informs® Institute for Operations Research and the Management Sciences

OR/MS IN THE COMMUNITY

INFORMS Annual Meeting 2003

October 19-22, 2003

Atlanta, Georgia



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ATLANTA ORGANIZING COMMITTEE

General Chair
Donna Llewellyn
Georgia Institute of Technology
donna.llewellyn@cetl.gatech.edu

Program Chair
Paul Griffin
Georgia Institute of Technology
pgriffin@isye.gatech.edu

Invited Sessions Chair
Joel Sokol
Georgia Institute of Technology
jsokol@isye.gatech.edu

Sponsored Sessions Chair
Ozlem Ergun
Georgia Institute of Technology
oergun@isye.gatech.edu

Contributed Sessions Chair
Francois Sainfort
Georgia Institute of Technology
fsainfort@isye.gatech.edu

Tutorial Sessions Chair
Augustine Esogbue
Georgia Institute of Technology
aesogbue@isye.gatech.edu

Practitioner Program Chair
Lloyd Clarke
ILOG, Inc.
lclarke@ilog.com

Poster Session Chair
Keith Hollingsworth
Morehouse College
khollingsworth@morehouse.edu

Local Arrangements Co-Chairs
Keith Hollingsworth
Morehouse College
khollingsworth@morehouse.edu

Lorraine Shaw
Georgia Institute of Technology
lshaw@isye.gatech.edu

Combined Colloquia Chair
Anuj Mehrotra
University of Miami
anuj@miami.edu

Doctoral Colloquium Chair
Pinar Keskinocak
Georgia Institute of Technology
pinar.keskinocak@isye.gatech.edu

Industrial Colloquium Chair
Kenneth E. Murphy
Willamette University
kmurphy@willamette.edu

Teaching Effectiveness Colloquium Chair
George G. Polak
Wright State University
george.polak@wright.edu

Teachers Program Chair
Dave Goldsman
Georgia Institute of Technology
sman@isye.gatech.edu

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.

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OR/MS IN THE COMMUNITY

Annual Meeting

INFORMS Atlanta 2003 October 19-22, 2003

THANKS TO OUR SPONSORS

These companies and universities have made generous contributions to the success of the INFORMS Annual Meeting 2003. Their support has helped create an expansive, diverse and exciting technical program and enhanced special events.

INFORMS gratefully acknowledges their sponsorship.

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Georgia Institute of Technology

Center for the Enhancement of Teaching and Learning
Atlanta, Georgia 30332-0383 USA
TEL 404·894·4474
FAX 404·894·4475

Greetings from the General Chair

It is my pleasure to welcome all of you to Atlanta. I hope that you find this an informative conference and that you also find some time to enjoy our city.

As we embark on the second half-century of work in this professional society, I think it is important that we concentrate harder on the issues that affect the quality of life for all people. Our fields had their origins in assisting the military to solve problems, and it has moved on to help many facets of industrial life. We chose our conference theme to shine the spotlight on the many problems that arise in the public sector – including health, education, the arts, disaster relief, and general infrastructure issues. We hope you accept our challenge to listen in earnest and to investigate the many opportunities to use OR/MS in the Community.

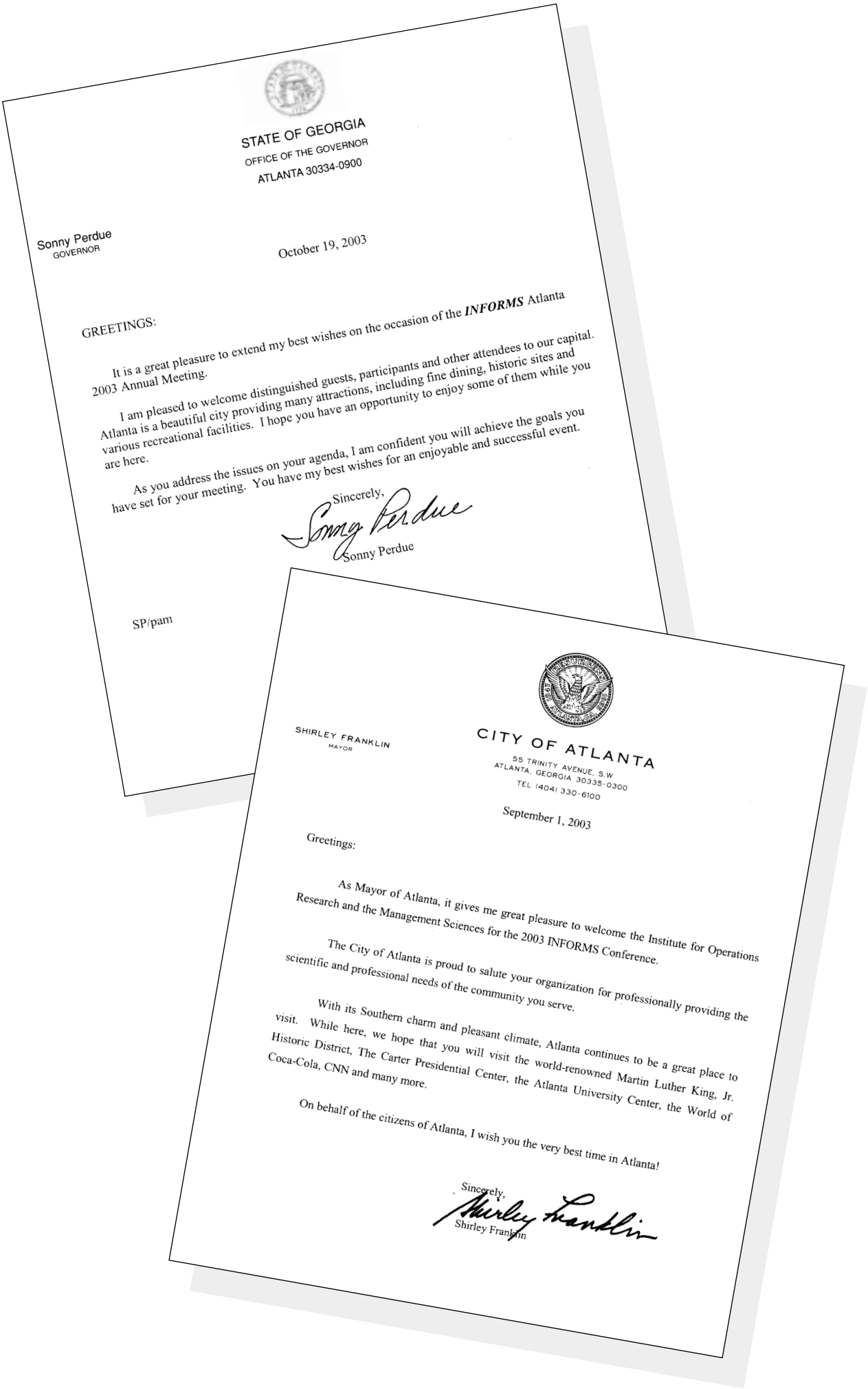
This conference offers more technical talks than any INFORMS conference before – this is not due to my efforts, but rather to your enthusiasm and interest in helping to further our field. I applaud your work and your contributions…and hopefully I will even make it to hear some of you talk! We have a great selection of tutorials, a tremendous practice track, and a wonderful collection of sessions in almost any area related to Operations Research or the Management Sciences. We welcome high school teachers, many graduate students, and the participants of the joint colloquia and the CIST conference.

I have to thank several people in this very public way. First and foremost, Paul Griffin is the best Program Chair that any one could ever ask for - without him there would be no conference! Thanks too to the rest of the committee – Lloyd Clarke, Ozlem Ergun, Augustine Esogbue, David Goldsman, Keith Hollingsworth, Pinar Keskinocak, Anuj Mehrotra, Kenneth Murphy, George Polak, Francois Sainfort, Lorraine Shaw, Joel Sokol, and Julie Swann. Special appreciation goes to Paulette Bronis, the new Meetings Program Editor at INFORMS. She came in after we had already started, picked up and started helping, and hasn't ever stumbled – thank you!

Please enjoy Atlanta while you are here. We have a wonderful selection of restaurants in the downtown area, and many interesting sites nearby. Come to the Welcome Reception on Sunday evening in the exhibit area and hear some local talent (presuming our arrangements go as planned), and then come to the General Reception on Monday evening and sample Coca Cola products from around the world. I truly hope this is a worthwhile conference experience for each of you – welcome!

Donna C. Llewellyn

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STATE OF GEORGIA
OFFICE OF THE GOVERNOR
ATLANTA 30334-0900

Sonny Perdue
GOVERNOR

October 19, 2003

GREETINGS:

It is a great pleasure to extend my best wishes on the occasion of the ***INFORMS*** Atlanta 2003 Annual Meeting.

I am pleased to welcome distinguished guests, participants and other attendees to our capital. Atlanta is a beautiful city providing many attractions, including fine dining, historic sites and various recreational facilities. I hope you have an opportunity to enjoy some of them while you are here.

As you address the issues on your agenda, I am confident you will achieve the goals you have set for your meeting. You have my best wishes for an enjoyable and successful event.

Sincerely,

Sonny Perdue

Sonny Perdue

SP/pam

SHIRLEY FRANKLIN
MAYOR

CITY OF ATLANTA
55 TRINITY AVENUE, S.W.
ATLANTA, GEORGIA 30335-0300
TEL (404) 330-6100

September 1, 2003

Greetings:

As Mayor of Atlanta, it gives me great pleasure to welcome the Institute for Operations Research and the Management Sciences for the 2003 INFORMS Conference.

The City of Atlanta is proud to salute your organization for professionally providing the scientific and professional needs of the community you serve.

With its Southern charm and pleasant climate, Atlanta continues to be a great place to visit. While here, we hope that you will visit the world-renowned Martin Luther King, Jr. Historic District, The Carter Presidential Center, the Atlanta University Center, the World of Coca-Cola, CNN and many more.

On behalf of the citizens of Atlanta, I wish you the very best time in Atlanta!

Sincerely,

Shirley Franklin

Shirley Franklin

NOTE:

Technical sessions are held at the Westin Peachtree Plaza and Merchandise Mart Atlanta. Check the Master Track Schedule on pages xxx-xxx for specific room locations.

KEY:
W-Westin
M-Mart

Atlanta 2003 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

Atlanta 2003 badges must be worn to all sessions and events. This year, 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 pick up their badges and register. 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 18

8:30am-5:00pm	CIST Conference	W – Atlanta D & E, 7th Floor
3:00pm-7:00pm	Registration	W – 6th Floor
5:00pm-6:00pm	INFORMS Membership Meeting	W – Vinings, 6th Floor

SUNDAY, OCTOBER 19

7:00am-5:00pm	Registration	W – 6th Floor
8:00am-9:30am	Technical Sessions (SA)	Westin, Mart
8:30am-5:00pm	CIST Conference	W – Atlanta D & E, 7th Floor
9:30am-10:00am	Coffee Break	W – Peachtree Ballroom Foyer, 8th Floor M – Meeting Room Foyer
10:00am-11:30am	Technical Sessions (SB)	Westin, Mart
11:40am-12:30pm	Plenary Presentation	Westin – Peachtree Ballroom, 8th Floor
12:00pm-5:00pm	Exhibits, Job Placement, Email Center	M – Exhibit Hall
12:30pm-1:30pm	Lunch Break (on your own)	
1:30pm-3:00pm	Technical Sessions (SC)	Westin, Mart
3:10pm-4:00pm	Plenary Presentation	Westin – Peachtree Ballroom, 8th Floor
4:00pm-4:30pm	Coffee Break	M – Exhibit Hall
4:30pm-6:00pm	Technical Sessions (SD)	Westin, Mart
6:15pm-7:15pm	Subdivision Business Meetings	(see p.9)
7:30pm-9:00pm	Welcome Reception	M – Exhibit Hall

MONDAY, OCTOBER 20

7:00am-5:00pm	Registration	W – 6th Floor
8:00am-9:30am	Technical Sessions (MA)	Westin, Mart
9:00am-5:00pm	Exhibits, Job Placement, Email Center	M – Exhibit Hall
9:30am-10:00am	Coffee Break	M – Exhibit Hall
10:00am-11:30pm	Technical Sessions (MB)	Westin, Mart
11:40am-12:30pm	Plenary: Welcome & Awards	W – Peachtree Ballroom, 8th Floor
12:30pm-1:30pm	Lunch Break (on your own)	
1:30pm-3:00pm	Technical Sessions (MC)	Westin, Mart
3:10pm-4:00pm	Keynote Presentations	W – Peachtree Ballrooms E & B, 8th Floor
4:00pm-4:30pm	Coffee Break	M – Exhibit Hall
4:30pm-6:00pm	Technical Sessions (MD)	Westin, Mart
6:15pm-7:15pm	Subdivision Business Meetings	(see p.9)
7:30pm-9:00pm	General Reception	World of Coke/Georgia Freight Depot

(Buses depart beginning at 7:00pm from hotel Motor Lobby.)

TUESDAY, OCTOBER 21

7:00am-5:00pm	Registration	W – 6th Floor
8:00am-9:30am	Technical Sessions (TA)	Westin, Mart
9:00am-5:00pm	Exhibits, Job Placement, Email Center	M – Exhibit Hall
9:30am-10:00am	Coffee Break	M – Exhibit Hall
10:00am-11:30pm	Technical Sessions (TB)	Westin, Mart
11:40am-12:30pm	Keynote Presentations	W – Peachtree Ballrooms E & B, 8th Floor
12:30pm-1:30pm	Lunch Break (on your own)	
1:30pm-3:00pm	Technical Sessions (TC)	Westin, Mart
3:10pm-4:00pm	Keynote Presentations	W – Peachtree Ballrooms E & B, 8th Floor
4:00pm-4:30pm	Coffee Break	M – Exhibit Hall
4:30pm-6:00pm	Technical Sessions (TD)	Westin, Mart
6:15pm-7:15pm	Subdivision Business Meetings	(see p.9)

WEDNESDAY, OCTOBER 22

7:30am-10:00am	Registration	W – 6th Floor
8:00am-9:30am	Technical Sessions (WA)	Westin, Mart
9:30am-10:00am	Coffee Break	W – Peachtree Ballroom Foyer, 8th Floor M – Meeting Room Foyer
10:00am-11:30am	Technical Sessions (WB)	Westin, Mart

Schedule of Special Events

FRIDAY, OCTOBER 17	LOCATION	TIME
Colloquia Registration & Dinner	International B-C, 6th Floor	4:30pm-9:00pm
SATURDAY, OCTOBER 18		
CIST Registration	Atlanta D-E, 7th Floor	7:30am-9:00am
Combined Colloquia Registration	International B, 6th Floor	7:30am-9:00am
CIST Coffee	Atlanta D-E, 7th Floor	8:00am-8:30am
Combined Colloquia Breakfast	International B-C, 6th Floor	8:00am-8:30am
CIST	Atlanta D-E, 7th Floor	8:30am-5:00pm
Doctoral Colloquium	International D-E-G, 6th Floor	8:30am-5:00pm
Teaching Effectiveness Colloquium	International A, 6th Floor	8:30am-5:00pm
Meetings Committee Meeting	Westin Suite, 70th Floor	8:30am-5:00pm
Combined Colloquia Luncheon	International B-C, 6th Floor	12:00pm-1:30pm
INFORMS Executive Committee Meeting	International Boardroom, 6th Floor	12:00pm-5:00pm
Subdivision Council Meeting	Augusta 3, 7th Floor	2:00pm-5:00pm
Meeting Registration	6th Floor	3:00pm-7:00pm
INFORMS Membership Meeting/Reception	Vinings, 6th Floor	5:00pm-6:00pm
Roundtable/CPMS Reception & Dinner	International B-C, 6th Floor	5:00pm-7:45pm
Minority Issues Forum Reception	International H, 6th Floor	6:00pm-8:00pm
Roundtable Meeting	International F, 6th Floor	7:45pm-11:00pm
SUNDAY, OCTOBER 19		
New Member/First-Time Attendee Breakfast	Plaza Ballroom, 10th Floor	7:00am-8:00am
Meeting Registration	6th Floor	7:00am-5:00pm
CIST Coffee	Atlanta D-E, 7th Floor	8:00am-8:30am
Guest Breakfast	Roswell 1, 8th Floor	8:00am-9:00am
INFORMS Board Meeting	Atlanta H, 7th Floor	8:00am-5:00pm
CIST	Atlanta D-E, 7th Floor	8:30am-5:00pm
Roundtable Meeting	Atlanta C, 7th Floor	8:30am-5:00pm
Colloquia Committee Meeting	Roswell 1, 8th Floor	11:30am-12:30pm
Junior Faculty INFORMS Group Luncheon	Plaza A, 10th Floor	11:30am-1:00pm
Plenary: Edward H. Kaplan	Peachtree Ballroom, 8th Floor	11:40am-12:30pm
CIST Lunch	Atlanta A, 7th Floor	12:00pm-1:30pm
Roundtable Lunch	Atlanta F, 7th Floor	12:00pm-1:30pm
Job Fair	Mart-Exhibit Hall	12:00pm-2:00pm
Exhibits/Job Placement/Email	Mart-Exhibit Hall	12:00pm-5:00pm
OR/MS in Practice Poster Display	Mart-Exhibit Hall	12:00pm-5:00pm
Management Science Editors Meeting/Lunch	International Boardroom, 6th Floor	12:30pm-2:00pm
Omega Rho Executive Committee & Annual Meeting	Atlanta B, 7th Floor	12:30pm-3:00pm
Nicholson Student Paper Prize Competition	Tower 1402, 14th Floor	1:30pm-6:00pm
Omega Rho Distinguished Lecture: Judith S. Liebman	Peachtree Ballroom, 8th Floor	3:10pm-4:00pm
President's Reception for Roundtable	Atlanta F, 7th Floor	5:00pm-6:30pm
Revenue Management & Pricing Board Meeting	Atlanta B, 7th Floor	5:15pm-6:15pm
Manufacturing & Service Operations Mgt. Reception	Plaza C, 10th Floor	6:15pm-7:15pm
Military Applications Society Council Meeting	Roswell 1, 8th Floor	6:15pm-7:15pm
Decision Analysis Society Council Meeting	Offsite	6:30pm
Welcome Reception	Mart-Exhibit Hall	7:30pm-9:00pm
Student Reception	Plaza A, 10th Floor	8:00pm-10:00pm
Women in OR/MS Forum Reception	Plaza B, 10th Floor	8:00pm-10:00pm

All events take place in the Westin unless otherwise indicated.

For Subdivision Business Meetings, see page 9.

COFFEE BREAKS

Sunday, Oct. 19

9:30am – 10:00am	W – Peachtree Ballroom Foyer, 8th Floor
	M – Meeting Room Foyer
4:00pm – 4:30pm	M – Exhibit Hall

Monday, Oct. 20

9:30am – 10:00am	M – Exhibit Hall
4:00pm – 4:30pm	M – Exhibit Hall

Tuesday, Oct. 21

9:30am – 10:00am	M – Exhibit Hall
4:00pm – 4:30pm	M – Exhibit Hall

Wednesday, Oct. 22

9:30am – 10:00am	W – Peachtree Ballroom Foyer, 8th Floor
	M – Meeting Room Foyer

Schedule of Special Events

All events take place in the Westin unless otherwise indicated.

For Subdivision Business Meetings, see page 9.

WHERE TO GO FOR LUNCH

Lunch will be available in the Westin at the Café on the lobby level (5th Floor) and at food carts located on the 8th floor terrace and on the 6th floor near INFORMS registration. A Starbucks Coffee outlet is located in the hotel lobby (5th floor). The nearby Peachtree Center Mall offers a food court (limited selection on Sunday).



© Robert Baker/Habitat for Humanity International

Volunteers work together on the framing of a Habitat house.

MONDAY, OCTOBER 20

	LOCATION	TIME
Board/Editors/Committee Chairs Breakfast	Atlanta E, 7th Floor	7:00am-8:00am
Meeting Registration	6th Floor	7:00am-5:00pm
Teachers Program for Atlanta Area Math Teachers	Atlanta B, 7th Floor	8:00am-4:00pm
Guest Breakfast	Roswell 1, 8th Floor	8:00am-9:00am
INFORMS Publications Session	International C, 6th Floor	8:00am-9:30pm
OR/MS in Practice Poster Display	Mart-Exhibit Hall	9:00am-5:00pm
Exhibits/Job Placement/Email	Mart-Exhibit Hall	9:00am-5:00pm
Plenary: Welcome & Awards Session	Peachtree Ballroom, 8th Floor	11:40am-12:30pm
Minority Issues Forum Business Meeting & Bag Lunch	Augusta 3, 7th Floor	12:00pm-1:00pm
COIN-OR Users Meeting	International A, 6th Floor	12:00pm-1:15pm
ACORD/Roundtable Luncheon	Atlanta D, 7th Floor	12:00pm-2:00pm
Subdivision Council Meeting	Atlanta H, 7th Floor	12:00pm-2:00pm
Editors in Chief & Publications Committee Meeting	Atlanta A, 7th Floor	12:00pm-3:00pm
Fellows Luncheon	Atlanta E-F, 7th Floor	12:45pm-2:30pm
Chapters/Fora Committee Meeting	Atlanta C, 7th Floor	2:00pm-3:00pm
Section/Society Committee Meeting	Atlanta H, 7th Floor	2:00pm-3:00pm
Education Committee Meeting	Roswell 1, 8th Floor	3:00pm-4:30pm
Keynote: Daniel C. Pantaleo, SAP	Peachtree Ballroom B, 8th Floor	3:10pm-4:00pm
Keynote: Edelman Reprise, Canadian Pacific Railway	Peachtree Ballroom E, 8th Floor	3:10pm-4:00pm
Dantzig Award Competition	International C, 6th Floor	4:30pm-6:00pm
Decision Analysis Awards Presentation	Tower 1206, 12th Floor	4:30pm-6:00pm
IOL Meeting/Reception	Roswell 1, 8th Floor	6:00pm-7:00pm
CPMS Isolated Practitioners Workshop	Atlanta E, 7th Floor	6:00pm-7:00pm
General Reception	World of Coke/Freight Depot	7:30pm-9:30pm

(Buses depart beginning at 7:00pm from hotel Motor Lobby.)

TUESDAY, OCTOBER 21

Chapters/Fora Officers Breakfast	Atlanta C, 7th Floor	7:00am-8:00am
Meeting Registration	6th Floor	7:00am-5:00pm
Student Chapter Officers Meeting	Atlanta C, 7th Floor	8:00am-8:45am
CPMS Council Meeting	Atlanta B, 7th Floor	8:00am-10:00am
Meetings Committee/Future Organizing Committees	Westin Suite, 70th Floor	8:00am-5:00pm
MSOM Editorial Meeting	Atlanta H, 7th Floor	8:00am-9:00am
Guest Breakfast	Roswell 1, 8th Floor	9:00am-10:00am
OR/MS in Practice Poster Display	Mart-Exhibit Hall	9:00am-5:00pm
Exhibits/Job Placement/Email	Mart-Exhibit Hall	9:00am-5:00pm
Keynote: James Holsen, UPS	Peachtree Ballroom E, 8th Floor	11:40am-12:30pm
Keynote: Marketing the Profession	Peachtree Ballroom B, 8th Floor	11:40am-12:30pm
OR Editors Meeting/Luncheon	International Boardroom, 6th Floor	12:00pm-1:00pm
Women in OR/MS Business Meeting & Lunch	Atlanta E, 7th Floor	12:00pm-1:00pm
Section/Society Officers Luncheon	Atlanta F, 7th Floor	12:00pm-1:30pm
Academic/Practitioner Interface Luncheon	Atlanta C-D, 7th Floor	12:30pm-1:30pm
Roundtable Luncheon	Atlanta H, 7th Floor	12:30pm-2:00pm
Teachers Program for INFORMS Members	Vinings 1, 6th Floor	1:30pm-3:00pm
Philip M. Morse 100th Anniversary Session	International C, 6th Floor	1:30pm-3:00pm
Atlanta Chapter Open House	Atlanta A, 7th Floor	1:30pm-4:30pm
IFORS Distinguished Lecture: Jan Karel Lenstra	Peachtree Ballroom E, 8th Floor	3:10pm-4:00pm
Keynote: What is OR?	Peachtree Ballroom B, 8th Floor	3:10pm-4:00pm
Future Organizing Committee Reception	Westin Suite, 70th Floor	5:00pm-6:00pm

WEDNESDAY, OCTOBER 22

Meeting Registration	6th Floor	7:30am-10:00am

Schedule of Subdivision Business Meetings

All events take place in the Westin unless otherwise indicated.

SUNDAY, OCTOBER 19	LOCATION	TIME
Information Systems	Atlanta D, 7th Floor	5:15pm-6:15pm
Railroad Applications	Mart-F	5:45pm-6:45pm
Aviation Applications	Mart-K	6:15pm-7:15pm
Data Mining	Tower 1401, 14th Floor	6:15pm-7:15pm
eBusiness	Offsite	6:15pm-7:15pm
Energy, Natural Resources & the Environment	International G, 6th Floor	6:15pm-7:15pm
Group Decision & Negotiation	Mart-I	6:15pm-7:15pm
Location Analysis	Tower 1406, 14th Floor	6:15pm-7:15pm
Revenue Management & Pricing	Atlanta B, 7th Floor	6:15pm-7:15pm
Simulation	International H, 6th Floor	6:15pm-7:15pm
Social Sciences	Offsite	6:15pm-7:15pm
Spreadsheet Productivity Research (SPRIG)	Vinings 1, 6th floor	6:15pm-7:15pm

MONDAY, OCTOBER 20		
Minority Issues Forum	Augusta 3, 7th Floor	12:00pm-1:00pm
Technology Management	Peachtree F, 8th Floor	6:00pm-8:00pm
Accounting, Auditing & Tax	International B, 6th Floor	6:15pm-7:15pm
Applied Probability	International E, 6th Floor	6:15pm-7:15pm
Computing	Tower 1204, 12th Floor	6:15pm-7:15pm
Decision Analysis	Tower 1206, 12th Floor	6:15pm-7:15pm
Health Applications	Peachtree G, 9th Floor	6:15pm-7:15pm
Manufacturing & Service Operations Management	Plaza C, 10th Floor	6:15pm-7:15pm
Quality, Statistics & Reliability	Tower 1201, 12th Floor	6:15pm-7:15pm
Telecommunications	International A, 6th Floor	6:15pm-7:15pm
Transportation Science & Logistics	Mart-E	6:15pm-7:15pm

TUESDAY, OCTOBER 21		
Women in OR/MS Forum	Atlanta E, 7th Floor	12:00pm-1:00pm
Artificial Intelligence	Tower 1203, 12th Floor	6:15pm-7:15pm
Financial Services	International B, 6th Floor	6:15pm-7:15pm
Forum on Education (INFORM-ED)	Vinings 1, 6th floor	6:15pm-7:15pm
Military Applications	Tower 1208, 12th Floor	6:15pm-7:15pm
Optimization	Tower 1404, 14th Floor	6:15pm-7:15pm
Public Programs & Processes	Vinings 2, 6th floor	6:15pm-7:15pm

© Gabriel Benzur



Carter Center

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 in Atlanta. 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 Projector Setup Room available near the registration area 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).

SAFETY FIRST – ATLANTA AMBASSADOR FORCE

Be sure to observe normal safety precautions in downtown Atlanta, as you would in any large city. Don't wear your INFORMS badge outside the hotel and Mart, carry your purse or briefcase securely, and walk with groups of people during the evening. Please also do not leave valuables, such as laptops, in the meeting rooms during breaks and lunch periods.

Downtown Atlanta has a special Ambassador Force of uniformed representatives who are trained to provide information and assistance to visitors and residents. They can give directions to downtown restaurants and businesses, provide escorts to MARTA stations and other locations, and can contact medical assistance or the Police Department. Watch for the Ambassadors in the white pith helmets with the red Ambassador logo – some of them will be riding Segways! Ambassadors are available weekdays 7:00am-10:00pm, Saturday 8:00am-10:00pm, and Sunday 8:00am-7:00pm. For an escort during those hours, call 404-215-9600.

Exhibit Hall
Name badges must be worn for admittance to the Exhibit Hall, located in the Mart during the following hours:

Sunday, Oct. 19	12:00pm-5:00pm & 7:30pm-9:00pm*
Monday, Oct. 20	9:00am-5:00pm
Tuesday, Oct. 21	9:00am-5:00pm

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

Email Center
Bring your own laptop PC to the Email Center, located in the Exhibit Hall at the Mart, 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. 19	12:00pm-5:00pm
Monday, Oct. 20	9:00am-5:00pm
Tuesday, Oct. 21	9:00am-5:00pm

Business Centers
The Westin Business Center is located on the 7th floor. It is open on Sunday, October 19, from 8:00am-2:00pm. Weekday hours are from 7:00am-5:30pm. A Sir Speedy is located in the Mart and is open weekdays from 8:30am-6:00pm.

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 the World of Coke/Georgia Freight Depot. Meals–other than hors d'oeuvres at the evening receptions–are not included.

BADGES REQUIRED FOR TECHNICAL SESSIONS

Atlanta 2003 badges must be worn to all sessions and events. This year, 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 pick up their badges and register. 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, Tours & Plant Tour

WHERE TO GO FOR LUNCH

Lunch will be available in the Westin at the Café on the lobby level (5th Floor) and at food carts located on the 8th floor terrace and on the 6th floor near INFORMS registration. A Starbucks Coffee outlet is located in the hotel lobby (5th floor). The nearby Peachtree Center Mall offers a food court (limited selection on Sunday).

Atlanta 2003 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.

