with asymmetric information refutes the logics of channel coordination and fixed cost irrelevance. With no fixed cost of non-distribution coordination is incompatible with serving both states-of-nature; with a fixed cost of non-distribution there are parameters for which (a) there is no channel, (b) only the high demand state is served, (c) both states are served but the channel is uncoordinated, and (d) both states are served and the channel is coordinated.

2 - Who Leads the Channel: Manufacturer or Retailer?

Paul Messinger, University of Alberta School of Business, 3-20E School of Business Bldg, Edmonton, AB, Canada, paulm@ualberta.ca, Sungchul Choi, Yuxin Chen

Should the relationship between a manufacturer and a retailer be modeled as leader-follower model or as symmetric equilibrium? Both approaches have been widely used in the literature (the former goes back to Spengler 1950 and the latter, to Jeuland and Shugan 1983.) Yet despite disparate implications, little systematic empirical evidence has been collected to indicate which approach is more applicable.

3 - An Empirical Analysis of the Effectiveness of Bundling Strategies in Auctions

Peter Popkowski Leszczyc, University of Alberta, 4-20F School of Business, Edmonton, AB, Canada, ppopkows@ualbert.ca, Gerald Häubl, Michael Shen

This research investigates bundling strategies in a variable-price setting. The objective is to determine the effectiveness of several key bundling formats in English auctions, and to examine the role of the degree of complementarity among the individual products. We compare the set of separate auctions with a single auction of the bundle of the same set of products. Results of three controlled field experiments involving real-world ascending-bid auctions are reported.

■ TB27

P-Room 3454

Applications in Financial Engineering

Sponsor: Applied Probability
Sponsored Session

Chair: Aparna Gupta, Assistant Professor, Rensselaer Polytechnic Institute, 110 8th Street, Troy, NY, 12180, United States, guptaa@rpi.edu

1 - An Emphatic PLS Method for Forecast Modeling

Dongming Zhao, Associate Professor, University of Michigan - Dearborn, 4901 Evergreen Road, 218 ELB, ECE, Dearborn, MI, 48128, United States, dmzhao@umich.edu, Bo Cheng, Jie Cheng, Yong Yang

Based on the Partial Least Squares (PLS) algorithm algorithm, this paper presents a new method, emphatic partial least squares (EPLS), to emphasize the impact of relevant information of independent variables on the dependent variable. The EPLS method obtains satisfying predicting results in the practical problems in forecasting or prediction. The performance of EPLS, PLS and some standard statistical methods are compared by a set of Monte Carlo experiments.

2 - Optimal Filtering of Jump-Diffusions: Extracting Latent State from Asset Prices

Jonathan Stroud, Assistant Professor, University of Pennsylvania, 400 Jon M. Huntsman Hall, 3730 Walnut Street, Philadelphia, PA, 19104, United States, stroud@wharton.upenn.edu, Michael Johannes, Nicholas Polson

This paper provides a filtering methodology for discretely observed, continuous-time jump-diffusion models. Our approach applies particle filtering methods to a system with data points simulated between observation times. We demonstrate the approach's accuracy and we address three empirical issues related to jumps and stochastic volatility.

3 -Credit Spread, Implied Volatility and Optimal Capital Structure with Jumps

Nan Chen , Columbia University, 331 Mudd Building, IEOR Dept., New York, NY, 10027,United States, nc2005@columbia.edu, S. G. Kou

We investigate a credit risk model with jumps. (1) Unlike pure diffusion models, the model can produce, consistent with empirical observations, non-zero credit spreads as the maturity of a bond tends to zero. (2) It can lead to the implied volatility smile for equity options, thus providing a unified framework for both credit markets and option markets. (3) Various analytical solutions are available under the model. (4) For the optimal capital structure (debt/equity ratio), the model also give an explanation to an empirical fact that highly risky firms tend to have little debt.

4 - Integrating Long-Term Care Insurance Purchase Decision with Saving and Investment for Retirement

Aparna Gupta, Assistant Professor, Rensselaer Polytechnic Institute, 110 8th Street, Troy, NY, 12180, United States, guptaa@rpi.edu, Lepeng Li

Due to high long-term care(LTC) risk among elderly, planning for LTC is regarded as the `third leg' of retirement planning. We integrate planning for LTC with saving and investment decisions for retirement planning. This integration allows addressing LTC related affordability issues. Using stochastic health events and asset return models, the problem is formulated as a nonlinear mixed-integer program and solved using a heuristic. Behavioral preferences are considered for robust decision support.

■ TB28

P-Room 3504

Distributed Sensing II

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: Yu Ding, Assistant Professor, Texas A&M University, Dept of Industrial Engineering, College Station, TX, 77843-3131, United States, YuDing@iemail.tamu.edu

Co-Chair: Shiyu Zhou, Assistant Professor, University of Wisconsin - Madison, 1513 University Ave., Department of Industrial Engineering, Madison, WI, 53706, United States, szhou@ie.engr.wisc.edu

1 - Multiagent Learning Strategies for Process Control through Distributed Sensing
Tapas K. Das, University of South Florida, 4202 E. Fowler Avenue, Tampa, FL, 33620, United States, das@latte.eng.usf.edu, K. Ramachandran, Rajesh Ganesan

This talk introduces a conceptual framework for multi-agent reinforcement learning based process control using distributed sensor data. The agents are cooperative in nature and use information derived through multiresolution analysis of multivariate sensor data in adopting process control strategies. An application of this concept for a nanoscale process involved in semiconductor wafer fabrication is discussed.

2 - Wavelet Distortion Energy Features for Structural Health Monitoring
Satish Bukkapatnam, Associate Professor, Oklahoma State University, School of IE & M, 322 Engineering North, Stillwater, OK, 75078, United States, satish.t.bukkapatnam@okstate.edu

This research extends sensor-based modeling approach for vibration-based naval plate structural monitoring. Distortion energy may be computed by comparing the wavelet representations of optical strain gage array responses under damaged and undamaged conditions. Experimental observation of higher distortion energies under damaged conditions indicates their adequacy for detecting structural damage.

3 - DOE-based Automatic Process Control in Distributed Sensing Environments
Jianjun Shi, University of Michigan, University of Michigan, Ann Arbor, MI, United States, shihang@umich.edu, Jing Zhong

An automatic control strategy is developed based on the model obtained from Design of Experiments. The control strategy considers various uncertainties from model parameter estimation and distributed sensing. A comparison study is conducted to evaluate the control performance with discussions.

4 - Pattern Matching for Root Cause Identification in Manufacturing Processes
Shiyu Zhou, Assistant Professor, University of Wisconsin - Madison, 1513 University Ave., Madison, WI, 53706, United States, szhou@engr.wisc.edu, Yu Ding, Zhiguo Li

Root cause identification has drawn recent attention in quality improvement. One widely used method is based on pattern matching technique. The presence of unstructured noises as well as sampling uncertainty will cause the fault symptom to deviate from the fault signature. This paper developed a robust pattern matching procedure considering both these effects simultaneously. The paper demonstrates that the proposed method is robust and hence is a preferable tool for quality improvement.

■ TB29

P-Room 3502

Supply Chain Issues in E-Business

Sponsor: E-Business
Sponsored Session

Chair: Paul Huang, Dr., IBM, Watson Research Center, Yorktown Heights, NY, United States, puhuang@us.ibm.com

1 - Payment to the Auctioneer in Multi-unit Vickrey Auctions
Rachel Chen, University of California at Riverside, Anderson School of Management, Riverside, CA, United States, Rachel.chen@ucr.edu, Rachel Zhang

We consider the charge system set by the auctioneer in multi-unit Vickrey auctions for procurement in supply chain settings. The auctioneer charges a two-part tariff, commission plus entry fee, to both the buyer and the sellers. The buyer and the sellers have outside options, and may change their bidding strategies depending on their payments to the auctioneer. We examine how the charge system affects bidding behavior as well as the exchange efficiency of the auction.

2 - Supply Contract Auctions with Uncertain Demand
Cuihong Li, Ph.D. Candidate, Tepper School of Business at CMU, United States, cuihong@andrew.cmu.edu, Alan Scheller-Wolf

We consider a procurement auction between a buyer and competitive suppliers in a single period model. At the time of the auction the buyer's demand is uncertain. After being awarded a supply contract the winning supplier decides and invests in the production capacity. We consider both the cases where the supplier's capacity investment is observable to the buyer, and when it is unobservable. In each of these situations we investigate the optimal procurement mechanism for the buyer.

3 - Demand and Supply Conditioning in High Technology Value Chains
Markus Ettl, Dr., IBM, T.J Watson Research Center, Yorktown Heights, NY, United States, msettl@us.ibm.com

We describe a system that continuously recognizes and transforms events of business processes, generates and provides access to business performance indicators, and triggers appropriate actions across the entire enterprise. We describe a pilot with a personal computer manufacturer and show how to use order trends to provide an early warning of constraints and excesses to make demand and supply conditioning more effective.

4 - Reinforcement Learning for Online Negotiation
Paul Huang, Dr., IBM, Watson Research Center, Yorktown Heights, NY, United States, puhuang@us.ibm.com

We show how multiple agents can collectively learn to find the sub-game perfect equilibrium of a complete-information extensive game without knowing each other's payoff. Our learning mechanism can be applied to on-line negotiation in e-commerce to ensure a fair outcome without requiring participating parts to disclose their private information.

■ TB30

P-Room 3512

Reliability Research

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: David Coit, Associate Professor, Rutgers University, Industrial & Systems Engineering, 96 Frelinghuysen Rd., Piscataway, NJ, 08854, United States, coit@rutgers.edu

1 - Designing Resilient Networks
Abdullah Konak, Assistant Professor, Penn State Berks, Tulpehocken Road, Reading, PA, 19610, United States, konak@psu.edu, Michael R. Bartolacci

Reliability has been a traditional goal within network design optimization. An alternative design consideration, network resilience, has not been studied or incorporated into network designs nearly as much. The authors propose a methodology for the difficult estimation of traffic efficiency, a measure of network resilience, using a hybrid genetic algorithm.

2 - The Impact of Uncertainty in Reliability System Design
Edward Pohl, Assoc. Professor, University of Arkansas, Fayetteville, Dept of Industrial Engineering, Fayetteville, AR, 72701, United States, epohl@engr.uark.edu, Patrick Driscoll

We investigate the impact component uncertainty has on the reliability redundancy allocation problem for a general parallel series system. Bounding conditions are established using the individual components uncertainty to rapidly reduce the design space and produce varaible and stage reliabilty bounds. Thes design space limits impose constraint structure on the problem that can be exploited for larger scale problems.

3 - Generalized Models for Multistate Network Reliability and Applications
Kailash Kapur, Professor, University of Washington, Industrial Engineering, Box 352650, Seattle, WA, 98195-2650, United States, kkapur@u.washington.edu, Sarintip Satitsatian

Many infrastructure problems are usually modeled as network reliability. The performance of the elements and the network system degrades continually. We propose models where the network and its elements can have a finite number of different states. Previous work assumed that the states of the elements and the network system are the same. Equations are developed for the structure function for these general models. They are used to develop reliability bounds and other performance measures.

4 - Maintenance Optimization without a Hazard Function
Jason Rupe, United States, jrupe@ieee.org

We use some simple degradation and cost assumptions to build models for deciding when to do rehabilitative maintenance on our outside plant. Most literature focuses on relaxing assumptions to develop complex models for maintenance optimization. In our application, however, we do not have reliable degradation data, and so only a very simple model will apply. With some inductions, we can demonstrate conditions for optimal replacement of degraded elements and subsystems.

■ TB31

P-Room 3545

Approaches to Knowledge Management

Sponsor: Information Systems
Sponsored Session

Chair: Suryanarayanan Ravindran, Assistant Professor, Arizona State University, W. P. Carey School of Business, Dept. of IS, Tempe, AZ, 85287, United States, sury.ravindran@asu.edu

1 - A Complex Adaptive Systems Perspective of Knowledge Management

David L Paul, Assistant Professor, University of Denver, Daniels College of Business, 2101 S. University Blvd. Suite 315, Denver, CO, 80208, United States, dapaul@du.edu

This presentation utilizes a complex adaptive systems (CAS) framework, drawn from complexity theory, to further the understanding of knowledge management (KM). A CAS perspective changes the conceptualization of knowledge and specifies aspects of KM researchers should be examining. A CAS perspective argues that organizational knowledge resides in the interaction of individuals, and managerial attention must be focused on those issues that can both enable and potentially inhibit such interaction.

2 - The Two Dimensions of Knowledge Management: Technology and Organizational Culture

Judy Scott, Assistant Professor, University of Colorado at Denver, Business School, Denver, CO, United States, judy.scott@cudenver.edu, Biswadip Ghosh

Healthcare organizations are increasingly adopting Knowledge Management Systems (KMS) to support professionals in their collective practice. In contrast, technical support organizations utilize KMS to directly address customer needs. Eight hypotheses are tested in each industry. The results indicate that culture plays a larger role than technology in healthcare. Also systems need personalization in healthcare while codification efficiently solves problems in technical support.

3 - Complementarity in Knowledge Assets

Suryanarayanan Ravindran, Assistant Professor, Arizona State University, W. P. Carey School of Business, Dept. of IS, Tempe, AZ, 85287, United States, sury.ravindran@asu.edu

We have constructed a Knowledge Management Integrative framework to represent a range of activities associated with knowledge assets and their management. We seek to apply complementarity theory and a business value modeling approach to this framework to explore the benefits that can accrue to an organization. We argue that organizational benefits from investments in KM initiatives can be maximized when knowledge assets are leveraged in a concerted manner.

■ TB32

T-Vail (Majestic Level)

Applications of OR to Semiconductor Manufacturing

Cluster: OR Practice
Invited Session

Chair: Brian Denton, Senior Engineer, IBM, 1000 River Road, Bld. 958A, Essex Junction, VT, 05452, United States, bdenton@us.ibm.com

1 - Continual Improvement in Supply Chain Optimization Methodologies at IBM Microelectronics

Robert Orzell, IBM, 1000 River St., Essex Jct, VT, United States, rorzell@us.ibm.com

OR methods have been used extensively in production planning in IBM's Microelectronics Division. Over many years, continual improvements have been made to the underlying methods and software in response to business need. We describe a brief history of what has been accomplished, latest problems solved and future challenges.

2 - Using MIP to Plan Sort Operations in Flash Manufacturing

James Wuerfel, Optimization Program Coordinator, Intel, 5000 W. Chandler Blvd, CH3-113, Chandler, AZ, 85225, United States, james.r.wuerfel@intel.com

We discuss an optimization used in planning the number of Sort testers to setup on each of multiple products at different steps in a reentrant process. This project is used to determine shiftly goals and to prioritize factory WIP flow at end of line operations.

3 - Central Planning at IBM Microelectronics Division

Alfred Degbotse, IBM, 1000 River Road, Essex Junction, VT, 05452, United States, adegbo@us.ibm.com

IBM's semiconductor supply chain consists of many plants geographically dispersed around the world. The coordination of production planning among the plants in the division is critical to efficient capacity resource and material utilization for meeting customer demands. We describe the model and methodology used for global supply chain optimization in IBM's Microelectronics division.

■ TB33

T-Savoy (Majestic Level)

Edelman Finalist Reprise

Sponsor: CPMS, The Practice Section of INFORMS
Sponsored Session

Chair: Tom Spencer, United States, tspencer@ADM.NJIT.EDU

1 - U.S. Department of Energy: The Adoption of Multi-Attribute Utility Theory for the Evaluation of Plutonium Disposition Options in the United States and Russia

James Dyer, Professor, University of Texas, Austin, Austin, TX, United States, Jim.Dyer@mccombs.utexas.edu, Thomas A. Edmunds, Alexander N. Chebeskov, John C. Butler, Vladimir I. Oussanov, Jianmin Jia

At the end of the Cold War, the U.S. and Russia entered into agreements that reduced the number of nuclear weapons in their arsenals. Weapons-usable plutonium recovered from dismantled weapons is extremely toxic in the environment. The possibility that this plutonium could fall into the hands of terrorists was an even greater concern. A multi-attribute utility model was implemented for the evaluation of weapons-usable plutonium disposition options for the U.S. Department of Energy, and supported the recommendation that has become current U.S. policy. This model was modified and implemented by Russian scientists, with the aid of the U.S. team, and its results have influenced the current policy of Russia. These policies enhance cooperation between the U.S. and Russia, and reduce the threat of nuclear proliferation in the world.

2 - Routing Optimization for Waste Management

Surya Sahoo, President & Chief Executive Officer, Institute of Information Technology, Inc., 2204 Timberloch Place, Suite 225, The Woodlands, TX, 77380, United States, surya@e-iit.com, Seongbae Kim, Bob Kraas, Byung-In Kim, Alex Popov

Waste Management, Inc.™ (WM) is North America's largest waste collection company. Two-thirds of WM revenue is from waste collection services: operational efficiency gained by addressing the needs of the fleet directly impacts the bottom line. Institute of Information Technology, Inc. was contracted to deliver WasteRouteô, a comprehensive route management application that took into account the specific routing considerations of WM: time windows, multiple vehicle disposal trips, and vehicles with varying capacities and service capabilities. The benefits of the system include reduced operating costs, improved customer service and appropriate pricing. The routing solutions of this system were gradually deployed across the nation beginning March 2003 with a net effect of 984 fewer routes at the end of 2003 . WM anticipates $44 million in annual savings in 2004 using WasteRoute™.

■ TB34

T-Columbine (Majestic Level)

Operations and Finance Interface

Sponsor: Manufacturing and Service Operations Management
Sponsored Session

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

1 - Inventory Control under Uncertain International Financial Environment

Lucy Gongtao Chen, Cornell University, Johnson Graduate School of Management, Cornell University, Ithaca, NY, 14853, United States, gc84@cornell.edu, Robin Roundy, Rachel Zhang

For firms conducting international businesses (e.g., purchase raw materials abroad and sell final products domestically), both their operational costs and discount rates are affected by national as well as international market indices. In this paper, international asset pricing models are introduced to estimate the stochastic discount rates for inventory decision making.

2 - Financial Hedging in the Supply Chain

Rene Caldentey, Assistant Professor, New York University, 44 West 4th Street, Suite 8-77, New York, NY, 10012, United States, rcaldent@stern.nyu.edu, Martin Haugh

We consider the problem of hedging the profits of a corporation when these profits are correlated with returns in the financial markets. We consider the problem of simultaneously optimizing over both the operating policy and the hedging strategy of the corporation. We apply our methodology in the context of a supply chain procurement/inventory problem.

3 - Shipper Valuation and Hedging of Interstate Natural Gas Pipelines Transportation Contracts

Nicola Secomandi, Assistant Professor, Tepper School of Business, Carnegie Mellon University, 5000 Forbes Avenue, Pittsburgh, PA, 15213, United States, ns7@andrew.cmu.edu

In the United States, interstate natural gas pipeline companies provide transportation services by stipulating contracts with shippers. Since these contracts link natural gas production with its local distribution and consumption, they play a fundamental role in the supply chain of this industry. The talk investigates how shippers should value and hedge them, with an emphasis on producers and local distribution companies.

4 - The Role of Commodity Markets in Optimal Procurement Policies.

Genaro Gutierrez, Associate Professor, UT-Austin, CBA 4.202, UT-Austin, Austin, TX, 78712, United States, genaro.gutierrez@mccombs.utexas.edu, Ankur Goel

We develop a multi-period inventory management model with stochastic prices and stochastic demand that explores the interaction with commodity markets. Commodity users can interact with the market through spot and forward transactions. Our analysis suggests that, apart from risk reduction, the potential savings in transaction costs in forward markets entice manufacturers to procure a relatively higher fraction of goods from these markets, using spot procurement to fine tune stocking levels.

5 - On the Integration of Production and Financial Hedging Decisions in Global Markets

Lingxiu Dong, Assistant Professor, John M. Olin School of Business, Washington University in St. Louis, One Brookings Drive, Campus Box 1133, St. Louis, MO, 63130, United States, dong@wustl.edu, Panos Kouvelis, Qing Ding

We study the integrated operational and financial hedging decisions faced by a global firm who has a production facility in the home country and sells to both the home country and a foreign country. A mean-variance utility function is used to model the firm's risk aversion in decision making. We derive the joint optimal capacity decision and financial option decision, and analyze the impact of the capacity allocation and the financial options on capacity investment and the firm's performance.

■ TB35

T-Terrace (Terrace Level)

Configuration Systems for Mass Customization

Cluster: Mass Customization in Mfg

Invited Session

Chair: Ralph Seelmann-Eggebert, Fraunhofer Institut f¸r Fabrikbetrieb und -automatisierung IFF, Sandtorstrasse 22, 39106 Magdeburg, Germany, Ralph.Seelmann-Eggebert@iff.fraunhofer.de

1 - A Multi-Perspective Approach for the Design of Product Configuration Systems

Lars Hvam, Associate Professor, Technical University of Denmark, Produktionstorvet, Building 423, Lyngby, DK2800, Denmark, lhv@ipl.dtu.dk

The article presents a procedure for design of product configuration systems. The procedure includes an analysis of the business processes and the product assortment. The configuration system is designed using object oriented modeling. The procedure has been developed in cooperation with - and tested in - several industrial companies e.g. F.L.Smidth, APC, Aalborg industries, NEG-Micon, and GEA-Niro. The article includes the experiences from a company making electronic switchboards.

2 - Effective Product Assortment Communication: Overcoming the "Product Variety Paradox" on the Net

Fabrizio Salvador, Professor, Instituto de Empresa, Maria de Molina, 13 B, 28006 Madrid, Madrid, Spain, fabrizio.salvador@ie.edu, Cipriano Forza

The assumption underlying variety-intensive product strategies (Sanderson and Uzmeri, 1995) is that customers have idiosyncratic needs. Consequently, by offering differentiated products a firm may be able to increase product price or market share because of the better fit of its products with what customers demand. However, the decision to proliferate the product offer, or to just allow customers to define more and more product features does not automatically lead to greater customer satisfaction and, hence, to greater commercial success. In fact, a wide assortment of product variants and options may end up confusing the customer, as he/she would experience high cognitive complexity in evaluating product alternatives (see Huffman and Kahn, 1998). Ultimately, while trying to please its customers by offering increased product variety, a firm may end up confusing or annoying its customers, thus loosing potential sales. In other words, the form faces a "product variety paradox". Recent developments in Information and Communication Technology made available a class of software products, often termed as "product configurators", which appears to offer new solutions not only to the back office - automatically generating technical product documentation - but to the front office as well - supporting the interaction with the customer when custom products are offered. To date, however, research on product configuration has been focussing especially on the back-office advantages of such solutions, while we still know very little of the potential of such class of software products to reduce the "product variety paradox". From a methodological standpoint, the present paper analyzes the underlying principles on which successful sales configurators have been built, based on anecdotal evidence present in the literature or on the analysis of sales configurators present on the web. In doing so, the paper attempts a formalization of the mechanisms through which a firm's product assortment can be efficiently and effectively presented to the customer. We then discuss how these mechanisms, as a whole interact and how they can increase a firm's commercial success. Finally, we speculate about the possibility of extending the proposed mechanisms outside the scope of designing sales configurators, proposing that they can be taken as general principles to describe efficiently and effectively a firm's product assortment.

3 - The Role of Companies in the Product Customization Process

Cipriano Forza, Università di Modena e Reggio Emili, Via Vignolese, 9005/a, 91100 Modena, Modena, Italy, forza.cipriano@unimo.it, Fabrizio Salvador

The presentation reports the preliminary findings of a project exploring how individual competencies can support a product customization process. In particular, the project explores distinctive individual competencies within engineering, sales and manufacturing areas, distinguishing between operative vs directive roles. Findings are based upon a qualitative research design, involving more than 55 interviews with executives across 5 European countries.

4 - The Configuration System as Guarantor for the "Zero-error-production"

Ralph Seelmann-Eggebert, Fraunhofer Institut für Fabrikbetrieb und -automatisierung IFF, Sandtorstrasse 22, 39106 Magdeburg, Germany, Ralph.Seelmann-Eggebert@iff.fraunhofer.de

In mass customization, the configuration of an individualized product determines the further process chain. This is due to the production or customization process only stars after a concluded contract with a customer who in terms has chosen or configured his product in advance. The data obtained in the configuration process can be separated into two generally different data sets. On being the customer specific data and the other one containing product specific information. Customer specific data represents personal customer data such as e.g. delivery information, interests, and behavior. This does not directly affect the production of the requested product. Product specific data can as well correspond to personal customer data such as a customer's measurements or matching colors of a product. However, product specific data is essential for the production of the good. Both data categories can be obtained by the use of a configuration system but are used differently in the hereafter following processes.

■ TB36

T-Capitol (Terrace Level)

Finance - Theory & Empirics I

Contributed Session

Chair: Louise Gunderson, Gamma Two, Inc., 1185 S. Huron St, Denver, CO, 80223, United States, lgunders@gamma-two.com

1 - Being Warren Buffett: Does an Investment Strategy Really Beat the Market?

Robert Stine, Professor, Statistics Dept, Wharton, Univ of Penn, 444 Huntsman Hall, Philadelphia, PA, 19104-6340, United States, stine@wharton.upenn.edu, Dean Foster

Almost everyone has heard of a scheme that "beats the market." How can we test such claims? Our test (using Bennett's inequality) only assumes that CAPM excess returns are martingale. Claimants scoff and say that this test lacks power to find the beauty of their schemes. With tongue firmly in cheek, we provide schemes that pass any weakening of our test. This approach has offered some wonderful teaching examples, since the schemes are understandable to undergrads and MBAs.

2 - Explaining Capital Market Success of Financial Services Outsourcing

Tom Gellrich, Johann Wolfgang Goethe University, Frankfurt, Rheinstr. 16, Frankfurt, 60325, Germany, gellrich@wiwi.uni-frankfurt.de, Lars Friedrich

Study of the stock market reaction of outsourcing announcements of the global financial services industry. A sample of 132 outsourcing transactions between 2000 and 2003 is analyzed in order to investigate the drivers of excess returns to shareholders. Study-focus is the global financial services industry.

3 - Testing the Fundamental Hypothesis of Pairs Trading on a Large Number of Stocks

Louise Gunderson, Gamma Two, Inc., 1185 S. Huron St, Denver, CO, 80223, United States, lgunders@gamma-two.com, Jeff Sigman, Seth Weiss

Pairs Trading is an investment strategy that has been shown to return a profit in excess of that explained by mean reversion profits. Because of the difficulties involved in the analysis, previous work has only reported on the results of small sets of stocks. In the last year, software has been developed that can discover Pairs Trading opportunities for a much larger numbers of stocks. Using this new software, Pairs Trading is tested for all of the stocks on the three major American exchanges.

4 - Toward a Framework of Financial Planning in New Venture Creation
Benjamin Gansel, Otto-von-Guericke-University of Magdeburg, Dept. of Economics and Management, Magdeburg, 39016, Germany, gansel@ww.uni-magdeburg.de

We develop a coherent comprehensive framework that draws out interdependencies among the financial planning components, elements, and individual items. We also determine a starting point of the planning process, show the linkage to other functional areas, and emphasize the structure, interdependence, and adjustment of elements within an iterative planning process. The robustness of the financial plan can be tested by employing sensitivity analysis, scenario analysis, and simulation.

■ TB37

T-Biltmore (Terrace Level)

Pollution Control Mechanisms and Compliance Management

Sponsor: Energy, Natural Resources and the Environment
Sponsored Session

Chair: Ravi Subramanian, Ph.D Candidate, Michigan Business School, D0261 Davidson Hall, 701 Tappan St., Ann Arbor, MI, 48109, United States, rsubramz@bus.umich.edu

1 - Modeling Emission Controls in Ontario: A Complementarity Programming Approach using ELEMCOMP.CT
J. Scott Rogers, Professor, Dept. of Mech. and Ind. Eng., University of Toronto, 5 Kings College Rd, Toronto, ON, M5S 3G8, Canada, rogers@mie.utoronto.ca, Karen Lew

This paper describes a Complementarity Programming model (ELEMCOMP.CT) that considers competition among firms in both the electricity market and "Cap and Trade" emissions markets. The model computes a Nash equilibrium in each market including appropriate relationships among the markets. Results are presented for Ontario to show how the "net cost" for retrofitting coal-fired units depends materially on the market structure and the behaviour of the gencos.

2 - Oligopolistic Power Markets with Transmission, Forward Contracts, Reserve Market and NOx Permits
Yihsu Chen, Ph.D. Student, The Johns Hopkins University, DoGEE, Baltimore, MD, 21218, United States, yschen@jhu.edu

We use a complementarity approach to simulate the interaction of the USEPA NOx Budget Program with PJM electricity market, considering forward contracts and the operating reserve market. Larger generating firms are modeled as Cournot in electricity market with a conjectured price response in permit market; smaller suppliers behave competitively. The results show that permits could be used by larger firms to enhance market power while forward contracts effectively mitigate its effects.

3 - Optimal Firm-provided R&D in Response to a Random Carbon Tax
Erin Baker, Department of Mechanical and Industrial Engineering, University of Massachusetts, Amherst, MA, United States, edbaker@ecs.umass.edu

I determine a firm's optimal R&D response to an uncertain carbon tax, for two different R&D programs. I find that optimal R&D does not increase monotonically in a carbon tax. Cost reduction R&D increases only if the firm is flexible enough; emissions reduction R&D first increases then decreases in a carbon tax. Firms that are very flexible may increase cost reduction R&D when the uncertainty surrounding a carbon tax is increased; otherwise firms generally decrease R&D investment in uncertainty.

4 - Emissions Compliance Strategies: A Permit Auction Model
Ravi Subramanian, Ph.D Candidate, Michigan Business School, D0261 Davidson Hall, 701 Tappan St., Ann Arbor, MI, 48109, United States, rsubramz@bus.umich.edu, Brian Talbot, Sudheer Gupta

We characterize the trade-offs among firms' compliance strategies in an emissions control regime where a regulator interested in controlling emissions from a given set of sources auctions off a fixed number of emissions permits. We model a three-stage game in which firms invest in abatement, participate in a share auction for permits, and produce output. We analyze two end-product market scenarios - independent demands and Cournot competition.

■ TB38

T-Beverly (Terrace Level)

OR in Sports I

Sponsor: OR in SpORts
Sponsored Session

Chair: Sergiy Butenko, Assistant Professor of Industrial Engineering, Texas A&M University, 236E Zachry Engineering Center, College Station, TX, 77843-3131, United States, butenko@tamu.edu

1 - Who's the Best? Data Envelopment Analysis and Ranking Players in the National Football League
Rob Callum, Senior Finance Analyst, Limited Brands, 2 Limited Parkway, Columbus, OH, 43230, United States, robert.l.callum.tu03@alum.dartmouth.org, Erickson DeOliveira

The question of who are the best players at any position is much more than a philosophical saw. We devise a data envelopment analysis (DEA) methodology for grading quarterbacks that is more accurate than the ranking system currently in use. The talk concludes with thoughts on how to use DEA to construct rating systems for other purposes.

2 - The General Manager as a Sabrmetrician: Quantitative Decision-making for Designing a Winning Team
Richard Levine, Associate Professor of Statistics, San Diego State University, United States, ralevine@sciences.sdsu.edu, Chii-Dean Lin, James Davis

A simulated annealing routine is developed to allow general managers in real time to evaluate team success as a function of team and player performance potential.

3 - Modeling a Baseball Game to Optimize Pinch-Hitting and Pitcher Substitution Strategies using DP
Nobuyoshi Hirotsu, Japan Institute of Sports Sciences, 3-15-1 Nishigaoka, Kita-ku, Tokyo, Japan, nhirotsu@hotmail.com, Mike Wright

A baseball game is modeled using a Markov chain, and a dynamic programming formulation is developed for identifying optimal pinch-hitting and pitcher substitution strategies. This method is demonstrated using the line-ups of Major League Baseball teams, by showing the timing of substitution and the increase of the probability of winning.

4 - Analytic Approaches to College Football Rankings
Sergiy Butenko, Assistant Professor of Industrial Engineering, Texas A&M University, 236E Zachry Engineering Center, College Station, TX, 77843-3131, United States, butenko@tamu.edu, Vladimir Boginski, Panos Pardalos

This talk will discuss some of the computer-based methods for ranking college football teams currently used by BCS and will propose an alternative ranking procedure based on the techniques of Analytic Hierarchy Process.

■ TB39

T-Tower Court A (2nd Floor)

Managing Supply Chain Uncertainty

Cluster: Supply Chain Mgmt & Operations
Invited Session

Chair: Karen Smilowitz, Assistant Professor, Northwestern University, 2145 Sheridan Road, M233, Evanston, IL, 60202, United States, ksmilowitz@iems.northwestern.edu

1 - An Inventory Model with an Unreliable Supplier
Lawrence Snyder, Asst. Professor, Lehigh University, Dept of Industrial & Systems Engineering, 200 West Packer Ave, Mohler Lab, Bethlehem, PA, 18015, United States, larry.snyder@lehigh.edu

We present an approximation for a continuous-review inventory model with constant, deterministic demand but unreliable supply. Our approximate model can be solved in closed form and lends itself to analysis similar to the analysis often performed on the EOQ model. For example, we derive closed-form sensitivity analysis results and discuss worst-case bounds for power-of-two policies. We also present empirical evidence of the accuracy of our approximation.

2 - Approximate Model for Integrated Location-Inventory Planning
Leyla Ozsen, Purdue University, Industrial Engineering Department, West Lafayette, IN, 47907, United States, lozsen@purdue.edu, Mark Daskin, Collette Coullard

We introduce an analytical model that integrates location and inventory decisions. We can obtain closed form optimal solutions. The approximation provides comparable results to that of the discrete Location-Inventory Model. Our sensitivity analysis suggests that the benefits from integration increase as inventory costs become a larger part of the cost structure.

3 - Network Configuration in Transshipment
Robert Lien, Northwestern University, 2145 Sheridan Road, Evanston, IL, United States, rlien@iems.northwestern.edu

In this talk, we explore the impact of network configuration on the effectiveness of transshipments between retailers in the presence of demand uncertainty.

4 - Designing Quantity Discounts to Moderate Buyer's Ordering Behavior in a Stochastic Environment
Nihat Altintas, Ph.D Student, Carnegie Mellon University, Tepper School of Business, Pittsburgh, PA, 15213, United States, nihat@andrew.cmu.edu, Feryal Erhun, Sridhar Tayur

We study a quantity discount problem under stochastic demand. For a single period problem, we derive the optimal policy for a buyer, which is a three-index policy. In an experimental analysis, we investigate the structure of the optimal policy for the infinite horizon problem, and show that higher index policies may turn out to be optimal. We suggest discount schemes that a supplier may use to moderate the buyer's ordering policy for operational efficiency.

■ TB40

T-Tower Court B (2nd Floor)

Empirical Research Using Secondary Data

Cluster: Supply Chain Mgmt & Operations
Invited Session

Chair: Vishal Gaur, New York University, 8-72, 44 West 4th St., New York, NY, 10012, United States, vgaur@stern.nyu.edu

1 - The Financial Impact of ISO 9000 Certification
Charles Corbett, Associate Professor, The Anderson School at UCLA, 110 Westwood Plaza, Box 951481, Los Angeles, CA, 90095, United States, charles.corbett@anderson.ucla.edu, Maria Montes, David Kirsch

We track financial performance from 1988 to 1997 of all publicly traded ISO 9000 certified manufacturing firms in the US. We employ event study methods, and find that firms' decision to seek their first ISO 9000 certification was indeed followed by significant abnormal improvements in financial performance. We also find that the results vary to some degree depending on the matching approach used.

2 - The Effect of Supply Chain Glitches on Operating Performance
Kevin Hendricks, Richard Ivey School of Business, University of Western Ontario, 1151 Richmond St. North, London, ON, N6G3B1, Canada, khendricks@ivey.uwo.ca, Vinod Singhal

This paper documents the impact of supply chain glitches on operating performance. Based on a sample of about 800 glitches announced by publicly traded firms, we estimate that in the year leading to the announcement, firms on average experience a 107% drop in their operating income, 114% drop in return on sales and 93% drop in return on assets. Furthermore, firms do not quickly recover from the negative economic consequences of glitches.

3 - Estimating Uncertainty Using Judgemental Forecasts
Saravanan Kesavan, Harvard Business School, Morgan Hall, Soldiers Field, Boston, MA, 02163, United States, skesavan@hbs.edu, Ananth Raman, Vishal Gaur

Traditional forecasting methods for estimating demand distribution do not apply to new/short lifecycle products due to the absence of historical demand data. Firms depend on experts to use their judgment and knowledge to develop forecasts for such products. We propose a methodology wherein dispersion among experts is used to estimate the standard deviation of demand, and use secondary data viz., large scale public financial data, to validate the methodology.

4 - The Impact of Sales Surprise on Inventory Turnover
Vishal Gaur, New York University, 8-72, 44 West 4th St., New York, NY, 10012, United States, vgaur@stern.nyu.edu, Ananth Raman

We use public financial data on U.S. retailers to investigate how sales surprise, defined by us as the deviation of annual sales from forecast, impacts realized inventory turnover. We compare the correlation of inventory turnover with sales surprise across firms and retail sectors as well as examine time trends.

■ TB41

T-Tower Court C (2nd Floor)

Supply Chain Management I

Contributed Session

Chair: Nicole DeHoratius, University of Chicago, Graduate School of Business, 1101 E. 58th Street, Chicago, IL, 60637, United States, ndehorat@gsb.uchicago.edu

1 - A Generic Newsvendor Optimality Condition for Multi-echelon Inventory Systems
Ton de Kok, TU Eindhoven, Technology Management, P.O. box 513, Eindhoven, 5600 MB, Netherlands, a.g.d.kok@tm.tue.nl

Given a class of policies, we present a necessary optimality condition for general multi-echelon systems under linear holding and penalty costs. The necessary condition generalizes existing necessary conditions for single- and multi-echelon inventory systems. The condition may serve as a basis for the development of heuristics for finding cost-effective policies for multi-echelon systems, for which optimal policies are not known to-date.

2 - Supplier Portfolio Selection and Execution with Demand Information Update
Haifeng Wang, Center For Intelligent Networked Systems, Department of Automation, Tsinghua University, Beijing, 100084, China, hfwang@se.cuhk.edu.hk, Houmin Yan

This paper considers a multi-period supplier-portfolio selection and execution problem with demand information updates. We develop a frame- work for the optimal portfolios selection and inventory replenishment (exercising multiple options). We demonstrate that the optimal portfolio selection follows a generalized base-stock policy and the inventory replenishment follows a modified base-stock policy. We also develop the structure properties of the optimal policy with respect to option contracts and inventories carried from a period to the next period.

3 - Culture Management: Formulating the Supply-Demand Network Business Problem
Michael O'Brien, Technical Program Manager, Intel, MS: CH3-10, 5000 W Chandler Blvd, Chandler, AZ, 85226, United States, michael.obrien@intel.com, Amit Devpura, Karl Kempf

We describe the core complexities of managing a supply-demand network. We discuss the historical evolution of the planning problem, the judgment based analysis solutions, and the systemic inefficiencies that have resulted. We describe a multi-faceted approach taken to refine our planning. We describe the processes used to refine the company's business rules and incorporate them into mathematical models. Last, we discuss the tangible and non-tangible benefits realized by these activities.

4 - The Economics of Outsourcing in a De-integrating Industry
Arif Iqbal Rana, Associate Professor, Lahore University of Management Sciences, DHA, Lahore Cantt, 54792, Pakistan, arif@lums.edu.pk, Jawaid Abdul Ghani

Many large firms in low scale economy industries are actively considering outsourcing options, in the face of competition from smaller more efficient players. Based on a review of the theoretical literature and a case-study of outsourcing decisions at two large vertically integrated footwear manufacturers in Pakistan, a framework is developed for determining which set of products and activities to outsource and which to keep in-house. The framework suggests activities being considered for outsourcing be evaluated in terms of level of proprietary knowledge, economies of scale, inefficiencies of vertical integration, transactional costs, and the existence of reliable vendors. It is suggested that activities with low levels of proprietary knowledge and activities where cost savings due to outsourcing justify the increased transaction costs, should be outsourced.

5 - Retail Execution Problems
Nicole DeHoratius, University of Chicago, Graduate School of Business, 1101 E. 58th Street, Chicago, IL, 60637, United States, ndehorat@gsb.uchicago.edu

Poor execution in retail supply chains has been identified as one cause of poor retail performance. Our objective is to identify and develop a typology of execution problems in retail distribution centers. We examine the role vendors play in preventing (or contributing to) such problems.

■ TB42

T-Tower Court D (2nd Floor)

Dynamic Pricing and Revenue Management

Sponsor: Revenue Management & Dynamic Pricing
Sponsored Session

Chair: Soulaymane Kachani, United States, sk2267@columbia.edu

Co-Chair: Georgia Perakis, Sloan Career Development Associate Professor of Operations Research, Sloan School, MIT, 50 Memorial Drive, Rm E53-359, Cambridge, MA, 02139, United States, georgiap@mit.edu

1 - On the Choice-Based LP Model for Network RM
Garrett van Ryzin, United States, gjv1@columbia.edu, Qian Liu

Recently, Gallego, Iyunger and Phillips proposed a choice-based LP model for network revenue management which extends the deterministic linear programming model widely used in current network RM. We build on their work in two ways: First, we characterize offer sets using a notion of "efficiency" and show that only efficient sets are optimal asymptotically. Second, we propose a practical decomposition heuristic that significantly improves on the performance of the static LP solution.

2 - Callable and Flexible Revenue Management
Guillermo Gallego, Columbia University, New York, NY, United States, gmg2@columbia.edu, Garud Iyengar, Steven Kou, Robert Phillips

A low-to-high fare structure requires limiting low-fare sales to reserve capacity for high-fare sales. Capacity providers can more aggressively sell capacity at the low-fare if some of the low-fare customers participate in a recall program that allows the provider to buy back capacity and resell it at a higher-fare. We show how this can be a win-win-win for low and high-fare customers and for the capacity provider.

3 - Competitive Analysis of On-Line Booking: Dynamic Policies
Michael Ball, Professor, University of MD, Robert H Smith School of Business, University of MD, College Park, MD, 20742, United States, MBall@rhsmith.umd.edu, Maurice Queyranne

We continue work on revenue management policies that view the problem from the perspective of online algorithms. This approach eliminates the need for demand forecasts and a risk neutrality assumption. Recent work has produced dynamic policies that adjust in response to orders previously accepted thereby producing increased performance guarantees.

4 - An MPEC Approach to Dynamic Pricing and Demand Learning
Georgia Perakis, Sloan Career Development Associate Professor of Operations Research, Sloan School, MIT, 50 Memorial Drive, Rm E53-359, Cambridge, MA, 02139, United States, georgiap@mit.edu, Soulaymane Kachani, Carine Simon

We present an optimization framework for joint pricing and demand learning in an oligopoly market for a perishable product. The model we consider assumes a parametric family of demand as a function of its price and other competitors' prices, the parameters of which are dynamic and are learned over time. We show and study how the problem reduces to an MPEC and propose two solution methods. We illustrate our approach using a 3-company example.

■ TB43

T-Denver (Mezzanine)

Technology-NPD interfaces

Cluster: New Product Development
Invited Session

Chair: Andrea Masini, Assistant Professor, London Business School, Regent's Park, London, NW1 4SA, United Kingdom, amasini@london.edu

1 - From EDI to B2B e-Procurement Systems: Motivations Behind its Adoption
Tomoaki Shimada, Ph.D student, INSEAD, Boulevard de Constance, Fontainebleau, 77305, France, tomoaki.shimada@insead.edu

In the electrical and electronics industry, a buyer (manufacturer) generally has power over its suppliers (raw material/component suppliers). Thus, the buyer normally initiates the adoption of inter-organizational systems, and some of its suppliers follow it. We empirically investigate motivations behind its adoption from the viewpoints of suppliers in Southeast Asia.

2 - The Impact of Outsourcing on Timing of Entry into Uncertain Markets
Sezer Ulku, Visiting Assistant Professor, Georgetown University, United States, SU8@georgetown.edu, Beril Toktay, Enver Yucesan

A new process technology becomes available, enabling the introduction of new products. The market potential that can be captured by the firms is decreasing with delays in product launch. However, the risks associated with early entry are high due to the low precision of demand forecasts. In this setting, we examine the impact of vertical organization on firm performance. Furthermore, we examine whether entry can be accelerated through risk sharing contracts.

3 - Technical Communication in Complex Product Development: A Longitudinal Study
Manuel Sosa, Assistant Professor of Technology and Operations Management, INSEAD, Boulevard de Constance, Fontainebleau, 77305, France, manuel.sosa@insead.edu

We present our approach to empirically study the dynamics of project and organizational structures in complex systems. We analyze how planned interfaces between design teams map onto email communications during the concept development of a new airplane. We discuss implications for organization design and project management.

4 - The Relationship Between IT Agility and NPD Effectiveness: An Empirical Investigation
Andrea Masini, Assistant Professor, London Business School, Regent's Park, London, NW1 4SA, United Kingdom, amasini@london.edu

IT agility is increasingly regarded as a key enabler of operational effectiveness. This paper has three main objectives: to provide a better characterization of the construct, to develop process-specific measures to assess agility for manufacturing and service firms and to examine the extent to which it affects NPD activities.

■ TB44

T-Spruce (Mezzanine)

New Product Development Applications of DEA

Cluster: Data Envelopment Analysis
Invited Session

Chair: Tim Anderson, Engineering & Technology Management Dept., Portland State University, PO Box 751, Portland, OR, 97207-0751, United States, tima@etm.pdx.edu

1 - Forecasting Future Performance of Enterprise Database Systems using TFDEA
Lane Inman, Veritas, Inc., United States, lanei@etm.pdx.edu, Tim Anderson

Technology Forecasting using Data Envelopment Analysis, (TFDEA) is introduced using price-performance information on enterprise database systems. Among the results are a quantitative indication for a potentially disruptive technology.

2 - Predicting Fifteen Years of Fighter Jet Performance
Tim Anderson, Engineering & Technology Management Dept., Portland State University, PO Box 751, Portland, OR, 97207-0751, United States, tima@etm.pdx.edu, Lane Inman

The TFDEA methodology was tested using a classic data set on US fighter plane performance. Data from 1944 to 1959 was used to forecast performance of future airplanes from 1967 through 1982 and compared to previously published results. TFDEA was found to better predict future performance.

3 - Computer Display Projectors
Supachart Iamratanakul, Portland State University, 1630 SW Clay ST APT #9C, Portland, OR, 97201, United States, iamratna@etm.pdx.edu, Lane Inman, Tim Anderson

Setting both competitive and realistic new product development targets is a challenge in rapidly changing industries. TFDEA was used to evaluate the changing capabilities of computer display projectors using hundreds of products released since 1995.

■ TB45

T-Gold (Mezzanine)

Optimization of Radiation Therapy Treatment Plans

Cluster: Oncology and OR
Invited Session

Chair: Edwin Romeijn, Associate Professor, ISE Department, University of Florida, 303 Weil Hall, PO Box 116595, Gainesville, FL, 32607, United States, romeijn@ise.ufl.edu

1 - Incorporating Patient Set-up Uncertainties in Optimization of IMRT
Mustafa Sir, University of Michigan, 1205 Beal Ave., Ann Arbor, MI, 48109, United States, msir@umich.edu, Stephen Pollock, Marina Epelman

We consider the problem of planning a sequence of radiation oncology treatments that takes into account errors in the delivery process due to uncertainty in patient set-up. The overall goal is to provide individualized adaptive treatment plans. The merits of heuristic policies for a resulting large-scale dynamic program are compared. The advantages of Bayesian updating of the probability distribution of the patient's location are also discussed.

2 - A Comparison of Convex Models and Algorithms for Fluence Map Optimization in Image-Guided IMRT
James F. Dempsey, Assistant Professor, University of Florida, Department of Radiation Oncology, Gainesville, FL, 32610-0385, United States, dempsey@ufl.edu, Edwin Romeijn, Jonathan G. Li, Erik Logdberg

Image-guided intensity modulated radiation therapy (IMRT) is currently under development in the field of radiation oncology. With this technology, patients are imaged daily or in real-time to account for variations in patient geometry from day to day or during treatment. Hence, there is a need for fast algorithms that can optimize IMRT plans with the patient on the treatment table. We present a comparison of convex programming models and algorithms applied to these problems using clinical data.

3 - Large-Scale Computational Techniques for Intensity-Modulated Radiotherapy Planning
Eva Lee, Associate Professor & Director, Center for Operations Research in Medicine, Georgia Institute of Technology, Industrial & Systems Engineering, Atlanta, GA, 30332-0205, United States, evakylee@isye.gatech.edu, Kyungduck Cha, Jin Shi

In this talk, we describe the use of large-scale mixed integer programming approach for simultaneously determining optimal beamlet fluence weights and beam angles in intensity-modulated-radiation-therapy treatment planning. For the tumor, explicit constraints include coverage with tumor underdose specified, conformity, and homogeneity; while DVH restrictions for critical structures and normal tissues are imposed. Computational results will be discussed.

■ TB46

T-Aspen (Mezzanine)

ScholarOne Demo

Cluster: ScholarOne Demo
Invited Session

Chair: Patricia Shaffer, INFORMS, 901 Elkridge Landing Road, Suite 400, Linthicum, MD, 21090-2909, United States, patricia.shaffer@informs.org

1 - Online Submission and Peer Review: No Longer "If," But "When"
Lisande Bissonette, ScholarOne, United States, lisande.bissonette@scholarone.com

The scholarly publishing community has come to realize that in order to remain competitive, journals must make the transition from paper- or e-mail-based processes to fully integrated, Web-based author submission and peer review. It is no longer a matter of "if, but of "when." This session is an overview and demonstration of version 3, the current release of the ScholarOne Manuscript Central system for online manuscript submission, peer review, and tracking. Even if your editorial office uses e-mail to send manuscripts and editorial correspondence, a Web-based system offers better time and cost savings by integrating online submission, author file conversion, correspondence, tracking, article solicitation, reviewer selection, late review notification, review completion, decision making, reporting, issue planning, user data management, broadcast e-mail, XML metadata capture, and post-acceptance integration with print and online production—all in one easy-to-use system.

■ TB47

T-Century (Mezzanine)

Software Demonstration

Cluster: Software Demonstrations
Invited Session

1 - Palisade Corp.- Desktop Monte Carlo Simulation Software
Dan Shikiar, Palisade Corp., 31 Decker Rd., Newfield, NY, 14867, United States, dshikiar@palisade.com

Desktop Monte Carlo simulation software is changing the role of analysts, planners, and forecasters allowing for advanced risk analysis. Palisade Corporation, the world leader in risk, decision, and statistical analysis software, will describe the value of Monte Carlo simulation and demonstrate the use of @RISK, Palisade's Monte Carlo simulation add-in for Microsoft Excel.

2 - SAS Institute, Inc.- SAS9: Meeting the Diverse Needs of the OR Analyst
Ed Hughes, SAS Institute, Inc., SAS Campus Dr., Cary, NC, 27513, United States, ed.hughes@sas.com

With SAS9, SAS is better suited than ever to OR modeling. Our broad spectrum of analytics, improved and enhanced, is complemented by our strengths in data acquisition, cleansing and organization. It's easier to encapsulate and deploy analytic methods. And the SAS language ties it all together, facilitating innovative, customized solutions.

Tuesday 1:30pm-3:00pm

■ TC01

P-Ballroom F

Tutorial: Radiation Oncology and Optimization

Cluster: Tutorials- Denver 2004
Invited Session

1 - Radiation Oncology and Optimization
Allen Holder, Trinity University, Department of Mathematics, One Trinity Place, San Antonio, TX, 78212-7200, United States, aholder@trinity.edu, Bill Salter

The field of medical physics increasingly relies on optimization techniques to improve nuclear procedures in medicine. Several treatment facilities are cooperating with academics, and a plethora of optimization problems have followed from these relationships. The most heavily studied problem is the design of a treatment plan for external beam radiotherapy, and because the treatment goals vary from patient to patient and clinic to clinic, many optimization models have been suggested (linear, nonlinear, and integer). While treatment design is the most prevalent research topic, there are other clinical questions that are naturally addressed by optimization, with treatment error and delivery receiving recent attention. The objectives of this tutorial are to 1) present the clinical issues needed to understand the optimization models, 2) provide a concise development of the physics describing how high-energy particles interact with the anatomy, 3) review the optimization and medical literature on treatment design, and 4) introduce some emerging problems.

■ TC02

P-Ballroom E

Metaheuristics II

Contributed Session

Chair: Bina Setyawati, Ph.D. Candidate, Industrial and Management Systems Engineering Department, West Virginia University, Morgantown, WV, 26506, United States, bsetyawa@mix.wvu.edu

1 - Augmented-Neural-Networks Approach for Multidimensional Knapsack Problems
Anurag Agarwal, Assistant Professor, University of Florida, Warrington College of Business, 351 Stuzin Hall, Gainesville, FL, 32611, United States, aagarwal@ufl.edu, Jason Deane

We present an Augmented-Neural-Networks approach for the multidimensional knapsack problem. The proposed approach is a meta-heuristic which combines a priority-rule heuristic with the iterative learning approach of neural networks.

2 - Tabu Search for Solving the Capacitated p-Median Problem
Vinìcius Armentano, Professor, Universidade de Campinas, FEEC-Av. Albert Einstein, 400, Campinas, SP, 13083-970, Brazil, vinicius@densis.fee.unicamp.br, Camila Mortati, Rodrigo Branchini

The capacitated p-median problem involves the selection of p medians and the assignment of clients' demands to the medians, such that their capacities are not exceeded and the sum of the distances of the clients to the medians is minimized. We propose a tabu search algorithm that uses a reduced neighborhood based on swaps between open and closed medians and that incorporates frequency-based memory for diversification and intensification. Tests are performed on instances from the literature.

3 - A Hybrid Tabu Search/Branch and Bound Approach to Solving the Generalised Assignment Problem.
Andrew Woodcock, Mr, Loughborough University, Business School, Loughborough, LE11 3TU, United Kingdom, A.J.Woodcock@lboro.ac.uk, John Wilson

This study is concerned with combining Tabu Search (TS) with Branch & Bound (B&B) to produce a hybrid solution method for solving the GAP. The approach taken is to use existing commercially available software (Xpress-MP)to provide the B&B aspect combined with a TS heuristic that interacts with the B&B software.In particular, some ideas due to Glover such as 'Tabu Branching Moves' and a 'Dynamic Branch and Bound' approach will be considered. Some initial results will be presented.

4 - Multilayer Feed Forward Neural Networks for Foreign Exchange Forecasting
Bina Setyawati, Ph.D. Candidate, Industrial and Management Systems Engineering Department, West Virginia University, Morgantown, WV, 26506, United States, bsetyawa@mix.wvu.edu, Robert Creese, Majid Jaraiedi

Multilayer Feed Forward Neural Network has been widely used for time series forecasting. Previous researches in this area advised topics that need to be investigated to improve NNs performance for this purpose, which include the need to obtain a tool to select the most appropriate NNs topology. This paper discusses various attempts to enhance the NNs performance by making certain that the correct topology has been used. The case study is foreign exchange rate forecasting.

■ TC03

P-Plaza Court 1

Biocomputing: Recent Advances on Modeling, Algorithms and Applications

Cluster: Science & OR
Invited Session

Chair: Cesar Rego, Associate Professor, University of Mississippi, School of Business Administration, Oxford, MS, 38677, United States, crego@bus.olemiss.edu

1 - A Filter-and-Fan Approach for Protein Folding
Haitao Li, University of Mississippi, Hearin Center for Enterprise Science, School of Business Administration, Oxford, MS, 38677, United States, hli@bus.olemiss.edu, Cesar Rego, Fred Glover

We show how special compound neighborhoods for adaptive search provide effective algorithms for protein folding problems. Computational tests of a filter-and-fan approach applied to standard benchmark instances of the protein folding problem in a 2D HP lattice model disclose highly promising outcomes.

2 - An Ejection Chain Approach for Protein Folding
Cesar Rego, Associate Professor, University of Mississippi, School of Business Administration, Oxford, MS, 38677, United States, crego@bus.olemiss.edu, Haitao Li, Fred Glover

We introduce a dynamic neighborhood search procedure based on an ejection chain model, identifying interesting similarities and contrasts with the filter-and-fan method of the previous talk. Computational results for the 2D HP model prove very impressive for all problems tested and suggest advantageous possibilities for new combined strategies.

3 - Solving RNA and DNA Design Problems using Stochastic Local Search
Holger Hoos, University of British Columbia, Computer Science Department, 2366 Main Mall, Vancouver, BC, V6T 1Z4, Canada, hoos@cs.ubc.ca

Computational methods for designing biomolecules with specific properties play an increasingly prominent role in bioinformatics, nanotechnology, and molecular therapeutics. In this talk, I will introduce two specific design problems, the RNA secondary structure design problem and the DNA code design problem, outline two state-of-the-art stochastic local search algorithms for these problems that have been developed in my group, and present some computational results.

4 - Tabu Search Enhanced Markov Blanket Classifier for High Dimensional Data Sets
Xue Bai, Carnegie Mellon University, The H. John Heinz III, School of Public Policy and Management, Pittsburgh, PA, 15213, United States, xbai@andrew.cmu.edu, Rema Padman

Data sets with many discrete variables and relatively few cases arise in health care, ecommerce, national security, and many other domains. We propose a Tabu Search procedure to learn a graphical Markov Blanket classifier from data. Computational results indicate that the TS/MB procedure converges very quickly, finds a parsimonious solution with substantially fewer predictor variables than in the full data sets, and can be advantageously compared with several machine learning methods.

■ TC04

P-Plaza Court 2

Joint Session Data Mining/Computing: Data Mining in Stochastic Decision-Making

Sponsor: Data Mining/Computing
Sponsored Session

Chair: Julia Tsai, Research Lead, Information Resources Inc., 150 N. Clinton St., Chicago, IL, 60661, United States, Julia.Tsai@infores.com

1 - Comparison of MARS and Neural Networks in Optimizing a Water reservoir
Aihong Wen, student, university of Texas at Arlington, 1110 S.Pecan st, Arlington, TX, 76010, United States, axw0932@omega.uta.edu, Cristiano Cervellera, Victoria Chen

An approximation algorithm for high-dimensional, continuous-state stochastic dynamic programming was first presented using an orthogonal array state space discretization and multivariate adaptive regression splines (MARS) value function approximation. Given the popularity of artificial neural networks (ANN), this talk

compares the MARS and ANN on an 8-dimensional water reservoir network.

2 - A Data Mining Analysis of Ordering Patterns in the Automotive Industry
Nihat Altintas, Ph.D Student, Carnegie Mellon University, Tepper School of Business, Pittsburgh, PA, 15213, United States, nihat@andrew.cmu.edu, Alan Montgomery, Michael Trick

We present a data mining analysis of a supplier's database consists of forecasts and final orders placed by his customers (auto manufacturers). Our goal is to improve the supplier's inventory planning decisions through a better understanding of his customers' forecast and order behavior. We demonstrate the application of some recent developments in clustering and pattern recognition which can have a significant impact on the performance analysis of customers.

3 - A Theoretic Approach for Comparing Heuristics to Dynamic Programming
Gerald Kobylski, Graduate Student, Stevens Institute of Technology, Department of Systems Engineering, Castle Point on Hudson, Hoboken, NJ, 07030, United States, gkobylski@wmconnect.com, John Farr, Dennis Buede

Most research efforts have failed to achieve a representation for decision problems that have many variables, particularly when the amount of uncertainty varies over time. This research explores the use of Dynamic Decision Networks (DDNs), a technique that merges concepts of Bayesian Networks and Influence Diagrams. In this presentation we will focus on the development of a theoretic approach for comparing heuristics (in this presentation a DDN)to Dynamic Programming.

4 - Quantification and Characterization of Uncertainty and the "Value of Research" Methodology
Urmila Diwekar, University of Illinois at Chicago, Inst. of Environmental Science & Policy, 851 S. Morgan St., Chicago, IL, 60607, United States, urmila@uic.edu, Karthik Subramanyan

We consider multi-objective optimization (MOP) of a hybrid fuel cell power plant, to have low emissions and competitive costs. With an extensive database we built,we can characterize,quantify uncertainties and propagate them through a MOP framework to study their effect on the optimal trade-off surfaces.Through a literature survey on the "value of information",we found that "value of research" would be be more suitable in this case due to multiple objectives and finally, we analyze this concept.

■ TC05

P-Plaza Court 3

Computational Integer Programming Approaches

Sponsor: Optimization/ Integer Programming
Sponsored Session

Chair: Andrew Miller, Assistant Professor, University of Wisconsin, Dept. of Industrial Engineering, Madison, WI, United States, amiller@ie.engr.wisc.edu

1 - On Capacitated Fixed-Charge Network Path-Set Polyhedra
Alper Atamturk, University of California, 4141 Etcheverry Hall, MC 1777, Berkeley, CA, 94720-1777, United States, atamturk@ieor.berkeley.edu, Simge Kucukyavuz

We describe strong valid inequalities for path relaxation of capacitated fixed-charge network flows. We discuss lifting problems and present computational experiments.

2 - Nested Partitions Based Column Generation
Andrew Miller, Assistant Professor, University of Wisconsin, Dept. of Industrial Engineering, Madison, WI, United States, amiller@ie.engr.wisc.edu, Leyuan Shi, Mehmet Bozbay, Robert R. Meyer

We present a Column Generation algorithm for generating lower bounds that takes advantage of feasible solutions produced by Nested Partitions. We demonstrate our approach by applying it to a set of multicommodity distribution system design problems, and the results show that our framework is capable of efficiently high quality bounds. The fact that our framework leverages the capabilities of a primal metaheuristic to generate lower bounds (and not just feasible solutions) is a particularly novel aspect of this research.

3 - Warm Starting and Sensitivity Analysis for MIP
Ted Ralphs, Lehigh University, 200 W Packer Ave, Bethlehem, PA, 18015, United States, tkr2@lehigh.edu, Menal Guzelsoy

We will discuss methods for starting MIP computations from a warm start, for performing sensitivity analysis on MIPs, and for analyzing multicriteria MIPs. We will discuss the implementation of these closely related methods in the new SYMPHONY callable library, and present computational results from several application areas.

4 - Facets of Conflict Hypergraphs — Theory and Computation
Siddhartha Maheshwary, Georgia Institute of Technology, Industrial and Systems Engineering, Atlanta, GA, 30332-0205, United States, sid@isye.gatech.edu, Eva Lee

In this talk, we present the construction of conflict hypergraphs from independent set and multi-dimensional knapsack polytopes. Valid and facet-defining inequalities will be identified from the hypergraphical structures. Computational results of these strong valid inequalities on real-world MIP-instances will be described.

■ TC06

P-Plaza Court 4

Integer Programming I

Contributed Session

Chair: Jianxiang Li, Ph.D Student, Northeastern University, Department of Systems Engineering, Shenyang, LN, 110004, China, Peoples Republic, jianxiang_li@hotmail.com

1 - A Labeling Algorithm to Solve the Assignment Problem
Adalet Oner, Ph.D, Turkish Naval Academy, Deniz Harp Okulu, Dekanlik, Endustri Muh.Bol.Bsk., Istanbul, 34940, Turkey, aoner@dho.edu.tr

This study describes a labeling algorithm to solve the assignment problem. The labeling algorithm is based on Hungarian method and offers a new approach to solve the problem of finding the fewest number of lines to cover all zeros in the reduced assignment matrix. The approach is useful for educational purposes and can be used without familarity with the special network structures.

2 - The Maximum Covering Problem and Extensions
Skylab R. Gupta, Auburn University, Industrial & Systems Engineering Dept., 208 dunstan hall, auburn, al, 36849, United States, guptasr@auburn.edu, R.L. Bulfin, Jeffrey S. Smith

We consider extensions to the maximum covering problem and uncapacitated facility location problem. One of these extensions is a budget constrained maximum covering problem. This problem is a special case of maximizing a submodular function subject to a knapsack constraint. Main components of a branch and bound algorithm for this problem are discussed and computational results presented. Using this, we then outline an algorithm to solve a special case of the binary quadratic knapsack problem.

3 - Using Strong Branching for the Multiple Sequence Alignment Problem
Todd Easton, Assistant Professor, Kansas State University, 237 Durland Hall, Manhattan, KS, United States, teaston1@ksu.edu, Abhilash Singireddy

Given a set of strings, the Multiple Sequence Alignment Problem seeks to find a sequence that "best" represents this set of input strings. Weighted operations of deletion, insertion and substitution define what is meant by best. A new branch and bound method that employees strong branching is used as a heuristic to solve this problem. Computational results are also presented.

4 - A Mathematical Programming Model for Hot Rolling Seamless Tube Production Planning
Jianxiang Li, Ph.D Student, Northeastern University, Department of Systems Engineering, Shenyang, LN, 110004, China, Peoples Republic, jianxiang_li@hotmail.com, Huijiang Wu, Lixin Tang

We formulated the production planning problem of hot rolling seamless steel tube in Tianjin Pipe Corporation, China as a mixed integer linear programming model. The formulation fits into the class of multi-stage multi-item capacitated lot sizing problem except several differences. Considering the problem is NP-Hard, We modified two existing LP-based heuristic algorithms to solve it.

■ TC07

P-Plaza Court 5

Solution Methods for Linear Programming and Linear Complementarity Problems

Sponsor: Optimization/Linear Programming and Complementarity
Sponsored Session

Chair: Xing Liu, Dept. of Math.&Stat., UMBC, 9 Merrill Rd. Apt. A, Baltimore, MD, 21228, United States, liu2@math.umbc.edu

1 - Predictor-Corrector Methods for Sufficient Linear Complementarity Problems
Xing Liu, Dept. of Math.&Stat., UMBC, 9 Merrill Rd. Apt. A, Baltimore, MD, 21228, United States, liu2@math.umbc.edu, Florian Potra

Two higher order predictor-corrector methods are proposed for solving sufficient linear complementarity problems. The methods produce a sequence of iterates in the wide neighborhood of the central path. The first method requires an explicit upper bound of the handicap of the problem while the second method does not. Both method share the lowest iteration complexity asymptotically. They are superlinearly convergent even for degenerate problems.

2 - A Long Step Algorithm for P*-Linear Complementarity Problems
Goran Lesaja, Dept. of Mathematics & Computer Science, Dept. of Mathematics & Computer Science, Georgia Southern University, Statesboro, GA, 30460, United States, goran@GeorgiaSouthern.edu

We generalize the new approach proposed by Ai and Zhang from monotone LCP to P*-LCP and obtain a long step algorithm for P*-LCP in the wide neighborhood of the central path that has the best known iteration complexity bound for interior-point methods operating in the wide neighborhood.

3 - Solving Large Scale Linear Network Flow Problems with MOSEK
Bo Jensen, MOSEK ApS, Fruebjergvej 3, Box 16, Copenhagen, 2100, Denmark, bo.jensen@mosek.com

This talk will present a new implementation of the network simplex algorithm intended for solution of huge network flow problems. In particular we will present detailed computational results that compare our network optimizer with other optimizers. Finally, we will discuss how to integrate the network optimizer into MOSEK.

■ TC08

P-Plaza Court 6

Network Flow Applications

Sponsor: Optimization/ Network Optimization
Sponsored Session

Chair: S. Thomas McCormick, Professor, Sauder School of Business, University of British Columbia, 2053 Main Mall, Vancouver, BC, V6T 1Z2, Canada, Tom.McCormick@sauder.ubc.ca

1 - Optimization Problems in Municipal Water Network Security
Cynthia A. Phillips, Sandia National Laboratories, PO Box 5800, MS 1110, Albuquerque, NM, 87185-1110, United States, caphill@sandia.gov, William E. Hart, Jean-Paul Watson, Jonathan Berry, Harvey Greenberg, James Uber, Robert Carr

I will present graph-based models of contaminant transportation in water networks and survey a number of optimization problems arising in water network security. Most of these problems involve sensor placement in water networks and can be solved in practice for moderate-sized water networks as integer programs. I will discuss methods for handling uncertainty in input parameters with fixed sums (such as discrete probability distributions for attack risk).

2 - Economically Preferred Facility Locations with Networking Effect
Dorit Hochbaum, Professor, UC Berkeley, IEOR Department Etcheverry Hall, Berkeley, Ca, 94720, United States, hochbaum@IEOR.Berkeley.edu

In the presence of networking effect, locating a facility is associated with a fixed cost but provides benefit to all open facilities. We devise a parametric minimum cut procedure algorithm that generates the efficient frontier of facilities' configurations maximizing the benefit-to-cost ratio, and finds a subset of those configurations that are nested for increasing budgets in polynomial time. The problem is closely related to the maximum clique and the maximum dispersion problem.

3 - Characterizing Flow through Components in Assembly Networks
S. Thomas McCormick, Professor, Sauder School of Business, University of British Columbia, 2053 Main Mall, Vancouver, BC, V6T 1Z2, Canada, Tom.McCormick@sauder.ubc.ca, Maurice Queyranne

Given a directed acyclic graph with sources and sinks, consider the set of flows induced by putting non-negative flows on all source-sink paths. When the number of paths is much larger than the number of nodes, it is more convenient to consider flows through nodes in place of of path flows. We give fast algorithms for separation, validity, dimension, and separating to a facet.

■ TC09

P-Plaza Court 7

Advances in Nonlinear Programming

Sponsor: Optimization/ Nonlinear Programming
Sponsored Session

Chair: Dominique Orban, Adjunct professor, Ecole Polytechnique de Montreal, 2900 Boulevard Ed. Montpetit, Montreal, QC, H3T1J4, Canada, Dominique.Orban@polymtl.ca

1 - A New Conjugate Gradient Method with Guaranteed Descent and an Efficient Line Search
Hongchao Zhang, Ph.D. Student, University of Florida, 358 Little Hall, Department of Mathematics, Gainseville, FL, 32611, United States, hzhang@math.ufl.edu, William Hager

A new nonlinear conjugate gradient method and an associated implementation, based on an inexact line search, are proposed and analyzed. With exact line search, our method reduces to a nonlinear version of the Hestenes-Stiefel conjugate gradient scheme. For any (inexact) line search, our scheme satisfies a descent condition. Moreover, a global convergence result is established when the line search fulfills the Wolfe conditions. Numerical comparisons are given.

2 - Limited Memory Solution of Complementarity Problems Arising in Video Games
Paul Armand, Maître de conférences, Université de Limoges, Laboratoire LACO, 123, Avenue Albert Thomas, Limoges, 87060, France, armand@unilim.fr, Michael C. Ferris, Andrew J. Wathen

We describe the solution of a complementarity problem with limited memory resources. The problem arises from physical simulations occurring within video games. The motivating problem is outlined, along with a simple interior point approach for its solution. Various linear algebra issues arising in the implementation are explored, including preconditioning, ordering and a number of ways of solving an equivalent augmented system. Some alternative approaches are briefly surveyed.

3 - High Order Algorithms for Nonlinear Programming
Benoit Hamelin, Ph.D student, Université de Sherbrooke, Département d'informatique, Sherbrooke, J1K2R1, Canada, benoit.hamelin@usherbrooke.ca, Jean-Pierre Dussault

Many algorithms for NLP are based on Newton's method. For LP, higher order variants of interior point predictor-corrector methods have been proposed. We are interested in the use of higher order iterations for NLPs. We develop a heuristic implementation and show how explicit high order tensors are avoided within a specialized version of an automatic differentiation tool. We also show preliminary numerical results.

■ TC10

P-Plaza Court 8

Transportation and Inventory Control

Sponsor: Transportation Science & Logistics
Sponsored Session

Chair: Yue Jin, University of Massachussetts - Amherst, University of Massachusetts, Amherst, MA, 01002, United States, yuej@acad.umass.edu

1 - Continuous-Move Vehicle Routing Problem
Prahalad Venkateshan, Doctoral Student, Department of Operations, Case Western Reserve University, 10900 Euclid Avenue, Cleveland, OH, 44106, United States, pxv28@weatherhead.cwru.edu, Kamlesh Mathur

This paper considers designing routes each ship in a fleet needs to follow over a planning horizon to satisfy customer demands. Each customer demands a certain amount of product to be picked up from a port of origin and delivered to a destination port. The problem is formulated as a set-partitioning problem. To solve this, an efficient column generation algorithm that finds a "time constrained shortest cost cycle" using the idea of scaling within a dynamic programming framework is proposed.

2 - A Revised Ant Colony Algorithm for the Vehicle Routing Problem with Time Windows
Büent Çatay, Assistant Professor, Sabanci University, FENS, Tuzla, Istanbul, 34956, Turkey, catay@sabanciuniv.edu, Elif Ilke Gökçe

We apply Ant Colony Systems (ACS) to the Vehicle Routing Problem with Time Windows (VRPTW). The approach has three steps. The first step finds an initial pheromone value. In the second step, a revised ant colony system is proposed to construct improved solutions. In the final step, the obtained solutions are further improved using 2-opt algorithm. We observe that the proposed ACS performs well compared to the benchmark results that exist in the literature for Solomon's problems.

3 - DSS LOGDIS Optimizes Routes for FRILAC Frozen Products
Javier Faulin, Department of Statistics and Operations Research, 31006 Campus Arrosadìa, Public University of Navarra, Pamplona, Spain, javier.faulin@unavarra.es, Pablo Sarobe, Jorge Simal, Alejandro G. del Valle

We have designed a DSS for the routing optimization in the frozen products delivery at FRILAC Company (Navarra, Northern Spain). We suggested creating a DSS which makes this procedure easier, reaching a twofold goal: the design of a route-builder and the integration of that DSS into the global management of the company. Both objectives were achieved by the construction of the DSS LOGDIS. The results have successfully been implemented and tested.

4 - Single-Warehouse Multi-Retailer Inventory Systems with Full TruckLoad Shipments
Yue Jin, University of Massachussetts - Amherst, University of Massachusetts, Amherst, MA, 01002, United States, yuej@acad.umass.edu, Ana Muriel

We consider a multistage inventory system composed of a single warehouse and n retailers. Ordering costs are dominated by the full truckload transportation costs with cargo capacity constraints. We show that both the shipments between the supplier and warehouse and between the warehouse and each retailer satisfy the so-called OLTL property. Using this property, we develop both an exact algorithm that runs in polynomial time for a given number of retailers and fast heuristic algorithms.

■ TC11

P-Governor's Square 9

Reverse Supply Chains and Reverse Logistics

Sponsor: Transportation Science & Logistics
Sponsored Session

Chair: Ronald Tibben-Lembke, Assoc. Prof, SCM, University of Nevada, Reno, MGRS / 028, Reno, NV, 89557, United States, rtl@unr.edu

1 - Optimization of Recycling-Networks for End-of-Life-Vehicles
Jens Wollenweber, RWTH Aachen, University, Templergraben 64, Aachen, —, 52062, Germany, Jens@or.rwth-aachen.de

Recycling of end-of-life-vehicles gains importance in the European Community. New laws force automotive companies to build an area-wide network for retraction and utilization of end-of-life-vehicles. We model such a recycling network as a multilevel warehouse location problem (wlp) with special cost functions and show some heuristics to solve this wlp. These heuristics are adaptations of well-known algorithms for wlp such as ADD, DROP and local search.

2 - Reverse Production System Planning
Matthew Realff, Dr, Georgia Tech, School of Chemical Engineering, ES&T Building, Atlanta, GA, 30332-0100, United States, Matthew.Realff@chbe.gatech.edu, Jane Ammons, Ethan Hong, Wuthichai Wongthatsanekorn, Tiravat Assavapokee

The design of recycling infrastructure requires that collection and processing systems be designed together leading to the notion of reverse production systems. This paper will discuss recent applications of a robust optimization framework to case studies to support decision making for the state of Georgia's electronic recycling program.

3 - New Findings in Reverse Logistics
Ronald Tibben-Lembke, Assoc. Prof, SCM, University of Nevada, Reno, MGRS / 028, Reno, NV, 89557, United States, rtl@unr.edu, Dale Rogers

We present findings from a new study into retail and manufacturer returns policies and reverse logistics. We will present results from a recent survey, and from numerous in-depth interviews, discussing returns rates and best practices.

■ TC12

P-Governor's Square 10

2004 Dantzig Dissertation Award Finalists

Cluster: Dantzig Dissertation Prize
Invited Session

Chair: Arnold Barnett, George Eastman Professor of Management Science, MIT, E53-379, 77 Massachusetts Ave, Cambridge, MA, 02139, United States, abarnett@mit.edu

1 - The Dantizg Dissertation Prize

The Dantzig Prize is offered for the best Ph.D in Operations Research with applied content. The winner will likely offer a presentation, as will some of the strongest finalists.

■ TC13

P-Governor's Square 11

Robust Airline Scheduling and Operations

Sponsor: Aviation Applications
Sponsored Session

Chair: John-Paul Clarke, johnpaul@mit.edu

1 - Robust Aircraft Fleeting, Routing and Scheduling
Cynthia Barnhart, MIT, 77 Massachusetts Avenue, Room 1-235, Cambridge, MA, 02139, United States, cbarnhar@mit.edu, John-Paul Clarke, Sepehr Samardi, Shan Lan

In this research, we present planning models and algorithms to re-route aircraft, adjust fleet assignments, and re-time flight leg departures simultaneously, with the goal of optimally distributing slack time in the network and reducing expected passenger delays. Using data from a major US airline to calibrate our models, we quantify and report the resulting reductions in propagated flight delays and passenger delays.

2 - Large Scale Crew Rostering
Marek Ozana, Carmen Systems, Odinsgatan 9, Gothenburg, SE-411 03, Sweden, marek.ozana@carmensystems.com

Carmen Systems' crew rostering product is currently used by several major European airline and railway companies. In the largest problem that is solved today, around 7,000 crew members are assigned roughly 22,000 tasks. Production quality rosters are produced within 14 hours of optimization time. We describe the sequence of algorithms that are applied and the way these have been modified and extended in order to cope with the largest problems.

3 - A Heuristic IP Solver in Column Generation for Crew Pairing
Johan Ivarsson, Carmen Systems, Odinsgatan 9, Gothenburg, SE-411 03, Sweden, johan.ivarsson@carmensystems.com, Tomas Gustafsson, Curt Hjorring

Column generation is the preferred approach to solving crew pairing problems. In this presentation we describe how we have integrated a heuristic IP solver in the column generator that frequently feeds the user with high quality solutions during an optimization run, and on the same time provides dual feedback to the pricing step. We provide computational results and compare this approach with other column generation approaches.

■ TC14

P-Governor's Square 14

Innovations in Organizations and on Markets

Sponsor: Technology Management
Sponsored Session

Chair: Christian Schade, Professor, Humboldt-Universität zu Berlin, Spandauer Str. 1, Berlin, D-, 10178, Germany, schade@wiwi.hu-berlin.de

1 - Institutional and Behavioral Economics in Organizational Technology and Knowledge Management
Michaela Haase, PD Dr., Freie Universität Berlin, Otto-von-Simson-Str. 13/15, Berlin, D-, 14195, Germany, mhaase@wiwiss.fu-berlin.de

The paper illuminates the knowledge conditions of organizational technology management whose prospective success depends on the managerial ability to combine and steer different but interrelated knowledge processes. The paper explicates contributions of institutional economics to the design of organizational arrangements suited for the coordination of knowledge-based social actions. It also considers impact and scope of the behavioral economics.

2 - Optimal Assortment and Inventory Control Policy in a Make-to-Stock
Susan Xu, Professor, Penn State University, The Smeal College of Business Adm., University Park, PA, 16802, United States, shx@psu.edu

We consider the joint assortment and inventory optimization problem for a periodic reviewed Make-to-Stock system with technology innovations. Our analysis provides insights about how the optimal assortment changes as the technology evolves and the optimal timing to introduce new products or discontinue the old ones.

3 - Intermediation in Innovation
Alexander Erdmann, Dipl.-Wirtsch.-Ing., Humboldt University, Spandauer Strasse 1, 10178 Berlin, Berlin, D, Germany, alex_erdmann@hotmail.com, Christian Schade

The transfer of patents from universities, research institutes and free inventors to potential commercial users of patents (companies) may be arranged with patent brokers which act as intermediation companies. This presentation contains the embodiment of a three-stage model for the intermediation process of innovation. The model is based on simultanous market entry games under asymmetric distribution of information and it reveals an explanation for the economic necessity of this intermediation.

4 - Reciprocity with Video File Sharing: Experimental Evidence
Christian Schade, Professor, Humboldt-Universität zu Berlin, Spandauer Str. 1, Berlin, D-, 10178, Germany, schade@wiwi.hu-berlin.de

We report on findings of a controlled experiment on consumer reciprocity. The experiment resembled a purchasing situation in an online video on demand (VOD) system. Payments and video purchases had real consequences. We find that individuals largely differ in their propensity to reciprocate by sharing videos just bought with other participants. Differences in reciprocal behavior between individuals are related to bidding behavior in a mutual ultimatum bargaining game. Implications are discussed.

■ TC15

P-Governor's Square 15

Job Shop Scheduling and Transportation

Cluster: Scheduling
Invited Session

Chair: Johann Hurink, Professor, University of Twente, Netherlands, j.l.hurink@utwente.nl

1 - Job-shop Scheduling with Limited Capacity Buffers
Tim Nieberg, University of Twente, P.O. Box 217, Enschede, 7500 AE, Netherlands, T.Nieberg@Math.UTwente.nl, Silvia Heitman, Johann Hurink, Peter Brucker

We investigate job-shop problems where limited capacity buffers to store jobs in non-processing periods are given. Concerning the specification of the buffers besides a general model, also specific configurations are considered. The aim of this study is to find a compact representation of solutions. After proposing two such representations based on the alternative and the disjunctive graph model, in a second part, it is investigated if the given solution representation can be simplified.

2 - A Branch-and-Bound Algorithm for Two-stage Hybrid Flow-shop Scheduling with Multiprocessor Tasks
Ceyda Oguz, Professor, The Hong Kong Polytechnic University, Department of Logistics, Hong Kong, lqtceyda@polyu.edu.hk, Lixin Tang

We consider scheduling problems in two-stage hybrid flow- shops with multiprocessor tasks to minimize makespan, which find their applications in machine-vision systems. We will present a branch-and-bound algorithm to provide exact solutions. We will also describe a lower bound which is better than the previous one given in the literature. We will conclude with the results of our computational experiments.

3 - Modeling of Capacitated Transportation Systems for Integral Scheduling
Johann Hurink, Professor, University of Twente, Netherlands, j.l.hurink@utwente.nl, Marco Schutten, Matthieu van der Heijden, Mark Ebben

Motivated by a planned automated cargo transportation network, we consider transportation problems in which the finite capacity of resources (such as vehicles, docks, parkings) has to be taken into account. For such problems, it is often even difficult to construct a good feasible solution. We present a flexible modeling methodology which allows to construct, evaluate,and improve feasible solutions. This approach is evaluated on instances stemming from the planned cargo transportation system.

4 - New Optimization Algorithms for the General Earliness-Tardiness Scheduling Problem
Leyuan Shi, Professor, University of Wisconsin, Department of Industrial Engineering, Madison, WI, 53706, United States, leyuan@engr.wisc.edu, Yunpeng Pan, Hoksung Yau

The general earliness-tardiness scheduling problem arises in Just-In-Time manufacturing environments. Despite its applicability, effective solution procedures for this general problem, especially optimal ones, have not been adequately discussed. The difficulty is that classical techniques such as dominance conditions and tailored lower bounds cannot be extended to the general case. We propose new algorithms that integrate dynamic programming, branch-and-bound, and constraint programming.

■ TC16

P-Governor's Square 17

Optimization Modeling in Practice I

Sponsor: Computing Society
Sponsored Session

Chair: Bjarni Kristjansson, President, Maximal Software, Inc., 2111 Wilson Boulevard, Arlington, VA, 22201, United States, bjarni@maximalsoftware.com

1 - An Example of How to Build Optimization Systems for Non-OR Users
Monique Guignard, OPIM Dept., The Wharton School, University of Pennsylvania, Suite 500, JMHH, 3730 Walnut Street, Philadelphia, PA, 19104-6340, United States, guignard@wharton.upenn.edu, Antoine Sauré

Solving real-world problems with OR tools involves more than applying optimization or simulation. We describe a complete system consisting of: an easy-to-use data-input module, a module that generates lines of code (such as instance-dependent constraints) and imbeds them in a GAMS code, and a module linking all these together.

2 - Using the Profit Network Model to Rationalize a Distribution System
Gene Ramsey, 3082 Argonne Drive, Atlanta, GA, 30305, United States, gene@profitpt.com

Profit Network is a supply chain network design system allowing users to make least cost decisions regarding the best locations for production and distribution facilities. Recently two merging distributors used it to identify the best facility configuration for their combined systems. I will discuss the business problem, the model and the types of results achieved.

3 - Implementing Real-World Optimization Applications with MPL and OptiMax
Bjarni Kristjansson, President, Maximal Software, Inc., 2111 Wilson Boulevard, Arlington, VA, 22201, United States, bjarni@maximalsoftware.com, Steven Pfaffle

We will present few customer case studies that use optimization to solve business problems including: 1) ProfitNetwork from ProfitPoint, a tool to analyze alternative placements of production facilities and distribution centers over the planning horizon; 2) Large-scale manpower forecasting system for US Army; 3) Mortgage Backed Securities application that allows traders at Wachovia to select optimal sets of tax lots; 4) Tool by Agilent to diagnose data communications faults in Internet routers.

■ TC17

P-Directors Row E

Teaching Decision Analysis

Sponsor: Decision Analysis
Sponsored Session

Chair: Eric Bickel, Assistant Professor, Department of Industrial Engineering, Texas A&M University, 236B Zachry Engineering Center, 3131 TAMU, College Station, TX, 77843-3131, United States, bickel@iemail.tamu.edu

1 - Worst to First: Winning Strategies and Tactics for MBA Courses
Patrick S. Noonan, Associate Professor, Goizueta Business School, Emory University, 1300 Clifton Road, Atlanta, GA, 30322, United States, patrick_noonan@bus.emory.edu

In teaching decision making, many paths lead to failure, and many to glory. One model of success uses a unifying framework to position decisions as the center of the management universe, reinforced by pedagogical approaches that emphasize the important role of a decision-centric view.

2 - Decision Education Foundation: "Better Decisions — Better Lives"
Carl Spetzler, Chairman, Strategic Decisions Group, 735 Emerson, Palo Alto, CA, 94301, United States, sswann@sdg.com

"Better Decisions - Better Lives" is the mission of Decision Education Foundation, a nonprofit organization that promotes decision education for teenagers. This session provides an overview of how DEF reaches out to teenagers, what it has learned over the past three years, and what its future holds.