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 9:00am-10:00am
Westin – Roswell 1, 8th Floor

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 Westin Motor Lobby (down the escalator from the main hotel lobby).

Atlanta City Tour
"Parade Down Peachtree"
Sunday, October 19
10:00am-2:00pm $24
Our city tour begins on Atlanta's Peachtree Street and proceeds to the Fairlie Poplar district, Centennial Olympic Park and the Civil Rights Movement landmarks. Lunch on your own, then continue to Buckhead, Atlanta's answer to Nob Hill, with mansion after mansion representing the finest architectural styles.

CNN Studio Tour/Carter Presidential Center
Monday, October 20
10:00am-3:00pm $44
A first-hand look at the fast-paced world of 24-hour network news, with a guided VIP tour that includes the CNN Control Room Theatre, Special Effects Studio, and an on-floor tour of the newsrooms. Lunch on your own, then tour the Carter Presidential Center and Library. Several exhibits focus on important 20th century events.

PLANT TOUR

A limited number of openings may still be available for the Lockheed Martin plant tour. Go to the INFORMS registration desk for information on availability. Buses will leave at the beginning time listed for the tour, and will return to the hotel at the ending time listed. Buses depart from the Westin Motor Lobby (down the escalator from the main hotel lobby).

Note: The Delta Air Lines tour was cancelled.

Lockheed Martin Aeronautics Co.
Tuesday, October 21
9:00am-12:30pm $25
Lockheed Martin Aeronautics Company's site in Marietta, Georgia, is home to the C-130J Hercules transport and the F-22 Raptor air dominance fighter plus many others. The tour will provide you the opportunity to see the assembly lines for aircraft production.

SAFETY FIRST – ATLANTA AMBASSADOR FORCE

Be sure to observe normal safety precautions in downtown Atlanta, as you would in any large city. Don't wear your INFORMS badge outside the hotel and Mart, carry your purse or briefcase securely, and walk with groups of people during the evening. Please also do not leave valuables, such as laptops, in the meeting rooms during breaks and lunch periods.

Downtown Atlanta has a special Ambassador Force of uniformed representatives who are trained to provide information and assistance to visitors and residents. They can give directions to downtown restaurants and businesses, provide escorts to MARTA stations and other locations, and can contact medical assistance or the Police Department. Watch for the Ambassadors in the white pith helmets with the red Ambassador logo – some of them will be riding Segways! Ambassadors are available weekdays 7:00am-10:00pm, Saturday 8:00am-10:00pm, and Sunday 8:00am-7:00pm. For an escort during those hours, call 404-215-9600.

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.



© Kevin C. Rose

High Museum of Art

SATURDAY, OCTOBER 18

INFORMS Membership Meeting & Reception
5:00pm-6:00pm
Westin – Vinings, 6th Floor
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.

Minority Issues Forum Reception
6:00pm-8:00pm
Westin – International H, 6th Floor
Come meet old friends, make new ones, and talk about unique intellectual issues and opportunities! This reception is sponsored by the Industrial and Operations Engineering Department at the University of Michigan, the Industrial Engineering and Management Science Department at the Northwestern University, and Professor Robert Bixby of Rice University.

SUNDAY, OCTOBER 19

Breakfast for New Members & First-Time Attendees
7:00am-8:00am (Ticket Required)
Westin – Plaza Ballroom, 10th Floor
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
Westin – Plaza A, 10th Floor
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 SAP, Yale University and Case Western Reserve University.

Welcome Reception
7:30pm-9:00pm
Mart – Exhibit Hall
Wear Badge For Admission. Meet with colleagues and visit the exhibits while enjoying great food. Cash bar, complimentary soft drinks. 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.

Women in OR/MS Forum Reception
8:00pm-10:00pm
Westin – Plaza B, 10th Floor
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 Georgia Institute of Technology.

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

MONDAY, OCTOBER 20

Welcome & Awards Ceremony
11:40am-12:30pm
Westin – Peachtree Ballroom, 8th Floor
Join the INFORMS Board and Atlanta 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 Award, 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 Award, Philip McCord Morse Lectureship Award and INFORMS Expository Writing Award. New for 2003 are the Bonder Scholarship for Applied OR in Military Applications and the Bonder Scholarship in Health Care.

Minority Issues Forum Business Meeting & Bag Lunch
12:00pm-1:00pm
Westin – Augusta 3, 7th Floor
Please join the members of the Minority Issues Forum for a "bring your own lunch" discussion and technical meeting. Agenda items for the meeting include new officer appointments, graduate student poster sessions at upcoming meetings and perennial updates for OR/MS Today and OR/MS Tomorrow.

COIN-OR Users Meeting & Bag Lunch
12:00pm-1:15pm
Westin – International A, 6th Floor
Anyone interested in open-source software tools, data sets, models and standards for operations research is encouraged to attend. The meeting room is conveniently located near food vendors. Bring your 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
Westin – Atlanta E, 7th Floor
CPMS, the Practice Section of INFORMS, sponsors this workshop on topics of interest to isolated practitioners, the "Lone Rangers" of OR/MS. The 20th 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
World of Coke/Georgia Freight Depot
7:30pm-9:30pm
Wear badge for admission. Buses depart from the hotel Motor Lobby (down the escalator from the main hotel lobby) beginning at 7:00pm. Buses will run continuously between the Westin and the reception (trip is only 5-10 minutes), with the last bus leaving the reception at 9:45pm.

The Georgia Freight Depot and World of Coke, two unique buildings on either side of a beautiful urban plaza, provide the perfect venue for our General Reception. Great food and drinks (cash bar, with complimentary soft drinks) will be provided at the Freight Depot. It's just a short walk across the plaza to the World of Coke museum, where memorabilia and hands-on displays provide a fun look at all things Coca Cola. The Freight Depot itself is one of the oldest buildings in downtown Atlanta, and is located right next to Underground Atlanta, one of the city's shopping and nightclub attractions.

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 21

Women in OR/MS Forum Business Meeting & Luncheon
12:00pm-1:00pm
Westin – Atlanta E, 7th Floor
Interested in issues related to women professionals in OR/MS? Come join us for lively conversation at our business meeting. Sponsored by Georgia Institute of Technology, School of Industrial and Systems Engineering.

Academic/Practitioner Interface Luncheon
12:30pm-1:30pm
Westin – Atlanta C-D, 7th Floor
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.

INFORMS Future Meetings

2004

April 25-27
INFORMS Conference on OR/MS Practice
Applying Science to the Art of Business
Hyatt Regency
Cambridge, Massachusetts
Chair: Grace Lin
www.informs.org/Conf/Practice04/

May 16-19
CORS/INFORMS Joint International Meeting
The Banff Centre
Banff, Canada
Chair: Erhan Erkut
www.informs.org/Conf/CORS-INFORMS2004/

October 24-27
INFORMS Annual Meeting 2004 Denver
Adam's Mark
Denver, Colorado
General Chair: Manuel Laguna
www.informs.org/Conf/Denver04

2005

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/

November 13-16
INFORMS Annual Meeting 2005 New Orleans
New Orleans Marriott and Sheraton New Orleans
Chair: James J. Cochran
jcochran@cab.latech.edu

INFORMS Subdivision Meetings

2003

December 7-10
Winter Simulation Conference 2003
Fairmont Hotel
New Orleans, Louisiana
Chair: David Ferrin
www.wintersim.org

2004

March 7-10
INFORMS Telecommunications Conference
Hilton Deerfield Beach
Boca Raton, Florida
Chair: Kemal Altinkemer
www.informs.org/Conf/Telecom04/

June 23-25
INFORMS Applied Probability Society Conference
The Peninsula Palace Hotel
Beijing, China
Chair: Hong Chen
hchen@ckgsb.com

June 24-26
INFORMS Marketing Science Conference
Erasmus University
Rotterdam, The Netherlands
Chair: Stefan Stremersch
www.few.eur.nl/few/conf/marketing-science2004

July 1-2
INFORMS MSOM Conference 2004
Multi-Echelon Inventory (June 30)
Technische Universiteit Eindhoven
Eindhoven, The Netherlands
www.tm.tue.nl/opc/msom2004/

December 5-8
Winter Simulation Conference 2004
Hilton Washington
Washington, DC
Chair: Jeff Smith
jsmith@auburn.edu

2005

January 5-7
INFORMS Computing Society Conference
Loews Annapolis Hotel
Annapolis, Maryland
Co-Chairs: Bruce Golden
bgolden@rhsmith.umd.edu
Ed Wasil, S. Raghavan

June 16-19
INFORMS Marketing Science Conference
Emory University
Chair: Douglas Bowman
doug_bowman@bus.emory.edu

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

For Practitioners/Poster Session

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

Focus on Practice
Sunday – Tuesday
Track 3 – Westin, International C, 6th Floor
Track 4 – Westin, International D, 6th Floor
Real-world applications are the focus of a special program, designed for both practitioners and academics. Each 1½-hour session offers a presentation by an invited speaker or panel discussion, with presenters from IBM, Forrester Research, Praxair, Georgia Pacific and Manhattan Associates, as well as leading universities. Practitioners and academics are encouraged to attend. CPMS, The Practice Section of INFORMS, also offers several panels on OR careers and consulting.

Tutorials
Sunday – Wednesday
Track 11 – Westin, Augusta 1, 7th Floor
These 90-minute sessions offer an in-depth look at current methodologies. Topics include call center modeling, spatial information metadata for web searching, web-enabled DSS and other key topics.

Software Demonstrations
Sunday – Tuesday
Track 47 – Westin, Atlanta G, 7th Floor
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.

2003 Franz Edelman Award Reprise
Sponsored by CPMS, The Practice Section of INFORMS

First Place: Canadian Pacific Railway and MultiModal Applied Systems
Keynote: Perfecting the Scheduled Railroad - Model-Driven Operating Plan Development
Monday, October 20
3:10pm-4:00pm
Westin, Peachtree Ballroom E, 8th Floor

Second-Place: United Parcel Service, MIT and US Air Force Academy
Planning the United Parcel Service Air Network
Monday, October 20
4:30pm-6:00pm
Track 4, Westin, International D, 6th Floor

Daniel H. Wager Prize Competition
Sponsored by CPMS, The Practice Section of INFORMS
Monday – Tuesday
Westin – International D, 6th Floor
Contestants from GE Plastics, Lucent, University of North Carolina and other organizations present their best projects in this competition that emphasizes the quality and coherence of implemented OR work.

CPMS Isolated Practitioner Workshop & Reception
Monday, October 20
6:00pm-7:00pm
Westin – Atlanta E, 7th Floor
CPMS, The Practice Section of INFORMS, sponsors this workshop on topics of interest to isolated practitioners, the "Lone Rangers" of OR/MS. The 20th 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.

Academic/Practitioner Interface Luncheon
Tuesday, October 20
12:30pm-1:30pm
Westin – Atlanta C-D, 7th Floor
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, biotechnology and many others.

OR IN PRACTICE POSTER SESSION

Sunday – Tuesday
Open session with presenters:
Monday, 1:30pm-3:00pm
Mart – Exhibit Hall
Professionals from both the practice and academic arenas will display their work in this poster session on implemented projects. Initiated by the INFORMS Academic-Practitioner Interface Committee, the session aims to showcase applications of OR/MS in different industries and to stimulate discussion between practitioners and academics. Poster presenters will be available to explain and discuss their projects on Monday, Oct. 20, 1:30pm-3:00pm.

Poster Session Committee
Keith Hollingsworth, Morehouse College, Chair
R. Jean Ruth, General Motors R&D Center
Markus Ettl, IBM Research

POSTERS

Optimizing Dynamic Repair Decisions in the Site Imbalance Problem of Semiconductor Testing Machine
Chen-Fu Chien, Jei-Zheng Wu, National Tsing Hua University; Chung-Jen Kuo, Taiwan Semiconductor Manufacturing Company

Interaction Value Analysis
Walid Nasrallah, American University of Beirut

Probabilistic Modeling of Population-Based Epidemiology and Treatment Modalities to Determine Global Therapeutic Demand for Hemophilia A
Jeff Stonebraker, Bayer Biological Products

Reducing Airplane Boarding Time at America West Airlines
Menkes H. L. van den Briel, J. Rene Villalobos, Gary L. Hogg, Arizona State University; Tim Lindemann, America West Airlines

Internet Development Standards: Current Practices and a Case Study of Development and Accessibility Standards
John W. Stamey, Jr., Andrew Pavlica, Coastal Carolina University

Constructing A System with Hybrid Data Mining Algorithm for Wafer Bin Map Clustering and Classification
Chen-Fu Chien, Shao-Chung Hsu, National Tsing Hua University; Cheng-Yung Peng, Ding-Hao Lin, Macronix International Co., Ltd.

Combination of Operations Research, Geographic Information System and the Internet for Waste Collection Vehicle Routing Problems
Surya Sahoo, Seongbae Kim, Byung-In Kim, Institute of Information Technology Inc.; Jason Marshall, Waste Management, Inc.

A Bi-Criterion Formulation for Designing Logistics Networks: Case Study
Poornachandra Rao Panchalavarapu, Schneider Logistics Inc.

Build Plan Optimization in a Push/Pull Production Environment
Feng Cheng, Markus Ettl, Grace Lin, Yingdong Lu, IBM; David D. Yao, Columbia University

Dynamic Capacity Allocation During New Product Introduction
Pu Huang, IBM Research; Alan Scheller-Wolf, Sridhar Tayur, Carnegie Mellon University

COFFEE BREAKS

Sunday, Oct. 19

9:30am-10:00am	W – Peachtree Ballroom Foyer, 8th Floor
	M – Meeting Room Foyer
4:00pm-4:30pm	M – Exhibit Hall

Monday, Oct. 20

9:30am-10:00am	M – Exhibit Hall
4:00pm-4:30pm	M – Exhibit Hall

Tuesday, Oct. 21

9:30am-10:00am	M – Exhibit Hall
4:00pm-4:30pm	M – Exhibit Hall

Wednesday, Oct. 22

9:30am-10:00am	W – Peachtree Ballroom Foyer, 8th Floor
	M – Meeting Room Foyer

Special Programs

JOB PLACEMENT SERVICES

INFORMS Job Placement Service
Sunday – Tuesday
Mart – 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 19
Track 6, Westin – International F, 6th Floor
THE INDUSTRY JOB SEARCH
8:00am – 9:30am
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.
THE ACADEMIC JOB SEARCH
10:00am – 11:30am
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.
Time will be provided for questions and answers at both sessions.

Job Fair
Sunday, October 19
12:00pm – 2:00pm
Mart – Exhibit Hall
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 have the opportunity to 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.

2003 Combined Colloquia
Friday – Saturday
Westin – International Rooms, 6th Floor
This year, two programs join forces in a Combined Colloquia. The Doctoral Colloquium is comprised of two tracks (academic and industry), which aim to prepare doctoral students for faculty roles or industry positions by acquainting them with issues they will encounter in both arenas. The Teaching Effectiveness Colloquium is targeted toward faculty and doctoral students who are interested in current trends in teaching in OR/MS. Participants in both colloquia will join together for a welcoming dinner on Friday evening, as well as breakfast, breaks and lunch on Saturday.

CIST 2003 – 8th Conference on Information Systems and Technology
Saturday – Sunday
Westin – Atlanta D-E, 7th Floor
"IT as a Platform for Agility" is the theme of the conference. The goal is to engage academic and industry researchers in a dialogue that examines a broad range of topics consistent with the spirit of this theme.

Nicholson Student Paper Competition
Sunday, October 19
1:30pm-6:00pm
Track 27, Westin – Tower 1402, 14th Floor
The George Nicholson Student Paper Competition honors outstanding student papers in the field of operations research and the management sciences. Up to six awards (first and second place awards and up to four awards for Honorable Mention) may be given upon recommendation of the selection committee.

INFORMS Publications Session
Monday, October 20
8:00am-9:30pm
Track 3, Westin – International C, 6th Floor
The dos and don'ts involved in the technical preparation of OR manuscripts are discussed in this session led by INFORMS Publications Department specialists.

Teachers Program for Atlanta Area Math Teachers
Monday, October 19
8:00am-4:00pm
Westin – Atlanta B, 7th Floor
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.

George B. Dantzig Dissertation Award Competition
Monday, October 20
4:30pm-6:00pm
Track 3, Westin – International C, 6th Floor
The Dantzig Award is given for the best dissertation in any area of OR/MS that is innovative and relevant to practice. The award was established to encourage academic research that combines theory and practice and stimulates greater interaction between doctoral students and the world of practice.

INFORMS Teachers Program: How to Teach the Teachers
Tuesday, October 21
1:30pm-3:00pm
Westin – Vinings 1 6th Floor
Help math teachers near you enrich high school students' appreciation of OR by attending this special session sponsored by the INFORMS Public Awareness committee (PAC).

100th Anniversary of the Birth of Philip M. Morse
Tuesday, October 20
1:30pm-3:00pm
Track 3, Westin – International C, 6th Floor
This special session honors Philip McCord Morse, the founding father of operations research in the United States. Presenters include John D.C. Little, MIT; William Thomas, Harvard University; and Robert M. Oliver, University of California, Berkeley.

Plenary & Keynote Presentations

PLENARY

Sunday, October, 19
11:40am-12:30pm
Westin – Peachtree Ballroom, 8th Floor

Adventures in Policy Modeling: Operations Research in the Community and Beyond

Edward H. Kaplan
William N. and Marie A. Beach Professor of Management Sciences
Yale School of Management
Professor of Public Health
Yale School of Medicine

The literature describing the social role of operations research is somewhat of a puzzle. On the one hand, several authors have denigrated the use of traditional operations research approaches in addressing community problems, yet several studies document successful applications. Arguing that the operations research mindset is itself a great strength, we will review several examples where operations research methods have been employed to the benefit of us all and will preview research opportunities in this exciting area.



Edward H. Kaplan
Edward H. Kaplan is the William N. and Marie A. Beach Professor of Management Sciences at the Yale School of Management, and Professor of Public Health at the Yale School of Medicine. He is best known for applying operations research methods to the design and evaluation of public health policies for the control of HIV/AIDS. More recently he has focused on bioterror response logistics. INFORMS has recognized Dr. Kaplan's contributions with several honors, including the Edelman Award, the Lanchester Prize and the INFORMS President's Award. He has also received awards from the State of Connecticut and the Connecticut Public Health Association for his evaluation of New Haven's needle exchange program, and twice served as Lady Davis Visiting Professor at the Hebrew University of Jerusalem. In February of this year, Dr. Kaplan was elected to the National Academy of Engineering. Before embarking on a career in operations research, Kaplan wanted to be a city planner. Exposure to both urban planning and operations research at MIT convinced him that he could solve more problems and better contribute to society by following the latter route.

OMEGA RHO DISTINGUISHED LECTURE

Sunday, October 19
3:10pm-4:00pm
Westin – Peachtree Ballroom, 8th Floor

Teaching for Learning: Past, Present, and Future

Judith S. Liebman
Professor Emerita of Operations Research
University of Illinois at Urbana-Champaign

Advances in both cognitive psychology and computer technology are changing the educational landscape. Knowing more about how individuals learn makes it clear that lectures using blackboards and chalk, or for that matter overhead transparencies, are rarely the most effective way to impart knowledge and understanding. There are an increasing number of pedagogical approaches now available: active learning, experiential learning, role modeling, games, simulations, lectures, textbooks, testing, etc. How do we choose? Are there approaches particularly useful for teaching operations research and management science? INFORMS has been a leader among engineering and scientific societies in recognizing the importance of teaching effectively. Can we do more?

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 35 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, Judith S. Liebman will be inducted as the 36th Honorary Member of Omega Rho.



Judith S. Liebman
Judith S. Liebman is Professor Emerita of Operations Research in the Department of Mechanical and Industrial Engineering, University of Illinois at Urbana-Champaign. She has been on the faculty there since 1972. From 1986 to 1992 she served as Vice Chancellor for Research and Dean of the Graduate College. Prior to 1972 she served on the faculty at Johns Hopkins University. Dr. Liebman received her B. A. in Physics at the University of Colorado in 1958 and her Ph.D. in Operations Research and Industrial Engineering at The Johns Hopkins University in 1971. Her research areas have included applications of operations research in engineering optimization, health systems, military and civil infrastructure investment, and studies directed towards improving engineering education. She has served on the Committee for Engineering Education of the National Academy of Engineering and has chaired the advisory committee to the College of Engineering and Applied Science at the University of Colorado at Boulder. Dr. Liebman is past president of the Operations Research Society of America, has chaired the Advisory Committee for the National Science Foundation Engineering Directorate, and has served on the Army Science Board. Since 1999 she has served on the University of Colorado Foundation Board of Directors. She has authored or co-authored many research publications and has received numerous awards for excellence in teaching.

Plenary & Keynote Presentations

Reprise Presentation

EDELMAN COMPETITION 2003 FIRST PLACE AWARD WINNER

Monday, October 20
3:10pm-4:00pm
Westin – Peachtree Ballroom E, 8th Floor

Perfecting the Scheduled Railroad: Model-Driven Operating Plan Development

Presenters:
Rob Ritchie, President & CEO, Canadian Pacific Railway

Neal Foot, Senior Vice President Operations, Canadian Pacific Railway

Phil Ireland, Assistant Vice President, Product Design & Interline Management, Canadian Pacific Railway

Carl Van Dyke, President & CEO, MultiModal Applied Systems

Coauthors:
Rod Case and John Fallis, Canadian Pacific Railway

Jason Kuehn and Marc Meketon, MultiModal Applied Systems, Inc.

North American railroads traditionally practice "tonnage-based dispatching" where trains run only when there is sufficient traffic. This results in poor customer service, crew and asset utilization, and additional railcar-handlings. Starting in 1997, Canadian Pacific Railway (CPR) began exploring the concept of running a scheduled railroad in which trains are operated with a high degree of schedule adherence. While this has the immediate benefit of improving customer service and asset utilization, it could also result in an excessive number of trains in operation and a dramatic increase in costs. Working with MultiModal Applied Systems, CPR employed new decision support tools that enabled the company to develop an operating plan that was tightly matched to their traffic patterns. This scheduled railway approach significantly improved customer service and reduced operating costs by $170M(US)/$300M(CAN) from the cost base.

KEYNOTE

Monday, October 20
3:10pm-4:00pm
Westin – Peachtree Ballroom B, 8th Floor

Corporate–Academic Research Collaboration: Directions and Hot Topics

Daniel C. Pantaleo
Vice President, SAP University and Innovation Alliances
SAP Global Communications
SAP AG

Recent literature and research clearly indicate that for today's corporations to continue to thrive and survive they must develop, effectively manage, and be fully committed to a process and environment that facilitates product and business process innovation. That is a complex mission not easily achieved. The process of accomplishing an ingrained innovation culture is fraught with inertia, clouded by the drive for revenue, and frustrated by politics. One of the most effective ways for a company to stimulate innovative thinking among its personnel is to establish an active and effective program of interaction with thought leaders and researchers on university campuses. The presentation will examine key elements for success and an implementation model for such a program. It will also consider topics that are of interest and importance to corporations in the present market environment.



Daniel Pantaleo
After a career of 25 years in higher education as a faculty member, Fulbright Scholar, dean, academic vice president and provost, Daniel Pantaleo spent four years as Vice President for Product Development with an interactive multimedia education and training developer. He left that post in 1997 to assume the responsibilities of Program Manager for SAP America's University Alliance Program where he has been able to apply his knowledge of higher education and interactive learning to significantly develop the program. Expanding his responsibilities, he was then appointed Director of Higher Learning Initiatives for SAP America with responsibility for several higher learning projects including the University Alliance Program throughout all the Americas. Dr. Pantaleo was appointed to lead the SAP Innovation Institute as its Vice President in October 2000. The SAP Innovation Institute is responsible for identifying and facilitating collaborative research projects with universities, an Executive Education program, and the University Alliance program. In July 2003, Dr. Pantaleo became part of the SAP Global Communications organization with global responsibility for the University and Innovation Alliances Program. He holds a B.S. in chemistry from Manhattan College and a Ph.D. in Inorganic Chemistry from Emory University. He served as a Fulbright Scholar in Science Education in the Philippines, held a post-doctoral appointment in the chemistry department at Louisiana State University, and took post-doctoral coursework in astrophysics at Georgia State University.

KEYNOTE

Tuesday, October 21
11:40 am-12:30pm
Westin – Peachtree Ballroom E, 8th Floor

Synchronizing Global Commerce: Operations Research at UPS

James Holsen
Vice President of Engineering
United Parcel Service

Founded in 1907 as a humble messenger company in the United States, UPS has grown into a $32 billion corporation by clearly focusing on the goal of enabling commerce around the globe. On any given day, UPS delivers 7 percent of the U.S. GDP and 2 percent of the world's GDP. For UPS, driving efficiencies and streamlining operations aren't merely strategic imperatives, they are a matter of survival. Optimizing a network of 360,000 employees, 88,000 vehicles, the world's 11th-largest airline and 1,700 operating facilities in over 200 countries is a serious undertaking rooted in a culture of operations research.

Jim Holsen will discuss the role of operations research in the 21st century multinational corporation, the challenges of integrating research into the operation, and the sustainable competitive advantages of enterprise-wide and indeed supply-chain-wide network optimization. He will also discuss how network optimization plays a central role in UPS's vision of synchronizing global commerce–coordinating and expediting the flows of goods, information and funds among trading partners around the world.



James Holsen
As Vice President of Engineering for United Parcel Service, James Holsen directs international and domestic strategic planning for the industrial, plant and automotive engineering groups, and the data systems that support the global UPS operations. He began his UPS career in 1975 in Wisconsin as a package car driver. He subsequently held several operations and engineering positions of increasing responsibility in the United States and internationally prior to becoming the Corporate Strategic Planning Manager in 1995. While the Strategic Planning Manager, Mr. Holsen was responsible for long-term strategic planning of U.S. and International operations, including facility acquisition, planning, technology and engineering. In 1996, he became UPS's Corporate Industrial Engineering Manager for the United States and three years later accepted additional responsibilities for the international group with his promotion to Vice President. Mr. Holsen graduated from Marquette University.

KEYNOTE

Tuesday, October 21
11:40 am-12:30pm
Westin – Peachtree Ballroom B, 8th Floor

Introducing the New INFORMS Campaign to Market the Profession

Moderator:
Thomas M. Cook, President, INFORMS; Chairman and CEO, Caleb Technologies Corp.

Panelists:
Philip Johnson, President, Philip Johnson Associates

Ralph Oliva, Executive Director, Institute for the Study of Business Markets, Smeal College of Business, Pennsylvania State University

Irvin J. Lustig, Manager of Technical Services, ILOG, Inc.

Most of us would agree that we live in a world in need of OR. Yet the world continues to lack the proper level of awareness of the profession, its value and its impact. In response, an INFORMS communications committee under the direction of Thomas M. Cook has spent the past year developing a strategy to market the profession of OR and increase awareness among two key audiences: business and the press. Come hear about the launch of this exciting campaign as key members of the communications committee present the plan and campaign creative.

Plenary & Keynote Presentations

IFORS DISTINGUISHED LECTURE

Tuesday, October 21
3:10pm-4:00pm
Westin - Peachtree Ballroom E, 8th Floor

Minimum Test Sets

Jan Karel Lenstra
General Manager
CWI, the Centre for Mathematics and Computer Science

Given a number of items and a collection of subsets, called tests, find a smallest number of tests that enable one to distinguish between each pair of items. I will describe several practical settings in which this problem occurs and discuss a variety of approaches to obtain optimal or approximate solutions. I will make an attempt to put these approaches in a historical context.



Jan Karel Lenstra
Jan Karel Lenstra is General Manager of CWI, the Centre for Mathematics and Computer Science in Amsterdam. He has been on the research staff of CWI; on the faculty of the Technische Universiteit Eindhoven, where he served as Dean of Mathematics and Computer Science; and at the Georgia Institute of Technology. His research interests are in combinatorial optimization–in particular sequencing and scheduling, complexity, approximation and local search. He is co-editor of 15 books, including *The Traveling Salesman Problem, History of Mathematical Programming* and *Local Search in Combinatorial Optimization.* He has been chair of the Mathematical Programming Society and of the Koninklijk Wiskundig Genootschap, and editor-in-chief of *Mathematics of Operations Research*. He is editor-in-chief of *Operations Research Letters.*

** Illustration represents traveling salesman tour of 25,081 cities*

KEYNOTE

Tuesday, October 21
3:10pm-4:00pm
Westin - Peachtree Ballroom B, 8th Floor

What is OR?

Moderator:
Michael H. Rothkopf, INFORMS President-Elect; Professor, RUTCOR, Rutgers University

Panelists:
John D.C. Little, Professor, Massachusetts Institute of Technology

George Nemhauser, Institute Professor, Georgia Institute of Technology

Randall S. Robinson, Retired Practitioner

Robert Eugene Woolsey, Professor, Colorado School of Mines

Who are we? What is it that we do that makes us valuable and successful? What, if anything, distinguishes us from other professions? The elders of our tribe will discuss its history and possible implications of that history for the course we should currently follow.

©Patrick Bonz/Habitat for Humanity International



College students raising a wall of a Habitat House in Columbus, Georgia

Westin – Augusta 1, 7th Floor

SUNDAY, OCTOBER 19

■ SA11
8:00am - 9:30am
An Introduction to Call Center Modeling
Ger Koole, Vrije Universiteit

First we show how call centers function and what their main characteristics are. Then we discuss the current practice in workforce planning, which is the main topic where mathematical modeling is (implicitly) used on a daily basis in thousands of call centers worldwide. Workforce planning consists of forecasting, determining occupancy levels, and shift determination. We discuss how commercial software tools tackle the different steps of workforce planning, and show where improvements can be useful. Here we concentrate on forecasting and queueing models for determining the right occupancy levels. Next we discuss issues that go beyond the baseline model: multi-channel customer contacts and multiple skills. We discuss both planning and online control issues.

■ SC11
1:30pm - 3:00pm
Hybrid Approaches to Model-Free Reinforcement Learning Controllers
Warren E. Hearnes II & Augustine Esogbue, Georgia Institute of Technology

Complex processes are characterized by uncertainties in behavior or measurement. Model-free reinforcement learning methods are potent and capable approaches for intelligent control. We examine the hybrid approach our laboratory developed using asynchronous dynamic programming and fuzzy sets to learn effective control laws for several terminal-control problems. Simulated demonstrations are shown.

■ SD11
4:30pm - 6:00pm
Fuzzy Probabilities/Sets in OR/MS
James J. Buckley, University of Alabama

We first discuss how to obtain fuzzy sets for probabilities and other parameters used in models in OR/MS. The fuzzy set captures the uncertainty in the estimator when its exact value is unknown and is estimated from data or from expert opinion. We then propagate these uncertainties, using fuzzy sets and standard fuzzy operations, through the OR/MS model. When the model is an optimization problem the fuzzy problem produces max/min[fuzzy set}, where this fuzzy set could represent profit/cost. We also discuss how we might solve the fuzzy optimization problems.

MONDAY, OCTOBER 20

■ MA11
8:00am - 9:30am
Looking for a Job? Sounds Like an OR Problem – The Workshop
Richard Hewitt, High Impact Career Products
Scott Ferguson, The Quatrefoil Group

Most people have never been shown how to run an effective job search campaign. Consequently, they follow the herd and wonder why they can't differentiate themselves from the masses. 9.4 million Americans are unemployed and 100% of them are sending resumes, networking, and responding to job ads. It worked in the past, but it's not working now. In this workshop you'll learn why the old methods aren't working now. You'll learn the 9-steps of an effective job search and how to apply those steps to land a new job and move up in your company. You'll also learn how you can apply the 9-steps to market the skills of your OR group. The 9-step process was developed by Richard Hewitt, Ph.D., an OR practitioner, who will be leading the workshop along with former military intelligence officer Scott Ferguson.

■ MB11
10:00 - 11:30am
Developing Spreadsheet-Based Decision Support Systems
Ravindra Ahuja & Michelle M. Hanna, University of Florida

This tutorial will describe how features in Excel and VBA (Visual Basic for Applications) can be used to develop decision support systems, which take data from spreadsheets, use optimization or simulation models and algorithms to process data, and package it with attractive and user-friendly graphical user interface. The tutorial will highlight the need of teaching these technologies to IE/OR/Management students and will provide the teaching material for a complete course on a CD to interested attendees.

■ MC11
1:30pm - 3:00pm
Developing Web-Enabled Decision Support Systems
Ravindra Ahuja & Abhijit Pol, University of Florida

The ability to extract data from databases and embed analytical decision models within larger systems are some of the most valuable skills required for students entering today's IT dominated workplace. This tutorial will show how to use IT tools to develop decision support systems arising in the practice of IE/OR/Management and to make them web-enabled. It will also describe how to teach courses imparting these skills and will provide the required course material on a CD to interested attendees.

TUTORIALS

■ MD11
4:30pm - 6:00pm
Credit Card Business Intelligence by Using Linear Programming-based Data Mining Techniques
Yong Shi, University of Nebraska-Omaha

This tutorial introduces an end-to-end real-world application of data mining technology, which is motivated by multiple criteria linear programming (MCLP), in credit card business intelligence. How to predict credit card delinquencies and personal bankruptcy in advance and avoid huge charge-off losses is a critical issue in credit card business intelligence. Traditionally, researchers in OR have studied various methods by using linear programming (LP) to solve discriminant problems with a small sample size of data. Recently, the author and his industrial colleagues extended such a research idea into classification via multiple criteria linear programming (MCLP), which differs from statistics, decision tree induction, and neural networks. This new approach has been successfully applied in large real-life credit card databases of First Data Corporation, the world-leading credit card company. The tutorial will first outline the development of both LP and MCLP techniques. Then, it will focus on the details of real-life experimental studies, including modeling, SAS algorithms, computations and knowledge representation in credit card portfolio management decisions.

TUESDAY, OCTOBER 21

■ TA11
8:00am-9:30am
A Structure of Spatial Information Metadata for Web Searching: Fuzzy Set Theoretic Approach
E. A. Shyllon & Gary J. Hunter, University of Melbourne

The current free-text method of reporting spatial metadata retrieves too many documents or "hits." There is a need to find a useful structure or pattern in the spatial information metadata for effective web searching. Like other objects, spatial metadata are documents-objects (fuzzy spatial objects) whose state and behavior are well defined by the information they bear or carry. They have "unique-identifiers" and "state" described by the attributes or core-elements (vague concepts), which can be modeled by fuzzy set.

■ TB11
10:00am-11:30am
Including the Human Dimension in Operations Management Models–Theory and Practice: On the Interface between Operations and Human Resources Management
Wallace Hopp, Northwestern University

This session will discuss past research and research needs in how to connect OR models better with human responses to different work settings. First a senior manager, William Jordan of General Motors R&D, will provide an industry perspective on the role of modeling human behavior on operations management practice. Next, Mark Van Oyen of Loyola University Chicago and Wallace Hopp present frameworks for assessing and classifying manufacturing and service operations with regard to their use of cross-trained (flexible) workers. Finally, John Boudreau, John McClain & Joseph Thomas of Cornell University, and Wallace Hopp probe the interface between operations and human resources by examining how human considerations affect classical OM results. Audience discussion of potential research topics will be encouraged throughout the tutorial.

■ TC11
1:30pm-3:00pm
Technology of the Future of Health Care
Myron Hatcher, California State University

Technology advances have changed the face of health care. This paradigm shift blurred the boundaries between public health, acute care and prevention. Technology's role in the diagnosis, treatment assignment, follow up and prevention will be reviewed and future impact projected. The shift in our expectation for each aspect of health care is the crucial requirement for success.


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Martin Luther King Jr. Birth Home

■ TD11
4:30pm-6:00pm
Optimization for Intensity Modulation Radiation Therapy Treatment Planning
H. Edwin Romeijn, Ravindra Ahuja, James Dempsey, Arvind Kumar & Jonathan Li, University of Florida

The goal of IMRT is to cure or control cancer by delivering a prescribed radiation dose to targets while sparing healthy tissues. We discuss the role of optimization in designing high-quality treatment plans by studying the core so-called fluence map optimization problem, as well as the problems of beam angle optimization and leaf sequencing. We review various methodologies, discuss the power of LP-based approaches, and demonstrate their performance using our in-house treatment planning system.

WEDNESDAY, OCTOBER 22

■ WA11
Nonlinear Optimization in Modeling Environments
János D. Pintér, PCS Inc. & Dalhousie University

We discuss the use of nonlinear (global and convex) optimization software across several development platforms (currently: C, Fortran, Excel, GAMS, and Mathematica). The presentation is mainly based on our algorithm and software development work, including "live" model and solution examples, as well as a review of some interesting challenges and advanced applications.

Software Demonstrations

Westin - Atlanta G, 6th Floor

SUNDAY, OCTOBER 19

■ SB47
10:00am-10:45am
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.

10:45-11:30
Dash Optimization
Nikhilesh Khotekar
nikhilesh@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.

■ SC47
1:30pm-2:15pm
Responsive Learning Technologies, Inc.
Sam Wood
wood@responsive.net

Web-Based Exercises and Cases for Operations and IT Management Courses
Littlefield Technologies is a competitive web-based factory simulator designed for assignments in operations and industrial engineering courses. The HP NADO case is a multimedia web-based case that describes the implementation of an ERP system at Hewlett-Packard. The demonstration of these two products will include technical and pedagogical issues.

2:15pm-3:00pm
Syncopation Software Limited
Chris Dalton
cdalton@syncopationsoftware.com

DPL: From Discounted Cash Flow to Decision Analysis in 20 Minutes
See how quickly and easily DPL takes you from a cash flow spreadsheet to a full decision analysis. The demonstration covers influence diagrams, Excel linking, sensitivity and decision analysis. The demonstration concludes with a pharmaceutical R&D case study, using a decision tree to illustrate the importance of the "fail fast" concept.

■ SD47
4:30pm-5:15pm
Catalyze Ltd.
Adrian Stock
adrianstock@catalyze.co.uk

Introduction to Hiview and Equity MCDA Tools
We will quickly describe the basics of Hiview and Equity and then focus on two main areas. Firstly, in Hiview, verbal judgments using MACBETH will demonstrate the ability to create a model without numerical input. Secondly, in Equity, we will show how trade-offs are used for portfolio tuning.

5:15pm-6:00pm
MINITAB, Inc.
Mary McCarty
mmccarty@minitab.com

MINITAB Release 13 and Quality Companion
We will present a basic introductory demo of MINITAB Release 13 and Minitab Quality Companion. MINITAB is statistical analysis software, whereas the Quality Companion is more of a project management tool. The Quality Companion contains some soft tools like Process Mapping, FMEA, etc. that MINITAB doesn't contain. Quality Companion is a fairly new package that just came out this year.

MONDAY, OCTOBER 20

■ MA47
8:00am-8:45am
Resampling Stats
Peter Bruce
pbruce@resample.com

Resampling Stats
XLMiner: data mining in Excel. CART, neural networks, discriminant analysis, naïve Bayes, k-nearest neighbors, logistic regression and multiple linear regression, association rules, principal components, clustering, boxplots, histograms, matrix plots and dendrograms, and more. Sampling from and scoring to databases and random partitioning of data into training, validation and test data sets.

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

Premium Solver Platform V5.5 and KNITRO Solver Engine
Frontline Systems, developers of the Microsoft Excel Solver, will demonstrate new, faster linear mixed-integer methods in Version 5.5 of the Premium Solver Platform, Large-Scale SQP Solver, and XPRESS Solver; new global optimization methods in our Evolutionary Solver; and the all-new KNITRO Solver, a very large scale interior point nonlinear optimizer.

■ MB47
10:00am-10:45am
Imagine That, Inc.
Dave Krahl
davek@imaginethatinc.com

Extend Simulation Software
Use the simulation tool professionals use most, Extend. The rich modeling environment allows you to introduce simulation concepts to novices and scholarly solution techniques to more advanced students. After all, developing an understanding of process dynamics is as important to students as it is to seasoned modelers. Extend . . . the software of choice for academia.

Software Demonstrations

10:45am-11:30am
Palisade Corp.
Shawn Harahush
sharahush@palisade.com

Overview of @RISK and StatTools
We will give an overview of two powerful Excel add-ins: @RISK and StatTools. @RISK uses Monte Carlo simulation to show you nearly all possible outcomes and account for uncertainty in your spreadsheets. StatTools replaces Excel's statistics with new robust statistical functions and allows you to easily write your own custom statistical procedures.

■ 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 their popular linear, integer, quadratic and general nonlinear optimization tools including the powerful new Global Solver. 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
Paragon Decision Technology B.V.
Johannes Bisschop
johannes.bisschop@paragon.nl

AIMMS for Building (End-User) Optimization Applications and/or Components
Get familiar with the extended possibilities of optimization modeling in AIMMS. The intuitive modeling environment allows you to create a complete end-user application, build strategic decision models, or create optimization components to be embedded within your own application or from within your Excel spreadsheet using the Spreadsheet Add-In. The latest development of Outer Approximation, combining MIP and NLP programs, will be demonstrated.

■ MD47
4:30pm-5:15pm
Maximal Software, Inc.
Bjarni Kristjansson
bjarni@maximalsoftware.com

Introducing New Release of MPL Modeling System for Optimization with New and Enhanced Features
We will be demonstrating 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.

5:15pm-6:00pm
ILOG, Inc.
Irv Lustig
ilustig@ilog.com

Special Release Preview - New CPLEX Version 9.0
The coming release of CPLEX 9.0 delivers new breakthrough performance enhancements to all the CPLEX optimizers, as well as other exciting new feature firsts. Learn about diagnosing and fixing infeasible models, solving new problem types, interacting with XML, using logical constructs to describe linear models and more. See it first, at INFORMS.

TUESDAY, OCTOBER 21

■ TA47
8:00am-8:45am
GoldSim Technology Group
Rick Kossik
GoldSim Technology Group
rkossik@goldsim.com

Probabilistic Dynamic Simulation Using GoldSim
GoldSim is a Windows-based probabilistic, dynamic simulation tool designed for building hierarchical models of complex systems to support strategic planning and risk management in business, engineering and science. The software can simultaneously address both continuous and discrete dynamics, and propagates uncertainty using Monte Carlo simulation. The probabilistic simulation philosophy on which the software is based will be discussed. Attendees will learn how GoldSim is different from other approaches (e.g., discrete event simulation, system dynamics, spreadsheets), and the kinds of problems to which the software can be applied. The key features and capabilities of the software will be demonstrated.

8:45am-9:30am
Decisioneering, Inc.
Lawrence Goldman
lgoldman@crystalball.com

Spreadsheet Simulation and Modeling Using Crystal Ball Professional
How will you teach risk analysis to your students? Crystal Ball, one of the most recognized simulation software tools, enhances Excel with the ability to easily perform Monte Carlo analysis, optimization, and time-series forecasting. This presentation will use practical examples to show how Crystal Ball can help quantify and reduce operational and financial risks.

■ TB47
10:00am-10:45am
Aptech Systems, Inc.
Ron Schoenberg
rons@aptech.com

Gauss Mathematical and Statistical System
GAUSS is a full-featured matrix programming language designed to provide rapid development of numerical analysis projects from the very simple in an interactive mode to the most complex and large scale using its thread-safe Engine. It is a 4th generation language optimized to eliminate the tradeoffs such languages have with respect to speed of execution. The GAUSS Engine provides a highly efficient means of delivering high-end analytics to any desktop. With GAUSS, research expertise is optimized through a highly efficient mathematical language combined with fast execution. With the Engine companies can combine the development efforts of both their research departments and IT departments in the deployment of high-end analytical solutions throughout the enterprise. The GAUSS Run-Time Engine (GRTE) allows unlimited royalty-free distribution of applications using the GAUSS Engine.

10:45am-11:30am
Expert Choice, Inc.
James Devlin
jdevlin@expertchoice.com

Strategic Portfolio Alignment
During the demonstration we will provide a brief background on Expert Choice. This will be followed by demonstrations of several different Expert Choice models, to include portfolio management and vendor selection applications.

■ TC47
1:30pm-2:15pm
SAS Institute, Inc.
Ed Hughes
ed.hughes@sas.com

Marketing Decision-Making with SAS Marketing Optimization
SAS Marketing Optimization assists marketing organizations in planning large, complex, multi-product, multi-channel campaigns. A scalable method determines the optimal assignments of offers to individual customers, producing the best results and meeting all relevant requirements. A graphical user interface places these capabilities squarely within the grasp of the marketing campaign decision-maker.

2:15pm-3:00pm
StrategyMap.com, Inc.
Mark Fabish
mark@strategymap.com

StrategyMap Tools Allow Measurement and Management of the Previously Immeasurable
StrategyMap can help you discover and achieve bottom line improvements in less than 90 days. Key areas such as customer service, sales activity management, communication, effect of incentives and team effectiveness can be measured, monitored and managed more effectively. Hidden root causes of problems are uncovered and corrected, and savings are documented.

■ TD47
4:30-5:15pm
Lumina Decision Systems, Inc.
Robert D. Brown, III
rbrown@decisionstrategies.com

Analytica: Beyond the Spreadsheet
Analytica offers intuitive user-interface metaphors better suited to effective business modeling than the standard spreadsheet grid. These metaphors include influence diagrams to visualize model structure, intelligent arrays for multidimensional data, and probabilistic views for uncertainty and risk. According to PC Week: "Everything that is wrong with the common PC spreadsheet is fixed in Analytica."

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April 24-25

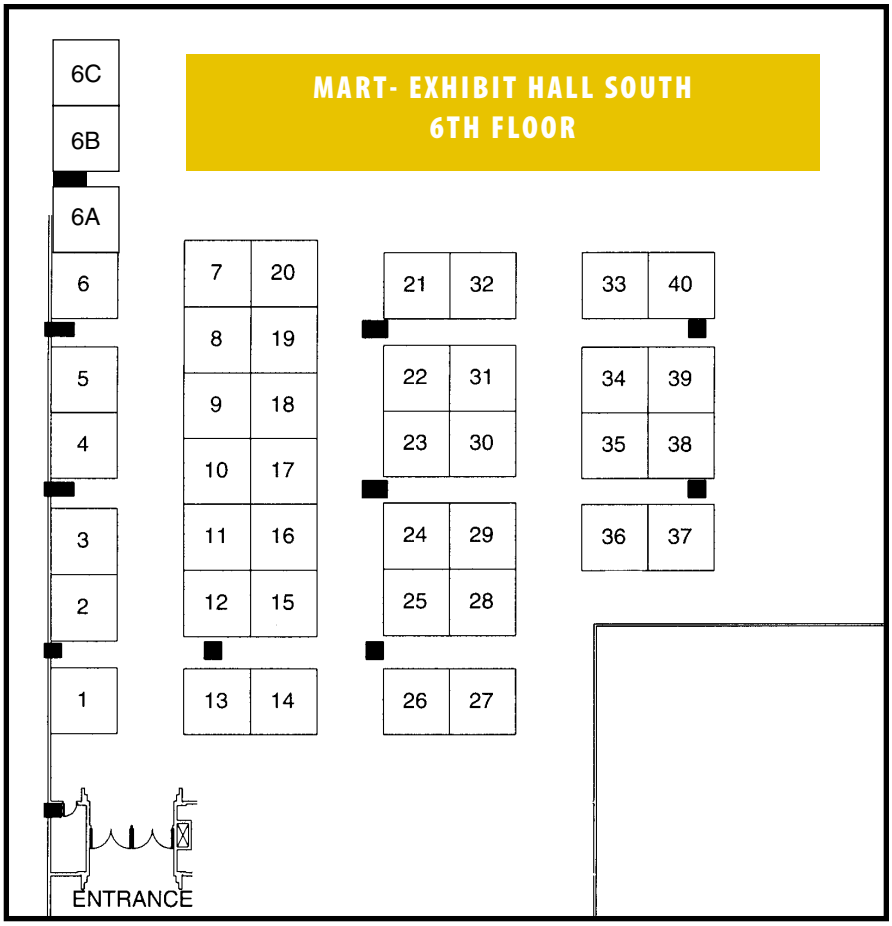
Joint MIT/INFORMS Symposium
April 25

www.informs.org/Conf/Practice04

EXHIBITORS

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

Exhibits Open:
Sunday, Oct. 19, 12noon-5:00pm
7:30-9:00pm
Monday, Oct. 20, 9:00am-5:00pm
Tuesday, Oct. 21, 9:00am-5:00pm



Aptech Systems, Inc. **Booth # 6**
23804 SE Kent-Kangley Rd.
Maple Valley, WA 98038
www.aptech.com
The GAUSS Engine, based on the fast and powerful GAUSS Matrix Programming Language, can be used to add the numerical computing power of GAUSS to multi-threaded, multi-user applications written in C, C++ or Java. GAUSS is used in all fields for solving large-scale optimization and data analysis problems.

Blackwell Publishing **Booth # 27**
350 Main St.
Malden, MA 02148
www.blackwellpub.com
Blackwell Publishing is a proud exhibitor at INFORMS and a leading publisher of books and journals in the fields of operations research and technology management. Blackwell invites attendees to visit our display at the INFORMS meeting. Receive a 20% discount on our books on display and take advantage of journal sample issues and subscription discounts.

Combined Book Display **Booth # 40**
Review titles and special offers from Lawrence Erlbaum Associates, Edward Elgar Publishing, Taylor and Francis and the University of Chicago Press.

Catalyze Ltd. **Booth # 23**
Yew Tree Cottage, Main Rd.
Colden Common
Winchester, Hampshire
United Kingdom SO21 1RR
www.catalyze.co.uk
Catalyze Ltd. provides decision support software and services, based on applied research and software development originated from the London School of Economics. Widely used by decision conferencing and OR professionals round the globe, both Hiview and Equity software packages are designed to support both individual users and the decision conferencing process.

Darden Business Publishing **Booth # 38**
P.O. Box 6550
Charlottesville, VA 22906-6550
www.dardenpublishing.com
Darden Business Publishing will be exhibiting their top selling cases, as well as their multi-media products and simulations. Darden cases provide a real life look at issues and scenarios that will be encountered in the world of business. Selected cases are brought to life visually and interactively with the multi-media cases and simulations.

Dash Optimization **Booth # 28**
560 Sylvan Ave.
Englewood Cliffs, NJ 07632
201-567-9445
www.dashoptimization.com
The Dash Optimization booth will feature live demonstrations of Dash's newest release, Xpress-MP 2003. Along with linear and mixed Integer programming, Dash also offers quadratic programming, non-linear (NLP) and mixed integer non-linear programming capabilities. All of these capabilities will be showcased along with Dash's modeling and programming language Mosel and Xpress-IVE windows development environment.

Decisioneering, Inc. **Booth # 29**
1515 Arapahoe St., Ste. 1311
Denver, CO 80202
www.decisioneering.com
Decisioneering, Inc. provides software and services that simplify spreadsheet risk analysis and improve decision-making. The company offers the Crystal Ball line of desktop tools for Monte Carlo simulation, optimization, and forecasting. Customers include over 90% of Fortune 500 companies and over 400 educational institutions worldwide. Free software demo disks available.

Duxbury/Thomson Learning **Booths # 4 & 5**
10 Davis Dr.
Belmont, CA 94002
www.duxbury.com
Please visit Duxbury's booths at this year's conference to see our latest offerings in quantitative methods. From our exciting list of best selling introductory texts to our provocative list of upper level titles, we have prided ourselves on over 30 years of quality and innovation to quantitative methods.

Elsevier Science **Booth # 16**
P.O. Box 1991
1000 BZ Amsterdam
The Netherlands
www.sciencedirect.com
Elsevier is the publisher of the Handbooks in Operations Research and Management Science (www.elsevier.com/locate/horms) and many OR/MS related journals, such as Decision Support Systems, European Journal of Operational Research, Journal of Operations Management, Omega and Operations Research Letters. All Elsevier journals, in total about 1800, are available on ScienceDirect.

Expert Choice, Inc. **Booth # 19**
1501 Lee Highway, Ste. 302
Arlington, VA 22209
www.expertchoice.com
Founded in 1983, Expert Choice helps business and government organizations around the world with their strategic planning, project portfolio management, resource allocation, vendor selection, risk assessment and human resources management challenges. Today, more than 15,000 individuals in 60 countries, including 25% of the Fortune 500 and half of U.S. Federal Agencies rely on Expert Choice's decision support software and services to help them make better, faster, more justifiable decisions and improve their bottom lines. For more information on Expert Choice, visit our web site.

Frontline Systems, Inc. **Booth # 17**
P.O. Box 4288
Incline Village, NV 89450
www.solver.com
Frontline Systems, developers of the Microsoft Excel Solver, will demonstrate the Premium Solver Platform, our compatible Excel upgrade offering greater capacity, speed and ease-of-use; our Solver DLL Platform for custom applications; and new versions of our Large-Scale SQP Solver, XPRESS Solver, and the all-new KNITRO Solver. Free demo CDs available.

GAMS Development Corp. **Booth # 30**
1217 Potomac St. NW
Washington, DC 20007
www.gams.com
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.

GoldSim Technology Group **Booth # 18**
18300 NE Union Hill Rd., Ste. 200
Redmond, WA 98052
www.goldsim.com
GoldSim provides general-purpose simulation software designed to help you understand complex systems and make better decisions. Key features that make this feasible include the ability to: quantitatively address the inherent variability and uncertainty present in real-world systems; superimpose the occurrence and consequences of discrete events onto continuously varying systems; build top-down models using hierarchical containers that facilitate the simulation of large, complex systems while keeping them easy to understand and navigate; dynamically link external programs or spreadsheets directly into your GoldSim model; and create custom designed graphical interfaces to explain and demonstrate your models.

ILOG, Inc. **Booth # 12**
1080 Linda Vista Ave.
Mountain View, CA 94043
www.ilog.com
Stop by the ILOG booth to pick up a free ILOG Optimization Technologies CD. Learn more about our newest products, academic programs and the ILOG software tutorial. Get help with your questions or just say hi. See the special Pre-Conference Programs list for information about our $^1/_2$-day ILOG Optimization Technologies Workshop.

Imagine That, Inc. **Booth # 26**
6830 Via Del Oro, Ste. 230
San Jose, CA 95119
www.imaginethatinc.com
Use the simulation tool professionals use most, Extend. The rich modeling environment allows you to introduce simulation concepts to novices and scholarly solution techniques to more advanced students. After all, developing an understanding of process dynamics is as important to students as it is to seasoned modelers. Extend . . . the software of choice for academia.

INFORMS **Booths # 6A & 6B**
901 Elkridge Landing Rd., Ste. 400
Linthicum, MD 21090
www.informs.org
Have a membership question? Want to know what's going on at INFORMS? Need to know the most current benefits and services or the hottest industry trends? Stop by the INFORMS booth to talk to the staff. We have the latest information on networking, meetings, publications, industry happenings and benefits and services. We look forward to seeing you!

INFORMS Future Meetings **Booth # 40**
12 Breakneck Hill Rd., Ste. 102
Lincoln, RI 02865
www.informs.org/Conf/
Come to the booth for a preview of our 2004 and 2005 meetings!

Exhibitors

INFORMS-Marketing the Profession **Booth # 6A**

Most of us would agree that we live in a world in need of OR. Yet the world continues to lack the proper level of awareness of the profession, its value and its impact. In response, an INFORMS communications committee under the direction of INFORMS President Tom Cook spent the past year developing a strategy to market the profession of OR and increase awareness among two key audiences: business and the press. Come learn about the 2004 launch of this exciting campaign. Share your thoughts and learn how you can participate.

Ketron Management Science **Booth # 31**

2001 Jefferson Davis Hwy., #1211
Arlington, VA 22202-3619
www.ketronms.com

Ketron Management Science specializes in design, development and application of mathematical programming optimizers and model management software. The software is used as optimization toolkits by analysts in every sector of the economy. KMS provides support for users of the software from hotline assistance through complete application system development.

Kluwer Academic Publishers **Booths # 24,25**

101 Philip Dr.
Norwell, MA 02061
www.wkap.nl

Kluwer Academic Publishers, a leading publisher of scientific books and journals, invites attendees to visit our display and browse through our latest publications. Receive a 25% discount on all titles on display and pick up free sample copies of our journals. For details on all our publications visit our web site.

LINDO Systems, Inc. **Booth # 1**

1415 North Dayton St.
Chicago, IL 60622
www.lindo.com

LINDO Systems will be highlighting recent enhancements to our popular optimization modeling software including the new global solver. We will be demonstrating LINDO API-our powerful solver engine, LINGO-our integrated modeling language and solvers, and What'sBest!-our large scale Excel solver. Stop by for a free trial CD.

Lumina Decision Systems, Inc. **Booth # 37**

26010 Highland Way
Los Gatos, CA 95033-9758
www.lumina.com

Lumina is pleased to present the premiere of Analytica 3.0. Analytica offers intuitive user-interface metaphors better suited to effective business modeling than the standard spreadsheet grid. It provides hierarchical influence diagrams for creating and communicating model structure, intelligent arrays for multidimensional data, and Monte Carlo for efficient uncertainty and risk analysis. The Analytica Decision Engine allows you to publish your models onto the Web. According to PC Week: "Everything that is wrong with the common PC spreadsheet is fixed in Analytica."

Maximal Software, Inc. **Booth # 8**

2111 Wilson Blvd., Ste. 700
Arlington, VA 22201
www.maximalsoftware.com

Maximal Software is the developer of MPL Modeling System, an advanced modeling language for formulating optimization models. We will demonstrate how MPL provides one of the fastest and most scalable modeling languages on the market and how the OptiMax 2000 Component Library add-on can be used to build customized end-user applications to solve real-world optimization problems.

McGraw-Hill/Irwin **Booths # 10, 11**

Two Penn Plaza, 20th Floor
New York, NY 10121
www.mhhe.com

McGraw-Hill/Irwin is the premier provider of textbooks and technology resources across the business and economics disciplines, with specialization in business statistics, business math, and operations management. McGraw-Hill/Irwin publishes instructional materials targeted at the higher education and professional markets, delivering a wide variety of student and instructor resources.

MINITAB, Inc. **Booth # 35**

1829 Pine Hall Rd.
State College, PA 16801
www.minitab.com

MINITAB' Release 13 is a comprehensive and easy-to-use statistical software package for data analysis and presentation. From start-ups to Fortune 500 companies, quality professionals worldwide trust MINITAB to provide the methods they need: basic and advanced statistics, regression and ANOVA, SPC, DOE, reliability, Gage R&R and more. For a free demo, go to www.minitab.com/demo.htm.

National Science Foundation **Booth # 36**

Directorate for Engineering
4201 Wilson Boulevard
Arlington, VA 22230
www.nsf.gov

The Engineering Activity supports fundamental research on engineering systems, devices, and materials, and the processes and methodologies that underpin them. Engineering investments contribute to technological innovation that is vital to the nation's future economic strength, security and the quality of life of its citizens.