■ TC18

P-Directors Row H

New Approaches to Network Management

Sponsor: Telecommunications
Sponsored Session

Chair: Jun Shu, Professor, Penn State University, 501G BAB, University Park, PA, 16802, United States, junshu@psu.edu

1 - Combinatorial Auctions for Telecommunications Bandwidth Pricing
G "Anand" Anandalingam, Professor, University of Maryland, College Park, Van Munching Hall, R H Smith school of business, College Park, MD, 20740, United States, ganand@rhsmith.umd.edu

When users request origin-destination bandwidth, network providers have to set up paths consisting of connected links. Links that are provided to some users are unavailable to others. The combinatorial auction mechanism allows users to bid for routes without having to know beforehand how to route the traffic.

2 - Congestion Pricing based on the VCG Mechanism
Jun Shu, Professor, Penn State University, 501G BAB, University Park, PA, 16802, United States, junshu@psu.edu

We propose a game theoretic congestion control mechanism. The mechanism provides differentiated qualities of service in a packet-switched network. The mechanism also provides a base for new type of pricing scheme that is incentive compatible. For users, the mechanism offers better quality and lower price. Service providers can base new service and revenue models within the mechanism.

3 - A Public Good Model of Availability in Peer to Peer Systems
Jonathan Shapiro, Professor, Dept. of Computer Science and Engineering, 3115 Engineering Building, Michigan State University, East Lansing, MI, 48824-1226, United States, jshapiro@cse.msu.edu, Don Towsley, Daniel Figueiredo

We apply insights from public good economics to the problem of user behavior in peer-to-peer systems, considering a form of free riding in which users cooperate when joined to the system, but stay joined only long enough to satisfy their individual needs. For a special cases of the model, one can readily show that this form of free riding can undermine the stability of many systems. We also consider the design of incentive mechanisms to mitigate the impact of free riding.

4 - Measuring the Delay of Packet-Switching Networks
Yupo Chan, Professor & Founding Chair, University of Arkansas at Little Rock, 2801 South University, Little Rock, AR, 72204-1099, United States, yxchan@ualr.edu, Gary Moy, Dong Wang, Richard Raines

This research presents the minimum and maximum delay encountered in a packet-switching network. The lower bound can be estimated at a given probability for the path with independent and identically distributed processors using the Central Limit Theorem. Similarly, the upper-bound estimating technique describes the maximum delay as a given probability. These two techniques were applied to two typical test networks. They appropriately bounded the representative sojourn times.

■ TC19

P-Directors Row F

Issues in Closed-Loop Supply Chains

Cluster: Reverse Supply Chains
Invited Session

Chair: Daniel Guide, Assistant Professor, Penn State University, Smeal College of Business, University Park, PA, United States, dguide@psu.edu

1 - Optimal Parts Procurement in a Remanufacturing Line
Prashant Yadav, Zaragoza Logistics Center, MIT- Zaragoza Int. Logistics Program, Avda. Gómez Laguna, 25 1 Planta, Zaragoza, AR, 50009, Spain, pyadav@cba.ua.edu, David Miller, John Mittenthal

A remanufacturing facility typically uses a combination of recovered parts and new parts to rebuild the product. Due to yield uncertainity, it is difficult to decide what fraction of parts to purchase new at the start of the planning horizon. We determine the optimal fraction of new parts to order and characterize the benefits of accurately forecasting yields by incorporating core-usage-history.

2 - Supply Chain Coordination for False Failure Returns
Daniel Guide, Assistant Professor, Penn State University, Smeal College of Business, University Park, PA, United States, dguide@psu.edu, Gilvan C. Souza, Mark Ferguson

We consider the problem of reducing consumer product returns via supply chain coordination. We propose a target rebate contract that pays the retailer for each unit of of false failure returns below a target. The target rebate provides an incentive to the retailer to increase their efforts to reduce false failure returns.

3 - A Nested Dynamic Programming Approach to Solve Lot Sizing Problems in Remanufacturing
Mehmet Yesildag, Dept. of Industrial & Systems Engineering, 303 Weil Hall, University of Florida, Gainesville, Fl, 32611-6595, United States, yesildag@ufl.edu, Elif Akcali

We consider a firm that operates a manufacturing facility with remanufacturing capability. The firm operates a collection center, where used products are consolidated, inspected, and shipped to the manufacturing facility. We introduce a dynamic lot-sizing formulation to minimize the total costs. We show that the general model with capacitated returns and concave cost functions is NP-hard. We then provide nested dynamic programming algorithms to solve these problems under general assumptions.

4 - Optimal Sourcing with Up and Downstream Uncertainty
Gerard Burke, Dept. of Decision & Information Sciences, Warrington College of Business Admin., University of Florida, Gainesville, FL, 32611, United States, burkegj@ufl.edu, Asoo Vakharia, Janice Carrillo

We analyze optimal supplier selection strategies in an environment with uncertain supplier reliability and uncertain demand. In particular, we analyze the explicit trade-off between supplier reliability and costs in determining an appropriate sourcing strategy.

■ TC20

P-Room 3304

New Models in Health Care OR

Sponsor: Health Applications
Sponsored Session

Chair: Stefanos Zenios, Graduate School of Business, Stanford University, Stanford, CA, 94305, United States, stefzen@stanford.edu

1 - Evaluation of a HEPA/vaccine Plan for Indoor Remediation After an Airborne Anthrax Attack
Lawrence Wein, Paul E. Holden Professor of Management Science, Graduate School of Business, Stanford University, Stanford, CA, 94305-5015, United States, wein_lawrence@gsb.stanford.edu, Yifan Liu

We develop a mathematical model to compare the safety, cost and recovery time of two indoor remediation strategies after an airborne anthrax attack: the fumigation strategy used after the 2001 postal attack, and a HEPA/vaccine plan, which relies on HEPA vacuuming, HEPA air cleaners, and reoccupant vaccination.

2 - Determining the Acceptance of Cadaveric Livers Using an Implicit Model of the Waiting List
Oguzhan Alagoz, Case Western Reserve University, 330 Peter B. Lewis Building, 10900 Euclid Avenue, Cleveland, OH, 44106, United States, oguzhan.alagoz@case.edu, Lisa Maillart, Mark Roberts, Andrew Schaefer

Although there is a shortage of cadaveric livers, 60% of all liver offers are declined by the transplant surgeons/patients, in the hope that they will receive a better organ offer in the future. We have developed an infinite horizon discounted MDP model that solves the decision problem faced by these patients: should an offered organ of a given quality be accepted or rejected? We derived the structural properties of this model and solved it using real data.

3 - Mechanism Design for Kidney Allocation
Xuanming Su, UC Berkeley, Haas School of Business, 545 Student Services Building # 1900, Berkeley, CA, United States, xuanming@haas.berkeley.edu, Stefanos Zenios

We formulate a mechanism design problem to study the impact of patient choice on kidney allocation outcomes. Under parametric assumptions on the survival distribution functions, this problem is solved explicitly using the achievable regions approach and polymatroid optimization techniques. Numerical results show that our analytical solutions perform well in the general case.

4 - Optimal Initiation of Dialysis: A Neuro-Dynamic Programming Approach
Chris Lee, Ph.D Candidate, Stanford University, Gates 2B, Stanford, CA, 94305, United States, cpclee@stanford.edu, Stefanos Zenios, Glenn Chertow

Due to dismal clinical outcomes and a rising cost of care, the End-Stage Renal Disease is a serious challenge to healthcare policy makers. Little is known about the relationship between the initiation time, cost, and effectiveness of the dialysis therapy. We discuss a simulation model for ESRD and compare various dialysis policies, including a policy computed using Neuro-Dynamic Programming. The comparisons are holistic in that we examine both cost and effectiveness.

■ TC21

P-Room 3302

Spreadsheet Analyst Productivity

Sponsor: Spreadsheet Productivity Research
Sponsored Session

Chair: Roger Grinde, Associate Professor of Management Science, University of New Hampshire, 15 College Road/McConnell Hall, Durham, NH, 03824, United States, roger.grinde@unh.edu

1 - Taming Big Spreadsheets
Doug Hay, Unit Leader, Weyerhaeuser Company, 32901 Weyerhaeuser Way S, Federal Way, WA, 98001, United States, doug.hay@weyerhaeuser.com

Spreadsheets support many OR applications, but can grow quite large. This paper describes a methodology for 1) rapidly inspecting large quantities of input data for significant outliers, 2) flexibly examining the results of a given LP solution and 3) organizing and evaluating the solution results for a large set of scenarios.

2 - Layout Driven Spreadsheet Visualization
Markus Clermont, Software Quality Research Laboratory, University of Limerick, University of Limerick, Limerick, Ireland, markus.clermont@ul.ie

We present an approach to spreadsheet auditing that is based on the visualization of the formula structure. Re-occuring similar blocks of cells are identified, and, based on certain heuristics, these blocks are attached to labels. Auditors are supported by visualization of the pattern of re-occuring blocks of similar cells that are very likely to be found in large spreadsheets, as they are the result of copy and paste (and modifications), and also by finding disruptions in the regular pattern.

3 - A Review of Spreadsheet Design, Development, and Testing Tools

Roger Grinde, Associate Professor of Management Science, University of New Hampshire, 15 College Road/McConnell Hall, Durham, NH, 03824, United States, roger.grinde@unh.edu

There are many spreadsheet add-ins providing advanced analytical capability to end-user and professional modelers alike. Relatively less attention has been devoted to the development of tools to aid the modeler in spreadsheet engineering itself, although this is beginning to change. This talk will highlight a number of spreadsheet engineering tools, discussing their features and relative strengths and weaknesses with regard to the design/build/test processes of spreadsheet engineering.

4 - Round Table Discussion on Publishing Spreadsheet Research

Thomas Grossman, Associate Professor, University of San Francisco, Masagung School of Management, San Francisco, CA, 94117-1045, United States, tagrossman@usfca.edu

■ TC22

P-Room 3312

Space Applications

Sponsor: Military Applications
Sponsored Session

Chair: Andy Armacost, Associate Professor, US Air Force Academy, 2354 Fairchild Drive, 6J100, Colorado Springs, CO, 80840, United States, andy.armacost@usafa.af.mil

1 - Identifying Key Factors in Solutions to Air Force Satellite Control Network Scheduling

Laura Barbulescu, Colorado State University, Computer Science Dept, Fort Collins, CO, 80523, United States, laura@CS.ColoState.EDU, Darrell Whitley, Adele Howe

For Air Force Satellite Control Network scheduling, we have found that approaches that make long leaps during search (e.g., Genetic Algorithm and Squeaky Wheel Optimization) tend to perform the best. Standard local search took excessive time to find good solutions. New results show that local search with a randomized neighborhood local search is also competitive with the best algorithms. We will discuss the problem structure and why randomization of the local search neighborhood is helpful.

2 - The Space Analysis Tool Kit (SATK)

Milton Diaz, Lt Col, USAF, Air Force Space Command Space Analysis Division, 150 Vandenberg Street, Suite 1105, Peterson AFB, CO, 80914-4650, United States, Milton.Diaz@Peterson.af.mil, Stacy Carpenter, Mark Reid, Lonnie Mathis, Shawn Hosp

Air Force Space Command's Space Analysis Division (AFSPC/XPY) has defined a Space Analysis Tool Kit (SATK) process and web database. The SATK process establishes a methodology and lexicon by which AFSPC/XPY and, eventually, the entire space community can present and evaluate the suitability of models to address each analytical problem. The presentation will focus on the development of the process, the process as it currently stands, and the SATK database tool that supports the process.

3 - AF Satellite Control Network Scheduling Using Binary Integer Programming

Andy Armacost, Associate Professor, US Air Force Academy, 2354 Fairchild Drive, 6J100, Colorado Springs, CO, 80840, United States, andy.armacost@usafa.af.mil, Tom DeLaCruz, Steve Baker, Lee J. Lehmkuhl

The Air Force Satellite Control Network (AFSCN) is a global configuration of satellite command, control and communications resources. The AFSCN coordinates fifteen automated tracking antennas to support over 100 satellites, each with a required number of contacts per day. We model this problem as a scheduling problem to allocate antennas to satellites. We exploit problem structure to create tractable optimization models.

■ TC23

P-Room 3354

Air Force Logistics

Sponsor: Military Applications
Sponsored Session

Chair: Timothy Porter, Captain, US Air Force, 50 Chennault Circle, Maxwell AFB, AL, 36112, United States, Timothy.Porter@maxwell.af.mil

1 - Air Force Wargaming and Logistics

Brian Detwiler, Logistics Analyst, Air Force Logistics Management Agency, 50 Chennault Circle, Maxwell AFB, AL, 36112, United States, brian.detwiler@maxwell.af.mil

In coordination with sister services, the Air Force uses modeling and simulation to aid in the execution of many of its wargames. Although these games are typically exploratory in nature, the modeling and simulation involved provide a tremendous "sanity-check" for methods and give decision makers a real world slant on the made-up scenarios. This briefing provides an overall look into Air Force wargaming and offers examples of how the military uses modeling and simulation in this environment.

2 - Air Force Priority Shipping: A New Metric

Timothy Porter, Captain, US Air Force, 50 Chennault Circle, Maxwell AFB, AL, 36112, United States, Timothy.Porter@maxwell.af.mil

ACC initiated a study comparing the movement of their critical parts with other, high priority, shipments. The difference was statistically significant, but practically immaterial. However, the investigation showed that the AF priority shipping system lacks adequate fidelity during times of constrained airlift. It also demonstrated that port hold time, the accepted standard metric, is inadequate to properly explain the efficiency of cargo movement.

3 - Unmanned Aerial Vehicle (UAV) Maintenance Personnel

Brian Detwiler, Logistics Analyst, Air Force Logistics Management Agency, 50 Chennault Circle, Maxwell AFB, AL, 36112, United States, brian.detwiler@maxwell.af.mil

There are Air Force (AF) concerns over perceived inefficiencies in the current UAV maintenance crew structure. The objective of the study is to start "from the foundation" and best match skill capabilities of individual AF maintenance career fields to maintenance requirements of an individual UAV (e.g., Predator). The capability vs. requirement matching process produces multiple combinations of career fields (i.e., maintenance crews) from which to choose, each with its own costs/benefits.

■ TC24

P-Room 3402

Omega Rho Undergraduate Project Award Winners

Cluster: Undergraduate OR Education
Invited Session

Chair: Jim Lowe, United States, jim.lowe@usafa.af.mil

1 - Statistical Analysis of 1990s New Yorker Fiction

Katherine Milkman, Princeton University, 715 Via Airosa, Santa Barbara, CA, 93110, United States, kmilkman@hbs.edu

This analysis examines editorial changes, autho-protagonist relationships and market influence within the New Yorker magazine. We present a quantitative analysis of 442 pieces of fiction published between October 5, 1992 and September 17, 2001 in the New Yorker magazine.

2 - Optimal Location of Community Health Care Centers (CHCs)

Sebastian Urbana, Georgia Institute of Technology, 1004 Summit North Drive, Atlanta, GA, 30324, United States, gte765y@prism.gatech.edu

Healthcare has become a growing concern in recent years, and increasingly more people find themselves without access to these much needed healthcare services. President Bush has pledged to try to improve the situation and has set a goal to reach the 1200 neediest communities and over 6 million people within 5 years. This research develops and analyzes models to find the best location for a set of CHCs throughout the state of Georgia.

3 - Decision Support for Natural Gas Contracting: A Stochastic Programming Approach

John Jarvis, & Claudia Johnson, Southern Methodist University, 17802 Hillcrest Road, Dallas, TX, 75252, United States, jjarvis@engr.smu.edu, Claudia Johnson

Quest Resource, Inc., a natural gas exploration and production company sells its monthly output under fixed-price negotiated contracts, and on the spot-market at fluctuating NYMEX prices. By optimizing the balance betwenn these two sales channels, mgt wishes to maximize profit and lower risk with robust solutions.

■ TC25

P-Room 3404

Recent Advances and Thoughts in Teaching Manufacturing-Related Topics

Sponsor: Education (INFORM-ED) SPONSORED/INVITED
Sponsored Session

Chair: Yavuz Bozer, Dept. of Industrial and Operations Engineering, University of Michigan, 1205 Beal Avenue, Ann Arbor, MI, 48109-2117, United States, yavuz.bozer@umich.edu

1 - Engineering Case Study Use and Development in the Area of Facility Logistics
Russell Meller, Assoc. Professor, Grado Department of Industrial & Systems Engineering, Virginia Polytechnic Institute & State University, 250 Durham Hall (0118), Blacksburg, VA, 24061, United States, rmeller@vt.edu

Engineering case studies are a valuable aid in teaching industrial engineering, but there are not very many of them available. As a result, engineering case study development is a task that must be undertaken by professors if they want to use them in their courses. The speaker will discuss the method he uses to develop engineering case studies in the area of facility logistics and will bring along examples of what he has developed to share with the attendees.

2 - Multimedia Tools for Use in Materials Handling Classes
Sunderesh Heragu, Professor, Rensselaer Polytechnic Institute, DSES Dept., CII 5015, 110, Eighth St, Troy, NY, 12180-3590, United States, herags@rpi.edu, Robert J. Graves, Charles J. Malmborg, Sybillyn Jennings

We demonstrate a highly interactive, self-paced, multi-media based learning CD for the "10 Principles of Materials Handling". The principles and concepts introduced, for example, planning, and systems, are of relevance and interest to introductory industrial engineering and operations management courses. The CD was a finalist for the 2002 PREMIER award.

3 - Blending Engineering and Business Disciplines to Teach Manufacturing and Related Topics to Students from both Degree Programs
Yavuz Bozer, Dept. of Industrial and Operations Engineering, University of Michigan, 1205 Beal Avenue, Ann Arbor, MI, 48109-2117, United States, yavuz.bozer@umich.edu

Several programs in manufacturing and related areas offer joint-degree programs or offer classes designed to accommodate students from various degree programs. Such classes offer unique challenges to the instructors and the students. We discuss various techniques used to deliver such classes successfully and share some of the lessons learned.

4 - A Simulation Game on the Benefits of Enterprise Resource Planning Systems and the Balanced Scorecard Framework for a Wireless Telecommunication Firm
Douglas Morrice, Professor, The University of Texas at Austin, Management Department, Red McCombs School of Business, Austin, TX, 78712-0210, United States, morrice@mail.utexas.edu, James Dyer, James Ritchie-Dunham, Edward Anderson

We describe a simulation game designed to quantify the benefits of an enterprise-wide information system (ES) coupled with the balanced scorecard framework (BSF) in an extended enterprise. Game results from business and engineering students at the University of Texas at Austin reveal that significant benefits follow from the inclusion of an ES and from the combined use of an ES and the BSF.

■ TC26

P-Room 3412

Inferences in Auctions and Sports

Sponsor: Marketing
Sponsored Session

Chair: Dipankar Chakravarti, The Ortloff Professor of Business, University of Colorado, Boulder, Leeds School of Business, UCB 419, Boulder, CO, 80309, United States, Dipankar.Chakravarti@colorado.edu

1 - Outcome Contingent Regret in Descending and Ascending Auctions
Dipankar Chakravarti, The Ortloff Professor of Business, University of Colorado, Boulder, Leeds School of Business, UCB 419, Boulder, CO, 80309, United States, Dipankar.Chakravarti@colorado.edu, Amar Cheema, Atanu Sinha

This paper reports how motivational (i.e., a winning-oriented or a prudent, value-oriented focus) and cognitive antecedents (precision of value information and its salience during the auction) influence consumers' experienced regret, contingent on the auction outcome (winning versus losing). We compare the pattern of direct and interactive effects in two experiments (involving a descending and an ascending auction, respectively).

2 - Paying Less for More: Hyper-subadditivity in Consumer Evaluation of Product Bundles
Peter Popkowski Leszczyc, Associate Professor Marketing, University of Alberta, 4-20F School of Business, Edmonton, AB, Canada, ppopkows@ualberta.ca, John Pracejus, Michael Shen

A model of multiple-product bundle valuation is developed and tested. It is proposed that consumers use their assessment of the value of high certainty goods to draw inferences about the value of low certainty goods in a bundle. Results of three experiments indicate that bundling a low-value certain item with high-value uncertain item results in a bundle valuation lower than the value of the uncertain item alone.

3 - Varsity Sports and Student Enrollment: Are they Independent to each other?
Chaim Ehrman, Loyola University Chicago, 820 North Michigan Avenue, Chicago, IL, 60611, United States, cehrman@wpo.it.luc.edu, Allen Marber

In the field of Varsity sports, many Universities invest heavily to have a "Top" varsity team. This includes primarily Football, Basketball. The investment is far from trivial. Many scholarships are offered, special sports arenas are constructed, top coaches are hired, cheerleaders are selected, etc. In the past, superstars (Pat Ewing, Georgetown; Doug Flutie, Boston College) did make a difference. Is this a one-time phenomenon? We use statistical analysis to investigate this possibility. Incidentally, many coaches make contributions to their University, such as Joe Paterno for Penn State and Dean Smith of North Carolina.

■ TC27

P-Room 3454

Diffusion and Fluid Models

Sponsor: Applied Probability
Sponsored Session

Chair: Otis Jennings, assistant professor, Duke University, Durham, NC, 27708, United States, otisj@duke.edu

1 - Asymptotic Optimality of Maximum Pressure Policies for Stochastic Processing Networks
Wuqin Lin, Georgia Tech, 331804 Gatech Station, Atlanta, Ga, United States, gte004y@prism.gatech.edu, Jim Dai

We consider a wide class of stochastic processing networks. Assume that the networks satisfy a resource pooling condition. We prove that maximum pressure policies asymptotically minimize the workload processes in a heavy traffic regime. A key to the proof is to show the network processes exhibit state space collapse.

2 - The Finite Decomposition Property in Multistation Fluid Networks
Utku Yildirim, The University of Texas at Austin, 1 University Station C2200, Austin, TX, United States, yildiriu@mail.utexas.edu, John Hasenbein

In Gamarnik and Hasenbein (2004) it is shown that a finite decomposition property of non-idling fluid trajectories implies a converse to the stability theorems of Dai and Chen. We prove that this property holds for certain multistation fluid networks, implying that a stability converse holds for these networks.

3 - Optimal Draining of Fluid Networks with Probabilistic Service Rates
Burak Buke, Ph.D Student, The University of Texas at Austin, Department of Mechanical Enginerring, C2200 The University of Texas at Austin, Austin, TX, 78712, United States, bukeb@mail.utexas.edu, John Hasenbein, David Morton

Draining a fluid network in minimum time when the service rates are deterministic, is a well-solved problem. In this work we are assuming the service rates mu_k's for buffers are random variables. We show the deterministic solution may not solve the problem. We apply stochastic programming techniques to minimize the expected draining time of a network.

4 - Approximating Stationary Performance Measures of Queueing Networks with Reneging
Joshua Reed, United States, je-reed@isye.gatech.edu, Amy R. Ward

Motivated by diffusion approximations of queueing networks with reneging, we consider a multidimensional, reflected Ornstein-Uhlenbeck process in a convex, polyhedral domain. Specifically, we (1) provide sufficient conditions for the existence of a unique stationary distribution (2) provide a numerical algorithm for computing the stationary distribution, and (3) establish necessary and sufficient conditions for the stationary distribution to be of Gaussian form.

■ TC28

P-Room 3504

System Engineering in Nonstandard Applications

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: Jye-Chyi Lu, Professor, Georgia Institute of Technology, 765 Ferst Drive, Campus Box 0205, Atlanta, GA, 30332, United States, jclu@isye.gatech.edu

1 - Multi-Scale Spatial Modeling for Logistics System Evaluations
Ni Wang, Ph.D. student, Georgia Institute of Technology, The School of Industrial and Systems Eng, Campus Box 0205, Atlanta, GA, 30332, United States, gtg586c@mail.gatech.edu, Jye-Chyi Lu, Paul Kvam

This article proposes a multi-scale modeling idea suitable for describing patterns of data aggregated at different levels of details. This model serves as an approximation of large-size complex supply-chain systems represented by numerous data including store locations. The approximated model supports various levels of decisions such as robust logistics network designs for meeting system reliability requirements and serving area allocations for product distribution centers.

2 - Service Quality Analysis and Improvement:Development of a Systematic Framework and a Case Study
Kwang-Jae Kim, Associate Professor, Department of Industrial Engineering, Pohang Univ of Science and Technology, San 31, Hyoja-Dong, Nam-Gu, Pohang, Ky, 790-784, South Korea, kjk@postech.ac.kr

This paper proposes a systematic framework for service quality analysis and improvement. The proposed framework advantageously integrates quality function deployment and structural equation modeling. The proposed framework is demonstrated through a case study on the high speed internet service of a major telecommunication company in Asia.

3 - Supply-Chain Oriented Robust Parameter Design
Na An, Ph.D. student, Georgia Institute of Technology, School of Industrial and Systems Eng, Campus Box 0205, Atlanta, GA, 30332, United States, engp8759@isye.gatech.edu, Jye-Chyi Lu, Ni Wang, Myong-Kee Jeong

This presentation provides an overview of possible opportunities in the robust product/process design under the supply-chain oriented manufacturing environment. Examples of initial research will be given. Opportunities in NSF programs supporting this type of research will be presented.

4 - Warranty Reserve Management of Homogeneous Products over Finite Periods
Marlin Thomas, Professor, Purdue University, Department of Industrial Engineering, 315 N. Grant St., West Lafayette, IN, 47907-2023, United States, muthomas@purdue.edu, Kun Ren

We consider the problem of managing the inventory of warranty reserve over time. The objective is to minimize the present expected value of warranty cost for a product. By assessing the financial loss and penalty cost structure, we show how to initialize and balance the reserve fund level dynamically over a finite time horizon. In this problem, we assume that the failure rate is time-homogeneous and the number of products under warranty is generally stochastic during the time periods.

■ TC29

P-Room 3502

Electronic Commerce

Sponsor: E-Business
Sponsored Session

Chair: Mu Xia, University of Illinois at Urbana-Champaign, Dept of Business Administration, 350 WH, 1206 S 6th St, Champaign, IL, 61820, United States, mxia@uiuc.edu

1 - Internet Exchanges for Used Books: An Empirical Analysis of Welfare Implications and Policy Issues
Michael Smith, Assistant Professor, Heinz School of Public Policy and Management, Carnegie Mellon University, Pittsburgh, PA, 15123, United States, mds@cmu.edu, Anindya Ghose, Rahul Telang

Book publishers have speculated that used book exchanges will significantly cannibalize new book sales. We use a unique dataset from Amazon.com's used book market to analyze this proposition. We find that only 15% of used book sales at Amazon cannibalize new book purchases. The remaining 85% of used book sales would not have occurred at Amazon's new prices. While publishers face a loss of $32 million, consumers gain $70 million in surplus from the introduction of these electronic markets.

2 - E-Business Transformation: A Process-Oriented Study of its Value Creation in Organizations
Sean Xu, Graduate School of Management, University of California, Irvine, Irvine, CA, 92697, United States, xxu00@gsm.uci.edu, Kevin Zhu, Kenneth L. Kraemer

Drawing upon the IT value literature, the resource-based view of the firm, and the innovation diffusion theory, we develop a process-oriented model of IT value creation in the context of electronic business. This model incorporates three stages (investment-usage-value) of the diffusion process at the firm level, with actual usage being an important mediating variable. The model also includes both IT resources and organizational factors, and tests the complementarity between them.

3 - e-Markets As Complements to Existing Supply Contracts
Mu Xia, University of Illinois at Urbana-Champaign, Dept of Business Administration, 350 WH, 1206 S 6th St, Champaign, IL, 61820, United States, mxia@uiuc.edu, B. Rachel Yang, Michael Shaw

We propose that the companies (buyers) use e-Markets as a new outside sourcing option, through which an on-going negotiation with an existing supplier will be impacted. We investigate the impact in two areas: 1) contract price, 2) supplier incentive to invest in the relationship using the incomplete contract theory to model the contract negotiation between a supplier company and a buyer company where the buyer has invested in an outside e-Market as a sourcing option.

4 - Multiattribute Nonlinear Pricing of Network Goods
Thomas A. Weber, Assistant Professor, Stanford University, Management Science and Engineering, Stanford, CA, 94305-4026, United States, webert@stanford.edu

We characterize the class of all implementable menus and provide a full set of necessary optimality conditions for the underlying general multiattribute fulfilled-expectations screening problem. We also give sufficient conditions, some of which generalize the Spence-Mirrlees single-crossing requirement, that guarantee a simple pointwise optimal solution. In contrast to standard single-attribute nonlinear pricing an optimal multiattribute menu can be nonmonotonic in the consumers' type.

■ TC30

P-Room 3512

Reliability Research

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: David Coit, Associate Professor, Rutgers University, Industrial & Systems Engineering, 96 Frelinghuysen Rd., Piscataway, NJ, 08854, United States, coit@rutgers.edu

1 - Integer Program and Birnbaum's Importance Measure for Aviation Technology Decision Support System
Nathan Greenhut, Graduate Assistant, Rutgers University, 35 Patton Drive, East Brunswick, NJ, 08816, United States, hut@eden.rutgers.edu, David Coit, James Luxhoj

We present a heuristic for database formation from Bayesian Belief Networks and the corresponding Integer Program that is associated with the decisions to be made in these models. A reward and penalty comparison between the heuristic and complete information from the models is accomplished. In the work, Birnbaum's importance measures along with the Integer Program facilitate a decision support system for seven technology suites under the auspices of the NASA's Aviation Safety Program.

2 - Reliability of Distributed Coordinate Sensor Systems for Fault Diagnosis in Manufacturing Processes
Yong Chen, Assistant Professor, The University of Iowa, Dept. of Mechanical & Industrial Eng., Iowa City, IA, 52242-1527, United States, yong-chen@uiowa.edu

With increasing number of coordinate sensors employed in manufacturing processes to facilitate online diagnosis of process faults, it is important to investigate the performance of the sensing system in terms of diagnosability and reliability. Reliability and diagnosability structure of a sensing system highly relies on the process/product design information. Matroid theory is used to analyze sensing system structure and facilitate reliability related computation and optimization.

3 - Composite Importance Measures for Multi-state Systems
Jose Ramirez-Marquez, Assistant Professor, Stevens Institute of technology, Castle Point on Hudson, Hoboken, NJ, 07030, United States, jmarquez@stevens.edu, David W. Coit

This study evaluates composite importance measures (CIM) for multi-state systems with multi-state components (MSMC). Importance measures are important tools to evaluate and rank the impact of individual components in a system. For MSMC, previously developed measures do not meet all user needs. The focus of the study is to distinguish between two types of importance measures that can be used for evaluating the criticality of components in MSMC with respect to multi-state system reliability.

4 - System Reliability Estimation Sensitivity Measures Based on Variance Decomposition
David Coit, Associate Professor, Rutgers University, Industrial & Systems Engineering, 96 Frelinghuysen Rd., Piscataway, NJ, 08854, United States, coit@rutgers.edu

In this paper, we present and describe a new system reliability sensitivity measure that indicates the proportion of the system reliability estimate variance that can be attributed to individual component reliability uncertainty. A variance decomposition approach is used. This new measure is useful to prioritize testing and further analyses.

■ TC31

P-Room 3545

Information Security

Sponsor: Information Systems
Sponsored Session

Chair: Jacquelyn Rees, Assistant Professor of Management, Purdue University, 403 West State Street, West Lafayette, IN, 47907, United States, jrees@mgmt.purdue.edu

1 - Disclosure Control of Confidential Data using Learning Theory
Ling He, Ph.D student, University of Florida, 351 Stuzin Hall PO Box 117169, Gainesville, FL, 32611, United States, linghe@ufl.edu, Haldun Aytug, Gary Koehler

We approach the database security problem from a new perspective using Probably Approximately Correct learning theory. Based on this theory, we look at some popular database protection mechanisms and show private information can be compromised in a polynomially bounded time with high probability.

2 - Open Source vs Proprietary Software: A Security Perspective
Sanjay Sridhar, Purdue University, Krannert Grad. Sch. Mgmt., W. Lafayette, IN, 47907, United States, ssridhar@mgmt.purdue.edu, Kemal Altinkemer, Jacquelyn Rees

Security vulnerabilities are often addressed via the release of patches. Using data collected over a two year time period, the software reliability model is used to analyze the relative reliability of proprietary software compared to open source software. Preliminary results and insights are reported.

3 - Analyzing Information Revelation Policies: A Computational Approach
Karthik Kannan, Assistant Professor of Management, Purdue University, 403 West State Street, West Lafayette, IN, 47981, United States, kkarthik@mgmt.purdue.edu, Amy Greenwald, Ramayya Krishnan

The objective of our study is to develop a computational model using MDP that can study different information regimes available to a procurer in e-marketplace. We use the model to compare two commonly used revelation policies in the presence of two types of uncertainties faced by suppliers: uncertainty about their opponents' cost structures and uncertainty about the number of competitors. Analytical models are intractable in these cases, but our computational model provides useful insights.

■ TC32

T-Vail (Majestic Level)

The Integration of Simulation, BAM, and Optimization to Provide Managers a Desk Top Predictive Analysis Tool

Cluster: OR Practice
Invited Session

Chair: Mike Engiles, Program Manager, CACI, 14151 Park Meadow Dr, Chantilly, VA, 20151, United States, mengiles@caci.com

1 - Being Proactive in the Healthcare World!
Varun Panchapakesan, Operations Research Analyst, CACI, 14151 Park Meadow Dr, Chantilly, VA, 20151, United States, vpanchapakesan@caci.com

In this presentation we discuss the application of a tactical simulation based integrated business activity monitoring (BAM) technique to alleviate the time a patient spends through emergency treatment for a major healthcare services provider in the Southeastern US - Eastern Health Systems, Inc. The predictive capabilities of simulation are leveraged to do an impact analysis coupled with optimization to identify viable candidate solutions promoting a proactive approach vice reactive!

2 - Reducing Passenger Wait Time (Security Check) Using Simulation Modeling and Optimization Algorithms
Varun Panchapakesan, Operations Research Analyst, CACI, 14151 Park Meadow Dr, Chantilly, VA, 20151, United States, vpanchapakesan@caci.com

In this presentation we discuss the application of simulation modeling and optimization techniques to reduce the time a passenger spends waiting in line prescreening (wait time <= 20 minutes for >= 90% of passengers per day) by analyzing the workforce requirements during peak/non-peak hours. Non-linear optimization algorithms are used to generate multiple workforce solutions (data points) based on the passenger wait time and workforce capacity constraints.

3 - Using the Balanced Scorecard with Simulation to Monitor the FAAs Business Processes
David Buckler, Operations Reserach Analyst, CACI, 14151 Park Meadow Drive, Ashburn, VA, 20147, United States, dbuckler@caci.com

A Strategy Map and Balanced Scorecard are critical to simulation and outline the company's goals. A model is constructed and used to monitor performance. I will discuss a recent proposal with the FAA, who wanted to ensure their call centers were properly staffed. The FAA had pre-defined metrics that were used to build the Strategy Map and BSC. The process model's Optimization capabilities allowed for various examinations of staffing mixes across multiple site configurations.

4 - Redesigning the US Air Force's Maintenance Data System using Business Process Reengineering
David Buckler, Operations Reserach Analyst, CACI, 14151 Park Meadow Drive, Ashburn, VA, 20147, United States, dbuckler@caci.com

The United States Air Force wants to consolidate all of its maintenance data systems into one integrated database. This database should be accessible from anywhere around the world and allow for real-time updates. However, before designing this new application, it is critical to study the current business processes to ensure the new system meets to needs of the entire Air Force. CACI is currently working on the project to achieve this goal. Applying its repeatable methodology for software development, CACI is building business process models and Use Cases to define the requirements for the new integrated maintenance data system. This session will show in detail how to construct both the business process models and Use Cases, and how they relate to each other. It will also discuss the importance of effective configuration management when combining models of multiple systems, and the benefit of using the Internet for collaborative model reviews. Lastly, the session will show how the process models and Use Cases produce object models, which are the foundations for producing the data that populates the Air Force's relational maintenance database. The session will be organized as a case study, highlighting the different technical approaches used throughout the process.

■ TC33

T-Savoy (Majestic Level)

Panel: Building and Managing an OR Consulting Firm

Sponsor: CPMS, The Practice Section of INFORMS
Sponsored Session

Chair: Donald Smith, Associate Professor, Monmouth University, School of Business Administration, Monmouth University, West Long Branch, NJ, 07764-1898, United States, dsmith@monmouth.edu

1 - Building and Managing an OR Consulting Firm
Moderator: Donald Smith. Panelists: Warren Lieberman, Joseph H. Discenza, Jack Theurer, Marty Ellingsworth, Thomas Cook

Join several experienced consultants as they give their perspective on what it takes to make a successful OR consulting firm.

■ TC34

T-Columbine (Majestic Level)

Capacity and Inventory Management in Service Supply Chains

Sponsor: Manufacturing and Service Operations Management
Sponsored Session

Chair: Kathryn Caggiano, UW-Madison, 975 University Avenue, Madison, WI, 53706, United States, kcaggiano@bus.wisc.edu

1 - Case Managers for Services
Robert Shumsky, Associate Professor, Simon School, University of Rochester, Rochester, NY, 14627, United States, shumsky@simon.rochester.edu, Armann Ingolfsson

Many professionals (e.g., insurance claims adjusters and social workers) can be thought of as "case managers" in the sense that each employee works simultaneously on several "cases" or tasks. The total time spent on a case is typically interrupted by random external delays, for example to wait for information. We formulate a stochastic model of a system with multiple case managers, and use the model to understand the impact of the number of managers and case-load thresholds.

2 - Multi-Item Spare Parts Systems with Lateral Transshipments and Waiting Time Constraints

Atul Bhandari, Ph.D Candidate in Operations Reserch, Tepper School of Business, Carnegie Mellon University, 5000 Forbes Avenue, Pittsburgh, PA, 15213, United States, atulb@cmu.edu, A.A. Kranenburg, Geert-Jan van Houtum, Alan Scheller-Wolf

We analyze a multi-item, continuous review basestock policy for two-location, repairable spare parts inventory systems in which lateral and emergency shipments can occur. We show two solution methods for minimizing the total costs given a target level for the average waiting time at each location. The first heuristic method gives lower and upper bounds on the optimal costs. The second exact method uses Balance Inequalities and Disjunctive Programming resulting in a Linear Program formulation.

3 - Replenishment Policies for Supply Chains with Cross-Docking under Limited Transportation Capacity

Mustafa Gurbuz, TA/RA, University of Washington, University of Washington, Mackenzie Hall, PO Box 353200, Seattle, WA, 98195-3200, United States, mgurbuz@u.washington.edu, Kamran Moinzadeh, Yong-Pin Zhou

We consider a multiple retailer-single warehouse distribution system with cross-docking at the warehouse under limited transportation capacity. We create a framework for simultaneously making inventory and transportation decisions. We propose and analyze a hybrid policy, which is a combination of a special type of can-order policy and an echelon inventory based policy. Finally, hybrid policy is compared to three other well-known policies in literature via numerical tests.

4 - A Military Analysis of Capacitated Service in Multi-Echelon Inventory Systems

Ben Van Roo, RAND Summer Associate, Ph.D student, UW-Madison, 975 University Avenue, Madison, WI, 53706, United States, bdvanroo@students.wisc.edu

We discuss the design and placement of service capacity to support a multi-echelon, -item, -indentured inventory system in a military setting. The performance of a network of decentralized maintenance facilities is compared to a spectrum of alternative two-echelon base-depot networks. Our approach combines a MILP for determining facility locations with a METRIC-style model to determine finite repair capacity and inventory optimization. We present trade-offs between costs, capacity, and service.

■ TC35

T-Terrace (Terrace Level)

Session Mass Customization, Demand and Supply Chain Perspective

Cluster: Mass Customization in Manufacturing
Invited Session

Chair: Mitchell Tseng, Professor, HKUST, Clear Water Bay, Kowloon, HK, Hong Kong, tseng@ust.hk

1 - MC Supply Chains - The Customer Perspective

Frank Piller, Director Research Group Mass Customization, Technische Universitaet Muenchen (TUM), Dept. IOM, Leopoldstrasse 139, Munich, 80804, Germany, piller@wi.tum.de

The presentation places the customer of mass customization (MC) products in the center of attention. Mass customization demands that supply chains are organized around the individual customer. By taking a customers' perspective, we will analyze the activities and contributions of customers which are needed to manage the MC supply chain. The talk will also address how MC customers contribute to building ëcustomer knowledge' which helps the firm to improve its MC offerings continuously.

2 - Quick Response Manufacturing (QRM) and POLCA: Competitive Strategies for Customized Production

Rajan Suri, Professor, University of Wisconsin, Center for Quick Response Manufacturing, 1513 University Avenue, Madison, WI, 53706, United States, suri@engr.wisc.edu

Quick Response Manufacturing (QRM) is a powerful competitive strategy for companies with low-volume, high-variety or custom-engineered products. We give an overview of QRM and show its potential for dramatic lead time reduction, cost reduction and quality improvement. Next we describe POLCA, an alternative to Kanban, as a material control strategy for customized production. We illustrate our concepts with case studies and results from companies using these strategies.

3 - A New Approach for Production Planning in Mass Customization Environment

Vernon Zeng, Postgraduate student, Hong Kong University of Science & Technology, IEEM Dept., HKUST, Clear Water Bay, Kowloon, Hong Kong, Hong Kong, China, vernon@ust.hk, Mitchell Tseng

In the past decade, the global and intensive competition has made the Mass Customization (MC) increasingly popular. In this presentation, the technical challenges of managing high mix and low volume production in MC environment will be discussed. The applicability of current MRP/ERP system will also be addressed. A new approach to carry out capacity and material inventory planning on the aggregated level without reliance on end product forecast will be proposed.

■ TC36

T-Capitol (Terrace Level)

Achieving Flexibility Through Cross-training and Flexible Resources

Cluster: Workforce Flexibility & Agility
Invited Session

Chair: Eylem Tekin, University of North Carolina-Chapel Hill, 205 Smith Building, CB# 3180, Chapel Hill, NC, 27599, United States, eylem@email.unc.edu

1 - Multi-Actor Markov Decision Process

Hyun-Soo Ahn, Assistant Professor, Michigan Business School, University of Michigan, Ann Arbor, MI, 48109, United States, hsahn@bus.umich.edu, Rhonda Righter

We give a general reformulation of multi-actor MDPs and show that there will be a tendency for the actors to take the same action whenever possible. his considerably reduces the complexity of the problem, facilitating numerical computation of the optimal policy or providing a basis for a heuristic.

2 - Cross-training Strategies for Service Operations

Eylem Tekin, University of North Carolina-Chapel Hill, 205 Smith Building, CB# 3180, Chapel Hill, NC, 27599, United States, eylem@email.unc.edu

We consider service systems with multiple classes of customers and heterogeneous servers. Servers are cross-trained so that they may service more than one customer class. We develop models to provide insight into the effect of different cross-training strategies.

3 - Call Center Labor Cross-training: It's a Small World After All

Seyed Iravani, Assistant Professor, Northwestern University, 2145 Sheridan Road, C210 Tech., Evanston, IL, 60208, United States, s-iravani@northwestern.edu, Bora Kolfal, Mark Van Oyen

In this paper we extend the application of the Small World Networks (SWN) to the analysis of workforce cross-training in call centers, and we provide evidence that there is a link between the Average shortest Path Length (APL) metric of SWNs and the performance of workforce cross-training structures in call centers.

4 - A Deterministic Predictor of Operational Flexibility in Cross-trained Service/Queueing Systems

Bora Kolfal, Ph.D Student, Northwestern University, United States, b-kolfal@northwestern.edu, Seyed Iravani, Mark Van Oyen

Cross-training creates flexibility in a queueing system and results in shorter response times. We show that a math program incorporating the cross-training/multifunctional structure can be an effective measure of flexibility and an aid in system design.

■ TC37

T-Biltmore (Terrace Level)

Green Production and Recycling Process

Sponsor: Energy, Natural Resources and the Environment
Sponsored Session

Chair: Xiuli Qu, Purdue University, 315 N. Grant Street, West Lafayette, IN, 47907, United States, qu@ecn.purdue.edu

1 - Optimization for Monitoring Multiple Contaminants under Uncertain Hydrogeology

Christine Shoemaker, Ripley Professor, Cornell University, 210 Hollister Hall, Cornell University, Ithaca, NY, 14853, United States, cas12@cornell.edu, Pradeep Mugunthan

This study presents a method for identifying cost effective sampling designs for long term monitoring of remediation of groundwater over multiple monitoring periods under uncertain flow conditions. A new algorithm (MS-ER) that utilizes a new error-reducing search neighborhood is developed to solve the optimization problem. The best design of MS-ER algorithm produced a savings of nearly 25% in project cost over a conservative sampling plan that uses all possible locations and samples.

2 - Statics and Dynamics of Global Supply Chain Networks with Environmental Decision-Making
Anna Nagurney, John F. Smith Memorial Professor, Isenberg School of Management, University of Massachusetts, Amherst, MA, 01003, United States, nagurney@gbfin.umass.edu, Jose Cruz, Fuminori Toyasaki

In this paper, we develop static and dynamic models of global supply chain networks with multiple tiers of decision-makers who are faced with environmental concerns and with electronic commerce. We analyze the model theoretically and propose a discrete-time algorithm for tracking the product and financial flows.

3 - A Threshold Scheduling Policy for Plastics Recycling
Julie Stuart, Assistant Professor, Purdue University, 315 N. Grant Street, West Lafayette, IN, 47907, United States, stuart@purdue.edu, Xiuli Qu, Jamie Wieland, Pedro Rios, Ed Grant

Three billion obsolete consumer electronics contain 15 billion pounds of high value engineering thermoplastics. We model the process to identify and sort plastics from of end-of-life electronics as a multiclass queueing system. To improve the efficiency of plastics sortation and recovery, a threshold scheduling rule is presented. Testing the rule in a discrete-event simulation model shows that the rule effectively balances work-in-process with set-up time.

4 - A Pricing Strategy for an Automotive Shredding Recycler
Xiuli Qu, Purdue University, 315 N. Grant Street, West Lafayette, IN, 47907, United States, qu@ecn.purdue.edu, Julie Stuart

Automotive shredders need strategies to determine at what price to purchase vehicle hulks from different sources. We formulate the pricing problem in a nonlinear program, develop a nonlinear supply function for hulks when adjacent shredders price independently, and test the sensitivity of the optimal hulk purchase price to the supply function in a case study. The results demonstrate that a shredder can increase net revenue by setting different purchase prices based on hulk composition.

■ TC38

T-Beverly (Terrace Level)

OR in Sports II

Sponsor: OR in SpORts
Sponsored Session

Chair: Sergiy Butenko, Assistant Professor of Industrial Engineering, Texas A&M University, 236E Zachry Engineering Center, College Station, TX, 77843-3131, United States, butenko@tamu.edu

1 - Rotisserie Baseball Draft Strategies
Maciek Nowak, Assistant Professor, Georgia Southern University, Dept. of Mngment., Mrkt. and Logistics, P.O. Box 8154, Statesboro, GA, 30460, United States, mnowak@georgiasouthern.edu, Mike Hewitt

The Internet has allowed for a significant increase in interest in the world of Rotisserie (or Fantasy) Baseball. Because of this, there are a large number of "managers" playing each year for the first time, with little idea as to the strategies involved. We present a model to aid a manager during the draft at the beginning of the season. The model selects players based on their contribution to a variety of baseball statistics (RBI, ERA, etc.) in general, and relative to their position.

2 - Solving Sports Scheduling Problems with Constraint Programming
Alkis Vazacopoulos, Dash Optimization, Inc, 560 Sylvan Avenue, Englewood Cliffs, NJ, 07632, United States, av@dashoptimization.com, Abderrahmane Aggoun

In this presentation we give a quick overview of the CHIP constraint programming system of COSYTEC for solving time tabling and sport scheduling problems. We first focus on the definition and utilization of Global Constraints. We then present some successful and complex applications in a number of different problem areas. We then present examples of scheduling modeled and solved with Constraint Programming (CP) technology.

3 - Searching for Structure in Sports (squash) Contests
Tim McGarry, University of New Brunswick, Faculty of Kinesiology, Fredericton, NB, E3B5A3, Canada, tmcgarry@unb.ca

Visual inspections suggest the presence of structure in sports contests yet a formal description of such patterned behaviours remains equivocal. We report in brief on some of the challenges that have presented themselves in obtaining a satisfactory description for sports (squash) contests using probability analysis. These challenges lead us to some new considerations for future research using perceptual judgements as a means of identifying the behaviours that give shape to sports contests.

4 - The Design, Use, and Performance of Location-Based Mobile Decision Support Systems
Raul Chao, Georgia Institute of Technology, 800 West Peachtree Street, Atlanta, GA, 30332, United States, raul.chao@mgt.gatech.edu, Rahul Basole

The growth of wireless and mobile technology has given rise to new types of decision support utilities commonly referred to as location-based mobile decision support systems. These systems exploit knowledge about where a user is located and provide context-related decision support. Our research studies golfers that use mobile GPS devices while paying a round of golf. Our aim is to explore critical factors in the design, use, and performance of mobile GPS technologies.

■ TC39

T-Tower Court A (2nd Floor)

Closed Loop Supply Chains

Cluster: Supply Chain Mgmt & Operations
Invited Session

Chair: Canan Savaskan, Assistant Professor, Kellogg School of Management, 2001 Sheridan Road, Evanston, IL, 60208, United States, r-savaskan@kellogg.northwestern.edu

1 - Design Upgrades and Product Remanufacture
Ravi Subramanian, Ph.D Candidate, Michigan Business School, D0261 Davidson Hall, 701 Tappan St., Ann Arbor, MI, 48109, United States, rsubramz@bus.umich.edu, Sudheer Gupta, Brian Talbot

We study the design upgrade process in a hybrid manufacturing/remanufacturing environment where a manufacturer supplies new and remanufactured products to its customer. Products returning for remanufacture can be upgraded to more recent design vintages. The manufacturer's decisions include timing, pricing, and extent of design upgrades. The customer's objective is to cost-effectively manage its remanufacturable assets.

2 - The Business Paradox in Remanufacturing and Recycling
Pranab Majumder, Assistant Professor, Duke Univeristy, Box 90120, Durham, NC, 27708, United States, majumder@duke.edu

The recent growing interest in environmental friendly manufacturing and green design leads to natural questions about the competitive and strategic consequences of firms becoming more environmentally friendly in design and operations. We focus on the critical area of remanufacturing (and recycling) in order to examine strategic issues in an oligopoly.

3 - Installed Base Management versus Manufacturing in Monopolistic and Competitive Environments
Andreas Robotis, INSEAD, Boulevard de Constance, Fontainebleau, 77305, France, andreas.robotis@insead.edu

Installed Base Management is the policy in which a manufacturer becomes a service provider by tying products with services. We compare Installed Base Management and Manufacturing, under stable and improving technology when consumers are myopic and rational. We find that under the assumption of myopic consumers Manufacturing outperforms Installed Base Management. Under the assumption of rational consumers, Manufacturing is more attractive in monopolistic environments than in competition.

4 - A Dynamic Pricing Model for Remanufacturable Products
Canan Savaskan, Assistant Professor, Kellogg School of Management, 2001 Sheridan Road, Evanston, IL, 60208, United States, r-savaskan@kellogg.northwestern.edu, Umut Aytekin

This paper focuses on closed-loop supply systems with product remanufacturing which are driven by manufacturing cost savings from part/components reuse. More specifcally, using non-smooth dynamic optimization, we investigate the new product pricing strategy of a monopolist in a dynamic setting which jointly optimizes the revenues from new product sales and the cost savings from remanufacturing.

■ TC40

T-Tower Court B (2nd Floor)

Product Design and Supply Chains

Cluster: Supply Chain Mgmt & Operations
Invited Session

Chair: Sharon Novak, Assistant Professor, Kellogg School of Management, 2001 Sheridan Road, Evanston, Il, 60208, United States, s-novak@kellogg.northwestern.edu

1 - Building Efficient Product Portfolios at John Deere
Sridhar Tayur, United States, stayur@smartops.com, Alan Scheller-Wolf, Tallys Yunes, Dominic Napolitano

Deere & Company, one of the world's leading producers of machinery used in the agricultural, forestry, construction, and commercial sectors, has numerous product lines, comprised of machines with various features. For each feature available on a machine a customer may select one of a number of possible options — for example an engine is a feature, with different horsepowers being options. On any given John Deere product line there may be millions of configurations — combinations of options — that are feasible. This is problematic; maintaining such a large number of configurations inflates overhead costs. Consequently, Deere has been seeking a way to eliminate the least desirable configurations from their product lines. The solution to this problem is inherently a

trade-off analysis: Deere must balance the marginal cost of a configuration against its value to customers. In this paper we provide a detailed explanation of the marketing and operational methodology used, and tools built, to find the optimal number of configurations on two product lines at John Deere. We illustrate our work with computational results from John Deere, illustrating the potential benefits of our project and highlighting important customer behavior characteristics that must be taken into account when managing product line diversity. With respect to the two studied product lines, an increase in profit of up to 15\% has been identified, possible through reducing the number of configurations by 30-50\% from present levels, while maintaining the current high customer service levels.

2 - Value Chain Roadmapping
Charles Fine, United States, charley@mit.edu

This talk builds on the notion of technology roadmapping and adds in notions of business dynamics and regulatory policy dynamics to attempt a theoretical basis for what we call value chain roadmapping. We examine the interplay among multiple dynamic forces that impact complex value chains, including business cycle dynamics (e.g., the bullwhip), industry structure dynamics, (e.g., the double helix), customer preference dynamics, corporate strategy dynamics, technology dynamics, and regulatory policy dynamics. The resulting framework is used to assess possible futures in the (fast-clockspeed) telecommunications industry.

3 - Complementarity Among Vertical Integration Decisions: Evidence from Automobile Product Development
Scott Stern, Kellogg School of Management, Northwestern University, Evanston, IL, United States, s-stern2@kellogg.northwestern.edu, Sharon Novak

This paper examines complementarity among vertical integration decisions in automobile product development. Though most research assumes that contracting choices are independent of each other, contracting complementarity may arise when governance choices impact the equilibrium degree of coordination among agents. First, effective coordination may depend on the level of (non-contractible) effort on the part of each agent; contracting complementarity results if coordination efforts are interdependent and vertical integration facilitates a higher level of non-contractible effort. Second, effective coordination may require the disclosure of proprietary trade secrets, and the potential for expropriation through an external supply contract may induce complementarity among vertical integration choices. We provide evidence for complementarity in product development contracting by developing an instrumental variables estimator that distinguishes complementarity from unobserved firm-level factors determining contracting mode. While we interpret our findings cautiously, the results suggest that contracting complementarity may be important in contexts where coordination is important to achieve but difficult to monitor.

4 - Joint Pricing and Inventory Models for Multiple Products with Demand Substitution
Ling Wang, Ph.D. Student, University of Michigan, lingw@umich.edu

We consider joint pricing and inventory decisions when a firm sells multiple products with interdependent demands among them. We characterize the structure of the optimal joint policy for both up-front pricing and postponed pricing model for a single period. Two major extensions are analyzed: multi-period non-stationary model and competing-retailers model.

■ TC41

T-Tower Court C (2nd Floor)

Supply Chain Flexibility

Contributed Session

Chair: Ike Ehie, Associate Dean, College of Business, Kansas State University, Calvin Hall 107, Manhattan, KS, 66506, United States, iehie@ksu.edu

1 - Stochastic Available-To-Promise for Configure-To-Order Products with Flexible Supply
Ching-Hua Chen-Ritzo, Penn State University, 338 Beam Business Administration Building, University Park, PA, 16802, United States, chenritzo@psu.edu, Terry Harrison, Tom Ervolina, Barun Gupta

We address the problem of availability management for configurable products, which involves aligning demand, supply and sales targets with each other. We assume that the demand for products is endogenously determined (relative to sales targets) and that the supply for components is given, but flexible. Product configurations are uncertain in the sense that the quantities of components required configure the demanded products are stochastic.

2 - Quantifying and Optimizing Supply Chain Agility
Mariah McMurran, University of Central Florida, 4000 Central Florida Blvd., Orlando, FL, 32816, United States, mcmurran@mail.ucf.edu, Renee Butler

We present a two-phase modeling approach to quantify and optimize supply chain agility (the ability to respond to supply and demand uncertainty) and its cost. Polynomial and logistic regression are used to develop an objective function, which is optimized stochastically to determine the most cost effective agility level. Decision variables include inventory levels and transportation modes. We present a problem based on the semiconductor industry, as well as expected outcomes and contributions.

3 - A Theoretical Evaluation of Supply Chain Flexibility Dimensions
Kwame Adu-Bonnah, Graduate Student, University of Massachusetts, 345 Lincoln Ave., #126, Amherst, MA, 01002, United States, kadubonn@ecs.umass.edu, Asli Sahin

The dimensions of the individual supply chain dimensions have not been completely defined nor do we yet know how these dimensions can be evaluated to judge supply chain flexibility. We first define appropriate dimensions for six supply chain flexibility dimensions found in the limited literature on supply chain flexibility. We then provide generalizable measures that can be used to evaluate supply chain flexibility dimensions.

4 - On The Benefits of Flexibility in a Supply Chain with Transshipment
Dennis Z. Yu, Doctoral Candidate, Olin School of Business, Washington University, Campus Box 1133, One Brookings Drive, St. Louis, MO, 63130, United States, yuz@wustl.edu, Yu Tang, Haojun Shen, Julie Niederhoff

Transshipment is an effective way in supply chain management to get benefits from adding network flexibility. However, adding flexibility in the real world could be extremely expensive or even not achievable. We apply newsvendor network model in this study to demonstrate the actual benefits of order quantity optimization and transshipment flexibility in a two-stage supply chain with six typical flexibility levels.

5 - Driving Supply Chain Performance through Inbound Logistics
Ike Ehie, Associate Dean, College of Business, Kansas State University, Calvin Hall 107, Manhattan, KS, 66506, United States, iehie@ksu.edu, Srikanth Sankaran

Inbound logistics is a critical link in any supply chain network. Using network modeling, this study will evaluate the impact of inbound logistics on the supply chain performance.

■ TC42

T-Tower Court D (2nd Floor)

Pricing and Auctions

Sponsor: Revenue Management & Dynamic Pricing
Sponsored Session

Chair: Pinar Keskinocak, Coca-Cola Assistant Professor, Georgia Institute of Technology, School of Industrial and Systems Enginee, 765 Ferst Drive, Atlanta, GA, 30345, United States, pinar@isye.gatech.edu

Co-Chair: Wedad Elmaghraby, Assistant Professor, ISyE, Georgia Institute of Technology, 765 Ferst Dr., Atlanta, GA, United States, wedad@isye.gatech.edu

1 - Pricing and Inventory Decisions for a Retailer's Product Line
Bacel Maddah, Virgina Tech, Department of Industrial and Systems Eng, Blacksburg, VA, United States, bmaddah@vt.edu, Ebru K. Bish

Consider a retailer's product line where consumers behave according to a multinomial logit choice model. We (1) develop an integrated marketing-production model to determine the optimal assortment size, price, and inventory levels so as to maximize the retailer's expected profit, (2) analyze how the optimal prices and the assortment size change with demand function parameters, (3) compare our findings to the case of infinite inventory levels.

2 - Optimal Allocation Mechanisms When Bidders Ranking for the Objects is Common
Jane Feng, Assistant Professor, University of Florida, United States, jane.feng@cba.ufl.edu

Search engines commonly sell "sponsored links" for monetary return. It is natural to assume that all providers value a higher ranked position more than lower ranked ones. We find that the optimal incentive compatible allocation mechanism in this environment is quite different in the four cases we studied in determining the "pivot" types and the order to fill in the positions. The efficiency of these allocation rules are also discussed.

3 - Dynamic Price Competition in Oligopoly
Kyle Lin, Assistant Professor, Grado Department of Industrial and Systems Engineering, Virginia Tech, Blacksburg, VA, 24061, United States, kylin@vt.edu, Soheil Sibdari

Price competition is important because nowadays prices can be easily compared on the Internet. A firm usually loses much revenue if it sets the product price as if it enjoyed monopoly. In this talk we develop the market equilibrium in a game-theoretic model. We also introduce an effective strategy that does not require the real-time inventory of a firm's competitor.

4 - Dynamic Pricing through Active Learning
Yossi Aviv, Associate Professor of Operations Management, Washington University, Campus Box 1133, 1 Brookings Drive, Saint Louis, MO, 63130, United States, aviv@wustl.edu

We consider a retailer who sells a fashionable good during a short sales season, but is uncertain about the specific characteristics of the demand for the product. We develop a dynamic revenue-maximization model in which the seller continuously learns about demand through sales observations. We explore the value of proactively setting prices to impact revenues as well as learning ("active learning") versus "passive learning," where the impact of prices on learning is ignored.

■ TC43

T-Denver (Mezzanine)

NPD Education-Preparing Students for Leadership in a cross-functional environment

Cluster: New Product Development
Invited Session

Chair: Debasish Mallick, Assistant Professor, University of Minnesota, Carlson School of Management, 321-19th Avenue South, Minneapolis, MN, 55455, United States, Dmallick@csom.umn.edu

1 - Cross-Functional Collaboration and Leadership: Is That What we are Really Teaching?
Sara L. Beckman, Senior Lecturer with Security of Employment, University of California - Berkeley, Haas School of Business, S545 Student Services Building, Berkeley, CA, 94720, United States, beckman@haas.berkeley.edu

Many of us have taught courses on new product development with cross-functional development teams as the experiential learning base. This approach has worked well, and we have learned a lot about executing the course, but it seems appropriate to ask whether or not we are achieving all of the objectives the course set out to achieve, and whether or not there are more efficient or effective means of teaching NPD, or other application areas in which to teach innovation through collaboration.

2 - Product Design and Development: A Pilot Program at MIT and Helsinki University of Technology (HUT)
Katja Holtta, MIT, (visiting from HUT), E60-426, Cambridge, MA, 02139, United States, holtta@mit.edu, Thomas Roemer

Dispersed product development is becoming ever more prevalent across industries. To better prepare students for this challenge, MIT and HUT have started a pilot program to jointly teach product development. During the course of the class, students from both universities jointly develop a new product, across borders, cultures, and disciplines. We report on the structure of and lessons learned from this pilot program.

3 - Managing Innovation and Product Development
Alan MacCormack, Associate Professor, Harvard University, Morgan Hall Terrace, Soldiers Field Road, Boston, MA, 02163, United States, amaccormack@hbs.edu

I will describe the teaching objectives, pedagogical methods and course materials used in a second year elective on managing innovation and product development. The course adopts a specific point of view: that the main challenge in mastering innovation lies in addressing the various uncertainties that impact the innovation process. I will describe the frameworks I use to address these issues in the course.

4 - Preparing Students for Leadership in Technology Management at University of Minnesota
Debasish Mallick, Assistant Professor, University of Minnesota, Carlson School of Management, 321-19th Avenue South, Minneapolis, MN, 55455, United States, Dmallick@csom.umn.edu

We describe an experiential approach to teaching new product design and business development to business and engineering students. The course, taught by an interdisciplinary faculty from the management, engineering, and medical school, is an innovative university-industry partnership for preparing students for leadership in managing technology in a cross functional environment.

5 - Using Real-World Venture Ideas to Drive a Class: Lessons Learned
Larry Meile, Associate Professor, Boston College, O,I&S Mgmt., CSOM - Fulton Hall, 140 Commonwealth Ave, Chestnut Hill, MA, 02467, United States, meile@bc.edu, Gregory Stoller

Three years ago, a firm offered to provide product ideas that graduate student teams could take and develop into products. Although the resulting New Product Development course did not achieve its goal of bringing a successful product to market, the concept of using outside business ideas as the mechanism to deliver course content was proven. This paper will describe the way these products have been incorporated into the curriculum and some of the lessons learned when doing so.

■ TC44

T-Spruce (Mezzanine)

Engineering Applications of DEA

Cluster: Data Envelopment Analysis
Invited Session

Chair: Tim Anderson, Engineering & Technology Management Dept., Portland State University, PO Box 751, Portland, OR, 97207-0751, United States, tima@etm.pdx.edu

1 - Revisiting US Airport Efficiency: Impact of Economics
James Cheng, Portland State University, United States, jmcheng0211@yahoo.com.tw, Tim Anderson, Martin Rinne, Massound Bazargan

This paper has focused on the relative efficiency and the productivity change among three different types of airports in US during 1996 and 2000. Increased air transportation due to economic boom challenges the airport operation. The variable-return-to-scale output-oriented DEA model and Malmquist Productivity Index has been conducted for evaluating the impact of economic growth.

2 - Using DEA to Measure the Impact of 9/11 on Airport Productivity
Martin Rinne, Engineering & Technology Management Dept., Portland State University, PO Box 751, Portland, OR, 97207, United States, mrinne@pdx.edu, James Cheng, Tim Anderson

The recent recession and the events of 9/11 have forced the airlines to trim their workforces and shift some of their operations to regional jets. As a result, many airports have experienced both a decrease in passenger volume and an increase in traffic. In this paper, we use the Malmquist Productivity Index, and some of its decompositions, to measure and document these and other changes in airport productivity resulting from the events of 9/11.

3 - Succession Planning with DEA: Employee Supervisor Potential Identification
William Eisenhauer, Manager, Managment Sciences and Analytics, Wells Fargo, CCG - CFS - Servicing - Collections, MAC P60533-022: 18700 NW Walker Rd #92, Beaverton, OR, 97006, United States, ike.d.eisenhauer@wellsfargo.com

Data Envelopment Analysis is applied to employee performance in a collections operation to determine the efficiency frontier for goal planning. A side effect of the employee performance analysis results in identifying potential for DEA use in employee succession planning via the identification of potential "best practice" leaders who could become workflow supervisors. Impact, limitations, and challenges in the use of DEA in employee performance analysis are also discussed.

4 - Determining Crew Size Inefficiencies using DEA
Gerald H. Williams, Jr., Partner, R. Brown Consulting Group LLC, 2300 SW First Avenue, Suite 102, Portland, OR, 97212, United States, Gerry@CEMResearch.com, Tim Anderson

This paper documents our study to determine crew size inefficiencies in the construction drywall trade. Inefficiencies in trade productivity are a leading cause of construction project cost overruns and claims. We use data from one of the nation's leading interior construction companies to show the extent crew size has on production inefficiency

■ TC45

T-Gold (Mezzanine)

Optimization in Radiation Treatment Planning

Cluster: Oncology and OR
Invited Session

Chair: Gino (Jinho) Lim, Assistant Professor, University of Houston, E206 Engineering Bldg 2, Houston, TX, 77204, United States, ginolim@uh.edu

1 - Quadratic Programming for Intensity-Modulated Radiation Therapy Treatment Planning
Kyungduck Cha, Ph.D. student, Georgia Institute of Technology, Industrial and Systems Engineering, Atlanta, GA, United States, chacha2000@isye.gatech.edu, Eva Lee

In this talk, we introduce constrained quadratic programming for inverse planning in intensity-modulated radiation therapy. The model employs dose-volume based objective while explicitly constrains the solution space to include coverage, homogeneity, and conformity for tumor target, and dose volume restrictions for critical structures and normal tissues. Several methods to solve the quadratic programs will be discussed. Computational results on real patient cases will be presented.

2 - IMRT Treatmet Planning Under Uncertainty
Millie Chu, Ph.D student, Cornell University, 288 Rhodes Hall, Ithaca, NY, 14853, United States, mchu@orie.cornell.edu, Yuriy Zinchenko, Shane Henderson

Current models for Intensity Modulated Radiation Therapy (IMRT) treatment planning add a safety margin to the target region to ensure the tumor is irradiated. We present a probabilistic model which takes into consideration uncertainty in the exact location of the tumor and healthy structures. We show that under certain assumptions, our model is equivalent to using a robust optimization approach.

3 - Radiotherapy Planning Optimization using Anatomy-based Beam's-eye-view Segmentation
Gino (Jinho) Lim, Assistant Professor, University of Houston, E206 Engineering Bldg 2, Houston, TX, 77204, United States, ginolim@uh.edu

An optimization framework for 3D conformal radiotherapy is presented. Beam's-eye-view segmentation approach is used in conjunction with wedges to improve solution time without losing solution quality. A mixed-integer linear program optimizes for beam angles, beam weights, wedge angles, and segmented beam's-eye-view. We also present an implicit DVH control technique using hot-and-cold spot control parameters.

■ TC47

T-Century (Mezzanine)

Software Demonstration

Cluster: Software Demonstrations
Invited Session

1 - Dash Optimization- Fast Track Development of Optimization Applications using Xpress-MP
Nitin Verma, Sr Consultant, Dash Optimization Inc, 560 Sylvan Ave, Englewood Cliffs, NJ, 07632, United States, nitin.verma@dashoptimization.com

This software tutorial focuses on developing and deploying complex hybrid algorithms. Xpress-IVE: visual development environment to analyze and fine tune search procedures of MIP/QP/SLP problems using search visualization tools. Xpress-Mosel: the next generation language provides developers modeling and programming functionality in one medium, leading to fast implementation of advanced algorithms.

2 - Duxbury/Thomson- Using JMP INÆ 5.1 in Data Analysis Courses
Curt Hinrichs, Duxbury/Thomson, 10 Davis Dr., Belmont, CA, 94002, United States, curt.hinrichs@duxbury.com

JMP INÆ software is an ideal solution for instructors who need to teach statistical concepts in their classes. JMP IN is an intelligent, visual, interactive and easy way to use statistical software that allows students to learn statistical concepts quickly, and for instructors to spend less time on teaching how to use the software.

Tuesday 4:30pm-6:00pm

■ TD01

P-Ballroom F

Tutorial: Optimization Methods for Rescheduling

Cluster: Tutorials- Denver 2004
Invited Session

1 - Optimization Methods for Rescheduling
Nicholas G. Hall, Professor, Ohio State University, 2100 Neil Avenue, Columbus, OH, 43210-1144, United States, hall.33@osu.edu

Despite the extensive literature on scheduling problems, rescheduling has been much less well studied. Rescheduling problems arise when a previously planned optimal schedule is disrupted. In practice, frequent disruptions include: the arrival of new orders, delays in job availability, machine breakdowns, processing delays, order cancellations and changes in priorities. The rescheduling problem involves minimizing the cost of scheduling the revised data set, while minimizing the disruption to customer expectations and resource allocations. We will review the literature of this problem, and describe a variety of new optimization and approximation methods. Many new research directions and open problems will be discussed.

■ TD02

P-Ballroom E

CS Applications to OR

Contributed Session

Chair: Maria Cristina Gramani, Dr., Mackenzie University, Rua da Consolação, 896 prédio 06, São Paulo, SP, 01302-907, Brazil, gramani@mackenzie.com.br

1 - Computational Aspects of Some Medical Decision Making Problems
Aye Thanda, Tutor, University of Computer Studies, Hlaing Campus, Yangon, 951, Myanmar, ucsy1@most.gov.mm, Pyke Tin, Koichiro Ochimizu

In this paper, we will consider some problems of medical decision making by using Dynamic Programming models, Random Walk type models and Compartmental models. It will involve some methods of queuing system. An optimal treatment policy for Breast cancer will be developed in this paper. We consider the problem by using random walk type approach and the biological system can be divided into compartmental of cell. We can consider the compartmental model as a network of queues.

2 - A Minimum Path Approach for Optimization Problems
Maria Cristina Gramani, Dr., Mackenzie University, Rua da Consolação, 896 prédio 06, São Paulo, SP, 01302-907, Brazil, gramani@mackenzie.com.br

After using the Minimum Path Approach(MPA) for several optimization problems, it was evident the good performance of the results obtained through fast algorithms. In this paper we comment the use of the MPA for the cutting stock problem considering the change of patterns, the lot sizing problem and others. For all these problems we propose a new resolution method consisting in the representation of the problem in a graph and after that it only remains to solve a minimum path problem.

■ TD03

P-Plaza Court 1

Operations Research in Biological and Chemical Sciences

Cluster: Science & OR
Invited Session

Chair: Suvrajeet Sen, National Science Foundation, Arlington, VA, University of Arizona, Tucson, AZ, United States, ssen@nsf.gov

1 - Simulating Self-Assembly at Cellular Scales
Russell Schwartz, Assistant Professor, Carnegie Mellon University, Department of Biological Sciences, 4400 Fifth Avenue, Pittsburgh, PA, 15213, United States, russells@andrew.cmu.edu, Farokh Jamalyaria, Rori Rohlfs, Sue Yi Chew

Self-assembly systems, which consist of large numbers of molecular components that spontaneously assemble into functional structures, are crucial to many biological processes. We have developed a novel queue-based method for fast and memory-efficient quantitative simulation of complex self-assembly systems on the scale of single cells. This talk will describe our methods, examine their theoretical and practical efficiency, and look at their application to biologically important systems.

2 - Network Topology and Model Uncertainty in Signal Transduction Pathways
Christodoulos Floudas, Professor, Princeton University, Chemical Engineering, Princeton, NJ, 08544, United States, floudas@titan.princeton.edu

In this presentation, we will (a) address the topology determination in complex metabolic and signal transduction pathways, and (b) introduce new advances in robust optimization theory to address several types of uncertainty in mixed integer linear programming models and their applications in metabolic networks.

3 - Optimization of Biochemical Networks for Desired Dynamic Characteristics
Nick Sahinidis, Professor, University of Illinois, Dept. of Chemical and Biomolecular Eng., 600 South Mathews Avenue, Urbana, IL, 61801, United States, nikos@uiuc.edu, YoungJung Chang

Biochemical networks are often approached through optimization formulations that are solved to interpret and predict the behavior of the network under structural and environmental changes. We develop a semi-infinite programming model and a global optimization algorithm for the design of biochemical networks that are guaranteed to be robust under bounded external perturbations. Computational results are presented, including application to tryptophan biosynthesis in bacteria.

■ TD04

P-Plaza Court 2

Data Mining and Operations Research Engineering

Sponsor: Data Mining
Sponsored Session

Chair: Moises Sudit, Managing Director, Center for Multisource Information Fusion, University at Buffalo, 414 Bell Hall, Buffalo, NY, 14062, United States, sudit@eng.buffalo.edu

1 - Data Mining in an Engineering Design Environment: OR Applications from Graph Matching
Moises Sudit, Managing Director, Center for Multisource Information Fusion, University at Buffalo, 414 Bell Hall, Buffalo, NY, 14062, United States, sudit@eng.buffalo.edu, Rakesh Nagi, Carol Romanowski

This presentation focuses on the mining of BOMs, as a class of unordered trees. A new Tree Bundle Matching Problem has been presented and proven to be NP-hard. The overall contribution of this work is to demonstrate the OR applications from graph matching to data mining in the engineering design environment.

2 - Data Mining in Aerospace
Sabyasachi Basu, Sr. Statistician, The Boeing Company, P.O. Box 3707, MC 7L-22, Seattle, WA, 98124-2207, United States, sabyasachi.basu@boeing.com, Rod Tjoelker

In this talk we discuss some of the data mining techniques that are used to analyze different types of problems within the aerospace industry. These applications include detecting anomalies in time series data and detecting patterns in spatial data to detect the effect of weather on air traffic. In developing the analyses methods, we have to take into account the size as well as the real time implications of the algorithms as well as the statistical properties of the estimators that are used.

3 - INFERD: INformation Fusion Engine for Real-time Decision-making
Adam Stotz, CUBRC, 4455 Genesee Street, Buffalo, NY, 14225, United States, stotz@cubrc.org, Viral Garach, Moises Sudit

We introduce an environment for real-time fusion in the detection of a coordinated cyber attack, which can be expanded for a number of other applications. We use graphs and Gibbs-Boltzmann functions to develop an automated system in the detection of such attacks. We demonstrated the adaptability of our system, by showing it works with well known Situational Awareness models such as TMODS (Terrorist Modus Operandi Discovery System).

■ TD05

P-Plaza Court 3

Optimization Methods and Applications

Sponsor: Optimization/ Integer Programming
Sponsored Session

Chair: Cole Smith, University of Arizona, PO Box 210020, Tucson, AZ, 85721, United States, cole@sie.arizona.edu

1 - Optimal Branch Decompositions and Tangle Bases
Illya Hicks, Texas A&M University, TANUS 3131, College Station, TX, United States, ivhicks@tamu.edu

Branch decompositions and branchwidth were introduced by Robertson and Seymour in their proof of the Graph Minors Theorem and have been shown fruitful for solving NP-hard problems modeled on graphs with low branchwidth; however, computing optimal branch decompositions is NP-hard. An algorithm is presented to test whether a graph has branchwidth at most k using a branch decomposition of width k+1 and a new structure called a tangle basis.

2 - Solving Low-Risk, Low-Cost Routing Problems
April Andreas, University of Arizona, 9308 Manassas Ridge, McKinney, TX, 75071, United States, andreas@advantexmail.net, Cole Smith

Traditional routing problems assume perfect operability of all arcs. For the case in which arcs can fail, a secondary restriction may be present to retain some measure of expected functionality. One difficult design problem of this nature is the establishment of two arc-disjoint paths, wherein one path must remain fully operable with some threshold probability. Our algorithm examines several competing branch-and-bound strategies for solving the resulting nonlinear integer program.

3 - Optimal Political Platform Design — A Special Case of the Share of Choices Problem
James Cochran, Assistant Professor, Louisiana Tech University, P. O. Box 10318, Ruston, LA, 71272, United States, jcochran@cab.latech.edu, Jeff Camm, David Curry

We treat determination of an optimal political platform as a share of choices problem for which potential positions on issues are handled as levels of product attributes. The problem is formulated as a maximal coverage problem with special ordered sets, and a modified version of the logic-based algorithm we created for the share of choices problem is to solve this problem. Data availability permitting, we discuss our preliminary results with regards to the 2004 US Presidential election.

■ TD06

P-Plaza Court 4

Integer Programming II

Contributed Session

Chair: Steven Eriksen, Professor of Management Science, Babson College, Babson Park, Wellesley, MA, 02457-0310, United States, eriksen@babson.edu

1 - Use of Integer Programming for Investigating Forecast Horizons
Sanjeewa Naranpanawe, Doctoral Student, University of Texas at Dallas, School of Management, P.O. Box 830688, Richardson, TX, 75083, United States, sanjeewa@student.utdallas.edu, Suresh Sethi, Milind Dawande, Srinagesh Gavirneni

The concept of a forecast horizon has been widely studied in the operations management literature in the context of evaluating the impact of future data on current decisions in a multi-period decision making environment. Integer programming has significant modeling and structural advantages, that makes it ideal for use in practice.

2 - Parametric Tabu Search for Mixed Integer Programs
Rahul Patil, Doctoral Student, Leeds School of Business, University of Colorado 419, Boulder, CO, 80309, United States, Rahul.Patil@colorado.edu, Fred Glover

The choice of branching variables and branching directions in practical mixed integer programming (MIP) codes such as CPLEX and XPRESS-MP has an immense impact on solving MIP problems efficiently. We demonstrate the effectiveness of a conditional learning method based on exploiting strongly determined and consistent variables using tabu search designs

3 - A Specialized Branch-and-Price Algorithm for Solving Large Integer Programs
Eugene Zak, TietoEnator, 8343 - 154 the Ave, Redmond, WA, 98052, United States, eugene.zak@tietoenator.com

Blending branch-and-bound and column generation together into a branch-and-price (BP) algorithm is a fruitful approach in dealing with large integer programs. An implementation challenge here is to develop customized branching rules that retain the structure of the pricing problem. The basic idea of the proposed algorithm is to impose a lexicographic ordering over the matrix columns. Branching rules, that happen to be a tricky part in the existing BP algorithms, become intuitive here.

4 - Facets of the Set-Covering Polytope with Coefficients in {0,1,2,3}.
Anureet Saxena, Tepper School of Business, Carnegie Mellon University, Room No. 24, Tepper School of Business,, Carnegie Mellon University, Forbes 5000, Pittsburgh, PA, 15215, United States, anureet@cmu.edu

Balas and Ng characterized the class of facets of the set-covering polytope defined by inequalities with coefficients in {0,1,2}. We extend their work to the class of inequalities with coefficients in {0,1,2,3}. We discuss conditions for minimality (facetness), generating procedures, (sequential and simultaneous) lifting theory and other interesting theoretical properties of facets in this family.

5 - Transportation Problems with Piecewise Linear Cost Structures
Steven Eriksen, Professor of Management Science, Babson College, Babson Park, Wellesley, MA, 02457-0310, United States, eriksen@babson.edu

The transportaton problem with piecewise linear arc costs is analyzed using models and algorithms from both the integer programming and network flow perspectives. Convex and concave two-step cost functions, as well as concave multi-step convex cost functions are considered, and their computational results are provided.

■ TD07

P-Plaza Court 5

Recent Computational work in SDP and Cone Programming with Applications

Sponsor: Optimization/Linear Programming and Complementarity
Sponsored Session

Chair: Levent Tuncel, Professor, University of Waterloo, Dept. of Comb. and Opt., Waterloo, ON, N2L3G1, Canada, ltuncel@math.uwaterloo.ca

1 - Learning the Kernel Matrix with Semidefinite Programming
Gert Lanckriet, Department of Electrical Engineering and Computer Science, University of California, Berkeley, CA, 94720, United States, gert@eecs.berkeley.edu, Laurent El Ghaoui, Michael Jordan, Nello Cristianini, Peter Bartlett

Kernel-based learning methods have proven to be powerful tools in machine learning applications, e.g., binary classification. While classical kernel-based classifiers are based on a single kernel, in practice it is often desirable to base classifiers on combinations of multiple kernels. Here, we show that learning the optimal combination of kernel matrices for the support vector machine (SVM) reduces to a semidefinite programming problem (SDP).

2 - Clustering via Minimum Volume Ellipsoids
Romy Shioda, Assistant Professor, Univ of Waterloo, Dept. of Comb. and Opt., Waterloo, ON, Canada, rshioda@uwaterloo.ca, Levent Tuncel

Minimum volume ellipsoids (MVE) clustering allocates data points into clusters that minimize the total volumes of each cluster's covering ellipsoids - a problem that can be formulated as a mixed-integer semidefinite programming problem. We present some preliminary emprical results that illustrate MVE clustering as an appropriate method for clustering data from mixtures of Gaussians distributions and compare its performance with the k-means clustering.

3 - A Primal-dual Potential Reduction Method for Semidefinite Programs with Sparse Data
Gun Srijuntongsiri, Cornell University, 340 Upson Hall, Ithaca, NY, 14853, United States, gunsri@cs.cornell.edu, Stephen Vavasis

In this paper, we describe a primal-dual potential reduction method for solving a class of semidefinite programs with sparse data. We show that the gradient and the Hessian-matrix product of barrier functions, which are required to compute the search direction, can be computed in time and space proportional to those of the original barrier functions by using an idea from automatic differentiation in backward mode. The algorithm was implemented and tested on the maximum cut problem.

■ TD08

P-Plaza Court 6

Advances in Network and Combinatorial Optimization

Sponsor: Optimization/ Network Optimization
Sponsored Session

Chair: James Orlin, Professor, MIT, E40-147, Cambridge, MA, 02139, United States, jorlin@mit.edu

1 - Time Cost Trade-off in Quickest Flows
Raghavendran Sivaraman, United States, rags@mit.edu, Thomas Magnanti, Martin Skutella

We consider a budget-constrained design version of the Quickest Flow Problem (QFP) called the Time Cost Trade-off (TCT) problem. While researchers have proposed polynomial time algorithms for the QFP, the TCT is strongly NP-Hard. We show that the TCT satisfies a certain corner point property, and use this result to formulate the TCT as an integer program. We also propose a lower bound and evaluate its quality. Finally, we suggest, and computationally evaluate, heuristics for solving the problem.

2 - Functional Annealing
Dushyant Sharma, Department of Industrial and Operations Engineering, The University of Michigan, IOE Building, 1205 Beal Avenue, Ann Arbor, MI, 48105, United States, dushyant@umich.edu

We consider a technique inspired by simulated annealing in which the objective function is perturbed by an amount that decreases with the temperature, and one seeks local improvements. It shares a convergence property with simulated annealing, and in empirical tests on limited problems, it has outperformed simulated annealing.

3 - The Vehicle Routing Problem with Split Deliveries
Agustin Bompadre, MIT, MIT E40-130, Cambridge, MA, 02139, United States, abompadr@MIT.EDU, Moshe Dror, James Orlin

We present lower bounds for the vehicle routing problem (VRP) with and without split deliveries, improving the one of Haimovich and Rinnooy Kan. We also present approximation algorithms for vehicle routing problems that improve on the best known results of Altinkemer and Gavish.

■ TD09

P-Plaza Court 7

Column Generation/Cutting Plane Approaches to Large-Scale Conic Optimization

Sponsor: Optimization/ Nonlinear Programming
Sponsored Session

Chair: E. Alper Yildirim, Stony Brook University, Applied Mathematics and Statistics, Stony Brook, NY, 11794-3600, United States, yildirim@ams.sunysb.edu

1 - Towards a Practical Simplex Method for SOCP
Kartik Krishnan, McMaster University, Department of Computing and Software, Hamilton, ON, L8N 2X1, Canada, kartik@rice.edu, Gabor Pataki, Tamas Terlaky, Neha Gupta

It is of great interest to devise a theoretical and well working generalization of the LP simplex method for conic problems, which include SDP and SOCP. Extending the work of Pataki (1996) and Krishnan-Mitchell-Zhang (2003) we have devised such an algorithm for SOCP. We have also implemented the algorithm with special emphasis to doing every iteration quickly. In this talk, we will present this simplex method for SOCP together with our computational experiences with this algorithm.

2 - A Second-order Cone Cutting Surface Algorithm for Eigenvalue Optimization
Mohammad Oskoorouchi, California State University San Marcos, 333 S. Twin Oaks Valley Rd., San Marcos, CA, 92096-0001, United States, moskooro@csusm.edu

We present an algorithm to minimize the max-eigenvalue of an affine combination of symmetric matrices. The max-eigenvalue function is a convex nonsmooth function. We relax its subdifferential set by a set of second-order cone inequalities. Therefore, at each iteration we are dealing with a set of multiple second-order cone cuts. We show that the algorithm is polynomial and report numerical results on randomly generated problems.

3 - Efficient Algorithms for Large-Scale Geometric Optimization
E. Alper Yildirim, Stony Brook University, Applied Mathematics and Statistics, Stony Brook, NY, 11794-3600, United States, yildirim@ams.sunysb.edu, Piyush Kumar, Joseph S. B. Mitchell

We study the minimum enclosing ball (MEB) and the minimum volume enclosing ellipsoid (MVEE) problems for large sets of points in high dimensions. We propose a column generation algorithm that exploits the underlying structure in both problems. We establish new complexity results by finding upper bounds on the number of columns generated to obtain a desired approximation. Extensive experimental results indicate the efficiency of our algorithm in practice on large data sets.