Palgrave Macmillan **Booth # 9**

Houndmills, Basingstoke
Hampshire RG21 6XS
United Kingdom
www.palgrave-journals.com

Palgrave Macmillan is a global academic publisher with a fast-growing journals portfolio in a wide range of topics, including professional business, management and OR. Browse our publications–books, journals, reference and electronic works. Sample our NEW journal *Knowledge Management Research & Practice* and pick up information on a forthcoming title for 2004- *European Management Review.*

Palisade Corp. **Booth # 14**

31 Decker Rd.
Newfield, NY 14867
www.palisade.com

Palisade Corporation is the leading developer of software for risk, decision and statistical analysis as well as optimization. Flagship products include @RISK, the DecisionTools Suite, and StatTools, which are used by tens of thousands in hundreds of industries worldwide.

Paragon Decision Technology B.V. **Booth # 34**
Julianastraat 30
Haarlem
The Netherlands
www.aimms.com
Paragon Decision Technology B.V will present AIMMS® 3, the modeling system that offers: (1) a high-level declarative modeling environment with optimization support built-in, for capturing reality into working models much faster than lower-level programming environments; (2) advanced productivity tools to help you set-up your model intuitively and build a (data driven) GUI via point-and-click; and (3) creation of stand-alone end-user applications or optimization components for other applications.

Resampling Stats **Booth # 39**
612 N. Jackson St.
Arlington, VA 22201
www.resample.com
XLMiner: data mining in Excel. CART, neural networks, discriminant analysis, naïve Bayes, k-nearest neighbors, logistic regression and multiple linear regression, association rules, principal components, clustering, box plots, histograms, matrix plots and dendrograms and more. Sampling from and scoring to databases and random partitioning of data into training, validation and test data sets.

Responsive Learning Technologies, Inc. **Booth #21**
1072 S. De Anza Blvd., #A107392
San Jose, CA 95129-3556
www.responsive.net
RLT sells online supplements and assignments for undergraduate and graduate level courses in operations, industrial engineering, management of information technology, and finance. Products include the Littlefield Technologies factory simulator game, the eBeer supply chain exercise, and an online case describing the implementation of an ERP system at Hewlett-Packard.

SAS **Booth # 32**
SAS Campus Dr.
Cary, NC 27513
www.sas.com
SAS, the leader in analytic and enterprise intelligence, offers integrated, customizable management science and operations research capabilities complemented by broad-based analytic expertise and supported by excellence in data access, data transformation and reporting. Customers worldwide use SAS to model, solve, and communicate solutions to complex strategic and tactical planning problems.

SIAM **Booth # 7**
Society for Industrial and Applied Mathematics
3600 UCSC
Philadelphia, PA 19104
www.siam.org
Visit the SIAM booth to check out our new publications and to hear about the MPS-SIAM Series on Optimization, with John E. Dennis as EIC. There are new books in almost every SIAM series. Recently published books and information about our newest book series will be on hand. You will see sample journal issues of SIAM's renowned journals, plus membership information and applications will be available for those individuals interested in becoming a SIAM member. Don't forget to pick up a copy of SIAM News for the road.

South-Western/ Thomson Learning **Booths # 2, 3**
10 Davis Dr.
Belmont, CA 94002
www.swcollege.com
South-Western offers a wide spectrum of decision science publications for courses across your curriculum. From our best selling business statistics and management science texts to leading texts in quality, operations, and project management our books engage students, enrich them and enable them to succeed.

Springer-Verlag New York, Inc. **Booth # 13**
175 Fifth Ave.
New York, NY 10010
www.springer-ny.com
Save 20% on a wide selection of books and journals in operations research and management science at the Springer booth. New titles include Schrijver - Combinatorial Optimization, Monte Carlo Methods in Financial Engineering by Paul Glasserman, a new LP volume by George Dantzig and many more titles.

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Our featured imprints–Stanford Business Books and Stanford Economics and Finance–offer professionals books with a foundation in the latest theory and academic research in economics, finance, business strategy, quantitative methods, operations management, and innovation and technology as they have impact on the theory of the firm.

StrategyMap, Inc. **Booth # 33**
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www.strategymap.com
StrategyMap online tools enable significant financial and quality gains in areas such as; customer service, sales-person effectiveness, communication, effect of incentives, team effectiveness, and strategy execution. StrategyMap enables the measuring, automatic monitoring and management of these previously hard-to-measure activities that relate directly to the effectiveness of people.

Syncopation Software Limited **Booth # 22**
11 West Temple Sheen
London SW14 7RT
United Kingdom
www.syncopationsoftware.com
Syncopation Software is a leading provider of analytic software tools. DPL, Syncopation's flagship product, offers powerful tools for decision analysis, risk analysis and real option valuation. DPL links with Excel to bring state-of-the-art uncertainty modeling to the standard platform for financial analysis. DPL Fault Tree allows you to conduct security analyses via structured models of complex systems.

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100th Anniversary - Birth of Philip M. Morse
Saul I. Gass
University of Maryland
sgass@rhsmith.umd.edu

Active Learning in Education
Cesar Malave
Texas A&M University
malave@tamu.edu

Auctions
Wedad Elmaghraby
Georgia Institute of Technology
wedad@isye.gatech.edu

Data Envelopment Analysis
Timothy Anderson
Portland State University
tima@etm.pdx.edu

Keith Hollingsworth
Morehouse College
khollingsworth@morehouse.edu

Data Mining and Knowledge Discovery
Kwok-Leung Tsui
Georgia Institute of Technology
ktsui@isye.gatech.edu

Financial Engineering
Shi-Jie Deng
Georgia Institute of Technology
shijie.deng@isye.gatech.edu

Job Placement Committee
Candace Yano
University of California-Berkeley
yano@ieor.berkeley.edu

New Product Development
Stylianos Kavadias
Georgia Institute of Technology
stylianos.kavadias@mgt.gatech.edu

Nonlinear Programming
Marina Epelman
University of Michigan
mepelman@umich.edu

Operations Research for Medical Applications
Eva Lee
Georgia Institute of Technology
eva.lee@isye.gatech.edu

OR in the Arts: Applications in Music
Elaine Chew
University of Southern California
echew@usc.edu

OR in Biology
Dawn Strickland
Winthrop University
stricklandd@winthrop.edu

Overseas Collaborations
Ileana Castillo
ITESM Campus Toluca
ileana.castillo@itesm.mx

Parallel Computation
Eva Lee
Georgia Institute of Technology
eva.lee@isye.gatech.edu

Practice Track
Lloyd Clarke
ILOG, Inc.
lclarke@ilog.com

Public Health & Health Economics
Susan Griffin
Centers for Disease Control and Prevention
sig1@cdc.gov

Reverse Supply Chains
Julie Ann Stuart
Purdue University
stuart@ecn.purdue.edu

Beril Toktay
INSEAD
beril.toktay@insead.edu

Scheduling
Jay Sethuraman
Columbia University
js1353@columbia.edu

Security and Utility of Confidential Data
Rathindra Sarathy
Oklahoma State University
sarathy@okstate.edu

Semiconductor Manufacturing
Leon F. McGinnis
Georgia Institute of Technology
leon.mcginnis@isye.gatech.edu

Sports, Games and Recreational OR
Andrew Schaefer
University of Pittsburgh
schaefer@ie.pitt.edu

Supply Chain Management
Pinar Keskinocak
Georgia Institute of Technology
pinar@isye.gatech.edu

Julie Swann
Georgia Institute of Technology
julie.swann@isye.gatech.edu

Tutorials
Augustine Esogbue
Georgia Institute of Technology
aesogbue@isye.gatech.edu

Workforce Flexibility and Agility
Esma S.Gel
Arizona State University
esma.gel@asu.edu

Sponsored Cluster Chairs

Applied Probability
John Hasenbein
University of Texas at Austin
jhas@mail.utexas.edu

Mark Lewis
University of Michigan
melewis@engin.umich.edu

Artificial Intelligence
Haldun Aytug
aytugh@ufl.edu

Aviation Applications
Zelda B. Zabinsky
University of Washington
zelda@u.washington.edu

Stefan Karisch
Carmen Systems
stefan.karisch@carmensystems.ca

Computing
Ariela Sofer
George Mason University
asofer@gmu.edu

CPMS, The Practice Section of INFORMS
Frederic Murphy
Temple University
fmurphy@sbm.temple.edu

Daniel H. Wagner Prize Competition
Joseph Discenza
SmartCrane, LLC
joeh@discenza.com

Decision Analysis
George Wu
University of Chicago GSB
george.wu@gsb.uchicago.edu

Dana Clyman
The Darden School
clymand@darden.virginia.edu

E-Business
Arvind Rangaswamy
Penn State University
arvindr@psu.edu

Education (INFORMED-ED)
Janet Wagner
University of Massachusetts
janet.wagner@umb.edu

Energy, Natural Resources & the Environment
Chung-Li Tseng
University of Maryland
chungli@eng.umd.edu

Stephanie Snyder
USDA Forest Service
stephaniesnyder@fs.fed.us

Financial Services
Suresh Nair
University of Connecticut
suresh.nair@uconn.edu

Health Applications
Amy Wilson
University of Minnesota
arwilson@umn.edu

Information Systems
Kaushal Chari
University of South Florida
kchari@coba.usf.edu

Location Analysis
Michael Johnson
Carnegie Mellon University
johnson2@andrew.cmu.edu

Zvi Drezner
California State University-Fullerton
zdrezner@fullerton.edu

Richard Francis
University of Florida
francis@ise.ufl.edu

Marketing Science
Leonard Parsons
Georgia Institute of Technology
len.parsons@mgt.gatech.edu

Military Applications
Victor Wiley
United States Air Force
victor.wiley@afit.edu

Manufacturing and Service Operations Management
Pinar Keskinocak
Georgia Institute of Technology
pinar@isye.gatech.edu

OPTIMIZATION

Global Optimization
János D. Pintér
PCS Inc. / Dalhousie University
jdpinter@hfx.eastlink.ca

Integer Programming
Eva Lee
Georgia Institute of Technology
eva.lee@isye.gatech.edu

Linear Programming & Complementarity
Tamas Terlaky
McMaster University
terlaky@mcmaster.ca

Network Optimization
James Orlin
Massachusetts Institute of Technology
jorlin@mit.edu

Nonlinear Programming
Yin Zhang
Rice University
yzhang@caam.rice.edu

Stochastic Programming
Alexander Shapiro
Georgia Institute of Technology
ashapiro@isye.gatech.edu

Quality, Statistics and Reliability
Fugee Tsung
Hong Kong University of Science & Technology
season@ust.hk

Railroad Applications
Michael Gorman
University of Dayton
michael.gorman@udayton.edu

Revenue Management & Dynamic Pricing
Rene Caldentey
New York University
rcaldent@stern.nyu.edu

Mark Ferguson
Georgia Institute of Technology
mark.Ferguson@mgt.gatech.edu

Simulation
Russell Barton
rbarton@psu.edu

Social Science Applications
Myron Hatcher
California State University
myronh@csufresno.edu

Spreadsheet Productivity Research
Janet Wagner
University of Massachusetts
janet.wagner@umb.edu

Technology Management
Diane Bailey
Stanford University
debailey@leland.stanford.edu

Telecommunications
Luis Gouveia
DEIO-CIO
legouveia@fc.ul.pt

Eli Olinick
Southern Methodist University
olinick@engr.smu.edu

Transportation Science & Logistics
Alan Erera
Georgia Institute of Technology
alerera@isye.gatech.edu

Karen Smilowitz
Northwestern University
ksmilowitz@northwestern.edu

Women in OR/MS
Robin Lougee-Heimer
IBM Research
robinlh@us.ibm.com

Planner

All Plenaries and Keynotes take place in the Westin.

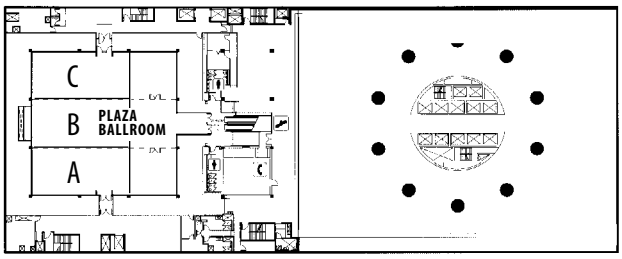
SUNDAY	MONDAY	TUESDAY	WEDNESDAY
SA 8:00 - 9:30	**MA** 8:00 - 9:30	**TA** 8:00 - 9:30	**WA** 8:00 - 9:30
SB 10:00 – 11:30	**MB** 10:00 – 11:30	**TB** 10:00 – 11:30	**WB** 10:00 – 11:30
Plenary 11:40 – 12:30 Edward H. Kaplan Peachtree Ballroom 8th Floor	**Welcome & Awards** 11:40 – 12:30 Peachtree Ballroom 8th Floor	**Keynotes** 11:40 – 12:30 James Holsen Peachtree Ballroom E Marketing the Profession Peachtree Ballroom B	
SC 1:30 – 3:00	**MC** 1:30 – 3:00	**TC** 1:30 – 3:00	
Plenary – Omega Rho 3:10 - 4:00 Judith S. Liebman Peachtree Ballroom 8th Floor	**Keynotes** 3:10 - 4:00 Daniel C. Pantaleo Peachtree Ballroom B Edelman Reprise Peachtree Ballroom E	**Keynotes** 3:10 - 4:00 Jan Karel Lenstra Peachtree Ballroom E What is OR? Peachtree Ballroom B	
SD 4:30 – 6:00	**MD** 4:30 – 6:00	**TD** 4:30 – 6:00	

Meeting Rooms

Track Numbers are shown for Technical Session rooms.

10TH FLOOR–WESTIN

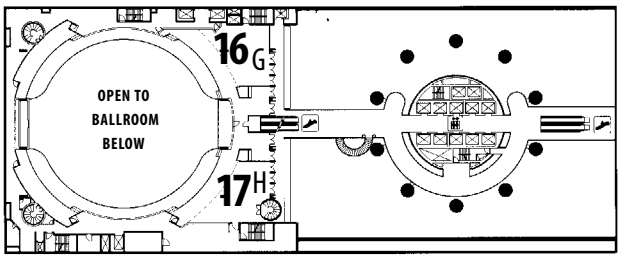
10
Plaza Ballroom



9TH FLOOR–WESTIN

9
TRACKS 16 & 17

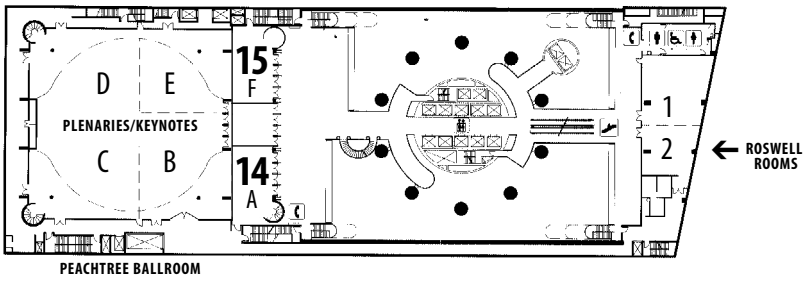
Peachtree Ballroom G&H



8TH FLOOR–WESTIN

8
TRACKS 14 & 15

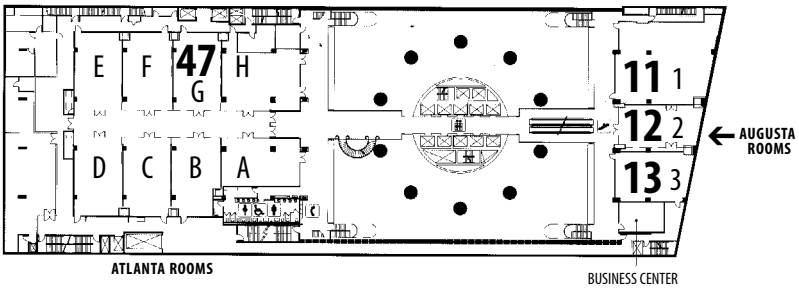
Plenaries and Keynotes
Peachtree Ballroom A-F
Roswell Rooms



7TH FLOOR–WESTIN

7
TRACKS 11–13, 47

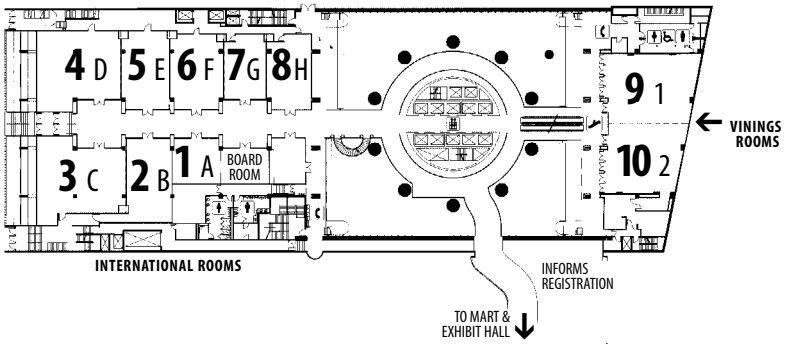
Atlanta Rooms
Augusta Rooms
Business Center



6TH FLOOR–WESTIN

6
TRACKS 1–10

INFORMS Registration
International Rooms
Vinings Rooms



Meeting Rooms

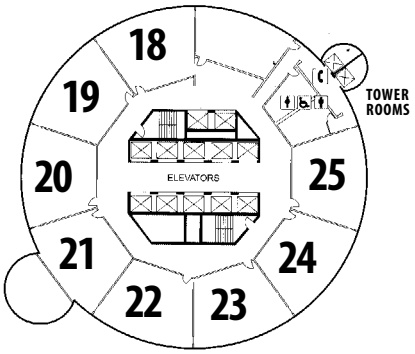
Track Numbers are shown for Technical Session rooms

12TH FLOOR–WESTIN

12

TRACKS 18–25

Tower Rooms 1201–1208

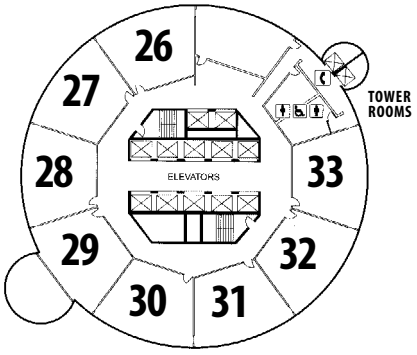


14TH FLOOR–WESTIN

14

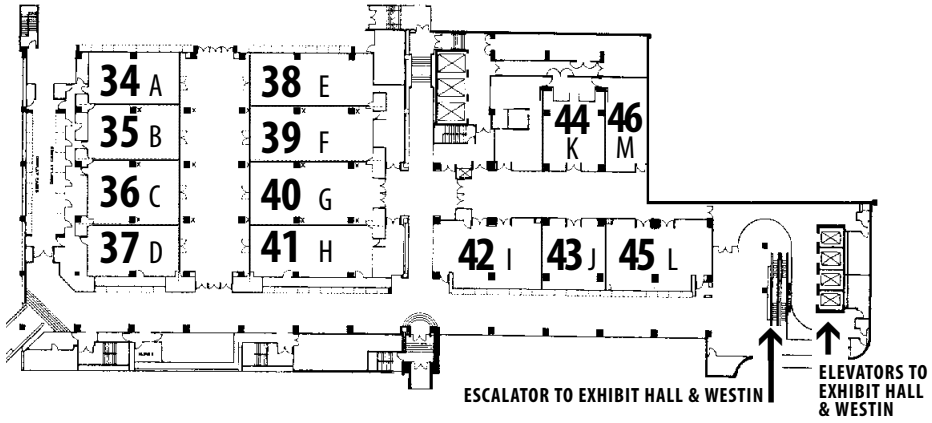
TRACKS 26–33

Tower Rooms 1401–1408



The Mart

TRACKS 34–46



How to Navigate the INFORMS Technical Sessions

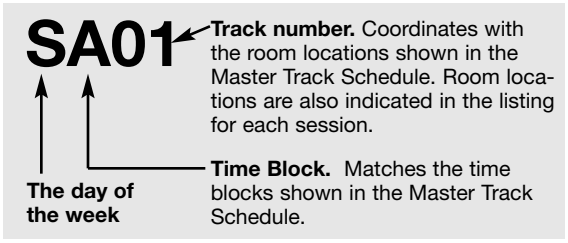
There are four primary resources to help you understand and navigate the INFORMS Technical Sessions:

- This technical session listing (pages 37-232), 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 Author, Session Chair and Session indices provide cross-reference assistance (pages 233-255).
- The "Floor Plans" on pages 256-257 show you where technical session tracks are located.
- The "Master Track Schedule" on pages 258-259. 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 235-248) — 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.

Room Locations/Tracks

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

Westin-Vinings 2, 6th Floor

Mart-Room D

Quick Reference

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

Sunday 8:00am - 9:30am

■ SA01

Westin-Intl. A, 6th Floor

Wireless Networks and Connectivity

Sponsor: Telecommunications
Sponsored Session

Chair: Michael Bartolacci, Assistant Professor of Information Sciences and Technology, Penn State Berks/Lehigh Valley College, 147 Academic Building, 8380 Mohr Lane, Fogelsville, Pa, 18051, USA, mrb24@psu.edu

1 — Optimization Models for W-CDMA Network Design
Eli Olinick, Assistant Professor, Southern Methodist University, EMIS Department, PO Box 750123, Dallas, TX, 75275-0123, United States, olinick@engr.smu.edu, Jeff Kennington, Joakim Kalvenes

Expanding and/or modifying a cost-effective W-CDMA network is a complicated task requiring the careful selection of sites for equipment, and analysis of customer demand and quality of service (QoS) requirements. We propose profit-maximization models that can assist a network planner with the selection of tower sites and the calculation of service capacity.

2 — A Connectivity Decision Support Framework for Wireless Networks
Michael Bartolacci, Assistant Professor of Information Sciences and Technology, Penn State Berks/Lehigh Valley College, 147 Academic Building, 8380 Mohr Lane, Fogelsville, Pa, 18051, USA, mrb24@psu.edu, Roger M. Whitaker, Abdullah Konak, Stuart Allen

The authors propose a framework for allowing wireless device users to adjust their "connectivity" through location-based feedback.

3 — Reliability Modeling and Analysis of Wireless Networks
Abdullah Konak, Assistant Professor of Information Sciences and Technology, Penn State Berks-Lehigh Valley College, PO Box 7009, Tulpehocken Rd., Reading, PA, 19610, United States, konak@psu.edu

Wireless technologies such as cellular networks and ad hoc mobile networks have been highly popular in the last decade. This research focuses on reliability issues related to design and analysis of wireless networks with unreliable components. Differences between wireless and wired networks are discussed in terms of reliability modeling and analysis. Various reliability measures for wireless networks and techniques for the computation of reliability are discussed.

■ SA02

Westin-Intl. B, 6th Floor

Derivative Pricing Methods

Cluster: Financial Engineering
Invited Session

Chair: John Birge, Northwestern University, Industrial Engineering & Management Scie, Evanston, IL, United States, jrbirge@northwestern.edu

1 - Work Reduction in Financial Simulations
Vadim Lesnevski, Cornell University, Ithaca, NY, United States, vadim@orie.cornell .edu, Jeremy Staum

We investigate the possibility of efficiency gains from schemes that reduce the expected cost of a simulated path, which allows more paths given a fixed computational budget. Many such schemes impart bias, so we look at the bias-variance tradeoff in terms of mean squared error. The work reduction schemes we consider are fast numerical evaluation of functions, such as the exponential, as well as changes to simulation structure and sampling schemes.

2 — The Spectral Decomposition of the Option Value
Vadim Linetsky, Northwestern University, Department of IEMS, 2145 Sheridan Rd, Evanston, IL, 60202, United States, linetsky@iems.nwu.edu

This paper develops a spectral expansion approach to the valuation of contingent claims when the underlying state variable follows a one-dimensional diffusion. The Spectral Theorem for self-adjoint operators in Hilbert space yields the spectral. Based on the Sturm-Liouville (SL) theory, we classify Feller's natural boundaries, characterize the qualitative nature of the spectrum, classify all diffusions satisfying given assumptions, and present simplified forms of the spectral expansion.

3 — A Model for Electricity Derivatives with Oligopoly and Infinite Mean in Spot
Steven Kou, Associate Professor, Columbia University, Department of IEOR, New York, NY, United States, sk75@columbia.edu, John Birge

We propose a new model for pricing of electricity derivatives. The model incorporates oligopoly, seasonality, spikes, and mean reverting in spot electricity markets. The model also leads to infinite mean in spot prices and finite mean for futures contracts, which are consistent with empirical observation. Analytical solutions for various option prices are also given.

■ SA03

Westin-Intl. C, 6th Floor

Tutorial: A Time-Based Approach to Modeling Inventory Problems

Cluster: Practice Track
Invited Session
Chair: Kaan Katircioglu

1 — A Time-Based Approach to Modeling Inventory Problems
Kaan Katircioglu, Research Staff Member, Value Chain & Stochastic Models Research, IBM T.J., Watson Research Center, PO Box 218, Yorktown Heights, NY, 10598, United States

We will introduce a time-based approach to modeling and solving a class of inventory problems. This approach does continuous review of inventory and updates the system status continuously. It also enables us to calculate best times to place orders to service the incoming demand units. We will present new optimal policies for some problems obtained by using this approach. We will also present numerous useful measures or quantities and show how to calculate them. We will conclude with comments on the potential opportunities for using this approach.

■ SA04

Westin-Intl. D, 6th Floor

Panel: Having a Career in OR Practice

Sponsor: CPMS, The Practice Section of INFORMS
Sponsored Session
Chair: Frederic Murphy, Professor, Temple University, School of Business and Management, Philadelphia, PA, 19122, United States, fmurphy@sbm.temple.edu

1 — Panel: Having a Career in OR Practice
Moderator: Frederic Murphy, panelists Tom Baker, Harlan Crowder, Joe Discenza, Howard Finkelberg.

Four senior members who have chosen different paths and worked in different kinds of organizations will describe how they made career choices and offer advice from their experiences. Students are invited to learn about their options. Practitioners in the audience are welcome to ask questions and add their experiences. Academics can learn about the career opportunities for their students.

■ SA05

Westin-Intl. E, 6th Floor

Asymptotics and Control of Stochastic Networks

Sponsor: Applied Probability
Sponsored Session
Chair: Kavita Ramanan, Carnegie Mellon University, Department of Mathematical Sciences, Wean Hall, Pittsburgh, PA, United States, kramanan@math.cmu.edu

1 — A Large Deviations Approach to Asymptotically Optimal Control of Crisscross Network in Heavy Traffic
Amarjit Budhiraja, Associate Professor, Department of Statistics, University of North Carolina, Chapel Hill, NC, United States, budhiraj@email.unc.edu, Arka Ghosh

We study the asymptotically optimal control of a well known multi-class queuing network, referred to as the "crisscross network", in heavy traffic. This problem has been studied in detail by Martins et. al.(1996) using viscosity solution methods. Here we present an elementary treatment of the problem using large deviation ideas introduced in Harrison(1998) and Bell and Williams(2001). We obtain an asymptotically optimal scheduling policy which is of threshold type.

2 — Earliest-Deadline-First Service in Heavy-Traffic Acyclic Networks
Steven Shreve, Professor, Department of Mathematical Sciences, Carnegie Mellon University, Pittsburgh, PA, United States, shreve@cmu.edu, John Lehoczky, Shu-Ngai Yeung, Lukasz Kruk

We consider a queueing networks with deadlines. Upon arrival, customers are assigned random lead times drawn from a distribution associated with the customer's class, and each class has a fixed acyclic route. Customers are served by earliest-deadline-first. We model the current lead times as a random counting measure on the real line. Under heavy traffic conditions, the scaled measure-valued lead-time process converges to a deterministic function of the workload process.

3 — Risk-Sensitive and Robust Control for a Class of Stochastic Networks
Paul Dupuis, Professor, Division of Applied Mathematics, Brown University, 182 George St., Providence, RI, 02912, United States, dupuis@cfm.brown.edu, Hui-Ming Pai, Hui Wang

We describe risk-sensitive and robust formulations of a network control problem. In the robust formulation, arrival and service rates are uncertain. A differential game is introduced, in which one player selects the "true" control (e.g., service decisions), while the other player selects the uncertain system parameters. We focus on the following issues: construction of explicit solutions to the game, and structural properties of the optimal "true" controls.

4 — Diffusion Control Problems for Treelike Parallel Station Systems
Rami Atar, Department of Electrical Engineering, Technion, Haifa, Israel, atar@ee .technion.ac.il

We study a diffusion control problem arising as the limit of a dynamic scheduling problem of a queueing system in the heavy traffic regime of Halfin and Whitt. The queueing system consists of several customer classes and many exponential servers grouped in several stations. Our main result is existence and uniqueness for the corresponding HJB equation. An integral formula relating queue length and idle processes serves here as a basic tool and may be of independent interest.

■ SA06

Westin-Intl. F, 6th Floor

Panel: The Industry Job Search

Cluster: Job Placement Committee
Invited Session
Chair: Zelda B. Zabinsky

Co-Chair: Russell, D Meller, United States, rmeller@vt.edu

1 — A Panel Discussion: The Industry Job Search
Zelda B. Zabinsky, Professor, Industrial Engineering, University of Washington, Seattle, WA, 98195, United States, zelda@u.washington.edu, David Kim

The panel will discuss the industry interview process and dos 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.

■ SA07

Westin-Intl. G, 6th Floor

Stochastic Energy Market Models

Sponsor: Energy, Natural Resources and the Environment
Sponsored Session
Chair: Ben Hobbs, The Johns Hopkins Univ., DoGEE, 313 Ames, Baltimore, MD, 21218, United States, bhobbs@jhu .edu

1 — Crossholdings, Information and Prices in a Bertrand-Edgeworth Double Auction
Derek Bunn, Professor, London Business School, Sussex Place, Regents Park, London, NW1 4SA, United Kingdom, DBunn@london.edu, Augusto Ruperez Micola

We present the results of a computational experimentation to study the effects on energy trading of both transparent and opaque information regimes when there are crossholdings on the sellers' side. The computational environment is simulated using the Roth and Erev adaptive learning algorithm, in a capacity constrained (Bertrand-Edgeworth) double auction duopoly.