■ TD10

P-Plaza Court 8

Joint Session TSL/MSOM/Supply Chain Management: Distribution Networks

Sponsors: Transportation, MSOM, Supply Chain
Sponsored Session

Chair: Anton Kleywegt, Associate Professor, Georgia Institute of Technology, School of Industrial and Systems Enginee, Georgia Institute of Technology, Atlanta, GA, 30332-0205, United States, anton@isye.gatech.edu

1 - A Continuous Model of Location Competition
Abdullah Dasci, University of Alberta, School of Business, Edmonton, AB, T6G 2C7, Canada, adasci@ualberta.ca, Gilbert Laporte

We analyze the location strategies of two firms planning to expand in a geographical market. Firms try to maximize their profits under a leader-follower type competition in which the number of stores is made endogenous by the introduction of fixed costs. Issues of entry prevention, entry accommodation, and judo strategy are also discussed.

2 - Price-Directed Control of a Closed Logistics Queueing Network
Dan Adelman, Associate Professor, University of Chicago, Graduate School of Business, 1101 East 58th Street, Chicago, IL, 60637, United States, dan.adelman@gsb.uchicago.edu

Motivated by one of the leading third party logistics suppliers, we consider an internal pricing mechanism for managing a fleet of service units flowing in a closed queueing network. The problem is to find an accept/reject policy that maximizes the long-run time average reward rate from accepting customer requests.

3 - Discretization and Validation of the Continuum Approximation Scheme for Terminal System Design
Yanfeng Ouyang, Univeristy of California at Berkeley, 416F Mclaughlin Hall, University of California, Berkeley, CA, 94720, United States, yfouyang@uclink.berkeley.edu, Carlos Daganzo

This paper proposes an algorithm that automatically discretizes the "continuum approximation" (CA) recipes for terminal location problems. The algorithm finds locations with a cost very close to the CA predictions. The paper also gives conditions under which the method yields a small optimality gap.

4 - Locating Crossdocks in a Distribution Network
Anton Kleywegt, Associate Professor, Georgia Institute of Technology, School of Industrial and Systems Engineering, Georgia Institute of Technology, Atlanta, GA, 30332-0205, United States, anton@isye.gatech.edu, Amy R. Ward, Jinpyo Lee

In order to transport shipments between many origins and destinations using crossdocks, a less-than-truckload carrier must trade off the crossdock cost, the line-haul cost, and the detour cost. Operational costs are complicated but should be estimated in the network design phase. We propose a simple method for estimating the costs and determining the number and locations of the crossdocks. We test our method using a carrier's data.

■ TD11

P-Governor's Square 9

Distribution Network Design

Sponsor: Transportation Science & Logistics
Sponsored Session

Chair: Halit Uster, Assistant Professor, Texas A&M University, Department of Industrial Engineering, College Station, TX, 77843, United States, uster@tamu.edu

1 - A Reliable Location-Inventory Model
Max Shen, University of California-Berkeley, IEOR Department, Berkeley, CA, 94720, United States, shen@ieor.berkeley.edu, Lian Qi

We propose a joint location-inventory model that considers the unreliable nature of the supplier, warehouses, and transportation. The problem is to decide where and how many warehouses to locate, which retailers should be served by which warehouses, to maximize profit while achieving a certain service requirements.

2 - Models for the Location of Cross-Docks
James H. Bookbinder, Professor, University of Waterloo, Department of Management Sciences, 200 University Ave. W, Waterloo, ON, N2L 3G1, Canada, jbookbinder@uwaterloo.ca, Mehmet Gumus

Cross-docking replaces traditional warehousing, enabling continuous flow of items without storage. We formulate several location models to decide the sites where CDs will be opened. These differ from typical warehouse-location models where facilities carry stock. Thus, opportunities to consolidate shipments of multiple products to one or several customers must be considered.

3 - Strategic Design of Distribution Systems with Economies of Scale in Transportation
Mark Turnquist, Professor, Cornell University, Civil & Environmental Engineering, 309 Hollister Hall, Ithaca, NY, 14853, United States, mat14@cornell.edu, Linda Nozick, Jenn-Rong Lin

We formulate and analyze a strategic design model for multi-product multi-echelon distribution systems where there are significant economies of scale in the transportation movements. An efficient heuristic solution method is developed. In test problems for which exact solutions are available, the heuristic is within 1 percent of optimal.

4 - Heuristics for Capacitated Network Design with Intermediate Consolidations
Halit Uster, Assistant Professor, Texas A&M University, Department of Industrial Engineering, College Station, TX, 77843, United States, uster@tamu.edu, Homarjun Agrahari

We consider a particular distribution network structure that explicitely considers intermediate consolidation of smaller loads into bulk loads and resource capacities. We provide alternative IP formulations for the corresponding network design problem and heuristic solution procedures including lagrangian relaxation. We also present some numerical results.

■ TD12

P-Governor's Square 10

Inventory Modeling IV

Contributed Session

Chair: Jie Cao, University of Florida, 303 Weil Hall, Gainesville, FL, 32603, United States, jiecao@ufl.edu

1 - Approximate Evaluation of Inventory Policies with Unidirectional Substitution

Jun Liu, Graduate Student, University of Toronto, 5 King's College Road, Toronto, ON, M5S3G8, Canada, liujun@mie.utoronto.ca, Chi-Guhn Lee

We investigate evaluation of multi-product base-stock inventory management policies when unidirectional substitution is allowed among multiple parts. We develop two approximation approaches that are based on decomposition of multi-dimensional state transition and aggregation of multiple states, respectively. Both approaches perform reasonably well compared with simulation.

2 - Stock Rationing in Production-Inventory Systems with Batch Orders

Boray Huang, Northwestern University, Department of Industrial Engineering, and Management Sciences, Evanston, IL, 60208, United States, b-huang@northwestern.edu, Seyed Iravani

Current literature on stock rationing in a make-to-stock system with multi-class customers assumes unitary Poisson demand for each class. We extend the existing research in two different directions. First, we consider a case where customers' orders arrive as compound Poisson processes. Second, we generalize the results in the context of a two-level supply chain with information sharing. Optimal policies are identified and insights are provided by numerical examples.

3 - The Single-period Inventory Problem with Price Variability

Xiaoou Zhang, Ph.D Candidate, Ivey School of Business, Ph.D Program, Ivey School of Business, London, ON, N6A3K7, Canada, mzhang@ivey.uwo.ca, Lijuan Zhang

In this paper, we examine the single-period inventory problem, where the item can be sold to different demand classes at different prices. The demands are realized simultaneously. We investigate two cases where demands are either independent or dependent. We characterize the structure of an optimal combined pricing and inventory strategy for both cases. Numerical analysis is provided.

4 - A Stochastic Multi-item Inventory Model with Unequal Replenishment Intervals and Limited Capacity

Jie Cao, University of Florida, 303 Weil Hall, Gainesville, FL, 32603, United States, jiecao@ufl.edu, Edwin Romeijn

We study stochastic inventory models for multiple items with both equal and unequal replenishment intervals under limited warehouse capacity. We propose three efficient and intuitively attractive heuristics. We show that these heuristics provide the optimal replenishment quantities in case of equal replenishment intervals. For the general model, a numerical comparison of the heuristic solutions to the optimal solutions shows that the heuristics yield high quality solutions in very limited time.

5 - A Comparison of Inventory Control Policies with Remanufacturing Yield Loss

Z. Pelin Bayindir, University of Florida, 303 Weil Hall POB 116595, Gainesville, United States, bayindir@ise.ufl.edu, Ruud Teunter, Rommert Dekker

In this study we consider a joint manufacturing and remanufacturing environment. The remanufacturing process is imperfect. Unsatisfied demand is completely lost. It is possible to dispose the returns. Manufacturing and remanufacturing operations are carried out in the same facility on dedicated lines. The objective is to maximize expected average profit. We propose 4 alternative policies to control the system. In this talk, the policies and the computational study are discussed.

■ TD13

P-Governor's Square 11

Aviation Applications

Contributed Session

Chair: Maurice Levy, Universidad Anàhuac, Av. Lomas Anàhuac s/n, Lomas Anàhuac, Huixquilucan, Edo. Mex., 52786, Mexico, mlevy@anahuac.mx

1 - Integer Programming Conversion of Influence Diagram for Aviation Decision Support System

Nathan Greenhut, Graduate Assistant, Rutgers University, 35 Patton Drive, East Brunswick, NJ, 08816, United States, hut@eden.rutgers.edu, James Luxhoj, David Coit

We present a heuristic for database formation from Bayesian Belief Networks and the corresponding Integer Program that is associated with the decisions to be made in these models. A reward and penalty comparison between the heuristic and complete information from the models is accomplished. In the work, Birnbaum's importance measures along with the Integer Program facilitate a decision support system for seven technology suites under the auspices of the NASA's Aviation Safety Program.

2 - Workload Balancing under Uncertainty at Airport Cargo Terminal

Huei-Chuen Huang, Associate Professor, National University of Singapore, 10 Kent Ridge Crescent, Singapore, S, 119260, Singapore, isehhc@nus.edu.sg, Zhiyong Xu, Chul Ung Lee

An important planning problem for airport terminal operators is the scheduling of cargo handling employees at the cargo terminals. While there seems to be not enough manpower during peak hours, idle time occupies a large portion of working hours. This is caused by severely unbalanced workload distribution. This paper presents a zero-one integer programming model and appropriate solution approaches for the workload balancing problem under uncertainty. Experimental results are also presented.

3 - Assessment of Traffic Flow Management (TFM) Strategies Using a ATC Simulation

Jerome Freedman, Lead Engineer, MITRE Corporation, 500 Scarborough Drive, Suite 101, Pleasantville, NJ, 08232, United States, jfreedma@mitre.org

A new simulation tool which models the National Airspace System in mid level detail was used to conduct a case study of alternative TFM strategies applied to arrival operations at Chicago O'Hare Airport on a bad weather day that occurred 14 April 2003. Fuel burn and passenger delay metrics were the basis for the evaluation.

4 - An Application of Queuing Theory to Calculate the Number of Gates of Mexico City's New Airport

Maurice Levy, Universidad Anàhuac, Av. Lomas Anàhuac s/n, Lomas Anàhuac, Huixquilucan, Edo. Mex., 52786, Mexico, mlevy@anahuac.mx, Margarita Castro, Gabriela Méndez

The passenger terminal of Mexico City's airport has an insufficient capacity to handle the growing traffic of airplanes and passengers. The Government is planning to build a new airport and it is necessary to calculate the number boarding gates with jetway. With the application of queuing theory, it is possible to solve in a simple and economic way this problem and to greatly improve the level and quality of the service given to the airlines and the passengers.

■ TD14

P-Governor's Square 14

Time Matters: Managing Speed as Managing Technology

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 - Firm Performance in Drug Development: Integrating Knowledge-Based and Transaction Cost Explanations

Jeffrey Macher, Assistant Professor, McDonough School of Business, Georgetown University, Washington, DC, 20057, United States, jtm4@georgetown.edu, Christopher Boerner

We study how performance in new drug product development differs across pharmaceutical firms and what factors account for these differences. Combining transaction cost economics and the knowledge based view, we explore how organizing drug development activities affects performance. Using novel firm-level proxies for organizational competence, we show that organizing and managing drug development and regulatory approvals are key sources of competitive advantage in the pharmaceutical industry.

2 - Making it Pay to be First: Determining Entry Timing and the Advantages of Moving First

Nile Hatch, Assistant Professor, Marriott School, Brigham Young University, 790 TNRB, Provo, UT, 84602, United States, nile@byu.edu, Douglas Johnson

Competitive advantage through moving first typically requires large investments in a race to beat rivals to market. Beating rivals reveals the need for game theory while investments in uncertain assets points to real options analysis. We integrate these methods and find that rivals exhibit heterogeneous preferences for moving first that depend on their capabilities. Thus, competitive advantage through first-mover advantages requires transforming capabilities to make early entry profitable.

3 - Synchronizing Investments in Product and Process Throughout the Product Life Cycle

Janice Carrillo, Assistant Professor, Warrington College of Business, University of Florida, PO Box 117169, Gainesville, FL, 32611-7169, United States, janice.carrillo@cba.ufl.edu, Richard Franza

Firms must develop appropriate design and production capabilities to bring valuable new products to market in an efficient manner. We introduce a normative model which yields insights concerning the appropriate timing of investments in product design and process capacity during the product life cycle.

■ TD15

P-Governor's Square 15

New and Open Problems in Scheduling

Cluster: Scheduling
Invited Session

Chair: George Vairaktarakis, Case Western Reserve University, Weatherhead School of Management, Cleveland, OH, 44106, United States, gxv5@weatherhead.cwru.edu

1 - Minimizing Mean Flowtime and Makespan on Master-Slave Systems
Hairong Zhao, Ph.D candidate, New Jersey Institute of Technology, Dept of Computer Science, Newark, NJ, 07102, United States, hz2@oak.njit.edu, Joseph Leung

We consider the problems of minimizing mean flowtime and makespan in master slave models. We show that these problems are strongly NP-hard even with severe constraints. We propose several heuristics for some special cases of these problems, and analyze their worst case performance.

2 - Coordination of Production and Distribution of Bundling Operations
George Vairaktarakis, Case Western Reserve University, Weatherhead School of Management, Cleveland, OH, 44106, United States, gxv5@case.edu, Chung-Lun Li

A product consists of a bundle of modules each produced on a dedicated center and then distributed to a customer. Work centers operate in parallel. We minimize a composite function of the production flowtime plus the distribution cost to the customer. Basic results and algorithms are presented.

3 - Complexity of Two Dual Criteria Scheduling Problems
Joseph Leung, Professor, New Jersey Institute of Technology, Dept. of Computer Science, Newark, NJ, 07102, United States, leung@oak.njit.edu, Hairong Zhao, Huo Yumei

We consider the complexity of two dual criteria scheduling problems on single machine. Both problems have the number of tardy jobs as the primary criterion. One problem has the total completion time and the other has the total tardiness as the secondary criterion. We show that both problems are binary NP-hard.

4 - Identical Jobs Cyclic Scheduling: Formulation and Solution
Keli Feng, Ph.D student, University of Cincinnati, 523 Lindner Hall, College of Business, University of Cincinnati, Cincinnati, OH, 45221, United States, fengk@email.uc.edu, Uday Rao, Peter Jackson

We study the re-entrant flow, cyclic scheduling problem considered by Graves et al (1989) and Roundy (1992). We present two problem formulations to minimize job flow time (work-in-process), given a target cycle length (throughput). We develop effective heuristic and optimization methods, which we test computationally.

■ TD16

P-Governor's Square 17

Software and Algorithms for Semidefinite Programming

Sponsor: Computing Society
Sponsored Session

Chair: Brian Borchers, New Mexico Tech, Department of Mathematics, 801 Leroy Place, Socorro, NM, 87801, United States, borchers@nmt.edu

1 - Recent Enhancements to CSDP
Brian Borchers, New Mexico Tech, Department of Mathematics, 801 Leroy Place, Socorro, NM, 87801, United States, borchers@nmt.edu

CSDP is a software package for the solution of semidefinite programming problems. This presentation will include an overview the algorithm used by CSDP and recent enhancements to the package. Computational results will be presented, including results on some large problem instances that have been solved by a parallel version of CSDP.

2 - Solving Structured Semidefinite Programs with DSDP5
Steven Benson, Assistant Scientist, Argonne National Laboratory, Building 221, 9700 S. Cass Avenue, Argonne, IL, 60439, United States, benson@mcs.anl.gov

Semidefinite programming often have structure that can reduce the amount of memory or FLOPs required by interior-point methods. This structure is lost when represented in standard forms. While general purpose data structures suffice for most applications, specialized kernels can significantly improve performance. We show how the dual-scaling algorithm can be implemented to provide efficient default performance and allow the flexibility to improve performance on selected applications.

3 - Computational Enhancements in Low-Rank Semidefinite Programming
Samuel Burer, Assistant Professor, University of Iowa, Department of Management Sciences, S346 Pappajohn Business Building, Iowa City, IA, 52242-1000, United States, samuel-burer@uiowa.edu, Changhui Choi

We present computational enhancements of the ``low-rank" semidefinite programming algorithm based on the truncated Newton method. Also detailed are strategies for preconditioning the Newton system. Computational results demonstrate improved accuracy and robustness of the algorithm.

4 - The State of the Art in Software for SDP&SOCP and Applications
Hans Mittelmann, Professor, Arizona State University, Box 871804, Tempe, AZ, 85287-1804, United States, mittelmann@asu.edu

For the Seventh DIMACS Implementation Challenge in SDP&SOCP we had evaluated all submitted codes (see Math. Progr. 95). Several of the codes have been developed further since then. We will report independent evaluation results on a variety of problem classes including those generated by special application programs based on some of the codes.

■ TD17

P-Directors Row E

Joint Session Decision Analysis/ Military App.: Military Applications of Decision Analysis

Sponsor: Decision Analysis, Military Applications
Sponsored Session

Chair: Gregory Parnell, Professor of Systems Engineering, United Stated Military Academy, Department of Systems Engineering, West Point, NY, 10996, United States, gregory.parnell@usma.edu

1 - Army Budget Prioritization
COL William Klimack, United States Military Academy, United States, william.klimack@usma.edu, Gregory Parnell, Maj. Greg Lamm, Brian Stokes

A multi-objective analysis was used to optimize the Army Budget, based on the Chief of Staff of the Army's objectives described in The Army Plan. The model, implemented in MS Access, allows portfolio optimization with variable program constraints and costs. We compared a linear programming methodology and simulated annealing heuristic to determine the best optimization approach. Users may examine portfolio information in a variety of formats, including cost of portfolio constraints.

2 - Application of Multi-Attribute Utility Theory to Software Technology Evaluation
LTC William Hensley, Chief, Decision & Strategic Analysis, Department of Defense, 797 Seneca Drive, Odenton, MD, 21113, United States, wrhensl@nsa.gov

A govt agency provides numerous reports to decision-makers. Each report must meet, and cite, a specific information requirement. Daily reports and changing requirements make citation very time-consuming. The agency is searching for new technologies to help analysts cite reports more quickly. Approaches & technologies will be evaluated in the lab to see which work best. The effort will use a MAU model to evaluate and select the best package. Details and results will be presented.

3 - A Risk Analysis Methodology to Assess Proposed Foreign Ownership of US Telecom Infrastructure
Terry Bresnick, President, Innovative Decisions, Inc, 3011 Weber Place, Oakton, VA, 22124, United States, tabresnick@innovativedecisions.com, Gregory Parnell

This presentation describes a risk methodology to assess proposed transactions involving U.S. telecommunications infrastructure and foreign ownership, control or influence. The methodology uses a decision-analytic framework to combine threat, vulnerability, and consequence information regarding the baseline telecommunications infrastructure and the specific transaction that is under review.

4 - Using Decision Analysis for Army Stationing
MAJ Paul (Lee) Ewing, Center for Army Analysis, 6001 Goethals Rd., FT. Belvoir, VA, United States, paul.ewing@us.army.mil, Cpt. John Harris, Gregory Parnell

Army installations provide facilities and maneuver space to organize, train and equip the United States Army. Four previous base closure rounds in 1988, 1991, 1993, and 1995, resulted in 97 major domestic base closures, 55 major base realignments, and 235 minor installations being either closed or realigned. We describe decision analysis methods the Army can use to support future installation and stationing decision-making.

■ TD18

P-Directors Row H

Wireless Network Design

Sponsor: Telecommunications
Sponsored Session

Chair: Eli Olinick, SMU, EMIS Department, PO Box 750123, Dallas, TX, 75275-0123, United States, olinick@engr.smu.edu

1 - Network Design for CDMA Systems
Qibin Cai, SMU, EMIS Department, Dallas, TX, United States, qcai@engr.smu.edu

Designing a cost-effective CDMA network is a complex task in which system capacity and quality of service are intimately related through signal-to-interference measures. CDMA network design requires selecting sites for radio towers, and analysis of customer demand patterns. We propose optimization models to assist a network planner with the selection of radio tower and mobile telephone switching offices, and design of a survivable backbone network, and the calculation of service capacity.

2 - Optimizing Revenue in CDMA Networks Under Demand Uncertainty
Jay Rosenberger, University of Texas at Arlington, Industrial and Manufacturing Sys. Eng., Campus Box 19017, Arlington, TX, 76019-0017, United States, jrosenbe@uta.edu, Eli Olinick

Optimizing revenue in a CDMA network involves service-capacity reservation in each market subject to signal-to-inteference constraints at the radio towers. We present a yield management model for CDMA networks inspired by those from the airline industry to optimize revenue under demand uncertainty. We describe the optimality conditions and develop a supergradient algorithm. We provide computational results that show the effects of the distribution and variance of demand.

3 - Stochastic Characterization of MANETS
Timothy Matis, Assistant Professor, NMSU Dept of Industrial Engineering, P.O. Box 30001 MSC 4230, Las Cruces, NM, 88003, United States, tmatis@nmsu.edu

We are attempting to close the gap between MANET performance predicted by network simulations and that observed in actual field tests. This is being accomplished through the creation of simulations that more realistically characterize the general operational environment of the MANET without excessive modeling effort or execution time. The effect of the stochastic RF environment on the performance of popular MANET protocols is examined.

4 - Greedy Hub Location-Allocation in Fixed-Wireless Networks
Uday Rao, University of Cincinnati, QAOM Dept., Cincinnati, OH, 45221, United States, raous@ucmail.uc.edu, Ramesh Bollapragada, Jeff Camm, Junying Wu

We study a two-phase, budget-constrained, network-planning problem with multiple hub types and demand scenarios. In each phase, we install (or move) capacitated hubs on selected buildings. We allocate hubs to realized demands, under technological constraints. We present a greedy algorithm to maximize expected demand covered and computationally study its performance.

■ TD19

P-Directors Row F

Auctions I

Contributed Session

Chair: Abhishek Pani, Ph.D Student, University of Maryland, College Park, Van Munching Hall, R H Smith school of business, College Park, MD, 20740, United States, apani@rhsmith.umd.edu

1 - Reverse-auction Modeling
Guoren Zhang, Ph.D. Candidate, Richard Ivey School of Business, 1151 Richmond Street North, University of Western Ontario, London, ON, N6A 3K7, Canada, gzhang@ivey.uwo.ca, John Wilson

We model the reverse-auction problem, which is applied in www.priceline.com. We find the optimal biding policy for customers based on this model. And we study how the website should adjust their policy to maximize their profit according to the strategic behaviour of the customers.

2 - A Stochastic Differential Game Based Study of Channel Power in a Supply Chain
Anand Nair, Assistant Professor, Auburn University, 418, Lowder Business Building, Dept. of Management, College of Business, Auburn, AL, 36849, United States, nairana@auburn.edu, Ram Narasimhan

A stochastic dynamic game between a supplier firm and a buyer firm is considered to investigate strategic supply chain issues. The two firms make investments in innovation capabilities to wield channel power and to lock-in the collaborating partner. The situation is modeled as a stochastic differential game. The Nash equilibrium expressions for the investment strategies of the buyer and supplier firms are presented and the underlying implications in a supply chain setup are examined.

3 - Combinatorial Auctions with Budget and Other Constraints
Abhishek Pani, Ph.D Student, University of Maryland, College Park, Van Munching Hall, R H Smith school of business, College Park, MD, 20740, United States, apani@rhsmith.umd.edu, G "Anand" Anandalingam

The paper aims to solve practical combinatorial auction problems with budget and additional system constraints. We seek to find a solution in the core and determine the applicability of multi-round, ascending auction format with proxy agents to solve the problem of determining equilibrium prices, under budget and attribute-based restrictions. We also seek to evaluate the performance of the above algorithms along with insights into the derived prices from math programming theory.

■ TD20

P-Room 3304

Health Care Applications I

Contributed Session

Chair: Linda LaGanga, Ph.D. Candidate, University of Colorado-Boulder, Leeds School of Business, UCB 419, Boulder, CO, 80309-0419, United States, laganga@colorado.edu

1 - Managing Surgical Waitlists for a Canadian Health Authority
Pablo Santibanez, Graduate Sudent & Project Analyst, Centre for Operations Excellence, University of British Columbia, University of British Columbia, 2053 Main Mall, Vancouver, BC, V6T 1Z2, Canada, pablo.santibanez@coe.ubc.ca, Mehmet Atilla Begen, Derek Atkins

Managing surgical facilities to provide acceptable waitlists for a Health Authority in the publicly funded Canadian system is complex. We were asked for a system wide (11 hospitals) strategic tool to let management explore trade-offs between OR availability, bed capacity, OR booking privileges by surgeons, and waitlists for patients by speciality and procedure. An IP model schedules procedures into OR's for all the hospitals, under OR time availability and post-surgical resources constraints.

2 - Capacity Management in Health-Care
Sanjeev Bordoloi, Assistant Professor, College of William & Mary, School of Business, Williamsburg, VA, 23187, United States, skbord@business.wm.edu

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.

3 - Financial Feasibility of New/Expanded Imaging Services
Andrew Ganti, Sr. Consultant/MBB, General Electric, 300 Winged Ter. Dr., San Ramon, CA, 94583, United States, Andy.Ganti@med.ge.com, Anita Ganti

Simulation is a low cost option to physical changes. Crystal Ball add-on to MS-Excel is simpler than other tools. This paper describes Monte-Carlo simulation to healthcare operations to determine the financial feasibility of new/expanded services with case studies. It also covers: overview of the Crystal Ball with selection criteria as a simulation tool, limitations and alternate simulation tools. This is for beginners to simulation and treated as a tutorial for management/industrial engineers.

4 - Newsvendor Models for Clinical Appointment Scheduling
Linda LaGanga, Ph.D. Candidate, University of Colorado-Boulder, Leeds School of Business, UCB 419, Boulder, CO, 80309-0419, United States, laganga@colorado.edu, Stephen Lawrence

We use analytical newsvendor models to balance the costs of provider idle time and patient wait time when seeking the optimal allocation of time for each clinical appointment. We also apply a newsvendor model to determine the expected costs of various levels of appointment overbooking, then use simulation to test the performance of different scheduling rules for allocating overbooked appointments to time slots.

■ TD21

P-Room 3302

Transformative Uses of OR Spreadsheets

Sponsor: Spreadsheet Productivity Research
Sponsored Session

Chair: Jeffrey Keisler, Assistant Professor, University of Massachusetts Boston, College of Management, Boston, MA, 02125, United States, Jeff.Keisler@umb.edu

1 - Appealing Graphs Enable Massive Data Visualization
Janet Wagner, Associate Dean, UMASS Boston, CM Dean's Office, 100 Morrissey Blvd, Boston, MA, 02125, United States, janet.wagner@umb.edu

UMass Boston, like many AACSB accredited business schools, uses EBI benchmarking surveys of students and alumni. These surveys come with entire notebooks of paper reports on the results - last year more than a foot of shelf space. These results were hard to disseminate and difficult to digest. Spreadsheet-based visual displays of these were used to disseminate the EBI results and the resulting collaborative faculty and administration process led to significant program changes.

2 - Enhancing Microsoft Excel for Global Supply Chain Optimization
Larry LeBlanc, Professor, Vanderbilt University, Owen Graduate School of Management, 401 21st Avenue South, Nashville, TN, 37203, United States, Larry.Leblanc@owen.vanderbilt.edu, MIchael Galbreth

Nu-kote remanufactures cartridges for printers, copiers and fax machines at both domestic and overseas sites. We describe a linear programming model for minimal-cost procurement, remanufacture, and distribution of cartridges. Due to the multi-period, multi-echelon nature of the problem, our initial model was unsolvable in a reasonable amount of time. We describe enhancements to Excel (mostly using VBA) that resulted in a very useful, easily-solved model.

3 - Live Decision Analysis Enables a Changed Focus
Jeffrey Keisler, Assistant Professor, University of Massachusetts Boston, College of Management, Boston, MA, 02125, United States, Jeff.Keisler@umb.edu

By using lookup functions, ranking functions, data tables, and graphs we create spreadsheets that produce decision analysis artifacts instantly. By having hot probability distributions, tornado diagrams, tree-flipping, and value of information calculations, we can focus on our attention on second order decisions that sculpt distributions advantageously."

■ TD22

P-Room 3312

Simulation-Based Planning

Sponsor: Military Applications
Sponsored Session

Chair: Andy Armacost, Associate Professor, US Air Force Academy, 2354 Fairchild Drive, 6J100, Colorado Springs, CO, 80840, United States, andy.armacost@usafa.af.mil

1 - Results from Simulation-Based Planning of Theatre Air Warfare
Doug Popken, Systems View, 9139 Roadrunner St., Highlands Ranch, CO, 80129-5758, United States, dpopken@systemsview.com, Louis Anthony Cox, Jr

We describe a hierarchical framework for air warfare planning in which we focus on allocation of forces to roles and subsequent assignment of aircraft to targets. To determine optimal strategies, we use an innovative combination of heuristics, simulation-optimization, and mathematical programming. Initial results demonstrate the ability to generate optimal allocations when enemy force compositions are uncertain.

2 - Simulation V&V with Bioequivalence Testing
Ralph Boedigheimer, Associate Professor, US Air Force Academy, 2354 Fairchild Drive, Suite 6D2A, USAF Academy, CO, 80840, United States, Ralph.Boedigheimer@usafa.af.mil, Bradley Warner, Jeffrey Grobman

The V&V problem for OT&E demands proof of equivalence between the simulated and observed results. Unfortunately, traditional methods seek to demonstrate a statistical difference, while failing to reject a difference does nothing to establish equivalence. Medical researchers use bioequivalence testing to check equality between competing treatments. We discuss the applicability of the bioequivalence testing method to validate simulation results and demonstrate the concepts with an example.

■ TD23

P-Room 3354

Service Academy Projects: Summer and Capstone Experiences

Sponsor: Military Applications
Sponsored Session

Chair: Jim Lowe, United States, jim.lowe@usafa.af.mil

1 - Cargo Support During Operations Iraqi Freedom & Enduring Freedom
Sarah Gray, USAF Academy, 2354 Fairchild Drive, Suite 6H242, USAFA, CO, 80840, United States, C05Sarah.Gray@usafa.af.mil

An analysis of cargo movements during Operations Iraqi Freedom and Operations Enduring Freedom, specifically looking the C-130J versus the C27J.

2 - Agent-based Simulation Illustration: AirRecon & Surface-to-Air Defensive Assets
Brian LeMay, USAir Force Academy, 2354 Fairchild Drive, Suite 6H242, USAFA, CO, 80840, United States, C05Brian.Lemay@usafa.af.mil

Developed an agent-based simulation that incorporated both strike and reconnaissance aircraft and surface-to-air defensive assets. This technology is demonstrated using a novel scenario involving the Minnesota Vikings and the Green Bay Packers

3 - Defining Future Rescue Helicopter Requirements: A Survey Experience
Joe Thomer, US Air Force Academy, 2354 Fairchild Drive, Suite 6H242, USAFA, CO, 80840, United States, C05Joseph.Thomer@usafa.af.mil

My goal was to develop future requirements for the next generation rescue helicopter based upon operator inputs. Developing an interview and survey methodology was a new experience which presented many challenges unrelated to data analysis.

4 - Truth Sources for Weaponry Acceptable Launch Regions for the F-16
John Miller, US Air Force Academy, 2354 Fairchild Drive, Suite 6H242, USAFA, CO, 80840, United States, C05John.Miller@usafa.af.mil

Compare different truth sources for the Launch Acceptable Region for the F-16 block 30. Using a design of experiment method, I compared the Air Force mission support 3 degrees of freedom and 6 degrees of freedom models along with the F-16 flight simulator.

5 - West Point System Engineering Capstone Experience 04/05
Steve Henderson, Captain, USMA, United States, Steven.henderson@usma.edu

Two groups of US Military Academy Systems Engineering cadets will present an Overview of their capstone experience. They will summarize the overall process, and then discuss their specific project. Project Overview, Needs Analysis, Problem Identification, and Alternatives Analyses will be discussed.

■ TD24

P-Room 3402

Use of Technology in OR Education

Cluster: Undergraduate OR Education
Invited Session

Chair: Jill Hardin, Virginia Commonwealth University, 1001 W. Main St., P.O. Box 843083, Richmond, VA, 23284-3083, United States, jrhardin@vcu.edu

1 - Teaching Integer Programming Formulations via the Traveling Salesman Problem
Gabor Pataki, Department of Statistics and OR, University of North Carolina, Chapel Hill, NC 27599, www.or.unc.edu/~pataki, Chapel Hill, NC, United States, pataki@email.unc.edu

Convincing an undergraduate student of the value of strong IP formulations is no small task, since for many simple models (like facility location) a weak formulation is just as good: the IP solver will automatically strengthen it anyway. We show however that the TSP is suitable for this task. We use a strong, but exponential size formulation to gradually strengthen a weaker but compact one: thus students can solve realistic TSPs using only a few lines of code.

2 - Experiences with the IDEAS Teaching Software at the University of North Carolina
Scott Provan, Professor, University North Carolina, Dept of Stat and OR, Chapel Hill, NC, 27599, United States, Scott_Provan@UNC.edu

The IDEAS database is a MATLAB-based collection of easy-to-use teaching software modules that help the student analyze and solve a large number of basic operations-research related models. The software is designed to be accessible at a relatively elementary level, and contains submodules that help the student understand both the dynamics of the model and the the behavior of solution techniques. We will review its use and effectiveness in the teaching of operations research courses at UNC.

3 - Using Online Multimedia Tutorials to Teach Software in an Introductory Undergraduate Modeling Course
Jill Hardin, Virginia Commonwealth University, 1001 W. Main St., P.O. Box 843083, Richmond, VA, 23284-3083, United States, jrhardin@vcu.edu, Aimee Ellington

Multimedia tutorials were used to introduce basic software functions to students in an introductory modeling course. These tutorials reduced the amount of class time spent addressing software deficiencies and allowed more class time to focusing on modeling concepts. We discuss the motivation for developing these tools and discuss their design. We also provide a quantitative assessment of their value and offer student reactions and anecdotal evidence of their usefulness.

■ TD25

P-Room 3404

Evaluating Innovations in Teaching OR

Sponsor: Education (INFORM-ED) SPONSORED/INVITED
Sponsored Session

Chair: Thomas Willemain, Professor, Rensselaer Polytechnic Institute, Decision Sciences & Engineering Systems, CII 5015, Troy, NY, 12180-3590, United States, willet@rpi.edu

1 - Teaching LInear Program Formulation with a "Translation" Approach
Scott Stevens, Associate Professor, James Madison Universiy, Info Tech & Mgt Science Program, MSC 0202, Harrisonburg, VA, 22807, United States, stevensp@jmu.edu, Susan Palocsay

We describe a "translation" approach to teaching linear program formulation that breaks the process down into a series of small, well-defined steps. The underlying idea is to develop a representation of the problem in terms of measurable quantities that can then be translated, via application of an explicit rule, into the proper algebraic form and/or equivalent spreadsheet formulas. Preliminary data on its effectiveness for business students will also be presented.

2 - Utilizing Wireless Technology to Enhance the Teaching of Engineering Statistics
Jeffrey Arthur, Professor, Oregon State University, Dept. of Statistics, Corvallis, OR, 97331, United States, arthur@science.oregonstate.edu, Aimee Taylor

The introductory course in statistical methods for undergraduate engineers is often viewed by students as irrelevant. Partly to address this misconception, we have developed review modules that utilize enhanced classroom features such as wireless laptops. We discuss their design and implementation, student reactions in trial runs, and demonstrate their use.

3 - Novice Modelers: How Students Approach Unstructured Problems
Stephen Powell, Faculty, Dartmouth College, Tuck School of Business, Hanover, NH, 03755, United States, Stephen.G.Powell@Dartmouth.EDU, Thomas Willemain, Zeynep Aksehirli

We conducted a study of how novice modelers approach unstructured problems. Our aim was to compare the performance of novices and experts and use the comparison to guide our efforts to teach modeling skills. To do this, we analyzed think-aloud protocols from students working small modeling exercises: 6 MBA students who took a modeling course and 22 in a control group. This talk will describe the modeling exercises, the study design, and some preliminary results.

4 - Novice Modelers: Implications for Teaching
Thomas Willemain, Professor, Rensselaer Polytechnic Institute, Decision Sciences & Engineering Systems, CII 5015, Troy, NY, 12180-3590, United States, willet@rpi.edu, Stephen Powell, Zeynep Aksehirli

We consider the nature and content of the course, its role in the curriculum, and student reactions. We catalog the errors uncovered in student approaches to open ended modeling problems, illuminated by contrast with the behavior of experts. These errors include misplaced focus, number fixation, and reliance on magic wands instead of mathematics. We speculate on strategies for course design and delivery that might yield a higher level of initial competence.

■ TD26

P-Room 3412

Modeling Uncertainty and Reliability in Choice and Survey Data

Sponsor: Marketing
Sponsored Session

Chair: Ujwal Kayande, United States, ukayande@psu.edu

1 - Modeling The Variance of the Random Utility Component in Choice
Paul Burke, University of Technology, Sydney, Australia, Paul.Burke@uts.edu.au, Jordan Louviere, Chelsea Wise, Towhidul Islam

Many discrete choice datasets exhibit non-constant error variances. If error variances are not constant, there are serious confoundment issues, particularly for complex models like random coefficient (RC) models. We illustrate the issues and problems in a series of choice experiments. We also suggest a Scale Decomposition (SD) Model and apply it to empirical examples. Results suggest that there are serious issues associated with the use of RC models that the SD model can detect and resolve.

2 - Learning and Fatigue in Repeated Choice Experiments: Internet vs. Mail Surveys
Donald Waldman, Professor, University of Colorado, United States, Waldman@colorado.edu, Scott Savage

This study focuses on how mail and online survey modes affect the quality of data generated from repeated choice experiments. New econometric methods that account for error variance differences are developed to estimate the parameters of random utility models. Results indicate that while the online survey provides benefits in terms of lower administration costs, such benefits come at the cost of respondent fatigue and/or boredom, and greater variance in the unexplained component of utility.

3 - Generalizability in Marketing Theory Testing
Adam Finn, United States, adam.finn@ualberta.ca

Marketing theories account for relationships between constructs for elements within a universe of conditions. Theory tests only generalize to their sampled universe. Marketing research often uses a fixed product condition while sampling other conditions, such as customers of the fixed product. Such research can only be assumed to generalize to other customers of the product. We illustrate by testing the generalizability of the Oliver, Rust and Varki (1997) foundations of customer delight.

4 - Understanding the Drivers of Firm Performance Variability
Ujwal Kayande, United States, ukayande@psu.edu

While most research in marketing and business strategy focuses on the drivers of mean firm performance, we argue that it is also important to recognize the drivers of variability in firm performance. We applied a variance-function model to 15 years of data on the reputation and financial performance of about 500 firms. Results indicate that a firm's good reputation helps it to not only improve its future financial performance, but also manage the potential variability of that performance.

■ TD27

P-Room 3454

Applications in Finance and Economics

Sponsor: Applied Probability
Sponsored Session

Chair: Jussi Keppo, Assistant Professor, University of Michigan, IOE Department, 1205 Beal Avenue, Ann Arbor, MI, 48109, United States, keppo@umich.edu

1 - A Coherent Approach to Operational and Financial Hedging
Martin Haugh, Assistant Professor of IE&OR, Columbia University, 308 S.W. Mudd Building, 500 West 120th Street, New York, NY, 10027, United States, mh2078@columbia.edu, Rene Caldentey

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 - Analysis of Slow and Fast Transition in Self-Fulfilling Prophecy via Birth-Death Processes
Nan Chen, Columbia University, 331 Mudd Building, IEOR Dept., Columbia University, New York, NY, 10027, United States, nc2005@columbia.edu, Steven Kou

In the case of self-fulfilling prophecy, a system can have a fast transition from one state to another closely related state, which has been well studied and has a great impact in sociology and finance (e.g. the financial market crashes). In this paper, we show that the system may also have a slow transition to an totally opposite state. The analysis is based on a model using birth-death processes.

3 - Does Market Risk Capital Requirement Affect Bank Behavior?
Leonard Kofman, Ph.D Candidate, Industrial and Operations Engineering - University of Michigan, 1205 Beal Ave, Ann Arbor, MI, 48105, United States, lkofman@umich.edu

The Basel Accord sets minimum capital requirements on both credit and market risk. In this paper we analyze the effect of market risk on banks' behavior. We find that the main effect of the market risk requirement is to curtail excessive investment when banks are doing well and there is almost zero effect on companies that are close to bankruptcy. Therefore, the market risk requirement has only a small effect on banks' default probabilities and in this sense the requirement is inefficient.

4 - Employment Protection and Labour Market Demand
Tim Maull, University of Michigan, United States, timmaull@umich.edu, Jussi Keppo, Samu Peura

We analyze how hiring and firing costs as well as firing delays affect the labour market demand. We solve companies' optimal hiring and firing policies by using stochastic control. Then we study the effect of the costs and delay by using estimated model parameters for different OECD countries.

■ TD28

P-Room 3504

Distributed Sensing III

Sponsors: Quality, Statistics and Reliability, Military Applications
Sponsored Session

Chair: Yu Ding, Assistant Professor, Texas A&M University, Dept of Industrial Engineering, College Station, TX, 77843-3131, United States, YuDing@iemail.tamu.edu

Co-Chair: Daniel W. Apley, Professor, Northwestern University, Dept. of Industrial Engineering, 2145 Sheridan Rd., Evanston, IL, 60208-3119, United States, apley@northwestern.edu

1 - Classificable Populations Issues for Automated Inspection
Rene Villalobos, Associate Professor, Arizona State University, Dept. of Industrial Engineering, PO Box 875906, Tempe, AZ, 85287-5906, United States, rene.villalobos@asu.edu, Hugo Garcia

As part of the development of automated visual inspection algorithms it is necessary to determine if a set of discriminatory variables render an acceptable separation between two targeted populations. This process can be an expensive and time-consuming exercise. In this presentation we describe a methodology that gives a quick evaluation of whether the level of discrimination of a given set of variables is adequate. We will use examples from the electronics assembly inspection industry.

2 - Nonlinear Blind Source Separation for Diagnosing Multiple Manufacturing Variation Patterns
Feng Zhang, Texas A&M University, College Station, TX, 77843, United States, zhangfeng@neo.tamu.edu, Daniel W. Apley

We present a nonlinear blind source separation approach for identifying complex variation patterns in multivariate manufacturing processes. Using no prior knowledge of the nature of the variation patterns, the method is capable of separating the effects of multiple variation sources mixed together in the data. In conjunction with visualization techniques, the approach provides an effective tool for diagnosing root causes of process variability.

3 - Optimal Automatic Control Incorporating Sensor Data of Multi-Stage Manufacturing Processes
Myong-Kee Jeong, Assistant Professor, University of Tennessee-Knoxville, 311 East Stadium Hall, Knoxville, TN, United States, mjeong@utk.edu, Jye-Chyi Lu

The advancement of distributed sensing techniques provides opportunities for on-line automatic control of multi-stage manufacturing systems. We present a framework of developing multi-stage automatic control schemes incorporating sensor data collected at several process stages. The proposed method is applied to the photolithography process for improving semiconductor manufacturing quality.

4 - Fault Region Localization using Distributed data from Design, Manufacturing and Field
Kamal Mannar, University of Wisconsin - Madison, Madison, WI, 53706-1572, United States, kmannar@wisc.edu, Darek Ceglarek

This paper proposes a new Fault Region Localization (FRL) methodology integrating information from warranty with process measurements from manufacturing for identifying root causes of the warranty failures. The mapping of warranty failures to manufacturing/design parameters in FRL is a supervised learning approach using a Generalized Rough Set methodology which allows better incorporation of the noise in the system, easy interpretation of results and is more robust.

■ TD29

P-Room 3502

Technology-enabled Outsourcing: Opportunities and Challenges

Sponsor: E-Business
Sponsored Session

Chair: Arvind Rangaswamy, Jonas H. Anchel Professor, Penn State University, 707D, BAB, The Smeal College of Business, University Park, PA, 16801, United States, arvindr@psu.edu

1 - Best Practices in E-government Outsourcing
Alina Chircu, UTexas Austin, CBA 5.202 B6500, austin, United States, Alina.Chircu@mccombs.utexas.edu

As the U.S. public sector organizations jump on the IT outsourcing bandwagon, many of them now provide electronic government, or e-government, services through a variety of outsourcing agreements with private organizations. This research identifies best practices in e-government outsourcing, provide insights on the costs, benefits and risks of e-government outsourcing, and offer examples of possible ways of structuring outsourcing agreements based on international best practices.

2 - An MIP Examination of an Underappreciated Motivation for IT Outsourcing in an e-goods Company
Tim Anderson, Engineering & Technology Management Dept., Portland State University, PO Box 751, Portland, OR, 97207-0751, United States, tima@etm.pdx.edu, Asser Fayed, Dave Fenwick

The underlying reason for outsourcing has often been assumed to be cheaper labor offshore as compared to labor flexibility. This paper quantitatively tests a software company's motivation to secure a flexible labor pool. An ILP optimization model is used to evaluate an outsourcing decision by including labor flexibility, integrating labor efficiency, cost and learning curve.

3 - Outsourcing of Manufacturing Resources: An Empirical Study
John Gray, Ph.D Student, University of North Carolina at Chapel Hill—Kenan-Flagler Business School, CB 3490 McColl Building, Chapel Hill, NC, 27599, United States, John_Gray@unc.edu, Aleda Roth

Outsourcing decisions are important and complex. We use a large database of global manufacturers to study the firm and market characteristics that relate to plans to outsource. The study provides insights about the key antecedents of outsourcing in practice.

■ TD30

P-Room 3512

Process Variability Modeling and Optimization

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: Kwang-Jae Kim, Associate Professor, Department of Industrial Engineering, Pohang Univ of Science and Technology, San 31, Hyoja-Dong, Nam-Gu, Pohang, Ky, 790-784, South Korea, kjk@postech.ac.kr

1 - A Quartic Loss Function and its Properties
Yahya Fathi, Department of Industrial Engineering, North Carolina State University, Raleigh, NC, 27695, United States, fathi@eos.ncsu.edu, Chanwut Poonthanomso

We propose a quartic function to represent a family of continuous quality loss functions and examine its application in the parameter design problem. Depending on the choice of its parameters this family covers a range of shapes from the conventional step function to the ubiquitous quadratic loss function.

2 - Determining the Relative Weights of Bias and Variance in Dual Response Surface Optimization
In-Jun Jeong, Doctoral Student, Department of Industrial Engineering, Pohang University of Science and Technology, San 31, Hyoja-Dong, Nam-Gu, Pohang, Ky, 790-784, South Korea, mrking@postech.ac.kr, Kwang-Jae Kim, Soo Chang, Dennis Lin

Mean squared error (MSE) is an effective criterion to combine the mean and the standard deviation responses in dual response surface optimization. The bias and variance components of MSE need to be weighted properly in the given problem situation. This paper proposes a systematic method to determine the relative weights of bias and variance in accordance with a decision maker's prior and posterior preference structure.

3 - Variability Analysis in QFD: Prioritizing Engineering Characteristics
Dae-Kee Min, Doctoral Student, Department of Industrial Engineering, Pohang Univ of Science and Technology, San 31, Hyoja-Dong, Nam-Gu, Pohang, Ky, 790-784, South Korea, pupamin@postech.ac.kr, Kwang-Jae Kim

This paper proposes a new framework for variability analysis in QFD. The proposed framework considers the uncertainty of the information contained in the house of quality chart and analyzes the variability resulting in the outcome. A new scenario for prioritizing engineering characteristics is presented and illustrated using a case example.

4 - SELC : Sequential Elimination of Level Combinations by Means of Modified Genetic Algorithms

Abhyuday Mandal, Industrial and Systems Engineering, Georgia Institute of Technology, 765 Ferst Drive NW, Atlanta, GA, 30332, United States, amandal@isye.gatech.edu, Kjell Johnson, C. F. Jeff Wu

To search for an optimal design in a large search space, Wu, Mao, Ma (1990) suggested the SEL-method. Genetic algorithms (GA) can be used to improve upon this method. New ideas of forbidden array and weighted mutation are introduced. Relaxing the condition of orthogonality, GA is able to accommodate a variety of design points and enhances the chance of getting the best setting in fewer runs, particularly in the presence of interactions.

■ TD31

P-Room 3545

Contemporary Issues in IS Research

Sponsor: Information Systems
Sponsored Session

Chair: Judy Scott, Assistant Professor, University of Colorado at Denver, Business School, Denver, CO, United States, judy.scott@cudenver.edu

1 - Business Process Outsourcing — An Organizational Boon or Bust?

Biswadip Ghosh, University of Colorado at Denver, Business School, Denver, CO, 80217, United States, bish@avaya.com, Judy Scott

This research studies the impacts of Business Process Outsourcing (BPO) using Coordination Theory. The study evaluates the success of candidate processes suitable for a BPO by measuring four dimensions—adaptability, vulnerability, coordination and production. The study finds that processes or functions that are more mechanistic and centralized will fare better when outsourced. Organismic and decentralized functions become more vulnerable to missing market changes after a BPO.

2 - User Ownership in ERP Projects

Jim Maginnis, University of Colorado, 9865 S. Wyecliff Dr, HR, CO, 80126, United States, jmmaginnis@earthlink.net

Shortcomings with Enterprise Resource Planning (ERP) projects can often be attributed to problems with the users. Frequently, management attitude is: "Nothing is impossible for the person that doesn't have to do it." Management forgets they are not the ones to adapt the most to changes imposed by a new ERP system. Rather employees typically pay this price. In this study, we suggest that many failures could be avoided if the user was at least part owner of the project.

3 - Influencing Consideration Sets: A Defensive Marketing Strategy for the Web

Joseph Hasley, CU Denver, CU Denver, Denver, CO, United States, jhasley@hotmail.com

This paper explores the ability of a web site to dictate a customer's product consideration set and limit the breadth and depth of their investigation into information about value options offered by competitors.

4 - Surface Credibility and Theory of Social Response

Ashwin Pingali, 9081 S. Yosemite St. #1505, Lonetree, CO, 80124, United States, ashwinp@lmcus.com

The Theory of Social response posits that there is a psychological relationship that is formed between individuals and computers (or software). The creation of these psychological relationships might lend way to a better explanation of website surface credibility that is related to the credibility of the information given on the website. Our research is an exploratory experimental design to understand surface credibility and its relationship to the psychological relationships with the website.

■ TD32

T-Vail (Majestic Level)

Personnel Planning And Analysis

Cluster: OR Practice
Invited Session

Chair: Keith Womer, Dean, College of Business Administration, University of Missouri— St. Louis, One University Boulevard, St. Louis, MO, 63121-4400, United States, womerk@UMSL.edu

1 - Simulation of Multi-attribute Auction for Navy's Personnel Assignment and Distribution System

Yuting Cheng, United States, ycheng@bus.olemiss.edu, Keith Womer

Navy's personnel assignment and distribution problem typically involves the matching of people to jobs according to many complex, frequently changing rules and regulations. We propose multi-attribute reverse auction as an approach to solve the problem. We will run simulations with different bidding considerations and evaluate auction parameters. Based on the simulation results, we will evaluate the performances of different auction designs according to well defined measures of effectiveness.

2 - Guided Design Search in the Interval-Bounded Sailor Assignment Problem

Mark Lewis, University of Mississippi, Rm 221 Holman Hall, University, MS, United States, mlewis@bus.olemiss.edu, Karen Lewis, Barbara White

The problem of assigning Navy sailors to jobs is performed by enlisted detailers with some decision systems support. We offer an expanded network model with interval bounding variables modeling training courses creating teams of skilled sailors. Guided Design Search is integrated with CPLEX for a >10x speed increase and much better solutions. We show how GDS can be used by detailers to rank alternative decisions, quantify bonuses, and validate objective function coefficients.

3 - A Quantitative Evaluation of Savings from Cross Training in Workforce Scheduling

Yongyue Li, Ph.D Candidate, University of Alberta, 3-40F Business Building, Edmonton, AB, T6G2R6, Canada, yongyue@ualberta.ca

Managers usually believe that cross training reduces staffing costs since employees can serve multiple queues at the same time. The savings however were never quantitatively evaluated. Because of the cost of training and high wages for the multi-tasked employees, finding out the range of such savings is important. In this paper, the savings from cross training with various arrival patterns of multiple tasks are evaluated. The proper proportion of the cross-trained employees is suggested.

4 - A Hybrid MILP/CP Approach for Project Scheduling with Skilled Labor

Haitao Li, University of Mississippi, Hearin Center for Enterprise Science, School of Business Administration, Oxford, MS, 38677, United States, hli@bus.olemiss.edu, Keith Womer

Technical advancement and improved personnel training often makes it possible to save personnel cost to conduct a project. We present a hybrid MILP/CP model and algorithm to tackle this assignment type project scheduling problem which could be difficult for either technique to solve alone.

■ TD33

T-Savoy (Majestic Level)

Strategic OR: An Update on Some Edelman Prize Finalists

Sponsor: CPMS, The Practice Section of INFORMS
Sponsored Session

Chair: Peter Bell, Professor, Ivey School of Business, University of Western Ontario, London, N6A 3K7, Canada, pbell@ivey.uwo.ca

1 - Strategic OR

Peter Bell, Professor, Ivey School of Business, University of Western Ontario, London, N6A 3K7, Canada, pbell@ivey.uwo.ca

This presentation will briefly review our research findings on strategic OR, and will introduce the speakers in this session.

2 - Rising Tide - Creating 10 Years of Increasing Value Through OR at Procter & Gamble

Glenn Wegryn, Associate Director, Global Analytics, The Procter & Gamble Company, 2 Procter & Gamble Plaza, TN-05, MS 30, Box #2, Cincinnati, OH, 45202, United States, wegryn.gw@pg.com

Since being a Finalist in the 1996 Edelman Competition, Procter & Gamble's Global Analytics organization has delivered modeling and analysis techniques leading to the realization of in excess of $3 Billion of NPV, with additional cost savings estimated at well over $400 million for the Company. This session will highlight the history of the group, the principles and strategies used to grow to a 17-member, highly sought out analysis group within P&G, and the future opportunities for OR at P&G.

3 - Continuous Improvement in Semiconductor Supply Chain Optimization at IBM Systems & Technology Group

Brian Denton, Senior Engineer, IBM, 1000 River Road, Bld. 958A, Essex Junction, VT, 05452, United States, bdenton@us.ibm.com

IBM was an Edelman Award Finalist in 2000 for the application of its supply chain optimization software to its semiconductor manufacturing division. The software is still a key to strategic supply chain management, and retains its linear programming and heuristic heritage. Since 2000 it has been re-architected and extended to support many new O.R. enhancements. This talk describes this evolution and the increasing usage of O.R. in planning of IBM's semiconductor operations.

■ TD34

T-Columbine (Majestic Level)

Behavioral Operations

Sponsor: Manufacturing and Service Operations Management
Sponsored Session

Chair: Kenneth Schultz, Assistant Visiting Professor, Cornell University, 3312 E. Mulberry Drive, Bloomington, IN, 47401, United States, keschult@indiana.edu

1 - Order Stability in Supply Chain: Coordination Risk and the Role of Coordination Stock
Karen Donohue, Associate Professor, Carlson School of Management, University of Minnesota, Minneapolis, MN, 55455-9940, United States, KDonohue@csom.umn.edu, Rachel Croson, Elena Katok, John Sterman

We examine the bullwhip effect in a simple serial supply chain with known and constant demand. We find that "coordination risk", namely a failure of common knowledge and trust among supply chain members, significantly impacts the magnitude of the effect from a behavioral point of view. Since eliminating coordination risk is impractical in most settings, we test the effectiveness of two mechanisms for reducing it: (1) adding excess inventory to the system and (2) creating common knowledge.

2 - Process and Outcome Measurement in Performance Based Logistics
Kenneth Doerr, Associate Professor, Naval Postgraduate School, 555 Dyer Road, Monterey, CA, United States, khdoerr@nps.navy.mil, Don Eaton, Ira Lewis

Performance Based Logistics (PBL) is a tool the DoD uses when outsourcing logistical support. Under PBL the program manager should specify outcomes desired rather than the process of obtaining outcomes. In giving up process specification, managers may not give up process measurement. In some cases, PBL is associated with a superabundance of metrics, including process measures. We report on an experiment to assess whether outcome measurement may be obscured by process measurement.

3 - Aligning Customization Strategies and Product Types In Electronic Business-to-Consumer Commerce
Kingshuk Sinha, Professor, University of Minnesota, 3-150, OMS, 321 19th Ave S, Minneapolis, MN, 55455, United States, KSinha@csom.umn.edu, Sriram Thirumalai

This study examines the effectiveness of three customization strategies (service, experience, & product customization respectively) across three product types (convenience, shopping, & specialty goods). It involves an experimental approach where respondents are introduced to purchase scenarios of products belonging to different product types and surveyed on the value for the three customization strategies under each scenario. Implications of the results for both theory & practice are identified.

4 - Resonant Dissonance: Sources of Lagged Operational Variance following Large-Scale Centralized System
Elliot Bendoly, Assistent Professor, Emory, 1300 Clifton, Atlanta, GA, United States, elliot_bendoly@bus.emory.edu, Mark Cotteleer

This study focuses on performance dynamics resulting from perceived system misalignments with operational processes. Case studies and controlled experiments are used to support the theoretical concept of "resonant dissonance" and the time-lagged performance deviations it implies. Findings confirm a strong intention of managers to circumvent systems given task-technology mismatches. Ease of circumvention factors significantly into the timeframe within which it is attempted.

■ TD36

T-Capitol (Terrace Level)

Workforce Scheduling and Flexibility

Cluster: Workforce Flexibility & Agility
Invited Session

Chair: Bryan Norman, University of Pittsburgh, 1048 Benedum Hall, Pittsburgh, PA, United States, banorman@engr.pitt.edu

Co-Chair: David Nembhard, Associate Professor, Penn State University, 310 Leonhard Bldg., Dept. of Industrial Eng., University Park, PA, 16802, United States, dnembhard@psu.edu

1 - Preference Based Search Approach for Scheduling Workers with Learning and Forgetting
Bex Thomas, Graduate Student, University of Wisconsin-Madison, 1513 University Avenue, Room 381, Madison, WI, 53706, United States, bgthomas@wisc.edu, David Nembhard

The problem of scheduling and assigning workers sequentially in time to maximize production is formulated as a network problem whose structure allows for efficient computation. We consider Generalized Dynamic Programming (GDP) approach and Artificial Intelligence based algorithm, U* to solve this network flow problem and compare it with conventional Dynamic Programming (DP) approach.

2 - Multiproject Selection, Team Formation and Task Scheduling with Time-Sensitive Returns
Ronald Askin, Professor and Department Head, Arizona, Dept. of Systems and Industrial Eng., University of Arizona, Tucson, AZ, 85721, United States, ron@sie.arizona.edu, Jiaqiong Chen

We model the selection of a portfolio of projects and scheduling their tasks in a labor-constrained, time-critical environment. Project profit is a function of completion time. Project teams are allowed to evolve based on worker skills, behavioral traits, and task requirements. The model maximizes profit while maintaining team synergy.

3 - Worker Multifunctionality with Process and Operational Factors
David Nembhard, Associate Professor, Penn State University, 310 Leonhard Bldg., Dept. of Industrial Eng., University Park, PA, 16802, United States, dnembhard@psu.edu, Jihong Yan

We investigate the impacts of worker multi-functionality in a heterogeneous serial production system and in the presence of individual differences in experiential learning and forgetting. The tradeoffs of multi-functionality are examined in conjunction with several process characteristics and operational decisions such as staffing level, system bottleneck position, task similarity degree, and worker rotation interval.

■ TD37

T-Biltmore (Terrace Level)

Operations Research in the Mining Industry

Sponsor: Energy, Natural Resources and the Environment
Sponsored Session

Chair: Alexandra Newman, Assistant Professor, Colorado School of Mines, Division of Economics and Business, Golden, CO, 80401, United States, newman@mines.edu

1 - Long-term Production Scheduling Model Tractability for LKAB's Kiruna Mine
Mark Kuchta, Associate Professor, Colorado School of Mines, Mining Engineering Department, 1500 Illinois Street, Golden, CO, 80401, United States, mkuchta@mines.edu, Alexandra Newman

Very long-term production scheduling at LKAB's Kiruna Mine (Sweden) requires excessive computation time to solve a mixed integer program with thousands of variables and constraints. We discuss some variable reduction techniques and cut generation methods to expedite solution time.

2 - Short-term Production Scheduling at LKAB's Kiruna Mine
Kira Beth Jeffery, graduate student, Colorado School of Mines, Division of Economics and Business, Golden, CO, 80401, United States, kjeffery@mines.edu, Alexandra Newman, Mark Kuchta

LKAB's short-term (daily) mine production schedules are not simply abbreviated versions of long-term schedules, but are carefully tailored to specific operational details while maintaining consistency with the long-term plans. We formulate the short-term scheduling model, using MIP, and provide some guidance to enhance its tractability.

3 - Planning Production Operations at Aggregate Industries, Inc.
Peter McKenzie, plant manager, Aggregate Industries, 1707 Cole Blvd., Golden, CO, 80401, United States, peter.mckenzie@aggregate.com

Sand and gravel (aggregate) is extracted from an open pit site with front-end loaders and hauled to a feeder, which releases the aggregate onto a conveyor belt connected to a processing plant. We present a method for determining when the feeder should be moved closer to the current extraction location.

■ TD38

T-Beverly (Terrace Level)

OR in SpORts III

Sponsor: OR in SpORts
Sponsored Session

Chair: Andrew Schaefer, University of Pittsburgh, 1048 Benedum Hall, Pittsburgh, PA, 15261, United States, schaefer@ie.pitt.edu

1 - Competitive Season Pass Pricing in the Ski Industry
Eric Huggins, Assistant Professor of Management, Fort Lewis College, 1000 Rim Drive, Durango, 81301, United States, huggins_e@fortlewis.edu, Michael Fry

We examine the pricing of lift tickets in the ski industry. Skiers are typically offered a choice of purchasing a daily lift ticket or a season pass good for the entire year. We consider such pricing decisions in both monopolistic and competitive settings. We investigate the effect of risk preference, ski area quality, and stochastic snow conditions on optimal price settings.

2 - A Model for Ranking NCAA Basketball Teams
Joel Sokol, Assistant Professor, Georgia Institute of Technology, School of ISyE, Georgia Institute of Technology, Atlanta, GA, 30332-0205, United States, jsokol@isye.gatech.edu, Paul Kvam

We describe how to rank NCAA basketball teams using a Markov chain model overlaid with a logistic regression. The input data are simple, yet the model has compared favorably with NCAA tournament seeds, writers' and coaches' polls, and RPI over the past few years when predicting outcomes of NCAA tournament games. As a side effect, we also estimate the value of home-court advantage, and find that it is significantly different than the value used by standard systems like the Sagarin ratings.

3 - To Take (a pitch) or Not to Take
Eric Bickel, Assistant Professor, Department of Industrial Engineering, Texas A&M University, 236B Zachry Engineering Center, 3131 TAMU, College Station, TX, 77843-3131, United States, bickel@iemail.tamu.edu

We will examine the decision to take a pitch during a baseball game. For example, should the batter take a 3-0 pitch (and other counts)? Under what conditions is this a sound strategy? Using a Markov model and actual game data we determine in which counts a pitch should be taken and how much of an advantage is gained by doing so. The results confirm the common baseball practice of taking 3-0 but also suggest taking pitches in situations where batters tend to swing away.

■ TD39

T-Tower Court A (2nd Floor)

Supply Chain Management II

Cluster: Supply Chain Mgmt & Operations
Invited Session

Chair: Brian Tomlin, Assistant Professor, University of North Carolina at Chapel Hill, CB3490, McColl Building, Chapel Hill, NC, 27599, United States, brian_tomlin@unc.edu

1 - The Benefits of Re-evaluating Real Time Fulfillment Decisions
Stephen Graves, Professor, MIT Sloan School of Management, Cambridge, MA, 02142, United States, sgraves@mit.edu, Russell Allgor, Ping Josephine Xu

When a customer orders, an e-retailer assigns the order to one or more of its warehouses, to minimize its logistics costs, based on current information. This assignment is necessarily myopic as it cannot account for future orders or replenishments. We examine the benefits from periodically re-evaluating these order-assignment decisions. We construct heuristics to re-assign customer orders to minimize the number of shipments. We test the heuristics on order data from a major e-retailer.

2 - Optimal Inventory Placement in Acyclic Networks
Sean Willems, Shool of Management, Boston University, United States, willems@bu.edu, Salal Humair

We present an algorithm to optimize inventory levels and locations in acyclic networks. This work extends the framework in Graves and Willems (2000) which optimizes inventory placement in spanning tree networks.

3 - The Value of Postponement: Market Drivers and Input Commonality
Jiri Chod, visiting assistant professor, Boston College, Fulton Hall 350 D, Chestnut Hill, MA, United States, chodj@bc.edu, David Pyke, Nils Rudi

This article challenges the commonly accepted insight that the value of postponement is always increasing in demand variability and decreasing in demand correlation, by showing that both of these effects depend critically on the commonality structure of the whole product line. This is shown assuming (1) an arbitrary bill of material, (2) an arbitrary multivariate demand distribution, (3) price sensitive demands, and (4) the existence of a secondary market for inputs.

4 - Coping with Supply Chain Disruptions: Dual Sourcing, Volume Flexibility and Contingency Planning
Brian Tomlin, Assistant Professor, University of North Carolina at Chapel Hill, CB3490, McColl Building, Chapel Hill, NC, 27599, United States, brian_tomlin@unc.edu

We investigate the optimal mix of three strategies for coping with supply chain disruptions: inventory, supplier diversification, and the temporary leveraging of volume-flexibility at unaffected suppliers. In doing so, we consider both risk-neutral and risk-averse firm firms. We show that there is a high value to having suppliers with volume flexibility, but that the value is heavily dependent on the nature of disruptions and the speed with which the firm responds to a disruption. We also show that the level of supplier diversification is heavily influenced by volume flexibility (cost, speed and magnitude), the relative cost of suppliers, supplier reliability, supplier capacity, and the firm's risk tolerance.

■ TD40

T-Tower Court B (2nd Floor)

Behavioral Causes of Supply Chain Instability

Cluster: Supply Chain Mgmt & Operations
Invited Session

Chair: Paulo Goncalves, Assistant Professor, School of Business Administration, University of Miami, Kosar Epstein 404, Coral Gables, FL, 33124, United States, paulog@miami.edu

Co-Chair: Rogelio Oliva, Associate Professor, Mays Business School, Texas A&M University, 325M Wehner - 4217 TAMU, College Station, TX, 77843-4217, United States, roliva@tamu.edu

1 - System-wide Training and Communication, the Impact of Learning on Ordering Decisons in Supply Chains
Diana (Yan) Wu, Ph.D Candidate, Penn State University, 337 Beam Building, University Park, State College, PA, 16801, United States, yxw146@psu.edu, Elena Katok

This paper investigates the extent to which system-wide training and team communication help mitigate the "Bullwhip Effect", the observation that the variability of orders in supply chains increases as one moves upstream, using the popular Beer Distribution Game. We find that in the laboratory allowing participants to discuss team strategy prior to the game alleviates the bullwhip effect. System-wide training also helps stabilize the system, when combined with the opportunity to communicate.

2 - Behavioral Dynamics in Supply Chain Management
Noel Watson, Assistant Professor, Harvard Business School, Soldier's Field Road, Cambridge, MA, 02163, United States, nwatson@hbs.edu

Acting under the premise that SCM theory can be greatly enhanced by integrating behavioral assumptions concerning the individuals and groups involved in SC decision making and activities, we provide examples of the type of research that can be undertaken and questions that could be asked in the enhancement effort.

3 - Behavioral Causes of Demand Amplification in Supply Chains: "Satisficing" Policies with Limited Cues
Rogelio Oliva, Associate Professor, Mays Business School, Texas A&M University, 325M Wehner - 4217 TAMU, College Station, TX, 77843-4217, United States, roliva@tamu.edu, Paulo Goncalves

Whereas previous studies have focused on underestimation of the supply line as the main source of order amplification in the beer game, we articulate a complementary behavioral source of supply chain instability: overreaction in response to shortages. We find instead that players limit the amount of orders placed when in backlog and that they seem to adopt a decision rule that minimizes their local cost at the expense of creating higher costs for upstream players by amplifying the demand signal.

■ TD41

T-Tower Court C (2nd Floor)

Supply Chain Inventory Management II

Contributed Session

Chair: Jiang Zhang, Assistant Professor, School of Business, Adelphi University, 1 South Avenue, Garden City, NY, 11530, United States, Jiang.zhang@case.com

1 - An Inventory Model with Both Backorders and Lost Sales
Yanyi Xu, Ph.D candidate, Purdue University, 403 W. State Sreeet, W. Lafayette, IN, 47906, United States, xu21@mgmt.purdue.edu, Maqbool Dada

In this paper, we consider an inventory problem with both backorders and lost-sales: one retailer faces random demand (discrete) periodically, which is IID; there is a constant supply lead time; ordering cost is linear (no fixed set-up cost) also the holding, backlogging and shortage cost. Unlike traditional inventory model, we accept demand up to inventory position, not on-hand inventory level. Our goal is to find the optimal base stock policy.

2 - Inventory Management for a Three-tier Supply Chain: An Industrial Case Study
Qinli Zhang, HKUST, Department of IEEM, Clear Water Bay Road, Kowloon, HK, Hong Kong, qlzhang@ust.hk, Avaneesh Gupta, Vernon Zeng, Mitchell Tseng

We report a case study on improving inventory management in a three-tier supply chain with multiple production sites, multiple warehouses, and multiple distributors. Based on a novel heuristic and simulation, the SC configuration (location and number of warehouse, items to be centralized, replenishment policy) is determined satisfying the objective of minimizing the overall inventory and logistics costs.

3 - Fill Rate of General Review Supply System
Jiang Zhang, Assistant Professor, School of Business, Adelphi University, 1 South Avenue, Garden City, NY, 11530, United States, zhang@adelphi.edu, Matthew J. Sobel

This paper obtains fill rate formulas for general review inventory models with base-stock-level policies. Ordering decisions in a general review model are made every R (R>=1) periods but demand arises every period. We provide exact fill rate formulas for single-stage model with a general demand distribution. For multi-stage models, we discuss a general review procedure at each stage and provide exact fill rate formulas for multi-stage systems.

4 - The Study On the Performance of Supply Chain Management in Textile & Garment Industry
Sangmoo Shin, Visiting Scholar, University of California, Berkeley, Haas School of Business, Berkeley, CA, 94720, United States, smshin@ssu.ac.kr

The purpose of this study was to investigate how the SCM factors affect the performance of textile/apparel firms. We found that the performance was affected by information system (standardization, information sharing, infrastructure), business environment (CEOs' concern, the degree of assistance from government and textile/apparel federation), and partnership (strategic alliance, openness about corporate culture and information sharing, and credibility of partnership) in a descending order.

■ TD42

T-Tower Court D (2nd Floor)

Robust Optimization in Revenue Management

Sponsor: Revenue Management & Dynamic Pricing
Sponsored Session

Chair: Aurelie Thiele, Assistant Professor, Lehigh University, Dept of Industrial Engineering, Bethlehem, PA, 18015, United States, aurelie@mit.edu

1 - The Curse of Uncertainty in Dynamic Programming, and How to Fix it
Laurent El Ghaoui, United States, elghaoui@eecs.berkeley.edu, Arnab Nilim

Optimal Policies (OPs) of Dynamic Programming (DP) are very sensitive w.r.t. the Transition Matrices (TMs). In our proposed robust control formulation, we seek to compute the OPs where an adversary chooses the TMs from the specific uncertainty sets. We show that this problem can be solved by a variant of the classical DP recursion. Further, we show that a statistically accurate representation of uncertainty sets, derived via KL divergence, leads to calculating the OPs at no extra computing cost.

2 - Robust Models for Service Operations
Garud Iyengar, Columbia University, United States, garud@ieor.columbia.edu

In this talk we introduce simple robust models for service operations. In particular, we focus on the problem of robust routing and staffing of call centers where the arrival rate of the customers is uncertain. We will present extensions to models which allow the trade-off between fill rate and cost of capacity.

3 - Robust Network Revenue Management
Fernando Ordonez, Assistant Professor, University of Southern California, 3715 McClitock Ave, GER 247, Los Angeles, CA, 90089, United States, fordon@usc.edu, Rene Caldentey

We investigate the significance of robust optimization methodology to revenue management problems in a networked setting. We present the robust optimization problem, investigate the conditions of when it is a tractable problem, and present computational experiments that shed light on its applicability for networked systems, such as airline operations.

4 - Data-Driven Revenue Management
Aurelie Thiele, Assistant Professor, Lehigh University, Dept of Industrial Engineering, Bethlehem, PA, 18015, United States, aurelie@mit.edu, Dimitris Bertsimas

We propose an approach to revenue management that (a) works directly with data, i.e., combines historical data and optimization in a single framework, (b) leads to tractable algorithms and closed-form solutions, (c) incorporates risk aversion using a single scalar parameter, and (d) leads to strong empirical performance.

■ TD43

T-Denver (Mezzanine)

Managing New Product Portfolios

Cluster: New Product Development
Invited Session

Chair: Stylianos Kavadias, Assistant Professor, Georgia Institute of Technology, 800 West Peachtree, Atlanta, GA, 30332, United States, stylianos.kavadias@dupree.gatech.edu

1 - Product Portfolio Strategy and the Industry Lifecycle
Karthik Balasubramaniam, University of Pennsylvania, Suite 500 JMHH, 3730 Walnut St, Philadelphia, PA, 19104, United States, karthikb@seas.upenn.edu, Karl Ulrich, Taylor Randall

No abstract provided

2 - Strategic NPD Portfolio Management in Complex Environments
Raul Chao, Georgia Institute of Technology, 800 West Peachtree Street, Atlanta, GA, 30332, United States, raul.chao@mgt.gatech.edu, Stylianos Kavadias

We analyze how various NPD portfolio strategies succeed in complex environments. At the strategic level, managers exhibit bounded rationality and must search for the best outcome in a complex and unknown landscape. In our setting, search takes place through a mix of incremental and revolutionary projects in a portfolio. Our results indicate that optimal balance in the NPD portfolio is dependent on the "environmental complexity" and on the "industry lifecycle".

3 - Optimal Project Selection and Budget Allocation for R&D Portfolios
Leonardo Santiago, Boston University, Manufacturing Eng. Dept., 15 Saint Mary's Street, Brookline, MA, 02446, United States, leonardo@bu.edu, Pirooz Vakili

We introduce a novel formulation of the problem of project selection and budget allocation for R&D portfolios. A two-stage and interdependent optimization problem that links the R&D development stage with that of commercialization is considered and the solution methodology will be presented.

4 - Product Portfolio and Capacity Management
Kristin Fridgeirsdottir, Assistant Professor, London Business School, Regent Park, London, NW1 4SA, United States, kristin@london.edu, Ram Akella

We present a methodology for product portfolio management at a strategic level. We first determine the optimal portfolio of products characterized by potential profit, delay sensitivity and resource requirement. In addition, we determine the optimal capacity level. Our findings are based on several structural results, which should also be interesting in other settings.

■ TD44

T-Spruce (Mezzanine)

Algorithms and Computations in DEA

Cluster: Data Envelopment Analysis
Invited Session

Chair: Jose Dula, Associate Professor, University of Mississippi, School of Business Administration, Oxford, MS, 38677, United States, jdula@olemiss.edu

1 - Algorithms for Identifying Anchor Points in DEA.
Marie-Laure Bougnol, Assistant Professor, Western Michigan University, Haworth College of Business, Kalamazoo, MI, 49008, United States, ml.bougnol-potter@wmich.edu, Jose Dula

Anchor points are of special interest in DEA because they define the transition on the boundary of the production possibility set from the efficient frontier to its "free-disposability" portion. Their identification presents interesting theoretical and computational problems. We will present some ideas and report on a new algorithm that is effective at finding these special extreme-efficient DMUs.

2 - DEA Computations with Mangasarian's Newton LP Algorithm
Todd Shurn, Associate Professor, Howard University, School of Engineering, 2300 Sixth Street, NW, Washington, DC, 20059, United States, shurn@scs.howard.edu, Jose Dula

Mangasarian offers a new LP algorithm that is particularly well suited to problems with large aspect ratios. The procedure is based on a primal exterior penalty formulation with interesting interaction with its dual and peculiar properties. We test this procedure on DEA problems. DEA generates extreme aspect ratio LPs which are also fully dense. We report on our computational experience.

3 - Using Lexicographic Parametric Programming for Classifying Units in DEA
Pekka Korhonen, Dept. of Quantitative Methods in Economics and Management Science, Helsinki School of Economics, Runeberginkatu 22-24, 00100 Helsinki, Finland, Pekka.Korhonen@Hkkk.fi, Pyry-Antti Siitari

Using lexicographic parametric programming, we can effectively classify efficient and inefficient units in Data Envelopment Analysis (DEA). We may move from unit to unit by varying the rhs-vector of an envelopment problem. On the way from one unit to another, we recognize all units inefficient which are dominated by the efficient path. The lexicographic parametric approach is used to avoid to diagnose weakly efficient units efficient.

■ TD45

T-Gold (Mezzanine)

Manufacturing I

Contributed Session

Chair: Suresh Udayagiri, Student, Kansas State University, 363,N 14 th Street, Apt #7, Manhattan, KS, 66502, United States, rsuresh@ksu.edu

1 - An Efficient Approach to Group Technology Problem in a Flexible Manufacturing System

Haibo Wang, School of Business Administration, P.O,Box 1588, University of Mississippi, University, MS, 38677, United States, hwang@bus.olemiss.edu, Bahram Alidaee, Gary Kochenberger

This study proposes an efficient clique partitioning problem model and solution methodology to the group technology problem in a flexible manufacturing system with a unique weight formulation incorporating the production volume or material cost. Many existing models are represented by a binary machine/part matrix without production volume or material cost information. The preliminary results are reported.

2 - An Approach of Capability Representation for Improving Capacity Planning

Avaneesh Gupta, Ph.D Student, HKUST, Department of IEEM, Clear Water Bay Road, Kowloon, Hong Kong, avaneesh@ust.hk, Qinli Zhang, Vernon Zeng, Mitchell Tseng

We propose an approach of capability representation for improving capacity planning. The machines in the work system are distinguished based on critical capability drivers and its range. As a result, overlapping and non-overlapping capability regions can be identified and their inter-relationships with respect to capacity can then be applied for capacity planning. An example is presented to demonstrate the proposed approach and to compare it with traditional MRP planning.

3 - Analysis of Demand Uncertainty in Multi-Level Production Control

Berkin Toktas, Research Associate, University of Washington, Industrial Engineering Box 352650, Seattle, WA, 98195, United States, berkin@u.washington.edu, Zelda B. Zabinsky, Mark Spearman

In some multi-stage production systems (e.g., semiconductor), cycle times exceed demand forecast horizons. In these cases, in addition to the usual “what to start” and “what to expedite” decisions, we often must determine “what to scrap”. This combination of decisions is difficult and suffers from great uncertainty. We propose a stochastic programming formulation to address these decisions under demand uncertainty. We also present numerical results from a parametric analysis.

4 - Prediction of Drill-Bit Breakage from Degradation Signals using Mahalanobis-Taguchi System Analysis

Bharatendra Rai, Ph.D Student, Wayne State University, 37724 Willow Lane, T-16, Westland, MI, 48185, United States, bkrai@wayne.edu

Drilling is a widely used machining process. Replacing a drill-bit after it’s breakage can be costly in certain special applications. At the same time an early tool replacement decision may lead to lower tool life utilization. In this paper we study two degradation signals and provide a methodology for accurate prediction of drill-bit breakage.

5 - Value Stream Analysis in a Manufacturing Company

Suresh Udayagiri, Student, Kansas State University, 363,N 14 th Street, Apt #7, Manhattan, KS, 66502, United States, rsuresh@ksu.edu, ZJ Pei

The lean thinking consists of five principles about value, value stream, flow, pull and perfection. This paper deals with value stream, which is one of those five lean principles and explains about the application of the value stream analysis in a real world manufacturing industry.This paper explains about the project on value stream analysis in a manufacturing company.

■ TD46

T-Aspen (Mezzanine)

Natural Resources Management and Conservation

Cluster: Agricultural Economics

Invited Session

Chair: Hayri Onal, Associate Professor, University of Illinois, Dept. Agricultural and Consumer Economic, 305 Mumford Hall, MC-710, Urbana, IL, 61801, United States, h-onal@uiuc.edu

1 - Modeling Agricultural Production Considering Water Quality and Risk

Corbett Grainger, Graduate Student, University of Minnesota, Department of Applied Economics, 1994 Buford Avenue, St.Paul, MN, 55108, United States, grai0008@umn.edu, Jeffrey Apland, Jeffrey Strock

Environmental goals often conflict with agricultural producers’ economic goals. The Cottonwood River Watershed in Minnesota is heavily polluted with N, P, and sediment from agricultural sources; goals of profit maximization for producers conflict with those of effluent alleviation. We incorporate water quality goals and risk into a mathematical programming framework to examine economically efficient means of pollution abatement while considering a wide range of alternative production practices.

2 - Economics of Soil Carbon Sequestration Through Biomass Crops in Illinois

Basanta Dhungana, Graduate Student, University of Illinois at Urbana-Champaign, Department of Agricultural and Consumer, 305 Mumford Hall, Urbana, IL, 61801, United States, dhungana@uiuc.edu, Madhu Khanna, Michelle Wander, Hayri Onal

This paper explores the potential for biomass energy crops to sequester carbon in agricultural soils in Illinois. A finite horizon discrete-time linear programming model is used to determine the profit maximizing crop rotation and tillage practices at county-level and appropriate market based incentives, such as carbon credits, for switching to biomass energy crops so that the socially optimal land use can be achieved while meeting the state-level carbon sequestration goal.

3 - Optimum Retirement of Agricultural Lands in a River Basin to Improve Water Quality

Hayri Onal, Associate Professor, University of Illinois, Dept. Agricultural and Consumer Economic, 305 Mumford Hall, MC-710, Urbana, IL, 61801, United States, h-onal@uiuc.edu, Xiaolin Ren, Madhu Khanna, Deva Borah

The Conservation Reserve and Enhancement Program aims to reduce agricultural pollutant runoff in the Illinois River basin to improve water quality. Land retirement is the main program instrument. We use a large-scale linear programming model and a dynamic programming model to examine the optimum land retirement in twelve spatially integrated watersheds where the program target for pollution loading is met and the pollutant concentration is nearly uniform across different segments of the river.

■ TD47

T-Century (Mezzanine)

Software Demonstration

Cluster: Software Demonstrations

Invited Session

1 - Responsive Learning Technologies, Inc.- Web-Based Exercises for Operations and Modeling Courses

Sam Wood, Responsive Learning Technologies, Inc., 1072 S. DeAnza Blvd. #A107392, San Jose, CA, 95129, United States, wood@responsive.net

Littlefield Technologies, the Supply Chain Game, and the Venture Capital Game are competitive web-based simulations used in Operations Management, Supply Chain Management, and Modeling courses in more 30 universities. This demonstration of this software will include a description of existing assignments and pedagogy.

2 - Salford Systems- A Tour of Advanced Data Mining Products, Alternatives to Standard Statistical Modeling

Mikhail Golovnya, Salford Systems, 8880 Rio San Diego Dr., Ste. 1045, San Diego, CA, 92108, United States, info@salford-systems.com

Recent methodological developments using entirely new technology are showing enormous promise. Techniques recently developed by Stanford University Professor Jerome Friedman and Berkeley Professor Emeritus Leo Breiman will be discussed. TreeNet/MART and Random Forests methodologies will be presented and the application and results of real-world analyses will be shown.

Wednesday 8:00am-9:30am

■ WA01

P-Ballroom F

Tutorial: Issues and Possibilities in Contemporary Simulation

Cluster: Tutorials- Denver 2004
Invited Session

1 - Issues and Possibilities in Contemporary Simulation

David Kelton, Professor, CoB Research Fellow, and Acting Department Head, University of Cincinnati, Department of Quantitative Analysis and Operations Management, Cincinnati, OH, 45221-0130, United States, david.kelton@uc.edu

Simulation remains one of the most frequently used OR techniques, yet its application often falls short of its potential. This tutorial is for newcomers to the possibilities with modern simulation methods and tools. It will start by discussing the different approaches and tools for building simulation models, including current software options, with examples. Then, additional focus will be given to estimating and rendering randomness in simulation models, including generating random numbers, variates, and processes. Finally, the important but often-neglected topics of designing and analyzing simulation experiments will be discussed. Throughout, the value of these possibilities to simulation projects will be stressed. Some modest proposals for the future direction of simulation research and software will also be offered.

■ WA02

P-Ballroom E

OR and CS Applications

Contributed Session

Chair: Praveen Elakkumanan, State University of New York at Buffalo, Computer Sci and Engg Dept, 201 Bell Hall, Buffalo, NY, 14260, United States, pe2@cse.buffalo.edu

1 - An Integer Support Vector Machine

Peguy Pierre-Louis, Towson University, Department of Mathematics, 8000 York Rd, Towson, MD, 21252, United States, ppierr1@towson.edu, Mary Domm, Andrew Engel, Jeff Goldberg

The problem of binary classification is to predict which of two sets a given data point belongs. A class of binary classifiers is Support Vector Machines (SVMs). SVMs attempt to minimize the distance from a separating hyperplane of points classified in the incorrect set. Unfortunately, this distance isn't always meaningful. In order to account for this difficulty, we propose to use binary indicator error variables to directly minimize the number of potential errors this classifier makes.

2 - Resource Allocation for Large-Scale Computing Utility using Mathematical Programming

Cipriano Santos, Senior Scientist, HP Laboratories, 1501 Page Mill Road, Mail Stop 1140, Palo Alto, CA, 94304, United States, cipriano_santos@hp.com, Xiaoyun Zhu, Dirk Beyer, Sharad Singhal

We address a resource allocation problem for a large-scale computing utility, s uch as an enterprise data center. This problem is formulated as a mixed integer program. The MIP was numerically tested on a number of examples, ranging from a 125-server real data center to a set of hypothetical data centers with increasing size.