2 — Learning in Electricity Markets
Enrique Campos-Nanez, University of Virginia, 107 Albert H. Small, Charlottesville, VA, 22904, United States, ecamposn@virginia.edu, Alfredo Garcia

Simple Cournot-Nash adjustment processes illustrate how equilibria may be reached. However, the underlying electricity market game structure may be altered so that adjustment processes, diverge. A class of congestion management protocols is studied for which simple learning algorithms are proven to converge to a Nash equilibrium.

3 — Non-Cooperative Oligopolistic Games under Uncertainty
Talat Genc, University of Arizona, McClelland 401, Tucson, AZ, United States, tgenc@u.arizona.edu, Stanley Reynolds, Suvrajeet Sen

In this presentation we will discuss two-stage and multi-stage games under uncertainty. In this framework, uncertainty is modeled via a scenario tree, and

an equilibrium is obtained for each node of the scenario tree. Under certain assumptions, we show that as volatility increases, expected profitability of all firms also increases.

4 — Computing Cournot Equilibria in Two Settlement Electricity Markets with Transmission constraints
Shmuel Oren, Professor, UC Berkeley, IEOR Departemnt, Berkeley, CA, 94720, United States, oren@ieor.berkeley.edu, Jian (Jay) Yao, Ilan Adler

We formulate a two-settlement equilibrium in competitive electricity markets as a subgame-perfect Nash equilibrium in which each generator solves a Mathematical Programming problem with Equilibrium Constraints (MPEC), given other generators' forward and spot market sales commitments. We implement two solution strategies, one of which is based on Penalty Interior Point Algorithm (PIPA) while the other is based on Steepest Descent (SD) algorithm.

■ SA08

Westin-Intl. H, 6th Floor

spORts: OR in Sports

Cluster: Sports, Games, and Recreational OR
Invited Session

Chair: Matthew Bailey, University of Pittsburgh, Industrial Engineering, Pittsburgh, PA, United States, mdbailey@engr.pitt.edu

1 — Season Pass Pricing in the Ski Industry
Eric Huggins, Assistant Professor of Business, Fort Lewis College, School of Business Administration, 1000 Rim Drive, Durango, CO, 81301, United States, huggins_e@fortlewis.edu, Michael Fry

We discuss lift ticket pricing in the ski industry. We consider a single ski resort that offers both daily lift tickets and season passes that allow skiers all-year mountain access. Our preliminary model attempts to optimize profit for the ski area while limiting potential losses due to stochastic weather conditions; the model also incorporates skier congestion and concession sales.

2 — Agent-Based Modeling of Teamwork and Competition in the NBA
Jeffrey Ohlmann, Ph.D. Candidate, University of Michigan, 1205 Beal Avenue, Ann Arbor, MI, 48109, United States, johlmann@engin.umich.edu

We present an agent-based model of the National Basketball Association. Cooperation among teammates and competition between opposing players is modeled to capture the dynamics of a basketball game. We present results from Swarm simulations of the 2000 NBA season.

3 — Assignment of Swimmers to Dual Meet Events
Maciek Nowak, Georgia Institute of Technology, 765 Ferst Drive, Atlanta, GA, United States, mnowak@isye.gatech.edu, Marina Epelman, Stephen Pollock

We describe a binary integer model that allows an examination of the times for swimmers on a team, compares these to those of the expected opponent, and determines an overall assignment that maximizes the total number of points scored by the squad. Cases with three and four entries per event are analyzed.

4 — Handicapping Two-Person Golf Scrambles
Scott Grasman, Assistant Professor, University of Missouri Rolla, 219 Engineering Management, 1870 Miner Circle, Rolla, MO, 65409-0370, United States, grasmans@umr .edu, Barrett Thomas

In scramble format golf, each player plays a ball off the tee, and then from the better of all resulting lies until the ball is stroked into the hole. Although official handicapping systems have been developed for medal and match play, an official handicapping system for scrambles has yet to be developed and implemented. It is our goal to develop a model that will provide a rationale for assigning a handicap to a two-person golf scramble team.

■ SA09

Westin-Vinings 1, 6th Floor

Incorporating Communication in Engineering Undergraduate Education

Sponsor: Education (INFORM-ED)
Sponsored Session

Chair: Judith Norback, Ph.D, Director of Workplace and Academic Communication, Georgia Institute of Technology, Industrial and Systems Engineering, 765 Ferst Drive, Atlanta, GA, 30332, United States, judith .norback@isye.gatech.edu

Many engineering schools are working to incorporate communication skills into undergraduate curriculum. In this session, faculty will give an update on several universities' approaches, including one that focuses on workplace communication.

1 — Implementation of a Course on Communications in Statistics and Operations Research
Jill Hardin, Ph.D, Assistant Professor, Virginia Commonwealth University, Department of Statistical Sciences & Operations Research, Richmond, VA, 23284, United States, jrhardin@vcu.edu

We discuss implementation of a "writing intensive" course in the Department of Statistical Sciences and Operations Research. Such a course is required for all majors. We discuss student and faculty reactions to the course and observe how the course content and structure may be improved based upon its first offering.

2 — Integrating Communication Skills Across the Industrial Engineering Curriculum
Bryan Norman, Ph.D, Associate Professor, University of Pittsburgh, 1033 Benedum Hall, Department of Industrial Engineering, Pittsburgh, PA, 15261, United States, banorman@pitt.edu, Kim LaScola Needy

The University of Pittsburgh Industrial Engineering Department is undertaking an initiative to better integrate communications skills into the undergraduate curriculum. One goal is to reinforce the importance of communication and demonstrate it in different contexts while taking into account limited faculty resources and the need for curriculum flexibility.

3 — Incorporating Workplace Communication in Engineering Undergraduate Curriculum
Judith Norback, Ph.D, Director of Workplace and Academic Communication, Georgia Institute of Technology, Industrial and Systems Engineering, 765 Ferst Drive, Atlanta, GA, 30332, United States, judith.norback@isye.gatech.edu, Peter J. McGuire, Ph.D.

The Georgia Institute of Technology's School of Industrial and Systems Engineering has two workplace communication initiatives underway, with one funded by the National Science Foundation. Both involve workplace research regarding required communication skills. One focuses on incorporating the skills in Senior Design; the second involves integrating the skills into Technical Communication.

■ SA10

Westin-Vinings 2, 6th Floor

Organizational Theory I

Contributed Session

Chair: Walid Nasrallah, Assistant Professor, American University of Beirut, 3 Dag Hammarskjold Plaza Fl 8, AUB FEA, New York NY 10017, United States, walid@alum.mit.edu

1 — Reconstructing Duality and Dualism of Technology in Organizations
Deniz Tuncalp, Ph.D. Student, Sabanci University, Orhanli Tuzla, Istanbul, TR, Turkey, deniztuncalp@su.sabanciuniv.edu.tr, Meltem Denizel, Ahmet Oncu

Giddens' structuration theory has offered a view of human action and social structure as a mutually interacting duality rather than a dualism. Mouzelis proposes that both duality and dualism is needed. This article considers institutionalization of technology as a structuration . Orlikowski's structuration of technology model is reconsidered to articulate how institutions are formed and modified as an interplay of action and structure, incorporating both duality and dualism of technology.

2 — Autoethospoiesis, Towards a Function that Reveals the Social Systems
Roberto Zarama, Associate Proffesor - Head of the Department of Industrial Ingineering, Univesidad de los Andes, Cra. 1 Este # 18 - A - 70, Bogota, DC, Colombia, rzarama@uniandes.edu.co, Nelson Lammoglia

It is possible to invent a function that reveals the body (ethos) of the social systems. We propose a function composed of three operators. 1) The recurrent works towards a self-construction of the individual knowledge. 2) The recursive refers to the way in which autonomous systems interact. 3) The incursive deals with the rules that subject the subsystems. The invention proposed will be applied in two cases: Development and the production of knowledge.

3 — Emotionally Intelligent Organization Today: Challenges and Advantages
Natalie Chastukhina, Associate, Antora Consulting Group, 535 Market Street, Metropolis, IL, 62960, United States, nchastukhina@antoraconsulting.com

Emotional Intelligence at a macro-level is "organizational ability to intelligently handle matters with empathy." Recent studies show a significant relationship between a degree of organizational emotional intelligence and its success level. Various techniques can be used to develop an emotionally intelligent organization. This paper discusses existing methods and tools of organizational EQ assessment. It presents the EQ development model designed by Antora Consulting Group.

4 — Sequencing with Limited Flexibility
Saif Benjaafar, Professor and Director, University of Minnesota, Center for Supply Chain Research, Minneapolis, MN, 55455, United States, saif@ie.umn.edu, Maher Lahmar

We consider the problem of resequencing a set of prearranged jobs when there is limited resequencing flexibility and sequence dependent changeover costs. Resequencing flexibility is limited by how far forward or backward a job can shift in the sequence relative to its original position. We show how the problem can be modeled as constrained TSP and solved using dynamic programming in time polynomial in the number of jobs. We discuss various applications.

5 — Interaction Value Analysis (IVA) : A Model for Assessing Organizations
Walid Nasrallah, Assistant Professor, American University of Beirut, 3 Dag Hammarskjold Plaza Fl 8, AUB FEA, New York, NY, 10017, United States, walid@alum .mit.edu

Depending on circumstances, a competitive organizational climate may be better or worse for performance than a cooperative one. I replicate this phenomenon by using a model which sums all value added through dyadic interactions between members of an organization. Different organizational forms will maximize this sum under different steady-state queuing conditions and at different game-theoretic equilibria. IVA result mirror published Organization Theory research.

■ SA11

Westin-Augusta 1, 7th Floor

Tutorial: An Introduction to Call Center Modeling

Cluster: Tutorials
Invited Session

1 — An Introduction to Call Center Modeling
Ger Koole, Department of Mathematics, Vrije Universiteit, De Boelelaan 1081a, 1081 HV Amsterdam, Netherlands, koole@cs.vu.nl

First we show how call centers function and what their main characteristics are. Then we discuss the current practice in workforce planning, which is the main topic where mathematical modeling is (implicitly) used on a daily basis in thousands of call centers worldwide. Workforce planning consists of forecasting, determining occupancy levels, and shift determination. We discuss how commercial software tools tackle the different steps of workforce planning, and show where improvements can be useful. Here we concentrate on forecasting and queueing models for determining the right occupancy levels. Next we discuss issues that go beyond the baseline model: multi-channel customer contacts and multiple skills. We discuss both planning and online control issues.

■ SA12

Westin-Augusta 2, 7th Floor

Tutorial: Workforce Agility in Production and Service Operations Systems

Cluster: Workforce Flexibility and Agility
Invited Session

Chair: Seyed Iravani, Assistant Professor, Department of IEMS, Northwestern Unversity, Evanston, IL, United States, s-iravani@nwu.edu

1 — Tutorial: Workforce Agility in Production and Service Operations Systems

Flexibility is a concept used frequently to describe a desirable characteristic of production and service operations systems. It is typically achieved through a variety of mechanisms including the use of cross-trained (agile) workforce. We present frameworks for classifying production systems in terms of their suitability for the use of agile workforce. We also present a survey of the literature on design and control of agile workforce.

■ SA13

Westin-Augusta 3, 7th Floor

Measure Development and Usage: Substantiative and Methodological Issues

Sponsor: Marketing Science
Sponsored Session

Chair: Alka Citrin, Assistant Professor of Marketing, Georgia Institute of Technology, 800 West Peachtree, NW, DuPree College of Management, Atlanta, GA, 30332, United States, alka.citrin@mgt.gatech.edu

1 — Improving Attribute-Importance Measurement: A Reference-Point Approach
Koert van Ittersum, Assistant Professor, Georgia Institute of Technology, Dupree College of Management, 800 West Peachtree, NW, DuPree College of Management, Atlanta, GA, 30332, United States, koert.vanittersum@mgt.gatech.edu, Joost M.E. Pennings, Brian Wansink, Hans C.M. Van Trijp

To increase the validity of attribute-importance measurement, we focus on consumers' valuation curve of an attribute — the idiosyncratic valuation of an attribute at different attribute levels relative to consumers' reference points. We propose two new attribute-importance measures that reflect the determinance and the relevance of an attribute respectively, and show that accounting for the effects of reference points increases the predictive validity of attribute-determinance measures.

2 — Threats to Construct Validity in Cross-Cultural Survey
Nancy Wong, Assistant Professor, Georgia Institute of Technology, 800 West Peachtree, NW, DuPree College of Management, Atlanta, GA, 30332, United States, nancy.wong@mgt.gatech.edu

Construct validity has been a critical issue in evaluating consumer values through survey-based research. These problems are exacerbated when researchers move from the domestic settings into the global domain. Developing approaches to minimize such threats to validity take on greater importance as global trade and communication intensify. The problems of response styles, thinking styles and context dependence are examined and the efficacy of different solutions are discussed.

3 — Criterion Validity: Importance and Assessment
Patty Swafford, Assistant Professor, University of Texas at Arlington, Box 19437, Business Building, 530, Arlington, TX, 76019-0437, United States, swafford@uta.edu

The issue of criterion validity arises in survey based research in the form of a question: "How well do respondents' answers reflect actual characteristics/performance?". Criterion validity can be demonstrated by showing that a strong relationship exists between the scale and surrogate measures of the concept. Using examples from published studies, I discuss different techniques using secondary data for assessing criterion validity.

4 — Scale to Measure Consumer Need for Tactile Input
Alka Citrin, Assistant Professor of Marketing, Georgia Institute of Technology, 800 West Peachtree, NW, DuPree College of Management, Atlanta, GA, 30332, United States, alka.citrin@mgt.gatech.edu

In this paper issues involved in developing a scale to measure consumer need for tactile input in making product evaluations are discussed. Measurement issues related to defining the construct domain in addition to establishing face and construct validity are presented. Finally, methods used to establish nomological validity are highlighted.

■ SA14

Westin-Peachtree A, 8th Floor

Pedagogy: NPD in Business School Settings

Cluster: New Product Development
Invited Session

Chair: Christian Terwiesch, Wharton School of Business, 1319 Steinber-Dietrich Hall, Philadelphia, PA, United States, terwiesch@wharton.upenn.edu

1 — Using the Xpult to Teach Process Capabilty and Experimental Design
Karl Ulrich, Professor, Wharton School, Huntsman Hall, Philadelphia, PA, United States, ulrich@wharton.upenn.edu, Christian Terwiesch

We have developed a small low-cost catapult that provides a hands-on exercise for learning about process capability and experimental design. In this talk, we demonstrate the device — the Xpult— and show how it can be used in courses on operations management, process improvement, product design, or quality.

2 — Product Development as the Integrating Theme in Business Core Classes
Nitin Joglekar, Assistant Professor, Boston University, 595 Commonwealth Avenue, Boston, MA, United States, joglekar@bu.edu, Jonathan Hibbard, Frederic Brunel

Our undergraduate core consists of traditional marketing, operations, information systems, and finance courses integrated into a unique sequence through the new product development project. Statistics from 350 team projects are used to illustrate the strengths of this type of pedagogy . Teaching innovations needed to institute the integrated curricula are highlighted.

3 — Student Projects in Product Devlopment
Christian Terwiesch, Wharton School of Business, 1319 Steinber-Dietrich Hall, Philadelphia, PA, United States, terwiesch@wharton.upenn.edu, Karl Ulrich

Many product development classes require or encourage their students to "get their hands dirty" by developing an actual product over the course of the quarter / semester. The purpose of this session is to discuss the logistics of student proj-

ects for courses we taught to undergraduate students, MBA students, and executive MBA students. Participants of this session are encouraged to share their experiences and best practices.

■ SA15

Westin-Peachtree F, 8th Floor

Innovation/Entrepreneurship

Contributed Session

Chair: Michael Roach, Fuqua School of Business, Duke University, Durham, NC, 27708-0120, United States, mwr3@duke .edu

1 — Enhancing New Product Performance through Innovation: an Empirical Study
Liming Yu, Sun Shing Mansion, Flat G, the 3rd Floor, 27-39 Queen's Road, West, Hong Kong, lmyu@cmhk.com, Jie Yang

Drawing on the resource based view, this study explores the role of innovation diffusion in new product performance. There are external and internal factors impacting on innovation diffusion. New marketing creativity plays an moderating role in the relationship between innovation diffusion and new product performance. The results suggest the need for a firm to promote innovation diffusion to achieve superior proactive and reactive innovation in response to evolving customers' needs.

2 — The Dynamic Role of Technology Push and Demand Pull in the development of Product Life Cycle
WonJoon Kim, Visiting Scholar, Yale University, 470 Prospect Street #81, New Haven, CT, 06511-2176, United States, wonjoon.kim@yale.edu, Jeong Dong Lee

We analyze the profit of firms and consumer's surplus which are determined by the interaction between the supply-side innovation and the dynamic changes of demand environment throughout the product life cycle. In so doing, the Technological Push and the Demand Pull, each as the derivative of the innovation from supply- and demand-side, is modeled to describe their relative role in the development of technological innovation in the global DRAM market.

3 — Knowledge Familiarity in Technological Change
Michael Roach, Fuqua School of Business, Duke University, Durham, NC, 27708-0120, United States, mwr3@duke.edu

Prevalent in the study of technological change is that belief that major advances are made by the introduction of new knowledge. Yet, little is known about the role that knowledge familiarity plays in stimulating change. We examine how varying combinations of core, proximate, and peripheral knowledge influence an innovation's impact on subsequent innovations. Using patent data, we find that proximate knowledge has a greater impact than core knowledge, while peripheral knowledge has no impact.

4 — A Learning Model for New Product Introduction
Debasish Mallick, Assistant Professor, Carlson School of Management, University of Minnesota, Twin Cities, 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 that provides a dynamic, integrated and interactive view of the new product introduction process.

■ SA16

Westin-Peachtree G, 9th Floor

Supply Chain Management - Applications in Health Care

Sponsor: Health Applications
Sponsored Session

Chair: John Blake, Associate Professor, Dalhousie University, Dept of Industrial Engineering, PO Box #1000, Halifax, NS, B3J 2X4, Canada, john.blake@ns.sympatico.ca

1 — User Acceptance and Adoption of a Clinical Reminder System: A Developmental Trajectory Approach
Rema Padman, Professor of Operations & Information Mgmt., Carnegie Mellon University, The Heinz School, Pittsburgh, PA, 15213, United States, rpadman@andrew .cmu.edu, Kai Zheng, Michael Johnson, John Engberg, Herbert Diamond

In this study, we assess medical residents' acceptance and adoption of a clinical reminder system for chronic disease and preventive care management in the ambulatory care environment using a novel developmental trajectory approach. This group-based, semi-parametric statistical modeling method identifies distinct groups, following distinct usage trajectories, among those who recorded use of the reminder system within an evaluation period of 10 months.

2 — Modelling the Healthcare System: A Discussion Paper
Michael Carter, Professor, University of Toronto, Mechanical & Industrial Eng, 5 King's College Rd, Toronto, ON, M5S3G8, Canada, carter@mie.utoronto.ca

The Healthcare Resource Modeling Laboratory at the University of Toronto recently started a project to develop a simulation model of the healthcare system. The initial model involves five acute care hospitals with strategic and operational level components. The key to success is the interface between the levels. The models will include primary care, clinics, home care and long term care facilities. The presentation will discuss the issues and promote discussion of the concepts.

3 — Using Dynamic Programming To Optimize Platelet Inventory.
John Blake, Associate Professor, Dalhousie University, Dept of Industrial Engineering, PO Box #1000, Halifax, NS, B3J 2X4, Canada, john.blake@ns.sympatico.ca

Platelets are a vital blood component with a limited shelf life. In this paper we present two models, based on dynamic programming and simulation, to optimize platelet supply in a supply chain with one producer and three consumers.

■ SA17

Westin-Peachtree H, 9th Floor

Operations Research and Management Science in Public Health: Part I

Cluster: Public Health & Health Economics
Invited Session

Chair: Michael Washington, Industrial Engineer, Centers for Disease Control and Prevention, National Immunization Program, 1600 Clifton Rd, NE, MS E62, Atlanta, GA, 30329, United States, Mtw4@cdc.gov

1 — Optimal Allocation of Resources Based on the Diabetes Report Card for Quality of Care
Stephen Sorensen, United States, zuc7@cdc.gov, Katherine Hicks

The Diabetes Report Card for Quality of Care studied population-based cross-sectional surveys and found that a gap exists between recommended diabetes care and the care patients actually receive. We apply theoretical results from earlier work on the optimal allocation of diabetes interventions to the short-falls in the Diabetes Report Card. We identify budget trade-offs to improve the quality of care to meet recommendations, as well as estimate the effects of budget and equity constraints.

2 — Curing Chlamydial Infection among Asmptomatic Women at Clinics Operating on a Fixed Budget
Guoyu Tao, Health Scientist, CDC, 1600 Clifton RD, MS-E80, Atlanta, GA, 30333, United States, gat3@cdc.gov

We developed an integer linear program to maximize the number of infected women cured from the clinical perspective and to maximize the cost-benefit value from the health care system perspective. The program included 3 age-groups, 2 tests, and 2 drugs. Our findings showed that budget constraint had a great impact on screening coverage, test selection, and treatment. Using ILP, clinic managers can maximize the number of women cured or the cost-benefit value with a fixed budget.

3 — Using Integer Programming Models to Price Combination Vaccines for Childhood Immunization
Edward Sewell, Southern Illinois University Edwardsville, Department of Mathematics and Statistics, Edwardsville, IL, United States, esewell@siue.edu, Sheldon H. Jacobson

Pediatric combination vaccines provide a significant breakthrough for making additional space available in the crowded recommended national childhood immunization schedule. They also provide a combinatorial explosion of choices for health-care providers. Integer programming models are used to determine the value of such vaccines and their impact on pediatric vaccine formularies.

4 — Modeling and Optimizing a Smallpox Vaccination Clinic Using Computer Simulation
Michael Washington, Industrial Engineer, Centers for Disease Control and Prevention, National Immunization Program, 1600 Clifton Rd, NE, MS E62, Atlanta, GA, 30329, United States, Mtw4@cdc.gov, Jacquelyn Mason, Ph.D., Martin Meltzer, Ph.D.

A need exists to plan and prepare for a possible large-scale release of an infectious agent. We constructed a simulation of a mass smallpox vaccination clinic. With the assistance of an optimization tool, we allocated staff (doctors, nurses, and other personnel) to 10 required stations to maximize the total number of people vaccinated. Simulation can help public health officials plan for the most efficient response to a catastrophic infectious disease event.

■ SA18

Westin-Tower 1201, 12th Floor

Recent Developments in Robust Parameter Design

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: Roshan Vengazhiyil, Assistant Professor, Georgia Institute of Technology, School of Industrial and Systems Enginee, 765 Ferst Drive, Atlanta, GA, 30332, United States, roshan@isye.isye.gatech.edu

1 — Statistical Modeling for Experiments with Sliding Levels
Jeff Wu, Coca Cola Chair Professor of Engineering Statistics, Georgia Institute of Technology, School of Industrial and Systems Enginee, 765 Ferst Drive, Atlanta, GA, 30332, United States, jeff.wu@isye.gatech.edu

Design of experiment with related factors can be implemented by using the technique of sliding levels. Two analysis methods were proposed by Taguchi and Wu-Hamada. We show the inadequacy of both methods when the objective is response prediction. We propose a method based on a response surface model, and demonstrate its superiority for prediction. We also study the relationships between these three modeling strategies.

2 — Robustness Experiments with Two Variance Components
Bruce Ankenman, Associate Professor, Northwestern University, Dept. of Ind. Eng., 2145 Sheridan Rd., Evanston, IL, 60208, United States, ankenman@northwestern.edu

In this talk, we discuss the use of assembled designs for robustness experiments when there are dispersion effects on two different variance components. Given experimental budget, an algorithm is provided for finding a nearly D-optimal design for dispersion effect estimation.

3 — A Bayesian Approach for Model-Robust Process Optimization
Ramkumar Rajagopal, Ph.D. Student, Pennsylvania State University, Industrial &Manufacturing Engineering, United States, rram@psu.edu, Enrique Del Castillo

Process optimization approaches start by fitting a parametric model and then optimizing it. Approaches exist to account for the uncertainty in the parameter estimates, but not for the uncertainty in the assumed form of the model. A model-robust Bayesian technique is presented that finds the optimal settings by maximizing the model-averaged posterior predictive density of a response integrated over some given interval.

■ SA19

Westin-Tower 1202, 12th Floor

Integration of Multiscale Wavelet Analysis and SPC for Process Monitoring, Diagnosis, and Control (I)

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: Judy Jin, Assistant Professor, The University of Arizona, Department of Systems & Industrial Eng, Tucson, AZ, 85721-0020, United States, jhjin@sie.arizona.edu

1 — Multiscale Strategy in Statistical Processing Control - A Review and Discussion
Xiaoming Huo, Assistant Professor, Georgia Institute of Technology, Georgia Tech. School of ISyE, 765 Ferst Drive, Atlanta, GA, 30332, United States, xiaoming@isye .gatech.edu

Multiscale methodologies, e.g. wavelets, have been utilized in Statistical Processing Control (SPC). We survey the results in this field, as long as the statistical properties which were discovered in the past two decades in mathematical statistics. We discuss how the findings from the statistical community will impact the applications of multiscale techniques in SPC

2 — Multi-scale Control Charts for High-Dimensional Functional Data: The Feature Extraction
Jye-Chyi Lu, Professor, Georgia Institute of Technology, Groseclose Building, Room 335, 765 Ferst Drive, Atlanta, GA, 30332, United States, JCLU@isye.gatech.edu, Myong K. Jeong

In multi-scale SPC, the importance of each scale may not be equal. The step-down procedure with scale information metric is studied to monitor the process with high-dimensional functional data. Some theoretical properties of the proposed statistics are presented. Simulation study is conducted to study the power functions of the method.

3 — Properties of Applying Wavelet Analyses Toward Change Point Detections
Shing Chang, Associate Professor, Industrial and Manufacturing Systems Engineering, Kansas State University, 228 Durland Hall, Manhattan, KS, KS 66506, United States, changs@ksu.edu

A change point is defined as the locations in a time series where either mean or variance is changed. We apply wavelet analyses on a data series and decompose it into multiple channels which are then used to detect change points. Our simulation results show that the wavelet analysis works the best when change points locate in the middle of a detection window.

4 — An SPC Monitoring System for Cycle-Based Waveform Signals Using Haar Wavelet
Shiyu Zhou, Assistant Professor, University of Wisconsin-Madison, 1513 University Ave., Madison, WI, 53706, United States, szhou@engr.wisc.edu, Baochen Sun, Jianjun (Jan) Shi

In this paper, an Statistical Process Control (SPC) monitoring system is developed for a class of commonly available process measurements — generic cycle-based waveform signals. This system integrates the statistical process control technology and the Haar wavelet transform. With it, one can not only detect a process change, but also identify the location and estimate the magnitude of the process mean shift within the signal. A case study demonstrates the effectiveness of the proposed method.

■ SA20

Westin-Tower 1203, 12th Floor

Reliability Research I

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@rci.rutgers.edu

1 — Machine Replacement with Deterioration and Warranty
Marlin Thomas, Professor, Purdue University, IE, GRIS, 315 N. Grant St., West Lafayette, IN, 47907-2023, United States, muthomas@purdue.edu, Yue Pan

This paper extends recent work on repair versus replacement problems for products with multistage deterioration under warranty. Under the proposed improved policy we show that where an item has large deterioration prior to failure, it is economic to replace that item even under warranty.

2 — Leveraging Reliability Analytics to Minimize Inventory Costs
Brock Osborn, Statistician, GE Global Research, 1 Research Circle, Niskayuna, NY, 12309, United States, osborn@crd.ge.com

Improvements in material science and part design have led to an increased ability to repair expensive parts, reducing the need for part replacement. This paper will discuss statistical techniques combining reliability analytics with operations research to optimize reparable part utilization and minimize inventory costs. Application in GE's service operations will be described.

3 — Reliability Optimization of Systems Susceptible to Common-Cause Failures
David Coit, Associate Professor, Rutgers University, Industrial & Systems Engineering, 96 Frelinghuysen Rd., Piscataway, NJ, 08854, United States, coit@rci .rutgers.edu, Jose Ramirez-Marquez

The redundancy allocation problem is formulated to maximize system reliability considering common cause failures. These are events that cause simultaneous failure of multiple components due to a common cause. A non-linear optimization model is presented. Solutions to an illustrative problem are obtained to demonstrate that consideration of common cause failures will lead to different and preferred "optimal" design strategies.

4 — An Optimum Accelerated Testing Plan Based on Mean Residual Life
E.A. Elsayed, Professor, Rutgers, The State University of New Jersey, Dept of Industrial Engineering, 96 Frelinghuysen Road, Piscataway, NJ, 08854-8018, United States, elsayed@rci.rutgers.edu, Wenbiao Zhao

In this paper, we present a new approach to design accelerated life testing plans. The plan is based on "distribution-free" regression model, namely the proportional mean residual life (PMRL) model. The objective is to design a test plan so that the asymptotic variance of the mean residual life estimate at normal conditions is minimized over a prespecified period of time T. Numerical results and LED experiments show the proposed ALT plan is robust and promising.