3 - A Game Theoretical Model of Intrusion Detection

Andrew Engel, Towson University, Department of Mathematics, 8000 York Rd, Towson, MD, 21252, United States, aengel@towson.edu, Mike O'Leary, Michael Jones, Ferenc Szidarovszky

Currently, the problem of detecting and responding to a computer network attack is of great interest. While the problem of detecting these network attacks has received a large amount of attention, the consideration of the appropriate response to an attack has been largely neglected. In this talk, a game theoretic model of the interaction between a network administrator and an attacker and the consequences of this model on the appropriate responses to a network attack will be presented.

4 - Minimum Sum-of-Squares Clustering

Yu Xia, McMaster University, Computing and Software, 1280 Main Street West, ITB-202, Hamilton, ON, L8S 4K1, Canada, xiay@optlab.mcmaster.ca, Jiming Peng

The minimum sum-of-squares clustering problem is shown to be a concave continuous program. Modifying Tuy's cutting plane method we are able to find its global minimum in a finite number of steps. Numerical examples confirm that this method can find a better solutin than that by the popular k-means algorithm.

5 - Dynamic MEXCLP based Load Balanced Clustering Algorithm for a Wireless Ad Hoc Network

Praveen Elakkumanan, State University of New York at Buffalo, Computer Sci and Engg Dept, 201 Bell Hall, Buffalo, NY, 14260, United States, pe2@cse.buffalo.edu, Karthik Thyagarajan, Sumita Mishra, Ramalingam Sridhar

Ad hoc networks (fully mobile networks) do not have a fixed network or topology. In this paper, we consider a wireless ad hoc network configuration and propose a dynamic MEXCLP formulation for clustering with provision for load balancing among nodes. A greedy heuristic solution is presented and compared with existing solution methodologies for solving the dynamic MEXCLP

■ WA03

P-Plaza Court 1

Analytic Hierarchy Process

Contributed Session

Chair: Haibo Wang, School of Business Administration, P.O,Box 1588, University of Mississippi, University, MS, 38677, United States, hwang@bus.olemiss.edu

1 - Prioritizing Measures and Policies of a Local Government in Administrative Reform

Yuji Sato, Professor, Graduate School of Policy Science, Matsusaka University, 1846 Kubo, Matsusaka, Mie, 515-8511, Japan, ysatoh@matsusaka-u.ac.jp

This study considers how to prioritize measures and policies of a local government in administrative reform. In the re-formation, devolving authorities from public sector to other sectors would be crucial issues through the consequences; smooth empowerment is achieved by rational prioritization. The prioritization was implemented by the characterizations of public and other sectors, and the evaluations of measures and policies of a local government, both of which were conducted using the AHP.

2 - Survey Respondent Satisfaction Index for the Statistics Quality for ICT in Korea

Taehee Moon, Ph.D. Candi., Yonsei University, Yonsei University, 134 Shinchon-dong, Seoul, South Korea, mthstat@yonsei.ac.kr, So Young Sohn, In Sang Chang

Upon rapid growth of ICT in Korea, the necessity of improved quality of official statistics in ICT is uprising. ICT statistics are basically collected based on the survey and the survey respondents would play very important roles on the quality improvement. We propose a structural equation model to find a relationship among various factors. Also survey respondent satisfaction index is obtained and it is used to provide the valuable feedback information to improve the statistics quality.

3 - Local Search Heuristic Algorithms for Complex Network

Haibo Wang, School of Business Administration, P.O.Box 1588, University of Mississippi, University, MS, 38677, United States, chwang@olemiss.edu, Bahram Alidaee, Gary Kochenberger

It is difficult to model and search complex network, which exists in many nature and human-made systems. We develop a new approach to model complex network and abstract knowledge from the complex network applications. Applications from biological system, social network and information technology are formulated into the new model, which can be solved by local search heuristic algorithms.

■ WA04

P-Plaza Court 2

Data Mining and Predictive Modeling for the Earth Sciences and Earth Systems Engineering

Sponsor: Data Mining
Sponsored Session

Chair: Auroop Ganguly, Visiting Research Faculty, University of South Florida, Mail Stop: ENB 118, 4202 East Fowler Avenue, Tampa, FL, 33620, United States, argangul@eng.usf.edu

1 - Complexity Analysis and Predictive Models for Hydrologic Systems

Shiraj Khan, Research Assistant, University of South Florida, 3725 Rocinante Blvd. Apt #167, Tampa, FL, 33613, United States, skhan4@eng.usf.edu, Auroop Ganguly, Sunil Saigal

Recent literature appears to indicate that hydrologic observations like rainfall or runoff may be chaotic, which in turn have implications for predictability and predictive modeling. Empirical demonstrations notwithstanding, the applicability of these studies have been questioned. These issues are investigated in detail, specifically the ability to detect chaotic signals in the presence of noise and seasonality, especially with limited time series data.

2 - Image to Intelligence Archive(I2IA): Content-based Information Retrieval from Massive Image Archives
Budhendra Bhaduri, Group Leader, Oak Ridge National Laboratory, PO Box 2008, MS 6017, Oak Ridge, TN, 379831, United States, bhaduribl@ornl.gov, Tom Potok, Ken Tobin

Geospatial images are valuable for situation awareness and assessment and are critical for detecting changes and enhancing decision support systems. However, there is a lack of comprehensive tools that allow fast and efficient processing of information from voluminous images coming from a variety of remote sensors. This research describes the development of a comprehensive image data management and analysis system utilizing intelligent software agent, geospatial modeling, and image analysis.

3 - What is Special about Mining Spatial Datasets?
Shashi Shekhar, Professor of Computer Science, University of Minnesota, 4-192, EE/CS Bldg., 200 Union St. SE, Minneapolis, MN, 55455, United States, shekhar@cs.umn.edu

The importance of spatial data mining is growing with the increasing incidence and importance of large geo-spatial datasets such as maps, repositories of remote-sensing images, and the decennial census. Classical data mining techniques often perform poorly when applied to spatial data sets because of the several reasons. This talk survey some of the new methods including those for discovering spatial co-locations, detecting spatial outliers and location prediction.

4 - Texture Feature Selection for Retrieval and Classification of Multi-Spectral Remote Sensed Imagery
Shawn Newsam, Postdoctoral researcher, Lawrence Livermore National Laboratory, 7000 East Ave. L-551, Livermore, CA, 94550, United States, newsam1@llnl.gov, Erick Cantu-Paz, Chandrika Kamath

Texture features have shown great promise for annotating large collections of remote sensed imagery. However, the number of such features that can be extracted from high-resolution multi-spectral imagery is often very large. Using several popular texture descriptors extracted from the different spectral bands, we show how feature selection can be used to reduce the number of features in problems such as similarity retrieval and classification.

■ WA05

P-Plaza Court 3

Nonlinear Optimization

Contributed Session

Chair: Joseph Geunes, University of Florida, 303 Weil Hall, Gainesville, FL, 32611, United States, geunes@ise.ufl.edu

1 - Defining and Optimizing Variables as a Function of Time: Applications to Decision-Making in Finance
Januj Juneja, Graduate Student, Seton Hall University, 11 Pinewood Lane, Warren, NJ, 07059, United States, junejaja@shu.edu

We observe that many variables in the business world achieve their optimal value within a finite range. As every variable is a function of time, we redefine this finite range as a function of time and understand when in time a particular magnitude, optimal or specified, of the variable will occur. Some applications using variables from business are provided.

2 - Optimality Conditions for Vector Optimization with Set-Valued Maps
Yongwei Huang, Department of Systems Engineering and Engineering Management, The Chinese University of Hong Kong, Shatin, N.T., Hong Kong, Hong Kong, ywhuang@se.cuhk.edu.hk

In this paper, we establish an alternative theorem under the assumption of nearly semiconvexlike set-valued maps in the context of linear topological spaces. The notion of weak E-efficient solutions for vector optimization is newly introduced. Based on the alternative theorem, we establish several necessary optimality conditions and sufficient optimality conditions for vector optimization problems with extended inequality constraints in the sense of weak E-minimizers.

3 - Designing a Server Form with Stochastic QoS Constraints Using Laplace-Stieltjes Transforms
Emmanuelle Wallach, Ph.D student, the Pennsylvania State University, Industrial Engineering Department, 310 Leonhard Building, University Park, PA, 16802, United States, ejw169@psu.edu, Natarajan Gautam

Consider the strategic problem of designing a minimum cost server form, composed of elements in series, to guarantee Quality of Service (QoS) to incoming requests. The total time a request spends in processing is limited. The speed of each element must be found. Laplace-Stieltjes transforms are used in the queueing analysis, resulting in non closed-form constraints. However, derivation properties of the transforms are useful in the development of the efficient solution algorithm presented here.

4 - Polynomial Convergence of Interior-Point Algorithms on Symmetric Cones
Bharath Rangarajan, Center for Operations Research and Econometrics, Universite Catholique de Louvain, United States, bharath@orie.cornell.edu

An interior-point algorithm for conic programs over symmetric cones derived from Jordan algebras is presented. This setting naturally generalises semidefinite programming. In the process, a Lyapunov-type lemma is established in this framework. The algorithms start at an initial point that is in the interior of the cone but not necessarily in the affine space. This work provides for the first time a polynomial complexity for semidefinite programming problem for the symmetric primal dual direction proposed by Nesterov and Todd.

5 - Solution Methods for a Class of Nonlinear, Non-Separable Knapsack Problems
Joseph Geunes, University of Florida, 303 Weil Hall, Gainesville, FL, 32611, United States, geunes@ise.ufl.edu, Edwin Romeijn, Kevin Taaffe

We consider a class of knapsack problems where the objective is a general differentiable function of a weighted sum of the decision variables. Special cases of this problem arise frequently in production and logistics planning contexts. For cases where the KKT optimality conditions are necessary, we provide an efficient solution for the continuous version of the problem. This solution can serve as a starting point for a branch-and-bound algorithm when the variable values must be binary.

■ WA06

P-Plaza Court 4

Advances in Commercial IP Solvers

Sponsor: Optimization/ Integer Programming
Sponsored Session

Chair: Eva Lee, Associate Professor & Director, Center for Operations Research in Medicine, Georgia Institute of Technology, Industrial & Systems Engineering, Atlanta, GA, 30332-0205, United States, evakylee@isye.gatech.edu

1 - Finding Good Integer Solutions
Mary Fenelon, ILOG, United States, mfenelon@ilog.com

CPLEX MIP has many heuristics for finding integer solutions. The most recent version of CPLEX includes the new Relaxation Induced Neighborhood Search (RINS) heuristic. This heuristic combines local search with MIP and is often able to find good solutions for difficult models. Our experience with RINS and other heuristics will be discussed.

2 - New IP Features in LINGO, WhatsBest, and LINDO API
Linus Schrage, LINDO Systems, N. Dayton, Chicago, IL, United States, linus.schrage@gsb.uchicago.edu

We describe recent enhancements in the integer programming capabilities of LINGO, WhatsBest, and the LINDO API callable library. The areas of interest are nonlinear and quadratic integer programming, global optimization, analyzing and exploiting problem structure, and improvements in the dual simplex updates as used in branch and bound.

3 - Recent Improvement in the Xpress-MP MIP Solver
Alkis Vazacopoulos, Dash Optimization, Inc, 560 Sylvan Avenue, Englewood Cliffs, NJ, 07632, United States, av@dashoptimization.com, Richard Laundy

This talk will discuss the recent improvements in the Xpress-MP MIP solver. We will discuss some of the techniques that have been used and present results showing the performance improvements that have been achieved.

■ WA07

P-Plaza Court 5

Advances in Interior-Point Methods

Sponsor: Optimization/Linear Programming and Complementarity
Sponsored Session

Chair: Jerome W. O'Neal, Georgia Institute of Technology, 765 Ferst Drive NW, School of Industrial and Systems Enginee, Atlanta, GA, 30332-0205, United States, joneal@isye.gatech.edu

1 - A Self-Regular Predictor-Corrector IPM
Tamas Terlaky, Professor, McMaster University, Department of Computing and Software, 1280 Main St. W. Hamilton, Hamilton, ON, L8S 4L7, Canada, terlaky@mcmaster.ca, Maziar Salahi

A new self-regular predictor-corrector IPM is designed. The two new features of our algorithm are: 1) The SR corrector direction allows to decrease the duality gap in the corrector step; 2) The predictor step is an SR-step when the affine scaling step does not allow sufficient reduction of the duality gap. An O(sqrt(n)log(n)L) complexity and superlinear convergence of the new large-neighborhood algorithm is proved.

2 - A New Conjugate Gradient Algorithm Incorporating Adaptive Ellipsoid Preconditioning

Jerome W. O'Neal, Georgia Institute of Technology, 765 Ferst Drive NW, School of Industrial and Systems Enginee, Atlanta, GA, 30332-0205, United States, joneal@isye.gatech.edu, Renato Monteiro, Arkadi Nemirovski

In this talk, we discuss an adaptive preconditioning procedure which improves the practical performance of the conjugate gradient algorithm on extremely ill-conditioned systems. After showing the theoretical convergence properties of our algorithm, we perform two types of computational results, showing its ability to solve systems of equations both as a stand-alone solver and as a subroutine in a linear programming interior-point method.

3 - On Solving the Arrow-Debreu Competitive Market Equilibrium

Yinyu Ye, Department of Management Science and Engineering, Stanford University, Stanford, CA, 94305, United States, yinyu-ye@stanford.edu

We present polynomial-time interior-point algorithms for solving the Fisher and Arrow-Debreu competitive market equilibrium problems with "n" players. The algorithm for solving the Fisher problem is a modified primal-dual path-following algorithm, and the one for solving the Arrow-Debreu problem is the so-called primal-based algorithm. Both of them have the arithmetic computation complexity bound that is in line with the best complexity bound for linear programming of the same dimension and size. We also present a continuous path leading to the set of the Arrow-Debreu equilibrium, similar to the central path developed for linear programming interior-point methods. This path is derived from the weighted logarithmic utility and barrier functions and the fixed point theorem. The defining equations are bilinear and possess some primal-dual structure for the application of Newton's path-following method.

■ WA08

P-Plaza Court 6

Networks & Graphs

Contributed Session

Chair: Usha Nandini Raghavan, Graduate Student, Pennsylvania State University, 310, Leonhard Bldg., University Park, PA, 16802, United States, nandu@psu.edu

1 - Recent Advances in the Augmenting Graph Technique

Vadim Lozin, Rutgers University, RUTCOR, 640 Bartholomew Rd., Piscataway, NJ, 08854-8003, United States, lozin@rutcor.rutgers.edu, Alain Hertz

The method of augmenting graphs is a general approach to solve the maximum independent set problem. It is in the heart of the famous solution of the maximum matching problem, which is equivalent to finding maximum independent sets in line graphs. Recently, the approach has been successfully applied to solve the problem in many other special classes of graphs. We report recent advances on this topic and propose some new contributions.

2 - A Specialized Network Simplex Algorithm for the Constrained Maximum Flow Problem

Cenk Caliskan, Assistant Professor, University of Delaware, Department of Business Administration, Newark, DE, 19716, United States, caliskanc@lerner.udel.edu

The constrained maximum flow problem is to send the maximum possible flow from a source node to a sink node in a directed network with arc capacities where a budget constraint limits the total flow. Each arc flow has an associated cost per unit of flow and total cost of the flow cannot exceed the budget. We present a specialized simplex algorithm for this problem and compare it computationally against other existing general and specialized algorithms.

3 - Minimum Spanning Trees in Networks with Varying Edge Weights

Kevin Hutson, Assistant Professor, Denison University, Dept. of Mathematics-Box M, Granville, OH, 43023, United States, hutsonk@denison.edu, Douglas Shier

This talk considers the problem of determining minimum spanning trees in networks in which each edge weight can assume a finite number of distinct values. We use the algebraic structure of an underlying Hasse diagram to describe the relationship between different edge-weight realizations of the network, yielding new results on how MSTs change under multiple edge-weight perturbations. We will provide various implementation strategies for updating MSTs in the manner.

4 - Survivability of Large Scale Networks: Topological Perspective

Usha Nandini Raghavan, Graduate Student, Pennsylvania State University, 310, Leonhard Bldg., University Park, PA, 16802, United States, nandu@psu.edu, Hari Prasad Thadakamalla, Soundar R. T. Kumara

Real-world complex networks such as World Wide Web, social and biological interaction networks, were found to be highly resilient and survivable to changes in their environments. A significant part of these complex systems' ability to survive has been attributed to their topological structure. In this paper, we address the survivability of large-scale networks from the topological perspective using the principles of complex network theory.

■ WA09

P-Plaza Court 7

Optimization Techniques I

Contributed Session

Chair: Weiqi Li, Assistant Professor of MIS, University of Michigan-Flint, 303 East Kearsley Street, Flint, MI, 48502, United States, weli@umflint.edu

1 - On Continuous Approaches to Graph Problems

Balabhaskar Balasundaram, Texas A&M University, Department of Industrial Engineering, College Station, TX, 77843, United States, baski@tamu.edu, Sergiy Butenko

Continuous formulations of some optimization problems on graphs are considered, including the maximum independent set, maximum clique and max cut problems. Some sample test functions for global optimization packages based on these formulations are proposed. Properties of local maxima of selected formulations are discussed and computational results comparing the performance of standard algorithms and heuristics with respect to these formulations are reported.

2 - Moving Sensor Localization for Wireless Sensor Networks

Holly Jin, student, Univ of Toronto/Stanford Univ, Terman Engineering Center, Dept of Management Science & Engineering, Stanford, CA, 94305, United States, hollyjin@stanford.edu, Michael Carter, Michael Saunders

Moving sensor localization addresses the need for tracking dynamic sensors' locations in wireless sensor networks. An algorithm is developed for estimating moving sensors' locations in a real-time environment. The method uses dynamic distance measurement updates among sensors and utilizes an existing approach for static sensor localization based on semidefinite programming relaxation of a geometric optimization model. Computational results will be presented.

3 - Attractor of Local Search Space in the Traveling Salesman Problem

Weiqi Li, Assistant Professor of MIS, University of Michigan-Flint, 303 East Kearsley Street, Flint, MI, 48502, United States, weli@umflint.edu, Ming Li

Local search technique is locally convergent and outputs a local optimum. For many optimization problems, there is an attractor in the search space that drives search trajectories to converge into a small region. To gain insight into the basic properties of the attractor, this paper studies the attractor of local search space for TSP. The experimental results show that there is an empirical evidence for the existence of the attractor in the local search space for the TSP.

■ WA10

P-Plaza Court 8

Vehicle and Truckload Routing

Contributed Session

Chair: Byung-In Kim, Director of Research and Development, Institute of Information Technology, Inc., 2204 Timberloch Place, Suite 225, The Woodlands, TX, 77380, United States, bkim@e-iit.com

1 - A Hierarchical Optimization Approach to the Truckload Routing Problem

Virginia Miori, Doctoral Student, Drexel University, Academic Bldg - 2nd floor, 33rd and Arch Streets, Philadelphia, PA, 190104, United States, vmm32@drexel.edu

Hierarchical optimization with percolation theory has been applied to the PTSP. This paper explores the same approach for the truckload routing problem (TRP), an extension of the PTSP. A balance between current knowledge and information on future options is struck to try to derive an optimal policy. The technique relies on determination of costs applied to each node. These include opportunity cost of foregoing exploration of subtrees, and results in more complete determination of "cost to go."

2 - Vehicle Routing with Soft Time Windows and Random Travel Times

Robert Russell, University of Tulsa, 600 S. College, Tulsa, OK, 74104, United States, rrussell@utulsa.edu, Timothy Urban

This paper investigates vehicle routing problems in which the travel times are random variables, and deliveries are made subject to soft time windows. We model the travel time using a shifted gamma distribution. Penalties are incurred for deviations from the time windows and are evaluated using a fixed cost, a linear cost penalty, and/or a quadratic loss penalty. A tabu search metaheuristic is developed, and computational results on test problems from the literature are reported.

3 - An Algorithm for Periodic Vehicle Routing Problems with Time Windows.
Byung-In Kim, Director of Research and Development, Institute of Information Technology, Inc., 2204 Timberloch Place, Suite 225, The Woodlands, TX, 77380, United States, bkim@e-iit.com, Seongbae Kim, Surya Sahoo

In this research, we address a real-world periodic vehicle routing problems with time windows. Each stop requires its own frequency of visits: once a week, once in every other week, and once in a month. The problem also requires consistent vehicle assignment to the stops. We developed a series of algorithms for this problem. Using those algorithms, we could reduce the number of routes and improve the routing efficiency.

■ WA11

P-Governor's Square 9

Transportation II

Contributed Session

Chair: Manathattai S. Annapoornima, Ph.D Candidate, National University of Singapore, Department of Decision Sciences, NUS, Business School, 1 Business Link,, Singapore, 117592, Singapore, g0305938@nus.edu.sg

1 - A Capacitated Location-Routing Problem with Time Windows Considered
Chang Sup Sung, Professor, Department of Industrial Engineering, Korea Advanced Institute of Science and Technology, Kusong-dong 373-1, Yusong-ku, Daejon, South Korea, cssung@kaist.ac.kr, Woosuk Yang

This paper deals with a capacitated location-routing problem with time windows considered (CLRPTW). The problem is a generalized capacitated location-routing problem (CLRP) which is concerned with where to locate capacitated facilities, how many different vehicles to be stationed at the located facilities, and routing schedules for each vehicle at the associated facility. The objective is to minimize the associated total cost in satisfying each customer's demand. In the problem CLRPTW, each customer service must start within a given time interval, called time window, so that it is formulated as a set partitioning problem subject to capacity constraints. Some valid inequalities are derived for the problem, which are used to derive an exact approach to find a good dual bound based on column generation and cutting plane techniques. Its performance is evaluated through several experimental tests as showing very effective.

2 - Capacity Contracts-A Solution to Sharing Profit between Airline Partners
Youyi Feng, Associate Professor, Dept of SEEM, Chinese Univ of Hong Kong, Sha Tin, N.T., Hong Kong, China, yyfeng@se.cuhk.edu.hk, Gallego Guillermo

This paper studies the evaluation of capacity contracts between two airlines. A capacity contract is an agreement which stipulates the airline cooperation in operating two connecting flights. This agreement allows airlines A to buy (rent) a block of capacity from airlines B at a certain price. Airlines A uses these seats to manipulate a new itinerary passing through two flights.

3 - Fleet-Sizing in Stochastic, Dynamic Fleet Management Problems
Huseyin Topaloglu, Cornell University, 223 Rhodes Hall, Ithaca, NY, 14853, United States, topaloglu@orie.cornell.edu, Warren Powell

We present tractable algorithms to assess the sensitivity of a stochastic fleet management model to fleet size and load availability. In particular, we show how to compute the change in the objective value in response to an additional vehicle or an additional load introduced into the system, and how this information can be used when making fleet-sizing decisions.

4 - Multi-Objective Transportation under Uncertainty
Ebrahim Nasrabadi, Amirkabir University of Technology, No. 424, Hafez Ave., Tehran, Te, Iran, nasrabadi@cic.aut.ac.ir, Ali Reza Nasrabady

In this paper, we introduce the multi-objective fuzzy stochastic transportation problems and propose a method for solving these problems.

5 - Operations and Logistics as a Panacea for Burgeoning Operating Expenses: Case of Indian Railways
Manathattai S. Annapoornima, Ph.D Candidate, National University of Singapore, Department of Decision Sciences, NUS, Business School, 1 Business Link,, Singapore, 117592, Singapore, g0305938@nus.edu.sg, Shirish C. Srivastava

We identify some of the areas where Indian Railways (IR) can benefit by application of mathematical models. We bridge the gap between theory and practice by demonstrating how IR can adopt operations modeling techniques for increasing their profitability. The models identified from the existing literature have been tailored to solve the real life operational problems of IR related to freight transportation, warehouse selection, dynamic pricing of tickets, and maintenance scheduling of trains.

■ WA12

P-Governor's Square 10

Inventory Management

Contributed Session

Chair: Eugenio Cornacchia, CTO, ToolsGroup, 246 Commonwealth Ave., Boston, MA, 02116, United States, eugenio.cornacchia@toolsgroup.com

1 - Managing Leased, Customer Premise Equipment
Paul Thompson, Zaragoza Logistics Center, Avda. Gomez Laguna 25, 50009 Zaragoza, Spain, pthompson@zaragozalogistics.com

We consider the problem of managing systems of leased, customer premise equipment. These problems are characterized by equipment located at peripherally-located sites, which returns to the system when a customer releases it. We present an economic analysis of (1) the timing of equipment replenishment and (2) policies for reserving spare equipment for later use at a customer location. Analytical results lead to several interesting insights.

2 - Vendor Managed Inventory Promising Value for the Truck Parts Industry
Carl Hall, President, Enterprise Data Management, 9916 Carver Suite 500, Cincinnati, OH, 45242, United States, sales@edm1.com

The study looked at 3 truck parts suppliers that have been using VMI for over a year. These companies represented 4 distributor supplier relationships and 21 unique distributor locations. We compared the data for sales, inventory turns and in-stock percentage. Results indicate that distributors using VMI increased their sales on average by 21 percent inventory turns increased an average of 22 percent. Instock percentages remained constant.

3 - Spare Parts Inventories and Maintenance: Overview, Case Study, and Future Research
Jonathan Bates, Lieutenant, U.S. Coast Guard, University of South Florida, 4202 E. Fowler Ave., Tampa, FL, 33620, United States, jbatescg@tampabay.rr.com

A case study is performed for a spare parts inventory model. The (s,S) model has been generally accepted to be the most appropriate model for this type of system. This model will be described along with several methods to calculate nearly optimal values for s and S, including the Revised Power, Normal, Naddor's, and Porteus' algorithms. Solutions are presented as well as the results for several forecasting methods using case study data from the U.S. Coast Guard's Engineering Logistics Center.

4 - Using Separable Programming to Solve the Multi-Product Multi-Constraint Newsvendor Problem
Julie Niederhoff, Washington University, 1312 Boland, STL, 63117, United States, niederhoffj@olin.wustl.edu

In the multi-product, multi-constraint system, multiple products are stocked but are constrained by common resources. By exploiting the separable nature of the problem, a close approximation of the optimal solution can be found using convex separable programming. Sensitivity analysis of the linear program provides managerial insight into the effects of parameters of the problem on the optimal solution and future decisions.

5 - Recent Trends in Inventory Optimization
Eugenio Cornacchia, CTO, ToolsGroup, 246 Commonwealth Ave., Boston, MA, 02116, United States, eugenio.cornacchia@toolsgroup.com

More than 100 Supply Chain Planning vendors now promote "Inventory Optimization". Beyond the marketing, though, only a few provide the real thing. To automatically determine correct stock levels, fulfill a global service level, and optimize a desired objective function are very complex tasks, requiring sophisticated technology only a few vendors provide. This paper gives guidelines on what is required for Inventory Optimization, how it is accomplished, and trade-offs between different approaches.

■ WA13

P-Governor's Square 11

Air Traffic Flow Management

Sponsor: Aviation Applications
Sponsored Session

Chair: Octavio Richetta, University of Mass., MSIS Department, Boston, MA, 02125, United States, Octavio.Richetta@umb.edu

1 - Equitable Models for the Stochastic Ground Holding Problem Under Collaborative Decision Making
Octavio Richetta, University of Mass., MSIS Department, Boston, MA, 02125, United States, Octavio.Richetta@umb.edu

We present stochastic programming models for the ground-holding problem with nonlinear ground delay cost functions. We explore the computational complexity of the models and conditions under which the linear programming relaxation yields integer solutions that are compatible with the Collaborative Decision Making - Enhanced Ground Delay Program.

2 - An Optimisation Model For Airport Taxi Scheduling
Maarten Soomer, Vrije Universiteit, Faculty of Sciences, De Boelelaan 1081 A, 1081 HV Amsterdam, Netherlands, mjsoomer@cs.vu.nl, P.R. de Waal, J.W. Smeltink, R.D. van der Mei

In this paper we present an optimisation model for airport taxi scheduling. We introduce a mixed-integer programming problem to represent the optimal movement of aircraft on the surface of the airport. In the optimal schedule delays due to taxi conflicts are minimised. We discuss implementation issues for solving this optimisation problem. Numerical results with real data of Amsterdam Airport Schiphol demonstrate that the algorithms lead to significant improvements of the efficiency with reasonable computational effort.

■ WA14

P-Governor's Square 14

Management of Technology I

Contributed Session

Chair: Stefano Perlusz, Assistant Professor, Singapore Management University, 469 Bukit Timah Road, Singapore, 259756, Singapore, stefano@smu.edu.sg

1 - Automatic Review System of Research Information
Masatake Saito, Assistant Professor, Chuo University, (office 21134) 742-1, Higashi Nakano, Hachioji, Tokyo, Japan, msaito@tamacc.chuo-u.ac.jp

Researchers in universities and companies always spend a lot of time on discovery and searching for a new theme in their research. It is important that the researchers stop to analyze problems and to seek originality as well as grasping the progress of the research. The purpose of this study is to develop a automatic review system which supports the research information analysis. Especially, the developed system outputs the branching of the research linkage diagram.

2 - From Cycles to Kaleidoscopes: Mapping the Nonlinear Dynamics of Technological Evolution
Greg Daneke, Professor, ASU, 7001 E. Williams Field Rd., MSABR, Mesa, AZ, 85212, United States, Greg.Daneke@asu.edu, Kevin Dooley

Problems exist with life cycle models of technological evolution, i.e., their failure to fully account for accelerating cycles, emergent processes, and network externalities. We explore a nonlinear processes that may be cyclical or epochal. Centering Resonance Analysis is used to model the content of the texts, and various multivariate statistical and time series methods are used to detect patterns of activity. It is demonstrated on a series of actual cases.

3 - ProFIS — An Integrated Process-Approach to Early Information
Matthias C. Freund, RWTH Aachen University, Secretary of Business Administration Department of Technology and Innovation Management, Templergraben 64, Aachen, 52064, Germany, freund@tim.rwth-aachen.de, Ralf Wassenhoven

Early Information Systems (EIS) which focus upon detection of new patterns, is one of the strategies companies followed to cope with the pressure of dynamic markets. With ProFIS we propose an approach for an EIS for SMEs. Within our contribution the process, specially the two steps configuration (a psychometric method for the Selection of human Sensors) and Information Mining (Detection and Changes of (Word-)Associations) are presented.

4 - Diffusion of New IT Systems and Products: The Role of Affect and Emotions on Adoption
Stefano Perlusz, Assistant Professor, Singapore Management University, 469 Bukit Timah Road, Singapore, 259756, Singapore, stefano@smu.edu.sg

This research investigates the role of affect and emotions in the adoption and use of new IT systems and products. Two studies are conducted to measure the concepts of affect and emotions as they relate to the use of IT. These measures are then related to factors typically deployed in prominent models of technology acceptance. The results show that affect and emotions exert a systematic influence on IT adoption. Implications for researchers and practitioners are provided.

■ WA15

P-Governor's Square 15

Multiple Machine and Distributed Scheduling Problems

Cluster: Scheduling
Invited Session

Chair: Robert Storer, Lehigh University, Industrial and Systems Engineering, Bethlehem, PA, 18015, United States, rhs2@lehigh.edu

1 - Predictive/reactive Scheduling with Controllable Processing Times
Ayten Turkcan, School of Industrial Engineering, Purdue University, West Lafayette, IN, 47907, United States, aturkcan@purdue.edu, Robert Storer, Selim Akturk

We address non-identical parallel machine scheduling and processing time selection problems simultaneously. The objective is the minimization of manufacturing cost and total weighted earliness and tardiness. A time-indexed IP model and a Lagrangian-relaxation based algorithm are used to solve the problem. The algorithm can be used effectively in reactive scheduling.

2 - Distributed Scheduling without Coupling Agents
Sun Woo Kim, Texas A&M University, College Station, TX, United States, sun-woo-kim@neo.tamu.edu, Jorge Leon

We develop optimization methods for organizationally distributed systems where each subsystem has autonomous decision authority. Information about subsystems is considered private, but partial information sharing is allowed in the pursuit of global optimization. A distributed model is proposed in which subsystems must resolve conflicts via direct interactions without third party mediation.

3 - Job Formation and Scheduling Problem with Capacitated Containers
Erhan Kutanoglu, The University of Texas at Austin, 1 University Station C2200, Austin, TX, 78712, United States, erhank@mail.utexas.edu, Fehmi Tanrisever

Motivated by the latest challenges in semiconductor wafer fab scheduling, we study a new problem where orders of different characteristics are grouped together to form jobs which are then scheduled through the machines. We investigate efficient solution techniques to solve the capacitated problem, where specialized containers (each associated with a job) can only hold up to a certain number of wafers. Using the efficient algorithm developed for the uncapacitated case, we propose a heuristic.

4 - Scheduling with Non-regular Performance Measures
Robert Storer, Lehigh University, Industrial and Systems Engineering, Bethlehem, PA, 18015, United States, rhs2@lehigh.edu, Selcuk Avci

We address scheduling with non-regular performance measures, and in particular, the weighted early-tardy job shop scheduling problem. We combine Lagrangean relaxation and Tabu search in a synergistic way. This leads to a significant reduction in the size of the local search neighborhoods in the Tabu search, and produces excellent results.

■ WA16

P-Governor's Square 17

Tutorial: IPOPT — A Software Package for Nonlinear Optimization

Sponsor: Computing Society
Sponsored Session

Chair: Robin Lougee-Heimer, Research Staff Member, IBM Research, IBM T.J. Watson Research Center, 1101 Kitchawan Road, Yorktown Heights, NY, 10598, United States, robinlh@us.ibm.com

1 - IPOPT, A Software Package for Nonlinear Optimization
Carl Laird, Graduate Student, Chemical Eng. Dept. Carnegie Mellon University, 5000 Forbes Ave, Pittsburgh, PA, 15213, United States, claird@andrew.cmu.edu, Andreas Waechter, Lorenz Biegler

The optimization package, IPOPT, has been shown to be robust and efficient for large-scale, nonlinear optimization problems. We present the numerical algorithm, illustrate the use of the package, and show how the object-oriented software design allows problem specific specialization. IPOPT is available from COIN (www.coin-or.org).

■ WA17

P-Directors Row E

Decision Analysis I

Contributed Session

Chair: Wynship Hillier, Principal, Kalchas, Inc., 30 Day St, San Francisco, CA, 94110, United States, wynship@kalchas.net

1 - A Validational Analysis of Utility Elicitation Methods
Radhika Nath, Center for Policy Research, 135 Western Avenue, Milne 300, Albany, NY, 12222, United States, aunaturad@comcast.net

Utility elicitation is used in medical settings to inform decision making and to facilitate cost-effectiveness analyses. While scholars have argued the merits of utility elicitation methods, no consensus exists regarding the use of these methods. This study examines the validity of 3 widely used utility elicitation methods-standard gamble, time tradeoff and visual analog scale. The relationship between individual characteristics (such as risk preference) and utilities elicited is also examined.

2 - Electricity Transmission Network Planning In Deregulated Power Market under Uncertainties
Yang He, Research Assistant, The University of Arizona, 4515 E.Grant Rd Apt B231, Tucson, AZ, 85712, United States, hey@email.arizona.edu, Pitu Mirchandani

Stochastic programming formulation is used to model electricity transmission network operator's planning strategies in transmission capacities and transmission pricing, faced with a set of competing deregulated power generating firms and future market uncertainties. The problem can be solved by reformulating it as an MCP problem. The cases of profit-maximizing and social welfare-maximizing grid operators are studied. Some numerical results are presented, and the insights behind these results are discussed.

3 - Information Preference Reversals for a Risk Averse Decision Maker
Niyazi Onur Bakir, Postdoctoral Research Fellow, Texas A&M University, United States, nob3152@unix.tamu.edu

The degree of risk aversion is key determinant of the value of information to the decision maker. There is no monotonic relation between the two. In this talk, we show that monotonicity exists if we restrict ourselves for a specific class of information bundles. We illustrate examples where preference reversals occur.

4 - Results in the Sequential Decision Analysis of a Housing Reserve
Wynship Hillier, Principal, Kalchas, Inc., 30 Day St, San Francisco, CA, 94110, United States, wynship@kalchas.net

We used sequential DA to set reserve assessments for an obligation with uncertain due date. This approach produced typical results: modest reduction of loss over a point-estimate-based method, and a lesson on undue optimism. Surprisingly, the main impact was to reduce uncertainty in the result, regardless of neutrality towards risk. Furthermore, this uncertainty was highly sensitive to changes in time preference. Alternate objectives for reserve assessments are also discussed.

■ WA18

P-Directors Row H

Telecommunications

Contributed Session

Chair: Ramesh Bollapragada, San Francisco State University, College of Business,, San Francisco, CA, 94132, United States, rameshb@sfsu.edu

1 - Spot Pricing Framework for Loss Guaranteed Internet Service Contracts
Lingyi Zhang, Rensselaer Polytechnic Institute, 110 8th Street, Troy, NY, 12180, United States, zhangl5@rpi.edu, Shivkumar Kalyanaraman, Aparna Gupta

We develop a spot pricing framework for intra- domain expected bandwidth contracts with loss based QoS guarantees. The framework accounts for both costs and risks associated with QoS delivery. Nonlinear pricing is used for cost recovery, and an options pricing approach is developed for risk related pricing. Application of options pricing techniques provides a mechanism for fair risk sharing between the provider and the customer, and may be extended to price other uncertainties in QoS guarantees.

2 - Optimizing Bandpass in Optical Rings
George Bell, Cox Associates, 5040 Ingersoll Pl, Boulder, CO, 80303, United States, gibell@comcast.net, Djangir Babayev

We consider a telecommunications problem arising from the packing of an optical ring. Mathematically, the problem reduces to reordering the rows of a binary MxN matrix to maximize the number of consecutive 1's over all columns. We compare several heuristics by speed and ability to find the optimal solution.

3 - An Approach to Planning Broadband Wireless Networks
Ramesh Bollapragada, Professor, San Francisco State University and Bell Laboratories, College of Business, 1600 Holloway Avenue, San Francisco, CA, 94132, United States, rbollapragada@yahoo.com

We discuss network planning for broadband converged voice, data and video networks for Broadband Wirless Service Providers. The network planning methodology is implemented in 4 phases: market scenario planning, cluster analysis to identify pockets of demand, hub configuration planning (RF design), end-to-end economic analysis of networks and network architecture design.

■ WA19

P-Directors Row F

Auctions II

Contributed Session

Chair: Liad Blumrosen, The Hebrew University, Givat-Ram, Jerusalem, 91904, Israel, liad@cs.huji.ac.il

1 - Pre-auction Investments
Ying Li, Michigan Business School, 807 Plum Hollow, College Station, TX, 77845, United States, yingl@bus.umich.edu, Sudheer Gupta, William Lovejoy

Optimal auctions can be implemented through standard auctions under the assumption that a bidder does not have any influence over his cost/value. Allowing bidders to make cost-effective investments before auctions, we examine the drivers behind a bidder's investment decision and how the pre-auction investments affect the auctioneer's optimal auction.

2 - Information Leakage of First and Second Price Auctions in a Supply Chain Environment
Ying-Ju Chen, Student, New York University, 44 W 4th Street, KMC 8-151,, New York, NY, 10012, United States, ychen0@stern.nyu.edu, Gustavo Vulcano

We analyze a two-stage supply chain setting, where two retailers bid for the capacity of a manufacturer, and then they compete in the consumer market. The manufacturer's capacity is sold as a bundle, and the auction loser can get items in a spot market. We study this model under a first and second price auction, and analyze the impact of the information about the price of the auction disclosed by the manufacturer in the first stage of the game.

3 - Computationally Feasible Truthful Auctions for Convex Bundles
Liad Blumrosen, The Hebrew University, Givat-Ram, Jerusalem, 91904, Israel, liad@cs.huji.ac.il, Moshe Babaioff

In many economic settings, convex figures on the plane are for sale to a set of selfish agents. For example, when selling advertising space or spectrum licences. The agents must be motivated to report their true values for the figures. Moreover, a feasible approximation algorithm should be used for this computationally hard problem. We present feasible truthful mechanisms that guarantee a certain fraction of the social welfare, as a function of the geometric diversity of the shapes.

■ WA20

P-Room 3304

Health Care Applications II

Contributed Session

Chair: George Miller, Altarum, 3520 Green Court, Ann Arbor, MI, 48105, United States, george.miller@altarum.org

1 - Predicting Eyelid Elevation Correction following the Müller Muscle-Conjunctival Resection
Donna Retzlaff-Roberts, Professor, University of South Alabama, Mitchell College of Business, Dept. of Managment, Mobile, AL, 36688, United States, retzlaff@usouthal.edu, Elizabeth Holley, Mark Brown

The Müller muscle-conjunctival resection is a surgical procedure for correcting droopy eyelids. The surgeon must determine the number of millimeters to remove from the eyelid prior to commencing the procedure. The desired result involves not only raising the elevation of the eyelids, but also achieving relative symmetry between the two eyelids. In this analysis 471 cases that were preformed by the same surgeon were studied.

2 - Optimal Package of Women's Health Services Delivered in a Single Health Care Visit
Jane Kim, Student, Harvard University, 718 Huntington Avenue, Boston, MA, 02115, United States, jkim@hsph.harvard.edu, Joshua Salomon, Sue Goldie

A public health priority is providing primary care services for older women in low resource settings. We developed an integer programming (IP) model to identify an optimal package of interventions targeted to older women during a one-time visit. Inputs into the IP model were estimated using Markov models which calculated benefits and costs associated with seven diseases and interventions. The IP model was constructed to maximize DALYs-averted, subject to a budget and human resource constraint.

3 - Framework for Strategic Biotech/Pharma Alliance Planning and Negotiations
Vladimir Shnaydman, ORBee Consulting, 57 East Bluff Rd, Ashland, MA, 01721, United States, vlad_shnaydman@yahoo.com

Strategic alliance planning is challenging for biotech/pharma due to contradictory goals, complicated deals structure, long-term commitments, and risk and uncertainty associated with limited knowledge of a partner product. Proposed framework is based on two models: (1) multicriteria model to define favorable negotiation zones for each partner and derive effective negotiation strategy for "milestone-royalty" types of deals; (2) compensation model for "profit sharing" types of deals.

4 - Mississippi County Public Health Assessment: A Preference-based Approach to Geographical Rankings.
Miguel A. Zuniga, Assistant Professor, Texas A&M University System Health Science Center, School of Rural Public Health, 3000 Briarcrest Dr. Suite 300, Bryan, TX, 77845, United States, mzuniga@srph.tamu.edu, Peter Fos, Brian W. Amy

We used multi-attribute utility to determine population-based health status for all Mississippi. A public forum technique helped identify health status indicators weights. Indicators data were abstracted from federal, private, and professional organizations. Objectives related to health risks, outcomes, resources, and quality were used for creating health status based priority-rankings for all indicators and counties.

5 - Modeling Healthcare Responses to Bioterrorism
George Miller, Altarum, 3520 Green Court, Ann Arbor, MI, 48105, United States, george.miller@altarum.org, Steve Randolph

The Healthcare Complex Model simulates healthcare delivery at the patient episode level throughout a network of medical facilities. This paper describes a research program to tailor and apply the model to improve the medical response of a community to a bioterrorist attack. We summarize the model structure and discuss its use to investigate ways to meet the surge in demand for medical care resulting from possible attacks with pneumonic plague and smallpox.

■ WA21

P-Room 3302

Manufacturing II

Contributed Session

Chair: SugJe Sohn, Georgia Institute of Technology, 765 Ferst Dr., Atlanta, GA, 30332, United States, sjsohn@isye.gatech.edu

1 - The Three-Dimensional Packing Problem: A Dynamic Programming Approach
Randy Martens, University of Puerto Rico, P.O. Box 9043, Mayaguez, 00681, United States, rmartens@uprm.edu

Two algorithms are presented that solve the three-dimensional packing problem. The first, solves the unconstrained problem, where unlimited number of boxes of each size can be used. The second, solves the constrained problem using a limited-breadth first search (after depth-first searches proved more time consuming). Both heuristics employ dynamic programming in a multi-stage fashion and are fast enough to be used for automated pallet loading.

2 - An MINLP Model for Profit Maximization Considering Cycle Times, Throughputs, and Investment
SugJe Sohn, Georgia Institute of Technology, 765 Ferst Dr., Atlanta, GA, 30332, United States, sjsohn@isye.gatech.edu, Shabbir Ahmed, Chen Zhou

The research is focusing on the determination of the production quantities of multiple products and tool capacity of facility for maximized profit satisfying the strategic constraints including cycle times, throughputs, and investment. The formulation of the problem is a mixed-integer nonlinear programming (MINLP) with the parameters obtained from mean value analysis (MVA) and queuing network models. An example of semiconductor manufacturing is modeled and numerically analyzed.

■ WA22

P-Room 3312

Analytical Techniques for Space Operations

Sponsor: Military Applications
Sponsored Session

Chair: Lee J. Lehmkuhl, The MITRE Corporation, 1155 Academy Park Loop, Colorado Springs, 80910, United States, leel@mitre.org

1 - Space Surveillance Contributions to the STS 107 Accident Investigation
R.F. Morris, Space Analysis Division, HQ AFSPC/XPY, 150 Vandenberg Street, Suite 1105, Peterson AFB, CO, 80914-4650, United States, Robert.Morris@peterson.af.mil

This presentation addresses the analyses conducted by Air Force Space Command (AFSPC) Space Analysis Center (ASAC) in support of the Columbia accident investigation. The analyses covered a range of space surveillance issues—from examining the breakup of a rocket body during the STS 107 mission, reviewing results of the recent NASA debris campaign, and assessing a "close approach" reported by the crew on Flight Day 5. Most notably, this presentation will show how the Flight Day 2 piece discovered by the 1st Space Control Squadron was analyzed to determine its ballistic and radar characteristics and how this effort helped NASA determine whether this piece was from Columbia and, if so, what it might have been.

2 - Space Situation Awareness Metrics
Phil Kerchner, The MITRE Corporation, 1155 Academy Park Loop, Colorado Springs, CO, 80910-3704, United States, pkerchner@mitre.org

Space situation awareness (SSA) enables space operations and is an increasingly important part of battle-space awareness for the conduct of joint operations. During 2003, assessment of SSA indicated the need to enhance the metric characteristics of SSA requirements. This should be accomplished by transforming the historic requirements of SSA stakeholders to national capabilities stated in terms of quality, quantity, timeliness, and confidence (QQTC). With SSA capability needs and performance parameters better defined in terms of QQTC, architectures will focus on reflecting important operational behavior and systems implementation. A value model is used to assess architecture alternatives, and is based on space mission tasks, sub-tasks, measures of effectiveness and measures of performance. In recent analysis with a value model, the primary impact of QQTC metrics occurred in measures of performance for SSA. This paper addresses improvement in prescribing capability needs using QQTC, the reflection in architecture and the impact on measures used for assessment of SSA.

■ WA23

P-Room 3354

Data Identification & Optimization Techniques

Sponsor: Military Applications
Sponsored Session

Chair: June Rodriguez, Chief, Modeling & Simulation, AETC SAS, 151 J St Ste 2, Randolph AFB, TX, 78150, United States, june.rodriguez@randolph.af.mil

1 - Technical Training Facility Fund
Susan Lynch, Chief, Data Mining, USAF, AETC SAS, 151 J St. Ste 2, Randolph AFB, TX, 78150, United States, susan.lynch@randolph.af.mil

Due to the high cost of facilities and their impact on Technical Training, AF/XPP suggested establishing a surcharge per student non-MILCON fund to replace facilities to alleviate spikes in AETC MILCON. Currently $750M is required to replace the Recruit Housing and Training Facilities, and other spikes exist in the Technical Training facility inventory. This type of funding would make facilities a "must-pay" bill to ensure there systematic replacement. The Recruit Housing and Training (RH&T) facilities will require $68.2M of $80M a year from current mission MILCON each year a RH&T is replaced. This poses the question; can AETC meet facility strategic plans and still replace these facilities? The data suggests not at current funding levels. The establishment of a facility fund would require a ~$8 per student per day surcharge required to maintain a ~$40M per year fund. This fund would be maintained in a 3 year cycle to allow for the replacement of all Technical Training facilities in the DoD mandated 67 year recapitalization rate. The benefits of such a fund are that it ensures steady state funding, makes facility replacement a "must-pay" bill, and stops facilities from driving Training Program Requirements. With this fund AETC would also be able to design facilities when need arises to maintain capacity, not waiting for appropriation. The drawback to this type of funding is that it requires Congressional legislation change. Currently the AETC corporate structure does not support this type of facility replacement funding.

2 - Co-Occurence Matrix Feature Vectors and Cluster Classification Bases Steganalysis
Benjamin M. Rodriguez II, University of Texas San Antonio, EE Master's Student, United States, bmrodriguez2002@yahoo.com, Sos S. Agaian, June Rodriguez

Several articles have proposed various statistical methods for detecting steganographic information within digital images such as: pixel comparison statistics, cosine transform steganographic detection and higher order statistic based stego detection. We present a new method for steganalysis that combines pixel comparisons, a newly self-organizing clustering classification and new co-occurrence matrices feature vectors. Experimental results show that the performance of the new proposed method performs better than other existing methods.

3 - Long Range Course Scheduler Optimizer
Paul Clemans, Flight Commander, Command Studies Flight, AETC SAS, USAF, 151 J ST. STE 2, Randolph AFB, TX, 78150, United States, paul.clemans@randolph.af.mil

In order to facilitate the completion of an Air Force General Officer tasked capabilities prototype model, a Long Range Course Scheduler was built to schedule technical training classes through the Future Years Defense Program (FYDP). This enlisted technical training scheduling model builds schedules taking into account yearly fluctuations in students and seeks to optimize schedules by smoothing daily student loads. This enables AETC to predict infrastructure requirements throughout the FYDP. The course scheduler can schedule by course, by base, by fiscal year. Model allows training managers the opportunity to select start dates by course by fiscal year or provides start dates using a heuristic method that utilizes an academic calendar. AETC DO developed the original course scheduler model, which was used as the foundation model for the current Long Range Course Scheduler. The schedules produced by the Long Range Course Scheduler are then fed into a schoolhouse simulation model currently under development

by RAND Corporation. This presentation will provide methodology and results.

■ WA24

P-Room 3402

Scheduling I

Contributed Session

Chair: Douglas Shier, Professor, Clemson University, Department of Mathematical Sciences, Clemson University, Clemson, SC, 29634-0975, United States, shierd@clemson.edu

1 - Exact and Heuristic Approaches to the Component Set Identification Problem

Diego Klabjan, Assistant Professor, University of Illinois at Urbana-Champaign, Dept. of Mechanical and Industrial Eng., 140 Mechanical Engineering Building, Urbana, IL, 61801, United States, klabjan@uiuc.edu, Soo Chang, Patrick Bless

The component set identification problem is to find the least cost subset of components. Each component produces a set of outputs, which can be used as inputs to other components. A component can be selected only if all of its required inputs were produces earlier by other components. We propose several integer programming formulations. For large instances we propose several heuristics that first build an initial solution and then improve it by using local search.

2 - Recent Advances in Deterministic and Stochastic Flow Shop Scheduling

Jerzy Kamburowski, Professor, Ph.D., D.Sc., The University of Toledo, College of Business Administration, Toledo, OH, 43606, United States, jkambur@utnet.utoledo.edu

The problem of minimizing the makespan in deterministic and stochastic flow shops is discussed. We show network representations of the makespan in no-wait and no-idle flow shops, and new efficiently solvable special cases. We also show a generalization of Johnson's and Talwar's rules for minimizing stochastically the makespan in two-machine Johnson's flow shops, and NP-hardness of minimizing the expected makespan in two-machine blocking flow shops with exponential job processing times.

3 - A New Solution Method for RCPSP/t by Multi-Lexicographical Search Procedures

Masanori Horio, Dr. Assistant Professor, Nagoya University of Arts and Sciences, Iwasaki-cho,Takenoyama-57, Nisshin, 470-0196, Japan, horio@nuas.ac.jp, Atsuo Suzuki

In the RCPSP/t each activity requires time dependent amount of resource during its procedure. The optimal solutions can not be necessarily obtained by using merely the SSGS. We have developed a general project scheduler based on the RCPSP/t. The scheduler adopts a new solution method which searches using two types of search trees (the eligible activity lists and the candidate allocation time lists). Using the method, our scheduler can find the optimal solutions to our bench-mark problems.

4 - Optimization Models for Dynamic Scheduling of Parallel Jobs

Douglas Shier, Professor, Clemson University, Department of Mathematical Sciences, Clemson University, Clemson, SC, 29634-0975, United States, shierd@clemson.edu, Sathish Indika

Suppose that a number of existing jobs, with known starting and completion times, have already been scheduled at a facility. New jobs (of given durations) are to be scheduled in the available free time in order to provide the most flexibility in accommodating future jobs. We model this problem using a mixed integer nonconvex quadratic programming problem. In view of the difficulty of exact solution of this exact model (even for very small instances), we develop heuristic techniques based on a generalized bin packing approach supplemented with a neighborhood search technique.

5 - Single Machine Scheduling of Jobs and Preventive Maintenance for Jobs Subject to Deterioration

Shrikanth Mysore, Ph.D. Candidate, Management Science, University of Alabama, 249, Bidgood Hall, Box 870318, Tuscaloosa, AL, 35487, United States, smysore@cba.ua.edu, John Mittenthal

Jobs scheduling and preventive maintenance are two important issues to be considered while planning production, however, are done separately in practice. The jobs considered for scheduling are subject to deterioration. The deterioration depends on the time that the machine is made to work without any preventive maintenance. We develop heuristics to determine solutions for developing job sequences while simultaneously incorporating preventive maintenance operations.

■ WA26

P-Room 3412

Implications of Fairness on Consumer Behavior and Channel Modeling

Sponsor: Marketing
Sponsored Session

Chair: Paul Messinger, University of Alberta School of Business, 3-20E School of Business Bldg, Edmonton, AB, Canada, paulm@ualberta.ca

1 - The Influence of the Source and the Direction of Price Change on Perceptions of Price Fairness

Margaret C. Campbell, Associate Professor, Leeds School of Business, University of Colorado at Boulder, 419 UCB, Boulder, CO, 80304, United States, Meg.Campbell@Colorado.edu

We show that the source of price change information—whether human or inanimate—can influence consumers' perceptions of price fairness. A price increase is perceived as more unfair when presented by a human than an inanimate source; there is no source effect for a price decrease. However, when processing is constrained, a human—versus inanimate—source of a price increase results in greater price unfairness while a price decrease leads to greater price fairness. We explore reasons for effects.

2 - Fairness and Channel Coordination

Tony H. Cui, Doctoral Student, The Wharton School, University of Pennsylvania, 3730 Walnut Street 700 JMHH, Philadelphia, PA, 19104, United States, haitao@wharton.upenn.edu, Z. John Zhang, Jagmohan S. Raju

In this paper, we incorporate the concept of fairness into the conventional dyadic channel to investigate how fairness may affect the interactions between the manufacturer and the retailer. We show that channel coordination in a channel where partners care about fairness does not require any nonlinear pricing scheme such as a two-part tariff or quantity discount. The manufacturer can use a simple wholesale price above its marginal cost to coordinate this channel.

3 - Fairness and Power Relations in a Two-Manufacturer/One-Retailer Channel: An Experimental Study

Sungchul Choi, Assistant Professor, University of Northern British Columbia, Prince George, BC, Canada, schoi@unbc.ca, Paul Messinger

In the context of Choi's (1991) analysis of two manufacturers and a common retailer, we conduct a laboratory experiment to test competing channel models and to examine deviations of individual pricing behavior from optimal reactions. In particular, we note that players do not fully capitalize on advantageous structural advantages in the experimental design involving high product substitutability and asymmetric costs structures.

■ WA27

P-Room 3454

Financial Engineering

Sponsor: Applied Probability
Sponsored Session

Chair: Martin Haugh, Assistant Professor of IE&OR, Columbia University, 308 S.W. Mudd Building, 500 West 120th Street, New York, NY, 10027, United States, mh2078@columbia.edu

1 - A Tale of Two Growths: Modeling Stochastic Endogenous Growth and Growth Stocks

Steven Kou, Associate Professor, Columbia University, 312 Mudd, Dept. of IEOR, Columbia University, New York, NY, 10027, United States, sk75@columbia.edu

A stochastic endogenous growth model is proposed, which provides an understanding of the links between economic growth, monopolistic competition in R&D, and the valuation of growth stocks. Dynamically, the model implies that the value of growth stocks should be very volatile while the long-run average return is roughly equal to the growth rate of R&D labor. Cross-sectionally, the model also explains an empirical size distribution puzzle observed for growth stocks.

2 - Portfolio Selection with Transaction Costs and Delays

Jussi Keppo, Assistant Professor, University of Michigan, IOE Department, 1205 Beal Avenue, Ann Arbor, MI, 48109, United States, keppo@umich.edu, Tim Maull

We analyze the effects of transaction costs and trading delays on the optimal portfolio strategy of individual investors. Trading delays occur with large block orders in liquid markets and any orders in illiquid markets. The investor attempts to maximize expected terminal utility by allocating wealth between risk-free and risky assets. We analyze the effect of these frictions on the optimal trading strategy. Under high volatility the affect of delay is significant.

3 - Calibrating Credit with Incomplete Information
Kay Giesecke, Visiting Assistant Professor, School of ORIE, Cornell University, 237 Rhodes Hall, Ithaca, NY, 14853, United States, giesecke@orie.cornell.edu, Lisa Goldberg

We discuss the calibration of I^2, a hybrid structural/reduced form credit model that is based on incomplete information of investors. We pool data from equity and credit markets and show how to calibrate the model simultaneously to the physical measure and the equilibrium pricing measure. We obtain the default event and diffusive risk premia and the fractional recovery implied by the market. This yields estimates of the market implied physical probability of default.

■ WA28

P-Room 3504

Reliability

Contributed Session

Chair: Xiaoyue Jiang, Louisiana State University, CEB A 3128, Baton Rouge, LA, 70820, United States, jiang@lsu.edu

1 - Statistical Estimation of Automobile Field Reliability from Warranty Data
Bharatendra Rai, Ph.D Student, Wayne State University, 37724 Willow Lane, T-16, Westland, MI, 48185, United States, bkrai@wayne.edu, Nanua Singh

A complex product such as an automobile has parameter state space prohibitively large for detailed testing during development, manufacturing, and assembly. Thus when the vehicle is put into the market, the likelihood of unexpected failures resulting in a high cost is not uncommon. Field data available from the warranty claims, if well analyzed and communicated can help to reduce the recurrence of old problems along with the expenses on recalls, repairs, and liabilities.

2 - Proportional Intensity Models Robustness for Recurrent Failure Data with Overhaul Intervals
Shwu-Tzy Jiang, Postdoctoral Research Associate, University of Oklahoma, 202 West Boyd St., Carson Engineering Center, Rm., 107, Norman, OK, 73019, United States, Shwu-Tzy.Jiang-3@ou.edu, Thomas L. Landers, Teri Reed Rhoads

The class of semi-parametric proportional intensity (PI) models applies to recurrent failure event modeling for a repairable system with covariates. Certain systems (e.g., aircraft and power plants) experience a substantial period of downtime due to performing maintenance (i.e. major overhaul) following a major failure. This discontinuity in observation time has been a concern in the accuracy of estimating the covariate effect. This paper has examined three semi-parametric PI models, and has recommended selecting appropriate PI models as a function of the overhaul duration.

3 - A Dynamic Software Testing Model with Release and Crash Options
Xiaoyue Jiang, Louisiana State University, CEB A 3128, Baton Rouge, LA, 70820, United States, jiang@lsu.edu

We present a model of software releasing with crash option. The software testing dynamics under considerations is modeled as a conditional non-homogeneous Poisson process on [0, D], and the optimization problem is formulated in optimal stopping framework. Under intuitive assumptions, we show that the optimal policy has a very simple control-limit structure.

■ WA29

P-Room 3502

E-Business Auctions and Contracts

Contributed Session

Chair: Gangshu Cai, Ph.D. candidate, North Carolina State University, 2311 Crescent Creek Dr., Apt 308, Raleigh, NC, 27606, United States, gcai@unity.ncsu.edu

1 - e-Pay Predictive Model for e-Banking Payments
Vasilis Aggelis, University of Patras, Rio, Patras, Patras, Greece, Vasilis.Aggelis@egnatiabank.gr, Dimitris Christodoulakis

The development of prediction models is a very significant task, especially for bank organizations. The establishment of such models with the capacity of accurate prediction of future facts enhances the decision making especially in case these models are applied on specific bank units such as e-banking. Scope of this paper is the presentation of the e-Pay predictive model which allows successful prediction of e-banking transactions volume in relation with the active users' number.

2 - An Extension of NegotiAuction to Multi-Unit Combinatorial Bundle Auctions
Jyrki Wallenius, Helsinki School of Economics, POB 1210, 00101 Helsinki, Helsinki, Finland, walleniu@hkkk.fi, Riikka-Leena Leskelä, Jeffrey Teich, Hannele Wallenius

We consider multi-unit combinatorial bundle auctions and extend NegotiAuction, a progressive hybrid multiple-issue auction and negotiation system, to such a situation. An interesting feature of our combinatorial auction is the possibility to provide 'quantity support' to bidders, that is suggestions regarding what would constitute 'good' bids from the bidders' point of view. Computational results testing the 'quantity support' feature are discussed both in the linear programming (partial bids accepted) and integer programming (partial bids not accepted) contexts.

3 - Non-Existence of Equilibrium in a Model of Sequential Auctions
Gangshu Cai, Ph.D. candidate, North Carolina State University, 2311 Crescent Creek Dr., Apt 308, Raleigh, NC, 27606, United States, gcai@unity.ncsu.edu, Peter Wurman, Xiuli Chao

Sequential auctions are common in public marketplaces. Weber introduces two price quotes in a classic symmetric sequential auction model. However, there is one very popular price quote, reveal-all-bid price quote, which is not incorporated into the model. We examine the stability of Weber's equilibrium in a modified Weber's model with the new price quote. We show that a pure-strategy equilibrium, either symmetric equilibrium or asymmetric equilibrium, does not exist in this symmetric model.

■ WA30

P-Room 3512

Quality Management

Contributed Session

Chair: David Heimann, Professor, University of Massachusetts Boston, Mgmt. Science & Info. Systems Dept., 100 Morrissey Blvd., Boston, MA, United States, david.heimann@umb.edu

1 - Investigating Search Strategies and Inspection Performance
Edem Gerard Tetteh, Student, North Carolina A&T State University, 1601 E Market St, Greensboro, 27405, United States, etetteh@ncat.edu

Previous studies have showed that systematic search strategy improved significantly the inspector performance. Although prior studies showed that horizontal search strategy constitutes the most efficient search strategy compared to vertical, the impact of others search strategies with inspection performance is still unclear. This paper will investigate the effects of others search strategies and task complexity on inspection performance.

2 - Optimum Policies with Imperfect Maintenance
Shey-Huei Sheu, Professor, Department of Industrial Management, National Taiwan University of Science and Technology, 43 Keelung Road, Section 4, TAIPEI, Taiwan, shsheu@im.ntust.edu.tw, Gwo-Liang Liao

This paper considers a repairable system which undergoes preventive maintenance(PM) periodically. By incorporating planned PM, perfect repair, minimal repair, mathematical formulas expressing the expected cost per unit time are obtained for the three models. For each model, the existence of a unique and finite optimal T for PM under certain reasonable conditions is demonstrated. Various special cases are considered. Finally, numerical examples are given to illustrate the method.

3 - Total Quality Management in Strategic Alliances
Mahour Mellat-Parast, Ph.D Candidate, University of Nebraska-Lincoln, 175 NE Hall, Dept of Ind & Mgmt Sys Eng., Lincoln, NE, 68588, United States, mmellatparast3@unl.edu

This paper attempts to provide a framework for Total Quality Management (TQM) applicable in strategic alliances. The paper argues that the essence of strategic alliances is continuous learning, which is achieved by developing a learning environment. Such an environment is facilitated by developing trust among organizations in the alliance. A conceptual framework for TQM practices within strategic alliances has been developed and key areas for research have been identified.

4 - Automating the Weekly Software Defect-Tracking Report: From Half a Day to Half an Hour
David Heimann, Professor, University of Massachusetts Boston, Mgmt. Science & Info. Systems Dept., 100 Morrissey Blvd., Boston, MA, United States, david.heimann@umb.edu

The quality-assurance (QA) department of a telecommunications company tracked software defects, using a spreadsheet to show weekly defect activity. However, each spreadsheet took a QA analyst half a day to complete per project, significant since each analyst had several projects. We developed an automated approach by which a QA analyst could produce the project report in only half an hour instead of half a day. We discuss the package and the way the QA department used it.

■ WA31

P-Room 3545

Information Collaboration and Integration in Enterprise Information System

Sponsor: Information Systems
Sponsored Session

Chair: Namkyu Park, Associate Professor, Wayne State University, Dept. of Industrial & Manufacturing Eng., 4815 Fourth Street, Detroit, MI, 48202, United States, namkyup@purdue.edu

1 - Federated Repository Management for the Acceleration of Innovations to the Market

Namkyu Park, Associate Professor, Wayne State University, Dept. of Industrial & Manufacturing Eng., 4815 Fourth Street, Detroit, MI, 48202, United States, namkyup@purdue.edu, Uniyoung Choi, Dong Soo Shin

Innovations could be achieved through a combination of various knowledge residing within an organization including human resources. Fast deployment of innovations to the market, such as a new product development, plays a key role in defining a competitiveness of a firm. This research addresses a way of collecting and systematically organizing information from various sources while minimizing up-front knowledge engineering. Integrated document management, knowledge management with e-business repository, business process management issues will be investigated in the light of acceleration of innovations to the market.

2 - Information Architecture for Collaborative Working in Knowledge Intensive Processes in Extended Enterprise

Namkyu Park, Associate Professor, Wayne State University, Dept. of Industrial & Manufacturing Eng., 4815 Fourth Street, Detroit, MI, 48202, United States, namkyup@purdue.edu, J.W. Yoo, C.S. Im

The goal of this research will be to develop a system to support the collection of innovative ideas and relevant knowledge throughout the extended enterprise for new and existing process and product developments, especially for knowledge intensive processes such as new product development, consulting, and strategy, and to develop these ideas and knowledge into a means of fostering industrial innovations. Innovation is to be achieved by combining the ideas and feedback from all parts of the product life cycle, including customer interaction with existing products and new product/process ideas, and including customer service and field engineers, including suppliers, and including pooling of knowledge between multiple sites. Such a system will enable organizational learning by providing a means to collect, store and use/develop innovative ideas over the extended enterprise. A product-process-organization (PPO) analysis method, corporate memory, and community.

3 - A Design and Implementation of Distributed Information System for Collaborative Product Development

Teresa Wu, Assistant Professor, Industrial Engineering Dept., Arizona State University, PO Box 875906, Tempe, AZ, 85287, United States, Teresa.Wu@asu.edu, Nan Xie

Due to increased competition in today's global environment, companies are embracing Collaborative Product Development (CPD) as a path to success in new product development. CPD is an engineering process that involves decision-making through the iterative communication and coordination among product designers. The high level of collaboration and communication of a CPD environment requires a robust Distributed Information System. In this paper, we review existing research related to CPD and propose an information framework termed VE4PD based upon the integration of web services and agent technologies. An implementation system is developed to validate the application.

■ WA32

T-Vail (Majestic Level)

Joint Session OR Practice/CPMS- Panel: Academic/Practitioner Interaction and Cooperation

Cluster: OR Practice, CPMS
Invited Session

Chair: Michael Rothkopf, United States, rothkopf@rutcor.rutgers.edu

1 - Academic/Practitioner Interaction and Cooperation

Michael Rothkopf, United States, rothkopf@rutcor.rutgers.edu, Warren Powell, Irv Salmeen, Richard Rosenthal, Charles W. Beall

The panel will discuss the challenges of interaction and cooperation between practitioners on the one hand, and teachers and researchers on the other. What makes such interaction valuable? What makes it difficult? What works? What has failed?

■ WA34

T-Columbine (Majestic Level)

Operations Management I

Contributed Session

Chair: Tarkan Tan, Assistant Professor, Eindhoven University of Technology, Paviljoen F-07, P.O. Box 513, Eindhoven, 5600MB, Netherlands, t.tan@tm.tue.nl

1 - Cross-functional Operational Capacity Planning

Jingfang Zheng, Master of Management Candidate and Project Analyst, University of British Columbia, RM209, Centre for Operations Excellence, 2053 Main Mall, UBC, Vancouver, BC, V6T1Z2, Canada, jean.zheng@coe.ubc.ca, Mats Gerschman, Harish Krishnan, Timothy C. Y. Chan

A company is trying to improve capacity planning. We present a simulation model of the process of responding to breakdowns in service to customers. The end-to-end model incorporates all functions that respond to a service breakdown, starting with the call centers and including downstream workgroups. Special features such as feedback loops, call abandons, outages and escalations are built in the model. The model allows management to effectively and proactively manage capacity at all levels.

2 - A Short Term Capacity Adjustment Procedure, Based on Expected Tardiness

Henny van Ooijen, Professor, Technische Universiteit Eindhoven, P.O. Box 513, Eindhoven, 5600MB, Netherlands, h.p.g.v.ooijen@tm.tue.nl

In this research we develop a procedure for adjusting the capacity on the short term for a job-shop like production system. This adjustment is a trade-off between the costs of varying the capacity and the expected tardiness costs. We consider situations with constant, order dependent or shopload-dependent lead times. The performance of our procedure is investigated by systematic computer simulation.

3 - An Integrated Approach to Inventory and Capacity Control under Periodic Stochastic Demand

Tarkan Tan, Assistant Professor, Eindhoven University of Technology, Paviljoen F-07, P.O. Box 513, Eindhoven, 5600MB, Netherlands, t.tan@tm.tue.nl, Osman Alp

In a manufacturing system with flexible capacity, inventory control can be coupled with capacity control in order to handle fluctuations in demand more effectively. A typical example is the use of contingent labor (temporary workers). In this talk, we discuss a model that integrates capacity control with inventory control under periodic stochastic demand. We analyze the characteristics of the solution to the integrated problem and present computational results.

■ WA35

T-Terrace (Terrace Level)

Strategic Implications of Mass Customization

Cluster: Mass Customization in Mfg
Invited Session

Chair: Rebecca Duray, Associate Professor, Univ of Colorado at Colorado Springs, 1420 Austin Bluffs Parkway, College of Business, Colorado Springs, CO, 80933, United States, rduray@mail.uccs.edu

1 - Strategies of Mass Customization

Rebecca Duray, Associate Professor, Univ of Colorado at Colorado Springs, 1420 Austin Bluffs Parkway, College of Business, Colorado Springs, CO, 80933, United States, rduray@mail.uccs.edu

One of the basic strategic decisions of a company is the selection of products to produce. The choice of product variety impacts the choice of production processes and operations strategy. In today's competitive market, many manufacturers are choosing to mass customize products. This paper explores the strategic orientation and the tactical operations strategies used to successfully achieve mass customizations through a longitudinal investigation of companies producing mass customized goods.

2 - Critical Success Factors for Mass Customization

Klaus Moser, Technische Universitaet Muenchen, Leopoldstrasse 139, Muenchen, 80804, Germany, k.moser@wi.tum.de

Empirical research on an overall concept of critical success factors for MC has not been done so far. Together with industry partners a model of success factors is currently been developed. In a later step this model will be tested through an empirical study that includes MC companies worldwide. The objective of the research project is an empirical founded concept of critical success factors for MC that explains the success and profitability of MC businesses.

3 - Modelling Virtual Build-to-Order (VBTO) Systems for Mass Customisation

Philip Brabazon, Research Fellow, Nottingham University, NUBS, Jubilee Campus, Nottingham, United Kingdom, philip.brabazon@nottingham.ac.uk, Bart MacCarthy

VBTO is an emerging order fulfilment approach in sectors with significant physical and planned (virtual) production pipelines, high product variety and a need to maintain continuous production cycles. It extends Locate-to-order by exploiting the volume and variety in the production pipeline. Markov modeling and discrete event simulation are used to study VBTO systems in relation to likelihood of fulfilment, modes of fulfillment, inventory behaviour and the importance of pipeline/variety ratio.

■ WA36

T-Capitol (Terrace Level)

Facilities Planning & Design

Contributed Session

Chair: Zsolt Ugray, Assistant Professor, Utah State University, BIS Department, 3515 Old Main Hill, Logan, UT, 84322-3515, United States, zsolt.ugray@usu.edu

1 - A Reference Model for Order-picking in a Warehouse

Andrew Johnson, Ph.D. Student, Georgia Institute of Technology, Industrial and Systems Engineering, 765 Ferst Drive NW, Atlanta, GA, 30332-0205, United States, ajohnson@isye.gatech.edu, Jinxiang Gu, Leon McGinnis

We introduce a reference model for order picking and define eight categories for order-picking systems. The reference model is used to describe the eight categories and to identify areas of the order-picking literature that currently are well described. We also outline the areas, that if developed, would improve the understanding of order-picking systems.

2 - Exact and Heuristic Procedures for the Material Handling Circular Flow Path Design Problem

Ardavan Asef-Vaziri, Assistant Professor, California State University, College of Business and Economics, 18111 Nordhoff St., Northridge, CA, 91330, United States, ardavan.asef-vaziri@csun.edu, Gilbert Laporte, Robert Ortiz

A binary integer programming model describes the problem of determining the circular flow path and locations of the pickup and delivery stations. The empty vehicle dispatching rule of shortest trip distance first is implemented inside the optimization model. We provide a decomposition procedure based on a loop enumeration strategy coupled with a streamlined integer linear programming model. We also propose a neighbourhood search heuristic method and report on its performance.

3 - Warehouse Sizing and Dimensioning to Minimize Total Life-Cycle Cost

Jinxiang Gu, Georgia Institute of Technology, School of Industrial and Systems Engi, Atlanta, GA, 30332, United States, gtg816c@prism.gatech.edu, Leon McGinnis, Marc Goetschalckx

We consider the sizing and dimensioning of a warehouse and its departments to minimize not only the initial investment, but also operational costs related to inventory and material handling. A mixed integer nonlinear model is formulated to capture the various tradeoffs in the warehouse sizing and dimensioning problem, and a generalized benders decomposition based algorithm is proposed to solve it to optimality.

4 - Selection and Scheduling of Interdependent Transportation Projects with Island Models

Xianding Tao, Senior Engineer, InDyne Inc., 6862 Elm Street, Suite 700, McLean, VA, 22101, United States, xtao66@yahoo.com, Paul Schonfeld

The paper developed island models, the variations of genetic algorithms, for optimization of project selection and scheduling under resources constraints, while utilizing the simulation to evaluate the project impacts. The simulation model is used to evaluate the total system cost. The study investigates the island models with different domain partitioning and solution migration methods. It shows that an island model can generally achieve better solutions than a conventional genetic algorithm.

5 - Workload Balancing in a Cross-docking Environment

Zsolt Ugray, Assistant Professor, Utah State University, BIS Department, 3515 Old Main Hill, Logan, UT, 84322-3515, United States, zsolt.ugray@usu.edu, Karina Hauser

We are looking at a special case of cross-docking, the widely used logistic technique to transfer incoming/outgoing shipments. In the studied environment multiple lanes are operated by several crew members. Our goal is to minimize the overall workload of the crew members while keeping the individual workloads balanced. We present the formulation of the problem and compare several approaches on how to solve it for a plant in the automotive industry.

■ WA37

T-Biltmore (Terrace Level)

Environment/Natural Resources

Contributed Session

Chair: Chialin Chen, Assistant Professor, Queen's University, Queen's School of Business, Kingston, ON, K7L 3N6, Canada, cchen@business.queensu.ca

1 - Controlling Ozone and Fine Particulates: Cost Benefit Analysis with Meteorological Variability

Jhih-Shyang Shih, Fellow, Resources for the Future, 1616 P St., NW, Washington, DC, 20036, United States, shih@rff.org, Michelle Bergin, Alan Krupnick, Armistead Russell

We develop an integrated framework for ozone and particulate control, accounting for meteorological variability. The framework includes simulation, sensitivity analysis and stochastic multi-objective air quality management model. We demonstrate the framework for alternative pollutant control policies. Alternative objectives for stochastic air quality management include optimization of the net social benefits and maximization of the reliability of satisfying air quality goals.

2 - WACFACS - A Decision Support Tool for Low Level Radioactive Waste Acceptance

Kenneth Redus, Principal, Redus and Associates, 189 Lafayette Drive, Suite C, Oak Ridge, TN, 37830, United States, kredus@icx.net

The Waste Acceptance Criteria Forecasting and Analysis Capability System (WACFACS) is used to accept the supply of waste at a Department of Energy low level radioactive waste landfill. WACFACS propagates uncertainties inherent in waste contaminants, disposition volumes, and project schedules to determine that risk-based performance standards are met. Trade-offs in schedule, volumes of waste lots, and allowable concentrations of contaminants are performed to optimize project waste disposition.

3 - Why Not a 40-MPG SUV? Analyzing the Effects of Green Product Development on the Natural Environment

Chialin Chen, Assistant Professor, Queen's University, Queen's School of Business, Kingston, ON, K7L 3N6, Canada, cchen@business.queensu.ca

We develop a model and conduct an empirical study to analyze the impacts of different strategies for developing products with environmental attributes on the natural environment. The analysis shows that the introduction of environmentally friendly products does not necessarily lead to better overall environmental quality, a result that is supported by the empirical data of vehicle fuel economy collected from the automobile industry.

■ WA38

T-Beverly (Terrace Level)

Stochastic Processes II

Contributed Session

Chair: Miguel Gomez-Sanchez, Associate Professor, Universidad de las Americas, Puebla, Department of Actuarial Sciences, Sta. Catarina Martir, Cholula, Puebla, 72820, Mexico, magomez@mail.udlap.mx

1 - Performance Evaluation of a Single Server Under Various Setup Policies

Ketan Khowala, Graduate Research Assistant, Arizona State University, Department of Industrial Engineering, Tempe, AZ, 85287, United States, Ketan.Khowala@asu..edu, Esma Gel, John Fowler

We present queueing approximations for several well-known setup policies (FIFO, setup avoidance, setup minimization, priority) to estimate the average cycle time at a single machine workstation. The formulas are exact for the FIFO case. We show, that the formulas developed for the other setup policies perform reasonably well using simulation results.

2 - A Queueing Model with Partial Processing Prior to Custom Service

Attahiru Alfa, Professor, University of Manitoba, Dept. Electrical & Computer Eng., Winnipeg, MB, R3T 5V6, Canada, alfa@ee.umanitoba.ca, Elizabeth Jewkes

Jobs are partially processed and then sent to a limited buffer queue to await final custom processing requests. The proportion of partial completion determines suitability for custom processing and how long it takes for complete final processing. We study queue length and the waiting time of requests.

3 - Spatial Service Systems with Customer Interactions

Matthew Jones, Ph.D Student, Georgia Tech, ISyE, 765 Ferst Drive NW, Atlanta, GA, 30332, United States, mojones@isye.gatech.edu, Richard Serfozo

We develop Markovian models of spatial service systems with customer interactions. As customers arrive into a general space, they may cause customers in the system to depart prematurely with a probability that is a function of the locations of the existing customers and the new arrivals. We establish that the stationary and limiting behavior of the customers in the system is a spatial Poisson process.

4 - Multi-Objective Optimization and Evolutionary Techniques: A Pareto Front Under Stochastic Conditions

Miguel Gomez-Sanchez, Associate Professor, Universidad de las Americas, Puebla, Department of Actuarial Sciences, Sta. Catarina Martir, Cholula, Puebla, 72820, Mexico, magomez@mail.udlap.mx, Carmen Flores-Mendoza, Harumi Shibata-Salazar

Real life applications involve more than one objective function. Traditional techniques use deterministic elements to solve network problems, but some recent studies incorporate discrete probability functions. In this study we incorporate both, the use of probability functions and the multi-objective evolutionary techniques to create a Pareto front for a stochastic shortest path problem. The results show that using evolutionary techniques it is not necessary to solve a complex set of equations.

■ WA39

T-Tower Court A (2nd Floor)

Supply Chain Management II

Cluster: Supply Chain Mgmt & Operations

Invited Session

Chair: Mahesh Nagarajan, Assistant Professor, University of British Columbia, 2053 Main Mall, Vancouver, BC, v6t1z2, Canada, mahesh.nagarajan@sauder.ubc.ca

1 - Optimal Replenishment with Two Delivery Sizes

Anita Parkinson, Ph.D student, University Of British Columbia, 2053 Main Mall, Vancouver, BC, V6T1Z2, Canada, parkinson@exchange.commerce.ubc.ca, S. Thomas McCormick

Consider a periodic review inventory system where a retailer can order in multiples of a fixed quantity Q, or multiples of 2Q, where the per unit material cost is less for ordering 2Q. We extend a result of Fangruo Chen to show that an optimal replenishment policy has a reorder point R, as well as a second parameter controlling when the last order should be for Q instead of 2Q.

2 - External Validation of OM Research

Hiroshi Ochiumi, Ph.D student, U.S.C, 3670 Trousedale pkwy, Los Angeles, CA, 90089, United States, ochiumi@marshall.usc.edu, Sriram Dasu

We present an exploratory frame-work for empirically determing the relative value of alternative operational levers. An objective of this research is to develop models that provide an adequate description of the production system, and at the same time allow us to use data from industry to identify the relative significance of alternative operational decisions. Our overall goal of this research is to provide external validity to optimization problems.

3 - How Much Demand Should be Fulfilled?

Amar Sapra, Cornell University, 278 Rhodes Hall, Ithaca, NY, 14850, United States, as236@cornell.edu, Rachel Zhang, Van Anh Truong

Almost all research in inventory management focuses on meeting customer demand with minimum inventory and stockouts. However, fashion retailers as well as everyday stores use expensive advertisements to create interest and then hold back production to create waiting lists. We study the impact of this strategy from the perspective of inventory management.

4 - Approximation Algorithms for Stochastic Inventory and Lot-Sizing Models

Retsef Levi, Ph.D Student, ORIE Department, Cornell University, 206, Rhodes Hall, Cornell University, Ithaca, NY, 14853, United States, rl227@cornell.edu, Martin Pal, Robin Roundy, David Shmoys

We consider several inventory control and lot-sizing models with finite horizon, periodic review and stochastic demands. We develop approximation algorithms for these models with proven worst-case performance guarantees on the expected cost they incur. The algorithms are extremely simple and robust. In particular, they allow correlation between the demands in different periods.

■ WA40

T-Tower Court B (2nd Floor)

Supply Chain Coordination II

Contributed Session

Chair: Jianghua Wu, Ph.D Candidate, Krannert School of Management, Purdue University, West Lafayette, IN, 47907, United States, wu8@mgmt.purdue.edu

1 - Optimal Production Across Markets with Stochastic Exchange Rates

Umut Aytekin, Ph.D Student, Northwestern University, Dept. of Industrial Eng. and Management, Sci. 2145 Sheridan Rd MEAS C210, Evanston, IL, 60208, United States, umut@northwestern.edu, John Birge

We consider a multinational manufacturer meeting demand in home and foreign markets in a stochastic exchange rate and a continuous-time framework for production decisions. When there is no cost to switch production, we find the value of the firm and characterize optimal foreign investment level. Given fixed costs to switch production, we find an optimal policy for switching production between the markets. We show how to determine the policy and examine the effects of varying parameters.

2 - Collaborations in Supply Chain: Value of Information Sharing

Namit Mehta, Consultant, Infosys Technologies Ltd., Electronic City, Husor Road,, Bangalore, 600119, India, Namit_Mehta@infosys.com, Devanath Tirupati

In a single-supplier, multiple-distributor setting, different levels of collaboration are defined based on the extent of demand related information shared in each period. The finite horizon, non-stationary stochastic multi-echelon inventory policy problem is solved to re-adjust the inventory policy parameters at the supplier. The value of information sharing is rigorously measured through numerical analysis based on an experiment design developed to represent various operating environments.

3 - Evaluating the Effect of Information Sharing and Production Control Strategies on Supply Chains

Shravan Krishnan, Ph. D Student, University of Arizona, Dept. of Systems and Industrial Eng., University of Arizona, Tucson, AZ, 85721, United States, shravank@email.arizona.edu, Ronald Askin

We examine the effect of various system policies on supply chain performance. We consider a pull system with and without information sharing, and a centralized push system with information sharing. We use experiment design to estimate the supply chain savings due to the use of information.

4 - Information Transformation in a Supply Chain: A Theoretical Analysis

Gang Li, Ph.D Student, University of Texas at Austin, Department of MSIS, B6500, Austin, TX, 78712-0212, United States, gang.li@mail.utexas.edu, Gang Yu, Shouyang Wang, Hong Yan

Our paper extends the two-stage supply chain model by Lee et al. (1997) to a multi-stage supply chain model. Applying the model, we study the forms and characteristics of information transformation and derive the rules for information propagation. Our work lays a theoretical foundation to some newly discovered phenomena and provides an explanation to the long-term controversial issue in economics on the validity of the production smoothing model.

5 - Information Visibilty and its Impact in a Supply Chain

Jianghua Wu, Ph.D Candidate, Krannert School of Management, Purdue University, West Lafayette, IN, 47907, United States, wu8@mgmt.purdue.edu, Ananth Iyer

This paper examines the impact of information visibility in a two-level supply chain consisting of an upstream manufacturer and many downstream retailers. We develop a game-theoretical framework to investigate the ex ante incentives for the retailers to share their private information. Our results show that boundary equilibria may reverse the retailer's incentives to share information.

■ WA41

T-Tower Court C (2nd Floor)

Supply Chain Management II

Contributed Session

Chair: Huimin Wang, Professor, Hohai University, 1 Xikang Road,, School of Business, Hohai University, Nanjing, 210098, China, Peoples Republic, huiminwang63@hotmail.com

1 - Construct Dynamic Supply Chain by Using Agent Negotiation

Jui-Wen Hung, Lecturer, Ling Tung College, NO.1, Ling Tung Rd.,, Taichung, 80408, Taiwan, harng@mail.ltc.edu.tw, Fu-Ming Lee

This paper proposes a Dynamic Information Exchange Center for creating a dynamic supply chain network in an Internet environment. Agent technology supports users in negotiating with upstream suppliers or downstream demanders and making decisions regarding partner selection. The framework allows enterprises to find more opportunities to cooperate with other partners. In business, such a framework not only reduces purchase costs but also saves time for enterprises in reaching agreements.