■ SA21

Westin-Tower 1204, 12th Floor

Optimization Problems in IT Operations

Sponsor: Computing
Sponsored Session

Chair: Hemant Bhargava, Professor, Graduate School of Management, University of California Davis, Davis, CA, United States, bhargava@computer.org

1 — Optimal Duplication in Cooperative Caching
Kartik Hosanagar, Carnegie Mellon University, Pittsburgh, PA, United States, kartikh@andrew.cmu.edu, Yong Tan

Cooperative caching is a popular mechanism to allow an array of caches to cooperate and serve each others' web requests. The extent of duplication of content in cooperating caches presents a challenging operational problem to cache managers. Protocols with no duplication of content are able to store a large number of objects and increase the cache array hit ratio. The drawback is that a given cache can store a smaller fraction of the content resulting in a lower local hit ratio and thus higher latencies. Latency can be minimized by increasing duplication but at the cost of lower array hit ratios. In this paper, we analyze this trade-off and propose an approach to determine optimal levels of duplication.

2 — Applying Optimization Techniques for Enabling Compute Resource Virtualization
Helen Thomas, Carnegie Mellon University, United States, hthomas@andrew.cmu.edu, Kaushik Dutta, Debra VanderMeer, Anindya Datta

Compute resource virtualization, i.e., pooling a set of compute resources (e.g., memory, CPUs, JVMs) so that they can be allocated/de-allocated on demand, has the potential to dramatically improve IT efficiency and reduce data center costs. In this presentation, we introduce the challenges of compute resource virtualization from an OR/MS perspective and discuss the application of optimization techniques to address these challenges.

3 — Energy-Efficient Multi-Path Routing in Unreliable Wireless Sensor Networks
Yalcin Akcay, Koc University, Rumeli Feneri Yolu, Sariyer, Istanbul, 80910, Turkey, yakcay@ku.edu.tr, Ozgur Ercetin

Wireless sensor networks (WSNs) have emerged as a potential data gathering technology with the advances in micro-sensors, low cost wireless communication systems and embedded microprocessors . Prolonging the lifetime of these networks is a prominent concern due to low battery capacities. We consider a WSN with multi-path routing to ensure the availability of sensor data to the monitor. We use a multi-commodity network flow model to formulate the lifetime maximization problem in this setting.

■ SA22

Westin-Tower 1205, 12th Floor

Real Time Analysis Support to the Warfighter

Sponsor: Military Applications
Sponsored Session

Chair: Harry Conley, HQ Air Combat Command, HQ ACC/DRYS, 204 Dodd Blvd Ste 226, Langley AFB, VA, 23665, United States, Harry.Conley@langley.af.mil

1 — The Challenge of Analysis Support to Warfighting Operations
Harry Conley, HQ Air Combat Command, HQ ACC/DRYS, 204 Dodd Blvd Ste 226, Langley AFB, VA, 23665, United States, Harry.Conley@langley.af.mil

Real-time operations analyses in support of warfighting operations have characteristics which distinguish them from traditional analyses. This presentation will discuss the author's experiences supporting combat operations and will suggest methods for dealing with the unique challenges of "real-time analysis" to provide meaningful, timely insights to decision makers.

2 — Analytical Support to Warfighters in Real-World Operations
Michael Webb, The Center for Naval Analyses, 4825 Mark Center Drive, Alexandria, VA, 22311, United States, webbm@cna.org

Analysts that deploy to support warfighters face unique challenges. The pace of real-world operations often outstrips the timeframe in which operations analysts typically work. The nature of the analyses requires skills and techniques that may be different from those the analyst uses in a traditional setting. This presentation will share insights gained while supporting warfighters engaged in real-world operations, and outline how analysts might prepare to work in this challenging environment.

3 — Is My Helmet on Backwards: Operations Research in Support of Forward Ground Forces
Richard Kohout, Research Analyst, Center for Naval Analyses, 4825 Mark Center Dr., Alexandria, VA, 22311, United States, kohoutr@cna.org

O.R. in support of forward ground combat commanders is challenging. The pace of ops, compressed decision cycle, and austere conditions affect data collection and methodology. Moreover, the commander's application of operational art—the blending of experience and training—seems incompatible with analysis. But the need exists. This presentation covers my experiences with I MEF during Iraqi Freedom and my efforts to provide analytical context and highlight risks and alternatives.

■ SA23

Westin-Tower 1206, 12th Floor

Portfolio Decision Analysis

Sponsor: Decision Analysis
Sponsored Session

Chair: Jeffrey Keisler, Assistant Professor, University of Massachusetts Boston, M/5-230, 100 Morrissey Boulevard, Boston, MA, 02125, United States, Jeff.Keisler@umb.edu

1 — A Practice in Pharmaceutical Portfolio Management.
Kazuo Ezawa, Director, Decision Analysis & Portfolio Management, Bristol-Myers Squibb Company, Route 206 & Provinceline Road, Princeton, NJ, 08540, United States, kazuo.ezawa@bms.com

The development of a new drug involves significant technical, regulatory and financial risks. To mitigate these risks and other uncertainties,it is critical for a company to establish a clear strategy and sound portfolio management to balance these risks. We discuss these challenges and issues based on current experience in portfolio management at major pharmaceutical company.

2 — Selecting a Portfolio of Research and Development Projects
Roger Burk, Assistant Professor, US Military Academy, Department of Systems Engineering, West Point, NY, 10996, United States, roger-burk@usma.edu, Brian Stokes, Gregory Parnell

We present a mathematical description of the problem of selecting the best portfolio of R&D projects from a set of possible projects, subject to a budget limit. This decision analysis problem involves combinatorial optimization with some or all of these additional features: (1) Multiple criteria; (2) Nonadditivity regarding projects; (3) Side constraints; and (4) Risk in project outcome. We review how we have structured and solved this class of problem and practical results we have obtained.

3 — The Value of Refining Alternatives in Portfolio Decision Analysis
Jeffrey Keisler, Assistant Professor, University of Massachusetts Boston, M/5-230, 100 Morrissey Boulevard, Boston, MA, 02125, United States, Jeff.Keisler@umb.edu

Portfolio decision analysis may include solicitation of alternatives for a range of budget levels for each asset. The value added by this step depends on conditions such as the available funds and the shapes of the individual buyup curves. This value is computed for various simulated portfolios.

■ SA24

Westin-Tower 1207, 12th Floor

Information, Technology and Market Structure

Sponsor: Information Systems
Sponsored Session

Chair: Shiri Shneorson, Stanford University, Graduate School of Business, Stanford University, Stanford, CA, 94305-5015, United States, shiri@stanford.edu

1 — Capacity and Market Structure for Consumer Data Networks
Shiri Shneorson, Stanford University, Graduate School of Business, Stanford University, Stanford, CA, 94305-5015, United States, shiri@stanford.edu, Haim Mendelson

We analyze consumer to consumer and consumer to Website connections on a network of networks for delay-sensitive consumers. We use a game-theoretic framework to study the network operators' pricing and capacity strategies in both a centralized and decentralized market. We analyze the resulting market structures and study their implications.

2 — Network Effects, Pricing, and Technology Adoption
Deishin Lee, Stanford University, Graduate School of Business, Stanford University, Stanford, CA, 94305-5015, United States, deishin@stanford.edu, Haim Mendelson

We model the adoption of a new technology, characterized by network effects, by multiple user types. We analyze the vendors' pricing strategies and the resulting network dynamics and its implications for the adoption of information technologies from both the vendors' and users' perspectives.

3 — Mass Customization and Market Structure
Ali Parlakturk, Stanford University, Graduate School of Business, Stanford University, Stanford, CA, 94305-5015, United States, pturk@Stanford.EDU, Haim Mendelson

This model considers the effects of mass customization on market structure, specifically we consider the case, where either one firm or two competing firms can customize their products to customer requirements a-l-a dell. We study the effects of these capabilities on profitability and market structure.

4 — R&D and Market Structure
Korhan Gurkan, Assistant Professor, Carnegie Mellon University GSIA, 5000 Forbes Avenue, Posner 372, Pittsburgh, PA, 15232, United States, kgurkan@cmu.edu, Haim Mendelson

Advances in Information Technology have brought on a fast pace of technological change that catapulted innovation and R&D to the forefront: this paper investigates the relationship between the structure of an industry, product development processes and costs of innovation.

■ SA25

Westin-Tower 1208, 12th Floor

Tutorial: Supply Chain Vulnerability

Sponsor: Military Applications
Sponsored Session

Chair: Terry Harrison, Professor of Supply Chain and Information Systems, Penn State University, 509L Business Administration Building, Smeal College of Business Administration, University Park, PA, 16802, United States, tharrison@psu.edu

1 — Tutorial: How to Build a Robust Supply Chain, or Harden the One You Have
Kevin Wood, Naval Postgraduate School, Operations Research Dept., Monterey, CA, 93943, United States, kwood@nps.navy.mil, Gerald Brown, Matt Carlyle, Javier Salmeron

An optimal supply-chain design can be quite fragile: If the system gravitates toward minimum-cost options, the resulting product-flow patterns may depend upon a minimum, non-robust, number of favored paths; and planned sole sourcing represents explicit, designed-in fragility . Supply chains are vulnerable to acts of nature like earthquakes, but also to the belligerent acts of a competitor or terrorist, and military interdiction models have proven useful in analyzing these situations. We begin with an overview of supply-chain vulnerability problems and their importance; then describe the optimization models and solution techniques we use to address these problems; present several case studies; and finally, demonstrate a decision-support tool for identifying weak spots in your supply chain's infrastructure.

■ SA26

Westin-Tower 1401, 14th Floor

Tutorial: Data Mining Applications and Forecasting

Cluster: Data Mining and Knowledge Discovery
Invited Session

Chair: Kwok-Leung Tsui

1 — A Tutorial in Data Mining and Forecasting Applications
Kwok-Leung Tsui, Professor of School of Industrial and Systems Engineering, Georgia Insitute of Technology, Industrial and Systems Engineering, Atlanta, GA, 30332, United States, ktsui@isye.gatech.edu, Tom Au, Wei Jiang

This tutorial discusses data mining applications and forecasting methods. DM applications include telecom, logistics, inventory control, express mail service, and used cars auctions. Forecasting methods include predicting future activities with historical data on phone usage, sales orders, revenue, and daily transactions. Effective data mining and forecasting help managers make planning and decisions timely and correctly.

■ SA27

Westin-Tower 1402, 14th Floor

Integer Programming: Algorithms and Theory

Sponsor: Optimization/Integer Programming
Sponsored Session

Chair: Warren Adams, Professor, Clemson University, Department of Mathematical Sciences, Clemson, SC, 29634, United States, wadams@clemson.edu

1 — Level-1 RLT Bounds for the 3-Dimensional Assignment Problem and the Quadratic 3-Dimensional Assignment Problem
Peter Hahn, Electrical and Systems Engineering Department, Rm 278,Towne, University of Pennsylvania, Philadelphia, PA, 19104-6315, United States, hahn@seas.upenn.edu, William L. Hightower

The Quadratic 3-Dimensional Assignment Problem (Q3AP) arises in data transmission design. It is a generalization of the 3-dimensional assignment problem (3AP), which is NP-hard. One calculates Q3AP lower bounds using a sequence of 3APs. We demonstrate methods for achieving good lower bounds for the 3AP and consequently for the Q3AP.

2 — Exploiting Block-Diagonal Structure in Solving RLT Formulations of 0-1 Programs
Richard J. Forrester, Department of Mathematics and Computer Science, Dickinson College, Carlisle, PA, 17013, United States, forrestr@dickinson.edu, Warren Adams

We investigate the block-diagonal structure that arises from applying the special-structure Reformulation-Linearization Technique to 0-1 Quadratic Programs. An algorithm for exploiting this structure is developed and tested on the 0-1 quadratic knapsack problem. Computational experience and relationships to published methods are discussed.

3 — Heuristic Approaches to the Size Assortment Problem
Douglas R. Shier, Department of Mathematical Sciences, Clemson University, Clemson, SC, 29634-0975, United States, SHIERD@clemson.edu, Kenneth W. Flowers

The size assortment problem involves optimally aggregating a large number of size distributions (e.g., for stores) into a relatively small number of groups. All stores within a group are allocated merchandise according to their common size distribution. A neighborhood search heuristic is developed to produce near-optimal solutions, and computational results are reported.

4 — A Hierarchy of Relaxations for General Discrete Optimization Pograms
Warren Adams, Professor, Clemson University, Department of Mathematical Sciences, Clemson, SC, 29634, United States, wadams@clemson.edu, Hanif Sherali

We present a hierarchy of relaxations leading to the convex hull representation for general discrete optimization problems. The results generalize and encompass earlier arguments for mixed 0-1 problems. The product factors defining the hierarchical levels are Lagrange interpolating polynomials, and the convex hull proofs use Kronecker products of Vandermonde matrices.

■ SA28

Westin-Tower 1403, 14th Floor

Interior-Point Methods for Nonlinear Programming

Cluster: Nonlinear Programming
Invited Session

Chair: Hande Benson, Drexel University, Decision Sciences, Philadelphia, PA, United States, hbenson@usna.edu

1 — KNITRO: An Integrated Approach for Nonlinear Optimization
Richard Waltz, Northwestern University, Dept. of Electrical & Computer Eng., 2145 Sheridan Road, Evanston, IL, 60208-3118, United States, rwaltz@ece.northwestern.edu

We will discuss developments in the KNITRO optimization package, focusing on the integration of two different approaches - a primal-dual interior-point approach and an SLP-EQP active-set approach. We will discuss how these approaches can be integrated to create a more powerful and robust optimization package. Numerical results will be presented.

2 — LOQO: An Infeasible Interior-Point Algorithm for Nonlinear Programming
Hande Benson, Drexel University, Decision Sciences, Philadelphia, PA, United States, hbenson@usna.edu, David Shanno, Robert Vanderbei, Igor Griva, Arun Sen

In this talk, we will outline the recent changes to LOQO, an infeasible interior-point algorithm for solving nonlinear programming problems. Of particular note will be the discussion of the filter method used in LOQO and the handling of unbounded Lagrange multipliers.

3 — Nonlinear Optimization Arising in Planet Finding and Celestial Mechanics
Robert Vanderbei, Professor, Princeton University, United States, rvdb@princeton .edu

We will discuss two exciting new application areas for nonlinear optimization: (1) optical design problems involving high-contrast imaging for NASA's Terrestrial Planet Finder space telescope and (2) finding new periodic orbits for the n-body problem by minimizing the associated action functional. These two application areas provide a wealth of new and interesting nonlinear optimization problems which can be solved with modern NLP tools.

■ SA29

Westin-Tower 1404, 14th Floor

Network Design

Sponsor: Optimization/Network
Sponsored Session

Chair: Teodor Crainic, Professor, U.Q.A.M., Dept. Management et technologie, C.P. 8888, succ. Centre-ville, Montreal, QC, H3C 3P8, Canada, theo@crt.umontreal.ca

1 — Variable Disaggregation in Network Flow Problems with Piecewise Linear Costs
Bernard Gendron, University of Montreal, C.P. 6128, succ. Centre-ville, Montreal, QC, Canada, bernard@crt.umontreal.ca, Keely Croxton, Thomas Magnanti

We consider mixed-integer programming formulations based on variable disaggregation for a generic multi-commodity network flow problem with piecewise linear costs. We present several stuctural results for these formulations and we analyze the results of extensive experiments on a large set of instances with various characteristics.

2 — A Scalable Approximate Dynamic Programming Algorithm for the Single-Link Dispatch Problem
Warren Powell, Professor, Princeton University, Dept of Opns Res and Financial Eng'g, Princeton, NJ, 08540, United States, powell@princeton.edu, Katerina Papadaki

A basic problem in dynamic network design is the control of batch processes over a single link. We present an approximation strategy that is shown to provide near optimal results for the single link problem with homogeneous customers. The algorithm is easily extended to problems with a large number of customer types. The complexity of the algorithm is comparable to a myopic heuristic, and therefore offers the potential of being a scalable algorithm for large scale networks.

3 — The Single-Node Dispatching Problem and Dynamic Service Network Design
Teodor Crainic, Professor, U.Q.A.M., Dept. Management et technologie, C.P. 8888, succ. Centre-ville, Montreal, QC, H3C 3P8, Canada, theo@crt.umontreal.ca, Warren Powell, Jose Eugenio Leal, Leonardo Dall'Orto

We present stochastic and deterministic formulations that aim to optimize the problem over a given planning horizon. Efficient tabu search-based heuristics are proposed for the static version. Together with a long-term learning mechanism, these heuristics are imbedded into a dynamic programming-type procedure for the stochastic formulation. Applications of this methodology to the time-dependent service network design will also be discussed.

■ SA30

Westin-Tower 1405, 14th Floor

Non-Convex Sochastic Programming

Sponsor: Optimization/Stochastic Programming
Sponsored Session

Chair: Shabbir Ahmed, Assistant Professor, ISyE, Georgia Tech, Atlanta, GA, 30332, United States, sahmed@isye.gatech .edu

1 — A Disjunctive Programming Approach to Multistage Stochastic Optimization
Vikas Goel, Graduate Student, Carnegie Mellon University, 5000 Forbes Avenue, Dept. of Chemical Eng, Pittsburgh, PA, 15213, United States, vgoel@andrew.cmu.edu, Ignacio Grossmann

We present a novel disjunctive formulation for stochastic programs where the scenario tree is a discrete function of decisions. We show that the disjunctions of non-anticipativity constraints can be replaced by a smaller subset of constraints. A branch and cut algorithm and numerical results are also presented.

2 — Facility Layout and Sizing under Uncertainty
Wei Xie, University of Illinois at Urbana-Champaign, Dept. of Chemical & Biomolegular Eng., Urbana, IL, United States, wxie@uiuc.edu, Nick Sahinidis

We develop a mixed-integer nonlinear program for simultaneous facility layout and sizing. The objective is to minimize expected costs under a given number of flow-cost scenarios. A spatial branch-and-bound algorithm is developed for this problem and computational results will be presented.

3 — A Monotonic Optimization Approach for Probabilistically Constrained Stochastic Programs
Myun-Seok Cheon, Georgia Institute of Technology, School of Industrial & Systems Eng., Atlanta, GA, United States, powstone@isye.gatech.edu, Shabbir Ahmed, Faiz Al-Khayyal

We exploit the monotonic structure inherent in a wide class of probabilistically constrained stochastic programs, and modify H. Tuy's polyblock algorithm for this class of problems. Various algorithmic enhancements along with computational results will be provided.

4 — Characterizing Sampling Error for Optimization under Uncertainty: A Fractal Geometry Approach
Ki-joo Kim, US EPA, Cincinnati, OH, United States, Kim.Ki-Joo@epamail.epa.gov, Urmila Diwekar

Sampling accuracy plays an important role in enhancing the efficiency of optimization algorithms. Statistical techniques provide error-bandwidth-sample-relation only for Monte Carlo but not for any other more efficient sampling techniques. We present a novel approach based on concepts from fractal geometry to characterize the precision of the new sampling techniques.

■ SA31

Westin-Tower 1406, 14th Floor

Location Analysis

Sponsor: Location Analysis
Sponsored Session

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

1 — Location and Pricing Decisions of a Multi-Store Monopoly in a Spatial Market
Abdullah Dasci, Postdoctoral Fellow, University of Montreal, Center for Research on Transportation, C.P. 6128 succursale Centre-ville, Montreal, QC, H3C 3J7, Canada, dasci@crt.umontreal.ca, Gilbert Laporte

We analyze location and pricing decisions of a monopolist locating stores in a compact geographical space. Fixed location costs make the number of stores endogenous. We propose a novel model in which the firm's location and price decisions are represented as continuous functions defined over the geographical space.

2 — Selection and Space Requirement for Congested Connections
Rajan Batta, Professor, University of Buffalo (SUNY), Department of Industrial Engineering, 342 Bell Hall, Buffalo, NY, NY 14260, United States, batta@buffalo.edu, Simin Huang, Rakesh Nagi

We model connections as M/G/1 queues. Our objective is to minimize the total cost of transportation, fixed connection installation, capacity, and space requirement, simultaneously. We propose models to address this question. Some properties of the problem are explored and solution procedures are proposed.

3 — Locating Mobile Servers under Stochastic Demands and Congestion
Seokjin Kim, Ph. D. Candidate, Universtiy of Toronto, Rotman School of Management, 105 St. George Street, Toronto, ON, M5S 3E6, Canada, skim@rotman.utoronto.ca, Oded Berman, Dmitry Krass

Consider the problem of minimizing the number of mobile servers to be located subject to a constraint on server availability. We review known models and show that they often fail to provide a feasible solution. We introduce new models which guarantee feasibility while keeping the number of servers competitive.

4 — An Integrative Framework for Location Problems with Large-scale Demand Data
Vedat Verter, McGill University, 1001 Sherbrooke St. W., Montreal, PQ, H3A 1G5, Canada, vedat.verter@mcgill.ca, Alper Murat

Demand aggregation is a common technique for solving location problems with numerous demand points. Continuous approximation of the demand data represents another viable alternative for tackling such problems. We present the conditions under which each of these methods are more effective and report on our computational experiments.

■ SA32

Westin-Tower 1407, 14th Floor

New Scheduling Models

Cluster: Scheduling
Invited Session

Chair: Marc Posner, Professor, The Ohio State University, Industrial Engineering, 1971 Neil Ave, OH, 43210, United States, posner.1@osu.edu

1 — Scheduling of Perishable Jobs under an Uncertain Delivery Time
Xiaoqiang Cai, The Chinese University of Hong Kong, Shatin, N.T, Hong Kong, xqcai@se.cuhk.edu.hk, Xian Zhou

We study a problem that often arises in food processing industries. A set of jobs are to be processed by a single machine. Each finished job has a fresh-duration, after which it will start to decay. The objective is to find an optimal policy to process the jobs so that each completed job can be delivered by a transporter that arrives with uncertainty. We find the optimal solutions for the problem in a number of situations.

2 — Order Scheduling in an Environment with Dedicated Resources in Parallel
Joseph Leung, United States, leung@cis.njit.edu, Haibing Li, Michael Pinedo

We consider m machines in parallel with each machine capable of producing one specific product type. There are n orders with each one asking for specific quantities of the various product types. Our objective is to minimize the total (weighted) completion times. Complexity results and heuristics will be presented.

3 — Profit Scheduling
Zhi-Long Chen, Associate Professor, R.H. Smith School of Business, University of Maryland, College Park, MD, 20742, United States, zchen at rhsmith.umd.edu, Nicholas G. Hall

The classical scheduling literature considers many problems where a given set of jobs is processed to minimize a measure of cost. By contrast, we consider several diverse practical situations where efficient scheduling affects not only cost but also revenue and net profit. Algorithms and complexity results are provided.

4 — On the Integrated Production and Distribution Problem with an Expiring Product and Non-Instantaneous Transportation Time
Neil Geismar, Professor, University of Texas, Dallas, School of Management, SM30, P .O. Box 830688, Richardson, TX, 75083-0688, United States, ngeismar@yahoo.com, Lei Lei, Chelliah Sriskandarajah

We consider the integrated production-distribution problem involving expiring products and transporters. The objective is to minimize the total time required to produce and deliver to meet customer demands, subject to production capacity, transportation time and product life-span constraints. We show the problem complexity and propose heuristics algorithms. Empirical results are presented.

■ SA33

Westin-Tower 1408, 14th Floor

Data Envelopment Analysis I

Cluster: Data Envelopment Analysis
Invited Session

Chair: Fred Phillips, Oregon Health and Sciences University, United States, fphillips@admin.ogi.edu

1 — Technological Change and Environmental Regulations: Application of Luenberger and Malmquist Indices
Shunsuke Managi, Dr., South Carolina State University, P.O. Box 8040 SCSU, Orangeburg, SC, 29118, United States, smanagi@scsu.edu

Technology can play a key role in maintaining a high standard of living while addressing environmental problems. Well-designed environmental regulations encourage innovation, while poorly designed regulations can inhibit progress. We apply DEA and measure Luenberger and Malmquist Productivity Indices. We test the direction of causality between innovation and environmental regulation

2 — Nonparametric Measures of Capacity Utilization in U.S. Manufacturing: An Inter-Industry Comparison
Kankana Mukherjee, Assistant Professor, Worcester Polytechnic Institute, Department of Management, 100 Institute Road, Worcester, MA, 01545, United States, kmukher@WPI .EDU, Xia Wang, Subhash C. Ray

In this paper we apply the nonparametric dual procedure developed by Ray (2002) to data from the Bureau of Labor Statistics in order to compute the capacity output level for selected manufacturing industries in the US for the years 1968 through 1998. The dual measures are then compared to the primal measures. Further a statistical analysis examines the relation between the rate of capacity utilization on the levels of output in the user industries and energy price.

3 — Data Envelopment Analysis and Relative Variety Analysis: Formal Relationships and Joint Performance Tests
Fred Phillips, Oregon Health and Sciences University, United States, fphillips@admin.ogi.edu, Gyoung Sook Moon, Gary Summers

In previous papers we have introduced Relative Variety Analysis, an optimization-based characterization of organizational flexibility. We now present evidence of the market conditions under which RVA and DEA are correlated and under what conditions they are complementary. Further, we show that for certain classes of probability distributions of the inputs/outputs, RVA takes on a formal resemblance to DEA and may be solved using DEA software. DEA and RVA continue to jointly explain long-term performance of enterprises in rigorous simulated markets

■ SA34

Mart-Room A

Supply Chain Design Issues

Sponsor: Transportation Science & Logistics
Sponsored Session

Chair: Doug Popken, Systems View, 9139 Roadrunner St., Highlands Ranch, CO, United States, dpopken@systemsview .com

1 — Optimal Allocation of Safety Stock in Supply Chain Networks with Stochastic Sequential Lead-times
Yao Zhao, Assistant Professor, Rutgers University, Dept of Management Science and Info. Sys, 180 University Ave, Newark, NJ, 07102, United States, yaozhao@andromeda .rutgers.edu, David Simchi-Levi

We consider multi-stage, a-cyclic, production-inventory systems with stochastic sequential lead-times. Assuming that each stage uses a continuous time base-stock policy, we present a framework to determine the safety stock allocation so as to minimize system-wide inventory cost subject to providing certain service level to external customers.

2 — An Integrated Supply Chain Design Model: with Inventory, Location, and Distribution Decisions
Lian Qi, University of Florida, Dept. of Industrial and Systems Engr., FL, 32611, United States, liqian@ise.ufl.edu, Zuo-Jun Max Shen

We consider a stochastic supply chain design problem where we need to decide the number and locations of the distribution centers by taking into consideration the inventory costs and the distribution costs. We propose an efficient algorithm to solve the problem and show computational results.

■ SA35

Mart-Room B

Closed-Loop Supply Chain Strategy

Cluster: Reverse Supply Chains
Invited Session

Chair: Geraldo Ferrer, University of North Carolina at Chapel Hill, Kenan-Flagler Business School, McColl Bldg, CB#3490, Chapel Hill, NC, 27599-3490, United States, Geraldo_Ferrer@unc.edu

1 — The Time-Value of Commercial Product Returns
Daniel Guide, Assistant Professor, Smeal College of Business Administration, The Pennsylvania State University, University Park, PA, 16802, United States, dguide@psu.edu, Gilvan Souza, Joseph Blackburn, Luk Van Wassenhove

The management of commercial product returns is an area where there are significant opportunities to build competitive advantages from the appropriate choices in reverse supply chain design. We use a simple queuing network model to provide managerial insights into the marginal value of time in the product returns stream. Examples from two companies in different industries are provided to show how industry clockspeed affects the choice between an efficient and a responsive returns network.

2 — Entry Timing for a Remanufactured Product
Enno Siemsen, Chapel Hill, NC, 27599-3490, United States, siemsene@kenan-flagler .unc.edu, Geraldo Ferrer, Ann Marucheck

We determine the optimal timing of introduction of a remanufactured product that must coexist with the original product in the market. If the remanufactured product is introduced too early, the inventory of cores is insufficient to meet the remanufacturing production plan. If the introduction is too late, there is limited opportunity to profitably use all cores. We provide decision rules to develop a strategic lifecycle plan assuming a limited supply of cores.

3 — Managing New and Remanufactured Products
Geraldo Ferrer, University of North Carolina at Chapel Hill, Kenan-Flagler Business School, McColl Bldg, CB#3490, Chapel Hill, NC, 27599-3490, United States, Geraldo_Ferrer@unc.edu, Jayashankar Swaminathan

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.

■ SA36

Mart-Room C

Supply Chain Disruption: Risk Management

Sponsor: Manufacturing and Service Operations Management
Sponsored Session

Chair: Mike Magazine, University of Cincinnati, College of Business, Cincinnati, OH, 45221, United States, mike .magazine@uc.edu

Co-Chair: Michael Fry, Assistant Professor, University of Cincinnati, QAOM Department, College of Business, Cincinnati, OH, 45221, United States, mike.fry@uc.edu

Co-Chair: Uday Rao, Associate Professor, University of Cincinnati, QAOM Department, College of Business, Cincinnati, OH, 45221, United States, uday.rao@uc.edu

1 — Managing Risk in Global Supply Chains
Paul Kleindorfer, University of Pennsylvania, The Wharton School, Philadelphia, PA, United States, kleindorfer@wharton.upenn.edu, Luk Van Wassenhove

We discuss risk management preparedness and mitigation of disruptions to supply chain activity, whether through major accidents, sabotage or economic event. Using theory and case studies, we illustrate the operational problems of integrating management systems in 4 areas: (i) identifying underlying sources of risk; (ii) estimating the consequences of these risks under various scenarios; (iii) mitigation and financing of residual risks; (iv) emergency response and crisis management systems.

2 — Managing Enterprise Risks from the Perspective of the Extended Supply Chain
Dailun Shi, Research Staff Member, IBM T.J. Watson Research Center, 19 Skyline Drive, Hawthorne, NY, 10532, United States, dailun@us.ibm.com, William Grey

Enterprises have traditionally failed to manage risk in an integrated fashion. Many risks are managed only at the corporate level. Attempts to effectively assess and manage risk across organizational boundaries are hindered by the lack of uniform risk metrics.Firms find it difficult to thoroughly understand their total risk exposures, much less measure, manage or control them. We describe a general framework for enterprises to manage risks from the the perspective of the extended supply chain.

3 — Supply Chain Disruption Management: A Simulation Study
Yanni Papadakis, Drexel University, 3141 Chestnut Street, Philadelphia, PA, 19010, United States, isp@drexel.edu

A Make-To-Order supply chain consisting of a producer and the suppliers of two complementing inputs are examined in a simulation study with respect to behavior after disruption. We develop a model that clarifies the importance of three risk management strategies: a) flexibility of production capacity, b) early detection of the nature of disruption, and c) using passive and active disruption management approaches.

4 — Incorporating Options Market Data into Planning and Investment Models
Alan King, Mathematical Sciences, IBM Research, POB 218, Yorktown Heights, NY, 10598, United States, kingaj@us.ibm.com

Market prices for securities are based on forward-looking information. Exchanges also list options on securities and other such derivatives, whose price data are an important source of information for traders and other market participants. This talk will present the basic mathematical structures for option price data, and also present a discussion of the value of incorporating this information into planning and investment models.

■ SA37

Mart-Room D

Pricing and Design of Differentiated Services

Sponsor: Manufacturing and Service Operations Management
Sponsored Session

Chair: Assaf Zeevi, Columbia University, NY, 10027, United States, assaf@gsb.columbia.edu

Co-Chair: Costis Maglaras, Columbia University, 409 Uris Hall, 3022 Broadway, NY, NY, 10027, United States, c .maglaras@columbia.edu

1 — Delaying Customers for Revenue Management in Queueing Systems
Philipp Afeche, Kellogg School of Management, 2001 Sheridan Road, Evanston, IL, 60202, United States, p-afeche@kellogg.northwestern.edu

We study the design of incentive-compatible revenue-maximizing price-service mechanisms for queueing systems serving heterogeneous time-sensitive customers. The cmu-Rule, long known as the best mechanism under social optimization, need not be the revenue-maximizing rule, which we derive for several models. Revenue maximization and delay cost minimization are incompatible in various cases.

2 — Economics of Content Delivery Internetworking
Giuseppe Paleologo, United States, gappy@us.ibm.com

Content replication is a popular and effective strategy to improve performance of content delivery over the internet. While the early research and development has focused on systems operated by a single provider, new federated, interoperable Content Distribution Networks are emerging. I will describe the salient features of CDNs, isolate some economic issues of immediate and-not-so-immediate interest, and provide some answers.

3 — Models of Service Differentiation for Systems with Shared Resources
Costis Maglaras, Columbia University, 409 Uris Hall, 3022 Broadway, NY, NY, 10027, United States, c.maglaras@columbia.edu, Assaf Zeevi

We focus on problems of analysis and design of differentiated services, with emphasis on the layer of interaction between the service provider and the potential users of these services. This talk describes and analyzes a set of related models for such systems operating under different assumptions that lead to valuable design insights.

4 — Pricing of "Guaranteed" and "Best-Effort" Type Services
Assaf Zeevi, Columbia University, NY, 10027, United States, assaf@gsb.columbia.edu, Costis Maglaras

We describe a simple stylized model of a system that delivers "Guaranteed" and "Best-effort" service grades. Simple pricing rules based on a deterministic analysis are shown to be near-optimal in terms of their revenue performance in the original stochastic system.

■ SA38

Mart-Room E

Public Transportation Applications of OR

Sponsor: Transportation Science & Logistics
Sponsored Session

Chair: Mark Hickman, University of Arizona, P.O. Box 210072, Tucson, AZ, 85721-0072, United States, mhickman@engr .arizona.edu

1 — Transit Operations Control using Reinforcement Learning
Amer Shalaby, Assistant Professor, University of Toronto, 35 St. George St., Toronto, ON, M5S 1A4, Canada, amer@ecf.utoronto.ca, Kenny Ling

Two agents were developed for transit operations control. The first agent determined the best duration of each signal phase such that transit vehicles can recover to the scheduled headway. The second is a multi-agent applied to 3 consecutive signalized intersections so as to break up any vehicle bunch encountered, and recover an acceptable headway. A case study was carried out using the software Paramics to simulate transit and traffic operations along one transit route in Toronto.

2 — Vehicle Scheduling For a Branching Transit Route
Aichong Sun, University of Arizona, 1209 E. 2nd Street, Tucson, AZ, 85721-0072, United States, suna@email.arizona.edu, Mark Hickman

This paper addresses the problem of vehicle scheduling for one-end branching transit route through applying vehicle allocation, offset shifting and holding in combination in the scheduling process to improve the overall route performance. Several vehicle scheduling strategies are devised and examined based on a variety of passenger boarding scenarios using deterministic models. Results show that the scheduling strategy performance varies with the passenger distribution profile along the route.

3 — Real-Time Vehicle Dispatching at a Transit Transfer Terminal
Mark Hickman, University of Arizona, P.O. Box 210072, Tucson, AZ, 85721-0072, United States, mhickman@engr.arizona.edu, Aichong Sun

This paper investigates the potential of integrating vehicle swapping as a control strategy at a transit transfer terminal. Simulation is employed to evaluate the significance of vehicle swapping through comparing the performance of swapping-holding combined strategy with a holding-only strategy. Results show that substantial benefits can be achieved by applying real-time vehicle swapping, with varying sensitivity to different operations parameters.

■ SA39

Mart-Room F

Demand Forecasting for Railroad Systems

Sponsor: Railroad Applications
Sponsored Session

Chair: Kal Silverberg, Sr. Manager Service Design, BNSF Railway, 2600 Lou Menk Drive, P. O. Box 961034, Ft. Worth, TX, 76161-0034, United States, kalman.silverberg@bnsf.com

1 — Replenishment Planning Possibilities for the Railroad Industry
Tony Player, Finmatica, Inc., 2100 RiverEdge Parkway, Atlanta, GA, United States, t .player@finmatica.com, Tony Perri, Drew Carlyle

This presentation will explore possibilities for replenishment planning for rail cars in the railroad industry. Using state-of-the-art forecasting techniques and requirements planning, this presentation will show how organizations can reduce inventory costs and improve deliverability on product. We will look at initiating business process re-engineering in the railroad industry from reactive response to stock-outs to pro-active response requirements planning.

2 — Adaptive, Hierarchical Forecasting for Short-Term, Tactical Forecasting
Warren Powell, Director, CASTLE Laboratory, Princeton University, Dept of Operations Research, Princeton, NJ, 08544, United States, powell@princeton.edu

We describe a powerful forecasting technique that we have developed over the years specifically for forecasting in freight transportation. We produce daily forecasts at multiple levels of aggregation, taking into account day of week, week of month, holidays and "special days", including those which only occur once per year. Hierarchical learning at different levels of aggregation combines responsiveness to structural changes (seasons, economy, new business) with stability at low levels of aggregation. Prebook distributions are produced to merge forecasts with actual orders. Error distributions are estimated to track forecast error.

■ SA40

Mart-Room G

Supply Chain Management

Cluster: Supply Chain Management
Invited Session

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

1 — Contracting, Loss Aversion and Risk Preferences
Yehuda Bassok, Associate Professor, University of Southern California, Marshall School of Business, Los Angeles, CA, 90089, United States, bassok@marshall.usc.edu, Mahesh Nagarajan

We study contracting between players with different risk preferences. We look at scenarios when players are strictly loss averse and in general when players are risk averse. We analyze situations when players make take-it-or-leave-it offers and when players negotiate. We show optimality of certain contracts and compare one contracting mechanism with another.

2 — Managing Buyers and Purchasing Managers with Private Information
Hiroshi Ochiumi, University of Southern California, Marshall School of Business, Los Angeles, CA, United States, ochiumi@marshall.usc.edu, Sriram Dasu

For many firms purchasing costs account for more than 45% of the cost of goods sold. Buyers and Purchasing Managers (PM) are responsible for purchase price and at times purchase quantities. These managers are hired, presumably because of their private knowledge about markets. Using alternate models of private information, we study incentives that allow firms to identify those with more accurate forecasts. We also discuss situations under which PM would not act on his private information.

3 — Supply Intelligence
Sridhar Seshadri, New York University, 44 West 4th Street, New York, NY, 10012, United States, sseshadr@stern.nyu.edu, Eitan Zemel

We construct a general model of a supply chain in which obtaining complete information about suppliers is costly. We show that despite the generality the buyer can guarantee significant profit levels for herself and induce the channel to perform efficiently, further, the buyer can combine auctions with audits to increase her share of the channel profits. We also examine the behavior of biased audit-based auctions.

4 — Order-up-to Policies for Inventory Systems with Lost Sales and Lead Times
Ganesh Janakiraman, New York University, Stern School of Business, 40 West 4th Street, New York, NY, 10012, United States, ganesh@orie.cornell.edu

The structure of the optimal policy for a single stage system with lost sales and lead times is not known. Since the objective functions in inventory control problems are usually flat around the optimal solutions, it seems reasonable to restrict attention to the class of order-up-to policies. Two questions now emerge. How can we determine an "optimal" order-up-to policy for such a system? Can we bound the performance of order-up-to policies relative to the overall optimal policies?

■ SA41

Mart-Room H

Supply Chain Demand Management

Cluster: Supply Chain Management
Invited Session

Chair: Beril Toktay, INSEAD, Boulevard de Constance, Fontainebleau, 77305, France, beril.TOKTAY@insead.edu

1 — Analysis of a Decentralized Supply Chain with Advance Order Information
Fikri Karaesmen, Koc University, Dept of Industrial Eng., Sariyer, Istanbul, 34450, Turkey, fkaraesmen@KU.EDU.TR, Zied Jemai

We consider a supply chain consisting of a supplier and a manufacturer. The manufacturer shares customer order information with the supplier and specifies a future delivery date for each order. The parties then choose their respective inventory policies to minimize their own cost functions in a decentralized manner. We investigate the performance of the system as a function of advance order information availability, supplier capacity and delivery structure.

2 — Learning and Pricing
Martin Puterman, University of British Columbia, The Sauder School of Business, Vancouver, BC, Canada, marty@coe.ubc.ca, Alex X. Carvalho

This talk addresses optimal dynamic price setting when the demand function follows a parametric model with unknown parameters.The prudent decision maker trades off learning about uncertainty with revenue maximization.The focus is on obtaining methods which produce good performance over short horizons.Our approach combines ideas from dynamic programming, reinforcement learning and statistical estimation.A heuristic based on a Taylor series expansion to the value function is shown to perform well.

3 — Demand Inducement for Credence Goods
Beril Toktay, INSEAD, Boulevard de Constance, Fontainebleau, 77305, France, beril .TOKTAY@insead.edu, Laurens Debo, Luk Van Wassenhove

For some services, the customer, even ex-post, cannot verify whether it was necessary. Services that have these characteristics are referred to as "credence goods." In such a setting, the server may have an incentive to recommend more service than necessary, in order to induce demand and increase his revenues. Rational customers process ex ante the server's incentives before deciding whether to purchase the service or not. We show that the server can use congestion to signal his credibility.

4 — Dynamic Pricing through Active Learning
Yossi Aviv, Associate Professor of Operations Managament, Washington University, Campus Box 1133, 1 Brookings Drive, St. Louis, MO, 63130, United States, AVIV@olin .wustl.edu, Amit Pazgal

We describe a stylized, partially observed Markov decision process (POMDP) framework, to study a dynamic pricing problem faced by sellers of fashion-like goods. The seller's objective is to dynamically price the product in a way that maximizes expected revenues. Our model brings together various types of uncertainties about the demand, some of which are resolvable through sales observations.

■ SA42

Mart-Room I

Multi-disciplinary Approaches to Revenue Management

Sponsor: Revenue Management & Dynamic Pricing
Sponsored Session

Chair: Mustafa Karakul, University of Toronto, 105 St. George Street, Toronto, ON, M5S 3E6, Canada, Mustafa .Karakul98@Rotman.Utoronto.Ca

1 — Competitive Revenue Management: Evaluating Mergers Among Cruise Lines
Luke Froeb, Owen Graduate School of Management, Vanderbilt University, United States, luke.froeb@owen.vanderbilt.edu, Steven Tschantz

The Princess-Carnival cruise line merger raised the policy question of how to evaluate the effects of mergers among firms who practice revenue management. To answer this question, we draw on elements of operations research and economics to model mergers among non-cooperative firms facing stochastic demand.

2 — Dynamic Revenue Management Games with Forward and Spot Markets
Guillermo Gallego, Professor, Columbia University, 500 West 120th Street, 324 Mudd Bldg, New York, NY, 10027, United States, gmg2@columbia.edu, Srinivas Krishnamoorthy, Robert Phillips

We consider sequential and repeated games between two providers each with fixed capacity, who compete to sell in both a forward market and a spot market. Demand is either from a single buyer or a population of independent consumers. We identify outcomes for the sequential game and subgame-perfect Nash equilibria for the repeated game

3 — Dynamic Pricing of Perishable Assets under Competition
Abdullah Dasci, Canada, Abdullah.Dasci@ualberta.ca, Paul Messinger

We present a two-firm, two-period dynamic game to study the impact of dynamic pricing on firm profits. We show that the game has no quilibrium even in mixed strategies, but it has a unique epsilon-equilibrium in pure strategies. Properties of this equilibrium and comparison to the equilibrium static pricing will be discussed.

4 — Pricing Decisions in the Substitutable Product Introduction Problem
Mustafa Karakul, University of Toronto, 105 St. George Street, Toronto, ON, M5S 3E6, Canada, Mustafa.Karakul98@Rotman.Utoronto.Ca, Lap Mui Ann Chan

This paper considers the problem of combining the pricing and production decisions faced by a company introducing a new product. The new product is superior to a well-established product. The demand for the existing product is fairly stable and has only n+1 possible values. And, the demand distribution of the new product has to be estimated by a set of price dependent continuous functions. We study the effect of offering the new product as a substitute if the existing product runs out.

■ SA43

Mart-Room J

Hybrid Bidding Mechanisms

Cluster: Auctions
Invited Session

Chair: Jeremie Gallien, MIT Sloan School of Management, Cambridge, MA, United States, jgallien@MIT.EDU

1 — Simultaneous On-line Selling Using Auctions and Posted Price
Edieal Pinker, University of Rochester, Simon School of Business, Rochester, NY, United States, PINKER@simon.rochester.edu, Hila Etzion, Abraham Seidmann

In this talk we analyze the key tradeoffs faced by a firm that sells identical products on-line using auctions and posted price concurrently. We model consumer channel choice behavior and identify the optimal design strategy of the dual channel. Our results show that these two channels can reinforce and not cannibalize each other, so increasing the seller's profits.

2 — Competition in the Supply Option Market
Victor Martinez de Albeniz, M.I.T., 77 Mass Ave, Room E40-130, Cambridge, MA, 02139, United States, albeniz@mit.edu, David Simchi-Levi

We develop a multi-attribute competition model for procurement. We describe the negotiation between a buyer and many suppliers for options. Suppliers' bids consist of the option reservation and execution prices and, given these, the buyer awards capacity to each supplier. In equilibrium, the market will be segmented in clusters of suppliers of similar technologies offering the same type of option. The equilibrium option prices lie in the lower envelope of the suppliers' costs.

3 — Efficient Descending-Price Auctions for the Assignment Problem
Debasis Mishra, Ph. D. Student, University of Wisconsin, Madison, 1513 University Avenue, Room 258, Madison, WI, 53706, United States, dmishra@cae.wisc.edu, David Parkes

We consider an economy with one seller, selling N indivisible heterogeneous items, and M buyers, each of which wants at most one item. We propose efficient descending-price auctions for this problem and show a significant reduction in communication complexity in comparison with known ascending-price auctions. The terminating conditions of the auctions are related to a concept called Universal Competitive Equilibrium, from which we demonstrate convergence to the Vickrey payoff point.

■ SA44

Mart-Room K

Joint Session AAS/TSLS: Robust Airline Scheduling & Recovery I

Sponsors: Aviation Applications, Trans. Science & Logistics
Sponsored Session

Chair: Cynthia Barnhart, Professor, MIT, Center for Transportation and Logistics, room 1-229, cambridge, ma, 02139, United States, cbarnhar@MIT.EDU

1 — Evaluation of an Auction Mechanism for Allocating Airport Arrival Slots
Eric J. Cholankeril, MIT/Draper Laboratory, MS 3F, 555 Technology Square, Cambridge, MA, 02139, United States, superejc@mit.edu, William D. Hall, John-Paul Clarke

A sequential, sealed-bid Vickrey auction w/o package bidding is proposed as a mechanism for allocating arrival slots during Ground Delay Programs. The auction was simulated on flight data and compared with two other methods-Collaborative Decision Making, and a "global optimization" method that determines an upper bound on the delay reduction achievable. At least 5-7% of passenger delay was reduced through the auction, and as much as 75% of the maximum possible delay reduction was achieved.

2 — Virtual Hubs: An Airline Schedule Recovery Concept and Model
Michelle Karow, MIT, 1650 Estate Circle, Naperville, IL, 60565, United States, karow@mit.edu

Inclement weather at hub airports can be devastating to airline operations. We propose a model that determines the flights to shift from a connecting complex at a hub airport during irregular operations to a strategically located, under-utilized airport. This "virtual hub" model would, in addition to maximizing passenger flow through the network, also reduce delays at the original hub airport. We show through computation that this approach reduces the total number of minutes of passenger delay.

3 — Airline Recovery Models that Minimizes Operating Costs and Passenger Delay or Disruption Costs
Stephane Bratu, PhD Student, Organization: MIT, United States, sbratu@mit.edu

We provide models and on-line algorithms to reduce passenger delays by canceling and postponing flight departures. These online optimization approaches can be used by airline operations control centers to recover from schedule perturbations. We present an integrated algorithm that provides recovery plans for aircraft, crews and passengers, and minimizes operating costs and passenger delay or disruption costs. We demonstrate, through computational experiments, using passenger and flight information from a major U.S. airline, that our models can be implemented in a real-time decision-making environment and reduce passenger delays and disruptions noticeably

4 — An Airline Disruption Recovery Model
Alexander D. Morton, National University of Singapore, 10 Kent Ridge Crescent, Singapore, SG, Singapore, isemad@nus.edu.sg, Huei Chuen Huang, Rongheng Li, Zhe Liang

Airlines frequently find themselves in the position where an aircraft becomes unavailable. Finding a recovery strategy which minimises costs due to delay and disruption is not trivial because of the combinatorial explosion in the number of alternatives. We present a conceptual framework and algorithm for finding good solutions to this problem. The framework and algorithm build on the existing literature, and exploit the way the airline's schedule and network structure the set of alternatives.

■ SA45

Mart-Room L

SRC/IMST Factory Operations Research Center

Cluster: Semiconductor Manufacturing
Invited Session

Chair: John Fowler, Professor, Arizona State University, Dept. of Industrial Engineering, Tempe, AZ, 85287-5906, United States, john.fowler@asu.edu

1 — Overview of the Factory Operations Research Center
John Fowler, Professor, Arizona State University, Dept. of Industrial Engineering, Tempe, AZ, 85287-5906, United States, john.fowler@asu.edu, Mani Janakiram, Frank Robertson, K. J. Stanley

The Factory Operations Research Center (FORCe) is a 3 year, approximately $1million/year, collaborative effort between Semiconductor Research Corp. and International Sematech (semiconductor manufacturing consortia) to address the factory operations challenges delineated in the International Technology Roadmap for Semiconductors. FORCe's objective is to conduct research on factory operations at universities and work with suppliers to convert research into software tools for use by the industry.

2 — New Approaches to Simulation for Semiconductor Manufacturing
Lee Schruben, University of California, Berkeley, 4135 Etcheverry Hall, Berkeley, CA, 94720, United States, schruben@ieor.berkeley.edu, John Fowler, Gerald Mackulak

We present some experiences in detailed modeling of the resource cycles involved in semiconductor production. This is different from the typical approach of modeling a factory by tracking the flow of individual jobs and resulted in much faster executing code. However, certain constraints and dispatching policies appear to be difficult to model accurately and there is some loss of information. Some approximation techniques are used to mitigate this loss of information.

3 — Scheduling Wafer Fab Operations
Michele Pfund, Portfolio Optimization Manager, Johnson & Johnson, United States, michele.pfund@asu.edu, John Fowler, Scott J. Mason, Oliver Rose, Esma S. Gel, George Runger, Lars Moench

Semiconductor wafer fabrication facilities are characterized by reentrant or recirculating product flow through a number of different tool groups (one or more machines operating in parallel). These tool groups typically contain batching machines, as well as machines that are subject to sequence-dependent setups. A modified Shifting Bottleneck heuristic are presented for obtaining "good" solutions to this complex job shop scheduling problem.

4 — An Algorithm to Convert Wafer to Time-Based PM Schedules for Semiconductor Manufacturing Systems
Emmanuel Fernandez, Electrical & Comp. Eng. & Comp. Sci. Dept., 837 Rhodes Hall, University of Cincinnati, Cincinnati, OH, 45221-0030, United States, emmanuel@ECECS .UC.EDU, José A. Ramìrez-Hern·ndez, Michael Fu, Steven Marcus, Xiaodong Yao

We present models and algorithms to convert PM tasks scheduled on the base of the count of wafers processed into equivalent calendar PM schedules. These equivalent calendar-based tasks can then be used within an optimization algorithm for PM scheduling. We propose a discrete mathematical model and an algorithm to convert from wafer-count targets into equivalent calendar dates. An extension of this model and algorithm is presented to convert of other types of PM's (e.g., processing-time).

■ SA46

Mart-Room M

Security and Utility of Confidential Data 1

Cluster: Security and Utility of Confidential Data
Invited Session

Chair: Rick Wilson, Professor, Department of MSIS, Oklahoma State University, Stillwater, OK, 74078, United States, rlwilsn@okstate.edu

1 — Data Protection and Accuracy On Statistical Database Systems
Manuel A. Nunez, School of Business, University of Connecticut, 2100 Hillside Road Unit 1041, Storrs, CT, 06269-1041, United States, Manuel.Nunez@business.uconn.edu, Robert Garfinkel, Ram Gopal

Perturbation methods are used to protect confidentiality in statistical database systems, but they rarely allow for exact answers to linear queries. When there is an incentive to provide exact answers, deciding which queries to answer is a difficult problem. Moreover, some users might have partial knowledge of the data, so that the risk of disclosure could adversely affect the number of answerable queries. We propose models to determine answerable queries under partial user knowledge.

2 — Exploring Perturbation Impacts on Knowledge Discovery in Small Databases
Rick Wilson, Professor, Department of MSIS, Oklahoma State University, Stillwater, OK, 74078, United States, rlwilsn@okstate.edu, Peter A. Rosen

While an initial study indicated some evidence of 'data mining bias' in perturbation techniques for databases, there was also evidence of other unexpected phenomenon. This study expands the investigation of the impact of data perturbation techniques on KD in small databases.

3 — Extracting Knowledge from Perturbed Databases: Impact of Knowledge Structure and Discovery Tools
Mohammad Al-Ahmadi, Department of MSIS, Oklahoma State University, Stillwater, OK, 74078, United States, alahmadi2000@hotmail.com, Peter A. Rosen, Rick Wilson

Using a large, artificially constructed dataset with a given 'knowledge structure', the impact on knowledge discovery when using perturbation techniques in a database is explored. Multiple KDD tools are analyzed.

Sunday 10:00am - 11:30am

■ SB01

Westin-Intl. A, 6th Floor

Optimization Models in Telecommunications

Sponsor: Telecommunications
Sponsored Session

Chair: Rosemary T. Berger, Assistant Professor, Lehigh University, Industrial and Systems Engineering, 200 W. Packer Ave., Bethlehem, PA, 18015-1582, United States, rtb3@lehigh.edu

1 — Integer Programming Approaches to Designing Nonsimultaneous Multicommodity Flow Networks
Cole Smith, Assistant Professor, University of Arizona, PO Box 210020, Tucson, AZ, 85721, United States, cole@sie.arizona.edu

We examine a nonsimultaneous multicommodity flow problem wherein the transmission of certain flows can be delayed, permitting the flexibility of staggering flow traffic in order to satisfy capacity constraints. We follow the exploration of this problem by describing an integer programming approach to designing multicommodity flow networks that permit the flexibility of delayed transmissions. We conclude with computational results and implications for solving survivable network flow problems.

2 — Designing Stacks of Interconnected Bidirectional SONET Rings
Rosemary T. Berger, Assistant Professor, Lehigh University, Industrial and Systems Engineering, 200 W. Packer Ave., Bethlehem, PA, 18015-1582, United States, rtb3@lehigh.edu, Karen A. Kelly

The problem of designing stacks of interconnected bidirectional SONET rings arises in the capacity planning of telecommunications networks. Given a topology of interconnected rings and a set of demands, the objective is to determine how to route each demand and where to place ADMs to minimize the total number of ADMs required. Two linear integer programming formulations are presented, and solution algorithms are described. Computational results comparing the two formulations are reported.

3 — Optimization Models for Traffic Engineering in MPLS Networks
Saib Jarrar, MCI Telecommunications, Richardson, TX, 75275, United States, Saib .Jarrar@mci.com, Richard Barr

MPLS is an emerging technology for telecommunications networks that facilitates traffic engineering by giving users control over packet flows in IP networks. Presented are a series of integer programming models for MPLS network engineering and an in-depth study of their behavior on realistic problem sets.

■ SB02

Westin-Intl. B, 6th Floor

Financial Modeling and Real Options

Cluster: Financial Engineering
Invited Session

Chair: Shi-Jie Deng, Assistant Professor, Georgia Institute of Technology, Industrial & Systems Engr, Atlanta, GA, 30332, United States, shijie.deng@isye.gatech.edu

1 — Option-Based Valuation of Public Sector Investments
William Rouse, United States, brouse@isye.isye.gatech.edu

Public sector investments present valuation problems because their returns are often very uncertain and distant in time, and these returns cannot be expressed as cash flows in terms of profits. This paper outlines an options-based methodology for valuation of such investments where the cash flows needed for these models are represented in terms of costs savings for providing public sector capabilities. The methodology is illustrated for defense investments and economic development investments.

2 — Continuous-Time Mean-Variance Portfolio Selection with Short-Selling Prohibition
Xun Yu Zhou, Professor, The Chinese University of Hong Kong, Dept of Systems Engg & Engg Mgmt, Shatin, NT, Hong Kong, xyzhou@se.cuhk.edu.hk, Ying Hu

A continuous-time mean-variance portfolio selection problem is studied where all the market coefficients are random and short-selling prohibited. Feasibility of the problem is characterized, and efficient portfolios and efficient frontier are presented in closed forms.

3 — Vulnerable Deferment Options in Supply Chains and Effects of Correlated Supplier Defaults
Volodymyr Babich, University of Michigan, IOE Department, 1205 Beal Avenue, Ann Arbor, MI, 48109, United States, vob2@weatherhead.cwru.edu, Apostolos Burnetas, Peter Ritchken

We consider a single-period, multi-stage, supply chain model with a retailer and two competing risky suppliers and find equilibrium prices and order quantities. We show how the introduction of the deferment options alters the nature of competition between suppliers to the retailer's disadvantage. The ramifications to the retailer are most profound when suppliers' defaults are highly correlated.

4 — Strategic Warehouse Design: A Real Options Analysis
Shi-Jie Deng, Assistant Professor, Georgia Institute of Technology, Industrial & Systems Engr, Atlanta, GA, 30332, United States, shijie.deng@isye.gatech.edu, Steven Hackman

We consider a warehouse design problem exploiting the value of flexibility associated with various design factors in hedging against business growth uncertainty. By explicitly modeling the exogenous dynamics of incoming material flows to a warehouse facility and the physical characteristics of design factors, we establish a real options analytic framework for evaluating warehouse designs from a strategic viewpoint of minimizing the present value of total fixed and operational costs.

■ SB03

Westin-Intl. C, 6th Floor

Applications of OR to Semiconductor Manufacturing

Cluster: Practice Track
Invited Session

Chair: Brian Denton, IBM - 958C, 1000 River Street, Essex Junction, NJ, 05452, United States, bdenton@us.ibm.com

1 — Impact of Factory Operations Research (FORCe) on Semiconductor Manufacturing
Mani Janakiram, Intel Corp., CH3-113, 5000 W. Chandler Blvd, Chandler, AZ, United States, mani.janakiram@intel.com, K. J. Stanley, Frank Robertson, John Fowler

Factory Operations Research Center (FORCe) a 3 year, ~ $1million/year, effort between SRC and ISMT, addresses the ITRS factory operations challenges. These 5 projects address demand planning, PM, scheduling and modeling. University researchers are working together with MC's to develop solutions. The last year of the FORCe is focused around providing pathways for commercialization and implementation of the research results and that would be discussed at detail in this presentation.

2 — On Experiences Using The Operating Curve Methodology for Controlling and Performance Evaluation of Semiconductor Manufacturing
Alexander K. Schoemig, Infineon Technologies AG, Corporate Logic, Strategic Production Management, D-81730 Munich, Germany, Alexander.Schoemig@infineon.com, Manfred Mittler

In 1997 Infineon Technologies started the Productivity Offensive. The Operating Curve Methodology was introduced as the standard factory productivity measurement along with new performance indicators. We discuss the experiences concerning the application of this methodology and elaborate about shortcomings of the operating curve methodology and present directions for future research.