2 - Stratified Supplier Base Management: A Framework

Charuhas Padole, Student, Wichita State University, 1755 North Roosevelt Court, Wichita, KS, 67208, United States, cvpadole@wichita.edu, Mehmet Barut, Mehmet Yildirim

The current body of the knowledge in the literature is lacking to provide a generic framework for stratified supplier base management. This study attempts to bridge the gap by providing a framework considering many factors in conjunction with the phases of product life cycle, which gives the focal organization a holistic view of market. A matrix is presented to serve as a guide for organizations in creating their own supplier base to achieve their goals.

3 - Coordination of Stocking Decisions in an Assemble to Order Environment

Xiaohong Zhang, Business School, National University of Singapore, 1 Business Link, BIZ 1 Building, Singapore, 117592, Singapore, dsczxh@nus.edu.sg, Stephen M. Gilbert

We consider an environment in which components must be stocked in advance for a produce-to-order environment where demand is uncertain. Assembly capacity is limited depending on the demand and the availability of appropriate components. We first consider the first-best stocking policy for components, which is interesting in and of itself. We then consider how different forms of contract between the assembler and the component manufacturers will affect coordination.

4 - The Present Situation and Development Trend of Supply Chain Management in China

Huimin Wang, Professor, Hohai University, 1 Xikang Road,, School of Business, Hohai University, Nanjing, 210098, China, Peoples Republic, huiminwang63@hotmail.com

In this presentation, we summarize the current research status on supply chain management (SCM) in China. Based on some Comparison and analysis with the western countries as well a special consideration of the China's present practice, we point out that the application of SCM in the aspect of natural resource allocation will be a new direction.

■ WA42

T-Tower Court D (2nd Floor)

Forecasting

Contributed Session

Chair: Nezih Altay, Assistant Professor, University of Richmond, Robins School of Business, Richmond, VA, 23173, United States, naltay@richmond.edu

1 - Improving Strength Conservation in the Civilian Forecasting System (CIVFORS)

Reid Gilliam, Operations Research Analyst, AT&T Government Solutions Inc., 1900 Gallows Road, Vienna, VA, 22182, United States, rbgilliam@att.com

CIVFORS produces short-term and long-term forecasts of workforce strength and personnel actions on a quarterly basis. Strength conservation error (SCE) is produced when strength in a given time period does not equal the prior period strength plus all gains, minus all losses to the workforce. A new algorithm recomputes strength using integer-valued personnel action counts and resolves resulting negative strength counts in an innovative way, thus reducing SCE to negligible levels.

2 - Relationship Between Revenue Management and Discounted Ticket Fare Level of Inter-city Rapid Train

Saratchai Ongprasert, Mr., Kochi University of Technology, Department of Infrastructure Systems Eng, 185 Miyanokuchi, Tosayamada-cho,Kami-gun, Kochi, 7828502, Japan, zrushayee@hotmail.com, Shintaro Terabe

Multinomial Logit model (MNL) was applied in this research to estimate passenger demand, both the inter-city rapid train and its competitors, which was the effect of discounted fare ticket.Passengers' behaviors including Stated Preference (SP) were surveyed for the O-D of Northern Kyushu and Kinki area.The passengers' demand estimation model was separated into 2 groups;passengers who prefer inter-city rapid train (Shinkansen) and air transportation.

3 - Real Tme Tracking and Prediction of Vehicle Platoons

Lili Pu, Research Assistant, University of Arizona, ATLAS Research Center, 1216 E 8th St., Tucson, AZ, 85719, United States, pll@email.arizona.edu, Pitu Mirchandani

This paper presents a new model for real time tracking and matching of freeway platoons. The model dynamically estimates each driver's short term goals and characteristics. It combines an integrated driving behavior model of Toledo (2003) with a Bayesian estimation method as well as a network flow algorithm. Each model component is introduced and, for computational experience, three platoons are tracked satisfactorily with this model.

4 - Effects of Forecasting Error on Optimal Continuous Review Inventory Policy for Lumpy Demand Items

Nezih Altay, Assistant Professor, University of Richmond, Robins School of Business, Richmond, VA, 23173, United States, naltay@richmond.edu, Ibrahim Kurtulus

The challenge in managing spare parts is forecasting demand for better inventory planning. This research pursues the answers to the following questions: How does the choice of forecasting method affect the inventory policies of the firm? And, when demand is intermittent do traditional statistical error measures reveal the same forecasting method as the best choice compared to economic measures.

■ WA43

T-Denver (Mezzanine)

New Product Development I

Contributed Session

Chair: Renato de Matta, Associate Professor, University of Iowa, 108 PBB, Iowa City, IA, 52242, United States, renato-dematta@uiwo.edu

1 - Goal Programming Model for Optimizing Product Modularity at Early Stages of PDD

Bimal Nepal, Ph.D. Candidate, Wayne State University, Dept. of Industrial & Manufacturing Engg, 4815 Fourth Street, Detroit, MI, 48202, United States, bnepal@wayne.edu, Leslie Monplaisir, Nanua Singh

The modularity helps to develop more product variety at lower cost. This paper presents a Chebychev's goal programming model to simultaneously optimize modularity and cost of product architecture during concept development phase. However, this framework can be generalized to include more number of objectives. Fuzzy logic is used to analyze the information available at early stages of product development. Two case study results are presented to demonstrate the application of the proposed model.

2 - After Sales Service, Product Line Design, and Supply Chain Decision

Wenge Zhu, University of Texas at Austin, 1630 W 6th St Apt. E, Austin, TX, 78703, United States, zwenge@mail.utexas.edu

We consider the impact of after sales service offerings on firms' product line and channel decision when the firms start to view the services as an important revenue source. We show that by managing the transition from transaction-based service to relation-based service, the firm is more profitable by offering better tailored services and better differentiated service.

3 - Managing Product Variety in a Supply Chain

Renato de Matta, Associate Professor, University of Iowa, 108 PBB, Iowa City, IA, 52242, United States, renato-dematta@uiwo.edu, Tim Lowe, Lifang Wu

Managing the production and marketing of vertically differentiated products presents challenges. A firm must determine the product offerings, qualities and prices. We develop analytic models to study the relationships among the product variety, design and pricing decisions in a centralized and decentralized supply chain. An optimal scheme to coordinate the product variety and pricing decisions of a manufacturer and a retailer in a decentralized supply chain is presented.

■ WA44

T-Spruce (Mezzanine)

DEA Methology

Cluster: Data Envelopment Analysis

Invited Session

Chair: John Ruggiero, University of Dayton, 517 Miriam Hall, Dayton, OH, United States, John.Ruggiero@notes.udayton.edu

1 - Measurement Error, Education Production and Data Envelopment Analysis

John Ruggiero, University of Dayton, 517 Miriam Hall, Dayton, OH, United States, John.Ruggiero@notes.udayton.edu

DEA has become a popular tool for evaluating the efficiency of DMUs. The approach has been widely applied to educational production. The deterministic approach leads to biased estimates in the presence of measurement error. In this paper, we exploit known properties of educational production to show that aggregation can also have a smoothing effect on production with measurement error, suggesting that efficiency analyses are more reliable than previously believed.

2 - Logistic Regression based Discriminant Analysis as an integral part of a DEA controlling for quality

Ole Olesen, United States, ole@sam.sdu.dk

Differences in quality are represented in a DEA model by an estimated probability of getting bad or good quality while controlling for exogenous characteristics. Inference of the relative probabilities are estimated as an integral part of the DEA by either a logistic regression or logistic regression based discriminant analysis. Two extended DEA models are applied to Danish data on hospital performance ...

3 - Selecting DEA Variables: A Stepwise Method

Daniel G. Shimshak, University of Massachusetts Boston, Department of Management Science and Information Systems, 100 Morrissey Blvd, Boston, MA, 02125, United States, daniel.shimshak@umb.edu, Janet Wagner

One of the most important steps in the application of DEA modeling is the choice of input and output variables. In this paper we develop a "stepwise" approach to variable selection by selecting variables with the largest impact on the results by considering the impact of each variable on the total change in efficiency scores. This intuitively appealing method is demonstrated on classic DEA datasets.

■ WA45

T-Gold (Mezzanine)

Operations Management II

Contributed Session

Chair: Richard Vail, Mesa State College, 1100 North Avenue, Grand Junction, CO, 81501-3122, United States, rvail@mesastate.edu

1 - Efficiency Assessment of Portering Operations

Li Chen, Centre for Operations Excellence, University of British Columbia, 2053 Main Mall, Vancouver, Canada, li.chen@coe.ubc.ca, Martin L. Puterman, Frederik Odegaard, Mats Gerschman, David Puterman, Ryan Quee

Timely access to portering services in hospitals is very important as it may cause congestion in upstream operations and poor utilization of limited resources when patients cannot be moved away from a congested area soon enough. We were asked to measure performance and structure portering services from a system point of view for two Canadian hospitals. A simulation model is used to schedule staffing levels and to optimize the system structure for enhancing service levels.

2 - The Dynamics of Price, Quality and Productivity Improvement Decisions

Jozsef Voros, University of Pecs, Rakoczi 80, Pecs, Hungary, voros@ktk.pte.hu

A model is introduced to guide a firm in addressing price-quality-improvement decisions. Demand for the product in the industry depends on both price and performance quality. Increasing productivity knowledge decreases unit production cost, but demand for the company's product decreases over time.The paper provides an optimal control formulation of the problem and develops necessary conditions for optimality and characterizes the dynamics of optimal price, quality and investment decisions.

3 - On the Interactions Between Routing and Inventory-Management Policies 1-Warehouse N-Retailer Supply

Xin Zhai, Krannert School of Management, Purdue University, 403 West State Street, West Lafayette, IN, 47907-2056, United States, xzhai@mgmt.purdue.edu, Leroy Schwarz, James Ward

We believe that this paper is the first to explicitly examine the interactions between routing and inventory-management policies in a two-level supply chain. Our goal is to determine a combined system inventory-replenishment, routing, and inventory-allocation policy that minimizes the total expected cost/period of the system over an infinite time horizon. We determine the optimal static route; and develop/test heuristics for dynamic routing.

4 - Exploring the Service Profit Chain using an Agent-based Model

Richard Vail, Mesa State College, 1100 North Avenue, Grand Junction, CO, 81501-3122, United States, rvail@mesastate.edu

Service profit chain theory links profitability through customer loyalty to employee satisfaction and capabilities. To gain new insight into the emergent properties of a professional service profit chain, a model was built in the near-English' language NetLogo programming environment with customers and employees as agents.

Wednesday 10:00am-11:30am

■ WB01

P-Ballroom F

Tutorial: Connecting mrp, MRP II and ERP Supply Chain Planning via Optimization Models

Cluster: Tutorials- Denver 2004
Invited Session

1 - Connecting mrp, MRP II and ERP Supply Chain Planning via Optimization Models
Stefan Voss, Professor, University of Hamburg, Dept. of Information Systems, Von-Melle-Park 5, Hamburg, 20146, Germany, stefan.voss@uni-hamburg.de

This tutorial begins with a broad overview of operations research in the supply chain area; we then focus on optimization applications in production planning in a supply chain. We demonstrate by construction that we can begin with mrp and MRP II and end up with a useful basis for a planning model. In order to produce a useful model, we add extensions and ultimately arrive at models that bear little resemblance to mrp and certainly solutions for the optimization problems cannot be obtained using mrp or MRP II processing or logic. We display implementations of these models in five popular modeling languages. As time permits, we will highlight connections with hierarchical systems for planning and detailed scheduling.

■ WB02

P-Ballroom E

Marketing I

Contributed Session

Wouter Buckinx, Research assistant, Ghent University, Hoveniersberg 24, Ghent, 9000, Belgium, Wouter.Buckinx@Ugent.be

1 - How to Design and Price a High-tech Bundle under Competition
Juan-Carlos Ferrer, P. Universidad Católica de Chile, United States, jferrer@ing.puc.cl, Gabriel R. Bitran

This research addresses the problem of how to determine the composition and price of a bundle so as to maximize total expected profits. The setting is a high-tech company in a highly competitive environment. Bundles are set of components that must meet technical constraints. The company's objective is to build a bundle and offer it in a market where it will compete with other bundles. Consumers purchase the bundle that maximizes their utility after examining all available bundles. The company selection of the bundle's components and its price is made in light of the bundles with which it will be competing in the market and the uncertainty in the consumer choice process. The optimal decision can be found by solving a nonlinear mixed integer program. We propose a solution method to determine the optimal composition for the bundle and the price at which it should be offered.

2 - Antecedents of Brand Loyal Behavior: Investigating the Influence of Brand Attribute
Michael Martell, Business Student, School of Business and Economics, Indiana University Northwest, United States, mike@ecopiersplus.com, Subir Bandyopadhyay

Despite a plethora of studies on brand loyalty over last thirty years, the research paradigm is unique in its inability to produce generalizable results. The research suffers from a lack of agreement over the operationalization of the construct of brand loyalty. Many researchers (e.g., Blattberg and Sen 1974, Kahn et. Al. 1986, and Ehrenberg et. al. 1990) have defined brand loyalty only from a narrow behavioral perspective. The underlying assumption is that repeat purchasing can capture the loyalty of a consumer towards the brand of interest. Many other researchers (e.g., Baldinger and Rubinson 1996, and Dick and Basu 1994), however, have cast a doubt on this practice because it fails to distinguish between "spurious loyalty" as captured by the behavioral patterns and "true loyalty" that extends beyond the regular purchasing of a brand. In order to circumvent the inherent limitations of a purely behavioral measurement of brand loyalty, many researchers (e.g., Day 1969, Jacoby 1971, Dick and Basu 1994, Baldinger and Rubinson 1996) have suggested that attitude should be included along with behavior to define loyalty. In particular, Dick and Basu (1994) were precise in suggesting that a favorable attitude and repeat purchase were required to define loyalty. By viewing loyalty as an attitude-behavior relationship in their framework, they were thus able to investigate the concept from a causal perspective thereby permitting the identification of the antecedents of loyalty. Their research, however, offers only a theoretical framework, and thus validation through empirical results is still awaited. Our research attempts to fill this important void in the brand loyalty literature. We propose a conceptually clear, and operationally meaningful way of segmenting the market on the basis of not only the behavior patterns (i.e., sole-, multiple-, and non-users) but also on the basis of the antecedent attitudes that govern this behavior. Finally, using a unique survey data set that includes both behavioral (purchase) patterns and attitudes of the respondents for all major brands of toothpaste, we demonstrate a generalizable pattern of brand specific attitudinal loyalty across all brands of the toothpaste category.

3 - How to Deal With Member Drop-Outs? Developing an Effective Retention Strategy for the Fitness Services Industry
Subir Bandyopadhyay, Associate Professor of Marketing, Indiana University Northwest, School of Business & Economics, 3400 Broadway, Gary, IN, 46408, United States, sbandyop@iun.edu, Kumar Banerjee

Starting January 1st of every year, thousands of health and fitness conscious exercisers flock to their local health club, at yet another attempt in making their New Year's resolution of getting into shape a reality. Regardless of their good intentions and even financial commitment, about half of these people that join health clubs will stop exercising after six months. This group of people, "low users", "de-conditioned" or "new-members", pose a real problem to the fitness club industry as they represent a significant loss to the business. However, for marketers, this group of "low users" represent an ideal market of consumers, which according to Handelsman (1999), is made up of more than 29.5 million health club members who are affluent, educated, professional, and have a proven willingness to spend money on their own personal well being. This study sheds light on the reasons why so many exercisers cease to continue with their exercise regimen, and provide solutions (such as effective retention programs) so that future marketers will have greater insight when targeting this untapped yet lucrative market. Additionally, examples of successful businesses are presented in order to provide a basis for future business opportunities.

4 - Successfully Predicting Customer Loyalty using the Internal Customer Database
Geert Verstraeten, Research Assistant, Ghent University, Department of Marketing, Hoveniersberg 24, Ghent, -, 9000, Belgium, geert.verstraeten@ugent.be, Wouter Buckinx, Dirk Van den Poel

Loyalty and targeting are central topics in CRM. Yet, the information that resides in customer databases only records transactions at a single company, whereby customer loyalty is generally unavailable. In this study, we enrich the customer database with a prediction of a customer's loyalty such that it can be deployed for targeted marketing actions. To this end, we compare three predictive techniques, and show the importance of avoiding overfitting by using variable-selection procedures.

5 - "Loyalty" Programs: Are they Designed to Reward Loyals?
Wouter Buckinx, Research assistant, Ghent University, Hoveniersberg 24, Ghent, 9000, Belgium, Wouter.Buckinx@Ugent.be, Geert Verstraeten, Dirk Van den Poel

Past literature supports that loyal customers are beneficial for a company and therefore need to be rewarded. However, companies are usually rewarding customers based on proxy variables like spending and lifetime because they are easily accessible.This study shows a new method to reward customers in proportion to their loyalty by building a predictive model. Moreover, we can demonstrate that programs based on predicted loyalty are more efficient to remunerate loyals than traditional methods are.

■ WB03

P-Plaza Court 1

Applied Probability I

Contributed Session

Chair: Ramandeep Randhawa, Stanford University, Grad. School of Business, Stanford, CA, 94305, United States, rsr@stanford.edu

1 - Optimization and Statistics: MLE for Multivariate Hypergeometric Probability Distributions
Tom Knowles, Professor, Illinois Institute of Technology, Stuart Graduate Sch. of Bus., 565 West Adams Street, Chicago, IL, 60661, United States, knowles@stuart.iit.edu

The Multivariate Hypergeometric probability distribution classifies each member of the population into one of K categories. The population size is known as well as the number in each category in a sample are known. Maximum likelihood estimates (MLEs) are needed for the number in each category of the population. The concavity of the likelihood function is proved. An ILP model is presented with a naturally integer solution. Also, a "greedy" algorithm is presented to give the MLEs.

2 - Stocking and Pricing Reusable Products for Subscribers
Ramandeep Randhawa, Stanford University, Grad. School of Business, Stanford, CA, 94305, United States, rsr@stanford.edu, Sunil Kumar

We consider a firm that offers reusable products to a fixed number of subscribers who are sensitive to price and quality of service. Each subscriber switches between two states ON and OFF, using the product in the ON state if feasible until turned OFF, and repeating. We analyze the asymptotic regime where the number of potential subscribers increases without bound and use it to compute the optimal number of units that must be stocked, and the optimal price to be set by the manager.

3 - Optimal Routing in Output-Queues Flexible Server Systems
Alexander Stolyar, Member of Technical Staff, Bell Labs, Lucent Technologies, 600 Mountain Ave, 2C-322, Murray Hill, NJ, 07974, United States, stolyar@research.bell-labs.com

We consider a flexible parallel server queueing system, and study an "output-queued" (OQ) version, where each customer must be routed to one of the servers immediately upon arrival. We introduce 'MinDrift' routing rule for an OQ-systems, and show that it induces optimal system behavior under heavy load, which matches the optimal behavior of the corresponding "input-queued" systems. We also show that some known 'stable' algorithms are suboptimal under heavy load.

■ WB04

P-Plaza Court 2

Scheduling II

Contributed Session

Chair: Alex Ruiz-Torres, Associate Professor, Polytechnic University of Puerto Rico, PO Box 192017, San Juan, PR, 00919, United States, aruiztor@msn.com

1 - Single Machine Batch-Scheduling to Minimize Total Completion Time and Resource Consumption Costs
Dvir Shabtay, McMaster University, MGD A114, Hamilton, ON, L8S 4M4, Canada, shabtay@mcmaster.ca, George Steiner

We study the single machine batch-scheduling problem where both set-up and job processing times are controllable by allocating a continuously divisible nonrenewable resource. We present a polynomial time algorithms to find the job sequence, the partition of the jobs to batches and the resource allocation, which minimizes the total completion time and the total production cost.

2 - Dynamic Scheduling in Assembly Flow Shop Environments Considering Earliness and Tardiness
Leonardo Bedoya-Valencia, Ph.D Student, Old Dominion University, 129 Kaufman Hall, Norfolk, VA, 23529, United States, lbedo001@odu.edu, Yaneth Cristina Correa-Martinez, Ghaith Rabadi

Dynamic assembly flow shop problems are among the most difficult scheduling problems. The work on assembly problems has been focused on regular measures of performance. Also, dispatching rules have been used to solve dynamic problems. In this work, earliness and tardiness are to be considered. This problem is known in the literature as the early tardy problem. Minimizing earliness would reduce the holding cost while minimizing tardiness would reduce the cost of missing due dates.

3 - A Column Generation Approach for a Vessel Scheduling Transportation Problem
Jafar Ali, Associate Professor, Kuwait University, Quantitative Methods & Information Systems, College of Business Administration, Kuwait, Kuwait, jafar@cba.edu.kw, Salem Al-yakoob

This paper presents an integer programming model and a column generation approach for a vessel scheduling problem. The number of constraints in the model based on realistic instances are moderate. In contrast, the overwhelming number of columns in the model, render a model whose linear relaxation is intractable. However, the continuous relaxation of the model can be solved by a column-generation method. Consequently, a column-generation heuristic is developed and tested.

4 - Investigation of Resource Flexibility in Parallel Machines To Minimize Makespan and Total Tardiness
Alex Ruiz-Torres, Associate Professor, Polytechnic University of Puerto Rico, PO Box 192017, San Juan, PR, 00919, United States, aruiztor@msn.com

This research addresses the scheduling of jobs and the assignment of a secondary flexible resource on identical parallel machines. In this problem the time to process a job depends on the quantity of this flexible resource. Two measures of performance are considered, the makespan and the average tardiness. The paper presents solution methodologies and their performance, comparing them to heuristics previously proposed for the makespan problem.

■ WB05

P-Plaza Court 3

Optimization Techniques II

Contributed Session

Chair: Hong Ryoo, Assistant Professor, Korea University, Industrial Systems & Information Eng., 1, 5-Ka, Anam-Dong, Sungbuk-Ku, Seoul, 136-701, South Korea, hsryoo@korea.ac.kr

1 - Bounds on the Value of Stochastic Mixed-Integer Programs
Burhaneddin Sandikci, University of Pittsburgh, 1048 Benedum Hall, Pittsburgh, PA, 15261, United States, bus2@pitt.edu, Nan Kong, Andrew Schaefer

We consider a general two-stage stochastic mixed-integer program, where randomness appears in all the second-stage components of the program. We present bounds for the optimal objective value of this problem. These bounds differ from those of Birge (1982), i.e., the sum of group expected values (SGEV) bounds. Computational results for both stochastic linear and integer programs are also presented.

2 - New Optimization Algorithm for Support Vector Machine in Text Categorization
Yaquan Xu, University of Mississippi, P.O. Box 6829, University, MS, 38677, United States, axu@olemiss.edu, Sumali Conlon, Gary Kochenberger, Haibo Wang, Bahram Alidaee

Support vector machine has been a promising method for the text categorization because of its solid mathematical foundation that convey several properties that other method do not provide. In this paper we use binary feature which is easier to obtain comparing with TF feature and apply tabu search algorithm as the optimization method to solve. our purpose is to find a way that dramatically reduce the system computing time and without losing precision and recall rate .

3 - A Methodology to Optimize Foundation Seminar Assignments
Keith Willoughby, Bucknell University, Department of Management, Lewisburg, PA, 17837, United States, kwilloug@bucknell.edu, Christopher J. Zappe

First-year students entering Bucknell University are required to enroll in a first-year experience course called a Foundation Seminar. Before arriving at Bucknell, students submit a prioritized list of these courses. Using both manual and heuristic methods, officials make assignments based on capacity and scheduling constraints. We propose to apply an optimization methodology in an attempt to determine assignments that better satisfy the highest preferences of entering first-year students.

4 - Conditons of Minimax Existence Under Integral Transportation Constraints
Vladimir Tsurkov, Professor, Computing Center of RAS, 40 Vavilov str., Moscow, 119991, Russia, tsurkov@ccas.ru, Anatoly Mironov

A method of charactristic equations is proposed for finding minimax of functions of two arguments in a rectangle. The integrals of these nonnegative functions with respect to each variable are bounded by given staircase functions for which integral balance condition holds, by analogy with classical transportation problem.

5 - MILP Approach for Pattern Generation in Logical Analysis of Data
Hong Ryoo, Assistant Professor, Korea University, Industrial Systems & Information Eng., 1, 5-Ka, Anam-Dong, Sungbuk-Ku, Seoul, 136-701, South Korea, hsryoo@korea.ac.kr, In-Yong Jang

We develop a compact MILP-based procedure for pattern generation in Logical Analysis of Data (LAD). Extensive experiments with various two- and multi-class databases from the University of California at Irvine repository of machine learning databases and domain theories demonstrate that the proposed procedure is efficient as well as effective and presents a practical way of generating patterns in LAD.

■ WB06

P-Plaza Court 4

Problems on Graphs: Solution Methods and Applications

Sponsor: Optimization/ Integer Programming
Sponsored Session

Chair: Wilbert Wilhelm, Professor, Texas A&M University, Department of Industrial Engineering, TAMUS 3131, College Station, TX, 77843-3131, United States, wilhelm@tamu.edu

1 - Maximum Clique Problems in Massive Data Sets
Panos Pardalos, Professor, University of Florida, 303 Weil Hall, Gainesville, FL, United States, pardalos@ufl.edu

We discuss exact algorithms and heuristics for solving maximum clique problems in massive data sets. Such problems appear in telecommunications, social, and biological networks.

2 - Tight Inequalities for t-designs
Illya Hicks, Texas A&M University, TANUS 3131, College Station, TX, United States, ivhicks@tamu.edu, Ivette Arambula

We introduce Chvatal-Gomory inequalities and other new classes of tight inequalities for t-designs. The classes of tight inequalities can be used equivalently in the construction of t-designs by polyhedral methods. We analyze and computationally evaluate these classes for the construction of t-designs where the separation problem is formulated as a constrained edge-weighted bi-clique problem in a bipartite graph.

3 - Critical Sets and the Maximum Independent Set Problem
Sergiy Butenko, Assistant Professor of Industrial Engineering, Texas A&M University, 236E Zachry Engineering Center, College Station, TX, 77843-3131, United States, butenko@tamu.edu

Given a simple undierected graph, a critical independent set is an independent set for which the difference between its cardinality and the cardinality of its neighborhood is maximized. The maximum independent set problem is a well known NP-hard problem. On the other hand, the problem of finding a critical independent set is polynomially solvable. We investigate the possibility of using critical independent sets of a graph for the maximum independent set problem solving.

4 - Partitioning Methods for the Maximum Weight Independent Set Problem
Illya Hicks, Texas A&M University, TANUS 3131, College Station, TX, United States, ivhicks@tamu.edu, Sandeep Sachdeva, Deepak Warrier, Jeffrey Warren, Wilbert Wilhelm

We describe a branch-and-price approach to the maximum weight independent set problem and present computational results using several vertex-set partitioning schemes.

■ WB08

P-Plaza Court 6

Dynamic Programming/Control in Supply Chain

Contributed Session

Chair: Earnest Foster, Research Engineer, GM, 30500 Mound Rd, Mail Code: 480-106-359, Warren, MI, 48090, United States, earnest.foster@gm.com

1 - Optimality of an (s,S) Policy with Compound Poisson and Diffusion Demands: A QVI Approach
Alain Bensoussan, Professor, University of Texas at Dallas, School of Mgmt., SM30, P.O. Box 830688, Richardson, TX, 75083-0688, United States, alain.bensoussan@wanadoo.fr, Ruihua Liu, Suresh Sethi

We prove that an (s,S) policy is optimal in a continuous-review stochastic inventory model with a fixed ordering cost when the demand is the sum of a diffusion process and a compound Poisson process. The proof uses the theory of impulse control. The Bellman equation for our problem reduces to a set of quasi-variational inequalities (QVI). An analytical study of the QVI leads to showing the existence of an optimal policy as well as the optimality of an (s,S) policy.

2 - An Pricing and Inventory Control for Perishable Products in a Two-Echelon Supply Chain
Sun Park, Student, Kaist, Kusong-dong 373-1, Yusong-ku, Daejon, South Korea, tempest@kaist.ac.kr, Chang Sup Sung

This paper considers a pricing and inventory control for perishable products in an (1:N) supply chain system where demands depend on retail price and (s,S) ordering policy is considered. The objective is to maximize the expected average profit of the chain where inventory is subject to lost due to perishing. Some approximations are made on the objective function and then an associated solution method is derived.

3 - Statistical Process Control and Delivery Chains
Earnest Foster, Research Engineer, GM, 30500 Mound Rd, Mail Code: 480-106-359, Warren, MI, 48090, United States, earnest.foster@gm.com

We examine a delivery chain application for process performance improvement using Statistical Process Control (SPC). Travel times along delivery chain routes are collected and monitored with SPC tools. Process variables are the elapsed times from origins to destinations. The disaggregating of process variables by delivery mode allows a process-oriented analysis. In addition, we show how a ëbundled' control chart reduces the number of charts monitored for larger delivery chains.

■ WB09

P-Plaza Court 7

Optimization Techniques III

Contributed Session

Chair: Gyana Parija, Research Staff Member, IBM Research, 1101 Kitchawan Road, Route 134, Yorktown Heights, NY, 10598, United States, parija@us.ibm.com

1 - Subsequential Convergence of DIRECT
Daniel Finkel, Graduate Student, North Carolina State University, Operations Research, Box 8205, Raleigh, NC, 27695, United States, definkel@eos.ncsu.edu, C.T. Kelley

DIRECT is a direct search optimization algorithm that aggressively searches for the global minima of a real valued objective function. The algorithm does not use derivative information in its search; instead it relies on the iteration history to determine its sampling locations. In this talk, we describe DIRECT, and introduce our new nonsmooth convergence analysis of the algorithm.

2 - Parametric Ghost Image Processes for Fixed-Charge Problems: A Study of Transportation Networks
Mehdi Amini, Fogelman College of Business and Economics, The University of Memphis, Memphis, TN, 38152, United States, mamini@memphis.edu, Fred Glover, Gary Kochenberger

We present a parametric approach for solving fixed-charge problems. The network models treated by our method include the most general members of the network flow class, consisting of generalized networks that accommodate flows with gains and losses. Computational comparisons reveal that our approach performs exceedingly well on a comprehensive testbed problems.

3 - Strategic Budgeting for Initial Response Costs Incurred in Wildfire Management
Gyana Parija, Research Staff Member, IBM Research, 1101 Kitchawan Road, Route 134, Yorktown Heights, NY, 10598, United States, parija@us.ibm.com, Brian Booher, Dan Keller

We will present an IP model for optimizing the initial response (IR) organization needed to maximize the effectiveness of various fire containment activities. An initial response organization could consist of a set of hand crews, engines, bulldozers, helicopters, and the like.

■ WB10

P-Plaza Court 8

Transportation III

Contributed Session

Chair: Janny Leung, Professor, The Chinese University of Hong Kong, Systems Engineering & Eng. Mgt. Dept.,, The Chinese University of Hong Kong, Shatin, Hong Kong, janny@se.cuhk.edu.hk

1 - Train Dispatching System with Deadlock Avoidance
Worawan Suteewong, University of Southern California, Industrial and System Engineering, Los Angeles, CA, 90089, United States, suteewon@usc.edu

Train dispatching can be a complex problem because a rail network configuration may consist of a single-track in some locations and multiple-tracks in other locations. In this presentation, we propose a train dispatching configuration in a multiple-track rail network which ensures a deadlock-free solution while minimizing total train traveling times. We implement this by using a graphical technique and utilizing a genetics algorithm as our methodology to find the optimal solution.

2 - Transit Timetable Synchronization: Evaluation and Optimization
Charles Fleurent, Manager - Optimization algorithms, GIRO Inc., 75, Port-Royal East, suite 500, Montreal, QC, H3L3T1, Canada, charles.fleurent@giro.ca

Trip synchronization is an important issue for most public transit companies. Minimizing waiting times for transfers between trips can improve customer satisfaction, which in turn leads to increases in ridership and revenues. This paper presents an elaborate measure of synchronization so it reflects the real concerns of schedulers in practice. It also proposes an optimization approach that embeds trip synchronization into a global algorithm that can minimize other vehicle scheduling costs.

3 - Analysis of Vehicular Delays and Queues at Intersection with Adaptive Control
Ning Zou, Systems and Industrial Engineering Department, The University of Arizona, United States, zoun@email.arizona.edu, Pitu Mirchandani

We develop a queuing model for analyzing vehicular delays and queue distributions at an intersection with a two-phase signal. The vehicle arrival process is Poisson for both fixed time signal control and traffic-adaptive signal control. The adaptive signal control strategy is an approximation of the RHODES strategy (Mirchandani and Head, 2001), which essentially “switches to next phase when the served queue clears.” Numerical results for the two control strategies are provided and compared.

4 - Timetable Synchronization for Mass Transit Railway
Janny Leung, Professor, The Chinese University of Hong Kong, Systems Engineering & Eng. Mgt. Dept.,, The Chinese University of Hong Kong, Shatin, Hong Kong, janny@se.cuhk.edu.hk, Rachel Wong

In public transport systems, passengers would like to interchange between different lines with minimal delay. We propose a mixed-integer-programming model for designing timetables to minimize interchange waiting-times of all passengers. A novelty in our formulation is the correct representation of waiting-times for the “next available” train, using binary variables. Preliminary numerical results indicate significant improvements in synchronization over current practice.

■ WB11

P-Governor's Square 9

Transportation IV

Contributed Session

Chair: Daniel J. Dailey, Professor, University of Washington, Box 352500, Dept. of Electrical Engineering, Seattle, WA, 98155, United States, dan@its.washington.edu

1 - Decision Rules for Allocation of Dock Storage Space for Export Containers

Evangelos Kaisar, University of Maryland, 1173 Glen Martin Hall, College park, United States, kaisar@glue.umd.edu, Ali Haghani

Container terminals are an important issue In order to reduce berthing time, the terminal managers must select accessible and efficient storage locations for containers that arrive in the port to be loaded on the vessel. Dynamic programming model is formulated to determine the storage locations to minimize the number of re-handling movements expected for the loading operations. Also, we develop a decision tree from the set of optimal solutions to support space allocation decisions.

2 - Models Algorithms of Vehicle Rescheduling Problem

Jingquan Li, University of Arizona, SIE, Tucson, AZ, 85721, United States, jingquan@email.arizona.edu, Pitu Mirchandani

Vehicle rescheduling problem presented considers the situation where one vehicle becomes disabled. The objective is to minimize the total operating and delay costs with the constraints that include 1) picking up the passengers from the disabled vehicles, and 2) finishing all of the remaining trips. We model the vehicle rescheduling as several vehicle scheduling problems, and the efficent algorithms will be presented.

3 - The Impact of the Los Angeles Transit Strike on Highway Transportation

Shih-Che Lo, National Taiwan University of Science and Technology, Department of Industrial Management, 43 Keelung Road, Section 4, Taipei, 106, Taiwan, sclo@mail.ntust.edu.tw, Randolph Hall

The 2003 mass transit strike in Los Angeles was the second in 3 years. In LA County, where 7 million motor vehicles are registered, displacement of 500,000 transit riders would seem to have a small effect on roadways. Nevertheless, because delay on congested roadways is highly sensitive to changes in traffic, even a small disruption can have significant impact. We investigate the impact of the transit strike through analysis of highway sensor data by using a before-and-after comparison.

4 - Data Integration and Web Apps for a Multi-Modal/Multi-Agency Transit

Daniel J. Dailey, Professor, University of Washington, Box 352500, Dept. of Electrical Engineering, Seattle, WA, 98155, United States, dan@its.washington.edu, Stuart Maclean, Frederick Cathy

We present a set of web apps for use in a multi-modal transit system. This set of applications depends upon multi-modal transit data and the ability to use this data in an integrated manner. A framework for transit data whose concepts span the implementations by the four agencies is presented. These data concepts are compared to the TCIP data dictionary concepts. A set of web applications that operate using a standard schema to integrate the various multi-modal data available are described.

■ WB12

P-Governor's Square 10

Inventory Modeling V

Contributed Session

Chair: 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

1 - The Value of Supply Process Asset Visibility in Inventory Control

James Luedtke, Student, Georgia Institute of Technology, 765 Ferst Drive NW, Atlanta, GA, 30332-0205, United States, jluedtke@isye.gatech.edu, Chip White

Technologies such as RFID allow firms to monitor in detail the movement of goods throughout the supply chain. We investigate the potential value to inventory control of detailed information about the status of goods in the supply process. We show that in a simple model there is no value, but there is potential for value when the model is modified slightly. We discuss the tractability of solving and implementing the optimal solutions to the modified models and present some numerical results.

2 - Periodic Ordering Policy for One Warehouse, Multi-Retailer Systems under Stochastic Demand

Leon Chu, student, UF, 303 Weil Hall, P.O. Box 116595, Gainesville, FL, 32611, United States, zhuyang@ufl.edu, Zuo-Jun Shen

We consider how to use periodic ordering policy to coordinate inventory management for one warehouse, multi-retailer systems when facing stochastic demand. Under normal approximation, we develop a polynomial algorithm to find a near-to-optimal power-of-two ordering policy, which guarantees that its cost is no more than 1.618 times the optimal cost for arbitrary target service level.

3 - Ordering and Pricing with Demand Learning

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, Maqbool Dada

We address the problem of jointly ordering and pricing by a Bayesian newsvendor with censored demand. For a broad class of demand functions, we obtain the dynamic optimal policies and their structural properties. An expression is derived for the marginal expected value of information. This helps to explain why the first-period optimal stocking factor may not increase with the problem length. We also compare the optimal and myopic policies for additive and multiplicative demand models.

■ WB13

P-Governor's Square 11

Logistics I

Contributed Session

Chair: Chunmei Lang, Ph.D, City University of Hong Kong, Dept.of Management Sciences, City U, Hong Kong, China, mscmlang@cityu.edu.hk

1 - Collaborative Logistics in Sea Cargo Industry

Richa Agarwal, Georgia Institute of Technology, 336674 Georgia Tech Station, Atlanta, Ga, 30332, United States, ragarwal@isye.gatech.edu, Ozlem Ergun

In today's transportation industry alliances between carriers are an important factor in staying competitive. Particularly when asset costs are expensive, such as for the ocean and air cargo carriers, companies form alliances to increase asset utilization and extend customer base. Given the demand patterns a common problem faced by ocean carries is to design their collaborative service routes. With some simplifying assumptions this problem can be formulated as a linear mixed integer program. Studing the LP dual and the lagrangean dual of this problem gives us an indight into the possible solution methods. Since numerous carriers are involved with varying degress of collaboration and selfish motives, the problem naturally gives rise to numerous game theoretic issues. We talk about the various factors that are specific to the sea cargo industry and that help carriers to collaborate. Also we address issues involving fair and stable allocation of space and cost among carries on collaborative routes.

2 - Multidimensional Discrete Location-Allocation Optimization Model for Logistics Distribution Planning

Somchai Pathomsiri, Ph.D. Student, University of Maryland, 1173 Glen Martin Hall, College Park, MD, 20742, United States, egspt@wam.umd.edu, Ali Haghani

This research presents an integrated discrete location-allocation optimization model considering simultaneously aspects of multicommodity, multi-echelon, and multi-period. The objective aims at minimizing net present value of total cost over planning periods, subject to a set of practical constraints. We propose a heuristic algorithm to solve this NP-hard problem within a reasonable computation time. Results are promising for solving large-scale practical logistics distribution problem.

3 - A Dynamic Continuous Approximation Heuristic for Logistics Network Design Problems

Alper Murat, McGill University, Faculty of Management, 1001 Sherbrooke St, Montréal, Québec, H3A 1G5, Canada, alper.murat@mail.mcgill.ca, Vedat Verter

We present a novel solution approach to the generalized network design problems where the location of facilities is considered on a planar territory. Our approach is best-suited for problems with large scale demand data set which are cumbersome to solve with standard discrete optimization methods. We'll first introduce our method for a simple problem instance and then discuss the extensions to different real-life logistics applications while preserving the computational efficiency.

4 - Competition Models in Intermodal Transport Logistics
Chunmei Lang, Ph.D, City University of Hong Kong, Dept.of Management Sciences, City U, Hong Kong, China, mscmlang@cityu.edu.hk, Lawrance C K Leung, Anming Zhang, Yer Van Hui

This paper considers a strategic alliance model to evaluate the competitiveness of service providers in air cargo logistics. Business models and profitability of freight forwarders and integrators are studied. The general model shows that an integration among forwarders and service providers leads to high output and profit. With the same service quality, low market demand brings more output and profit to forwarder than to integrator.

■ WB14

P-Governor's Square 14

Management of Technology II

Contributed Session

Chair: Shankar Sundaresan, Assistant Professor, Penn State University, BAB 509Q, University Park, PA, 16802, United States, shankar-s@psu.edu

1 - Maintenance Outsourcing Contracts with Options for Technology Adoptions
Fu-Shiang Tseng, Purdue University, Krannert Graduate School of Management, 403 W. State St., West Lafayette, IN, 47907, United States, tsengf@mgmt.purdue.edu, Kwei Tang

Under a maintenance outsourcing contract, an external contractor receives a payment from a manufacturer for periodically performing preventive maintenance and for performing minimal repairs whenever process failures occur. We propose using real options in maintenance contracts to provide flexibility for new technology adoption and changes in maintenance policies.

2 - Reuse of Technical Solutions Resulting from Collaborative Product Development Projects
Gita Mathur, Associate Professor, San Jose State University, Organization and Management Department, College of Business, San Jose, CA, 95192-0070, United States, mathur_g@cob.sjsu.edu

Suppliers often introduce new technology through collaborative product development efforts with customers. The division of development activity between two organizations can affect the potential for reuse of technical solutions that result from such product development projects. Findings from a field study of semiconductor component development illustrate the managerial challenge.

3 - Dynamic Pricing for Obsolescing Technology Products
Shankar Sundaresan, Assistant Professor, Penn State University, BAB 509Q, University Park, PA, 16802, United States, shankar-s@psu.edu, Michael Pangburn

Technology products obsolesce quickly, implying that consumers' willingness-to-pay falls over time, forcing substantial price declines. If price does not drop, consumers will not buy, yet if price falls too rapidly, consumers may defer purchase. We consider the firm's revenue problem and develop a model for intertemporal pricing of high-technology products under obsolescence with capacity constraints. We validate the structure of our pricing policy with data from the semiconductor industry.

■ WB15

P-Governor's Square 15

Scheduling III

Contributed Session

Chair: Joseph Szmerekovsky, Assistant Professor, North Dakota State University, Putnam Hall, P.O. Box 5137, Fargo, ND, 58105-5137, United States, Joseph.Szmerekovsky@ndsu.nodak.edu

1 - Single CNC Machine Scheduling with Controllable Processing Times
Selim Akturk, Assoc. Professor, Bilkent University, Dept. of Industrial Engr., Ankara, 06800, Turkey, akturk@bilkent.edu.tr, Sinan Gurel

Most of the existing scheduling algorithms assume that the processing times are fixed and known. However, the time it takes to process each part on a CNC machine is a controllable variable. Our aim is to find an approximate efficient frontier for a bi-criteria scheduling problem. We have two objectives: minimizing the manufacturing cost and minimizing weighted completion time. Consequently, we demonstrate how the process planning and scheduling decisions can be integrated through timing data.

2 - Genetic Algorithm for Single Machine Scheduling with Family Set-up Time
Byung Soo Kim, Graduate Student, Auburn University, Department of Industrial and Systems Engineering, Auburn University, Auburn, AL, 36849-5346, United States, kimbyun@auburn.edu, R.L. Bulfin

This paper describes a general approach to a class of single machine scheduling problems. We consider a set-up time between independent families of jobs and maximize the number of jobs scheduled on time. We use a genetic algorithm (GA) to identify a good sequence of jobs within a family and each family simultaneously. The results show the GA to be computationally efficient and flexible for a variety test problem.

3 - Three Machine Group Scheduling Problems in PCB Manufacturing
Rasaratnam Logendran, Associate Professor, Oregon State University, Department of Industrial Engineering, 118 Covell Hall, Corvallis, OR, 97331-2407, United States, logendrr@engr.orst.edu, Cumhur Gelogullari

We consider the three machine group scheduling problem in printed circuit board (PCB) manufacturing with carryover sequence dependency and makespan minimization as the objective. To its non-carryover version, we propose an integer column generation approach based on Dantzig-Wolfe reformulation to identify tight lower bounds on large instances with nine or more board groups, and demonstrate the approach on an example problem.

4 - Single Machine Scheduling under Market Uncertainty
Joseph Szmerekovsky, Assistant Professor, North Dakota State University, Putnam Hall, P.O. Box 5137, Fargo, ND, 58105-5137, United States, Joseph.Szmerekovsky@ndsu.nodak.edu

A single machine scheduling problem is considered where the processing times of activities are known and deterministic but where the reward recieved at the completion of each activity follows a stochastic process. The objectives of maximizing the expected NPV, minimizing the variance of the NPV and maximizing the probability of achieving a benchmark reward are considered. The complexity of the problems is discussed and enumerative procedures are presented for their solution.

■ WB16

P-Governor's Square 17

Optimization Modeling in Practice II

Sponsor: Computing Society
Sponsored Session

Chair: Bjarni Kristjansson, President, Maximal Software, Inc., 2111 Wilson Boulevard, Arlington, VA, 22201, United States, bjarni@maximalsoftware.com

1 - Building Financial Optimization Applications using Mosel
Alkis Vazacopoulos, Dash Optimization, Inc, 560 Sylvan Avenue, Englewood Cliffs, NJ, 07632, United States, av@dashoptimization.com

XpressMP has been used for varied financial applications ranging from portfolio creation, re-balancing to index tracking and matching orders at electronic trading platforms. We will be discussing the 'Portfolio Re-balancing and Index tracking' application. The challenge was to generate an automated re-balancing system which minimizes the number of trades or turnover when rebalancing current portfolio allocation to the target allocation.

2 - Solving Multiround Combinatorial Auctions via Branch-Cut-Price
Laszlo Ladanyi, IBM Research, 1101 Kitchawan Road, Yorktown Heights, NY, 10598, United States, ladanyi@us.ibm.com, David Jensen, Marta Eso

In this talk we describe the FCC Auction 31 and its two formulations: one with a compact representation solvable via branch-and-cut, and one with column generation using branch-and-price. We show how the second formulation can be interpreted as a Dantzig-Wolfe decomposition and that this interpretation leads to a branch-cut-price algorithm. Finally, we extend the applicability of linear complementarity to solve the problem with multiple (lexicographic) objectives.

3 - COE Optimization Projects
Mehmet Atilla Begen, Associate Director, Research, University of British Columbia, Centre for Operations Excellence, HA 209, 2053 Main Mall, Vancouver, BC, V6T 1Z2, Canada, mabegen@coe.ubc.ca

We present an overview of applied optimization projects from various areas.: We share our challenges and experience and demonstrate the end tools developed for these projects. Centre for Operations Excellence (COE) is a research center at the Sauder School of Business at the University of British Columbia and offers a 16 month masters program in OR.

■ WB17

P-Directors Row E

Decision Analysis II

Contributed Session

Chair: Fumiko Seo, professor, Emeritus, Kyoto University, Yoshida-Honmachi, Sakyoku, Kyoto, 606-8501, Japan, fseo@kier.kyoto-u.ac.jp

1 - Financial Networks with Intermediation: Risk Management with Variable Weights

Ke Ke, University of Massachusetts, Isenberg School of Management, Amherst, MA, 01003, United States, keke@som.umass.edu, Anna Nagurney

We develop a framework for the modeling, analysis, and computation of solutions to multitiered financial network problems with intermediaries in which both the fund sources and intermediaries are multicriteria decision-makers who seek to maximize net revenues and minimize risk with the risk being penalized by a variable weight. We derive the optimality conditions, provide the qualitative properties of the equilibrium pattern, propose a computational, and apply it to several numerical examples.

2 - Development of Multiobjective Interactive Decision Analysis Support Systems for Strategic Use

Fumiko Seo, professor, Emeritus, Kyoto University, Yoshida-Honmachi, Sakyoku, Kyoto, 606-8501, Japan, fseo@kier.kyoto-u.ac.jp, ichiroh Nishizaki, Hidenobu Hamamoto

This paper discusses interactive multiobjective decision analysis support systems, MIDASS, newly developed for strategic use of expected utility theory. Decision analysis based on expected utility hypothesis is an effective prescriptive approach, but usually difficult for realistic use. MIDASS provides an integrated system for supporting multiobjective decision analysis under uncertainty and constructs the expected multiattribute utility function.

■ WB18

P-Directors Row H

Telecommunications/Internet Applications

Contributed Session

Chair: Pamela Murray-Tuite, Booz Allen Hamilton, 3190 Fairview Park Drive, Falls Church, VA, 22042, United States, murray-tuite_pamela@bah.com

1 - Decentralized Search Strategies in Disordered Complex Networks

Hari Prasad Thadakamalla, Graduate Student, Pennsylvania State University, 310 Leonhard Bldg.,, University Park, PA, 16802, United States, hpt102@psu.edu, Soundar R. T. Kumara, Usha Nandini Raghavan

Most of the real-world systems such as biological, social, and communication systems are represented as complex networks. With the advances in digital technology and emergence of many file-sharing systems such as Freenet, Gnutella etc, one of the important problem that attracted many researchers is in finding efficient decentralized algorithms for search in these complex networks. In this paper, we introduce and investigate different decentralized algorithms in disordered complex networks.

2 - Modeling Congested Internet Connections

Ian Frommer, University of Maryland, Mathematics Department, College Park, MD, United States, orbit@glue.umd.edu, Ryan Lance

We introduce 2 deterministic models aimed at capturing the dynamics of congested Internet connections. Results from these models show good agreement with the well-known ns network simulator, better than the results of a previous, similar model. This is due in large part to the use of a sudden change in one of the state variables to reflect the impact of lost data packets. We propose model extensions to improve their accuracy in anticipation of their use in a network traffic prediction scheme.

3 - Modeling Residential Internet Use and Choices through Household Characteristics

Pamela Murray-Tuite, Booz Allen Hamilton, 3190 Fairview Park Drive, Falls Church, VA, 22042, United States, murray-tuite_pamela@bah.com, Javier Alday

Modeling Internet traffic is extremely complex. Affordable technology constrains residential users. As technology improves, latent demand floods the network. To determine where residential latent demand may lie, household characteristics and their Internet use impacts are explored through a mathematical modeling methodology. This methodology may aid service providers and government agencies to predict capacity needs and to predict regulatory needs and develop priority services, respectively.

■ WB19

P-Directors Row F

Data Envelopment Analysis

Contributed Session

Chair: Liam O'Neill, Assistant Professor, Cornell University, Policy Analysis & Mgmt. Dept., Ithaca, NY. 14853, United States, lo22@cornell.edu

1 - Application of Bayesian Clustering in Classification of Online Visitors

Mansour Abdoli, University of Nebraska-Lincoln, 175 Nebraska Hall, Lincoln, NE, 68588-0518, United States, mansour@engrs.unl.edu, F. Fred Choobineh

We consider classification of online customers with Bayesian clustering methods using click-stream data, where the cluster-set with maximum posterior probability given data is sought. Markov models of different orders are used for modeling sequences. Inspired by dictionary-based compression methods, we also present the use of a mixed-order Markov model. Moreover, two distance measures are used for assessing clusters' similarities, and different parameters estimation methods are utilized.

2 - Measuring the Shift of the Efficient Frontier using Multiplicative DEA and CFA

Takashi Namatame, Associate Professor, Senshu University, 2-1-1, Higashimita, Tama-ku, Kawasaki, Kanagawa, 214-8580, Japan, takashi@isc.senshu-u.ac.jp, Tomoaki Tabata

In this study, we propose a method to measure the shift of DEA efficient frontier based on the method of Wei et al. (1995), our method uses multiplicative DEA model and constrained facet analysis (CFA) to overcome the problem of their method, which there may exist efficient DMUs that it cannot be, calculated the growth ratio. Then, an example will be demonstrated for our method.

3 - An Analysis of Bank Performance in Selected Arab Countries using DEA & Malmquist Productivity Index

Ramakrishnan Ramanathan, Assistant Professor, Sultan Qaboos University, College of Commerce and Economics, Post Box 20, Post Code 123, Muscat, 123, Oman, ramanathan@squ.edu.om

Operational efficiencies of about 50 banks operating in selected Arab countries are examined in this study using DEA. DEA efficiencies are calculated for the year 2000. A regression analysis shows that efficiency scores are significantly positively influenced by the Return on Assets and Return on Equity. Changes in efficiency of the banks are further analyzed using Malmquist Productivity Index approach for the period 1996-2000.

4 - Strategic Use of Slacks in Super-Efficient DEA Models

Liam O'Neill, Assistant Professor, Cornell University, Policy Analysis & Mgmt. Dept., Ithaca, NY, 14853, United States, lo22@cornell.edu, Franklin Dexter

How much improvement is possible for a DMU that is already on the best-practice frontier? The slack values from the super-efficient DEA model can address this question. We demonstrate that the slacks from the super-efficient DEA formulation are biased upward leading to erroneous conclusions. An alternative measure is proposed.

■ WB20

P-Room 3304

Health Care Applications III

Contributed Session

Chair: Hokey Min, Director, UPS Center for WWSCM, University of Louisville, LL 23 Burhans Hall-Shelby, Louisville, KY, 40292, United States, h0min001@gwise.louisville.edu

1 - Resource Allocation and Process Flow for the Management of Surgical Patient Waitlists

Craig O'Neill, Project Analyst, Centre for Operations Excellence, 2053 Main Mall, Vancouver, BC, Canada, craig.oneill@coe.ubc.ca, Mehmet Atilla Begen, Eric Cope, Andrew Gray

We present two simulation models to improve surgical waitlist management and process flow. The models allocate time for surgical classes and OR patients and test patient schedules on hospital resources determining their optimal allocation. The models assess the relation between wait times and resources, the impact of resource allocation on waitlists, and how changes to scheduling and process policies affect waitlist management.

2 - Sampling Techniques for Intensity Modulated Radiation Therapy (IMRT) Optimization

Sushma Sukumaran, Research Assistant, Purdue University, 632, North Grant Street, West Lafayette, IN, 47906, United States, ssukumar@purdue.edu, Van Thai, Ronald Rardin, Mark Langer

IMRT is an advanced mode of cancer treatment that is designed to focus an intense dose to the tumor while minimizing the exposure of normal tissues. The computation time of the algorithm is a major criterion in the treatment planning and function of the sample points in the tissues. This research investigates the efficacy of sampling schemes, including sampling based on the dose distribution in the tumor, and subdivision of the treatment region into areas of like beam intersection.

3 - Cost-effectiveness of Multidrug-resistant Tuberculosis Control using a Dynamic Model

Stephen Resch, Harvard University, 718 Huntington Ave, HCRA, Boston, MA, 02115, United States, resch@fas.harvard.edu, Milton Weinstein, Joshua Salomon, Megan Murray

Because tuberculosis (TB) is a communicable disease, treating cases benefits the patient and the population. A trade-off exists between efficiency in curing cases of TB in the short-term and minimizing future cases of drug-resistant TB. Control strategies are explored in deterministic simulation of TB epidemics using a dynamic model. The externalities of emerging drug-resistance and transmission reduction due to TB treatment are captured. Cost-effectiveness analysis is used to evaluate policies.

4 - The Cost Effectiveness Analysis of Interventions in Preventing Mother-to-Child Transmission of HIV in China

Hui Zhang, Ivey Business School, UWO, Canada, Apt 537, 291 Windermere Rd., London, ON, N6G,2J9, Canada, hzhang@ivey.uwo.ca, Gregory Zaric

This paper evaluated the cost-effectiveness of interventions in preventing MTCT of HIV in China. A decision tree model was set up to analyze the effects of anti-retroviral drugs and breastfeeding in preventing MTCT. Special concern was on China because of the high expense and limited resources. The focus is thus on the relative cost-effectiveness of interventions. Sensitivity analysis was implemented to help decision-makers choosing appropriate interventions.

5 - A Decision Support System for Planning the Spray Operations of West-Nile Disease Insecticides

Hokey Min, Director, UPS Center for WWSCM, University of Louisville, LL 23 Burhans Hall-Shelby, Louisville, KY, 40292, United States, h0min001@gwise.louisville.edu, Emanuel Melachrinoudis

With the re-emergence of West-Nile diseases in the US, a growing number of health-care organizations increased their spray efforts to control the outbreaks of mosquitoes causing West-Nile epidemics. This paper poposes a model-based DSS that helps to determine the number and location of depots housing insecticide spraying vehicles as well as the type, number, and routes of insecticide spraying vehicles.

■ WB21

P-Room 3302

Manufacturing III

Contributed Session

Chair: Yun Fong Lim, Ph.D Candidate, Georgia Institute of Technology, Sch. of Industrial & Systems Engineering, Georgia Institute of Technology, Atlanta, GA, 30332-0205, United States, yflim@isye.gatech.edu

1 - Optimal Allocation of Workload and Buffer Space in Unpaced Production Lines

Mark Hillier, Associate Professor, University of Washington, Box 353200, Seattle, WA, 98195, United States, mhillier@u.washington.edu, Fred Hillier

We consider the simultaneous assignment of workload and storage space for assembly lines with variable processing times. Using a cost model (including revenue from throughput and cost of storage space), it will be shown that simultaneously unbalancing the workload (less work at center stations) and unbalancing the storage space allocation (more buffers between center stations) is typically optimal.

2 - Determining the Right Sequence of Car-models on the Assembly Line

Nils Boysen, Research Assistant, University of Hamburg, Industrielles Mgmt., Von-Melle-Park 5, Hamburg, HH, 20146, Germany, boysen@econ.uni-hamburg.de, Karl-Werner Hansmann, Christian Marc Ringle

Traditional models like level scheduling or mixed-model sequencing focus on certain objectives while neglecting others. With an innovative approach, we bridge the gap between these models and integrate their objectives in a joint model. Extensive computational results evaluate the superiority of our approach. We are able to completely incorporate mixed-model sequencing and car sequencing, whereas the popular fallacy is disproved that car sequencing leads to a steady material supply.

3 - Analytical Models for Finite Buffer Tandem Lines with Dynamic Servers

Miki Fukunari, Rensselaer Polytechnic Institute, 110 8th Street, Troy, NY, 12180, United States, fukunm@rpi.edu, Ananth Krishnamurthy

The paper analyzes performance of tandem lines in which one or more servers have the ability to switch their service rates based on state of the downstream buffer. Decomposition techniques are used to analyze the underlying queuing model and compare the system performance under different line designs and switching policies.

4 - Bucket Brigades with Multiple Job Sources

Yun Fong Lim, Ph.D Candidate, Georgia Institute of Technology, Sch. of Industrial & Systems Engineering, Georgia Institute of Technology, Atlanta, GA, 30332-0205, United States, yflim@isye.gatech.edu, John Bartholdi, III, Donald Eisenstein

The bucket brigade protocol can be adapted to a flow line in which jobs arrive randomly in time and are introduced into the system at various points along the line. We perform a case study of the order-picking operation at a distribution center by comparing the adapted bucket brigade protocol with the current order-picking practice at the distribution center.

■ WB22

P-Room 3312

Capabilities-Based Analysis for Operationally Responsive Spacelift Analysis of Alternatives

Sponsor: Military Applications
Sponsored Session

Chair: Greg Keethler, Chief Analyst, Air Force Space Command Space Analysis Division, United States, greg.keethler@peterson.af.mil

1 - Operationally Responsive Spacelift (ORS) Analysis of Alternatives (AoA) Military Utility Analysis

Greg Keethler, Chief Analyst, Air Force Space Command Space Analysis Division, United States, greg.keethler@peterson.af.mil

This presentation introduces the Operationally Responsive AoA and discusses the capabilities-based approach taken by the team. The presentation then provides details of the initial campaign analysis, or Military Utility Analysis, conducted to establish the performance levels for the alternatives to meet as well as to determine the overall utility of mission accomplishment.

2 - Operationally Responsive Spacelift (ORS) Analysis of Alternatives (AoA) Alternative Analysis Process and Results

John Mayberry, The Aerospace Corporation, United States

This presentation describes how various levels of military utility, from a campaign analysis, were converted to specific space asset configurations and deployment timeframes, and how that data was then used to establish launch schedules that launch vehicle architectures had to meet. It will describe the process used to develop the various space futures for analysis and launch vehicle architectures, as well as the life cycle costs used for comparison. Finally, it will discuss the surprising results.

3 - Operationally Responsive Spacelift (ORS) Analysis of Alternatives (AoA) Cost-Effectiveness Mini-Max Regret Analysis

Robyn A Kane, MITRE Corporation, United States, rkane@mitre.org

The results of the Military Utility Analysis and Alternative Development Phases of the ORS AoA resulted in a large number of alternatives developed to meet three different performance levels. At any given performance level, there were uncertainties associated with production costs and turnaround time. This presentation discusses how two forms of regret analysis were used to distill this virtual mountain of data into meaningful cost effectiveness information for the decision-maker. Average regret and mini-max regret analysis will be discussed and their results summarized.

■ WB23

P-Room 3354

Joint Session MAS/SIM- Sociocultural Modeling in Agent-based Simulations

Sponsors: Military Applications, Simulation
Sponsored Session

Chair: Susan Sanchez, Naval Postgraduate School, Monterey, CA, United States, smsanche@nps.edu

1 - Sociocultural Modeling in NetLogo for Stability and Support Operations Analysis

Philip Barry, Dept Head W903, The MITRE Corporation, 7515 Colshire Drive, McLean, VA, 22102, United States, pbarry@mitre.org

Project Albert has created sociocultural models in NetLogo for the USMC I MEF to explore the effects of Stability and Support Operations on civilian populations. This presentation will discuss how sociocultural aspects of civilian populations were captured in NetLogo, and will include our methodology to tune and validate the model.

2 - Sociocultural Modeling in MANA and Pythagoras
Matthew Koehler, The MITRE Corporation, 2750 Killarney Dr, Suite 100, Woodbridge, VA, United States, mkoehler@mitre.org

Project Albert has ported a number of tools into the Data Farming environment. Two of these tools, MANA and Pythagoras, will be discussed here. Both of these models provide modelers with a rich, but distinct, set of capabilities to model sociocultural features of a group. Finally, both are easy to use.

3 - Modeling Peace Support Operations
Susan Sanchez, Naval Postgraduate School, Monterey, CA, United States, smsanche@nps.edu

PAX is a software platform for developing agent-based models of peace support operations. We describe its approach to behavioral modeling for individuals and groups, using food distribution and election security vignettes from recent Project Albert International Workshops for illustration.

■ WB24

P-Room 3402

Scheduling IV

Contributed Session

Chair: Christopher Rump, Assistant Professor, Bowling Green State University, Applied Statistics &Operations Research, College of Business Administration, Bowling Green, OH, 43403, United States, cmrump@cba.bgsu.edu

1 - Solving Nurse Preference Scheduling Problem with Column Generation
Hadi Purnomo, University of Texas at Austin, C2200, ETC 5-160, Austin, TX, United States, hadiwaskito@yahoo.com

This paper presents a methodology for scheduling nurses that takes into account individual preferences. In addition, it must also provide sufficient coverage on hospital units at all times. This problem is solved with a column generation approach that involves heuristics. A set covering-type formulation whose columns correspond to alternative schedules for nurses is utilized, while columns are generated by a double swapping heuristic. The methodology was tested on problems with up to 100 nurses.

2 - Exploiting Wireless and Advanced Notification Information in Vehicle Shipment Planning
Xuequn Ding, Graduate Student, The Penn State University, The Department of Industrial and, Manufacturing Engineering, University Park, PA, 16802, United States, dxq106@yahoo.com

Finished vehicles are transported from automobile plants to distribution centers via trains. Vehicle shipment planning is to assign a set of vehicles to another set of train seats so as to achieve highest train utilization and the least dwell time with the satisfaction of a set of blocking rules. We designed our algorithms based on two aspects: 1. real time vehicle information provided by wireless technology based vehicle locating system, 2. advanced notification of future production plan.

3 - Heuristics Approaches for the Task Assignment Problem
Lin Wan, University of Texas at Austin, ETC 5.160, C2200, Austin, TX, 78712, United States, wanlin@mail.utexas.edu

To formulate the task assignment problem, a multi-commodity network is constructed in which each worker corresponds to a separate commodity and each node represents a workgroup-period pair. A daily decomposition approach and a tabu search heuristic are developed and tested with the data from a mail processing and distribution center. The results showed that combining the decomposition and tabu search provides near-optimal solutions.

4 - Stochastic Scheduling of Emergency Vehicles for Disaster Response
Christopher Rump, Assistant Professor, Bowling Green State University, Applied Statistics &Operations Research, College of Business Administration, Bowling Green, OH, 43403, United States, cmrump@cba.bgsu.edu, Jae Young Choi

We consider stochastic scheduling to maximize the number of jobs that meet an earliness chance constraint. We assume independent arbitrary processing times and independent distinct exponential due dates for a set of n jobs. When processing times meet an order-invariance condition, a revised Moore's algorithm solves this problem in O(n log n) time. Otherwise, a binary integer program is proposed. We present computational experience for emergency vehicle dispatching in the wake of an earthquake.

■ WB25

P-Room 3404

Education I

Contributed Session

Chair: Xue Bai, Associate Professor, Virginia State University, 1 Hyden Drive, P.O. Box 9038, Petersburg, VA, 23806, United States, xbai@vsu.edu

1 - Multimedia Supplements in MIS courses: Do They Really Help Student Learning?
Leonard Presby, Professor, William Paterson University, 1600 VAlley Road, Wayne, NJ, 07470, United States, presbyL@wpunj.edu

This paper offers a look at the inclusion of a personalized video cd, created through Tegrity Software, containing spreadsheet instruction. Delivery, as well as assignments is augmented with the cd. Students are tested on the material and provide feedback as to their usefulness of the CD.Preliminary results indicate significant increases in student interest and involvement in learning, and improved test scores.

2 - Improving the Retention and Measurement of Learning with Technology Intervention
Rachna Kumar, Professor, Alliant International University, 10455 Pomerado Road, San Diego, CA, 92131, United States, rkumar@alliant.edu, Tim Becker

The purpose of this study was to improve the retention and forgetting of knowledge by students by supplementing classroom instruction with a scientifically based intervention utilizing technology. We developed a synergistic learning algorithm based on two separate streams of research: Bloom's taxonomy of learning (1956) and Ebbinghauus' curve of forgetting (1987).

3 - Improving Web Course Management Systems
Xue Bai, Associate Professor, Virginia State University, 1 Hyden Drive, P.O. Box 9038, Petersburg, VA, 23806, United States, xbai@vsu.edu, Qidong Cao, Yingjin Cui

In order to improve quality of existing Web-based teaching-support systems, the questions must be answered are what underlying dimensions of user's satisfaction exist and on which of those dimensions we should apply the resources. In this study, the principal component analysis was undertaken to determine the underlying dimensions. Then bivariate correlations were used to assess the marginal importance of each dimension in improving web course management systems.

■ WB27

P-Room 3454

Probability Models in the Service Industries

Sponsor: Applied Probability
Sponsored Session

Chair: Kyle Lin, Assistant Professor, Grado Department of Industrial and Systems Engineering, Virginia Tech, Blacksburg, VA, 24061, United States, kylin@vt.edu

1 - Dynamic Load Balancing with Flexible Workers
Hyun-Soo Ahn, Assistant Professor, Michigan Business School, University of Michigan, Ann Arbor, MI, 48109, United States, hsahn@bus.umich.edu, Rhonda Righter

We study the problem of dynamically allocating flexible workers to stations in tandem or serial systems. We show that the optimal policy is often LBFS (last-buffer first-served) or FBFS (first-buffer first-served). These results generalize earlier results on the optimality of the pick-and-run, bucket brigade, and expedite policies. We also show that for exponential processing times and general networks, the optimal policy tends to assign several workers to the same station.

2 - Optimal Dynamic Pricing for a Line of Substitutable Products
Kyle Lin, Assistant Professor, Grado Department of Industrial and Systems Engineering, Virginia Tech, Blacksburg, VA, 24061, United States, kylin@vt.edu, Feng Li

Dynamic pricing for a product line is difficult because changing the price of one product also affects the revenue stream of another product. In this talk we describe a general model and develop an effective dynamic-pricing policy. Our policy applies to arbitrary customer choice probabilties and arbitrary customer arrival processes—even if the customer arrival process does not have independent increments.

3 - Determining the Acceptance of Cadaveric Livers for Patients that have an Available Living Donor
Oguzhan Alagoz, Case Western Reserve University, 330 Peter B. Lewis Building, 10900 Euclid Avenue, Cleveland, OH, 44106, United States, oguzhan.alagoz@case.edu, Lisa Maillart, Mark Roberts, Andrew Schaefer

Our previous research considered the problem of optimally timing liver transplantation with a living donor and the problem of accepting/rejecting a cadaveric liver when the patient is offered an organ for transplantation. This study extends the previous research by combining the two models into a single decision model. We formulate this problem as an infinite horizon discounted MDP, in which the state is described by patient health and organ quality. We solved the problem using real data.

■ WB28

P-Room 3504

Applied Probability II

Contributed Session

Chair: Angela Giddings, Assistant Director for Recruiting Research and Analysis, Office of the Deputy Under Secretary of Defense (MPP)/AP, 4000 Defense Pentagon, Washington, DC, 20301-4000, United States, Angela.Giddings@osd.mil

1 - A Rank Reduction Method for Computing Stationary Distributions of Markov Chains

Bin Peng, A Rank Reduction Method for Computing Stationary Distributions of Markov Chains, NCSU, 1222B, Carlton Ave, Raleigh, NC, 27606, United States, bpeng2@unity.ncsu.edu, William J. Stewart

We prove that, for an irreducible Markov chain, iterative methods converge in a single step if and only if the iteration matrix has rank one. The Wedderburn rank-1 reduction formula is used to develop a rank reduction procedure with time complexity of O(r^2n) with r being the rank of the iteration matrix.

2 - A M/M/1 Queue-Length Cutoff Model with Two Priorities

Qiang Gong, University at Buffalo (SUNY), 342 Bell Hall, Dept of Industrial Engg, Buffalo, NY, 14260, United States, qgong@eng.buffalo.edu, Rajan Batta

We consider a two-priority, preemptive, M/M/1 queueing model. A queue-length cutoff method is considered. Steady-state balance equations are established for this system. Then we introduce two-dimensional generating functions to obtain the average queue lengths. A heuristic algorithm is developed to find the queue-length-threshold which minimizes the average weighted queue length.

3 - On the Existence of Threshold-Type Admission Policies in Series Queueing Networks

William Millhiser, Case Western Reserve University, Dept. of Operations, Peter B Lewis Building, 10900 Euclid Ave, Cleveland, OH, 44106, United States, william.millhiser@case.edu, Apostolos Burnetas

We prove the existence of a threshold-type optimal admission policy when two customer classes seek access to a Markovian loss queueing system consisting of two stations in series. This is the first work that shows that thresholds exist when customers (and upstream servers) wait during system blockages.

4 - A New Approach to Solution Value Assessment

Angela Giddings, Assistant Director for Recruiting Research and Analysis, Office of the Deputy Under Secretary of Defense (MPP)/AP, 4000 Defense Pentagon, Washington, DC, 20301-4000, United States, Angela.Giddings@osd.mil, Reha Uzsoy, Bruce Schmeiser, Ronald Rardin

Many authors have used statistical methods to assess the quality of heuristic solutions to combinatorial optimization. We present the probability modeling framework that applies whenever randomized heuristic techniques are applied to solve combinatorial optimization problems. Proper consideration of this probability model suggests a new approach to solution value assessment. We discuss the promise inherent in this approach as well as challenges to successful implementation.

■ WB29

P-Room 3502

E-Business/E-Commerce I

Contributed Session

Chair: Timothy Butler, Associate Professor, Wayne State University, 5201 Cass Avenue, Detroit, MI, 48202, United States, Timothy.Butler@Wayne.edu

1 - Optimizing Procurement — Successes and Challenges

Martin Shell, Principal, Park Place Decision Sciences, 26 Park Place, Newton, MA, 02460, United States, mshell@parkplace-ds.com

The presence of mathematical optimization has become a standard feature of most leading software applications in the domain referred to as “strategic sourcing”, “spend management “or” e-procurement. In this paper we discuss the structure of the commonly used models and some success stories, focusing, however, on the challenge of bringing the potential benefits beyond the small number of highly motivated early adopters, and into the mainstream of corporate procurement practice.

2 - Intra and Inter-industry Comparison of Organizational Websites: An Analysis of Three US Industries

Shirish C. Srivastava, Ph.D. Candidate, National University of Singapore, Department of Decision Sciences,, NUS, Business School, 1 Business Link,, Singapore, 117592, Singapore, g0305937@nus.edu.sg, Thompson S. H. Teo, Manathattai S. Annapoornima

This cross industry empirical study analyzes the websites of 243 US firms: 91 IT companies, 67 business schools and 85 banks on 22 website features. Statistical analysis shows that though there is homogeneity in the website features within each industry, there are significant differences across the industries, indicating the presence of industry specific website norms. Study also shows that bank websites are the most advanced in terms of utilization of website features.

3 - Price Dispersion in the E-market

Hejun Zhuang, Ph.D Student, The Chinese University of Hong Kong, G23, KKL, The Chinese U. of Hong Kong, Hong Kong, Hong Kong, hejun@baf.msmail.cuhk.edu.hk, Ching Chyi Lee

The popularity of the electronic market has changed the way firms do the business. In the E-market, individual consumer search pattern changes with the help of search engines, the search cost is no longer measured by the distance of the firms but the brand reputation. We analyze the customer’s optimal search rule and firms’ strategies in such a market.

4 - Survey of Senior Citizen Technology Utilization

Timothy Butler, Associate Professor, Wayne State University, 5201 Cass Avenue, Detroit, MI, 48202, United States, Timothy.Butler@Wayne.edu, Alexander DePetro, Joseph Tan

The increasing number of senior citizens over the next several decades will only be matched by the influence of technology over their lives. There has been numerous studies on how to train senior citizens how to use technology, especially computers. This paper considers the research done on technology training and adoption by senior citizens. Current business models for computer and technology training are examined and a general model is proposed.

■ WB30

P-Room 3512

Statistics/Quality Control

Contributed Session

Chair: Hong Wan, Assistant Professor, School of Industrial Engineering, Purdue Univeristy, 315 N. Grant Street, West Lafayette, IN, 47907-2023, United States, h-wan@northwestern.edu

1 - Customer Satisfaction Index of Official Statistics Quality for Information & Communication Technology

So Young Sohn, Professor, Yonsei University, 134 Shinchon-dong, Seoul, SE, South Korea, sohns@yonsei.ac.kr, In Sang Chang

The necessity of improved quality of official statistics in ICT(Information and Communication Technology) is uprising. In order to improve the quality of ICT statistics, various factors such as survey quality, processing quality, output quality and reputation of statistical agency need to be considered together. We use a structural equation model to find a relationship among such factors which can influence the customer satisfaction.

2 - Efficient Fractional Factorial Mixed-level Designs

Yong Guo, Department of Industrial Engineering, FAMU-FSU College of Engineering, 2525 Pottsdamer ST., Tallahassee, FL, 32310, United States, guo@eng.fsu.edu, James Simpson

Often the mixed-level designs involve too many experimental runs that are not necessary in practice. As a result, fractional designs with optimal orthogonality have been developed for reducing experimental runs. However, maintaining balance requires too many runs. So we propose a new criterion to evaluate the balance property for mixed-level designs so as to construct efficient fractional factorial mixed-level designs with the most desirable combination of near-balance and near-orthogonality.

3 - Constraint-Based Designs Using a Network Model and DOE

Mehmet Aktan, Assistant Professor, Ataturk University, College of Engineering, Dept. of Industrial Engineering, Erzurum, 25240, Turkey, maktan@atauni.edu.tr, Harriet Black Nembhard

Constraint-based design has been recognized as an effective tool, particularly for the design of mechanical parts or assemblies. We present a methodology that can be used to find feasible solutions for constraint-based designs. A network model is used to represent relationships among design variables. If the relationship between some design variables cannot be expressed with analytic equations, we apply design of experiments (DOE) to discover the relationship.

4 - Classify HCI users through Multi-scale Schur Convex Measure

Bin Shi, ISyE, GA Tech, 332227 Tech St, Atlanta, GA, United States, bshi@isye.gatech.edu

This paper addresses the problem of classifying users with different visual abilities. Multiscale Schur convex (MsSC) measures of the pupil diameter measurements are employed as feature vectors. Six MsSCs are studied to compare performances. Bayesian Classifier combining is proposed to stabilize classifier. Wavelet basis selection of for best classification performance is discussed. The methods are validated by measurements from 36 subjects. The expected misclassification rate achieved is 21%.

5 - Simulation Factor Screening in the Presence of Interactions
Hong Wan, Assistant Professor, School of Industrial Engineering, Purdue Univeristy, 315 N. Grant Street, West Lafayette, IN, 47907-2023, United States, h-wan@northwestern.edu, Barry L. Nelson, Bruce E. Ankenman

Controlled Sequential Bifurcation (CSB) is a new factor-screening methodology for discrete-event simulations. CSB controls the power at each bifurcation step and Type I Error for each factor under heterogeneous variance conditions. We present an improved CSB that has the same error control for screening main effects even when two-factor interactions are present. A modified fully sequential testing procedure improves the efficiency of the method.

■ WB31

P-Room 3545

Information Systems I

Contributed Session

Chair: Margaret Beranek, Associate Professor, University of Colorado - Colorado Springs, 1420 Austin Bluffs Parkway, colorado Springs,, 80933, United States, mberanek@uccs.edu

1 - Knowledge Sharing in Organizations: Models and Mechanisms
Bambang Setiarso, Dr, Indonesia Institute of Sciences, jl.Gatot Subroto no.10, Jakarta, ID, 12910, Indonesia, setiarso@pdii.lipi.go.id

The objectives and functions proposed at Center for Scientific Information and Documentation - Indonesian Institute of Sciences (CSDI-IIS), suggests an organizational form and structure for the organization which is considered here to be a networked concortium of science and technology knowledge and information services in Indonesia. The concept of CSDI-IIS extention agents is considered to provide S&T knowledge services for the public and knowledge sharing among Indonesia's S&T communities whose members depend on having timely, reliable and economical access to problem solving. Usability issues should be considered during the model of S&T knowledge sharing in order to build systems which people with limited technological skills and readily use, we discuss two key form s of knowledge sharing usability, interface usability and the human-computer-interaction has helped model knowledge sharing principles to improve interface usability. We cover the following phases : (1).The paradigm shift is quite obvious with respect to knowledge sharing from an organizational perspective; (2). The communicative paradigm of knowledge sharing is also increasingly relevant as a means of organizing learning processes as collaborative, cooperative, exchange knowledge processes. (3). Knowledge sharing in the communicative paradigm which at least with respect to the topic, self-organizing paradigm will have major consequences for librarians work and the structure and information transfer institutions. In this model, a hightened awareness of user preferences and needs more so than in the user interface model is proposed such as: know the user, competitive analysis, setting goals, parallel design, participatory design, coordinated design, apply guidelines, prototyping S&T "knowledge sharing", empirical testing, collect feed back from the users for the future design.

2 - Performance Evaluation of Knowledge Management Systems
Edward Chen, Associate Professor, University of Massachusetts Lowell, Management Department, One University Avenue, Lowell, MA, 01854, United States, edward_chen@uml.edu

Many firms have implemented knowledge management systems (KMS) to improve their firm performance. There is little research has done on the performance evaluation. This study analyzes the performance of those firms with KMS implemented since 1999. The results show that administrative costs decreased and efficiency increased.

3 - Managing the Virtual Team: Directions for Project Managers
Margaret Beranek, Associate Professor, University of Colorado - Colorado Springs, 1420 Austin Bluffs Parkway, colorado Springs,, 80933, United States, mberanek@uccs.edu

Geographically distributed teams communicate via computer-mediated systems, and many times never meet face-to-face. While clearly having advantages over collocated teams, they do pose many new managerial problems. Some of the problems are exacerbated by distance but managing distributed teams can give birth to new, unexpected problems as well. This paper presents a compendium of information describing these changes and new problems, and provides techniques for management of these problems.

■ WB32

T-Vail (Majestic Level)

Strategic Planning

Contributed Session

Chair: Hilda Blanco, Professor and Chair, Dept. of Urban Design and Planning, University of Washington, Box 355740, Seattle, WA, 98195, United States, hblanco@u.washington.edu

1 - The Balanced Scorecard and OR/MS
Snjolfur Olafsson, Professor, University of Iceland, Faculty of Economics and Business Admini, Oddi vid Sturlugotu, Reykjavik, IS-101, Iceland, snjolfur@hi.is

The Balanced Scorecard (BSC) has gained much popularity the last decade. Basically, the BSC is intended to help organizations implement their strategy. It offers two main tools, the strategy map and the scorecard. Strategy maps can be seen as a version of cognitive maps, which entered operations research in the 80s. The core of scorecards is a set of measurements and related objectives end in OR/MS there has always been emphasis on objectives and measurements.

2 - The Virtual Company — An Empirical Analysis of Positive Effects on a Partner's Long Term Success
Christian Marc Ringle, Research Assistant, University of Hamburg, Industrielles Mgmt., Von-Melle-Park 5, Hamburg, HH, 20146, Germany, cringle@econ.uni-hamburg.de, Karl-Werner Hansmann, Nils Boysen

This article explores the effects of a participation in several Virtual Companies (VCs) on the strategic success factors of collaborating partners. A theoretically deducted Structural Equation Model (SEM) is applied to explain the long term success of cooperating in VCs. The Partial Least Squares-Analysis (PLS) is applied to measure this model with data from a broad empirical survey. This analysis gives implications for the assessment of a strategically motivated collaboration in VCs.

3 - Applying Modern Portfolio Management: A Case of An Upstream Oil and Gas Portfolio Optimization
Meftun Erdogan, Landmark Graphics Corporation, 2101 City West Blvd, Houston, TX, 77042, United States, merdogan@lgc.com, Dave Stegemeier, Brett Mudford

In this paper, first, collection of real-life exploration and development projects are evaluated using stochastic simulation techniques. Portfolio analysis is then carried on with the optimization methodology of Harry Markowitz and OptQuest optimization system is used to solve for optimal portfolios. Paper demonstrated that portfolio optimization empowers decision makers to look beyond conventional decision-making approaches and helps senior management to maximize financial returns while accurately measuring and controlling risk.

4 - Towards an Integrated Management Science
Hilda Blanco, Professor and Chair, Dept. of Urban Design and Planning, University of Washington, Box 355740, Seattle, WA, 98195, United States, hblanco@u.washington.edu, Shishir Mathur

In this paper, we argue: a) that there are several major management approaches that incorporate some aspect of scientific or systematic inquiry: systems analysis/thinking, quality management, and strategic planning; b) that these approaches in themselves do not constitute comprehensive management approaches; c) that these approaches can be integrated into a comprehensive management approach that responds to both the interests of the operations and leadership in a firm.

■ WB34

T-Columbine (Majestic Level)

Operations Management III

Contributed Session

Chair: Enno Siemsen, University of North Carolina at Chapel Hill, Kenan Flagler Business School, McColl Building, CB 3490, Chapel Hill, NC, 27599-3490, United States, siemsene@kenan-flagler.unc.edu

1 - Human Resource Impact in Manufacturing
Brian Neureuther, Indiana State University, College of Business, Analytical Department, Terre Haute, IN, 47809, United States, sdbrian@isugw.indstate.edu

The proper management of human resources in manufacturing is paramount in today's competitive environment. One aspect of manufacturing that is often overlooked is the human resource dimension and the possibility of enhanced performance, especially in cycle time, based on well managed human resources. The impact of human resource management, in terms of labor reduction, on the productivity of manufacturing environments is examined.

2 - Manufacturing Strategy Alignment Models: Perspectives, Principles and Prospects
Mattias Hallgren, Linköping Institute of Technology, Department of Production Economics, Linköping, 58183, Sweden, mattias.hallgren@ipe.liu.se, Jan Olhager, Martin West

We investigate alignment issues and models in manufacturing strategy. Manufacturing strategy alignment, sometimes referred to as fit or congruence, is most often concerned with the relationship with markets and market requirements; however, alignment issues may also concern the relationships with business and marketing strategies. We review and categorise qualitative and quantitative extant approaches in the literature and develop a framework for modelling manufacturing strategy alignment.

3 - Incentives in Teams

Enno Siemsen, University of North Carolina at Chapel Hill, Kenan Flagler Business School, McColl Building, CB 3490, Chapel Hill, NC, 27599-3490, United States, siemsene@kenan-flagler.unc.edu, Aleda Roth, Sridhar Balasubramanian

Cooperation among workers can yield significant productivity gains. However, such cooperation will not occur in the absence of appropriate incentives systems. In an operations context, such incentive systems must accommodate the specific patters of dependency that exist between workers in teams. We explore the design of optimal incentive systems that promote effort and knowledge sharing in teams. We derive hypothesis from a game theoretic framework, and test some of these hypothesis empirically.

■ WB35

T-Terrace (Terrace Level)

Production & Scheduling

Contributed Session

Chair: Tadeusz Sawik, Professor, AGH University of Science & Technology, Dept. of Management, Al. Mickiewicza 30, Krakow, 30-059, Poland, ghsawik@cyf-kr.edu.pl

1 - Reducing In-Process Inventory in Flow Shop Production Environment

João Vitor Moccellin, Professor, University of São Paulo, Av. Trabalhador São-Carlense, 400, São Carlos, SP, 13566-590, Brazil, jvmoccel@sc.usp.br, Marcelo Seido Nagano

This paper introduces a new heuristic method for the flow shop sequencing problem with the objective of minimizing in-process inventory. In order to evaluate the performance of the proposed heuristic we compare it with one of the best heuristics that have been reported in the literature. Results from computational experience are discussed.

2 - Planning Models for Matching Demand and Production Capacity

Yasemin Merzifonluoglu, University of Florida, 303 Weil Hall, Gainesville, FL, 32611, United States, yasemin@ufl.edu, Joseph Geunes

We present models and solution methods for production and inventory planning problems when a supplier has supply- and demand-side flexibility. Demand-side flexibility arises when the supplier has leeway in delivery timing and order acceptance decisions, while supply-side flexibility implies an ability to adjust capacity levels at some cost. The resulting profit-maximizing models determine the best mix of supply capability (capacity) and demand in the production and delivery planning stage.

3 - Master Scheduling in Make-To-Order Discrete Manufacturing

Tadeusz Sawik, Professor, AGH University of Science & Technology, Dept. of Management, Al. Mickiewicza 30, Krakow, 30-059, Poland, ghsawik@cyf-kr.edu.pl

IP formulation with new cutting constraints is proposed for master scheduling in make-to-order discrete manufacturing. The objective is to allocate customer orders among planning periods to minimize number of tardy and early orders as well as to balance machine assignments over a planning horizon. Numerical examples modeled after a real-world long-term scheduling in the electronics industry are provided.

■ WB36

T-Capitol (Terrace Level)

Finance - Theory & Empirics II

Contributed Session

Chair: Ozgur Kaya, Ph.D. Candidate, Columbia University, Department of IEOR, 500 West 120th Street, New York, NY, 10027, United States, ok94@columbia.edu

1 - International E-Finance and the New Basel Accord

Hong-Jen Lin, Assistant Professor, Nyack College, 147-26 Roosevelt Ave. Apt.1B, Flushing, NY, 11354, United States, linh@nyack.edu, Winston Lin

E-finance is an inevitable trend in the practice of finance all over the world. And the New Basel Accord applies a new regulatory standard to international banking. Thus, the relationship between e-finance and the New Basel Accord becomes an urgent issue in today's international banking. This study discusses how e-finance helps commercial banks control their risk in accord with the New Basel Accord. Furthermore, the New Basel Accord may hinder commercial banks in their progress in e-finance.

2 - State-Space Partitioning Methods for Pricing High-Dimensional American-Style Options

Xing Jin, Department of Mathematics, National University of Singapore, 113 Clementi Road, Block D, #06-03, Singapore, 129793, Singapore, matjx@nus.edu.sg, Hwee Huat Tan, Junhua Sun

In this paper, a bundling method based on quasi-Monte Carlo sequences is proposed to price high-dimensional American-style options. By using low-discrepancy points, this approach partitions the state space and forms bundles. A dynamic programming algorithm is then applied to the bundles to estimate the continuation value of an American option. A convergence proof of the algorithm is provided. A variety of examples are investigated numerically and accurate results are obtained.

3 - Optimal Asset Allocation in a Dynamic Downside-Risk Framework: An Exact Solution for Complete Market

Xun LI, Department of Mathematics, The National University of Singapore, Singapore, 117543, Singapore, matlx@nus.edu.sg, Zhenyu Wu

This article presents, in closed form, an analytical solution to the optimal asset allocation problem in a dynamic downside-risk framework. It makes up the disadvantages of downside risk measure, the computational inefficiency and inaccuracy caused by the adoption of approximation and/or numerical methods, existing in the portfolio selection literature. More interestingly, this study highlights the importance of investors' downside-risk concerns, and provides an economic insight of the properties of optimal investment strategies. It sheds light on both academic and practical implications of dynamic below-target semi-variance model to the kingdom of investment.

4 - Exact Simulation of Option Greeks under Stochastic Volatility and Jump Diffusion Models

Ozgur Kaya, Ph.D. Candidate, Columbia University, Department of IEOR, 500 West 120th Street, New York, NY, 10027, United States, ok94@columbia.edu, Mark Broadie

We derive Monte Carlo simulation estimators to compute option price derivatives, i.e., the 'Greeks', under Heston's stochastic volatility model and some variants of it which include jumps in the price and variance processes. We use pathwise and likelihood ratio approaches together with the exact simulation method of Broadie and Kaya (2004) to generate unbiased estimates of option price derivatives in these models. Simulation estimators and numerical results for various options are given.

■ WB37

T-Biltmore (Terrace Level)

Environment/Natural Resources and AHP Applications

Contributed Session

Chair: Huseyin Balci, Ph.D Student, Auburn University, 207 Dunstan Hall, Auburn University, Auburn, AL, 36849, United States, balcihh@auburn.edu

1 - Agricultural Trade Policy Analysis in a Changing World

Suchada Langley, Chief, Global Agricultural Markets Branch, ERS-USDA, 1800 M Street, N.W., Room S5186, Washington, DC, 20036, United States, SLANGLEY@ers.usda.gov

Many changes in the agricultural business landscape in the last decades will have a lasting impact on the way economists analyze policy and how policymakers make policy. Changes related to globalization, consumer preferences, and income growth have called into question the role of public policy in agricultural trade analysis. This session looks at how changes in global markets affect trade policy analysis.

2 - Robust Optimization to Identify Regional Earthquake Mitigation

Ningxiong Xu, Research Associate, Cornell University, Civil and Environmental Engi, Hollister Hall, Ithaca, NY, 14850, United States, nx22@cornell.edu, Rachel Davidson, Linda Nozick

A model to optimize investment in regional earthquake mitigation strategies is developed under uncertainty. The key uncertainty is which earthquake events will occur and when. This structure provides an explicit mechanism to trade-off expected impacts against rare but severe consequences. We conclude with a case study from Los Angeles County.

3 - The Effects of Measurement Error on Solution Quality of an Optimal Bucking Algorithm.

Hamish Marshall, Ph.D. Candidate, Forest Engineering Department, Oregon State University, 215 Peavy Hall, Corvallis, OR, 97331-5706, United States, hamish.marshall@orst.edu, Kevin Boston, Glen Murphy

n the forestry supply chain, the bucking of trees into logs can result in large value losses. The use of optimization systems is increasingly being used to improve value recovery. As with all optimization systems the solution is only as good as the data provided. Studies have shown that the accuracy of the measuring systems used on modern harvesting heads can be low. This paper simulates, using a DP algorithm the economic impacts of different levels of diameter and length measurement error.

4 - Valuation of Generation Assets under Cournot Model using Real Options

Huseyin Balci, Ph.D Student, Auburn University, 207 Dunstan Hall, Auburn University, Auburn, AL, 36849, United States, balcihh@auburn.edu, Jorge Valenzuela

In this study, we present a procedure to value generation assets using the real options approach when the market is governed by the Cournot model. In our approch, the price of electricity is represented by a stochastic system-based model that takes into account strategic bidding and load elasticity.

■ WB38

T-Beverly (Terrace Level)

Simulation II

Contributed Session

Chair: Alexander Galenko, Graduate Research Assistant, University of Texas at Austin, 1 Texas Longhorns, #C2200, Austin, TX, 78712, United States, AGalenko@gmail.com

1 - Fluid-Based Simulation Approach for High Volume Conveyor Transportation Systems

Ying Wang, Ph.D student, Georgia Tech, 332022 Georgia Tech Station, atlanta, GA, 30332, United States, ying@isye.gatech.edu, Chen Zhou

This paper presents the use of Batches Petri Nets as fluid simulation-modeling framework in high volume conveyor systems simulation. The underlying model is a combination of an extension of a Batches Petri Nets and a Stochastic Petri Nets which we call Stochastic BPN. This approach generates much less discrete events compared to item-level cell-based simulation in current simulation system. Detailed model description and simulation implementation are presented along with an example.

2 - Transportation Systems Modeling Using the Level Architecture

Sharif Melouk, Assistant Professor, Air Force Institute of Technology, Department of Operational Sciences, 2950 Hobson Way, Wright-Patterson AFB, OH, 45433, United States, sharif.melouk@afit.edu

This research investigates the High Level Architecture, HLA, as a possible distributed simulation framework for transportation systems. HLA is an object-oriented approach to distributed simulations developed by the DoD to handle the issues of reuse and interoperability of simulations. Two independent transportation models, CORSIM and ARENA, comprised the trial environment. The CORSIM federate models a freeway feeder road with an on-ramp while the Arena federate models a tollbooth exchange.

3 - Optimal Replacement Tme for a Nuclear Pressure Vessel Head

Alexander Galenko, Graduate Research Assistant, University of Texas at Austin, 1 Texas Longhorns, #C2200, Austin, TX, 78712, United States, AGalenko@gmail.com, Elmira Popova, Ernie Kee, Alice Sun, Rick Grantom

A general study has been completed showing that it would be economical to replace a large nuclear pressure vessel head due to material corrosion issues related to the existing head . The main objective of this study was to find the optimal time to perform the replacement. There are numerous sources of uncertainties that influence the optimal decision. In addition, we present a real-options approach for alternative pricing of the project.

4 - Improving Efficiency of the Passenger Transportation System at an International Airport

Richard Fung, University of British Columbia, 2053 Main Mall, Vancouver, BC, V6T1Z2, Canada, Richard.Fung@coe.ubc.ca, Mehmet Atilla Begen, Bailey Kluczny, Daniel Granot, Chris Hall

Airports provide wheelchair and electric cart services to special needs passengers to get to their departure gates and for assistance upon arrival. Currently, at a Canadian airport, each airline is responsible for their own passengers. However, the airport is considering consolidating the service for all airlines. We present two simulation models that were designed to evaluate the benefits and required resources for the consolidated system.

■ WB40

T-Tower Court B (2nd Floor)

Supply Chain Management III

Contributed Session

Chair: Amit Devpura, Technical Program Manager, Intel, MS CH3-10, 5000 W Chandler, Chandler, AZ, 85226, United States, amit.devpura@intel.com

1 - Integrated Supply Chain Strategic Optimization using MIP and ABC

Javier Holguin de la Cruz, Ph.D Candidate, New Mexico State University, P.O. Box 4147, Las Cruces, NM, 88003, United States, javholgu@nmsu.edu

Our research developed and solved a new integrated single-period, multi-commodity, multi-echelon production-distribution supply chain strategic optimization model using mixed-integer programming (MIP) and activity-based costing (ABC) estimated data. We applied and implemented our model to a real reduced case study for a global Tier-1 automotive supplier with an international network.

2 - Real-Time Decentralized Supply Chain Management

Manoj Chopra, FedEx Corp, 3640 Hacks Cross Road, Memphis, TN, 38125, United States, manoj.chopra@fedex.com

Traditional supply chain management has concentrated on using global optimization approach. The nuances in the supply chain require re-planning and solving the global problem poses technical and practical challenges. Decentralized SCM plans by creating local problem with both global as well as local objectives. This reduces time to solve the planning problem as well as provides transitional stability to unaffected portions of supply chain.

3 - Supply Chain Design: An Integrated Decision-Making Approach

Hussein Naseraldin, Ph.D. Student, Technion - Israel Institute of Technology, Technion, Industrial Engineering Faculty, Haifa, 32000, Israel, nhussein@tx.technion.ac.il, Yale Herer

In this paper, we research a management approach that quantitatively combines strategic and operational decisions. Designing and managing a supply chain entails making different decisions of different horizons such as number and location of retail outlets and inventory control decisions. Our research lies in a multiple-newsvendor environment. The proposed model integrates strategic and operational decisions. We formulate, analyze, and derive the optimal values of the decision variables.

4 - A Robust Optimization Approach for Distribution Capacity Expansion

Renee Butler, Assistant Professor, University of Central Florida, 4000 Central Florida Blvd, Orlando, FL, 32816, United States, rjbutler@mail.ucf.edu, Abeer Sharawi, Lloyd Clarke

We develop a robust optimization model for capacity expansion of a distribution network with uncertain future demand. The uncertainty is modeled with a discrete scenarios and total system robustness is controlled with a constraint on the overall closeness to the optimal solution for all scenarios. The problem is motivated by the expansion of the distribution and retail network of a regional grocer and sample results are presented.

5 - Supporting & Enhancing Supply/Demand Network Automation Systems

Amit Devpura, Technical Program Manager, Intel, MS CH3-10, 5000 W Chandler, Chandler, AZ, 85226, United States, amit.devpura@intel.com, Michael O'Brien, Karl Kempf

Manufacturing at Intel has evolved from a simple flow to a complex and dynamic system. This has lead us to replace our old manual judgment-laden planning tools with an automated tool set based on mathematical optimization, and we have thereby revolutionized our planning processes. To enhance and maintain these tools and keep them synchronized with the business, we have deployed an infrastructure across planning providing many tangible and intangible benefits.

■ WB41

T-Tower Court C (2nd Floor)

Supply Chain Contracts and Games II

Contributed Session

Chair: Fernando Bernstein, Duke University, 1 Towerview Dr., Durham, NC, 27708, United States, fernando@mail.duke.edu

1 - Equilibrium Analysis of Supply Chain Structures

Chongqi Wu, Ph.D. student, University of Illinois at Urbana-Champaign, 1206 S. Sixth St., Rm. 339, Champaign, IL, 61820, United States, cwu5@uiuc.edu, Suman Mallik

We propose a game-theoretic model to study the vertical integration in supply chain design. Our model involves two manufacturers producing two substitutable products and selling them through either a franchised or a company-owned store established with a fixed fee. We show that many SC structures can be the equilibrium outcome, which depends not only on the market conditions such as product substitutability, but also on the decision variables and the game context.

2 - Procurement Strategy under Price Risk Sharing Contract

Qi Feng, Ph.D. Student, The University of Texas at Dallas, 2601 N Floyd Rd, SM 30, Richardson, TX, 75083, United States, qxf011100@utdallas.edu, Suresh Sethi

We develop a general framework to study a flexible supply contract. The manufacturer has several procurement options: early orders from price-only contracts, adjustment orders according to risk-sharing price arrangements with sellers, or adjustment orders directly from the market. This paper focuses on the optimal procurement strategy at different time points according to demand information updates and market price evolution. We generalize several results in the literature.

3 - Quality Control Issues in Contractual Supply Agreements

Xingchu Liu, Student, Texas A&M University, Department of Industrial Engineering, College Station, TX, 77843-3131, United States, liuxch@neo.tamu.edu, Sila Cetinkaya

Although quality control is a key issue within every production-inventory channel, it has been ignored in the existing supply chain contracts literature. Hence, we seek to provide practical contractual arrangements in a setting where the existence of individual incentives and private information remain as major hurdles. We investigate two different cases where the quality level of the lot is fixed and where the supplier has an option to invest in quality improvement. Our analysis results in practical recommendations on how to set lot sizes and quality targets for contract design and how to overcome existing inefficiencies caused by information asymmetries.

4 - Endogenous Reservation Profits and Supply Chain Bargaining

Fernando Bernstein, Duke University, 1 Towerview Dr., Durham, NC, 27708, United States, fernando@mail.duke.edu, Leslie Marx

We address the problem of supply chain performance when the retailers have bargaining power. In particular, in a supply chain with one supplier selling to multiple competing retailers, we investigate the effect of retailer bargaining power in the allocation of total supply chain profits among all channel members.

■ WB43

T-Denver (Mezzanine)

New Product Development II

Contributed Session

Chair: Joon Park, Assistant Professor, Singapore Management University, 469 Bukit Timah Road, School of Business, Singapore, Singapore, jpark@smu.edu.sg

1 - Modeling the Product Development Process: A Review of the Literature

Tyson Browning, Assistant Professor of Enterprise Operations, Texas Christian University, M.J. Neeley School of Business, TCU Box 298530, Fort Worth, TX, 76129, United States, tyson@alum.mit.edu, Ranga Ramasesh

Because of the crucial role of process modeling in product development research, and because a variety of approaches are proposed in the literature, a review and organization of these approaches is beneficial. We also see a need to organize the theory driving the modeling-oriented approach and identify opportunities for research to consolidate gaps.

2 - Organizational Configuration and Success in Open Source Software Projects

Jorge Colazo, Ph.D. Candidate, Richard Ivey School of Business, University of Western Ontario, 1151 Richmond St. North, Ivey Building - Office 2N08, London, ON, N6G 3B1, Canada, jcolazo@ivey.uwo.ca, Kevin Hendricks, Yulin Fang

Open source software (OSS) can be defined as software for which the source code is available to users. Its development process has been regarded as capable of generating better code, more efficiently than the proprietary process. There are many OSS projects underway, yet little is understood about the impact of different organizational characteristics on the project's performance. We shed some light on this important issue by analizing archival data from more than 50 relevant OSS projects.

3 - The Role of Manufacturing Flexibility on Product Platform Development

Joon Park, Assistant Professor, Singapore Management University, 469 Bukit Timah Road, School of Business, Singapore, Singapore, jpark@smu.edu.sg, Soumen Ghosh

Firms in many industries have invested heavily in manufacturing flexibility as a response to growing market uncertainty. Auto industry has looked into having common vehicle architecture as the key enabler for flexible manufacturing. "Vehicles go together the same way, with shared programme engineering and shared components." In this research, a decision support model is developed to investigate how common design among products models could be exploited to facilitate manufacturing flexibility.

■ WB44

T-Spruce (Mezzanine)

Logistics II

Contributed Session

Chair: Claudio Cunha, Professor, Escola Politécnica - University of Sao Paulo, Department of Transportation Engineering, CP 61548, São Paulo, SP, 05424-970, Brazil, cbcunha@usp.br

1 - Mexico, Global Strategic Logistic Center

Jaime Escalera, Universidad Politecnica de Aguascalientes, Calle Felipe Pescador No. 102, Director of Vinculation, Col. Ferronales, CP 20180 Aguascalientes, Ags, Mexico, jej@upa.edu.mx, Guillermo Hernandez Duque

Based on the analysis of the most outstanding Trade Agreements that Mexico has been signed, the strengths and weaknesses that the inbound and outbound logistics activities have in the international commerce are being analyzed. As a result of that, the authors propose that Mexico could be a Strategic Logistic Center due to the natural geographic position, and its relative situation between the three major economic blocks in the present world: North America, The European Union and Asia Pacific, situation that Mexico should take advantage of. The intention is to identify those areas of opportunity which if given attention, could help rank up the country as a global key logistic center generating thousands of productive job positions.

2 - A Highly Efficient Heuristic for Finding Good Dispatching Schedules from Warehouses to Stores

Pedro Gazmuri, Full Professor, Universidad Católica de Chile, V. Mackenna 4860, Santiago, Chile, pgazmuri@ing.puc.cl, José Zapata, Yadran Eterovic

A highly efficient heuristics is presented for the problem of defining weekly schedules for dispatching products from several warehouses (operating on different schemes) to a network of stores. The main purpose is to produce uniform operating levels at both the warehouses and the stores, from the point of view of loading and unloading activities at both types of sites. When applied on a real setting in Chile, it has been able to generate an 18% reduction in workforce costs.

3 - Inventory and Transportation Models in the Mobile Business Environment

Kurt Knut Richter, Professor, Dr., European university Viadrina Frankfurt (Oder), Grosse Scharrnstr. 59, Frankfurt (Oder), D-15230, Germany, richter@euv-frankfurt-o.de, Irena Okhrin, Grigorij Pishulov

Mobile business technologies allow to look at new dimensions for the inventory and transportation models: the applied information technology, the place, the time and the cost of the decision making. Based on some assumption concerning the relationship between these parameters and the model inputs two stage models of minimizing the overall cost of the decision making and of the logistical processes will be analysed.

4 - An Optimization Model for the Problem of Producing and Distributing a Major Weekly News Magazine

Claudio Cunha, Professor, Escola Politécnica - University of S„o Paulo, Department of Transportation Engineering, CP 61548, S„o Paulo, SP, 05424-970, Brazil, cbcunha@usp.br, Fernando Mutarelli

In this work we address the problem of producing and distributing a major weekly newsmagazine. It involves the determination of the quantity and location of industrial plants, the coverage area for each selected location, the sequencing of production and the best modes of transportation aiming to minimize the total production and transportation costs. Constraints regarding to production capacities and deadlines to delivery are considered. A MIP model is proposed and applied to a real case.

■ WB45

T-Gold (Mezzanine)

Operations Management IV

Contributed Session

Chair: Tomislav Mandakovic, Professor, Florida International University, Decision Sciences, College of Business, Miami, Fl, 33199, United States, mandakov@fiu.edu

1 - The Relationship Between Cultural Dimensions, Quality Practices, and Manufacturing Performance

Michael Naor, Ph.D Candidate, University of Minnesota, Opr & Mgmt Science University of mn, 321 19th Ave s Rm-3-150, Minneapolis, MN, 55455, United States, mnaor@csom.umn.edu

This study investigates the relationship between GLOBE cultural dimensions, quality management infrastructure practices, and plant performance in different countries. Furthermore, the study tests if manufacturing plant organizational culture and country national culture are similar and what is the impact of the fit between them on manufacturing performance. Contingency theory serves as theoretical lens to test mediation and moderation models as competing perspectives of fit.

2 - A Configurational Study of the Impact of Quality Management Practices on Firm

Weiyong Zhang, Ph.D. Candidate, University of Minnesota, 3-150 321 19th Avenue South, Minneapolis, MN, 55455, United States, wzhang@csom.umn.edu

A theory exploring the relationships between Six Sigma (SS)implementation, contextual factors, and firm performance is developed based on literature review and survey of experts using the Evocative Method. Contrary to the common belief that SS programs must be implemented in the standard way to be successful, the theory postulates that success is a result of appropriate customization and more importantly, consciously achieving internal consistence among the structural dimensions of SS programs.

3 - Modeling and Comparison of Productivity in Central European Countries

Josef Jablonsky, University of Economics, W. Churchill Sq. 4, Prague 3, 130 67, Czech Republic, jablon@vse.cz, Petr Fiala

The paper presents a modeling approach for productivity comparison of Central European countries. The model consists of two basic parts. The first one estimates the importance of branches within the countries and the second one evaluates the performance of the firms within branches. The results of both the parts are synthesized and the productivity of the countries are estimated. The evaluation is based on the data set resulting from a survey among firms of selected industries.

4 - Supply Chain: Comparing Manufacturing Global Firms

Tomislav Mandakovic, Professor, Florida International University, Decision Sciences, College of Business, Miami, Fl, 33199, United States, mandakov@fiu.edu, Christos Koulamas

We present results from a sample of existing Supply Chain designs in manufacturing global firms. Results include comparisons on chain structures and perceptions of customer and firm value added in each stage. Extensions are discussed.

Wednesday 12:00pm-1:30pm

■ WC02

P-Ballroom E

Marketing II

Contributed Session

Chair: Amy Kallianpur, University of Notre Dame, 381 MCoB, Notre Dame, IN, 46556, United States

1 - Coexistence of Selling and Leasing of Durable Goods to Individual and Corporate Customers

Vera Tilson, Ph.D Candidate, Department of Operations, Weatherhead School of Management, Case Western Reserve University, United States, vxt15@po.cwru.edu, Yunzeng Wang, Wei Yang

We consider a monopolist who concurrently sells and leases a finitely durable good to both individual and corporate consumers. We construct a model of a dynamic game to capture the interactions among the different distribution channels: (a) sale of new goods to consumers, (b) lease of new goods to both consumers and corporations, and (c) sale of off-lease goods to consumers. The managerial implications are drawn from the study of the monopoly's optimal pricing strategy for all channels.

2 - e-Audience Estimation: Modelling the Spread of Viral Advertising Using Branching Theory

David Stewart, Lecturer, Monash University, 26 Sir John Monash Drive, P O Box 197, Caulfield East, 3145, Australia, David.stewart@buseco.monash.edu.au, Michael Ewing, Dineli Mather

Unlike traditional mass media, "viral" or "buzz" communication is characterized by mutual dependence among members of the target audience. In other words, the message is propagated by audience members themselves. This study is concerned with electronic communication, which has the potential to greatly accelerate the rate and reach of ëinfection' (i.e. receipt of message). Drawing on branching theory, we develop a simulation model to explore the factors which influence the spread of the virus.

3 - Free-shipping Promotions and Internet Shopping Behavior: Theory and Evidence

Yinghui Yang, Wharton, 3730 Walnut st. Suite 500, Philadelphia, PA, 19104, United States, yiyang@wharton.upenn.edu, David Bell, Skander Essegaier

Internet retailers decide whether to: (1) offer free shipping, and (2) and under what conditions. We study the effect of fee schedules on a rational consumer's optimal shopping policy. Fixed fees reduce optimal order quantity per visit; linear in purchase quantity shipping fees do not. Retailers with high free-shipping thresholds and smaller price dispersion and those with low thresholds and greater price dispersion impose the same cost on rational consumers. Amazon data support this finding.

4 - A Model of Service Times

Amy Kallianpur, University of Notre Dame, 381 MCoB, Notre Dame, IN, 46556, United States, William Tunnercliffe

Walmart has lower prices than Target but Target offers quicker checkout times. In this paper we present a model where firms compete on the basis of service times.

■ WC05

P-Plaza Court 3

Optimization Techniques IV

Contributed Session

Chair: Louis Anthony Cox, Jr, Cox Associate, Inc., 503 Franklin Street, Denver, CO, 80218, United States, tony@cox-associates.com

1 - D.C. Optimization Methods for Solving Minimum Maximal Network Flow Problem

Jianming Shi, Associate Professor, Muroran Institute of Technology, 27-1 Mizumoto-Chou, Muroran, Japan, shi@mmm.muroran-it.ac.jp

We consider the minimum maximal flow problem, i.e., minimizing the flow value among maximal flow, which is an $\cal NP$-hard problem. After formulating the problem, we introduce some formulations of the problem and one of them is a minimization of a concave function over a convex set. The problem can also be cast into a d.c. programming. We propose a DCA algorithm for solving the problem.

2 - Multistage Stochastic Programming on the Computational Grid

Jeff Linderoth, Lehigh University, 200 W. Packer Ave, Bethlehem, PA, 18015, United States, jtl3@lehigh.edu, Jerry Shen

We will describe implementation details of a nested-decomposition-based, multi-stage stochastic linear programming solver running in on a computational grid. Computational results revealing the power of the approach will be presented.

3 - Sensitivity Analysis of Gear Center Location Algorithm for Computer Vision Gear Inspection System

Girish Nehate, Graduate Research Assistant, Kansas State University, 233 Durland Hall, Manhattan, KS, 66506, United States, girishn@ksu.edu, John Wu, Terry Beck

A non-contact computer vision gear inspection system is proposed to extract three-dimensional surface information of spur gears. The gear, which is placed on a magnetic based rotary table, may not have its center coaxial with the rotary table, creating a need to find the actual gear center location. Sensitivity analysis is performed on an automated tolerancing algorithm that uses a nonlinear least squares minimization technique for the calculation of the gear center location.

4 - Stochastic Optimization Via Random Sampling and Deterministic Solutions

Louis Anthony Cox, Jr, Cox Associate, Inc., 503 Franklin Street, Denver, CO, 80218, United States, tony@cox-associates.com, Djangir Babayev

A method (SORS) for solving the stochastic optimization problems is presented. The only requirement for applicability of the method is the existence of a computationally efficient method for solving the deterministic version of the original problem. The SORS method provides solutions of stochastic optimization problems asymptotically converging with probability 1 to the exact solutions, when the size of samples of probabilistic random data increases infinitely large.

■ WC06

P-Plaza Court 4

Integer Programming -Theory and Computation

Sponsor: Optimization/ Integer Programming

Sponsored Session

Chair: Eva Lee, Associate Professor & Director, Center for Operations Research in Medicine, Georgia Institute of Technology, Industrial & Systems Engineering, Atlanta, GA, 30332-0205, United States, evakylee@isye.gatech.edu

1 - Strengthening Concise Linearizations of 0-1 Quadratic Programs by Coefficient Adjustments

Dick Forrester, Assistant Professor of Mathematics, Dickinson College, College and Louther Streets, Carlisle, PA, 17013, United States, forrestr@dickinson.edu, Warren Adams

We revisit a classical linearization method of Glover for 0-1 quadratic programs. While this strategy produces concise representations, the linear programming bounds tend to be weak. We show how to improve the continuous relaxation of the linear reformulation by a simple adjustment of the quadratic coefficients. Computational results are presented.

2 - Sequence Dependent Lifting for Mixed Integer Programs with Variable Upper Bounds

Sergey Shebalov, United Airline, Chicago, Chicago, IL, United States, Sergey.Shebalov@united.com, Diego Klabjan

We investigate the convex hull defined by a single inequality with continues and 0/1 variables. We elaborate on sequence dependent lifting for this set and present a dynamic program for calculating lifting coefficients. We next consider its projections to knapsack covers and to the single 0/1 variable polytope. We explicitly give lifting coefficients of continuous variables when lifting the knapsack cover inequality, and two new families of facets for the single 0/1 variable polytope.

3 - Approximate Lifting for Integer Programming

Jean-Philippe Richard, Assistant Professor, Purdue Universtiy, 315 N. Grant Street, West Lafayette, IN, 47906, United States, jprichar@ecn.purdue.edu

Lifting is one of the most powerful tool in the generation of strong valid inequalities for Integer Programs. Exact Lifting is computationally tractable only for simple cases. For more complex problems, approximate lifting coefficients are typically obtained using the superadditive lifting theory introduced by Wolsey. In this talk, we present an alternative scheme to perform approximate lifting. We show how it can be used to strengthen Gomory cuts for integer programs with small bounds.

4 - Using Hypergraphs to Obtain Facial Structures of General Binary Integer Programs

Kevin Hooker, Kansas State University, 237 Durland Hall, Manhattan, KS, United States, kjh9898@ksu.edu, Todd Easton

Theoretical results relating to the facial structure of the general binary integer programming polytope are presented. A conflict hypergraph is constructed and various induced subhypergraphs create valid inequalities of the polytope. These inequalities are shown to produce large dimensional faces.

■ WC07

P-Plaza Court 5

Linear Programming & Linear Systems

Contributed Session

Chair: Svyatoslav Trukhanov, Texas A&M University, Department of Industrial Engineering, College Station, TX, 77843, United States, slavik@tamu.edu

1 - Applying Mixed Integer Programming to Devise a Training Course Schedule for the U. S. Air Force

Mary Crissey, Analytical Srategist, SAS Institute, 17030 Vista Park Drive, San Antonio, TX, 78247, United States, mary.crissey@sas.com, Jodi Blomberg

Each year, the arduous task of scheduling training for 400,000 military troops is done under limited budgets and over-committed calendars. A SAS/OR model now includes 250 parameters that impact training outcome as it optimizes while considering facility descriptions, class size, course length and student demographics. Future versions will be web-enabled to improve the interactivity of what-if decision making related to training requirements, budgets, student enrollment and course offerings.

2 - A Cutting Plane Method for Linear Generalized Disjunctive Programs

Nicolas Sawaya, Carnegie Mellon University, 4614 5th Avenue Apt 716, Pittsburgh, PA, 15213, United States, nws@andrew.cmu.edu, Ignacio Grossmann

A novel cutting plane method is proposed for linear disjunctive programs that is based on successively strengthening the big-M reformulation by cuts generated from a separation problem based on the convex hull of each disjunction. Theoretical properties are presented. Several examples illustrate the performance of the proposed method.

3 - A Review on Mathematical Programming Models to Fuzzy Regression

Mohammad Mehdi Nasrabadi, Payam Noor Univesrity of Birjand, Daneshgah Blv., Birjand, Iran, nasrabadi@yahoo.com, S.Mehdi Hashemi, Ebrahim Nasrabadi

Generally, fuzzy regression models can be classified into two classes. The first class includes Tanaka's approach and its extension. In this class, the total vagueness of the estimated values for the dependent variable is minimized. The second one adopts fuzzy least square method (FLSM) to minimize the total square of errors in the estimated value. In this paper, we review mathematical programming models to fuzzy linear regression.

4 - The Progress of Linear Programming Saddle Point Algorithm

Zhe Hu, Shenyang Aeroengineering Design & Research Institute, P.O. Box 428, No 55, Shenyang, 110015, China, kaotaci@yahoo.com.cn

The paper describes the progress of research work for linear programming saddle point algorithm in recent years. It discusses important characteristics of saddle point algorithm and its convergence. The compare of the computed results has been shown in the paper between the software of saddle point algorithm and the interior point algorithm Pcx. It also introduces the application situation of saddle point algorithm in petroleum industry.

5 - Powered Iterative Methods for Linear Systems

Svyatoslav Trukhanov, Texas A&M University, Department of Industrial Engineering, College Station, TX, 77843, United States, slavik@tamu.edu, Sergiy Butenko

A modification of the standard iterative schemes for solving linear systems is proposed. The ``powered" iterative methods based on this modification have several advantages over the original schemes, including faster convergence and reduced round-off errors.

■ WC08

P-Plaza Court 6

Computer-Assisted Analysis

Contributed Session

Chair: Tallys Yunes, Carnegie Mellon University, 5000 Forbes Avenue, Pittsburgh, PA, 15213, United States, tallys@cmu.edu

1 - Correlated Assignment for Product and Data Storage

Maurice Garfinkel, Georgia Tech, 1086 Burton Drive, Atlanta, GA, 30329, United States, mag@isye.gatech.edu, Gunter Sharp, Joel Sokol

We study the correlated storage problem that arises in product and data storage, focusing on minimizing multi-zone orders. Construction models include optimization models heuristics; improvement methods include 2-way and cyclic swaps. Computational results are presented for problems up to 5000 products. Problem variations include varying product sizes and stock splitting.

2 - Knowledge Base with Object-oriented Structure for Machining Technology Process

Dragan Eric, Technology Engineer, Company SLOBODA, Ratka Mitrovic b.b.,, 32000 Cacak, Yugoslavia, ericmdragan@yahoo.com, Savko R. Jekic, Michael Mladjenovic

This paper will demonstrate possible applications of expert system knowledge base in the manufacturing process for electric discharge machining. The structure of this knowledge base is the object-oriented programming with classes, subclasses, slots and rules. For inter-object communication we used messages, methods and monitors. Methods are procedures that are represented as object attributes. Monitors are methods that are linked to slots.

3 - Design and Implementation of an Object Oriented Area Access Control System Database

Bharath Natarajan, Graduate Research Assistant, University of South Florida, ENB118, IMSE, 4202 E. Fowler Avenue, Tampa, FL, 33620, United States, bharathn@eng.usf.edu, Ali Yalcin

Access control systems encompass integrated software and hardware systems to verify an individual's identity and determine if the individual has the required privilege to enter/operate the secured area/system. This work addresses the design and implementation of an object oriented area access control system database. The use of an object oriented database structure overcomes the difficulties encountered when using the traditional relational approach to database design.

4 - SIMPL: A System for Integrating Optimization Techniques

Tallys Yunes, Carnegie Mellon University, 5000 Forbes Avenue, Pittsburgh, PA, 15213, United States, tallys@cmu.edu, Ionut Aron, John Hooker

Recently, both the OR and Constraint Programming (CP) communities have acknowledged the benefits of combining OR and CP techniques to solve optimization problems. Nevertheless, little work has been done toward the implementation of a systematic approach to building and solving hybrid optimization models. We introduce a modeling language that uses an abstraction of search, inference and multiple problem relaxations as the paradigm that allows for a clean and generic integration of CP and OR.

■ WC09

P-Plaza Court 7

Decision Support Systems

Contributed Session

Chair: John Yi, Associate Director, Sanofi-Aventis, 90 Park Ave., New York, NY, 10016, United States, yij@seas.upenn.edu

1 - New Decision Based Models for Route Construction in the VRPTW

Eduardo Guillen, University of La Coruna, E.U. Diseno Industrial, DTOR Vazquez Cabrera SN, Ferrol-La Coruna, 15403, Spain, edugs@udc.es, Alejandro G. del Valle, Javier Faulin

In this paper we present a new decision based model for reoute construction in order to solve the well known vehicle routing problem with time windows constraints. The model involves a series of decision based on certain parameters the user must implement in order to construct every route. Computational results are provided for Solomon benchmark problems, as well as the complete decision sequence.

2 - Decision Support Models for Interdependent Infrastructure Systems

Earl Lee, Research Associate, Rensselaer Polytechnic Institute, CII 5107, 110 Eighth St, Troy, NY, 12180, United States, leee7@rpi.edu, John Mitchell, William A. Wallace

Critical infrastructure systems are considered so vital that their incapacity or destruction would have a debilitating effect on our national security. Our work has developed a formal, mathematical representation of the set of civil infrastructure systems that explicitly incorporates the interdependencies among them. With this broader perspective of impact, mitigation and preparedness strategies can be formulated and evaluated for their ability to reduce their effects on society.

3 - Building Stochastic Optimization Models for the Energy and Power Sectors

Nitin Verma, Sr Consultant, Dash Optimization Inc, 560 Sylvan Ave, Englewood Cliffs, NJ, 07632, United States, nitin.verma@dashoptimization.com, Horia Tipi

Deregulation, fragmentation, and shorter cycle-times in the energy sector have made decision-making a challenging task. We demonstrate how Xpress-SP from Dash Optimization can be used to capture the involved uncertainty and its impact in an optimization framework, and help make efficient decisions in areas such as capacity expansion, unit commitment, and energy trading.

4 - Decision Support System for Scheduling under Sequence Dependent Setup Time Constraint

Nabeel Mandahawi, Ph.D student, University of Texas at Arlington, 604Causely Ave Apt#102 Arlington Tx76010, Arlington, TX, 76010, United States, nabeelma@hotmail.com, Bonnie Boardman

In this paper, a Decision Support System (DSS) is built to confront the problem of optimizing specific performance measures under sequence dependent setup time constraint. The DSS can efficiently overcome the large number of permutations arising in this type of scheduling problems. The DSS is based on performance evaluation of ten algorithms; four of these algorithms are new and have been evaluated over a wide range of data set. The result is job schedules that optimize thirteen various performance measures by matching each measure with one of the ten algorithms in the paper. Moreover, most of these measures are classified as NP-hard problems.

5 - Decision Support System in Detailing Multiple Products

John Yi, Associate Director, Sanofi-Aventis, 90 Park Ave., New York, NY, 10016, United States, yij@seas.upenn.edu, G "Anand" Anandalingam

In the pharmaceutical industry, with the trend of decreasing face time to what is now about one to two minutes, the optimization of this time is critical to one's success. This paper shows an innovative optimization-based approach to measure the relative impact of each detailing product in its order of presentation. The result of this research can be applied to planning for the sales force resource allocation and improving customer relationship management.

■ WC10

P-Plaza Court 8

Transportation V

Contributed Session

Chair: Lin Wang, University of Pittsburgh, 1048 Benedum Hall, Pittsburgh, PA, 15261, United States, liw4@pitt.edu

1 - Are Hub-and-Spoke Airline Networks Always better than Point-to-Point Networks?

Qiaohai(Joice) Hu, Case Western Reserve University, 10900 Euclid Ave., Cleveland, OH, 44106, United States, qxh3@cwru.edu

We study a three-stage duopoly game between airlines: a network structure game, a capacity game and a quantity game. Network structure and capacity have to be decided while demands are unknown and the quantity decision is made after demand uncertainty is resolved. Three possible outcomes can comprise network structure at equilibrium and a mixed network is socially superior to a pure hub-and-spoke network.

2 - Determining the Number of Probe Vehicles Required to Estimate Travel Times in a Network

Mecit Cetin, Assistant Professor, University of South Carolina, Department of Civil Engineering, 300 S. Main Street, Columbia, SC, 29208, United States, cetin@engr.sc.edu, William A. Wallace, George F. List, Earl Lee

Probes vehicle can monitor roadway systems in real-time. Current methods use simulation to determine the number of probes needed to estimate travel times in a network. This paper presents an optimization approach that finds the smallest number of probes given minimum probe flow rates by link and an OD matrix. A second model finds the optimum distribution of probes among OD pairs for a fixed number of probes. This second model minimizes the sum of deviations from desired probe densities by link.

3 - Development of Flight Leg Robustness index(FLRI) and Its application

Vinay Mehendiratta, Doctoral Candidate, CLemson University, 221 B, Martin Street, Clemson, SC, 29631, United States, vinay_Mehendi@yahoo.com, Mary E. Kurz, Michael Leonard

Disruption is inherent in airline operations. Type, cause, and length of disruption vary depending on factors such as weather, carrier, and recovery policies. Effect of disruption on FL performance varies depending on set of qualities of FL. We develops Fight Leg Characterization (FLC) by associating qualities and causes defined by FAA which gives reasons for performance differences in FLs. FLRI has advantages over On-Time (%) used by FAA.

4 - Preemption Traffic Network Design

Lin Wang, University of Pittsburgh, 1048 Benedum Hall, Pittsburgh, PA, 15261, United States, liw4@pitt.edu, Ming-En Wang, Bryan Norman

Traffic Signal Preemption (TSP) is an equipment that can be added onto traffic signals for detecting approaching emergency vehicles and changing signal patterns to minimize delay at traffic intersections. For medium and large metropolises, it is infeasible to add TSP to every traffic signal due to budget constraints. We solve the problem of finding optimal TSP installations in a city to minimize the average response time of fire trucks as a multi-zone, multi-commodity network flow problem.

■ WC11

P-Governor's Square 9

Transportation VI

Contributed Session

Chair: Alessandro Carrotta, Ph.D student, ILOG SA, 9 rue de Verdun, Gentilly, 94253, France, acarrotta@deis.unibo.it

1 - An Evolutionary Game Theory Approach to the Day-to-day Traffic Dynamics

Fan Yang, Research Assistant, University of Wisconsin-Madison, Civil and Environmental Engineering Dept, 1415 Engineering Drive, Madison, WI, 53705, United States, yang@cae.wisc.edu, Bin Ran, Henry Liu

We adopt evolutionary game theory (EGT) approach to study the day-to-day traffic flow dynamics. EGT applies population dynamical methods into classic game theory, relaxing the requirements for rationality of the players and providing insight into the dynamic evolving behavior. Thus we are able to obtain a unique day-to-day trajectory of route flows over finite time span. When the traffic demand is large, the stochastic dynamic over finite time spans follow an almost deterministic trajectory.

2 - Routing of Automated Guided Vehicles

Loo Hay Lee, National University of Singapore, 10 Kent Ridge, Singapore, Si, Singapore, iseleelh@nus.edu.sg, Ek Peng Chew

An algorithm to solve the vehicle's route planning problem on bi-directional paths for an automated guided vehicles system (AGVS) is developed. The objective is to complete the assigned tasks for the vehicles in the shortest possible time by satisfying the vehicle's assignment and conflict constraints.

3 - Selectorecombinative GA Approach for Discrete Network Design Problem

Kyunghwi Jeon, Ph.D candidate, University of Illinois at Urbana-Champaign, B156 Newmark Civil Engineering Lab., 205 N Mathews, Urbana, IL, 61801, United States, kjeon1@uiuc.edu, S. Travis Waller, Satish Ukkusuri

This paper presents a discrete network design model that accounts for simulation-based DTA models that are adopted cell transmission model can account for traffic realities on links and networks, by employing a genetic algorithm to create feasible network design solutions. Selectorecombinative GA is used to reduce the solution space and find the feasible solution set to the discrete network design problem. We compare discrete network design solutions for DUE and DTA conditions.

4 - Intra-route Optimizer for the VRPTW

Alessandro Carrotta, Ph.D student, ILOG SA, 9 rue de Verdun, Gentilly, 94253, France, acarrotta@deis.unibo.it, Andrea Lodi, Bruno De Backer

ILOG Dispatcher provides a metaheuristic approach to solve routing problems. I propose a CP-OR complete hybrid algorithm based on the solution of a linear relaxation of the original problem and a Cost-Based Domain Filtering approach to re-optimize the single routes of the VRPTW solution given by Dispatcher. Then a Discrepancy Based Search methodology is proposed as alternative strategy to break down the difficult instances. Extensive computational results show the effectiveness of the method.

■ WC12

P-Governor's Square 10

Inventory Modeling VI

Contributed Session

Chair: Guodong(Gordon) Gao, Mr., The Wharton School, University of Pennsylvania, Suite 500, JMHH, 3730 Walnut Street, Philadelphia, 19104, United States, gaog@wharton.upenn.edu

1 - On the Use of Rational Inventory Policies

Xiaoming Li, Assistant Professor, Tennessee State University, 330 10th Ave. N., Nashville, TN, 37203, United States, xli1@tnstate.edu, Rui Wang

This paper studies how the use of rational inventory policies affects suppliers' performance and thus the whole supply chain. Using stochastic models, we first show how customer demand is transformed and distorted to the facility's orders. Then we examine how distorted demand information downgrades the supplier's performance. Finally, this study provides some managerial insights of allocating inventory along supply chains.

2 - How Product Variety Influences Firm Performance and JIT Adoption

Guodong(Gordon) Gao, Mr., The Wharton School, University of Pennsylvania, Suite 500, JMHH, 3730 Walnut Street, Philadelphia, 19104, United States, gaog@wharton.upenn.edu, Lorin Hitt

Large-scale empirical evidence of product variety's impact on production efficiency and firm performance has been scarce. Based on a sample of Fortune 1000 manufacturing firms over 1980-2000, we find that (1) product variety significantly increases finished goods inventory, but not raw materials or work in process; (2) product variety boosts sales but not profit margin; and (3) firms with higher product variety level are more likely to adopt JIT. Managerial applications are also discussed.

■ WC13

P-Governor's Square 11

Logistics III

Contributed Session

Chair: Sirong Luo, Ph.D Candidate, The University of Texas At Dallas, P. O. Box 830688, Richardson,, TX, 75083, United States, sxl01200@utdallas.edu

1 - A Framework and Model for Planning Air Cargo Shipments
Gang Chen, Chinese University of Hong Kong, Decision Sci & Mgl Eco, Shatin, N.T., Hong Kong, chengang@baf.msmail.cuhk.edu.hk, Lawrence C. Leung, Dong Cao, Yer Van Hui

With the development of Internet logistics platforms, an air freight forwarder can trade jobs and resources effectively. This paper addresses the formulation of a shipment plan where a forwarder would design consolidation and integration of air cargo shipments, with considerations of trading of jobs and resources. This problem is modeled as a mixed 0-1 LP. We also discuss respective rules and strategies that would aid the design and trading process.

2 - ECL (Empty Container Logistics) Optimization
Yossi Shiloach, Project leader, IBM, IBM Research Lab, Haifa University, Haifa, 31905, Israel, shiloah@zim.co.il

The logistics of empty containers is a major task in any container shipping company. Its main objective is to provide empty containers to any export point by quantity, type and time required and do it with minimal cost. A medium shipping company may hold hundreds of thousands containers, serving hundreds export ports (many inland). The cost of ECL may reach 10% of the annual turn over. The talk will overview a 2 years project that ended recently indicating possible saving of 20% in ECL costs.

3 - Integration and Consolidation of Air Cargo Shipment: A Mixed 0-1 LP Model
Wai Hung Wong, Chinese University of Hong Kong, DSE, KKL Building, CUHK, Shatin, Hong Kong, Hong Kong, whwong@baf.msmail.cuhk.edu.hk, Lawrence C. Leung, Yer Van Hui

The management of air cargo logistics is complicated as it involves the collaborations of many logistics agents. Freight forwarders are responsible for the planning and management of shipments and act as liaisons with other logistics agents for the clients. A forwarder's shipment plan must try to optimize the integration and consolidation of logistics activities. We formulate this shipment problem (including resources constraints) as a mixed 0-1 LP. We solve it using a Tabu search algorithm.

4 - Two Dimensional Overbooking in Air Cargo Management
Sirong Luo, Ph.D Candidate, The University of Texas At Dallas, P. O. Box 830688, Richardson,, TX, 75083, United States, sxl01200@utdallas.edu, Metin Ç anyildirim

In this paper, we address the two dimensional (weight and volume) overbooking problem in air cargo revenue management. We study two characterizations of showing up bookings in one dimensional model. For the two dimensional problem, we first present the "box model", which has a fixed weight (and a volume) overbooking limit. Finally, we provide a "general model" whose overbooking limits are given by a curve. We illustrate how the curve can be found.

■ WC14

P-Governor's Square 14

Technology Management/Business Process Reenginering

Contributed Session

Chair: Oscar A. Saenz, Ph.D Candidate, Florida International University, 10555 West Flagler Street, EC-3100, Miami, Fl, 33174, United States, oscar.saenz@fiu.edu

1 - Developing a Customer Satisfaction Model of Energy Technology in Korea
Sangjin Choi, Senior Researcher, Korea Institute of Energy Research, 71-2, Jangdong, YouseongKu, Daejeon, 305-343, South Korea, sjinchoi@kier.re.kr, Deokki Lee, Soouk Park

Customer satisfaction is a key issue for organizations in today's competitive market place. A new model to develop the customer satisfaction index of energy technology is developed, and Partial Least Square has been used to estimate the model. The Energy Technology Customer Satisfaction Index in Korea was developed in order to find out what variables affect the index more than others, and also what aspects of technologies should be studied further in order to get a higher index value.

2 - The Impact of CMMI Introduction on Engineering Relations: A Preliminary Study
Paul Nugent, Lead Engineer, Adjunct Prof, GDAIS, RPI, 62 New Lenox Road, Lenox, MA, 01240, United States, Paul.Nugent@gd-ais.com

This study examines the introduction of formal "process" (CMMI) to the work of systems and software engineering. Early qualitative data reveal that many of the community building aspects of production relations are being changed by this new process that emphasizes performance metrics and optimization. The concept of process is analyzed with respect to work structure, productions relations, and culture. Implications for engineering and management are discussed.

3 - Identification of Modeling Areas for Enterprise Systems Engineering
Oscar A. Saenz, Ph.D Candidate, Florida International University, 10555 West Flagler Street, EC-3100, Miami, Fl, 33174, United States, oscar.saenz@fiu.edu, Chin-Sheng Chen

Enterprise Systems Engineering is an emerging research field. The authors propose a matrix classification scheme that identifies modeling areas that need to be addressed as part of an ESE process, and classifies related research efforts on this subject. The approach breaks down an enterprise into enterprise elements, system facets, and engineering phases, to achieve pre-specified performance criteria.

■ WC16

P-Governor's Square 17

Neural Networks

Contributed Session

Chair: Mukul Patki, Doctoral Student, Oklahoma State University, 700 W. Scott, Apt. #2, Stillwater, OK, 74074, United States, mukulpatki@hotmail.com

1 - Assessment of the Equivalency of the Three-Dimensional Kinetics and Kinematics Using Neural Networks
Steven Yuhaski, Operations Research Analyst, Natick Soldier Center, Supporting Sci. & Tech. Directorate, 1 Kansas Street, Natick, MA, 01760, United States, steve.yuhaski@natick.army.mil, Lief Hasselquist

Artificial neural networks can be developed and trained to classify gaits under various walking conditions, such as load-carriage and inclination. Streamlining the heuristic used to optimize the weights of the neural network and revising the back-propagation scheme resulted in a significant increase in computational efficiency. Reformulation of the back-propagation target calculations, and the implementation of sigmoid transfer functions enhanced the accuracy of the data set classifications.

2 - Analyzing Designed Experiments Using Neural Networks For Reverse Mapping
Mukul Patki, Doctoral Student, Oklahoma State University, 700 W. Scott, Apt. #2, Stillwater, OK, 74074, United States, mukulpatki@hotmail.com

This paper aims at using neural networks in designed experiments to predict the value of controllable variables given a target value of the response variable. We simulate data for four scenarios by varying number of dependent variables and the degree of non-linearity. The data is collected as a central composite design. Statistical techniques and neural networks are used make the prediction mentioned above. Confirmation runs are simulated using both predictions and results are compared.

■ WC17

P-Directors Row E

DecisIon Analysis III

Contributed Session

Chair: John Aloysius, Associate Professor, University of Arkansas, WCOB 204, University of Arkansas, Fayetteville, AR, 72701, United States, aloysius@uark.edu

1 - Expertise Measure in Linguistic Group Decision Making
Zhifeng Chen, Kansas State University, 237 Durland Hall, Manhattan, KS, 66506, United States, zfchen@ksu.edu, David Ben-Arieh

A team of experts provide information to reduce uncertainty in group decision making problems. Consensus indicates the agreement between expert's opinions. Experts have their own expertise domain. They should not compromise their personalities for consensus. Given a group solution and consensus together with the information experts provided, we could evaluate their expertise. This should benefit the future selection of experts as well as the group solution.

2 - An Intrusion Detection Model with Multiple Alarm Types and Investigation Costs

Metin Çakanyildirim, Assistant Professor, The University of Texas At Dallas, P. O. Box 830688, Richardson, TX, 75083, United States, metin@utdallas.edu, Young Ryu, Wei Yue

We analyze intrusion detection decisions with alarm types differing in their occurrence probabilities, damage and investigation costs. Multi-period optimization models are used to study the following decisions: 1. Allocation of the investigation budget to periods and to alarms. 2. Choosing a false alarm rate for an IDS whose receiver operating characteristic curve is given. 3. Assigning appropriate amount of the investigation budget in the presence of alternative investment opportunities.

3 - Multiple Prospect Framing and Decision Behavior: Perceived Riskiness and Perceived Ambiguity

John Aloysius, Associate Professor, University of Arkansas, WCOB 204, University of Arkansas, Fayetteville, AR, 72701, United States, aloysius@uark.edu, Fred Davis, Srinivasan Venkatraman

Decision makers facing a multiple prospect are influenced by whether outcome information is framed narrowly (segregated) or broadly (aggregated). Benartzi and Thaler (1999) attributed this effect to myopic loss aversion. This research (a) explicitly tests the myopic loss aversion account by examining the mediating role of perceived riskiness, and (b) investigates whether perceived ambiguity is a second mechanism, distinct from perceived riskiness, linking prospect framing to decision behavior.

■ WC21

P-Room 3302

Organization Theory

Contributed Session

Chair: Darren Zinner, Harvard Business School, T81 Morgan Hall, Soldiers Field Road, Boston, MA, 02163, United States, dzinner@hbs.edu

1 - Allocation and Social Equity

H.Paul Williams, Professor of Operational Research, London School of Economics, Houghton Street, LONDON, WC2A 2AE, United Kingdom, h.p.williams@lse.ac.uk, Martin Butler

We will look at a number of problems of Allocation. A major concern arises as to the ëfairness' of the resulting allocation. We will discuss notions of fairness in contrast to other criteria (efficiency and maximising total ëgood'). Problems to be considered are Allocating Scarce Medical Resources among different patients, Allocating Limited Teachers among competing ability groups and Allocating Fixed Costs of facilities between different users.

2 - Organizational Change: A Social Network Approach

Zhengjun wang, Louisiana State University, 3650 Nicholson Dr. Apt,2133, Baton Rouge, LA, United States, zwang2@lsu.edu

This paper examines the effect of social networks on organizational change. The strength of ties in intra and inter-organizational networks play a different role in impacting the likelihood, direction, and consequence of organizational changes. Drawing upon both literature of organizational change and social networks, I develop several propositions about the effect of strength of ties on the three dimension of organizational change.

3 - The Effect of Focus on Operational Productivity: Lessons from the Management of Clinical Trials

Darren Zinner, Harvard Business School, T81 Morgan Hall, Soldiers Field Road, Boston, MA, 02163, United States, dzinner@hbs.edu, Robert Huckman

The theory of focus argues that organizations should devote resources to a single type of product or process. We empirically explore the notions of focus within the clinical trial setting, measuring investigative sites' productivity across common protocols. We test whether the "focused factory" and "plant-within-a-plant" operational designs are truly superior and suggest several new dimensions of operational focus.

■ WC23

P-Room 3354

Applications in Military and Space Decision Making

Sponsor: Military Applications

Sponsored Session

Chair: Richard Schooff, Lt Col, USAF Academy - Math Dept, HQ USAFA/DFMS, 2354 Fairchild Drive, Ste 120, USAF Academy, CO, 80840, United States, rich.schooff@usafa.af.mil

1 - Modeling and Analysis of a Theater Distribution System

Victor Wiley, Major, AF Institute of Technology, AFIT/ENS Bldg 641, 2950 Hobson Way, Wright-Patterson AFB, OH, 45433-7765, United States, victor.wiley@afit.edu, Jeffrey Brown

The focus of this research is to determine the best combination of controllable factors which exert the most influence on the efficient and effective use of C-130 airlift in Central Command's (CENTCOM's) AOR, to see what trade-offs exist, and to identify a subset of "best all around" system designs.

2 - Efficient Bayesian Methods for Updating and Storing Uncertain Search Information for UAV's

Matthew Flint, Ph.D Candidate, Univ of Cincinnati, Univ of Cincinnati, Dept. of ECECS, Cincinnati, OH, 45221-0030, United States, flintmd@email.uc.edu, Emmanuel Fernandez, Marios Polycarpou

Algorithms for the autonomous decision and control of unmanned aerial vehicles (UAV's) require access to accurate information about the state of the environment in order to perform well. However, this information is oftentimes uncertain and dynamically changing. Bayesian methods are used to take probabilistic information about reports of object detections and to incorporate this information into an information base. The resulting process is suited for cooperative search by a team of UAV's.

3 - Risk Assessment and Management for Military Space Projects

Stein Cass, Dr, Ball Aerospace and Technologies Corp, 1600 Commerce Street, MS:CC-3, Boulder, CO, 80301, United States, scass@ball.com, Richard Schooff

DoD customers are requiring more emphasis & rigor be placed on aerospace project risk management. This study investigated risk methods utilized by military space projects since the Challenger failure, to extract a matrix of tools & methods implemented. Using this matrix, risk managers can select tools appropriate for their organization/customers. Primary risk drivers were noted for 200+ programs, & recommendations made for risk process improvements in military space projects.

■ WC24

P-Room 3402

Scheduling V

Contributed Session

Chair: Patricia Randall, Clemson University, 110 Freeman Hall, Clemson, SC, 29633, United States, pcavedo@clemson.edu

1 - Multiple Batch, Two Machine, Flow Shop Lot Streaming to Minimize Makespan and Handling Costs

Ming Chen, ISE Virginia Tech, 250 Durham Hall, Blacksburg, VA, 24061-0118, United States, michen@vt.edu, Subhash Sarin

Lot streaming is the process of splitting a batch of jobs and processing it in an overlapping manner on the machines.In this paper,we address the problem of determining optimal number of sublots for processing multiple batches in a two machine flow shop,for the objective of minimizing a joint function of makespan and sublot handling costs.Computational results of the proposed methodology are presented and its various extensions are discussed.

2 - A Genetic Algorithm for Serial Batching on Unrelated Parallel Machines with Sequence-Dependent Setup

Patricia Randall, Clemson University, 110 Freeman Hall, Clemson, SC, 29633, United States, pcavedo@clemson.edu, Mary E. Kurz

Serial batching on unrelated parallel machines has been shown to be strongly NP-hard so traditional solution methods such as integer programming are unable to solve real world sized problems. Therefore, a genetic algorithm is given to batch and then schedule jobs on unrelated parallel machines. The performance of the genetic algorithm will be compared with the performance of traditional methods. Also, how to determine the best choices for parameter values and the chromosome will be discussed.

■ WC25

P-Room 3404

Education II

Contributed Session

Chair: Morgan Jones, Associate Professor, University of North Carolina, Kenan-Flagler Business School, Chapel Hill, NC, 27599-3490, United States, morgan_jones@unc.edu

1 - Dispensing Thirteen Fears in Thirteen Days
Wayne Russell, Instructor of Mathematics, Medgar Evers College, 233 Maple Street, Brooklyn, NY, 11225, United States, WRUSSE01@AOL.COM

This qualitative study chronicles the journey of thirteen women as they demystified and conquered their fear of mathematics. This research looks the humanistic approach to the teaching of mathematics, utilizing a scaffolding technique that embraces a low avoidance method. This technique gives ownership and authority to the students, thereby reducing anxiety and creates a sense of community within the class room; availing more hours for test taking techniques and examinations strategies.

2 - Mentoring OR at-a-distance
Terry Williams, Professor and Head of Department, Dept. Management Science, Strathclyde University, 40 George Street, Glasgow, G1 1QE, United Kingdom, terry@mansci.strath.ac.uk, Howard Ramsay

Strathclyde's leading OR MSc is action-oriented emphasising experiential learning with mentoring & reflection. Separating web-deliverable content, with our experience mentoring part-time students (in OR-related employment), enabled development of a mixed-mode MSc format, now world-wide. We will describe the course and lessons learned, including the value of immediate OR usage, culture mix, types of interaction, good online tutoring and student motivation as well as practical issues.

3 - Managing Field Study Projects: Not Exactly a Walk in the Park!
Susan A. Chesteen, Department of Management, University of Utah, 1645 E. Campus Center Dr., Salt Lake City, UT, 84112, United States, mgtsc@business.utah.edu, Steve B. Tallman

Even with the implementation of project management techniques many problems occur throughout the entire process of managing field study projects. This paper identifies critical incidents, issues, complexities, and empirical situations that challenge instructors of graduate field study programs. Solutions, tactics and suggestions for dealing with issues are also discussed.

4 - An Integer Programming Model for Student Class Scheduling
Dawn Strickland, Assistant Professor of Mathematics, Winthrop University, 156 Bancroft, Rock Hill, SC, 29733, United States, stricklandd@winthrop.edu, Joel Sokol, Sarah Mae Billingsley, Hannah Kolberg

We present an integer programming model designed to help students choose the best class schedule according to certain criteria. We illustrate the use of (and necessity for) this model using data taken from a university that stretches over 5 adjacent campuses, requires knowledge of 10 campus bus routes to determine the feasibility of taking back-to-back courses, and offers as many as 178 sections of a single course each semester.

5 - Teaching "Responsible" Optimization Techniques to MBA Students
Morgan Jones, Associate Professor, University of North Carolina, Kenan-Flagler Business School, Chapel Hill, NC, 27599-3490, United States, morgan_jones@unc.edu

MBAs approach optimization problems with a dangerous mindset - they "solve" spreadsheet models with Solver. Being aware of neither the underlying mathematics of their model, nor the limitations of Solver, their solutions may be far from optimal. Short of a full mathematical representation of the spreadsheet, we propose a compromise which requires students to use Excel tools, some mathematical understanding, and an understanding of how Solver works, to better approach optimization problems.

■ WC27

P-Room 3454

Stochastic Models in Financial Engineering

Sponsor: Applied Probability
Sponsored Session

Chair: Vadim Linetsky, Associate Professor, IEMS Department, Northwestern University, 2145 Sheridan Rd, RM C210, Evanston, IL, 60208, United States, linetsky@iems.northwestern.edu

1 - Good Deal Bounds for Valuation of Real and Financial Options
Jeremy Staum, Northwestern University, 2145 Sheridan Road, Evanston, IL, United States, j-staum@northwestern.edu

Good deal bounds for pricing contingent claims in incomplete markets can incorporate robustness or aversion to ambiguity about stochastic models. We explore an approach to constructing them by specifying the underlying acceptance set using equilibrium theories (such as the capital asset pricing model) which support the decision tools (such as net present value and real options analyses) currently used in practice to make real investment decisions.

2 - Optimal Partially Reversible Investment with Entry Decision and General Profit Functions
Xin Guo, Assistant Professor, Cornell, School of ORIE, Cornell University, Ithaca, NY, 14853, United States, xg29@cornell.edu, Huyen Pham

3 - Large Deviations and Fast Simulation of Multifactor Portfolio Credit Risk
Wanmo Kang, Ph.D Student, Columbia Univeristy, IEOR department, New York, NY, 10027, United States, wk2003@columbia.edu, Perwez Shahabuddin, Paul Glasserman

Monte Carlo simulation is widely used to estimate portfolio credit risk. We develop large deviations results and asymptotically optimal importance sampling techniques for fast simulation in the multifactor normal copula model.

4 - A Spectral Expansion Approach to Diffusion Hitting Times: Applications in Finance
Vadim Linetsky, Associate Professor, IEMS Department, Northwestern University, 2145 Sheridan Rd, RM C210, Evanston, IL, 60208, United States, linetsky@iems.northwestern.edu

Explicit analytical characterizations for first hitting time densities for square root, OU and CEV diffusions are provided in terms of relevant Sturm-Liouville eigenfunction expansions. The results are applicable to the analysis of mean-reverting models for interest rates, credit spreads, stochastic volatility and other mean-reverting financial variables, as well as to the pricing of lookback options on the maximum or minimum asset price achieved during the lifetime of the option."

■ WC28

P-Room 3504

Applied Probability III

Contributed Session

Chair: Ming-En Wang, Assistant Professor, University of Pittsburgh, 1034 Benedum Hall, Dept of Industrial Engr, Pittsburgh, PA, 15261, United States, mewang@engr.pitt.edu

1 - A New Tolerance Allocation Method with Stochastic Process Capability
Safwan Altarazi, Wichita State University, 7012E Kellogg #K, Wichita, KS, 67207, United States, sahmty@yahoo.com, Hossein Cheraghi

The majority of the published articles in tolerance allocation are optimization based, most of which are based on the cost-tolerance models. These models consider the machine capability as a single value. This is not quite right. In this work, the machine capability is formulated in two ways; as a stochastic distribution and as a linguistic variable that has a fuzzy nature. The results indicate the superiority of the proposed method over the current tolerance allocation methods.

2 - Preference Share Uncertainty for a Hierarchical Bayes Discrete Choice Model
Tomas Larsson, General Motors Corp., Mail Code 480-106-256, 30500 Mound Rd., Warren, MI, 48090-9055, United States, tomas.larsson@gm.com

Two methods are presented for obtaining an estimate of the uncertainty of preference shares obtained using a Hierarchical Bayes discrete choice model. The first method requires less computation time compared to obtaining the uncertainty from a Monte Carlo simulation for many models. However, for highly complex models the method looses its advantage, and a second approach is suggested that is slightly less accurate, but manageable from a computational standpoint even for very complex models.

3 - Funding Opportunity for Applied Probability at ARO
Mou-Hsiung Chang, Program Manager of Probability and Statistics, U. S. Army Research Office, P. O. Box 12211, RTP, NC, 27709, United States, ChangMH@aro.arl.army.mil

In this talk, funding opportunities for applied probability and stochastic analysis at U. S. Army Research Office will be presented.

4 - Diffusion Approximations for Congestion-Sensitive Input-Output Systems
David Alderson, Postdoctoral Scholar, California Institute of Technology, MC 107-81, 1200 E. California Blvd., Pasadena, CA, 91125, United States, alderd@cds.caltech.edu, Peter Glynn

We examine diffusion approximation models for stochastic input-output systems that are subject to congestion collapse. These models can be viewed as continuous-space analogs to particular birth-death models of congestion-sensitive queues, or they may also arise directly in the context of domain-specific applications. In either case, the application of the diffusion approximation model provides insight into system stability and allows the characterization of optimal admission control policies.

5 - A Probabilistic Evaluation of Ad Hoc Network Localization Methods

Ming-En Wang, Assistant Professor, University of Pittsburgh, 1034 Benedum Hall, Dept of Industrial Engr, Pittsburgh, PA, 15261, United States, mewang@engr.pitt.edu

Location information is valuable in ad hoc networks for embedding sensor data in the physical space and for efficient routing. Several node localization methods have been proposed for ad hoc networks, which are usually validated with simulation results under different configurations. We establish a probability foundation for an analytical performance evaluation of localization methods applied to randomly deployed ad hoc networks.

■ WC29

P-Room 3502

E-Business/E-Commerce II

Contributed Session

Chair: Auroop Ganguly, Visiting Research Faculty, University of South Florida, Mail Stop: ENB 118, 4202 East Fowler Avenue, Tampa, FL, 33620, United States, argangul@eng.usf.edu

1 - Optimal Return Policy for eBusiness

Samar Mukhopadhyay, Associate Professor, University of Wisconsin-Milwaukee, School of Business Administration, P.O. Box 742, Milwaukee, WI, 53201, United States, samar@uwm.edu, Robert Setoputro

In a direct supply chain, customers like the convenience, but sacrifice the benefit of physical inspection of the product increasing the likelihood of return. The seller can increase demand by offering easy return policies resulting in cost increase. We develop a profit-maximization model to jointly obtain optimal policies for price and return policy in terms of market reaction parameters. We obtain a number of managerial guidelines.

2 - Multidimensional Predictive Analytics for Managing Promotions and Product Portfolios

Auroop Ganguly, Visiting Research Faculty, University of South Florida, Mail Stop: ENB 118, 4202 East Fowler Avenue, Tampa, FL, 33620, United States, argangul@eng.usf.edu, Jim Langabeer

This paper describes multidimensional predictive analytics for managing promotions and product portfolios, embedded within the product suite of a specialized e-business vendor and analytical consulting company. Management and marketing science methods are blended with cutting-edge approaches for computational statistics, which lead to business solutions for designing effective promotions and advertisements, as well as product introduction or obsolescence strategies.

■ WC31

P-Room 3545

Information Systems II

Contributed Session

Chair: Sarah Aghazadeh, Ardebil Azad University, Research Building, IT Office, Iran

1 - Intelligent Agents Based Service Oriented Architecture for Application Integration

Ranjit Bose, Professor, University of New Mexico, Anderson School of Management, 1924 Las Lomas NE, Albuquerque, NM, 87131, United States, bose@mgt.unm.edu

Corporations are increasingly relying on technology-enabled services to gain a competitive edge. The way business application software is built is no exception. Service oriented architectures are gaining momentum as companies struggle with age-old issues of extending, scaling, maintaining, and integrating applications. This study provides such an architecture that is intelligent agents based.

2 - A Regression Model Based on Publication Records for Predicting Trends in New Research Developments

Peng Zhu, Student, Louisiana State University, 3128 CEBA, LSU,, Baton Rouge, LA, 70803, United States, pzhu1@lsu.edu, Evangelos Triantaphyllou

Publication trends in digital databases may provide a wealth of information for knowledge discovery. We develop a regression model that analyzes existing trends in publication records for predicting areas where it is most likely to witness new scientific discoveries. This model is based on the analysis of patterns in publications that mention certain concepts simultaneously. Key words: Knowledge discovery, Search engines, Regression models, Data mining, Bibliographic databases.

3 - Managing Information Systems Approach to New Organization

Sarah Aghazadeh, Ardebil Azad University, Research Building, IT Office, Iran, Hossein Mobaraki

Managing IT-Enabled Organizational Change. New IT/IS capabilities make it possible to achieve systematic and dramatic gains in business performance. BPR(Business Process Reengineering) is a particularly strong methodology of an IT-enabled organizational change. Meanwhile, a power, flexible IT infrastructure has become a prerequisite for new business model and organizational change. Information system planning has been defined as the process of identifying a portfolio of computer-based applications that will assist an organization in executing its new business model. Here, from view of tactical, we will discuss the concept and implementation methodology of BPR and information system planning. Managing IT-Enabled Organizational Change: Business Process Reengineering 1. The Essential of BPR 2. The Implementation of BPR 3. Case: BPR in Telecom Company in China. Building Information Systems and Information Systems Management From the view of the implementation of information systems in business, here, we will say all kinds of methods of building information systems. In addition, we will discuss relative issues about information systems management.

■ WC32

T-Vail (Majestic Level)

Resource Allocation & Planning

Contributed Session

Chair: Alex Zhang, Scientist, Hewlett-Packard, 1501 Page Mill Road, M/S 1140, Palo Alto, CA, 94304, United States, alex.zhang@hp.com

1 - Chance-Constraint Programming Approach to Solve the Power Generation Planning Problem

Hongman Gao, Ph.D Student, Hearin Center for Enterprise Science, MIS/POM Dept., School of Business Adm., University of Mississippi, University, MS, 38677, United States, hgao@bus.olemiss.edu

The problem of backup power generation planning is complicated due to the characteristics of electricity, to the variation of the generating fuel price, and to the stochastic nature of power demand. Our chance-constraint programming model is based on power generation planning under uncertainty with regard to stochastic energy demand, availability of purchased power, and generating fuel cost.

2 - The Best of Both Worlds: Combining Equity 3 and Integer Programming to Allocate Resources

William T. Hodson, Professor, Marymount University, 2807 N. Glebe Road, Arlington, VA, 22207, United States, william.hodson@marymount.edu, Bruce Wyman

Equity 3 uses an MCDA approach to solve those R&D resource allocation problems that permit projects to be done at different levels. Since it considers only points on the convex hull of the “efficient frontier” rather than all of it, optimal solutions at all possible funding levels cannot be guaranteed. This paper shows that when an integer programming formulation of the capital budgeting problem is used to complement it, these additional points will be found, thereby guaranteeing optimality.

3 - Server Resource Allocation Using an Open Queueing Model of Response Time

Alex Zhang, Scientist, Hewlett-Packard, 1501 Page Mill Road, M/S 1140, Palo Alto, CA, 94304, United States, alex.zhang@hp.com, Cipriano Santos, Dirk Beyer, Hsiu-Khuern Tang

We present a nonlinear integer optimization model for determining the number of servers at each tier in a multi-tier server network. We utilize a result from an open queueing network model on average response time; the optimization model is to minimize a weighted sum of servers while satisfying the average response time constraint (or a service level expression that is convertible to the average response time). We present a solution algorithm that utilizes a bounding procedure.

■ WC34

T-Columbine (Majestic Level)

Operations Management V

Contributed Session

Chair: Chunyang Tong, USC, 413 S. Orange Ave. #B, Monterey Park, United States, chunyant@usc.edu

1 - Production and Maintenance Policies in a Produce-to-stock System with Advance Demand Information
Viji Krishnamurthy, Student, Northwestern University, 2145 Sheridan Road, Evanston, IL, 60208, United States, viji@northwestern.edu, Seyed Iravani

We will show that the optimal integrated production and maintenance policy in produce-to-stock systems with advance demand information has a complex structure. We therefore propose a simple policy and evaluate its performance.

2 - Service Facility Design and Segmented Pricing Policies with Time-sensitive Customers
Michael Pangburn, University of Oregon, 488 Lillis Building, Eugene, OR, 97403, United States, pangburn@uoregon.edu, Effie Stavrulaki

We analyze a firm serving two customer segments from a single facility. Segments are heterogeneous in their reservation prices and costs of waiting. Consumers are sensitive not only to price, but also to time delays. Waiting costs accrue due to queuing at the facility, and from transportation time. In this setting, we examine the firm's optimal pricing and capacity policies, and address the benefits from segmentation tactics versus the queuing economies resulting from pooling across segments.

3 - Determining the Optimal Manufacturing Footprint when Local Tastes and Exchange Rates Matter
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, Chester Xiang

We consider a global firm, which serves multiple country markets with a world product. Each market may have different tastes and product regulations as well as different economic conditions. We provide guidelines for such a global firm making capacity investment decisions under demand and exchange rate uncertainty. We characterize optimal capacity investment strategies and determine conditions under which each strategy is optimal.

4 - Dynamic Pricing under Strategic Consumption
Chunyang Tong, USC, 413 S. Orange Ave. #B, Monterey Park, United States, chunyant@usc.edu, Sriram Dasu

We investigate the dynamic pricing of limited capacity when the seller faces strategic buyers. Two pricing schemes are analyzed: upfront pricing scheme and contingent pricing scheme. For the above two pricing schemes, consumers' equilibrium behavior is characterized. Numerical studies are conducted to show the potential gains for the seller if he considers buyer's strategic behavior.

■ WC35

T-Terrace (Terrace Level)

Military Applications

Contributed Session

Chair: Greg Parlier, Senior Research Scientist, University of Alabama in Huntsville, 301 Sparkman Drive, B-20, Von Braun Research Hall, Huntsville, AL, 35899, United States, parlieg@email.uah.edu

1 - Robust Solutions Of The Military Logistical Network Problem
Dror Yona, Technion-Israel Institute of Technology, Haifa, Israel, aynl@netvision.net

We provide robust solutions to the military logistical network problem, which obtain a military resources supply plan under uncertain resources demands. We also examine the robust solutions under unstable conditions in which uncertainty is underestimated, and information does not flow. This work is a master research thesis that was supervised by Professor Aharon Ben-Tal under the auspices of the IE faculty of the Technion in Israel.

2 - Probability Distribution of Battle Duration in Stochastic Combats
Yoon Gee Hong, Professor, Hansung University, 389, 3Ga, Samsun-dong, Sungbuk-gu, Seoul, 136-792, South Korea, yhong@hansung.ac.kr

Knowing the characteristic of battle duration is important for commanders and logicians in the analysis of combat realization. A stochastic combat simulation output data are utilized to study a probabilistic behavior of the combat duration which include a certain probability distribution, skewness, and kurtosis. Fire allocation strategies, reselect options, interfiring time random variables, and kill rates are considered to investigate how they affect the battle termination time.

3 - Integrating Unmanned Vehicles into Naval Missions: Analytically Based Tactics
Russell Gottfried, Military Faculty, The Naval Postgraduate School, Operations Research Department, 1411 Cunningham Dr., Monterey, CA, 93943, United States, gottfried@nps.navy.mil

The Naval Postgraduate School was tasked to develop doctrine for integrating unmanned vehicles into maritime missions. Through analysis, modeling and live observation, we provided the Fleet with a framework for the Fleet to develop plans, establish expectations, and adapt the technologies toward operations at sea. The presentation provides a systems overview, discusses methodologies , and highlights insights that point toward new Naval tactics and procedures.

4 - Enabling A Strategically Responsive, Transforming Army
Greg Parlier, Senior Research Scientist, University of Alabama in Huntsville, 301 Sparkman Drive, B-20, Von Braun Research Hall, Huntsville, AL, 35899, United States, parlieg@email.uah.edu

This paper summarizes a comprehensive systems approach, combining elements of classical inventory theory with recent developments in large-scale supply chain design and management theory along with innovative approaches pioneered in the corporate sector, culminating in the development of an "analytical architecture" to guide Logistics Transformation for the US Army.

■ WC39

T-Tower Court A (2nd Floor)

Supply Chain Management IV

Contributed Session

Chair: Barin Nag, Professor, Towson University, Department of Management, Towson, MD, 21252, United States, bnag@towson.edu

1 - Strategic E-Sourcing and Efficient Information Structure
Rui Dai, Assistant Professor, Georgia Tech, 800 West Peachtree Street, Atlanta, GA, 30332, United States, rui.dai@mgt.gatech.edu, Sri Narasimhan, D.J. Wu

Strategic e-sourcing (e.g. reverse auctions for RFPs) is playing an ever increasing role in firm's integrated supply chain. Using queuing techniques, we derive the optimal design of information structure for firm's strategic e-sourcing strategies. We model and compare two widely adopted information structure, the centralized structure vs. the network structure.

2 - Repeatedly Selling to the Newsvendor in Fluctuating Markets
Jiong Sun, Tepper School of Business, Carnegie-Mellon University, 5000 Forbes Ave, Pittsburgh, PA, 15213, United States, jiongs@andrew.cmu.edu, Laurens Debo

In this paper, we study supply chain coordination between a manufacturer and a retailer that is governed by a wholesale price contract in a repeated game setting. In a single-period interaction, the wholesale price contract cannot achieve channel coordination. With repeated interaction, we show that the supply chain can be coordinated if the supply chain members have a sufficiently high discount factor. We also show that signals about market fluctuation may constrain supply chain coordination.

3 - The Value of External Demand Information in Interacting Supply Chains
Xiaolong Zhang, Assistant Professor, Fairleigh Dickinson University/Department of Information Systems and Decision Sciences, 285 Madison Avenue, Madison, NJ, 07940, United States, zhang@fdu.edu, Yao Zhao

This paper considers two parallel serial supply chains with an interacting joint demand process. We show that the demand history of the one supply chain does not always help the other chain make better forecasts. Sufficient and necessary conditions are established for one supply chain to benefit from the external demand history of the other supply chain.

4 - Performance of Agents in Supply Chain Management
Barin Nag, Professor, Towson University, Department of Management, Towson, MD, 21252, United States, bnag@towson.edu, Songchul Hong, Dong Yao

Intelligent software agents perform buying and selling transactions over the Internet. We examine the characteristics of the buyer agents and seller agents, and propose models to optimize the goal-driven performance in a two-tier auction environment.

■ WC40

T-Tower Court B (2nd Floor)

Supply Chain Management V

Contributed Session

Chair: Jianli Hu, Assistant Professor, Chapman University, One University Drive, Orange, CA, 92866, United States, hu@mail.wsu.edu

1 - A Cost and Risk Routing Model for Transporting Hazardous Materials by Rail

Henry N. Amato, Professor, Supply Chain Management, University of Nevada, Reno, MGRS / 028, NV, 89557, United States, hna@unr.edu, Barry Spraggins

An integrated routing model is proposed to include transportation costs, risk costs, and risk reduction costs that will assist decision-makers from both industry and government to solve the logistical problems involved in rail hazardous materials movements. It is designed to find the best path through a rail network for hazardous shipments while considering acceptable risk cost, transportation cost, and risk reduction cost with the objective of minimizing the total cost for transporting the hazardous material.

2 - A Single-Period Inventory Placement Problem for a Supply Chain

Chia-Shin Chung, Professor, Cleveland State University, 1860 E.18th Street, Cleveland, OH, 44139, United States, c.chung@csuohio.edu, James Flynn, Piotr Stalinski

Consider the profit maximizing inventory placement problem in an N-stage, supply chain facing a stochastic demand for a single planning period for an item with a very short selling season. Stocking decisions are made before demand occurs. Demand can be satisfied from any stage. Because of delays, only a fraction of demand at a stage will wait for shipments. There are fixed costs for utilizing stages. After characterizing an optimal solution, we propose an effectivealgorithm for its computation.

3 - Comparing Supply Chain Performance when Order Quantity and Shipment Frequency are Decision Variables

Bogdan Bichescu, Ph.D student, University of Cincinnati, College of Business, Carl H. Lindner Hall, PO Box 210020, Cincinnati, OH, 45221, United States, bichesbc@email.uc.edu, Michael Fry

We compare models for centralized and decentralized supply chains where order quantity and delivery frequency decisions are made simultaneously under full information. We analyze the impact of channel power on the performance of the supply chain. We characterize optimal policies where possible and perform numerical analysis.

4 - Using Bounds to Solve the Dual Sourcing Problem

Jianli Hu, Assistant Professor, Chapman University, One University Drive, Orange, CA, 92866, United States, hu@mail.wsu.edu, Charles Munson

Due to the nature of the dual sourcing problem, optimal solutions are unavoidably complex, which makes them unattractive even when they can be computed efficiently. We present easily calculated bounds for the dual sourcing problem. Through an extensive numerical study, we show that the bounds are tight under most purchasing scenarios, and the determination of whether to use one or two suppliers is clearly provided by simply comparing the cost of single sourcing to the bounds of dual sourcing.

■ WC41

T-Tower Court C (2nd Floor)

Supply Chain Management VI

Contributed Session

Chair: Yale Herer, Technion - Israel Institute of Technology, On Sabbatical at Norhwestern University, Industrial Engineering & Management Sc., Chicago, IL, 60208-3119, United States, yale@technion.ac.il

1 - Simulation of Bottling and Labeling at a Winery

Sergio Maturana, Professor, Pontificia Universidad Catolica de Chile, Casilla 306, Correo 22, Santiago, Chile, smaturan@ing.puc.cl, David Arcos

The wine making industry has experienced an important growth world-wide. Bottling and labeling is complex since there are different types of bottles and labels, depending on the type of wine and the country. To improve bottling and labeling efficiency of a large Chilean wine producer, we developed a simulation model which allowed us to experiment with different production strategies. We concluded that simulation can be an important tool for helping to improve the efficiency of a wine producer.

2 - An Analysis of Heuristics in Supply Chain Scheduling

Katariina Kemppainen, Helsinki School of Economics, P.O.Box 1210, Runeberginkatu 22-24, Helsinki, 00101, Finland, kakemppa@hkkk.fi, Ari P.J. Vepsäläinen

In supply chains, scheduling orders in consecutive stages is based on different organizational cultures and information available possibly undermining the coordination of related decision processes. We analyze the working of these interlinked scheduling decisions by interpreting them as disciplines of dispatching heuristics. Existing and new approaches to inter-organizational scheduling are discussed.

3 - Combining MIP and CP for Solving Complex SCP Problems

Alkis Vazacopoulos, Dash Optimization, Inc, 560 Sylvan Avenue, Englewood Cliffs, NJ, 07632, United States, av@dashoptimization.com

In this talk we will examine the results of a three year EU funded R&D project in large-scale integrated supply chain optimization. The objective of the project was to use mixed-integer programming (MIP) and constraint programming (CP) to address the combined planning and scheduling problem that arises in supply chain planning and optimization.

4 - Transshipments with Fixed Transshipment Costs

Yale Herer, Technion - Israel Institute of Technology, On Sabbatical at Norhwestern University, Industrial Engineering & Management Sc., Chicago, IL, 60208-3119, United States, yale@technion.ac.il, Ilan Estrugo

Two locations face a stochastic periodic demand. In order to reduce inventory and shortage costs the locations can transship units between themselves. The common assumption of negligible fixed transshipment cost is relaxed. We first show that with the addition of the fixed transshipment cost the overall system cost is not convex and that the transshipment policy is not of the "complete pooling" type. Second, we present a branch and bound based algorithm to calculate replenishment quantities.

■ WC44

T-Spruce (Mezzanine)

Logistics IV

Contributed Session

Chair: Ravichandran Narasimhan, Professor, Indian Institute of Management, Ahmedabad, Wing 3, Indian Institute of Management, Ahmedabad, 380 015, India, nravi@iimahd.ernet.in

1 - AGV Positioning to Minimize the Maximum Response Time in Tandem Loops with Constrained Vehicle Availability

Shiwoo Lee, Assistant Professor, University of Illinois at Chicago, 842 W. Taylor St. (M/C 251), 2039 Engineering Research Facility, Chicago, IL, 60304, United States, slee150@uic.edu

One of important control issues in AGV systems is to determine the home locations for idle vehicles. The recursive dynamic programming algorithm of selecting the home locations of vehicles in a tandem loop AGV system with vehicle avail constrained is presented. The model is based on the objective of minimizing the maximum response time upon the requests from any stations in the system.

2 - Solving a Class of Conditional Location-Allocation Problems Utilizing Artificial Neural Networks

Aihong Wen, student, university of Texas at Arlington, 1110 S.Pecan st, Arlington, TX, 76010, United States, axw0932@omega.uta.edu, Victoria Chen

The problems of conditional location-allocation in a two-dimensional Euclidean space are treated. The method utilized is a 2-layer Artificial Neural Network adopting the architecture of Kohonen's self-organizing feature map, but with a variant of the learning rule. Computational results show the proposed method is superior to currently available ones, which utilize difference of convex programming and differentiable approximation method.

3 - AS/RS Study for Air Cargo Terminal Operations

Chulung Lee, Assistant Professor, National University of Singapore, 10 Kent Ridge Crescent, Singapore, 119260, Singapore, isechlee@yahoo.com, Huei-Chuen Huang, Zhiyong Xu, Bin Liu

In this study, the storage policies for an automatic storage and retrieval system (AS/RS) in an air cargo terminal are studied, and an optimal storage policy is proposed. The simulation model for the operations is developed and the simulation results are provided.

4 - Logistics Audit: The Bombay Dabbawala's Operations

Ravichandran Narasimhan, Professor, Indian Institute of Management, Ahmedabad, Wing 3, Indian Institute of Management, Ahmedabad, 380 015, India, nravi@iimahd.ernet.in

The Bombay Dabbawallas' operation is often quoted as an outstanding example of logistics operational efficiency. It is a home grown model conceived, developed and perfected by individuals who are not exposed to formal scientific methods and procedures. In this paper, we provide a detailed audit on the decisions related to the system which ensures its operational efficiency. We subject the model to a supply chain risk analysis and evaluate its overall performance

SESSION CHAIR INDEX

A

Abbas, Ali SB17
Abdul-Kader, Walid SA38
Adelman, Dan SA35 MB06
Afeche, Philipp MD34
Aghazadeh, Sarah WC31
Agnihothri, Sal SD24
Agrawal, Naren SB39 SC39
Ahmed, Shabbir SC06 SD05
Ahn, Hyun-Soo SD34
Akcali, Elif MC19 TB19
Aloysius, John WC17
Alptekinoglu, Aydin SB43
Altay, Nezih WA42
Anderson, Tim TB44 TC44
Andrew, John M. MD22
Anitescu, Mihai MD07 TA07 TB09
Annapoornima, Manathattai S. WA11
Anupindi, Ravi SA40
Apley, Daniel W. TD28
Araman, Victor MA27
Argon, Nilay SD26
Armacost, Andy MC23 TB22 TC22 TD22
Armony, Mor MB27
Arroyo, Sharon MD23
Ata, Baris MC40
Atamturk, Alper SB05
Aviv, Yossi MB35
Ayhan, Hayriye MC27

B

Bailey, Diane MB14 TB14
Baillo, Alvaro SC37
Bai, Xue WB25
Baker, Erin SD18 TA37
Bala, Ram MA31
Balci, Huseyin WB37
Balcioglu, Baris SA26
Ball, Michael SA11 SC10
Bandy, David MC38
Barnes, Earl MA46
Barnett, Arnold MB21 TC12
Barnhart, Cynthia SB33
Bass, Frank MB19
Baucells, Manel SB21
Bell, Peter TD33
Beranek, Margaret WB31
Berleant, Dan SB07
Berman, Oded SA22
Berndt, Antje SB36
Bernstein, Fernando WB41
Bhaskaran, Sreekumar SD09
Bickel, Eric MC17
Billups, Stephen SA09 TA03
Birge, John SD36
Bishwal, Jaya MA36
Bisi, Arnab WB12
Blair, Montgomery MC42
Blanco, Hilda WB32
Blumrosen, Liad WA19
Boginski, Vladimir SC15
Bollapragada, Ramesh WA18
Borchers, Brian TD16
Boros, Endre SD19
Bozer, Yavuz TC25
Bradley, Gordon SA16
Brigantic, Robert MB23
Buckinx, Wouter WB02
Butenko, Sergiy TB38 TC38
Butler, Timothy WB29

C

Cachon, Gerard TA34
Caggiano, Kathryn TC34
Cai, Gangshu WA29
Cai, Xiaoqiang MC15
Caldentey, Rene MB42
Cao, Heng MC29
Cao, Jie TD12
Carrotta, Alessandro WC11
Carter, Michael SA20 TB20
Cetinkaya, Sila SC33 SD33
Chakravarti, Dipankar MD29 TC26
Chaovalitwongse, Wanpracha MD45
Chelst, Kenneth MD32
Chen, Chialin WA37
Chen, Chien-Yu TA29
Chen, Victoria SC04
Cheng, Feng TA32
Chen, Zhi-Long MD15
Chiang, Wei-yu Kevin MD41
Chinneck, John SC16
Chiu, Yi-Chang SA10
Clarke, John-Paul TC13
Cobb, Barry R. SC17
Cochran, James MB25 MC25 MD25
Coit, David TA30 TB30 TC30
Cornacchia, Eugenio WA12
Côté, Murray SB20
Cox, Jr, Louis Anthony WC05
Cox, Lawrence SA32
Crainic, Teodor Gabriel SC03 SD03
Cunha, Claudio WB44

D

Dailey, Daniel J. WB11
Dalakouras, Georgios TA36
Das, Tapas K. MD37
Day, Jeff MC10
de Farias, Ismael SC05
de Matta, Renato WA43
DeHoratius, Nicole TB41
DeMiguel, Victor MC06
Deng, Shi-Jie SC36 MB37 MD27
Denton, Brian TB32
Deshpander, Vinayak SD35
Devpura, Amit WB40
Dewan, Pooja MD13
Ding, Yu MC30 TA28 TB28 TD28
Discenza, Joseph H. MB33 MC33 TA33
Djurdjanovic, Dragan SC29
Dong, Lingxiu TB34
Drezner, Zvi SB22
Drud, Arne SD16
Duenyas, Izak MA34
Dula, Jose TD44
Duran, Marco SB10
Durango-Cohen, Pablo SD12
Duray, Rebecca WA35
Dyer, James MC17

E

Ehie, Ike TC41
Eiselt, H.A. SC22
Elakkumanan, Praveen WA02
Ellingsworth, Marty SA15
Ellis, Kimberly SB12
Elmaghraby, Wedad SC44
Engiles, Mike TC32
Ergun, Ozlem MD10
Eriksen, Steven TD06
Erkoc, Murat SA41
Ezawa, Kazuo J. SA17 SD17

F

Ferguson, Mark SC02
Fixson, Sebastian SD14
Fleischer, Lisa SC08 MB08 MC08 TA08
Forrester, Dick TA24
Foster, Earnest WB08
Foster, Ken MC46
Fowler, John SB38
Francis, Richard SD22
Fried, Jeremy SD29
Friedlander, Michael P. MD09
Furman, Kevin SB10

G

Gabriel, Steve SA37
Galenko, Alexander WB38
Gallego, Guillermo MD42
Gallien, Jeremie SD44
Giambow, Norabela MB02
Ganguly, Auroop WA04 WC29
Ganti, Andrew SD38
Gao, Guodong(Gordon) WC12
Gassmann, Gus SA06
Gaur, Vishal TB40
Gavirneni, Srinagesh MD35
Gay, David MA16
Gendreau, Michel SD02
Generazio, Hoa TB23
Geunes, Joseph WA05
Giddings, Angela WB28
Goel, Ashish SD08
Goetschalckx, Marc TA12
Goldman, Lawrence SC32
Goldsman, David SC38
Gomez-Sanchez, Miguel WA38
Goncalves, Paulo TD40
Gonzalez-Velarde, Jose Luis TA35
Gorman, Michael MB13
Gosavi, Abhijit SA42 MD16
Gouveia, Luis MD18
Gramani, Maria Cristina TD02
Grinde, Roger TC21
Grossmann, Ignacio MB16
Grossman, Thomas MA25 TB21
Grundel, Don SB23
Gue, Kevin MA12
Guide, Daniel TC19
Gunderson, Louise TB36
Gunluk, Oktay TA05
Guo, Xin TA27
Gupta, Aparna TB27
Gurnani, Haresh MC34

H

Hahn, Eugene MB18
Haight, Robert SC29
Hale, Trevor MA22
Hammer, Peter L. SB19 MB15 MD03
Hardin, Jill TD24
Hatch, Nile TD14
Haugh, Martin WA27
He, Chuan MD26
Heese, H. Sebastian MA43
Heimann, David WA30
Herer, Yale WC41
Herroelen, Willy SA33
Hickman, Mark TA10

Hillier, Wynship WA17
Hobbs, Benjamin MC37
Holder, Allen SD20
Hollywood, John MA21
Holmstrom, Kenneth MA07
Homem-de-Mello, Tito MA06
Horne, Dr. Gary SC23
Huang, Deng MD38
Huang, Paul TB29
Hu, Jianli WC40
Hunt, David MC13 TB10
Hurink, Johann TC15

I

Iyengar, Garud MA08

J

Janakiraman, Ganesh MD40
Jenni, Karen MC18
Jennings, Otis TC27
Jha, Krishna SB13
Jiang, Wei SD15
Jiang, Xiaoyue WA28
Jing, Bing SA46
Jin, Jionghua (Judy) SA30 SC04 MA28
Jin, Yue TC10
Joglekar, Nitin SA43
Johnson, Blake MA35
Johnson, Eric TA23
Johnson, Michael MB22 MC22
Jones, Joni SB44
Jones, Morgan WC25

K

Kachani, Soulaymane TB42
Kallianpur, Amy WC02
Kaminsky, Phil TA15
Kapur, Kailash MC28
Karisch, Stefan SA13
Katok, Elena MB44
Kavadias, Stylianos TD43
Kayande, Ujwal TD26
Kaya, Ozgur WB36
Keeney, Ralph SB18 MB17
Keethler, Greg WB22
Keisler, Jeffrey TA17 TD21
Keon, Neil TB18
Keppo, Jussi TD27
Keskinocak, Pinar SC34 TC42
Kim, Byung-In WA10
Kim, David SB02
Kim, Kwang-Jae TD30
King, Susan SA29
Klabjan, Diego TB13
Klampfl, Erica SD32
Kleywegt, Anton TA40
Kleywegt, Anton TD10
Koppius, Otto MA44
Kornish, Laura TB17
Kouvelis, Panos MC35
Kraft, Edwin R "Chip" MA13
Krishnamurthy, Ananth SB26 MA26 MB26
Krishnan, Vish MB43 MC14 MD43
Kristjansson, Bjarni TC16 WB16
Kroese, Dirk SB27
Kulkarni, Shailesh MD21
Kutanoglu, Erhan MC12
Kvam, Paul SD28
Kwon, Roy MC44

L

LaGanga, Linda TD20
Lanckriet, Gert SB09 SC09
Landa Silva, Dario MA03
Lang, Chunmei WB13
Langley, Suchada MB46
Lasdon, Leon SC07
Lawphongpanich, Siriphong SA21 SD10
Lee, Chung-Yee MC15
Lee, Eva MA45 MB45 MC45 WA06 WC06
Lee, Roger SA36
Lehmkuhl, Lee J. WA22
Lei, Lei TB15
Leonard, Kevin SC20
Leung, Janny WB10
Levesque, Moren MA14
Levy, Maurice TD13
Lewis, Brian MC41
Lewis, Mark SD27
Liao, T. Warren MA04 MB04
Liberatore, Matthew SB24
Lieberman, Warren SD42
Lieckens, Kris SD41
Li, Jianxiang TC06
Lim, Gino (Jinho) TC45
Lim, Yun Fong WB21
Linderoth, Jeff MC05 MD06
Linetsky, Vadim WC27
Lin, Kyle WB27
Lipp, Astrid MB31
Li, Shanling TA44
Liu, Henry SB11
Liu, Jian SC13 SD13
Liu, Xing TC07
Li, Weiqi WA09
Lopes, Leo SB16
Lougee-Heimer, Robin TA16 WA16
Lowe, Jim TC24 TD23
Lowe, Robert SC14
Lu, Jye-Chyi MB28 TC28
Luo, Sirong WC13
Lu, Zhaosong TA09

M

Macal, Charles MA19
Maglaras, Costis SB42
Maillart, Lisa MD28
Mallick, Debasish MC43 TC43
Mallya, Sud MA24
Mandakovic, Tomislav WB45
Marklund, Johan TA46
Martì, Rafael MB03
Masini, Andrea TB43
Massey, William SA31
McCormick, S. Thomas TC08
McDill, Marc MA29
McGarvey, Ron SC11
Mehrotra, Anuj MA05
Meller, Russell SA02 SD11
Menon, Syam MC31
Merrick, Jason MA18
Messinger, Paul WA26
Mian, Sarfraz MD14
Miller, Andrew TC05
Miller, George WA20
Miller-Hooks, Elise MD12
Miller, Lisa MB05
Miller, Tan SC21
Min, Hokey WB20
Moore, James MA11 MB11 MC11 MD11
Moreau, Page MC26
Morgan, Kara SC18
Morrice, Douglas MA38
Muharremoglu, Alp TA39
Muller, Rudolf SA44
Murray-Tuite, Pamela WB18
Muthuraman, Kumar TA38

N

Nagarajan, Mahesh WA39
Nag, Barin MD31 WC39
Nair, Suresh MB24
Narasimhan, Ravichandran WC44
Nembhard, Harriet Black MA30
Nembhard, David TD36
Netessine, Serguei MB39
Newman, Alexandra SD23 TD37
Nieman, Timothy SA18
Norman, Bryan TD36
Notz, Bill MB30
Novak, Sharon TC40
Nowak, Maciek MA10

O

Ohlmann, Jeffrey MB10
Olafsson, Sigurdur SA04 SD15 MA15
Olinick, Eli TD18
Oliva, Rogelio TD40
Oliveira, Pedro TA14
Onal, Hayri TD46
O'Neal, Jerome W. WA07
O'Neill, Liam WB19
Orban, Dominique TC09
Oren, Shmuel SD37
Orlin, James MA09 TD08
Ozer, Ozalp MD39

P

Pachamanova, Dessislava MC24
Pan, Feng TA06
Pani, Abhishek TD19
Parija, Gyana WB09
Park, Joon WB43
Park, Namkyu WA31
Parlier, Greg WC35
Parnell, Gregory MD17 TD17
Pataki, Gabor MD05
Patki, Mukul WC16
Pellikan, Martin MA02
Peeta, Srinivas TA11
Perakis, Georgia SA08 SB08 MB40
Perlusz, Stefano WA14
Pesch, Erwin MC02
Peterson, Dale TB24
Petruzzi, Nicholas MA40
Pidd, Michael MC21
Pintér, Jànos D. SA07 SD07 MB07
Plambeck, Erica SD39
Popescu, Ioana SD25
Popkowski Leszczyc, Peter TB26
Porter, Timothy TC23
Possani, Edgar TB02
Potra, Florian TB07
Prestemon, Jeffrey SB29
Puterman, Martin L. MB09

Q

Qu, Xiuli TC37 TA19

R

Raghavan, Usha Nandini WA08
Ralphs, Ted TB05
Raman, Ananth MA39
Randall, Patricia WC24
Randhawa, Ramandeep WB03
Rangaswamy, Arvind TD29

Rao, Alan TA02
Ravindran, Suryanarayanan TB31
Raviv, Tal SD06
Ray, Sourav TA26
Rees, Jacquelyn SA19 TC31
Regan, Amelia SC46 SD46
Regnier, Eva TB04
Rego, Cesar MB02 TC03
Reynolds, Mark MA32
Riano, German TB12
Richetta, Octavio WA13
Ridder, Ad SA27
Rodriguez, June WA23
Romeijn, Edwin TB45
Ross, Andrew SB31 SC31
Ross, Jane TA25
Rothkopf, Michael WA32
Roth, Aleda TA14
Rothlauf, Franz MA02
Roughgarden, Tim SA45
Roughgarden, Tim MD08
Roundy, Robin MC09
Ruggiero, John WA44
Ruiz-Torres, Alex WB04
Rump, Christopher WB24
Runger, George SD04
Ruperez Micola, Augusto MA37
Ryoo, Hong WB05

S

Saenz, Oscar A. WC14
Sahinidis, Nick MC16 TB16
Salter, Bill TA45
Sanchez, Susan WB23
Savage, Sam SA25
Savaskan, Canan TC39
Sawik, Tadeusz WB35
Schade, Christian TC14
Schaefer, Andrew TA20 TB06 TD38
Scheller-Wolf, Alan SA34
Schmidt, Glen TA43
Schooff, Richard WC23
Schultz, Kenneth TD34
Schwarz, Leroy SD35
Schweikhart, Sharon MA20
Scott, Judy TD31
Sedej, John MB32
Seelmann-Eggebert, Ralph TB35
Sen, Suvrajeet TD03
Seo, Fumiko WB17
Seshadri, Sridhar SC40
Setoputro, Robert SB41
Setyawati, Bina TC02
Shaffer, Patricia TB46
Shah, Shital MC04
Shen, Max SD22
Shenoy, PrakashP. SC17
Sherali, Hanif SA05
Shier, Douglas WA24
Shi, Jianjun SD30
Shoham, Yoav SB45
Shu, Jun TC18
Shumsky, Robert SC42
Siemsen, Enno WB34
Simchi-Levi, David SD40 MA42
Smilowitz, Karen TB39
Smith, Cole TD05
Smith, Donald MA33 TC33
Smith, J. Macgregor MB20
Smith, James E. MA17 MC17
Smith, Stephen SA39 SB39 SC39
Snyder, Stephanie MB29
Sodhi, ManMohan S. TA41
Sohn, SugJe WA21
Song, Jeannette SB34
Sörensen, Kenneth MD02
Sosic, Greys MC39
Spencer, Tom TB33
Spetzler, Carl MC17
Staum, Jeremy MB38
Storer, Robert WA15
Stoumbos, Zachary G. SB30
Street, Nick SB15
Subramanian, Ravi TB37
Sudit, Moises TD04
Sullivan, Joe H. SC30
Sun, Aichong TB11
Sundaresan, Shankar MB41 WB14
Sun, Peng SB06
Swann, Julie SC34 SD40 MA42 MC20 TB25
Szmerekovsky, Joseph WB15

T

Tan, Tarkan WA34
Tekin, Eylem SC26
Tekin, Eylem TC36
Tesauro, Gerry SC45
Thibault, Marc MA23
Thiele, Aurelie TD42
Tibben-Lembke, Ronald TC11
Tjader, Youxu MA41
Toktay, Beril MD19
Tomlin, Brian SB35 TD39
Tong, Chunyang WC34
Toulouse, Michel SB03
Tretter, Marietta TA04
Trukhanov, Svyatoslav WC07
Tsai, Julia TC04
Tsai, Roger MC32
Tseng, Chung-Li SB37
Tseng, Mitchell TC35
Tsung, Fugee MD30
Tucker, Anita SA14 SC43 SD43
Tuncel, Levent TD07
Turvey, Calum MD46

U

Udayagiri, Suresh TD45
Ugray, Zsolt WA36
Ulku, Sezer TA43
Uryasev, Stanislav MB36 MC36
Uster, Halit TD11

V

Vail, Richard WA45
Vairaktarakis, George TD15
van den Briel, Menkes TA13
Van Mieghem, Jan SB40
Van Roy, Benjamin MD36
Vazirani, Vijay SD45
Veloso, Francisco SC14

W

Wagner, Janet TA21
Walczak, Darius TA42
Walker, Russell MD24
Waller, S. Travis SC12
Walls, Michael R. MC17
Wang, Haibo WA03
Wang, Huimin WA41
Wang, Lin WC10
Wang, Ming-En WC28
Wang, Zhouyan TA18
Wan, Hong WB30
Weber, Charles SB14
Wein, Lawrence SC35
Weir, Jeffery TA22
Wilhelm, Wilbert WB06
Willemain, Thomas TD25
Willis, John SA23
Wilson, Amy R. MD20
Womer, Keith TD32
Wu, David MD44
Wu, Jianghua WA40
Wu, John SC41

X

Xia, Cathy SD31
Xia, Mu TC29
Xu, Di MD04
Xu, Yi SD34

Y

Yano, Candace MB34
Yen, Joyce W. SB46
Ye, Yinyu TB08
Yi, John WC09
Yildirim, E. Alper TD09
Yunes, Tallys WC08

Z

Zabinsky, Zelda B. MC07
Zappe, Christopher J. SB25 SC25
Zeevi, Assaf SC27 MD34
Zenios, Stefanos TC20
Zhang, Alex WC32
Zhang, Jiang TD41
Zhang, Zuopeng TA31
Zhao, Zhenying TA29
Zhou, Shiyu SA28 SB28 TB28
Zhu, Guidong SA24
Zinner, Darren WC21

AUTHOR INDEX

A

Abayomi, Kobi TB04
Abbas, Ali SB17
Abbink, Erwin MB33
Abbott, Kirk SD42
Abdoli, Mansour WB19
Abdul-Kader, Walid SA38
Abid, Chafik TA02
Abler, David MB46
Aboolian, Robert MA22
Abt, Karen SB29
Acemoglu, Daron SA45
Acharya, Dharma MA13
Acharya, Raj SA09
Adams, Darius MB29
Adams, Warren WC06
Adelman, Dan SA35 MB06 TD10
Adida, Elodie MA42
Adler, Ilan SD37
Adra, Hosni TA47
Adu-Bonnah, Kwame TA37 TC41
Afeche, Philipp SB42 MD34
Agaian, Sos S. WA23
Agarwal, Amit SB08
Agarwal, Anurag TC02
Agarwal, Richa WB13
Aggelis, Vasilis WA29
Aggoun, Abderrahmane TC38
Aghassi, Michele SB05
Aghazadeh, Sarah WC31
Agnetis, Alessandro MB22
Agnihothri, Sal SD24
Agrahari, Homarjun TD11
Agrawal, Naren SB39
AhmadBeygi, Shervin SA13
Ahmadi, Reza SA41
Ahmed, Shabbir SB05 SD05 MD06 TB06 WA21
Ahmetov, Komil Tolib-ogl TA44
Ahn, Hyun-Soo SD34 MC27 TC36 WB27
Ahn, Soohan MB33
Ahuja, Ravindra SC13 SC20 MC13
Aiber, Sarel TA32
Akartunali, Kerem MC05
Akcali, Elif SB20 SD41 MC19 TB19 TC19
Akella, Ram TD43
Aksehirli, Zeynep TD25
Aktan, Mehmet WB30
Aktaran, Tuba SC38
Akturk, Selim WA15 WB15
Alagoz, Oguzhan TC20 WB27
Al-Ahmadi, Mohammad MC31
Albin, Susan MA28 MC28 MD04
Albright, Russell SA15
Alday, Javier WB18
Alderson, David WC28
Aleman, Dionne TA20
Alexe, Gabriela MB15 MC45
Alexe, Sorin MB15 MC45
Alexopoulos, Christos MA28
Alfa, Attahiru WA38
Alidaee, Bahram TD45 WA03 WB05
Ali, Jafar WB04
Alisan, F. Zeynep TA18
Alkire, Brien MA23
Allen, Theodore MD38
Allgor, Russell TD39
Allietta, Michael MC24
Allon, Gad MD34 TA39
Aloysius, John WC17
Alp, Osman WA34
Alptekinoglu, Aydin SB43 MA43 TA35
Altarazi, Safwan WC28
Altay, Nezih WA42
Altinkemer, Kemal TC31
Altintas, Nihat TB39 TC04
Al-yakoob, Salem WB04
Amato, Henry N. WC40
Amini, Mehdi WB09
Ammons, Jane TB19 TC11
Ammons, Jane TB19
Ammons, Jane SB46 MC19
Amouzegar, Mahyar SC11
Amy, Brian W. WA20
Anandalingam, G "Anand" TC18 TD19 WC09
Anand, Krishnan S. SA40 MA39
Andersen, Jeff SA18
Andersen, John SA18
Andersen, Kent TA05
Anderson, Chis MC42
Anderson, Edward SA43 TA43 TC25
Anderson, John MD29
Anderson, Richard MA24
Anderson, Tim TB44 TC44 TD29
Andradottir, Sigrun MC27 MD16
Andreas, April TD05
Angelis, John MA14
Angus, Derek TA20 TB20
Anitescu, Mihai MD07 TB09
Anjos, Miguel TA09
Ankenman, Bruce E. WB30
Ankenman, Bruce SB38
An, Lianjun MC32
An, Na TC28
Annapoornima, Manathattai S. WA11 WB29
Anshelevich, Elliot SA45
Anthony, Barbara MA08
Anthony, Martin MB15
Anupindi, Ravi SA40
Apland, Jeffrey TD46
Apley, Daniel W. SA28 SB30 TD28
Araman, Victor MA27 MB42
Arambula, Ivette WB06
Archer, Ben TA47
Arcos, David WC41
Argaez, Miguel TB09
Argon, Nilay SD26 MC27
Armacost, Andy TB22 TC22
Armand, Paul TC09
Armentano, Vinı̀cius MA03 TA02 TC02
Armony, Mor MB27
Armstrong, Michael MA23
Arntzen, Halvard MB02
Aron, Ionut WC08
Arslan, Hasan MC40
Arthur, Jeffrey MA29 TD25
Asef-Vaziri, Ardavan WA36
Asker, John MB44
Askin, Ronald TA12 TD36 WA40
Assavapokee, Tiravat MC19 TC11
Ata, Baris SB42 MD42
Atallah, Mikhail SD35
Ataman, Kaan SB15
Atamturk, Alper SA05 SD05 TC05
Atar, Rami SC27
Atkins, Derek TD20
Atlason, Julius SB31
Auer, Robert MC38
Au, Siu-Tong SD15
Avci, Selcuk WA15
Avellaneda, Marco SA36
Aviv, Yossi SD35 MB35 TC42
Awad, Hernan SC27
Axelrod, David MC45 MD03
Aydin, Goker SB39
Ayhan, Hayriye SD27 MC27
Aykut, Atali SC39
Aytekin, Umut TC39 WA40
Aytug, Haldun SA19 TC31
Aytug, Haldun SD19

B

Babaioff, Moshe WA19
Babayev, Djangir WA18 WC05
Bach, Francis SB09
Badawy, Michael MC14
Bader, David TA01
Bae, Suk Joo SD28
Bagatourova, Olga MA24 MC24 MD24
Bagchi, Sugato MC29
Baheranwala, Fatema TA30
Bailey, Bryan TA42
Bailey, Diane TB14
Bailey, Matthew SC20 MD22 MD37 TB20
Bai, Lihui SD10
Baillo, Alvaro SC37
Baiman, Stanley MB39
Bai, Song MC11
Bai, Xue WB25
Bai, Xue TC03
Bajari, Patrick SC44
Bakal, Ismail Serdar SD41 MB34
Baker, Erin SD18 TA37 TB37
Baker, Ken TA21
Baker, Steve TC22
Bakir, Niyazi Onur WA17
Bakshi, Nitin MA31
Balakrishnan, Anant SC34 MA05
Balakrishnan, S. SC37
Bala, Ram MA31
Balasubramaniam, Karthik TD43
Balasubramanian, Sridhar TA14 WB34
Balasundaram, Balabhaskar WA09
Balci, Huseyin WB37
Balcioglu, Baris SA26
Baldick, Ross MB37
Ballard, David TA13
Ball, Michael SC10 TB42
Bandy, David MC38
Bandyopadhyay, Shubho SA19
Bandyopadhyay, Subir WB02
Bandyopadhyay, Tridib MB24
Banerjee, Kumar WB02
Ban, Jeff SB11
Bansal, Nikhil MC08
Bansal, Vikas SB08
Bapna, Ravi MA44
Baraniuk, Richard MD05
Barbulescu, Laura TC22
Bardhan, Indranil MB43
Bard, Jonathan SA24
Bar-Gera, Hillel MB11
Barnes, Earl MA46
Barnes, J. Wesley MC12 MC23 TB22
Barnett, Arnold MB21
Barnhart, Cynthia SA08 MA05
Barnhart, Cynthia SB33 TB22 TC13
Baron, Opher MC22
Barry, Philip WB23
Bartholdi, III, John SA35 WB21
Bartlett, Peter TD07
Bartolacci, Michael R. TB30
Barton, Russell MA28
Barut, Mehmet WA41
Basole, Rahul TC38
Bassamboo, Achal SC27 MB27
Bass, Frank MB19
Bassok, Yehuda MC39
Bass, Portia MB19
Basu, Sabyasachi TD04
Bates, Jonathan WA12
Batta, Rajan SA42 MA22 MD22 TA12 WB28
Batur, Demet SC38
Baucells, Manel SB21
Baumgartner, Richard SB03
Baveja, Manas SC35
Bayindir, Z. Pelin TD12
Bayiz, Murat MD39
Bayrak, Halil MD22
Bayraksan, Guzin MA06
Bayraktar, Erhan SC28 SD33 MA36
Bazaraa, Mokhtar MA05
Bazargan, Massound TC44
Beall, Charles W. WA32
Bean, James MB10 TA19
Bebu, Ionut TB07
Beccue, Phil SA18
Becker, Tim WB25
Beckman, Sara L. TC43
Beck, Terry WC05
Bedoya-Valencia, Leonardo WB04
Beesley, John SA18
Beferull-Lozano, Baltasar SD08
Begen, Mehmet Atilla MD38 TD20 WB16 WB20 WB38
Beliën, Jeroen SA33
Bell, David WC02
Bell, George WA18
Bell, Peter SA25 TD33
Ben-Arieh, David WC17
Bendoly, Elliot TD34
Benjaafar, Saif SA26 SD26
Bennett, Bart MA21
Bennett, Kristin SC09 MD04
Benson, Hande TB09
Benson, Jan TB14
Benson, Steven TA09 TD16
Bensoussan, Alain WB08
Beranek, Margaret WB31
Bergen, Mark TA26

Berger, Jim SD30
Berger, Noam MC08
Berger, Rosemary T. MC05
Bergin, Michelle WA37
Berleant, Dan SB07
Berling, Peter TA46
Berman, Leonard MC29
Berman, Oded SA22 SB22 MB22 MC22
Berndt, Antje SB36
Bernstein, Fernando SB34 SD33 MB26 WB41
Berry, Jonathan TC08
Bertsimas, Dimitris SB05 MB40 TD42
Bessler, David MC46
Bevers, Michael SB29
Beyer, Dirk WA02 WC32
Bhaduri, Budhendra WA04
Bhandari, Atul SB31 TC34
Bharadwaj, Vijay SC06
Bhardwaj, Arjun SC21
Bhaskaran, Sreekumar SD09 MB39
Bhattacharyya, Siddhartha SA19
Bichescu, Bogdan WC40
Bickel, Eric MC17 MD25 TD38
Biegler, Lorenz WA16
Biehn, Neil TA42
Bienstock, Daniel MA08
Bier, Vicki SC18 MA18
Biller, Bahar WC34
Billingsley, Sarah Mae WC25
Billups, Stephen SA09
Birbilis, George SA06 MD38
Birge, John SD36 MC25 WA40
Birkler, John MA23
Bisgaard, Søren MA30
Bish, Ebru K. SC33 TC42
Bishwal, Jaya MA36
Bisi, Arnab WB12
Bissonette, Lisande TB46
Bitran, Gabriel R. WB02
Blackburn, Joseph MC19
Blackhurst, Jennifer MA22 SD32
Blair, Montgomery MC42
Blais, Marcel SB36
Blanchet, Jose MA27 SD27
Blanco, Hilda WB32
Blanford, Geoffrey SD18
Blazewicz, Jacek MC02
Bless, Patrick WA24
Blink, James SA18
Blomberg, Jodi WC07
Blum, Avrim SC08
Blum, Ben SB45
Blumrosen, Liad SA44 WA19
Blumstein, Alfred MB21
Boardman, Bonnie WC09
Boedigheimer, Ralph TD22
Boerner, Christopher TD14
Boginski, Vladimir SC15 MB36 MD45 TB38
Bohmer, Richard SB14
Bollapragada, Ramesh TD18 WA18
Bollapragada, Srinivas MC33
Bompadre, Agustin TD08
Bonates, Tiberius MB15 MD03
Bonawi-tan, Winston TA19
Booher, Brian WB09
Bookbinder, James H. TD11
Borah, Deva TD46
Borchers, Brian TD16
Bordoloi, Sanjeev TD20
Borgman, Alicia MC38
Borgs, Christopher MC08
Borodovsky, Mark MC04
Boros, Endre SB19 SD19 MC45
Bose, Ranjit WC31
Boston, Kevin WB37
Botev, Zdravko SD06
Bougnol, Marie-Laure TD44
Bouzaiene-Ayari, Belgacem MC10
Bowles, Kelly MC32
Bowman, Alan SC30
Bowman, Christopher SB03
Boyabatli, Onur SB40
Boyaci, Tamer MC19 MC34
Boyce, David MB11
Boylan, Gregory SA23
Boyle, Katharyn MA36
Boylu, Fidan SA19
Boysen, Nils WB21 WB32
Bozbay, Mehmet TC05
Bozer, Yavuz TC25
Brabazon, Philip WA35
Bradley, Gordon SA16
Braithwaite, Scott SC20
Branchini, Rodrigo TC02
Braziel, Carlos TA22
Bresnick, Terry TD17
Bretthauer, Kurt MC20 MD35
Brigantic, Robert MB23
Brigantic, Robert MB23
Broadie, Mark WB36
Brodfuehrer, Mark SD17
Broekmeulen, Rob TA18
Brookshire, Robert TB25
Brosig, Jeannette MB44
Brotherton, Edith SD11
Brown, Amy SB12
Browne, Hugh MC41
Browning, Tyson SA24 WB43
Brown, Jeffrey WC23
Brown, Mark WA20
Brown, Marvin L. SA04
Bruce, Peter MB47 TA04
Brucker, Peter TC15
Bruttin, Frances MC41
Buckinx, Wouter WB02
Buckler, David TC32
Buckshaw, Don TA17
Buczkowski, Peter S SC26
Buddhakulsomsiri, Jirachai SA24
Budhiraja, Amarjit SC27
Buede, Dennis TC04
Buke, Burak TC27
Bukiet, Bruce SA24
Bukkapatnam, Satish SA28 TB28
Bulbul, Kerem TA15
Bulfin, R.L. TC06 WB15
Bulldis, John MB23
Bunn, Derek MA37
Burer, Samuel SB15 MC05 TD16
Burke, Gene MA24
Burke, Gerard TC19
Burke, Paul TD26
Burk, Roger TA17
Burnetas, Apostolos WB28
Bussieck, Michael TA16
Busygin, Stanislav SC15
Butenko, Sergiy SC15 MB36 TB38 WA09 WB06 WC07
Butler, Grant MA38
Butler, John C. TB33
Butler, Martin WC21
Butler, Renee TC41 WB40
Butler, Timothy WB29
Byers, Simon MB33
Byrd, Richard SD16
Byun, Pillsung MC46

C

Caballero, Rafael MB03 MD02
Cabero, Jordi SC37
Cachon, Gerard SB39 MA39 TA34
Caggiano, Kathryn MD40
Cai, Gangshu WA29
Cai, Qibin TD18
Cai, Xiaoqiang MC15
Çakanyildirim, Metin WC13 WC17
Caldentey, Rene SC33 SD44 MB42 TA39 TB34 TD27 TD42
Caliskan Demirag, Ozgun MB34
Caliskan, Cenk WA08
Callum, Rob TB38
Calvin, Amy SA18
Cameron, Michelle TB20
Camm, Jeff TD05 TD18
Camm, Jeffrey D. MA33
Campbell, Ann MA10
Campbell, Margaret C. WA26
Campos, Vicente MB03
Canbolat, Yavuz MD32
Candas, Mehmet MC12
Cantillon, Estelle MB44
Cantu-Paz, Erick MA02 WA04
Cao, De-bi SC21
Cao, Dong WC13
Cao, Heng MC29
Cao, Jie TD12
Cao, Qidong WB25
Caplice, Chris SC44
Carmona, Rene MD27 TA27
Carney, Paul SC15 MD45
Caro, Felipe SD40
Carpenter, Stacy TC22
Carrillo, Janice TC19 TD14
Carrotta, Alessandro WC11
Carr, Peter SA36
Carr, Robert SB01 MA16 TC08
Carr, Scott MA31
Carter, Michael SA20 WA09
Cassady, Richard MD28
Cassidy, Michael TA10
Cass, Stein WC23
Castillo, Ignacio MB27 SD07
Castro, Margarita TD13
Çatay, Bülent TC10
Cathy, Frederick TB11 WB11
Caulkins, Jonathan MB21 TA21
Cecchini, Mark SD19
Ceglarek, Darek TD28
Celik, Sabri MB42
Centeno Hernaez, Efraim MC37
Centeno, Grisselle MC11 MD11
Cepeda, Manuel TB11
Cerisola, Santiago SC37
Cerulli, Raffaele MD18
Cervellera, Cristiano TC04
Cetinkaya, Sila TA41 WB41
Cetin, Mecit WC10
Chakravarthy, Srinivas SD24
Chakravarti, Dipankar MD29 TC26
Chakravarty, Amiya MA34
Cha, Kyungduck TB45 TC45
Chalermkraivuth, Kete Charles MC33
Chambal, Stephen TA22
Chandra, Charu MA35
Chand, Suresh MD21
Chan, Edward MA21
Chang, Harry MC30
Chang, In Sang WA03 WB30
Chang, Michael TB04
Chang, Mou-Hsiung WC28
Changpetch, Pannapa MA30
Chang, Shing SA30
Chang, Soo TD30 WA24
Chang, YoungJung TD03
Chan, Timothy C. Y. WA34
Chan, Yupo TC18
Chao, Raul TC38 TD43
Chaovalitwongse, Wanpracha SC15 SD20 MC45 MD45
Chao, Xiuli MA26 WA29
Charbonneau, Steven MD23
Charnes, John SC32
Charnsirisakskul, Kasarin MD35
Chayes, Jennifer MC08
Chebeskov, Alexander N. TB33
Cheek, Dennis TA45
Cheema, Amar TC26
Chelst, Kenneth MD32
Chen, Anthony SB11 MB11
Chen, Bo TB08
Chen, Chialin WA37
Chen, Chien-Yu TA29
Chen, Chin-Sheng WC14
Chen, Chun-Hung MD16
Chen, Edward WB31
Chen, Fangruo MD39 TA34
Chen, Feng MC39
Chen, Feng SD26
Chen, Gang WC13
Chen, Gang MD24 TA15
Cheng, Bo TB27
Cheng, Feng SB26 TA32
Cheng, James TC44
Cheng, Jie TB27
Cheng, Lifei SB10
Cheng, Shih-Fen MA11
Cheng, Yuting TD32
Chen, Haipeng TA26
Chen, Hung-Nan MC24
Chen, Jiaqiong TD36
Chen, Joseph MB09
Chen, Li WA45
Chen, Lijian MA06
Chen, Lucy Gongtao TB34
Chen, Ming WC24
Chen, Nan TB27 TD27
Chen, Rachel TB29
Chen-Ritzo, Ching-Hua TC41
Chen, Victoria SA06 TB04 TC04 WC44
Chen, Xin SA35 MD39
Chen, Yihsu TA37 TB37
Chen, Ying-Ju MA27 WA19
Chen, Yiyu SC31
Chen, Yong TA30 TC30

Chen, Yuxin MD26 TB26
Chen, Zhifeng WC17
Chen, Zhi-Long MD15 TB15
Cheong, Mei-Peng SB07
Cheraghi, Hossein WC28
Chertow, Glenn TC20
Chesteen, Susan A. WC25
Chew, Ek Peng WC11
Chew, Sue Yi TD03
Chhajed, Dilip SD41 MC43
Chiang, Wei-yu Kevin MD41
Chiang, Wen-Chyuan TA44
Chick, Stephen MD20
Childress, Suzanne SD12
Chin, Chang-Ho MD30
Chinneck, John SA04 SC16 MC01
Chircu, Alina TD29
Chisolm, Deena MA20
Chittamvanich, Suphalat MD19
Chiu, Wai Fung SC17
Chiu, Yi-Chang SA10 SB11 MA11 TA11
Chod, Jiri SB40 TD39
Choi, Changhui TD16
Choi, Jae Young WB24
Choi, Jaein SC06
Choi, Sangjin WC14
Choi, Sungchul MD26 TB26 WA26
Choi, Uniyoung WA31
Cho, Jung Jin SB28
Cho, Minho SB34
Choobineh, F. Fred WB19
Chootinan, Piya MB11
Chopra, Manoj WB40
Choueiki, Hisham SD24
Chowdhary, Pawan MC32
Christiansen, Marielle SB10
Christodoulakis, Dimitris WA29
Chu, Chao-Hsien MA02
Chu, Leon MD44 WB12
Chu, Millie TC45
Chung, Chia-Shin WC40
Cioppa, Thomas SA23
Claerhout, Diederik SB26
Clarke, John-Paul TC13
Clarke, Lloyd WB40
Clemans, Paul WA23
Clemen, Robert T. MA18
Clermont, Markus TC21
Cobb, Barry R. SC17
Cochran, James MB25 MD25 TD05
Cohen, Morris MC35
Cohn, Amy SA13 SB12
Coit, David W. TA30 TC30
Coit, David TA30 TC30 TD13
Cojocaru, Monica Gabriela MA11
Colazo, Jorge WB43
Coleman, Thomas F. SB36 MA36
Collins, Phil MB23
Combs, Todd MC23
Cominetti, Roberto TB11
Conejo, Antonio J. MC37
Conejo, Antonio SC37
Conitzer, Vincent SB45
Conlon, Sumali WB05
Contreras, Javier SD37
Cook, Thomas TC33
Cooper, William L. SA26 MD42
Cope, Eric WB20
Corberan, Angel MB03
Corbett, Charles MD39 SB43 TA35 TB40
Cordon, Oscar MB03
Cordova, Gonzalo TA12
Cornacchia, Eugenio WA12
Cornuejols, Gerard MB05
Corominas, Albert MC02
Correa, J. R. SB08
Correa-Martinez, Yaneth Cristina WB04
Cortés, Cristiàn MD10
Cosares, Steven TB18
Costa, Ana Paula C. S. MB18
Côté, Murray SB20 MC20
Cotteleer, Mark TD34
Coullard, Collette SD22
Coullard, Collette TB39
Cox, Jr, Louis Anthony TD22 WC05
Craighead, Christopher SD32
Crainic, Teodor Gabriel SB03 SC03 SD03 MB02 MC13
Cranfield, John MD46
Craven, Mark SA09
Creese, Robert TC02
Crissey, Mary WC07
Cristianini, Nello TA03 TD07
Croson, Rachel TD34
Crowley, Christian TA37
Cruz, Jose TC37
Crystal, Carrie SC02
Cui, Tony H. WA26
Cui, Wenbin SD29
Cui, Yingjin WB25
Cunha, Claudio WB44
Curry, David TD05
Cutright, Ken MA22

D

Dada, Maqbool MD21 TD41 WB12
Daganzo, Carlos TD10
Dai, Jim TC27
Dailey, Daniel J. TB11 WB11
Daily, Bonnie SB46
Dai, Rui WC39
Dalakouras, Georgios TA36
Dalton, Chris SB47 MA17
Damas, Sergio MB03
D'Amours, Sophie TA02
Daneke, Greg WA14
Daniele, Patrizia MA11
Dasci, Abdullah TD10
Dasgupta, Anirban SA45
Dash, Sanjeeb MD05
Daskin, Mark SD22 TB39
d'Aspremont, Alexandre SC09 MD36
Das, Tapas K. SA42 TB28
Das, Tapas MC45 MD37
Dasu, Sriram WA39 WC34
Daugherty, P.J. SD29
Davenport, Andrew MD44
Davidoff, Donald MC42
Davidson, Rachel WB37
David, Stanford SD27
Davis, Chad SD12
Davis, Courtney MB20
Davis, Fred WC17
Davis, James TB38
Davis, Larry MB29
Davis, Richard TA27
Davis, Timothy TB16
Dawande, Milind MD15 TD06
Dayanik, Savas SC28 SD33 SD36 MA36 MD27
Day, Jamison MA43
Day, Jeff MC10
Day, Robert MC44
de Almeida, Adiel Teixeira MB18
De Backer, Bruno WC11
de Farias, Daniela SB06 SC45
de Farias, Ismael SC05
de Kok, Ton TB41
de Lange, Gertjan MD47
de los Cobos Silva, Sergio MA03
de Matta, Renato SC21 WA43
De Reyck, Bert MA03
de Sousa, Mauricio MD18
de Vericourt, Francis SC42 SD33
de Waal, P.R. WA13
Dean, Doug MC41
Deane, Jason TC02
Dean, Keith MB31
Debels, Dieter MA03
Debo, Laurens SD09 MA31 MC40 WC39
DeCroix, Gregory MB26
Degbotse, Alfred TB32
DeHoratius, Nicole TB41
Deitz, Paul TB23
Dekic, Biljana MB11
Dekker, Rommert MC10 MD13 MD28 TD12
del Castillo, Enrique MB30
del Valle, Alejandro G. TC10 WC09
DeLaCruz, Tom TC22
Demeulemeester, Erik SA33
DeMiguel, Victor MC06 MD09 TA42
Demirci, Mehmet SC06
Dempsey, James F. MB45 TA20 TB45
Dempster, Arthur P. SC17
Dempster, Arthur SD30
Deng, Shi-Jie SC36 SC37 SD37 MB37 MD27
Deng, Shiming MA34
Deniz, Borga SA34
Denton, Brian SD20 TD33
DeOliveira, Erickson TB38
DePetro, Alexander WB29
Deshmukh, Abhijit MC30 TA28
Deshpande, Vinayak SB41 SD35 MB35
Desiraju, Ramarao SD34
Dessouky, Maged TA10
Detwarasiti, Apiruk SC17
Detwiler, Brian TC23
Devanur, Nikhil SD45 TA08
Deveau, Steven MA23
DeVito, Paul MD46
Devpura, Amit TB41 WB40
Dexter, Franklin WB19
Deza, Antoine MC16 TB07
Dhungana, Basanta TD46
Di Domenica, Nico SA06
Di Gaspero, Luca MD02
Diaz, Andres SD02
DÌaz, Jenny MC16
Diaz, Milton TC22
DiBenedetto, Anthony MC14
Dietz, Dennis MA32
Dilts, David SC41
Dimova, Boryana MC23
Ding, Lei SB21
Ding, Qing TB34
Ding, Xuequn TB02 WB24
Ding, Yu SB28 TB28
Diponegoro, Ahmed SB41
Dirkse, Steven TA16
Discenza, Joseph H. TC33
Diwekar, Urmila TC04
Djurdjanovic, Dragan SC28
D'Mello, Joe TA25
Dobra, Alin SD08
Doerr, Kenneth TD34
Dogan, Ibrahim MD32
Domm, Mary WA02
Dong, Lingxiu TB34
Dong, Yan TA31
Donohue, Karen TD34
Donovan, Geoffrey SC29
Dooley, Kevin WA14
Douglas, Rohan SB36
Down, Douglas MC27
Drabek, Andrea MB23
Drabek, Norm MB23
Drake, Matt TB25
Drake, Matt TA40
Dresner, Martin TA31
Drezner, Tammy MC22
Drezner, Zvi SA22 MA02 MC22
Driscoll, Patrick TB23 TB30
Dror, Moshe TD08
Drud, Arne SD16
Druehl, Cheryl SB34 TA43
Duarte, Renato MB02
Duenyas, Izak MA34
Duffie, Darrell SB36
Duffy, Tom MD33
Duguid, James SA18
Duhamel, Christophe MD18
Duin, Cees MD18
Dula, Jose TD44
Du, Lili MA12
Duling, David SC04
Durango-Cohen, Pablo SD12
Duran, Marco SB10
Duran, Serhan SC34
Duray, Rebecca WA35
Durham, Delcie MC30
Durrleman, Valdo SB36
Dussault, Jean-Pierre TC09
Duthie, Jennifer SC12
Dutta, Shantanu TA26
Dyer, James MC17 TB33 TC25

E

Easton, Todd TC06 WC06
Eaton, Don TD34
Ebben, Mark TC15
Edmondson, Amy SB14 SD43
Edmunds, Thomas A. TB33
Egami, Masahiko SD36
Ehie, Ike TC41
Ehlen, Mark SB35 SC41
Ehrman, Chaim TC26
Eiselt, H.A. SC22
Eisenhauer, William TC44
Eisenman, Stacy TA11
Eisenstein, Donald WB21

Eitel, Dave SB20
El Ghaoui, Laurent SB09 SC09 MD36 TD07 TD42
Elakkumanan, Praveen WA02
El-Darzi, Elia TB20
ElHafsi, Mohsen SD26
El-Khouri, William TA19
Elkins, Debra SD32
Ellingsworth, Marty SD15
Ellingsworth, Marty TC33
Ellington, Aimee TD24
Ellis, Hugh TA37
Ellis, Kimberly SB12
Elmaghraby, Wedad SC44 MB39
Elsayed, Elsayed TA28
Emir, Hulya MC19
Emsermann, Markus SD32
Enachescu, Mihaela SD08
Engel, Andrew WA02
Engelbrecht-Wiggans, Richard MA44 MB44
Epelman, Marina SB31 MA11 TB45
Erat, Sanjiv SD09 MA43 MD43
Erdmann, Alexander TC14
Erdogan, Meftun WB32
Eren, Serkan MD34
Erera, Alan SB10 MC10 MC41
Ergun, Ozlem MA10 MD10 TB13 WB13
Erhun, Feryal MC41 TB39
Eric, Dragan WC08
Eriksen, Steven TD06
Erkip, Nesim MB34
Erkoc, Murat SA41
Erkut, Erhan SB22
Ervolina, Tom TC41
Eryarsoy, Enes SD19
Escalera, Jiménez WB44
Eso, Marta WB16
Espinoza, Daniel MA05
Essegaier, Skander WC02
Esserman, Laura SC18 TB20
Estrugo, Ilan WC41
Eterovic, Yadran WB44
Ettl, Markus SB26 MC32 TB29
Evanchik, Mike TA25
Everson, Mark MA35
Ewing, MAJ Paul (Lee) TD17
Ewing, Michael WC02
Ezechukwu, Obi SA16 SB16

F

Fabregas, Aldo MC11 MD11
Fakcharoenphol, Jittat MB08
Fakih, Saif MC45
Fang, Xiang MC34 MD28
Fang, Yulin WB43
Fan, Ming SB34
Fan, Shuyu MD38
Fan, Wei TB11
Fan, Xiaofei SD27
Fan, Yueyue MB11
Farahat, Amr SA08 MA05
Faria, Jose A. SB29
Farmerie, William MD03
Farr, John TC04
Farzinnia, Neda TB17
Fathi, Yahya TD30
Faulin, Javier TC10 WC09
Fayed, Asser TD29
Federgruen, Awi SA41 MC35 TA39
Feigenbaum, Joan MC08
Feinberg, Eugene SB06 SD27
Feiveson, Alan MC30
Felder, Frank SB37
Feldman, Laura SB14
Fenelon, Mary WA06
Feng, Jane TA31 TC42
Feng, Keli TD15
Feng, Liming SD36
Feng, Qi WB41
Feng, Qi MC09
Feng, Qianmei MC28
Feng, Tianjun MC18
Feng, Youyi MB37 WA11
Fenwick, Dave TD29
Ferguson, Mark SA34 SB36 SC02 TC19
Ferland, Jacques SD02
Fernandes, Manuela MD18
Fernandez, Emmanuel WC23
Ferrer, Geraldo MD19
Ferrer, Juan-Carlos WB02
Ferris, Michael C. TC09
Fiala, Petr WB45
Figliozzi, Miguel Andres SA10 TA12
Figueiredo, Daniel TC18
Fine, Charles TC40
Fink, Andreas MD18
Finkel, Daniel WB09
Finkelstei, Daniel SC28
Finn, Adam TD26
Fischbeck, Paul SD18
Fischer, Martin MA32
Fischetti, Matteo MB33
Fisher, David MA20
Fisher, Marshall SC39
Fixson, Sebastian SD14
Fleischer, Lisa MA08 MC08
Fleming, Lee SC43
Fleurent, Charles WB10
Flint, Matthew WC23
Florax, Raymond MC46
Flores-Mendoza, Carmen WA38
Florian, Michael SD10 TB11
Floudas, Christodoulos TD03
Flynn, James WC40
Foote, Bobbie SA23
Forrester, Dick WC06
Forza, Cipriano TB35
Fos, Peter WA20
Foster, Dean TB36
Foster, Earnest WB08
Foster, Ken MC46
Foster, Michael SC36
Fourer, Robert SA16 SB16 SC16 SD16
Fowler, John SB38 WA38
Francis, Peter MA10 MC10
Francis, Richard SD22
Frank, Jim MA23
Fransoo, Jan TA18
Franx, Geert Jan SB31
Franza, Richard TD14
Fraticelli, Barbara MC25
Frausto, Juan MC16
Frederick, Shane MC18
Freedman, Jerome TD13
Freimer, Mike MC44 SB44
Freund, Matthias C. WA14
Frich, Ole-Tobias SB10
Fridgeirsdottir, Kristin TA42 TD43
Fried, Jeremy SD29
Friedlander, Michael P. MD09
Friedrich, Lars TB36
Friesz, Terry L. MC37
Frikken, Keith SD35
Frommer, Ian WB18
Fry, Michael SA41 TD38 WC40
Fukunari, Miki WB21
Fuloria, Manas C. SC39
Fulton, Brent SC11
Fu, Michael MB38
Fung, Richard WB38
Fuqua, Andrew TA42
Fylstra, Daniel SC16 MA47

G

Gabow, Harold MB08
Gabriel, Steve SA37 SB29 SB37 SC37
Galati, Matthew TB05
Galbreth, MIchael TD21
Galenko, Alexander WB38
Gallego, Guillermo MB40 MC09 TB42
Gallego, Guillermo SD42
Gallien, Jeremie SD40 SD44 MD34
Gallmeyer, Michael MC06
Gamarnik, David SC27
Gamboa, Dorabela MB02
Gamvros, Ioannis SA01 MD18
Gandibleux, Xavier MD02
Ganesan, Deepak SD08
Ganesan, Rajesh TB28
Ganguly, Auroop TB04 WA04 WC29
Gansel, Benjamin TB36
Ganti, Andrew TD20
Ganti, Anita TD20
Gao, Guodong(Gordon) WC12
Gao, Hongman WC32
Gao, Li-Lian SB41
Gao, Robert TA28
Garach, Viral TD04
Garcia, Alfredo MB37
Garcìa-Bertrand, Raquel MC37
Garcia, Hugo TD28
Garcìa-López, Félix SD03
Garcia, Renan MA05
Garcia-Torres, Miguel SD03
Garfinkel, Maurice WC08
Garfinkel, Robert SA32
Garg, Naveen TA08
Garg, Rahul SB08 SC08
Garrow, Laurie MD11 SA13
Gassmann, Gus SA06
Gattiker, Thomas SC43
Gaukler, Gary SB39
Gaur, Vishal SA39 SB40 SC40 TB40
Gautam, Natarajan SC31 WA05
Gavirneni, Srinagesh MA38 MC34 TD06
Gazmuri, Pedro WB44
Gebraeel, Nagi SC28
Gehrke, Johannes SD08
Geismar, H. Neil MD15
Gel, Esma WA38
Gellrich, Tom TB36
Gelman, Andrew TB04
Gelogullari, Cumhur WB15
Genc, Talat SB37
Gendreau, Michel SD02 SD03
Gendron, Bernard MC33 MD18
Geng, Qin MD41
Gentili, Monica MD18
George, Abraham MB06
George, Sonney MA29
Gerschman, Mats WA34 WA45
Geunes, Joseph WA05 WB35
Ghani, Jawaid Abdul TB41
Ghate, Archis MC07
Ghose, Anindya TC29
Ghosh, Biswadip TB31 TD31
Ghosh, Jay MD40
Ghosh, Soumen WB43
Giallombardo, Giovanni TA07
Giddings, Angela WB28
Giesecke, Kay WA27
Giesen, Ricardo MD10
Gilat, Dagan TA32
Gilbert, Stephen M. WA41
Gilbert, Steve SD40 MB39 TA40
Gilliam, Reid WA42
Gill, Matt MB23
Giloni, Avi SC40
Gilpin, Andrew TA42
Gino, Francesca MC38
Girotra, Karan SB43 MA39
Glasserman, Paul WC27
Glockner, Greg MD47
Glover, Fred SC01 SC03 SD03 TC03 TD06 WB09
Glynn, Peter SC27 SD27 SD40 MA27 MB37 WC28
Goel, Ankur TB34
Goel, Ashish SD08
Goetschalckx, Marc TA12 WA36
Gökçe, Elif Ilke TC10
Goldberg, Jeff WA02
Goldberg, Lisa WA27
Golden, Bruce SA01
Goldie, Sue WA20
Goldman, Lawrence SB47
Goldsman, David SC38 MA28 MB25
Goldsman, David MD16
Goldstein, Barry SA18
Golovnya, Mikhail TD47
Gomes, Paulo MB43
Gomez-Sanchez, Miguel WA38
Goncalves, Joao TA16
Goncalves, Paulo TD40
Gong, Qiang WB28
Gonzalez-Velarde, Jose Luis TA35
Goossens, Nico MA26
Gopal, Ram SA32
Gorman, Michael MB13 SB13
Gorman, Paul TB07
Gosavi, Abhijit SA42 MD16
Gotham, Douglas MD37
Gottfried, Russell WC35
Gouel, Phil SD14
Gouveia, Luis MD18
Govindaluri, Madhumohan SD24
Govindan, Ramesh SD08
Govind, Nirmal MA28
Govindu, Ramakrishna MD32
Goyal, Manu SA40 TA34
Goycoolea, Marcos MA05

Grabis, Janis MA35
Graf, Peter MD38
Graham, Stuart SC14
Grainger, Corbett TD46
Gramani, Maria Cristina TD02
Grande, Darby TA19
Granger, Julien MD23
Granot, Daniel MC39 WB38
Grant, Ed TC37
Grantom, Rick WB38
Graves, Robert J. TC25
Graves, Spencer MA30
Graves, Stephen MC40 TD39
Gray, Andrew WB20
Gray, John TD29
Gray, Sarah TD23
Greenberg, Harvey TA03 TC08
Greenhut, Nathan TC30 TD13
Green, Linda MB21
Greenstein, Shane MC38
Greenstreet, Kenneth MB23
Greenwald, Amy TC31
Greistorfer, Peter MB03
Griffin, Paul MC20 MD35 TA15 TA40 TB24 TB25
Griffin, Susan MC20 TB24
Griffith, Ron SC13
Grigorieva, Elena SA44
Grinde, Roger TC21
Grobman, Jeffrey TD22
Groenevelt, Harry SB43 TA18
Gronalt, Manfred SA29
Grossmann, Ignacio MB16 WC07
Grossman, Thomas MA25 TA21 TA21 TB21 TC21
Grothklags, Sven SA13
Grudic, Greg SB09
Grundel, Don MD23
Guan, Yongpei SB05 SD05
Guardiola, Ivan TA38
Gue, Kevin SB12 MA12
Guide, Daniel MC19 TC19
Guignard, Monique TC16
Guillen, Eduardo WC09
Guillermo, Gallego WA11
Gu, Jinxiang WA36
Gulcu, Altan SC34
Gullu, Refik MB34
Gumus, Mehmet TD11
Gunderson, Louise TB36
Gune, Kaushik MB04
Gunes, Evrim Didem MD20
Gung, Roger MC29
Gunluk, Oktay MD05
Gunn, Eldon MB29
Guo, Huairui SA30
Guo, Pengfei SB34
Guo, Xin WC27
Guo, Yong WB30
Gupta, Amar TB04
Gupta, Anuj MD11
Gupta, Anupam TA08
Gupta, Aparna TB27 WA18
Gupta, Ashish SC18
Gupta, Avaneesh TD41 TD45
Gupta, Barun TC41
Gupta, Diwakar SD20 MA26
Gupta, Neha TD09
Gupta, Shilpa SC30
Gupta, Shobhit SD44
Gupta, Skylab R. TC06
Gupta, Sudheer TB37 WA19
Gupta, Sudheer TC39
Gupta, Sunil MD26
Gurbuz, Mustafa TC34
Gurel, Sinan WB15
Gurnani, Haresh SA41 SD34 MC34
Gurtuna, F. TB07
Gustafsson, Tomas TC13
Gutierrez-Andrade, Miguel Angel MA03
Gutierrez, Genaro TB34
Guzelsoy, Menal TC05

H

Haase, Michaela TC14
Habenicht, Walter MB18
Hadavas, Paul TA24
Hafer, Lou TB16
Hager, William TB16 TC09
Haghani, Ali WB11 WB13
Hagstrom, Gary SA18
Hahn, Eugene MB18
Hahn, Peter SB22
Hahn, R. Tony SD23
Haight, Robert SC29
Haksever, Cengiz SB24
Haksoz, Cagri SC40
Hale, Fred MD24
Hale, Trevor MA22
Halim, Hans MC16
Hall, Carl WA12
Hall, Chris WB38
Hallgren, Mattias WB34
Hallman, William MD46
Hall, Nicholas G. MD15 TD01
Hall, Randolph WB11
Hamamoto, Hidenobu WB17
Hamdouch, Younes SD10
Hamelin, Benoit TC09
Hamilton, Richard MD24
Hammer, Joachim MD03
Hammer, Peter L. SB19 MB15 MC45 MD03
Hampshire, Robert SA31
Handfield, Robert SD32
Han, Jiarui (Jared) MD36
Hansen, Mark SA11 SC10
Hansmann, Karl-Werner WB21 WB32
Harchol-Balter, Mor SB31 SC31
Hardin, Jill TD24
Harrington, Joseph MC37
Harris, CPT John TD17
Harris, Steve MD29
Harrison, Michael J. MD42
Harrison, Michael SD29 MB27
Harrison, Terry SB33 MA33 TC41
Harrod, Steven TB12
Hart, Gary MD07
Hartline, Jason SC08
Hart, William E. TA01 TA03 TC08
Harwig, John MC23
Hasan, M. K. TB12
Hasenbein, John TC27
Hashemi, S.Mehdi WC07
Hasley, Joseph TD31
Hasselquist, Lief WC16
Hatch, Nile TD14
Hatzakis, Manos MD33
Häubl, Gerald TB26
Haugh, Martin TB34 TD27
Haugh, Martin MD36
Hauser, Karina WA36
Hausman, Warren SB39 SC39
Hawkins, Douglas M. SB30 SC30
Hay, Doug TC21
Hearn, Donald SD10
He, Chuan MD26
He, David SA30 TA28
Heerink, Koos MD47
Heese, H. Sebastian MA43
Heidenberger, Kurt SB20
Heimann, David WA30
Heitman, Silvia TC15
He, Ling TC31
Henderson, Shane SB31 TC45
Henderson, Steve TD23
Hendricks, Kevin TB40 WB43
Hensley, LTC William TD17
Heragu, Sunderesh MA12 MB26 TC25
Herer, Yale WB40 WC41
Herings, P.Jean-Jacques SA44
Hernandez, Jr., Jaime TB09
Hernandez Daque, Guillermo WB44
Hernandez, Jessica MA11
Herroelen, Willy SA33
Hertz, Alain WA08
Hewitt, Mike TC38
He, Yang WA17
Heyde, Chris TA27
Hickman, Mark TA10
Hickman, Mark TB11
Hicks, Illya TD05 WB06 WB06
Higle, J.L. TB06
Hildebrandt, Thomas SB22
Hillier, Fred WB21
Hillier, Mark WB21
Hillier, Wynship WA17
Hill, Ray TB22
Hinrichs, Curt TC47
Hirotsu, Nobuyoshi TB38
Hitt, Lorin WC12
Hjorring, Curt TB13 TC13
Hobbs, Benjamin MC37 TA37
Hochbaum, Dorit TC08
Hoda, Sam TA42
Hodson, William T. WC32
Hoffman, Alan MA09
Hoffman, Karla MD23 MD44
Hoffman, Robert SA11
Hof, John SB29
Hoivik, Tom SD23
Holder, Allen MB20 TA24 TC01
Holguin de la Cruz, Javier WB40
Holley, Elizabeth WA20
Hollywood, John MA21
Holmstrom, Kenneth MA07 MB07
Holtta, Katja TC43
Homem-de-Mello, Tito MA06
Hong, Ethan TC11
Hong, L. Jeff MB38
Hong, Songchul MD31 WC39
Hong, Yoon Gee WC35
Honhon, Dorothee SA39 SD31
Hooker, John WC08
Hooker, Kevin WC06
Hoos, Holger TC03
Hopman, Jay MA35
Hopp, Wallace J. SB33 SC26
Hopp, Wallace MA42
Hora, Manpreet SC21
Horgen, Richard SB10
Horio, Masanori WA24
Horne, Dr. Gary SC23
Hoshaw, Sarah MA20
Hosp, Shawn TC22
Howard, Ronald A. SB17
Howe, Adele TC22
Hsing, Yu SA46
Hsu, Wenyue MD33
Huang, Boray TD12
Huang, Deng MD38
Huang, Huei-Chuen TD13 WC44
Huang, Kai TB06
Huang, Paul MC32 TB29
Huang, Qiang SB28 TA28
Huang, Rongbing SA22 SB22
Huang, Simin TA12
Huang, Sui MC16
Huang, Tao SC26
Huang, Wei MD19
Huang, Yongwei WA05
Huang, Zhimin Huang TA44
Huckman, Robert WC21
Huggett, Jr, Robert SB29
Huggins, Eric TD38
Hughes, Ed TB47
Huh, Tim MC44 MD40
Hui, Yer Van WB13 WC13
Hu, Jianli WC40
Hultqvist, Daniel SA29
Humair, Salal TD39
Hung, Hui-Chih MC15
Hung, Jui-Wen WA41
Hunsaker, Brady SC06 MD05 TA20 TB06
Hunt, David TB10
Huo, Xiaoming MA04
Huq, Faizul MA22
Hu, Qiaohai(Joice) WC10
Hurink, Johann TC15
Hutchins, Mark MD24
Hutson, Kevin TA24 WA08
Hu, Xiaoping MB28
Huy, P.N.A. MB04
Hu, Zhe WC07
Hvam, Lars TB35
Hvattum, Lars Magnus MB02
Hwang, Wookyeon SD04

I

Iamratanakul, Supachart TB44
Iasemidis, Leonidas SC15
Ilhan, Aytac MB24
Im, C.S. WA31
Imbierowicz, Paul MD29
Immorlica, Nicole TA08
Inakawa, Keisuke SB22
Indika, Sathish WA24
Infanger, Gerd MB37
Ingene, Chuck TB26
Ingolfsson, Armann SB22 SB31 MB25 TC34
Inman, Lane TB44
Inniss, Tasha SA11 MA15

Iravani, Seyed SC26 TC36 TD12 WC34
Isken, Mark SA20
Islam, Towhidul TD26
Ivanhoe, Russell SC32
Ivarsson, Johan TC13
Ivy, Julie MD20
Iyengar, Garud MA08 MC09 TB42 TD42
Iyer, Ananth SD35 MB35 WA40
Iyer, Ganesh MD26

J

Jablonsky, Josef WB45
Jackman, John MA15
Jackson, Peter MC34
Jackson, Peter TD15
Jacobson, Sheldon SD20
Jafari, Mohsen MD45
Jaillet, Patrick SA10 MD10 MD12 TA12
Jain, Aditya TA18
Jain, Apurva SA26
Jain, Chitra MA24 MD24
Jain, Kamal SC08 SD45
Jain, Mayank SA36
Jalora, Anshu MA12
Jamal, A. M. M. SA46
Jamalyaria, Farokh TD03
Janakiraman, Ganesh MD40
Janakiram, Mani SD04 MA28
Jang, In-Yong WB05
Jang, Wooseung TA46
Jank, Wolfgang SB44 MA44
Jaraiedi, Majid TC02
Jaruphongsa, Wikrom MC09
Jarvis, John TC24
Jayakrishnan, R. MB11
Jayaraman, Vaidy TA19
Jeet, Vishv SA04 MC12
Jeffcoat, David SB23 MD23
Jefferson, Thomas SB24
Jeffery, Kira Beth TD37
Jekic, Savko R. WC08
Jenni, Karen SA18
Jennings, Sybillyn TC25
Jensen, Bo TC07
Jensen, David MC29 WB16
Jeong, In-Jun TD30
Jeong, Myong-Kee SA30 TC28 TD28
Jeon, Kyunghwi WC11
Jeske, Daniel MD04
Jewkes, Elizabeth WA38
Jha, Krishna MB13
Jha, Manoj TA02
Jia, Jianmin TB33
Jia, Jing MB26
Jiang, Li SA40
Jiang, Shwu-Tzy MD30 WA28
Jiang, Xiaoyue WA28
Jiang, Xuefeng SD36
Jimenez, Tania SB31
Jing, Bing SA46
Jin, Holly WA09
Jin, Jihong MC24
Jin, Jionghua (Judy) SA30 SB28 SC04
Jin, Mingzhou SA41
Jin, Nong SB28
Jin, Wenlong MA11
Jin, Xing WB36
Jin, Yue TC10
Joglekar, Nitin SA43 MB43 TA43
Johannes, Michael TB27
Johari, Ramesh SA45 SB08
Johnson, Alan MB23
Johnson, Andrew WA36
Johnson, Anne C. TB06
Johnson, Blake MA35
Johnson, Claudia TC24
Johnson, Daniel A SD17
Johnson, Douglas TD14
Johnson, Ellis SA34 MB34 TB13
Johnson, Eric SA43 TA23
Johnson, Erik SD17
Johnson, Kjell TD30
Johnson, Michael MB22
Johnson, Rachel SB38
Johnson, Roy MB31
Joines, Jeffrey SC38 MA38
Jones, Dean SD12
Jones, Joni SB44
Jones, Matthew WA38
Jones, Michael WA02
Jones, Morgan WC25
Jones, Wesley MD38
Jordan, Carsten MB32
Jordan, Michael SB09 SC09 TA03 TD07
Jordan, William TB14
Joro, Tarja MB27
Jouglet, Antoine MC02
Juneja, Januj WA05
Juneja, Sandeep SC27
Jun, Myungsoo SB23

K

Kababji, Hani TA28
Kachani, Soulaymane TB42
Kachroo, Pushkin MC26
Kahrimanis, George SB07
Kaisar, Evangelos WB11
Kaistha, Nitin MB30
Kakade, Sham SC45
Kalagnanam, Jayant MD44
Kallianpur, Amy WC02
Kalvenes, Joakim TB18
Kalyanaraman, Shivkumar WA18
Kamath, Chandrika WA04
Kamath, Manjunath MA26
Kamburowski, Jerzy WA24
Kaminsky, Phil TA15
Kampas, Frank J. SD07
Kane, Robyn A WB22
Kang, Wanmo WC27
Kaniel, Ron MC06
Kannan, Karthik TC31
Kaplan, Alan E. MB33
Kaplan, Edward H SC35
Kapoor, Sanjiv SC08 SD45
Kapoor, Shubir MC32
Kapur, Kailash MC28 TB30
Kapuscinski, Roman SA40
Karaesmen, Itir SA34 SA42
Karaesmen, Itir MD42
Karakayali, Ibrahim MC19
Karamanov, Miroslav MB05
Karatzas, Ioannis MA36
Karisch, Stefan SA13
Karmarkar, Uday MA31
Karnani, Tamana SD20
Karoonsoontawong, Ampol TA11
Kasilingam, Raja MB34
Katehakis, Michael MC09
Katok, Elena MA44 MB44 TD34 TD40
Kauffman, Robert SA19 TA26
Kaufman, David MC27
Kavadias, Stylianos SD09 MA43 MD43 TD43
Kaya, Murat MD39
Kayande, Ujwal TD26
Kaya, Onur TA15
Kaya, Ozgur WB36
Kazaz, Burak SA41
Kee, Ernie WB38
Keefer, Donald SA17
Keeney, Ralph SB18
Keethler, Greg WB22
Keha, Ahmet MB05 TA13
Keisler, Jeffrey SD17 TA17 TD21
Ke, Ke WB17
Kekre, Sunder SD09
Kelleher, Kelly MA20
Keller, Dan WB09
Keller, L. Robin MA17 MC18
Kelley, C.T. WB09
Kelly, James SC01
Kelton, David WA01
Kemahlioglu Ziya, Eda SA35
Kempe, David SD08
Kempf, Karl TB41 WB40
Kemppainen, Katariina WC41
Kennedy, Thomas MD46
Kennings, Andrew TA09
Kent, Brian SB29
Kenyon, Chris MC41
Kenyon, George MA41
Keon, Neil TB18
Keppo, Jussi TD27 WA27
Kerbache, Laoucine TB12
Kerchner, Phil WA22
Kesavan, Saravanan TB40
Keser, Claudia MC40
Keskin, Burcu Baris MA22
Keskinocak, Pinar SA34 SC34 MB34 MD35 TA15 TA40
Ketzenberg, Michael SA34
Khandekar, Rohit TA08
Khanna, Madhu TD46
Khan, Shiraj TB04 WA04
Kharoufeh, Jeffrey SC28
Khmelnitsky, Alex MA05
Khompatraporn, Charoenchai MC07
Khowala, Ketan WA38
Kiet, Supat SA37
Kikuchi, Shinya MD11
Kimbrel, Tracy MC08
Kimbrough, Steven SA46
Kim, Bum-Jin SB22
Kim, Byung Soo WB15
Kim, Byung-In TB33 WA10
Kim, David SA24 SB02 MA12
Kim, Hyoungtae MB28
Kim, Hyungmyung MB11
Kim, Jane WA20
Kim, Jindae TB02
Kim, Kwang-Jae SD04 TC28 TD30
Kim, Kwiseon MD38
Kimmel, Robert MA36
KIM, Sang-Won SD24
Kim, Seokjin SA22
Kim, Seongbae TB33 WA10
Kim, Seong-Hee SC38 MA28 MB25 MD16
Kim, Seongmoon MC11
Kim, Seoung Bum MC04
Kim, Sun Woo WA15
Kim, Yohan SB36
Kinney, Gary TB22
Kintner, Hallie TB14
Kirkman, Bob TB25
Kirkwood, Craig W. SD17
Kirsch, David TB40
Klabjan, Diego SA35 SC05 TB13 TB13 WA24 WC06
Klastorin, Ted SB24
Kleinberg, Jon SA45
Klein, Cerry TA46
Kleywegt, Anton SC06 SD29 TD10
Klimack, COL William TD17
Kloeber, Jack SA17 TA17
Kluczny, Bailey WB38
Knowles, Tom WB03
Kobylski, Gerald TC04
Kocabiyikoglu, Ayse SA42 TB17
Kochenberger, Gary TD45 WA03 WB09
Kochenberger, Gary WB05
Koch, Frank SA18
Koehler, Gary SA19 SD19 TC31
Koehler, Matthew SC23 WB23
Koellinger, Philipp MA14
Koepke, Corbin TB22
Koesrindartoto, Deddy MA37
Kofman, Leonard MB24 TD27
Kogan, Alex MB15
Kogan, Leonid MD36
Kok, Gurhan SC39
Kolberg, Hannah WC25
Kolev, Lubomir SC16
Kolfal, Bora TC36 TC36
Kolitz, Steve TB22
Koller, Daphne SB45
Konak, Abdullah TA30 TB30
Kong, Nan TA20 TB06 WB05
Konjevod, Goran SB01
Konopka, John MC32
Koole, Ger SB31 SD31
Koppelman, Frank SA13 MD11
Koppius, Otto MA44
Korada, Pavan SB11
Korhonen, Pekka TB01 TD44
Kornish, Laura TB17
Kostamis, Dimitris MA34
Kostreva, Michael MD07
Koulamas, Christos WB45
Kou, Steven SD36 MC09 MD27 TA27 TB42 TD27 WA27
Kouvelis, Panos TB34
Kraas, Bob TB33
Kraemer, Kenneth L. TC29
Kraft, Edwin R "Chip" SB13 MB13
Kraiselburd, Santiago MA39
Kranenburg, A.A. TC34
Krasik, Vladimir TA39
Krass, Dmitry MB22
Krass, Dmitry MC22

Kraus, Markus SB20
Kreke, Jennifer TA20 TB20
Kress, Moshe MA45
Krishen, Anjala MC26
Krishnamoorthy, Bala MB20 TA05
Krishnamoorthy, Srinivas SD42
Krishnamurthy, Ananth SB26 SD31 MB26 MD23 TA29 WB21
Krishnamurthy, Viji WC34
Krishnan, Harish MA40 WA34
Krishnan, Kartik TD09
Krishnan, Ramayya TC31
Krishnan, Shravan WA40
Krishnan, Vish MB43 MC14 MD43
Krishnan, Vish SD09
Kristjansson, Bjarni SB16 MC47 TC16
Kroese, Dirk SA27 SB27 SD06
Krokhmal, Pavlo MB36
Kroon, Leo MB33 MD13
Kros, John F. SA04
Krupnick, Alan WA37
Kubiak, Wieslaw MC02
Kuchta, Mark TD37
Kucukyavuz, Simge TC05
Kuhn, Kenneth SD12
Kuhn, Tom TA42
Kulahci, Murat MA30
Kulkarni, Devadatta TB19
Kulkarni, Kaustubh-ulhas MA28
Kulkarni, Shailesh MD21
Kulkarni, Vidyadhar SC26 SD26 MD19
Kulturel-Konak, Sadan TA30
Kumar, Arvind SC20
Kumar, Amar MD13
Kumara, Soundar R. T. TB02 WA08 WB18
Kumar, Deepak MD12
Kumar, Mahesh MA15
Kumar, Piyush TD09
Kumar, Rachna WB25
Kumar, Sanjay SB35
Kumar, Sunil SA21 SB42 TA38 WB03
Kumsaikaew, Piyamart MA15
Kuo, Way SD28
Kuper, Andre TB19
Kurata, Hisashi MD41
Kurtulus, Ibrahim WA42
Kurtulus, Mumin MB35
Kurz, Mary E. WC10 WC24
Kusiak, Andrew MC04
Kutanoglu, Erhan MC12 WA15
Kuyzu, Guletkin MD10
Kvam, Paul SD28 SD28 MC25 TC28 TD38
Kwinn, Michael SA23
Kwon, Roy MC44

L

Labe, Russ MD33
LaCourse, Dave SD38
Lada, Emily SC38
Ladanyi, Laszlo TA16 TB05 WB16
LaDue, Mariana MB34
LaGanga, Linda TD20
Laguna, Manuel MA03
Laird, Carl WA16
Lakhani, Karim SD14
Lall, Upmanu TB04
Lambert, Garry MC23
Lamm, MAJ Greg TD17
Lance, Ryan WB18
Lancia, Giuseppe MD03
Lanckriet, Gert SC09 MD36 TA03 TD07
Lanckriet, Gert SB09
Landau, Ariel TA32
Landers, Thomas L. WA28
Langabeer, Jim WC29
Lang, Chunmei WB13
Langer, Mark WB20
Langley, Suchada MB46 WB37
Lang, Thomas SC11
Lan, Shan TC13
Laporte, Gilbert TD10 WA36
Lapré, Michael SB14
Lara-Velazquez, Pedro MA03
Lariviere, Martin MA39
Larsen, Allan MC13
Larsen, Erik SC40
Larson, Richard SA22 SC35
Larsson, Tomas WC28
Lasdon, Leon SC07 MB07
Laszlo, Michael SA32
Latta, Greg MB29
Lau, Edward SC04
Lauer, Erik MA16
Laundy, Richard WA06
Lawley, Mark MC41
Lawphongpanich, Siriphong SD10
Lawrence, Stephen TD20
Lawton, Craig SD12
Le Tallec, Yann MD34
Leach, Major Sonia SB38
LeBlanc, Larry TD21
Lee, Chi-Guhn MC44 TA19 TD12
Lee, Ching Chyi WB29
Lee, Chris TC20
Lee, Chul Ung TD13
Lee, Chulung WC44
Lee, Chung-Yee MC09 MC15
Lee, Deokki WC14
Lee, Dongwon TA26
Lee, Earl WC09 WC10
Lee, Eunjin TA02
Lee, Eva MA45 MB45 MC45 MD03 TB45 TC05 TC45
Lee, Fu-Ming WA41
Lee, Hau SC39
Lee, Hyun Cheol SB30
Lee, Jaegul SC14
Lee, Jay H SC06
Lee, Jinpyo TD10
Lee, Loo Hay WC11
Lee, Minho SD24
Lee, Myeong-Soo SD04
Lee, Roger SA36
Lee, Shiwoo WC44
Lee, Sungjoo MD27
Lee, Young M. TA32
Lehman, JT SA15
Lehmkuhl, Lee J. TC22
Lei, Lei MD15 TB15
Leitnaker, Mary MB30
Lelarge, Marc SD31
LeMay, Brian TD23
Leonard, Kevin SC20
Leonard, Michael WC10
Leon, Jorge WA15
Lesaja, Goran TC07
Leskelä, Riikka-Leena WA29
Lesnevski, Vadim MB38
Letmark, Mattias MC36
Leung, Janny WB10
Leung, Joseph TD15
Leung, Lawrance C K WB13
Leung, Lawrence C. WC13
Leung, Ying Tat TA32
Leus, Roel SA33 MA03
Levesque, Moren MA14
Levi, Moti MB41
Levine, David TA42
Levine, Richard TB38
Levin, Yuri SC02
Levi, Retsef SA35 WA39
Levy, Amnon SC36
Levy, Daniel TA26
Levy, Maurice TD13
Lewis, Brian MC41
Lewis, Ira TD34
Lewis, Karen TD32
Lewis, Mark SB06 SD26 MB09 MC27
Lewis, Mark TD32
Lew, Karen TB37
Leyffer, Sven MD09
Lian, Z. MD30
Liao, Bonnie MD33
Liao, Gwo-Liang WA30
Liao, Jiali TA36
Liao, T. Warren MB04 MC28
Liberatore, Matthew SB24
Lichtendahl, Jr, Kenneth C. SC18 MA18
Li, Chung-Lun MC15
Li, Chung-Lun TD15
Li, Cuihong MC40 TB29
Lieberman, Warren SD42 TC33
Lieckens, Kris SD41
Lien, Robert TB39
Li, Feng WB27
Li, Gang WA40
Li, Haitao TC03 TD32
Li, Jian MD21
Li, Jianxiang TC06
Li, Jing SD04 MC04
Li, Jingquan WB11
Li, Jonathan G. MB45 TB45
Liker, Jeffrey MC14
Li, Lepeng MB24 TB27
Li, Lian SC41
Li, Lode SB40
Lim, Andrew SB05 MB42 TA27
Lim, Gino (Jinho) TC45
Li, Ming WA09
Lim, Juyoung SA36
Limon-Robles, Jorge TA35
Lim, Yun Fong WB21
Lin, Chii-Dean TB38
Lin, Chin-I SB20
Lin, Dennis TD30
Linderoth, Jeff MC05 MD06 WC05
Linetsky, Vadim SD36 WC27
Lin, Grace SB26
Lin, Hong-Jen WB36
Lin, Jenn-Rong TD11
Lin, Kyle TC42 WB27
Lin, Mike SA04
Lin, Shi-Woei MA18
Lin, Shu-Chuan MB28
Lin, Winston WB36
Lin, Wuqin TC27
Lipp, Astrid MB31
Lippman, Steven MB09 TB17
Lipton, Dick SA45
Li, Rong MB41
Li, Shanling MA40 TA44
List, George F. WC10
Li, Susan X. TA44
Little, Thomas SC31
Liu, Andrew MC37
Liu, Bin WC44
Liu, Henry SB11 WC11
Liu, Jian MA13
Liu, Jin SD42
Liu, John MD41
Liu, Jun TD12
Liu, Li MD03
Liu, Pei-chen Barry SC10
Liu, Qian MD42 TB42
Liu, Regina MD04
Liu, Ruihua WB08
Liu, Tieming SC34 SD40
Liu, Xing TC07
Liu, Xingchu WB41
Liu, Yifan SB35 TC20
Liu, Yong SA41
Liu, Yunchuan MD26
Liu, Zhen SD31
Li, Weiqi WA09
Li, Xiaoming WC12
LI, Xun WB36
Li, Yanjun SC05 MB05
Li, Ye SB03
Li, Ying WA19
Li, Yongyue MB27 TD32
Li, Yuwei TA10 TB10
Li, Yuying SB36 MA36
Li, Zhifeng SA05
Li, Zhiguo TB28
Llewellyn, Donna TB24
Lobo, Miguel SC42
Lodi, Andrea WC11
Loerch, Andrew MD23
Logdberg, Erik TB45
Logendran, Rasaratnam WB15
Lohmander, Peter SA29
Løkketangen, Arne MB02
Lopes, Leo SA16 SB16
Lopez-Calva, Gabriel MD09
Loredo, Elvira SC11
Lorenz, Ulf SA13
Lo, Shih-Che WB11
Lougee-Heimer, Robin TA16
Lou, Sheldon MA22
Louviere, Jordan TD26
Lovejoy, William WA19
Lovell, David SC10 TA02
Lowe, Robert SC14
Lowe, Tim WA43
Lowrance, Roy MD24
Lozina, Irina MB15 MD03
Lozin, Vadim WA08
Luangkesorn, Louis SC11
Lucas, Tom SA23
Luce, R. Duncan MB17
Lu, Chung-Cheng Jas MD11

Ludkovski, Mike TA27
Luedtke, James WB12
Lu, Jye-Chyi MB28 TC28 TD28
Lu, Jye-Chyi SA30
Lu, Ming SA46
Luo, Changyue MC43
Luo, Sirong WC13
Luo, Xiangdong MD33
Lutze, Holly SC34
Luxhoj, James TC30 TD13
Lu, Xiangwen SC26
Lu, Yingdong SB26
Lu, Zhaosong TA09
Lynch, Susan WA23

M

Mabert, Vincent A. MD35
Maboudou-Tchao, Edgard M. SB30
Macal, Charles MA19
MacCarthy, Bart WA35
MacCormack, Alan SD43 TC43
Machemehl, Randy TB11
Macher, Jeffrey TD14
Mackulak, Gerald SB38
MacLean, Leonard SC36
Maclean, Stuart TB11 WB11
Madanat, Samer SD12
Maddah, Bacel TC42
Maginnis, Jim SC21 TD31
Maglaras, Costis SB42 MA27 MB42 MD34
Magnanti, Thomas SA08 TD08
Mahabhashyam, Sai Rajesh SC31
Mahar, Stephen MD35
Mahdian, Mohammad MC08 MD08 TA08 TB08
Maheshwary, Siddhartha MA45 TC05
Mahmassani, Hani S. SA10 MD10 MD11 TA11 TA12
Mahmoud, Chowdhury MC46
Mahmoud, Mahmoud MB30
Maillart, Lisa MD28 TC20 WB27
Maine, Elicia SD14
Majumder, Pranab TC39
Ma, Jun SB16
Malayter, Maria TB25
Malca, Fabien SD02
Mallick, Debasish MC43 TC43
Mallick, Debraj MA24 MD24
Mallik, Suman MD41 WB41
Malloy, Thomas MC24
Mallya, Sud MA24 MC24 MD24
Malmborg, Charles J. TC25
Maltz, Arnold SD17
Mamer, John TB17
Mandahawi, Nabeel WC09
Mandakovic, Tomislav WB45
Mandal, Abhyuday MD30 TD30
Mandelbaum, Avi MB27
Mannar, Kamal TD28
Mannor, Shie SB06
Mantel, Ronald MA12
Marber, Allen TC26
Marcozzi, Michael SD36
Marcus, Benjamin MC42
Mardan, Setareh SA26
Markakis, Vangelis SA45
Marklund, Johan TA46
Markovich, Sarit MC38
Marmorstein, Howard SC32
Marshall, Hamish WB37
Martell, David SD29
Martell, Michael WB02
Martens, Randy WA21
Martinez de Albeniz, Victor SD44
Martinez, Wendy L. MC30
Martin, Kipp SA16 SB16
Martin, Kipp SA16
Martin, Phillip G SA23
Martì, Rafael MB03
Martonosi, Susan MC21
Marx, Leslie WB41
Masi, Denise MA32
Masini, Andrea TA14 TB43
Mason, Harland MA24
Mason, Jacquelyn MA45
Massey, Cade MC18
Massey, William SA31
Masters, Jim SC11
Mather, Dineli WC02
Matheson, James SB17
Mathews, Scott MA35
Mathis, Lonnie TC22
Mathur, Gita WB14
Mathur, Kamlesh TC10
Mathur, Shishir WB32
Matis, Timothy TA38 TD18
Maturana, Sergio WC41
Maull, Tim TD27 WA27
Maurer, Ruth TB25
Ma, Wenteng SB11
Mayberry, John WB22
Mayer, Greg TA22
Mayoral, Abelardo MD38
Ma, Zhong MC44
Mazumdar, Mainak SB37 MD37
McAlearney, Ann Scheck MA20
McAlpine, Donna D. MD20
McCardle, Kevin SA39 TB17
McClelland, David MB47
McCormick, S. Thomas TC08 WA39
McDaniel, Christine SC14
McDill, Marc MA29
McDonald, Mary SC23
McGarry, Tim TC38
McGarvey, Ron SC11
McGill, Jeff SC02
McGinnis, Leon WA36
McKenzie, Peter TD37
McManus, Stacy SD43
McMurran, Mariah TC41
McNeill, Jennifer SB38
McWilliams, Douglas MA46
McZeal, Cassandra SD32
Meconi, Mariagrazia MB22
Medow, Mitchell MA20
Meeraus, Alex SD47
Megiddo, Nimrod SC45
Mehendiratta, Vinay SD24
Mehendiratta, Vinay WC10
Mehrotra, Sanjay SA05 MA06 MD06
Mehrotra, Vijay MB27 TA21
Mehta, Namit WA40
Meile, Larry TC43
Meilke, Karl MD46
Meissner, Joern SA41
Melachrinoudis, Emanuel WB20
Melián-Batista, Belén SD03
Meliopoulos, Sakis SD37
Mellat-Parast, Mahour WA30
Meller, Russell SA02 SD11 TC25
Mello, Margarida MA09
Melouk, Sharif WB38
Mendelson, Haim SD39
Méndez, Gabriela TD13
Menezes, Mozart SA22
Menon, Dinesh MD44
Menon, Syam MC31
Merrick, Jason MA18
Mersereau, Adam MB06
Merzifonluoglu, Yasemin WB35
Messinger, Paul MC26 MD26 TB26 WA26
Metzger, Michael SA22
Meyer, Mike SA15
Meyer, Robert R. TC05
Meyers, William H. MB46
Meyer, Theodore SC23
Mian, Sarfraz MA14
Michael, Steven MA14
Michel, Laurent MA01
Milkman, Katherine TC24
Miller, Andrew TC05
Miller, Andrew MC05
Miller, Bruce MB09
Miller, David TC19
Miller, George WA20
Miller-Hooks, Elise SC12 MA10 MB10 MD12
Miller, John TD23
Miller, Lisa SC05
Miller, Luke TA36
Miller, Tan SC21
Millhiser, William WB28
Mills, Pat SC11
Milner, Joseph MA42
Min, Dae-Kee TD30
Min, Hokey WB20
Mintz, Alex SC35
Miori, Virginia WA10
Miranda, Caroline M. G. MB18
Mirchandani, Pitu SB11 MB22 WA17 WA42 WB10 WB11
Miro Quesada, Guillermo MB30
Mironov, Anatoly WB05
Mirrokni, Vahab MA08 TA08 TB08
Mishal, Shaul SC35
Mishra, Ajay MB41
Mishra, Debasis MD44
Mishra, Nishant TA42
Mishra, Sumita WA02
Misyutin, Rost MB32
Mitchell, Gary SB24
Mitchell, John WC09
Mitchell, Joseph S. B. TD09
Mitchell, Michelle MA24 MD24
Mitchell, Stuart MB29
Mithas, Sunil SB44
Mitra, Amit MA28
Mitra, Gautam SA06
Mitra, Supriya SD41
Mittelmann, Hans TD16 TB16
Mittenthal, John TC19 WA24
Miyaoka, Julia MB35
Mladjenovic, Michael WC08
Mobaraki, Hossein WC31
Moccellin, Joao Vitor WB35
Modi, Atul MD24
Moghrabi, Ahmad SA04
Moglen, Glenn E. SB29
Mohan, Baskar SA42
Mohanty, Natalie TA19
Moinzadeh, Kamran TC34
Mojduszka, Eliza MD46
Molina, Julian MB03 MD02
Molvalioglu, Orcun TA13
Momma, Michi MD04
Monib, Ahmed SA18
Monplaisir, Leslie MD32 WA43
Monplaisir, Leslie MD32
Montcalm, Robert MA23
Montealegre, Ramiro MD29
Monteiro, Renato TA09 WA07
Montes, Francisco MB03
Montes, Maria TB40
Montgomery, Alan TC04
Montgomery, Claire MB29
Montgomery, Douglas SC30
Montreuil, Benoit SD11 TA02
Mookherjee, Reetabrata MC37
Moon, Taehee WA03
Moore, David SA14
Moore, Jim MC23
Morales, Juan SB10
Morales, Yris Olaya SA37
Moreau, Page MC26
Moreno Palli, Natalia MC02
Moreno-Pérez, José A. SD03
Moreno-Vega, J, Marcos SD03
Morgan, Kara SC18
Morrice, Douglas MA38 TC25
Morrison, Brad SA14
Morris, R.F. WA22
Mortati, Camila TC02
Morton, David SC06 MA06 TA06 TC27
Moser, Klaus WA35
Mossel, Elchanan SA45
Motwani, Rajeev SD08
Moura, Pedro MD18
Moussourakis, John SB24
Moy, Gary TC18
Muckstadt, John MD40
Mudford, Brett WB32
Mueller, Michael TA36
Mugunthan, Pradeep TC37
Muharremoglu, Alp TA39
Mukherjee, Avijit SA11 SC10
Mukherjee, Sumitra SA32
Mukhopadhyay, Samar SB41 WC29
Mullarkey, Peter MA38
Müller, Georg TA26
Muller, Rudolf SA44
Munson, Charles WC40
Munson, Todd TA07
Muralidhar, Krish SA32 MC31
Murat, Alper WB13
Muriel, Ana TC10
Murphy, Fred MA33
Murphy, Frederic SA46
Murphy, Glen WB37
Murray, Megan WB20
Murray-Tuite, Pamela WB18
Murray, Walter MD09
Murty, Katta SB12
Mutarelli, Fernando WB44
Muthuraman, Kumar TA38

Mutlu, Fatih TA41
Mysore, Shrikanth WA24

N

Nachlas, Joel MD28
Nagarajan, Mahesh MC39 MD40
Nag, Barin MD31 WC39
Nagi, Rakesh MA22 MD22 TA12
Nagi, Rakesh TD04
Nagurney, Anna MA11 MD19 TC37 WB17
Nahapetyan, Artyom SD10
Nahar, Rahul MC32
Naidoo, Ramu MD37
Naidu, Tony SD47
Nair, Anand TD19
Nakamoto, Kent MC26
Nakhla, Michel MC01
Nalle, Darek MA29
Namatame, Takashi WB19
Nambisan, Satish MB43
Namboothiri, Rajeev MC10
Nandiraju, Srinivas MC44
Nanduri, Vishnuteja MD37
Naor, Michael WB45
Napolitano, Dominic TC40
Naranpanawe, Sanjeewa TD06
Narasimhan, Ram TD19
Narasimhan, Ravichandran WC44
Narasimhan, Sri WC39
Narula, Subhash SA46
Naseraldin, Hussein WB40
Nasrabadi, Ebrahim WA11 WC07
Nasrabadi, Mohammad Mehdi WC07
Nasrabady, Ali Reza WA11
Nastasi, Anthony MA47
Natarajan, Bharath WC028
Natarajan, Hari MA05
Natarajan, Venkatesh MA16
Nath, Radhika WA17
Nau, Robert MA17
Nayar, Arun MB04
Nazilli, Vuslat TA28
Nediak, Mikhail SC02
Neelakantan, Jay SA42
Neelamani, Ramesh MD05
Nehate, Girish WC05
Neilson, William SA46
Nelson, Barry L. SB38 MA38 MB38 WB30
Nematollahi, Eissa TB07
Nembhard, David TD36
Nembhard, Harriet Black MA30 WB30
Nembhard, Ingrid SB14
Nemhauser, George SB05 SD05 MA05
Nemirovski, Arkadi TA09
Nemirovski, Arkadi WA07
Nenov, Ivo SC16
Nepal, Bimal MD32 WA43
Netessine, Serguei SB42 MB39 TA34 TA40
Neureuther, Brian WB34
Newman, Alantha MB08
Newman, Alexandra MB34 TD37
Newman, Francis TA45
Newman, Thomas TB20
Newsam, Shawn WA04
Nieberg, Tim TC15
Niederhoff, Julie TC41 WA12
Nieman, Timothy SA18
Niemeier, Deb MC11
Nilim, Arnab TD42
Ning, Weiyi SA26
Nisan, Noam SA44
Nishizaki, Ichiroh WB17
Niwa, Kiyoshi SA14
Noble, William TA03
Nocedal, Jorge MD09 SD16
Nogales, Javier MD09
Noonan, Patrick S. TC17
Norman, Bryan WC10
North, Michael MA19
Noseworthy, Steven SA38
Nourelfath, Mustapha SD11
Novak, Sharon TC40
Novoa, Clara MB10 MC05
Nov, Yuval SA21
Nowak, Maciek MA10 TC38
Nozick, Linda SD12 TD11 WB37
Ntaimo, Lewis SD05
Nudelman, Eugene SB45
Nugent, Paul WC14
Nuggehalli, Ranganath SD22
Nunez, Manuel MC31
Nuyens, Misja SD31

O

O'Brien, Michael TB41 WB40
Ochimizu, Koichiro TD02
Ochiumi, Hiroshi WA39
Odegaard, Frederik WA45
O'Donnell, Michael MC04
Oduntan, Idowu O. SB03
Oglesby, Jerry TA04
Oguz, Ceyda MC02 TC15
Oh, Joon-Yeoul TA02
Oh, Jun-Seok MB11
Ohlmann, Jeffrey MB10
Oh, Se-Kyoung MB39
Oh, Seogchan TB02
Okhrin, Irena WB44
Olafsson, Sigurdur SA04 MA15
Olafsson, Snjolfur WB32
O'Leary, Mike WA02
Olesen, Ole WA44
Olhager, Jan WB34
Olinick, Eli MC25 TD18
Olivares, Elìas TA35
Olivares, Marcelo SC43 TA34
Oliva, Rogelio TD40
Oliveira, Carlos A.S. TA03 TB08
Oliveira, Pedro TA14
Olsen, Tava SD34
Olsson, Fredrik TA46
Olsson, Leif SA29
Olwell, PhD, Dave TB23
Onal, Hayri SD29 TD46
O'Neal, Jerome W. WA07
O'Neill, Craig WB20
O'Neill, Liam SB20 WB19
O'Neill, Richard SC44
Oner, Adalet TC06
Ong, Chee-Mun MD37
Ongprasert, Saratchai WA42
Onn, Shmuel MA09
Opasanon, Sathaporn MB10
Orban, Dominique SC16 SD16
Ordonez, Fernando TD42
Oren, Shmuel SC37 SD37
Orlin, James TD08
Ortiz, Robert WA36
Orzell, Robert TB32
Osei-Bryson, Kweku-Muata MA15
Oskoorouchi, Mohammad TD09
Osterman, Colin MB02
Ostrowski, David MA35
Otero, Luis MC11 MD11
Ouazzani, Nabil SD11
Ou, Jihong SA26
Oum, Yumi SC37
Oussanov, Vladimir I. TB33
Ouyang, Yanfeng TD10
Ovchinnikov, Anton MA42 MB22
Ovens, Matthew SA24
Owen, Susan SB02 TB14
Ozana, Marek TC13
Ozanne, Elissa SC18 TB20
Ozdaglar, Asuman SA45
Ozer, Ozalp SC39 TA39
Ozer, Ozalp SC34 MA34 MD39
Ozevin, Muhittin Gokhan MD06
Ozlük, Ozgür TA21
Ozsen, Leyla SD22 TB39

P

Pachamanova, Dessislava MC24
Pacifici, Andrea MB22
Padmanabhan, Balaji SB15
Padman, Rema TC03
Padole, Charuhas WA41
Paleologo, Giuseppe MC40
Palma, Cristian SD29
Pal, Martin WA39
Palocsay, Susan TB25 TD25
Panchapakesan, Varun TC32
Pandit, Vinayaka TA08
Pan, Feng TA06
Pangburn, Michael WB14 WC34
Pang, Jong-Shi MC37
Pani, Abhishek TD19
Pan, Yunpeng TC15
Papageorgiou, Dimitri TA06
Pardalos, Panos SC15 SD20 MB36 MC45 MD45 TB08 TB38 WB06
Parente, Diane SC43
Parija, Gyana WB09
Parker, Rodney SA40
Parkes, David C. SA44 MD44 TA42
Parkinson, Anita WA39
Park, Jeonghun SD24
Park, Joon WB43
Park, Kwangtae SD24
Park, Minyoung TB10
Park, Namkyu WA31 WA31
Park, Soouk WC14
Park, Sun WB08
Park, Yonil TA38
Parlakturk, Ali Kemal SA21 SD39
Parlier, Greg WC35
Parmar, Darshit MC29 SD04
Parnell, Gregory MD17 TA17 TD17
Parry, Mark TB26
Partani, Amit SA04
Parthasarathy, Srinivasan SA09
Pasiliao, Lewis SB23
Passarelli, James MA23
Pataki, Gabor TA05 TD24
Pataki, Gabor TD09
Patel, Nitin MA15
Pathak, Praveen SD19
Pathak, Surya SC41
Pathomsiri, Somchai WB13
PATIL, RAHUL TD06
Patki, Mukul WC16
Patron, Maria-Cristina SB36
Paul, David L TB31
Paz, Alexander TA11
Pazgal, Amit MD26
Pedersen, Michael Berline MC13
Pednault, Edwin MC32
Peeta, Srinivas SC12 MD38 TA11
Pei, ZJ TD45
Pekgun, Pelin TA40
Peleg, Barchi TA23
Pelletier, Dana MB23
Pendyala, Ram MD11
Peng, Bin WB28
Peng, Jiming WA02
Perakis, Georgia SB08 SC42 MA42 MB40 TB42
Perboli, Guido MB02
PEremans, Herbert TB12
Perlusz, Stefano WA14
Persinger, Charles SD17
Pesch, Erwin MC02
Peters, Brett SD11 MA12
Peterson, Dale TB24
Petrie, Adam SD31
Petruzzi, Nicholas MA40 SD41
Peura, Samu TD27
Peyghami, Reza TB07
Pfaffle, Steven TC16
Pfister, Henry SB23
Pham, Huyen WC27
Philipps, Robert MD42
Phillips, Cynthia A. MA16 TA01 TC08
Phillips, Robert SD42 TB42
Pidd, Michael MC21
Pierre-Louis, Peguy WA02
Pilla, Venkata SA06
Piller, Frank TC35
Pingali, Ashwin TD31
Pintér, János D. SA07 SD07 MB07
Pisano, Gary MC38
Pishulov, Grigorij WB44
Plambeck, Erica SD39
Plaschka, Gerhard SD43
Plazas, Miguel Angel SC37
Plummer, John SC07
Pogrebnyak, Yevgeniy MA37
Pohl, Edward TB23 TB30
Pollack-Johnson, Bruce SB24
Pollock, Stephen SD30 TB45
Polson, Nicholas TB27
Polycarpou, Marios WC23
Poole, David MB33
Poonthanomso, Chanwut TD30
Popescu, Andreea SA34 MB34
Popescu, Ioana SA42 SD29 MA42 MD42 TB17
Popken, Doug TD22
Popkowski Leszczyc, Peter TB26 TC26
Popova, Elmira MC23 WB38

Popov, Alex TB33
Popp, Michael MD03
Porter, Ryan SB45
Porter, Timothy TC23
Porteus, Evan SB34
Posner, Marc MC15
Possani, Edgar TB02
Post, Corinne MB14
Potok, Tom WA04
Potra, Florian TB07 TC07
Potthoff, Sandra MD20
Potvin, Jean-Yves MD18
Pourmohammadi, Hamid MC11
Powell, Stephen SA25 SC32 TA21 TD25
Powell, Steven TB18
Powell, Warren MA13 MB06 MC10 MD06 TB22 WA11 WA32
Pracejus, John TC26
Prasetio, Yanto MB38
Pratsini, Eleni MC41
Presby, Leonard WB25
Prestemon, Jeffrey SB29
Price, Bob MC26
Primbs, James SA36 MD36
Prokopyev, Oleg SC15 MD45
Protter, Philip SB36
Provan, Scott MB20 TD24
Pruessner, Armin SD47
Pu, Lili WA42
Pundoor, Guruprasad SA42 MD15 TB15
Purnomo, Hadi WB24
Puterman, David WA45
Puterman, Martin L. MB09 MD38 WA45
Puterman, Martin TA36
Pyke, David TD39
Pyles, Raymond SC11

Q

Qiao, Jianhong MC41
Qi, Lian SD22 TD11
Qi, Xiangtong TB15
Quadrifoglio, Luca TA10
Quayes, Shakil SA46
Quee, Ryan WA45
Queyranne, Maurice TB42 TC08
Qu, Xiuli TA19 TC37

R

Rabadi, Ghaith WB04
Rabinovich, Elliot MD21
Rabinovitch, Peter SC27
Rader, David TB24
Radkevitch, Uladzimir MA44
Raghavan, S. SA01 MC44 MD18
Raghavan, Usha Nandini WA08 WB18
Rai, Bharatendra TD45 WA28
Raines, Richard TC18
Raish, Carol SB29
Rajagopalan, Raj TA35
Rajan, Balaji MD37
Rajan, Deepak SA05 TA05
Rajan, Madhav SD39
Rajaram, Kumar SA39 SA41
Rajasekaran, Babu MA29
Rajavelu, Geetha MC24
Rajgopal, Jayant TA18
Raju, Jagmohan S. WA26
Rakas, Jasenka SC10
Ralph, Daniel TA07
Ralphs, Ted TB05 TC05
Ramachandran, K. TB28
Ramachandran, Karthik MD43
Ramakrishnan, Ram MB26
Raman, Ananth SA39 MA39 TB40
Ramanan, Kavita SC27
Ramanathan, Ramakrishnan WB19
Ramasesh, Ranga WB43
Ramaswami, Vaidyanathan MB33
Ramdas, Kamalini SA43
Ramirez-Marquez, Jose TC30
Ramos, Andres SC37
Ramsay, Howard WC25
Ramsey, Gene TC16
Rana, Arif Iqbal TB41
Ran, Bin SB11 WC11
Randall, Patricia WC24
Randall, Taylor SC43 TD43
Randhawa, Ramandeep SB42 WB03
Randolph, Steve WA20
Rangarajan, Bharath WA05
Rao, Alan TA02
Rao, Satish MB08
Rao, Satish MD08
Rao, Uday TD15 TD18
Rappold, James MD40
Rardin, Ronald MD37 WB20 WB28
Rasco, Barbara MD46
Rata, Cristina SB21
Rauch, Peter SA29
Rauner, Marion SB20
Ravid, Itzhak SC45
Ravindran, Suryanarayanan TB31
Ravi, R. TA08
Raviv, Tal SD06
Raychaudhuri, Samik MC32
Ray, Saibal MA40 MC34
Ray, Sourav TA26
Raz, Gal MA34
Razinkov, Natalia TA32
Read, Daniel MC18
Realff, Matthew SC06 MC19 TC11
Rebaine, Djama MD15
Redus, Kenneth WA37
Reed, Joshua TC27
Rees, Jacquelyn SA19 TC31
Reeves, Kingsley SD14
Regan, Amelia SB46 MC44 TB10
Regis, Rommel SC07
Rego, Cesar SB03 SD03 MB02 TC03
Rehmert, Ian MD28
Reichenbach, Charles MC24
Reid, Mark TC22
Reiman, Marty MA27
Reiss, Michael MC45
Reiss, Philipp MB44
Ren, Kun TC28
Ren, Xiaolin TD46
Repenning, Nelson SA14
Resch, Stephen WB20
Resnick, Adam SC11
Retzlaff-Roberts, Donna WA20
Reynolds, Jr., Marion R. SB30 MB30
Rhoads, Teri Reed WA28
Riano, German TB12
Ribeiro, Celso SD02
Rice, Daniel SA32
Richard, Jean-Philippe SC05 MB05 MC41 WC06
Richards, Mark SD15
Richetta, Octavio WA13
Richter, Kurt Knut WB44
Ridder, Ad SB27
Rideout, Douglas SC29
Rider, Brian SA31
Righini, Giovanni MC22
Righter, Rhonda SD31 TC36 WB27
Ringle, Christian Marc WB21 WB32
Rinne, Martin TC44
Rios, Pedro TC37
Ritchie-Dunham, James TC25
Robak, Dario SD29
Roberts, Mark TA20
Roberts, Mark SC20 TA20 TC20 WB27
Robinson, Larry SA02
Robinson, Powell SB41
Robinson, Rick MD29
Robinson, Stephen M. SD30 MD23
Robotis, Andreas TC39
Rockhold, Steven TB19
Rodriguez II, Benjamin M. WA23
Rodriguez, June WA23
Roe, Diana TA03
Roels, Guillaume MB40
Roemer, Thomas MC40 MC43 TC43
Rogers, Dale TC11
Rogers, J. Scott TB37
Rohleder, Thomas SA20
Rohlfs, Rori TD03
Romanowski, Carol TD04
Romeijn, Edwin MB45 TA18 TA20 TB45 TD12 WA05
Ronen, David SB10
Rosa, Charles SD42
Rosenberger, Jay SA06 SC06 MC04 TD18
Rosenthal, Richard SD23 WA32
Ross, Andrew SC31
Rosset, Saharon MC32
Ross, Jane TA25
Ross, Sheldon SA36
Roth, Aleda SD43 TA14 TD29 WB34
Rothblum, Uriel G. MA09
Rothkopf, Michael SC44 MA33 WA32
Roughgarden, Tim MD08 SA45
Roundy, Robin SA35 SB44 MC09 MC34 MC44 TB34 WA39
Rowe, Anton SD23
Rubinstein, Reuven SA27 SB27 SD06
Rudi, Nils TD39
Rudi, Nils SB40 SB43 TA18
Ruggiero, John WA44
Ruiz-Torres, Alex WB04
Rump, Christopher WB24
Runger, George SD04 MA28
Rupe, Jason TB30
Ruperez Micola, Augusto MA37
Rusmevichientong, Paat SD40
Russell, Armistead WA37
Russell, Robert WA10
Russell, Wayne WC25
Ruzika, Stefan MB18
Ryan, David MB29
Ryan, Jennifer MB41
Ryan, Jennifer SB41
Ryan, Kevin MA23
Ryan, Patrick MA23
Ryan, Sarah MD19
Ryoo, Hong MD45 WB05
Ryu, Young WC17

S

Saar-Tsechansky, Maytal SB15
Saberi, Amin SA45 MC08 TA08
Sachdeva, Sandeep WB06
Sackellares, J. Chris SC15 MD45
Sadat, Somayeh SA20
Saenz, Oscar A. WC14
Sager, Kevin TA06
Sahin, Asli TC41
Sahin, Funda SB41
Sahin, Guvenc SB13 MD13
Sahinidis, Nick MA07 MD45 TD03
Sahin, Ozge MB40
Sahni, Anuj MD03
Sahoo, Surya TB33 WA10
Saigal, Sunil WA04
Saito, Masatake WA14
Saka, Gorkem TA20
Salahi, Maziar WA07
Salman, Sibel MD38
Salmeen, Irv WA32
Salmeron, Javier MB37
Salomon, Joshua WA20 WB20
Salter, Bill TA45 TC01
Saltzman, Matthew SA16 TA16 TB05
Salvador, Fabrizio TB35
Salzarulo, Peter MC20
Samardi, Sepehr TC13
Samban, Claudio (Dicky) SC35
Sami, Rahul MC08
Samuelson, Douglas MA21
Sanchez, Susan SA23 WB23
Sandholm, Tuomas SB45 TA42
Sandhu, Rivi TB13
Sandikci, Burhaneddin WB05
Sankaran, Jay MD10
Sankaran, Srikanth TC41
Santamaria, Jose MB03
Santiago, Leonardo TD43
Santibanez, Pablo TD20
Santosa, Budi SC15
Santo, Sarah MC32
Santos, Cipriano WA02 WC32
Sapra, Amar SB44 MC44 WA39
Sarathy, Rathindra SA32 MC31
Sarin, Subhash WC24
Sarkar, Avijit MA22
Sarkar, Sumit MC31
Sarker, Bhaba SB41
Sarobe, Pablo TC10
Sarykalin, Sergey MB36
Sastry, Kumara MA02
Satapathy, Goutam SC47
Sathe, Aamod SC12
Satitsatian, Sarintip TB30
Sato, Yuji WA03
Satyam, Kumar SB26

Sauerwald, Thomas SA13
Saunders, Michael MD09 WA09
Sauré, Antoine TC16
Savage, Sam SA25
Savage, Scott TD26
Savasaneril, Secil TA15
Savaskan, Canan TC39
Savelsbergh, Martin SB10 MA05 MD10
Savin, Sergei SB42
Sawaya, Nicolas WC07
Sawik, Tadeusz WB35
Saxena, Anureet TD06
Schade, Christian TC14
Schaefer, Andrew SC06 SC20 TA20 TB06 TB20 TC20 WB05 WB27
Schaefer, Andrew TA18
Schaerf, Andrea MD02
Scheller-Wolf, Alan SA34 SB31 SC31 MA31 TB29 TC34 TC40
Schieber, Baruch MC08
Schilling, Brian MD46
Schmee, Josef SC30
Schmeiser, Bruce SC38 WB28
Schmidt, Carsten MB44
Schmidt, Glen TA43
Schmitt, Thomas SB35
Schneider, Markus MD03
Schoenherr, Tobias MD35
Schoenmeyr, Tor MD34
Schoenwald, David SC41
Scholtes, Stefan MD09
Schonfeld, Paul WA36
Schooff, Richard WC23
Schrage, Linus WA06
Schranz, David SB36
Schultz, Kenneth MC20
Schultz, Martin SD18
Schulz, A. S. SB08
Schutten, Marco TC15
Schuur, Pieter MA12
Schvaneveldt, Shane J. SC21
Schwartz, Russell TD03
Schwarz, Leroy SD35 WA45
Schweikhart, Sharon MA20
Schwetman, Herb MA38
Scott, Carlton SB24
Scott, Judy TB31 TD31
Secomandi, Nicola SC02 SD33 TB34
Sedej, John MB32
See, Kelly SB18
Seelmann-Eggebert, Ralph TB35
Segal, Ilya SA44
Seido Nagano, Marcelo WB35
Seifert, Ralf SB39 TA23
Sela, Aviad TA32
Semet, Frédéric SD02
Sen, Arun MD09 TB09
Sen, Kabir MA41
Sen, Suvrajeet MC30
Sen, Suvrajeet SB37 SD05
Seo, Fumiko WB17
Serfozo, Richard WA38
Seshadri, Sridhar SB40 SC40 SD31
Sethi, Suresh TD06 WB08 WB41
Setiarso, Bambang WB31
Setoputro, Robert SB41 WC29
Setter, Oren MD22
Setya, Adeesh MD33
Setyawati, Bina TC02
Sevaux, Marc MC02 MD02
Sewell, Edward SD20
Shabtay, Dvir WB04
Shachat, Jason SC44
Shachter, Ross SC17
Shahabuddin, Perwez WC27
Shah, Shital MC04
Shaltayev, Dmitriy TA41
Shanbhag, Uday MB37 MD09
Shane, Scott MC14 MD14
Shang, Jen S. TA44
Shang, Kevin SC39 MD40
Shanno, David MD09 TB09
Shanthikumar, George SB05 MB42
Shapiro, Jonathan TC18
Sharawi, Abeer WB40
Sharma, Dushyant SB12 TD08
Sharma, Manu TB19
Sharp, Gunter WC08
Shaw, Michael TC29
Shebalov, Sergey WC06
Sheblé, Gerry SB07
Shechter, Steven SC20
Sheehan, Jack TB23
Shekhar, Shashi WA04
Shell, Martin WB29
Shelton, Christian SB45
Sheng, Huanyuan MA06
Shen, Haojun TC41
Shen, Jerry WC05
Shenker, Scott MC08
Shen, Max SD22 MD44 TA15 TD11
Shen, Michael TB26 TC26
Shenoy, Prakash P. SC17
Shenoy, Shishir TA12
Shen, Sien MC21
Shen, Ting SB43
Shen, Yanfang MC07
Shen, Yide MB31
Shen, Zuo-Jun WB12
Sherali, Hanif SA05
Sheu, Shey-Huei WA30
Shiau, Deng-Shan SC15
Shibata-Salazar, Harumi WA38
Shi, Bin WB30
Shields, Robert TA42
Shier, Douglas WA08 WA24
Shih, Jhih-Shyang WA37
Shi, Jianjun SC04 SD04 SD30 MC04 TB28
Shi, Jianming WC05
Shi, Jin TB45
Shikiar, Dan TB47
Shi, Leyuan TC05 TC15
Shiloach, Yossi WC13
Shimada, Tomoaki TB43
Shimshak, Daniel G. WA44
Shinde, Rahul SB26
Shin, Dong Soo WA31
Shin, Sangmoo TD41
Shioda, Romy TD07
Shmoys, David SA35 WA39
Shmueli, Galit SB44 MA44
Shnaydman, Vladimir WA20
Shoemaker, Christine SC07 MB07 TC37
Shoham, Yoav SB45
Shortle, John MA32
Shou, Biying SC26
Shrimpton, Dan SD23
Shubik, Martin SB40
Shu, Jun TC18
Shu, Lianjie SC30
Shumsky, Robert SC42 TC34
Shum, Stephen MD39
Shurn, Todd TD44
Sibdari, Soheil TC42
Siemsen, Enno TA14 WB34
Sigman, Jeff TB36
Siitari, Pyry-Antti TD44
Simal, Jorge TC10
Simao, Hugo MC10
Simchi-Levi, David SA35 SC34 SD40 SD44 MD39 TB15
Simester, Duncan SB06
Sim, Melvyn SA21 SA35
Simmons Ivy, Julie SC28
Simon, Carine TB42
Simpson, James WB30
Simsek, Alp SA45
Sim, Thaddeus SB22
Singhal, Sharad WA02
Singhal, Vinod TB40
Singh, Nanua WA28 WA43
Singh, Praneet SB43
Singireddy, Abhilash TC06
Sinha, Amitabh TA08
Sinha, Atanu TC26
Sinha, Kingshuk TD34
Sir, Mustafa TB45
Sittig, Dean SC20
Sivaraman, Raghavendran TD08
Skutella, Martin TD08
Slaven, Matthew P. SD17
Sljivar, Slaven SD42
Small, Mitchell SD18
Smaros, Johanna SC40
Smeltink, J.W. WA13
Smilowitz, Karen MA10 MC10
Smimou, Kamal TA36
Smirnov, Yuri TA42
Smith, Cole SA05 MC25 TD05
Smith, Donald MA33 TC33
Smith, J. Macgregor MB20 MB26
Smith, James E. MA17 MC17 TB17
Smith, Jeffrey S. TC06
Smith, Michael TC29
Smith, Neale R. TA35
Smith, Robert MA11 MC07
Smith, Stephen SA39
Snyder, Don SC11
Snyder, Lawrence SB35 TB39
Sobel, Matthew J. MB09 TD41
Sobel, Matthew SB40
Sodhi, Manbir TA19
Sodhi, ManMohan S. SC40 TA41
Sodre Carlos, Patrick SC47
Sofer, Ariela MB45
Sohn, So Young WA03 WB30
Sohn, SugJe WA21
Sokol, Joel MB25 MC25 TD38 WC08 WC25
So, Kut C. MC34
Solow, Daniel MC16
Soman, Narendra SD38
Somaya, Deepak SC14
Somlo, Barbara SA41
Somorjai, Ray SB03
Song, Jeannette SB34 SC26
Song, Wheyming SC38
Song, Yuyue MA40
Sood, Anshul SC42
Soomer, Maarten WA13
Sörensen, Kenneth MD02
Soriano, Patrick MD18
Sosa, Manuel TB43
Sosic, Greys MC39
Soto, Daniel SB02
Sounderpandian, Jayavel MA41
Souyris, Sebastiàn MD10
Souza, Gilvan C. SA43 MC19 TC19
Sowlati, Taraneh WB19
Sox, Charles TA41
Sparrow, F Thomas MD37
Spearman, Mark TD45
Spetzler, Carl MC17 TC17
Spitzner, Dan SC30
Spouge, John TA38
Spraggins, Barry WC40
Spring, Daniel MB29
Sridhar, Ramalingam WA02
Sridhar, Sanjay TC31
Srijuntongsiri, Gun TD07
Sriskandarajah, Chelliah MD15
Srivastava, Shirish C. WA11 WB29
Srivathsan, Sandeep MA26
Stacchetti, Ennio MB37
Stalinski, Piotr WC40
Stanojevic, Daliborka SA01
Staum, Jeremy MB38 WC27
Stavrulaki, Effie WC34
Stecke, Kathryn SB35
Stefanescu, Catalina TA42
Stegemeier, Dave WB32
Steiger, Natalie SC38
Steinberg, Richard MB40
Steiner, George WB04
Sterman, John TD34
Sterna, Malgorzataa MC02
Stern, Scott TC40
Stevens, Scott TD25
Stewart, David WC02
Stewart, David MD07
Stewart, William J. WB28
Stewart, William SC44
Stier-Moses, Nicolas SB08
Stine, Robert TB36
Stoddard, Major Steven A. MD33
Stokes, Brian TD17
Stoller, Gregory TC43
Stolyar, Alexander WB03
Stonebraker, Jeff SA17
Storer, Robert MB10 MC05 WA15 WA15
Stotz, Adam TD04
Stoumbos, Zachary G. SB30 MB30
Stowe, Jill SA46
Stratila, Dan SA08
Stratman, Jeff TA14
Street, Nick SB15
Strickland, Dawn WC25
Strock, Jeffrey TD46
Strojwas, Marcin SA14
Stroud, Jonathan TB27
Strulovici, Bruno H. MA09
Stuart, Julie TA19 TC37
Subrahmanyam, Marti SB40
Subramanian, Ravi TB37 TC39
Subramanyan, Karthik TC04
Su, Che-Lin TA07

Sudit, Moises TD04
Sukhotu, Vatcharapol SD11
Sukumaran, Sushma WB20
Sullivan, Joe H. SB30
Sun, Aichong TA10 TB11
Sun, Alice WB38
Sundaramoorthi, Duraikannan MC04
Sundaresan, Shankar MB41 TA31 WB14
Sung, Chang Sup WA11 WB08
Sun, Jiong WC39
Sun, Junhua WB36
Sun, Peng SA35 SB06
Suri, Rajan SB26 TC35
Suri, Subhash TA42
Suteewong, Worawan WB10
Su, Xuanming TC20
Suzuki, Atsuo SB22 WA24
Sviridenko, Maxim MC08
Swaminathan, Jayashankar SA43 MD19
Swann, Julie SC34 MB34 MC20 TA40 TB25
Swanson, Dan MA24 MD24
Swarthout, J. Todd SC44
Syam, Siddhartha SB20
Sykes, Scott MD24
Szidarovszky, Ferenc WA02
Szmerekovsky, Joseph WB15

T

Taaffe, Kevin WA05
Tabata, Tomoaki WB19
Tabitha, James SD03
Tadei, Roberto MB02
Taimre, Thomas SD06
Taits, Eugene MA05
Talbot, Brian TB37
Talbot, Brian TC39
Tallman, Steve B. WC25
Talwar, Kunal MB08 MD08
Tang, Christopher S. MA43
Tang, Christopher SA39
Tang, Fengming MC28
Tang, Hao MA10
Tang, Hsiu-Khuern WC32
Tang, Kaizhi TB02
Tang, Kwei WB14
Tang, Leilei MC24
Tang, Lixin TC06 TC15
Tang, Yu TC41
Tan, Hwee Huat WB36
Tan, Joseph WB29
Tanrisever, Fehmi WA15
Tan, Tarkan WA34
Tao, Xianding WA36
Tardos, Eva SA45
Tavantzis, Thomas MD46
Tawarmalani, Mohit MA07
Taylor, Aimee TD25
Taylor, Terry SD39 TA40
Tayur, Sridhar TB39 TC40
Teich, Jeffrey WA29
Tekin, Eylem SC26 TC36
Telang, Rahul TC29
Teo, Thompson S. H. WB29
Terabe, Shintaro WA42
Terlaky, Tamas MC16 TB07 TD09 WA07
Terui, Nobuhiko TA38
Terwiesch, Christian SB43 SC43
Tesfatsion, Leigh MA37
Tetteh, Edem Gerard WA30
Teunter, Ruud TD12
Tew, Jeffrey TB02 TB19
Teyarachakul, Sunantha MD21
Thadakamalla, Hari Prasad WA08 WB18
Thai, Van WB20
Thaler, Richard MC18
Thanda, Aye TD02
Tharakunnel, Kurian SA19
Thearling, Kurt MA24 MD24
Theodosopoulos, Theodore TA36
Theurer, Jack TC33
Thibault, Marc MA23
Thibaux, Romain SB09
Thiele, Aurelie MB40 TD42
Thirumalai, Sriram TD34
Thomas, Barrett MA10 MB10
Thomas, Bex TD36
Thomas, Douglas TA41
Thomas, Lyn MC24
Thomas, Marlin TC28
Thomer, Joe TD23
Thompson, Paul WA12
Thoney, Kristin MA38
Thyagarajan, Karthik WA02
Tian, Feng MC40
Tibben-Lembke, Ronald MD19 TC11
Tiedeman, Ralph SD32
Tien, James M. TA29
Tilson, Vera WC02
Tim Huh, Woonghee SB44
Tin, Pyke TD02
Tipi, Horia WC09
Tirupati, Devanath WA40
Tishler, Asher MD22
Tiwari, Vikram MC20
Tjader, Youxu MA41
Tjoelker, Rod TD04
Tobin, Ken WA04
Toktas, Berkin TD45
Toktay, Beril SB40 MB35 TB43
Tollefson, Eric SA23
Tomlin, Brian SB35 TD39
Tompaidis, Stathis MC06
Tong, Chunyang WC34
Ton, Zeynep SA39
Topaloglu, Huseyin MD06 WA11
Topaloglu, Huseyin MA06
Tortorella, Michael TB23
Toth, Sandor MA29 MA29
Toulouse, Michel SB03 SC03
Tovey, Craig MD05
Towsley, Don TC18
Toyasaki, Fuminori MD19 TC37
Trafalis, Theodor SC15
Tremblay, Monica SB44
Tretter, Marietta TA04
Treviño, Gerardo TA35
Triantaphyllou, Evangelos MB04 MB18 WC31
Trick, Michael SA08 MD25 TC04
Trigos, Federico MC16
Tropsha, Alexander MB20
Trukhanov, Svyatoslav WC07
Truong, Van Anh WA39
Tsai, Julia TB04
Tsai, Roger MC32
Tsai, Yi-Chun SD26
Tseng, Fu-Shiang WB14
Tseng, Mitchell TC35 TD41 TD45
Tseng, Paul TB09
Tsikriktsis, Nikos SB14
Tsitsiklis, John SA45 SB06 SB08
Tsui, Kwok-Leung SC04 SC30 MA28 MC04
Tsung, Fugee MA30 SC30
Tsurkov, Vladimir WB05
Tucker, Anita SB14 SD43
Tunca, Tunay MB39 TA34
Tuncel, Levent TD07
Tunnercliffe, William WC02
Turkcan, Ayten WA15
Turnquist, Mark SD12 TD11
Turvey, Calum MD46
Tuv, Eugene SD04
Tu, Yufeng SC10
Tydesjö, Patrik TA46
Tzur, Michal MA10

U

Uber, James TC08
Udayagiri, Suresh TD45
Ugray, Zsolt SC07 WA36
Ukkusuri, Satish SA10 SC12 MD12 WC11
Ulku, Sezer TA43 TB43
Ulrich, Karl SB43 TD43
Ulu, Canan TB17
Unnikrishnan, Avinash SA10
Uppal, Raman MC06
Urbana, Sebastian TC24
Urban, Timothy WA10
Urbina, Sebastian MC20
Urmanov, A. TB07
Uryasev, Stanislav MB36 MC36
Uster, Halit MA22 TD11
Uzsoy, Reha WB28

V

V M, Tom MD12
Vaidyanathan, Balachandran MD13
Vaidyanathan, Ramnath SC39
Vail, Richard WA45
Vairaktarakis, George MC15 TD15
Vakharia, Asoo TC19
Vakili, Pirooz TD43
Valencia Oleta, Carlos E TB02
Valente, Patrick SA06
Valenzuela, Jorge SB37 MD37 WB37
Valverde-Ventura, Rene MA30
Van de Vonder, Stijn SA33
van den Briel, Menkes TA13
Van den Poel, Dirk WB02
van der Heijden, Matthieu TC15
van der Mei, R.D. WA13
van Donselaar, Karel TA18
van Dorp, J. Rene MA18
Van Dyck, Walter MC41
Van Dyke, Carl SC13 MC13
van Heck, Eric MA44
Van Hentenryck, Pascal MA01 SC16 SD05
van Houtum, Geert-Jan TC34
Van Mieghem, Jan SB40
van Ooijen, Henny WA34
Van Oyen, Mark TC36
Van Roo, Ben TC34
Van Roy, Benjamin SB06 SD40 MB06 MD36
van Ryzin, Garrett MD42 SB33 SD29 TB42
Van Slyke, Richard TB16
Van Wassenhove, Luk MC19 MD20
van Woensel, Tom TA18 TB12
Vandaele, Nico SB26 SD41 MA26 TB12
Vandenbussche, Dieter MC05
VanDenHeever, Susara MD44
Vanderbei, Robert J. MB01
Vanderbei, Robert TB09
Vanhoucke, Mario MA03
Vannelli, Anthony TA09
Vanteddu, Gangaraju MB41 TA41
Vardar, Cem MB32
Vasilakis, Christos TB20
Vavasis, Stephen TD07
Vazacopoulos, Alkis TA38 TC38 WA06 WB16 WC41
Vazirani, Vijay SC08 SD45 TA08
Veatch, Mike MB06
Veeraraghavan, Senthil MA31
Veinott, Arthur F. MD01
Velazquez, Leticia TB09
Veloso, Francisco SC14
Venkataramanan, M.A. MD35
Venkateshan, Prahalad TC10
Venkatraman, Krishna MC09
Venkatraman, Srinivasan WC17
Ventosa, Mariano SC37
Vepsäläinen, Ari P.J. WC41
Vera, Jorge SD02
Verma, Nitin TA38 TC47 WC09
Verma, Rohit SD43
Vermeulen, Dries SA44
Verstraeten, Geert WB02
Verter, Vedat MC19 WB13
Vetta, Adrian MA08
Villalobos, Rene TA13 TD28
Viniegra, Margarita TB02
Viswanath, Kannan MD38
Vizvari, B. MB15
von Winterfeldt, Detlof SB18 MB17
Vong, Lacy MB22
Voros, Jozsef WA45
Vossen, Thomas SA11
Voss, Stefan MB03 MD18 WB01
Voth, Michael SA17
Vromans, Michiel J.C.M. MB33 MD13
Vulcano, Gustavo SC33 SD44 MA27 WA19

W

Waechter, Andreas WA16
Wagner, Janet TD21 WA44
Wagner, Michael MD12
Walczak, Darius TA42
Waldman, Donald TD26
Waldorf, Brigitte MC46
Walker, Russell MA24 MD24
Wallace, Rodney SA31
Wallace, William A. WC09 WC10
Wallach, Emmanuelle WA05

Wallenius, Hannele WA29
Wallenius, Jyrki WA29
Waller, S. Travis SA10 SC12 MD12 TA11 WC11
Waller, Steven Travis MD12
Walls, Michael R. MC17
Walsh, William SC45
Waltz, Richard SD16
Wan, Hong WB30
Wan, Hong MA38
Wan, Lin WB24
Wander, Michelle TD46
Wang, Chung-Jui MC36
Wang, David SD24
Wang, Dong TC18
Wang, Haibo WA03
Wang, Haibo TD45 WB05
Wang, Haifeng TB41
Wang, Hui SB28
Wang, Huimin WA41
Wang, Jiamin SA22
Wang, Jian SC21
Wang, Lei MA26
Wang, Lin WC10
Wang, Lizhi MD37
Wang, Ming-En WC10 WC28
Wang, Ni TC28
Wang, Qiong SC33
Wang, Rui WC12
Wang, Shanshan TA36
Wang, Sheng-Pen (Ben) MC32
Wang, Shouyang WA40
Wang, Xiaoting MB18
Wang, Yicheng SD29
Wang, Yifen MD46
Wang, Yimin SB35
Wang, Ying WB38
Wang, Yulan MB26
Wang, Yunzeng MA40 MC34
Wang, Yunzeng WC02
Wang, Zhengjun WC21
Wang, Zhouyan TA18
Ward, Amy R. TC27 TD10
Wardell, Don SA28
Ward, James MD21 WA45
Ward, Julie MC09
Ward, Tim SA20
Ware, Keith SD22
Warner, Bradley TD22
Warren, Jeffrey MA46 WB06
Warrier, Deepak WB06
Warsing, Donald TA41
Wassenhoven, Ralf WA14
Wasserkrug, Segev TA32
Watanabe, Todd MA23
Watewai, Thaisiri TA27
Wathen, Andrew J. TC09
Watson, Jean-Paul SD02 TC08
Watson, Noel TD40
Weaver, Paul SD23
Weber, Charles SB14
Weber, Thomas A. SD34 MA09 TC29
Webster, Mort SD18
Webster, Scott SD41
Wegryn, Glenn TD33
Weidemann, Tim TA21
Weigelt, Mikael MA32
Wein, Lawrence SB35 SC35 TC20
Wein, Lawrence SA21
Weinstein, Milton WB20
Weintraub, Andres SD02 SD29 MD10
Weiss, Seth TB36
Wei, Wei MB09
Wellington, John SA46
Wen, Aihong TC04 WC44
Werner, Frank MC02
West, Martin WB34
West, Paul SA23
Wexler, Tom SA45
Whang, Seungjin (Jin) TA23
Whisman, Alan TB22
White, Barbara TD32
White, Chip MA10 MC41 WB12
Whitley, Darrell TC22
Whitt, Ward SA31
Widdowson, Brian SA23
Wiecek, Margaret MB18
Wieland, Jamie TC37
Wiley, Mark MC47
Wiley, Victor MC23 WC23
Wilhelm, Wilbert SC15 WB06
Willemain, Thomas TD25 TD25
Willems, Sean MC40 TD39
Williams, Jr., Gerald H. TC44
Williams, H.Paul WC21
Williams, Pamela MA46
Williams, Terry WC25
Willis, John SA23
Willoughby, Keith WB05
Wilson, Amy R. MD20
Wilson, F. Wesley SA11
Wilson, James SC38 TB25
Wilson, John TD19
Wilson, John TC02
Wingrove, Earl TA13
Winkler, Robert L. SC18 MA17
Winter, Ralph MA40
Wise, Chelsea TD26
Wlodarczyk, Darius MD07
Wollenweber, Jens TC11
Womer, Keith TD32
Wong, Hannah SA20
Wong, Rachel WB10
Wongthatsanekorn, Wuthichai TC11
Wong, Wai Hung WC13
Wongweragiat, Sudaratana TA19
Wood, MD, Bradford MB45
Woodall, William H. SC30 MB30
Wood, Chuck SA19 TA26
Woodcock, Andrew TC02
Wood, Kevin MB37
Wood, Lincoln MD10
Woodruff, David WB01
Wood, Sam TD47
Wright, Mike TB38
Wright, Stephen TB09
Wu, C. F. Jeff MB28 TD30
Wu, Cheng-Hung SD26
Wu, Chongqi MC43 WB41
Wu, D.J. WC39
Wu, Diana (Yan) TD40
Wuerfel, James TB32
Wu, Huijiang TC06
Wu, Jianghua WA40
Wu, John SC41 WC05
Wu, Junying TD18
Wu, Lifang WA43
Wurgaft, Hernan SB41
Wurl, Robin MC28
Wurman, Peter WA29
Wu, Teresa MC29 WA31
Wu, Tony TB22
Wu, Xianyi MC15
Wu, Yaozhong MA42 MD42
Wu, Zhen MD36
Wu, Zhenyu WB36
Wyman, Bruce WC32

X

Xia, Cathy SD31
Xia, Mu TC29
Xia, Nan TA35
Xiang, Chester WC34
Xiang, Zhi MD04 SC09
Xiao, Wen-Qiang MD39
Xiao, Wenqiang TA34
Xia, Yu WA02
Xia, Yusen SC34 SD09 SD40
Xie, Lei TA32
Xie, Nan WA31
Xi, Haifeng MC29
Xiong, Hongxia SD34
Xiong, Xiaoping MB38
Xu, Di MC28 MD04
Xu, Ningxiong WB37
Xu, Ping Josephine TD39
Xu, Sean TC29
Xu, Susan TC14
Xu, Xiaodong MB24
Xu, Xiaohui SD40 TA40
Xu, Xiaowei MA42
Xu, Yan TB05
Xu, Yanyi TD41
Xu, Yaquan WB05
Xu, Yi SD34
Xu, Zhiyong TD13 WC44

Y

Yadav, Prashant TC19
Yahalom, Tomer SB42
Yalabik, Baris SD41
Yalcin, Ali Wc08
Yamada, Yuji MD36 SA36
Yamashita, Denise MA03
Yang, B. Rachel TC29
Yang, Baiyu MD12
Yang, Fan WC11
Yang, Jaekyung SA04
Yang, Jian MD41 TB15
Yang, Lihua MD33
Yang, Nan TA39
Yang, Qingyu TA30
Yang, Shitao MD41
Yang, Tao MA02
Yang, Wei WC02
Yang, Woosuk WA11
Yang, Yinghui WC02
Yang, Yong TB27
Yang, Zehua TB04
Yan, Hong WA40
Yan, Houmin TA32 TB41
Yan, Jihong TD36
Yano, Candace MA34 MB34 MB40
Yao, David SB26
Yao, Dong MD31 MD41 WC39
Yao, Jian SD37
Yao, Kathe TB13
Yao, Vincent TB12
Yao, Yuliang(Oliver) TA31
Yarmish, Gavriel TB16
Yasar, Ali TA29
Yassine, Ali SA24
Yau, Hoksung TC15
Yazlali, Ozgur MC41
Yee, Shang-Tae TB02
Ye, Heng-Qing SA26
Yen, Joyce W. SB46 MB38 TA13
Yesildag, Mehmet TC19
Yetman, Greg TB04
Ye, Yinyu TB08 WA07
Ye, Yinyu SD45
Yih, Yuehwern MB04
Yi, John WC09
Yildirim, E. Alper TD09
Yildirim, Mehmet WA41
Yildirim, Utku TC27
Yildiz, Hakan SA08
Yin, Huifang SC10
Yin, Shuya MC39
Yona, Dror WC35
Yoo, J.W. WA31
Yucesan, Enver TB43
Yu, Dennis Z. TC41
Yue, Wei WC17
Yue, Xiaohang MD35
Yu, Feng-Tien SB12
Yu, Gang SA24 SD09 TB15 WA40
Yuhaski, Steven WC16
Yu, Jialin MA36
Yumei, Huo TD15
Yunes, Tallys TC40 WC08
Yu, Wang SB07
Yuzukirmizi, Mustafa MB26
Yu, Zuwei MD37

Z

Zabinsky, Zelda B. SA02 MB07 MB38 MC07 TA13 TD45
Zadrozny, Bianca MC32
Zak, Eugene TD06
Zamba, K. D. SC30
Zaniboni, Luca MC22
Zapata, José WB44
Zappe, Christopher J. WB05
Zaric, Gregory WB20
Zeevi, Assaf SB42 SC27 MD34
Zeevi, Assaf MB27 SC27
Zeng, Vernon TC35 TD41 TD45
Zenios, Stavros A. SD01
Zenios, Stefanos TA34 TA42 TC20 TC20
Zhai, Xin WA45
Zhang, Alex WC32
Zhang, Anming WB13
Zhang, Bin MC09
Zhang, Bo SC34
Zhang, Dan MD42 SC42
Zhang, Feng TD28
Zhang, Fuqiang SB39 SC42 SD34
Zhang, Guangming MC10
Zhang, Guoren TD19
Zhang, Hang MA28 MD04
Zhang, Hao TA28
Zhang, Hao SA40
Zhang, Hong SB15

Zhang, Hongchao TC09
Zhang, Hui WB20
Zhang, Jiang TD41
Zhang, Jiawei SD22 TB08
Zhang, Jun MA34
Zhang, Lijuan TD12
Zhang, Lingyi WA18
Zhang, Michael MA11
Zhang, Muhong SD05
Zhang, Nien Fan SA28
Zhang, Pengcheng SC12 TA11
Zhang, Q.J. MC01
Zhang, Qinli TD41 TD45
Zhang, Rachel MC34 TB29 TB34 WA39
Zhang, Weiyong WB45
Zhang, Xiaohong WA41
Zhang, Xiaolong WC39
Zhang, Xiaoou TD12
Zhang, Xueyi TA41
Zhang, Yi SB15
Zhang, Z. John MD26
Zhang, Z. John WA26
Zhang, Zhanmin SD12
Zhang, Zuopeng TA31
Zhao, Dongming TB27
Zhao, Hairong TD15
Zhao, Hui SB41
Zhao, Menxin TA44
Zhao, Yao MC09 MC38 TB15 WC39
Zhao, Yijia SC05
Zhao, Zhenying TA29
Zheng, Jingfang WA34
Zheng, Xiaona SB34
Zhong, Hua MD15
Zhong, Jing TB28
Zhong, Ming SC10
Zhou, Chen WA21
Zhou, Chen WB38
Zhou, Deming MA31
Zhou, Liang TA11
Zhou, Sean Xiang MA26
Zhou, Shiyu SB28
Zhou, Shiyu TB28
Zhou, Vickii Shu MC34
Zhou, Xian MC15
Zhou, Xuesong MA11 MD11
Zhou, Yong-Pin SB34 TC34
Zhou, Zhong MB11
Zhuang, Hejun WB29
Zhuang, Jifang SA37 SB37
Zhu, Guidong SA24
Zhu, Kaijie SC26
Zhu, Kevin TC29
Zhu, Peng WC31
Zhu, Wenge WA43
Zhu, Xiaoyun WA02
Zhu, Xuejun SB28
Ziemba, William SC36
Ziese, Erv MC38
Ziesler, Pamela SC29
Zinchenko, Yuriy TC45
Zinner, Darren WC21
Zipkin, Paul SB34
Zlobin, Natalya MC20
Zou, Ning WB10
Zuniga, Miguel A. WA20
Zuraikat, Natasha SC13

Sunday 8:00am-9:30am

SA01 Tutorial: Heuristic Search for Network Design
SA02 Panel: The Academic Job Search
SA04 Optimization in Data Mining
SA05 Mixed-Integer Programming: Theory, Algorithms, and Applications
SA06 Modelling in Stochastic Programming
SA07 Tutorial: Global Optimization in Integrated Computing Systems
SA08 Discrete Optimization in Networks
SA09 Joint Session Optimization/Computing/Health App.: Data Mining in Bioinformatics
SA10 Information and Uncertainty in Transportation Networks
SA11 Joint Session TSL/ Aviation: Air Traffic Management I
SA13 Airline Operations
SA14 Organizational Learning and Knowledge Management-I
SA15 Data Mining and Knowledge Discovery: Building Better Business Results
SA16 XML, Open Source Software, and Optimization
SA17 Decision Analysis in Pharmaceutical Industry
SA18 Decision Analysis Applications
SA19 Intelligent Agents
SA20 Simulation Modelling
SA21 Finalists- Nicholson Student Paper Prize Competition
SA22 Location Modeling I
SA23 Joint Session Military App./ Simulation: Advancements in Military Modeling and Simulation
SA24 Project Scheduling and Sports Applications
SA25 Tools vs. Concepts
SA26 Make-to-Stock Queues
SA27 Tutorial: A Tutorial Introduction to the Cross-Entropy Method
SA28 Process Monitoring and Diagnosis for Auto-Correlated Data
SA29 Forestry Applications - I
SA30 Advanced SPC using Multiscale Wavelets Analysis
SA31 Joint Session App. Prob./Minority Issues: Call Center Models for Design and Analysis
SA32 Balancing Data Quality and Confidentiality
SA33 Project Management and Scheduling
SA34 Managing Supply Chains of Perishable Goods
SA35 Inventory Theory
SA36 Financial Engineering
SA37 Natural Gas Market Models
SA38 Simulation of Manufacturing Systems
SA39 Retail Supply Chain Management I: Managing Variety
SA40 Supply Chain Management I
SA41 Supply Chain Pricing and Sourcing
SA42 Revenue Management and Dynamic Pricing I
SA43 Panel: Intersection of Product Development and Supply Chain Management Research
SA44 Auctions with Limited Communication
SA45 Algorithmic Game Theory
SA46 Economics

Sunday 10:00am-11:30am

SB01 Tutorial: Polyhedral Combinatorics
SB02 Panel: The Industry Job Search
SB03 Multilevel Metaheuristics
SB05 Robust/Stochastic Optimization
SB06 Markov Decision Processes - Optimization and Evaluation
SB07 Uncertainty Quantification for Financial Decisions in the Electric Energy Industry
SB08 On the Price of Anarchy
SB09 Convex Optimization in Machine Learning I
SB10 Joint Session TSL/Railroad App.: Mathematical Programming-Based Marine Transportation and Logistics
SB11 Algorithm Issues in Dynamic Traffic Assignment
SB12 Crossdocking
SB13 OR Applied to Railroads I
SB14 Organizational Learning and Knowledge Management-II
SB15 Recent Advances for Mining Business Data
SB16 XML and Web Services in Optimization
SB17 Decision Analysis: Foundations, Theory, and Practice
SB18 Appraisal of Graduate Decision Programs
SB19 Tutorial: Operations Research Problems in Data Analysis
SB20 Resource Planning in Health Care
SB21 Economics
SB22 Location Modeling II
SB23 Probabilistic and Combinatorial Methods in Military Applications
SB24 Project Management
SB25 Presentations of Finalists #1 and #2 for the Fifth Annual INFORMS Case Competition
SB26 Material Planning and Inventory Control
SB27 The Cross-Entropy Method for Monte-Carlo Simulation
SB28 Monitoring and Diagnosis for Engineering Systems with Complex Topologies
SB29 Forestry Session - Fire Applications I
SB30 Recent Developments in the Theory and Application of Statistical Process Control
SB31 Call Center Models
SB33 JFIG Panel on Research and Publications
SB34 The Impact of the Internet on Operations
SB35 Supply Chain Disruptions
SB36 Computational and Empirical Issues in Finance
SB37 Stochastic Energy Market Models
SB38 Estimation of Cycle Time - Throughput Curves via Simulation
SB39 Retail Supply Chain Management II: Supply Chain Coordination
SB40 Operational Hedging
SB41 Supply Chain Production Management
SB42 Pricing On-Demand Information Services
SB43 Product Variety Management
SB44 Auctions 1
SB45 New Algorithmic and Complexity Insights into the Nash Equilibrium
SB46 Panel: ADVANCEing Women in OR/MS
SB47 Software Demonstration

Sunday 1:30pm-3:00pm

SC01 Tutorial: Simulation Optimization
SC02 Modernization of Traditional Revenue Management Tools
SC03 Perspectives on Multilevel Meta-Heuristics
SC04 Joint Panel Session Data Mining/ QSR: Data Mining Research, Applications, and Software
SC05 Cutting Planes for Integer Programming Models
SC06 Recent Developments in Stochastic Programming
SC07 Global Optimization- Costly Functions and Multistart Methods
SC08 Auctions and Market Equilibrium
SC09 Convex Optimization in Machine Learning II
SC10 Joint Session TSL/Aviation App.: Air Traffic Management II
SC11 Military Logistics Research at RAND
SC12 Robustness and Stochasticity in Transportation Networks
SC13 RASIG Roundtable Conference
SC14 Patently Critical - Insights from Studies on the Strategic use of Patents
SC15 Data Mining in Biomedicine
SC16 Presolving and Pre-solution Analysis in Nonlinear Programming
SC17 Advances in Decision Analysis
SC18 Decision Analysis Research In Progress
SC20 Healthcare Models and Evaluation
SC21 Globalized Operations
SC22 Tutorial: Decision Analysis Tools
SC23 Joint Session Military/SIM: Project Albert and Data Farming: Vision, Applications, Capabilities and Transition
SC25 Presentations of Finalists #3 and #4 for the Fifth Annual INFORMS Case Competition
SC26 Stochastic Models for Production and Service Operations
SC27 Approximations and Limit Theorems in Queueing Networks
SC28 Proactive Maintenance in Reconfigurable and Flexible Manufacturing Systems
SC29 Forestry Session - Fire Applications II
SC30 Journal of Quality Technology
SC31 Time-Dependent Queueing Models
SC32 Spreadsheet Simulation and Optimization
SC33 JFIG Paper Competition I
SC34 Leadtime and Pricing Considerations
SC35 Operations Management and Homeland Security
SC36 Financial Engineering I
SC37 Risk Management in Power Markets
SC38 Simulation Output Analysis Techniques, I
SC39 Retail Supply Chain Management III: Improving Supply Chain Performance
SC40 Forecasting and Information Sharing in Supply Chains
SC41 Supply Chain Risk Analysis I
SC42 Multi-period Models for Revenue Management
SC43 Examining Empirical Research Trends in OM/ New Product Development
SC44 Auctions in Practice
SC45 AI and Game Theory
SC46 Panel: Junior Faculty Responsibilities and Tenure: Balancing Teaching, Research, Service and Life
SC47 Software Demonstration

Sunday 4:30pm-6:00pm

SD01 Tutorial: Computational Finance
SD02 Tabu Search: Theory and Applications
SD03 Sequential and Parallel Scatter Search
SD04 Process Data Mining
SD05 Integer/Combinatorial Optimization Under Uncertainty
SD06 Cross Entropy
SD07 Global Optimization- Packing Problems
SD08 Data Aggregation in Sensor Networks
SD09 Product and Supply Chain Innovation
SD10 Congestion Pricing and Related Models
SD11 Facility Layout Design
SD12 Transportation Infrastructure Management
SD13 RASIG Roundtable Conference (Continued)
SD14 Management of Technology: A Matter of Degree?
SD15 Data Mining for Fraud Detection and Marketing
SD16 Automatic Selection of NLP Solver or Sub-Solver
SD17 DAS Practice Award Finalists
SD18 Climate Change
SD19 Machine Learning
SD20 Pierskalla Award
SD22 Location Modeling III
SD23 Military Applications of Operations Research
SD24 Service Industry Applications
SD25 Teaching Pricing and Revenue Management
SD26 Dynamic Resource Allocation in Queueing Networks
SD27 Queueing Systems
SD28 Reliability Research
SD29 Forestry Session - Fire Applications III
SD30 Panel Discussion: Important Issues and Challenges on the Interface Between OR and Statistics
SD31 Asymptotics and Control of Stochastic Networks
SD32 OR in Industry
SD33 JFIG Paper Competition II
SD34 Pricing and Competition in Operations Management
SD35 Secure Supply Chain Collaborations
SD36 Financial Engineering Applications
SD37 Electric Power Transmission Markets
SD38 Simulation Applications to Healthcare and Aircraft Design
SD39 Contracting in Supply Chains and Markets
SD40 Managing Demand under Multiple Products or Retailers
SD41 Supply Chain Remanufacturing
SD42 Assorted Topics in Revenue Management
SD43 Empirical Research in New Product Development II
SD44 Bidding Mechanisms for Time-Sensitive Markets
SD45 Algorithms for Market Equilibria
SD46 Panel: Careers in Academia, Industry and the Public Sector: Opportunities and Challenges for OR/OR/MS Professionals
SD47 Software Demonstration

Monday 8:00am-9:30am

MA01 Tutorial: Constraint Languages for Combinatorial Optimization
MA02 Genetic Algorithms
MA03 Scatter Search and Path Relinking for Timetabling and Scheduling
MA04 Tutorial: Introduction to Manifold Based methods in Dimension Reduction and Model Estimation
MA05 Integer Programming Applications
MA06 Validation and Approximation in Stochastic Programming
MA07 Global Mixed-Integer Optimization
MA08 Network Games and Multicommodity Flows
MA09 Network Optimization
MA10 Vehicle Routing
MA11 Dynamic Traffic Assignment and Applications
MA12 Warehouse Design & Operations
MA13 OR Applied to Railroads II
MA14 Innovation and Entrepreneurship
MA15 Clustering Applications and Evaluation
MA16 Some New Results on Cuts and Cutting Planes
MA17 Decision Analysis Arcade
MA18 Expert Opinion: Overconfidence, Dependency and Aggregation
MA19 Tutorial on Agent-based Modeling and Simulation
MA20 Handheld Computers in Patient Care Delivery: Organizational and Physician Issues
MA21 Challenges to OR from the Public Policy Sector
MA22 Location Modeling IV
MA23 Maritime Military Applications
MA24 Optimization in Financial Services I
MA25 INFORMS Case and Teaching Materials: Dialog with Prospective Authors and Case Teachers
MA26 Stochastic Models for Process Industries and Supply Chains
MA27 Queueing Systems with Applications
MA28 Advanced SPC for Autocorrelated / Multivariate Data
MA29 Forestry Applications II
MA30 Directed Process Monitoring
MA31 Economics of Information Technology and Supply Chains
MA32 OR in Telecommunications
MA33 Panel: Is There a "Theory of Practice"?
MA34 Capacity Reservation and Coordination
MA35 Supply Chain Risk and Flexibility Management Industry Implementations
MA36 Financial Engineering II
MA37 Agent-based Modelling in Energy Markets
MA38 Simulation Applications
MA39 Supply Chain Management and Incentives
MA40 Newsvendor Pricing Models in Supply Chain Management
MA41 Supply Chain Networks
MA42 Optimal Pricing Policies
MA43 Supply Chain Issues in Product Design
MA44 Field Studies of Online Auctions
MA45 Vaccination Strategies
MA46 Optimization and Graph Problems
MA47 Software Demonstration

Monday 10:00am-11:30am

MB01 Tutorial: Nonlinear Programming and Engineering Applications
MB02 New Advances in Algorithm Design and Search Strategies
MB03 Scatter Search and Path Relinking Applications
MB04 Clustering Algorithms and Applications
MB05 Polyhedral Techniques for Integer Programming
MB06 Approximate Dynamic Programming
MB07 Panel: Advanced Global Optimization - Scientific and Engineering Applications
MB08 Graph Cuts and Connectivity
MB09 Honoring Pete Veinott: Dynamic Programming
MB10 Stochastic Models
MB11 Integrated Urban Transportation Modeling Approaches
MB13 OR Applied to Railroads III
MB14 Dissertation Award
MB15 Data Analysis via Combinatorics, Optimization and Logic
MB16 Tutorial: Logic-based Techniques for Linear and Nonlinear Discrete/ContinuousOptimization
MB17 Duncan Luce's 2003 Ramsey Award Session
MB18 Multicriteria Decision Making
MB19 Semiconductor Industry
MB20 Joint Session Health App./ Computing: Computational Biology and Bioinformatics
MB21 Threats To Life and Limb
MB22 Joint Session Location Analysis/Minority Iss./ Public Programs and Processes: Location Modeling V
MB23 Strategic Airlift Transportation - Recent Analyses and Current Insights
MB24 Student Research Paper Competition
MB25 Joint Session Education/OR in Sports: SpORts in the OR Classroom I
MB26 Analytical Approaches for Manufacturing Systems
MB27 Staffing Large-Scale Service Systems
MB28 Opportunities in Bioinformatics, Drug Development and Logistics
MB29 Forestry Applications III
MB30 Technometrics-Sponsored session
MB31 Collaborative Technology
MB32 Supply Chain Simulation Optimization, SimFlex Group - Flextronics
MB33 Daniel H. Wagner Prize Competition
MB34 Managing Capacity: Pricing, Competition and No-Shows
MB35 The Value of Collaborative Processes in the Supply Chain
MB36 Risk Management in Engineering Applications I
MB37 Electricity Pricing and Risk Management
MB38 Optimal Simulations and Simulation for Optimization
MB39 Sourcing and Procurement Strategies
MB40 Supply Chain and Pricing
MB41 Supply Chain Contracts and Games I
MB42 New Trends on Stochastic Revenue Management
MB43 Role of Technology in New Product Development
MB44 Multi-Attribute Auctions & Experiments
MB45 Cancer Therapeutics
MB46 Trade Policy Models and How They Are Used
MB47 Software Demonstration

Monday 1:30pm-3:00pm

MC01 Tutorial: Computer-Aided Design for Electrical and Computer Engineering
MC02 Coupling OR Techniques and Metaheuristics
MC04 Data Mining in Biomedical Applications
MC05 Computational Approaches for Integer Programs
MC06 Portfolio Optimization
MC07 Stochastic Adaptive Search in Global Optimization
MC08 Networks and Scheduling
MC09 Honoring Pete Veinott: Inventory and Operations Management. To Honor Pete Veinott's Illustrious Career, a Group of Students and Associates will Present 3-5 Talks on Inventory and Operations Management
MC10 Intermodal Freight Transportation
MC11 Optimization for Decison Support
MC12 Service Parts Logistics Network Design with Inventory Management
MC13 Joint Session Railroad App./ TSL: Scheduled Railroading: New Operating Strategies for Freight Trains
MC14 Joint NPD/TMS Panel: Editors' Views on Multidisciplinary Research
MC15 Logistics and Scheduling
MC16 Linear Programming
MC17 Panel Discussion: Perspectives on Corporate Risk Attitudes
MC18 Behavioral Decision Theory
MC19 Topics in Reverse Supply Chain Management
MC20 Demand Management in Healthcare
MC21 Public Processes and Industry Applications
MC22 Location Modeling VI
MC23 Mobility Applications I
MC24 Optimization in Financial Services II
MC25 Joint Session Education/OR in Sports: SpORts in the OR Classroom II
MC26 Consumer-Designed Solutions and Recommendation Agents
MC27 Queues with Flexible Servers
MC28 Variability Modeling and Classification
MC29 GRID Simulation and Supply Chain Analysis
MC30 Panel Discussion: Directors' Message - Funding Trend and Opportunities at Federal Agencies
MC31 Data Mining and Security
MC32 Demand Forecasting and Demand Management
MC33 Daniel H. Wagner Prize Competition
MC34 Issues in Supply Chain Management
MC35 Recognizing MSOM Fellows 2004 Research Accomplishments
MC36 Risk Management in Engineering Applications II
MC37 Electricity Market Modeling
MC38 Simulation I
MC39 Competition and Cooperation in Supply Chains
MC40 Topics in Supply Chain Management
MC41 Supply Chain Risk Analysis II
MC42 Revenue Management Application
MC43 Session on NPD Research
MC44 Multi-item Auction Mechanisms for Operations Research
MC45 Medical Diagnosis and Prediction
MC46 Economic Modelling Over Space or Time
MC47 Software Demonstration

Monday 4:30pm-6:00pm

MD01 Tutorial: Markov Decision Chains
MD02 Issues in Metaheuristics Design, Comparison and Testing
MD03 Biomedical Applications of Operations Research
MD04 Data Mining in Practice
MD05 Integer Programming
MD06 Modeling and Computation in Stochastic Programming
MD07 Algorithms for Complementarity Problems in Engineering Applications
MD08 Network Optimization
MD09 Interior Methods for Mathematical Programs with Equilibrium Constraints
MD10 Logistics and Routing
MD11 Choice Models
MD12 Transportation Network Optimization Problems in Complex Environments
MD13 RASIG Student Paper Contest Presentation
MD14 Technology Management Section Distinguished Speaker
MD15 Integrated Production and Distribution Scheduling
MD16 Simulation-Based Optimization
MD17 DAS 2004 Awards Session
MD18 Network Design
MD19 Return Flows: Management, Network Design, Forecasting Value
MD20 Applications in Patient Safety and Screening
MD21 Inventory Modeling I
MD22 Network Centric Warfare
MD23 Resource Allocation for Military Applications
MD24 Optimization in Financial Services III
MD25 Joint Session Education/OR in Sports: SpORts in the OR Classroom III
MD26 Strategic Models of E-commerce and Pricing
MD27 Applied Probability in Financial Engineering
MD28 Maintenance Optimization
MD29 "Marketing on the Internet: What's New and What Isn't?"
MD30 QSR Best Student Paper
MD31 Info-System
MD32 OR Models for the Automotive Industry
MD33 Daniel H. Wagner Prize Competition
MD34 Pricing and Revenue Management in Operations
MD35 Managing Supply Chains in e-tailing and e-procurement
MD36 Computational Finance
MD37 Pricing Issues in Electricity Markets
MD38 Simulation-Optimization
MD39 Decentralized Supply Chains: Quality Risk, Information Acquisition and Project Management
MD40 Stochastic Inventory Theory
MD41 Supply Chain Inventory Management I
MD42 Dynamic Pricing and Revenue Management
MD43 Product Development Deep Dive
MD44 Designing Auction Mechanisms: From Theory To Computing
MD45 Operations Research and Data Mining for Healthcare Systems and Medical Applications
MD46 Agroterrorism: Economic Considerations and Supply Chain Management
MD47 Software Demonstration

Tuesday 8:00am-9:30am

TA01 Tutorial: Parallel Algorithm Design for Branch and Bound
TA02 Heuristic Programming
TA03 Operations Research in Biology
TA04 Teaching Data Mining
TA05 Recent Progress in MIP
TA06 Stochastic Network Planning
TA07 New Algorithms for Mathematical Problems with Equilibrium Constraints
TA08 Network Design, Facility Location, and Cost Sharing
TA09 Large-Scale Nonlinear Programming
TA10 Applications in Public Transport
TA11 Modeling Advances in Dynamic Traffic Assignment
TA12 Supply Chain Design
TA13 Airport Customer Service
TA14 Technology and Strategy
TA15 Probabilistic Analysis and Supply Chain Scheduling and Due Date Quotation
TA16 COIN-OR: Open-Source Software for OR
TA17 Portfolio Decision Analysis
TA18 Inventory Modeling II
TA19 Analytical Modeling of Remanufacturing and Recycling Systems
TA20 Modeling and Optimizing Issues in Health Care
TA21 Research on Spreadsheet Engineering
TA22 VFT in the Military - Metrics and Sensitivity Analyisis
TA23 New Supply Chain Case Studies
TA24 Beyond the Traditional First OR Course: Design and Implementation
TA25 MBA Education: Experiences from UMUC Online
TA26 Price Adjustments in E-Commerce and Bricks and Mortar Retail
TA27 Financial Models and Analysis
TA28 Distributed Sensing I
TA29 Real-Time Supply Chain Optimization and Execution
TA30 Reliability Research
TA31 Managing Information and Knowledge
TA32 Business Process Simulation and Optimization
TA33 Daniel H. Wagner Prize Competition Awards
TA34 Strategic Operations
TA35 Mass Customization I
TA36 Finance - Risk Management
TA37 Modeling of Climate Change and Energy Markets
TA38 Stochastic Processes I
TA39 Capacity and Inventory Management
TA40 Incentives in Firms and Supply Chains
TA41 Supply Chain Coordination I
TA42 Revenue Management and Dynamic Pricing II
TA43 Supply Chains for Product Design
TA44 DEA Applications in IT Software and Finance Industries
TA45 Clinical OR Applications in Radiation Oncology
TA46 Inventory Modeling III
TA47 Software Demonstration

Tuesday 10:00am-11:30am

TB01 Tutorial: Multiple Criteria Decision Making
TB02 Metaheuristics I
TB04 Data Mining in Environmental Modeling
TB05 Integer Programming Software
TB06 Stochastic Integer Programming Algorithms
TB07 Advances in Linear and Quadratic Programming
TB08 Optimization and Approximation Algorithms
TB09 Emerging Techniques and Applications for Nonlinear Programming
TB10 Freight Transportation Systems
TB11 Public Transit
TB12 Transportation I
TB13 Joint Session Aviation/TSL: Integrated Airline Planning
TB14 Modern Technical and Professional Work
TB15 Supply Chain Optimization and Scheduling
TB16 Algorithms and Software for Linear Programming
TB17 Dynamic Programming Models
TB18 Communications Service Models
TB19 Industrial Applications
TB20 Optimization in Healthcare
TB21 Panel Discussion on Spreadsheet Research
TB22 Mobility Applications II
TB23 Systems of Systems Analysis
TB24 Successes and Innovations in the Teaching of Introductory OR Courses
TB25 Success Strategies for Learning, Mentoring, and Ethics
TB26 Channels and Auctions
TB27 Applications in Financial Engineering
TB28 Distributed Sensing II
TB29 Supply Chain Issues in E-Business
TB30 Reliability Research
TB31 Approaches to Knowledge Management
TB32 Applications of OR to Semiconductor Manufacturing
TB33 Edelman Finalist Reprise
TB34 Operations and Finance Interface
TB35 Configuration Systems for Mass Customization
TB36 Finance - Theory & Empirics I
TB37 Pollution Control Mechanisms and Compliance Management
TB38 OR in Sports I
TB39 Managing Supply Chain Uncertainty
TB40 Empirical Research Using Secondary Data
TB41 Supply Chain Management I
TB42 Dynamic Pricing and Revenue Management
TB43 Technology-NPD interfaces
TB44 New Product Development Applications of DEA
TB45 Optimization of Radiation Therapy Treatment Plans
TB46 ScholarOne Demo
TB47 Software Demonstration

Tuesday 1:30pm-3:00pm

TC01 Tutorial: Radiation Oncology and Optimization
TC02 Metaheuristics II
TC03 Biocomputing: Recent Advances on Modeling, Algorithms and Applications
TC04 Joint Session Data Mining/Computing: Data Mining in Stochastic Decision-Making
TC05 Computational Integer Programming Approaches
TC06 Integer Programming I
TC07 Solution Methods for Linear Programming and Linear Complementarity Problems
TC08 Network Flow Applications
TC09 Advances in Nonlinear Programming
TC10 Transportation and Inventory Control
TC11 Reverse Supply Chains and Reverse Logistics
TC12 2004 Dantzig Dissertation Award Finalists
TC13 Robust Airline Scheduling and Operations
TC14 Innovations in Organizations and on Markets
TC15 Job Shop Scheduling and Transportation
TC16 Optimization Modeling in Practice I
TC17 Teaching Decision Analysis
TC18 New Approaches to Network Management
TC19 Issues in Closed-Loop Supply Chains
TC20 New Models in Health Care OR
TC21 Spreadsheet Analyst Productivity
TC22 Space Applications
TC23 Air Force Logistics
TC24 Omega Rho Undergraduate Project Award Winners
TC25 Recent Advances and Thoughts in Teaching Manufacturing-Related Topics
TC26 Inferences in Auctions and Sports
TC27 Diffusion and Fluid Models
TC28 System Engineering in Nonstandard Applications
TC29 Electronic Commerce
TC30 Reliability Research
TC31 Information Security
TC32 The Integration of Simulation, BAM, and Optimization to Provide Managers a Desk Top Predictive Analysis Tool
TC33 Building and Managing an OR Consulting Firm (Panel Discussion)
TC34 Capacity and Inventory Management in Service Supply Chains
TC35 Session Mass Customization, Demand and Supply Chain Perspective
TC36 Achieving Flexibility Through Cross-training and Flexible Resources
TC37 Green Production and Recycling Process
TC38 OR in Sports II
TC39 Closed Loop Supply Chains
TC40 Product Design and Supply Chains
TC41 Supply Chain Flexibility
TC42 Pricing and Auctions
TC43 NPD Education-Preparing Students for Leadership in a Cross-functional Environment
TC44 Engineering Applications of DEA
TC45 Optimization in Radiation Treatment Planning
TC47 Software Demonstration

Tuesday 4:30pm-6:00pm

TD01 Tutorial: Optimization Methods for Rescheduling
TD02 CS Applications to OR
TD03 Operations Research in Biological and Chemical Sciences
TD04 Data Mining and Operations Research Engineering
TD05 Optimization Methods and Applications
TD06 Integer Programming II
TD07 Recent Computational work in SDP and Cone Programming with Applications
TD08 Advances in Network and Combinatorial Optimization
TD09 Column Generation/Cutting Plane Approaches to Large-Scale Conic Optimization
TD10 Joint Session TSL/MSOM/Supply Chain Mgmt.: Distribution Networks
TD11 Distribution Network Design
TD12 Inventory Modeling IV
TD13 Aviation Applications
TD14 Time Matters: Managing Speed as Managing Technology
TD15 New and Open Problems in Scheduling
TD16 Software and Algorithms for Semidefinite Programming
TD17 Joint Session Decision Analysis/ Military App.: Military Applications of Decision Analysis
TD18 Wireless Network Design
TD19 Auctions I
TD20 Health Care Applications I
TD21 Transformative uses of OR Spreadsheets
TD22 Simulation-Based Planning
TD23 Service Academy Projects: Summer and Capstone Experiences
TD24 Use of Technology in OR Education
TD25 Evaluating Innovations in Teaching OR
TD26 Modeling Uncertainty and Reliability in Choice and Survey Data
TD27 Applications in Finance and Economics
TD28 Distributed Sensing III
TD29 Technology-enabled Outsourcing: Opportunities and Challenges
TD30 Process Variability Modeling and Optimization
TD31 Contempory Issues in IS Research
TD32 Personnel Planning And Analysis
TD33 Strategic OR: An Update on Some Edelman Prize Finalists
TD34 Behavioral Ops
TD36 Workforce Scheduling and Flexibility
TD37 Operations Research in the Mining Industry
TD38 OR in SpORts III
TD39 Supply Chain Management II
TD40 Behavioral Causes of Supply Chain Instability
TD41 Supply Chain Inventory Management II
TD42 Robust Optimization in Revenue Management
TD43 Managing New Product Portfolios
TD44 Algorithms and Computations in DEA
TD45 Manufacturing I
TD46 Natural Resources Management and Conservation
TD47 Software Demonstration

Wednesday 8:00am-9:30am

WA01 Tutorial: Issues and Possibilities in Contemporary Simulation
WA02 OR and CS Applications
WA03 Analytic Hierarchy Process
WA04 Data Mining and Predictive Modeling for the Earth Sciences and Earth Systems Engineering
WA05 Nonlinear Optimization
WA06 Advances in Commercial IP Solvers
WA07 Advances in Interior-Point Methods
WA08 Networks & Graphs
WA09 Optimization Techniques I
WA10 Vehicle and Truckload Routing
WA11 Transportation II
WA12 Inventory Management
WA13 Air Traffic Flow Management
WA14 Management of Technology I
WA15 Multiple Machine and Distributed Scheduling Problems
WA16 Tutorial: IPOPT: A Software Package for Nonlinear Optimization
WA17 Decision Analysis I
WA18 Telecommunications
WA19 Auctions II
WA20 Health Care Applications II
WA21 Manufacturing II
WA22 Analytical Techniques for Space Operations
WA23 Data Identification & Optimization Techniques
WA24 Scheduling I
WA26 Implications of Fairness on Consumer Behavior and Channel Modeling
WA27 Financial Engineering
WA28 Reliability
WA29 E-Business Auctions and Contracts
WA30 Quality Management
WA31 Information Collaboration and Integration in Enterprise Information System
WA32 Joint Session OR Practice/CPMS- Panel: Academic/Practitioner Interaction and Cooperation
WA34 Operations Management I
WA35 Strategic Implications of Mass Customization
WA36 Facilities Planning & Design
WA37 Environment/Natural Resources
WA38 Stochastic Processes II
WA39 Supply Chain Management II
WA40 Supply Chain Coordination II
WA41 Supply Chain Management II
WA42 Forecasting
WA43 New Product Development I
WA44 DEA Methology
WA45 Operations Management II

Wednesday 10:00am-11:30am

WB01 Tutorial: Connecting mrp, MRP II and ERP Supply Chain Planning via Optimization Models
WB02 Marketing I
WB03 Applied Probability I
WB04 Scheduling II
WB05 Optimization Techniques II
WB06 Problems on Graphs: Solution Methods and Applications
WB08 Dynamic Programming/Control in Supply Chain
WB09 Optimization Techniques III
WB10 Transportation III
WB11 Transportation IV
WB12 Inventory Modeling V
WB13 Logistics I
WB14 Management of Technology II
WB15 Scheduling III
WB16 Optimization Modeling in Practice II
WB17 Decision Analysis II
WB18 Telecommunications/Internet Applications
WB19 Data Envelopment Analysis
WB20 Health Care Applications III
WB21 Manufacturing III
WB22 Capabilities-Based Analysis for Operationally Responsive Spacelift Analysis of Alternatives
WB23 Joint Session MAS/SIM- Sociocultural Modeling in Agent-based Simulations
WB24 Scheduling IV
WB25 Education I
WB27 Probability Models in the Service Industries
WB28 Applied Probability II
WB29 E-Business/E-Commerce I
WB30 Statistics/Quality Control
WB31 Information Systems I
WB32 Strategic Planning
WB34 Operations Management III
WB35 Production & Scheduling
WB36 Finance - Theory & Empirics II
WB37 Environment/Natural Resources and AHP Applications
WB38 Simulation II
WB40 Supply Chain Management III
WB41 Supply Chain Contracts and Games II
WB43 New Product Development II
WB44 Logistics II
WB45 Operations Management IV

Wednesday 12:00pm-1:30pm

WC02 Marketing II
WC05 Optimization Techniques IV
WC06 Integer Programming -Theory and Computation
WC07 Linear Programming & Linear Systems
WC08 Computer-Assisted Analysis
WC09 Decision Support Systems
WC10 Transportation V
WC11 Transportation VI
WC12 Inventory Modeling VI
WC13 Logistics III
WC14 Technology Management/Business Process Reenginering
WC16 Neural Networks
WC17 DecisIon Analysis III
WC21 Organization Theory
WC23 Applications in Military and Space Decision Making
WC24 Scheduling V
WC25 Education II
WC27 Stochastic Models in Financial Engineering
WC28 Applied Probability III
W29 E-Business/E-Commerce II
WC31 Information Systems II
WC32 Resource Allocation & Planning
WC34 Operations Management V
WC35 Military Applications
WC39 Supply Chain Management IV
WC40 Supply Chain Management V
WC41 Supply Chain Management VI
WC44 Logistics IV