3 — Supply Chain Optimization in the On-Demand Era
Robert Orzell, IBM, 9 Bobolink Circle, Essex Junction, VT, 05452, United States, rorzell@us.ibm.com

OR methods have been used extensively in production planning in IBM's Microelectronics Division. We describe the evolution of such techniques over time to cover an increasing number of essential business processes. We also describe the evolution of using such techniques to support on-demand operating environments and further goals and challenges in this arena

4 — A Semiconductor Manufacturing Model with Multiple Grade Products and Downgrading
Bala Ramachandran, IBM T.J., Watson Research Center, PO Box 218, Yorktown Heights, NY, 10598, United States, Kaan Katircioglu, Bala Ramachandran

We present a multi-echelon inventory model of a semiconductor manufacturing process that enables the analysis of drivers of supply chain performance. The model includes consideration of the multiple grades of products produced by the manufacturing process and effects of downgrading inventory.

■ SB04

Westin-Intl. D, 6th Floor

Panel: Building an OR Tools Business

Sponsor: CPMS, The Practice Section of INFORMS
Sponsored Session

Chair: Frederic Murphy, Professor, Temple University, School of Business and Management, Philadelphia, PA, 19122, United States, fmurphy@sbm.temple.edu

1 — Panel: Building an OR Tools Business
Moderator: Frederic Murphy. Panelists: Tom Baker, Tom Cook, Bjarni Kristjansson, and Irv Lustig

The practice area has many businesses where the value added is in the software tools they provide. This kind of business has very different strategic considerations versus consulting (the next panel). The panelists are with successful companies that focus on tools businesses. They will offer their insights into building and managing this kind of business. See how you can join John Malone as the next OR billionaire.

■ SB05

Westin-Intl. E, 6th Floor

Queueing Systems with Time Varying Parameters

Sponsor: Applied Probability
Sponsored Session

Chair: Hayriye Ayhan, Georgia Institute of Technology, School of Industrial and Systems Eng., 765 Ferst Drive, Atlanta, GA, 30332-0205, United States, hayhan@isye.gatech.edu

Co-Chair: Cathy Xia, Research Staff Member, IBM T. J. Watson Research Center, P. O. Box 704, Yorktown Heights, NY, 10598, United States, cathyx@us.ibm.com

1 — Analysis of Mean Response Time under Time-Varying Load for Different Scheduling Policies
Mor Harchol-Balter, Assistant Professor, Carnegie Mellon University, Computer Science Department, 5000 Forbes Hall, Pittsburgh, PA, 15213, United States, harchol@cs.cmu.edu, Bianca Schroeder

We are motivated by improving the performance of Web servers under transient overload conditions. We investigate both analytically and via implementation how SRPT scheduling can be used to improve mean response time under transient overload conditions.

2 — Fluid and Diffusion Limits for the Sojourn Time of the M(t)/M(t)/1/PS Queue
William Massey, Professor, Princeton University, ORFE Department, Engineering Quadrangle, Princeton, NJ, 08544, United States, wmassey@Princeton.EDU, Robert Hampshire, Mor Harchol-Balter

We study the type of sojourn times encountered by a single server queue under the processor sharing queueing discipline, with time varying arrival and service rates. We show how an asymptotic analysis for its queue length process can be transformed into a similar type of analysis for the response times of any "virtual customer" in the system. This yields simple formulas that approximate the means, variances and distributions of these sojourn times.

3 — Strong Approximations of Non-Stationary Queueing Networks
Kavita Ramanan, Associate Professor, Department of Mathematical Sciences, Carnegie Mellon University, Pittsburgh, PA, United States, kavitaramanan@hotmail.com, Avishai Mandelbaum

We develop a rigorous framework for an asymptotic analysis of time-varying queueing networks, using directional derivatives of the oblique reflection map. The single station model was analyzed by Mandelbaum and Massey, where it was shown that a time-varying queue typically alternates between three different phases of loading. We show that, while the same phases prevail for each queue in a network novel features arise due to dependence on network topology. We support our theory with some practical insights, gained through several illustrative examples.

4 — Dynamic Scheduling of a Multi-class Open Network in Slowly Changing Environment
Junxia Chang, Ph.D student, Georgia Institute of Technology, 765 Ferst Drive, Atlanta, GA, 30332-0205, United States, junxiach@isye.gatech.edu, Hayriye Ayhan, Jim Dai

We describe a general approach for the dynamic control of a system in a slowly changing environment, where in each environment state, the system behaves as a multi-class open network. We show that this system can be approximated by its fluid analog: a stochastic fluid model (SFM). By interpreting the SFM control policy, a scheduling rule for the original system is defined. This work is motivated by the observation of the high perk-to-mean ratio of the internet traffic.

■ SB06

Westin-Intl. F, 6th Floor

Panel: The Academic Job Search

Cluster: Job Placement Committee
Invited Session

Chair: Zelda B. Zabinsky, Professor, Industrial Engineering, University of Washington, Seattle, WA, 98195, United States, zelda@u.washington.edu

Co-Chair: Russell, D Meller, United States, rmeller@vt.edu

1 — A Panel Discussion: The Academic Job Search
Moderator: Zelda B. Zabinsky. Panelists: Mark Lewis, Leslie Morgan, Lawrence Robinson

The panel will discuss the academic interview process and dos 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.

■ SB07

Westin-Intl. G, 6th Floor

Modeling Competition in Electricity Markets

Sponsor: Energy, Natural Resources and the Environment
Sponsored Session

Chair: Alvaro Baillo, Professor, Universidad Pontificia Comillas, Sta Cruz de Marcenado 26, Madrid, Ma, 28015, Spain and Canary Islands, alvaro.baillo@iit.upco.es

1 — Impact of the Spanish Tariff Regulation on the Strategy Followed by Generation Companies
Alvaro Baillo, Professor, Universidad Pontificia Comillas, Sta Cruz de Marcenado 26, Madrid, Ma, 28015, Spain and Canary Islands, alvaro.baillo@iit.upco.es, Mariano Ventosa, Michel Rivier, Andres Ramos

Although the Spanish power industry is fully liberalized, two thirds of the supply remain subject to the official retail tariffs. This implies a fixed income that consistently does not match the amount needed to pay for this energy in the wholesale market. If a deficit occurs, it is allocated among generation companies, thus reducing their interest in high wholesale prices. We quantify the impact of this rule by means of a model formulated as a complementarity problem .

2 — Electricity Market Modeling Trends
Mariano Ventosa, Professor, Universidad Pontificia Comillas, Sta Cruz de Marcenado 26, Madrid, Ma, 28015, Spain and Canary Islands, mariano.ventosa@iit.upco.es, Alvaro Baillo, Andres Ramos, Michel Rivier

The paper presents a survey of the most relevant publications regarding electricity market modeling. It introduces a classification according to their most relevant attributes. Finally, it identifies the most suitable approaches for conducting various types of planning study or market analysis that take place in this new context.

3 — Tacit Collusive Game Solutions via Optimization
Joseph Harrington, The Johns Hopkins University, Dept. Economics, Baltimore, MD, 21218, United States, joe.harrington@jhu.edu, Ben Hobbs, Jong-Shi Pang, Andrew Liu

We study the optimization problem of a tacit collusive game ("super game") in which electric generators collectively maximize the Nash bargaining objective function subject to a set of incentive compatibility constraints. Although such a problem has an MPEC structure, certain smoothness, convexity, and boundness results facilitate computation.

4 — Dynamic Oligopolistic Network Competition and Electric Power Network Security
Terry Friesz, Harold and Inge Marcus Professor of Industrial and Manufacturing Engineering, The Pennsylvania State University, 305 Leonhard Building, University Park, PA, 16802, United States, druidz8@starpower.net

We present a model of dynamic oligopolistic network competition that determines plant-specific output, the allocation of outputs to meet demands and output shipment patterns (all three of which are control variables), as well as output inventories (which are state variables) when the firms compete non-cooperatively and construct temporal as well as spatial strategies for their network activities. We describe how this model may be employed to study electric power network security.

■ SB08

Westin-Intl. H, 6th Floor

Sports Scheduling - Going the Distance

Cluster: Sports, Games, and Recreational OR
Invited Session

Chair: Kelly Easton, Kansas State University, 1762 King's Rd, Manhattan, KS, 66503, United States, keaston0@yahoo .com

1 — The Traveling Baseball Fan Problem
Ryan Herring, United States, Ryan.Herring@oberlin.edu

In the Traveling Baseball Fan Problem, the goal is to see a game in each MLB stadium in as short a time span as possible, traveling by car. In one version, the starting city is given; in another it isn't. We present a constraint programming formulation and compare it to other approaches.

2 — A New Heuristic for the Traveling Tournament Problem
Kelly Easton, Kansas State University, 1762 King's Rd, Manhattan, KS, 66503, United States, keaston0@yahoo.com

The Traveling Tournament Problem (TTP) represents the fundamental issues involved in creating a schedule for sports leagues where the amount of team travel is an issue. This research presents a new heuristic for generating good solution to large instances of the TTP.

3 — How Big are the TTP 4, 6 and 8 Team Problems?
J. Mark Dorrepaal, Department Chairman, Mathematics & Statistics, Old Dominion University, BAL 500, Norfolk, VA, 23529, United States, jdorrepa@odu.edu, George Chackman

This talk will study the more elementary TTP problems with a view to enumerating the total number of legal schedules in each. Features which are common to near-optimal schedules will be examined and complexities posed by higher order problems will be discussed.

■ SB09

Westin-Vinings 1, 6th Floor

Undergraduate Capstone OR Projects

Sponsor: Education (INFORM-ED)
Sponsored Session

Chair: Jim Lowe, Associate Professor of OR/Mgt, US Air Force Academy, 2354 Fairchild Dr, Suite 6H242, USAir Force Academy, CO, 80840, United States, Jim.Lowe@usafa.af.mil

1 — Undergraduate Capstone OR Projects
Jim Lowe.

More and more undergraduate OR programs rely upon capstone application efforts. Individuals or teams of students complete projects for local communities and supportive clients. This session summarizes the accomplishments and lessons learned from these efforts. Students were selected by their faculty and invited to present during the INFORMS Conference to expose and motivate students to continue their studies of Operations Research.

■ SB10

Westin-Vinings 2, 6th Floor

Organizational Theory II

Contributed Session

Chair: Ignacio J. Martìnez-Moyano, Ph.D. Candidate, University at Albany, 135 Western Av., Milne Hall 318, Albany, NY, 12222, United States, im7797@albany.edu

1 — An "Organization" Logistic Equation and Possible Implications to the Social Sciences
Alan Zimm, Principle Professional Staff, The Johns Hopkins University Applied Physics Laboratory, 1987 Barley Road, Marriottsville, MD, 21104, United States, dradz@adelphia.net

A time-step equation has be derived for organizations in a competitive environment which is equivilent to the famous Logistic equation, generating chaotic dynamics, nonmonotonicity, the Butterfly Effect, and extreme sensitivity to initial conditions. If other social science processes admit to chaotic dynamics, there are considerable implications to the conduct of the social sciences and to the appropriate methodologies for growing social science knowledge.

2 — Globalism and Identity Formation: Human Movement and its Consequences-Immigration, Minorities
Adejo E. Akindele, Lecturer in mathematics/Economics, St Augustines College/IFCLA, No.2 Evbarunegbeifo St.Off Second e/c, Benin City, Nigeria, akinlandmillenium@yahoo .com, Felix E. Umweni

This topic for the purpose of comprehension and appreciation has to be looked at from the outside to the inside. Human movement may be voluntary or involuntary in whichever way it is considered, it is still human movement.We need to look at the causes of voluntary and involuntary human movement. Usually, when human movement takes place in a form of immigration, minority societies will surely be created. Being in the minority, usually in another person's country can be frustrating and prejudicial. In conclusion, this presentation will look at human movement, its consequences and the issue of becoming a minority as a result.

3 — A Knowledge-Based Perspective on Global Assignments
Won P. Shim, Professor, Andong National University, Dept. of International Business, Andong, KB, Korea Repof, wpshim@anu.ac.kr

This paper addresses the knowledge transfer and organizational learning processes of global assignments. In fact, expatriate managers are a source of competitive advantage because of the fact that expatriates are key agents of knowledge transfer and learning. To leverage these knowledge and learning, organizations must build infrastructure that facilitate the effective assignment program. Practical recommendations for a global assignment strategy are suggested.

4 — Two Discrete Optimization Models for Coordinated Multiple Autonomous UAV Applications
Moises Sudit, Director of Multidisciplinary Programs, Rochester Institute of Technology, 77 Lomb Memorial Drive, Rochester, NY, 14623, United States, mxseen@rit .edu, Dheeraj Talreja, Vijay Shetty

The potential advantages of Unmanned Aerial Vehicles (UAVs) over manned aircraft are significant and motivate the development of advanced Operations Research models and techniques to deal with a number of logistical issues. We will discuss the use of Discrete Optimization in solving two problems that arise from the introduction of teams of UAVs. In both problems we analyze the use of multiple aircrafts that are autonomous in nature and require coordination by some mathematical model.

5 — Rule Dynamics: Towards a Theory of Rule Evolution
Ignacio J. Martìnez-Moyano, Ph.D. Candidate, University at Albany, 135 Western Av., Milne Hall 318, Albany, NY, 12222, United States, im7797@albany.edu

This study draws on theory from different sources. First, following March and others (March, Schulz and Zhou, 2000) I conceptualize the process of rule evolution as an organizational phenomenon influencing decision making and action. Second, I model relations related to rule evolution using concepts drawn from structuration and institutional theories. Finally, I use system dynamics models and methods to assess change within systems of rules and to trace the origins of those changes.

■ SB12

Westin-Augusta 2, 7th Floor

Workforce Flexibility

Cluster: Workforce Flexibility and Agility
Invited Session

Chair: David Nembhard, University of Wisconsin-Madison, 1513 University Ave., 360 ME Bldg., Madison, WI, 53706, United States, nembhard@engr.wisc.edu

Co-Chair: Bryan Norman, Ph.D, Associate Professor, University of Pittsburgh, 1033 Benedum Hall, Department of Industrial Engineering, Pittsburgh, PA, 15261, United States, banorman@pitt.edu

1 — An Investigation of Worker Heterogeneity and Group Composition in Serial Production Systems
Karndee Leopairote, University of Wisconsin-Madison, 1513 University Ave., Madison, WI, 53705, United States, leopairo@cae.wisc.edu

We examine the effects of between-individual performance (worker heterogeneity) in a production environment where workers perform serial tasks. Worker heterogeneity is characterised by individual learning-forgetting behaviors. We present a heuristic approach for assigning workers to working team under varying system conditions and operating policies.

2 — The Effects of Coworker Speed on Processing Rates
Kenneth Schultz, Assistant Professor, Indiana University, Operations and Decision Technologies, Kelley School of Business, 1309 E. 10th, Bloomington, In, 47405, United States, keschult@indiana.edu, Tobias Schoenherr

You work in an automobile-plant with 6 parallel workstations pulling from a common buffer. You earn a straight hourly-wage. If you work with a 'fast' group do you work at the same rate, slower or faster than your expected speed? Why? We don't know yet. Hopefully, we'll know by November.

3 — An Analytic Performance Evaluation Model for Manufacturing Layouts
Michael Carbone, Clinical Assistant Professor, Rensselaer Polytechnic Institute, 110 8th Street, Troy, NY, 12180, United States, carbom2@rpi.edu, Sunderesh Heragu

In this paper, we provide a model, which uses queueing network theory to evaluate labor and queueing performance measures in a cellular manufacturing system. Manufacturing system inputs include part demand rates, processing information, machines and their cell assignments. Labor-staffing level is treated as a variable where capacity is maximized when the number of operators equals the number of machines. An open and closed network approach is used to model the system in this paper.

4 — Cross-Training and Worker Efficiency
Bryan Norman, Ph.D, Associate Professor, University of Pittsburgh, 1033 Benedum Hall, Department of Industrial Engineering, Pittsburgh, PA, 15261, United States, banorman@pitt.edu, David Nembhard

We investigate the trade-offs between training costs and worker flexibility in a dynamic production setting that uses cross-training. Several factors are considered including product change and worker turnover. We discuss managerial and research implications.

■ SB13

Westin-Augusta 3, 7th Floor

Word of Mouth: Theory and Practice

Sponsor: Marketing Science
Sponsored Session

Chair: David Godes, Assistant Professor, Harvard Business School, Morgan 165, Soldiers Field, Boston, MA, 02163, United States, dgodes@hbs.edu

1 — Word of Mouth Dispersion: A Natural Experiment
David Godes, Assistant Professor, Harvard Business School, Morgan 165, Soldiers Field, Boston, MA, 02163, United States, dgodes@hbs.edu, Dina Mayzlin

We hypothesize that, ceteris paribus, more dispersed conversations are more likely to diffuse information and opinions. Our previous research has identified dispersion as an important element of any word of mouth measurement strategy. Here, we argue that building dispersion should be part of a word of mouth management strategy as well. The data come from a natural experiment of a firm's attempt to build word of mouth for its product through a large group of product advocates.

2 — The Effect of Word of Mouth on Sales: Online Book Reviews
Dina Mayzlin, Assistant Professor, Yale University, 135 Prospect Street, New Haven, CT, 06520, United States, dina.mayzlin@yale.edu, Judith Chevalier

We examine the effect of consumer reviews on firms' sales. We use publicly available data from the two leading online booksellers, Amazon and BN.com, to construct measures of each firm's sales and consumer reviews of individual books. Comparing the sales of a given book across the two sites allows us to measure the effect of individual reviews on the sales of a book at each site, holding book quality constant.

3 — Social Contagion and Income Heterogeneity in New Product Diffusion
Christophe Van den Bulte, Assistant Professor, Wharton School, University of Pennsylvania, 700 Jon M. Huntsman Hall, 3730 Walnut Street, Philadelphia, PA, 19104-6340, United States, vdbulte@wharton.upenn.edu, Stefan Stremersch

The Bass model assumes that social contagion drives new product diffusion. However, Bass-like curves can also result from independent adoptions in a heterogeneous population. We confront both interpretations with meta-analytic data on the q/p ratio. We find that the ratio is associated with the extent of income inequality in a country. However, we also find that the ratio varies systematically with the Hofstede dimensions of national culture, supporting the contagion interpretation.

■ SB14

Westin-Peachtree A, 8th Floor

Panel: NPD Emerging Research Themes

Cluster: New Product Development
Invited Session

Chair: Vish Krishnan, Professor, University of Texas at Austin, TX 78712-5921, Austin, TX, United States, vish .krishnan@bus.utexas.edu

1 — Panel: NPD Emerging Research Themes
Vish Krishnan, Professor, University of Texas at Austin, TX 78712-5921, Austin, TX, United States, vish.krishnan@bus.utexas.edu, Christoph Loch, Karl Ulrich, William Lovejoy

■ SB15

Westin-Peachtree F, 8th Floor

Interactions: Technological and Organizational Change

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 — The Toyota Way: Creating an Environment for Innovation
Jeffrey Liker, Professor of Industrial and Operations Engineering, University of Michigan, 1205 Beal Avenue, Ann Arbor, MI, 48109, United States, liker@umich.edu

Toyota in 2003 was the most profitable company in Japan and more profitable than the Big-3 U.S. companies combined. Year after year profitability and quality awards are a result of internal social and technical systems that make up "the Toyota way." This philosophy and management approach supports innovation and continuous improvement.

2 — The Impact of ERP Adoption on Organizational Agility: An Empirical Investigation
Andrea Masini, Assistant Professor, London Business School, Regents Park, London, UK, United Kingdom, amasini@london.edu

This paper examines the impact of ERP adoption on the degree of formalization of organizational processes and on the cognitive mechanisms through which the firm responds to changes in its external environment. Theoretical and managerial insights are obtained via the analysis of a sample of American and European SAP clients.

3 — Unintended Consequences of Product Innovation: Organizational Change
Annique Un, Assistant Professor, Cornell University, Johnson Graduate School of Management, 370 Sage Hall, Ithaca, NY, 14850, United States, cau3@cornell.edu

This paper analyzes the unintended consequences of product innovation. It explains how when the firm innovates existing products to meet the changes in the demands of the market place, it is forced to alter its work processes because of the interdependencies in generating the product innovation.

4 — Product Architecture Changes and Firm Boundary Shifts: Causes and Consequences
Sebastian Fixson, Assistant Professor, University of Michigan, 1205 Beal Avenue, IOE 2793, Ann Arbor, MI, 48109, United States, fixson@umich.edu, Young Ro

Several conceptual models have been proposed to link product architecture and industry structure. To explore this relationship between product design decisions and firm boundary choices in more detail, this paper uses detailed case analyses to map individual event sequences. The direction of change and drivers from outside of the two domains are examined.

■ SB16

Westin-Peachtree G, 9th Floor

Modelling Applications I

Sponsor: Health Applications
Sponsored Session

Chair: Michael Carter, Professor, University of Toronto, Mechanical & Industrial Eng, 5 King's College Rd, Toronto, ON, M5S3G8, Canada, carter@mie.utoronto.ca

1 — Patient Flows In Hospitals, Balancing Clinical And Management Needs
Mohan Krishnamoorthy, Science and Industry Manager, CSIRO, Mathematical and Information Sciences, Private Bag 10, Clayton South MDC, Clayton, VIC, VI, 3169, Australia, Mohan.Krishnamoorthy@CSIRO.AU, David Sier

A concern of clinicians and administrators is to move patients through a hospital as quickly as possible so as to reduce patient waiting times. An approach is to quarantine beds for use by medical units. From a queuing perspective this reduces overall efficiency. This paper describes decision support tools used to find a partitioning of beds between medical units that gives optimal patient flow in a hospital. The tools have been used in planning processes at a few hospitals in Australia.

2 — Approximating Station Specific Vehicle Utilization for Emergency Service Systems
Susan Budge, University of Alberta, 2-24 Business Building, Edmonton, AB, T6G 2R6, Canada, sbudge@ualberta.ca, Armann Ingolfsson, Erhan Erkut

The average utilization of each vehicle in an emergency service system is an important quantity that is required for calculating various performance measures. Three features of such systems complicate estimating these vehicle "busy fractions"; the possibility of multiple vehicles per station, workload variation by station, and server cooperation between stations. We provide a method to approximate the server busy fractions that accounts for these features and builds on previous approaches.

3 — Managing Line-Ups for Albertas's MRIs... An Operations View
Sherry Oh, University of Calgary, Haskayne School of Business, 2500 University Drive NW, Calgary, AB, T2N 1N4, Canada, sherry.oh@haskayne.ucalgary.ca, Erhan Erkut, Armann Ingolfsson, Dan Haight

For many years, the Canadian media has used the waiting times for MRIs as a proxy for measuring the 'health' of our public health care system. On the surface, it may seem that this is a job for queueing theory, but in fact, the problem is in many ways both simpler and more complex. A brief summary of the many issues facing the management of these scarce medical resources will be discussed. Analysis of service data, simulation of the current system and recommendations will be presented based on service level guarantees currently proposed.

■ SB17

Westin-Peachtree H, 9th Floor

Operations Research and Management Science in Public Health: Part II

Cluster: Public Health & Health Economics
Invited Session

Chair: Michael Washington, Industrial Engineer, Centers for Disease Control and Prevention, National Immunization Program, 1600 Clifton Rd, NE, MS E62, Atlanta, GA, 30329, United States, Mtw4@cdc.gov

1 — The Effect of Bidding, Contract, and Purchase Practices on Vaccine Supply and Pricing in the US
Margaret Coleman, Economist, CDC/NIP/HSREB, 1600 Clifton Rd. NE, MS-E52, Atlanta, Ga, 30333, United States, zby5@cdc.gov, Rex Ellington, Dean Mason, Nalinee Sangrujee, Fangjun Zhou, Susan Chu

In 1993 legislation discontinued sole-source awards for government vaccine contracts and set price caps on then contracted vaccines. These changes had potentially inverse competitive effects on vaccine manufacturers. The numbers of vaccine manufacturers selling through government contracts and real price trends of vaccines were examined for the 1990s. Neither price caps nor changes in contract practices dominated the market enough to change manufacturing patterns.

2 — Humanitarian Daily Relief and the Automation in Pharmacies Projects
Anita Callahan, Associate Professor, University of South Florida, 4202 E. Fowler Avenue, United States, callahan@eng.usf.edu

3 — Properties of Risk-Adjusted Control Charts for Regional Adverse Event Surveillance
James Benneyan, Northeastern University, 334 Snell Engineering Center, Boston, MA, United States, benneyan@coe.neu.edu

Severity-adjusted Shewhart, EWMA, and Cusum control charts are developed based on a mixed-risk model for non-identical dichotomous events in which standard i.i.d assumptions are not reasonably satisfied. Statistical properties of these charts are presented, which can significantly differ from those under simple binomial or other assumptions. Applications include adverse events across locations, infection control surveillance, and others.

4 — Economic Implications of Prescription Variation
Suman Lahiry, Research Officer, Diabetic Association of Bangladesh, 122, Kazi Nazrul Islam Avenue, Dhaka - 1000, Dhaka, NA, 1205, Bangladesh, suman_lahiry@yahoo .com, Samira Habib

The inter-GP prescription variation has economic implications. This study examined prescribing behavior of GPs and evaluated variability. Thirty diabetic patients sent to two different GPs of identical qualifications showed considerable variation in drug amount, prescribing costs in 6-month. The amount of prescribed medications was strongly associated with prescriptions of other drugs; the GPs prescribing the most expensive medications also prescribed the most expensive drugs in general.

■ SB18

Westin-Tower 1201, 12th Floor

Quality, Statistics & Reliability Section Best Student Paper Competition

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: Daniel Apley, Assistant Professor, Texas A&M University, Dept. of Industrial Engineering, College Station, TX, 77843-3131, United States, apley@tamu.edu

The four finalists for the Annual QSR Best Student Paper Competition will present the results of their research. The winner will be chosen based on their paper and presentation. All are welcome to attend.

■ SB19

Westin-Tower 1202, 12th Floor

Integration of Multiscale Wavelet Analysis and SPC for Process Monitoring, Diagnosis and Control (II)

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: Judy Jin, Assistant Professor, The University of Arizona, Department of Systems & Industrial Eng, Tucson, AZ, 85721-0020, United States, jhjin@sie.arizona.edu

1 — A Control Strategy for Run-by-Run Control
Tapas K. Das, Professor, University of South Florida, 4202 E. Fowler Avenue, ENB 118, Tampa, FL, 33647, United States, das@eng.usf.edu, Santosh Kothamasu, Bhavaniprasad Rao, Rajesh Ganesan

The EWMA based run-by-run controller is known to be inefficient for processes with moderate to high autocorrelation. A new control strategy is developed, which is applied to a highly autocorrelated process with shifts in the mean, variance, and deterministic trend. The results show drastic improvements over the EWMA controller.

2 — On-line Surface Defect Detection in the Rolling Processes using Discrete Wavelet Analysis for Feature Extraction
Jianjun (Jan) Shi, Professor, The University of Michigan, Dept of Industrial and Operations Engr, Ann Arbor, MI, 48109-2117, United States, shihang@umich.edu, Jing Li

This research investigates the method regarding the detection of certain surface defect based on the image data acquired via the imaging sensors installed on production line. The proposed method starts from edge detection as a coarse level detection, follow by a refining procedure using wavelet analysis for feature extraction.

3 — Equipment Health Diagnosis Using A Wavelet-Based Data Mining Approach
David He, Department of Mechanical and Industrial Engineering, University of Illinois at Chicago, Chicago, IL, IL 60607, United States, davidhe@uic.edu

In this paper, a wavelet-based data mining approach for equipment health diagnosis is presented . The method is demonstrated with a case study in automatic health condition monitoring of hydraulic pumps. The results of the case study show that the wavelet-based data mining approach is effective for diagnosing the pump health states that are defined by the flow loss.

4 — Process Waveform Signal Analysis Using Wavelets
Judy Jin, Assistant Professor, The University of Arizona, Department of Systems & Industrial Eng, Tucson, AZ, 85721-0020, United States, jhjin@sie.arizona.edu

The waveform signals have the general characteristics of non-stationary with localized time and frequency components at different signal segments. In this research, a general method is presented by using the multiscale wavelet analysis for waveform signal segmentation, variation analysis, and diagnosis.

■ SB20

Westin-Tower 1203, 12th Floor

Reliability Research II

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@rci.rutgers.edu

1 — Optimum Accelerated Degradation Testing Plans
E.A. Elsayed, Professor, Rutgers, The State University of New Jersey, Dept of Industrial Engineering, 96 Frelinghuysen Road, Piscataway, NJ, 08854-8018, United States, elsayed@rci.rutgers.edu, Haitao Liao

We present an optimum Accelerated Degradation Testing plan as a mathematical programming problem under several constraints based on the Accelerated Geometric Brownian Motion Degradation Rate model. The purpose of the testing plan is to determine the decision variables such as test termination time, sample size, stress levels and allocation ratio of the sample in order to minimize the variance of the estimated reliability at normal operating conditions over a prespecified period of time.

2 — Combining Network Reductions and Simulation for Network Reliability Analysis
Abdullah Konak, Assistant Professor of Information Sciences and Technology, Penn State Berks-Lehigh Valley College, PO Box 7009, Tulpehocken Rd., Reading, PA, 19610, United States, konak@psu.edu, Alice E. Smith

The biggest challenge in the simulation approach to network reliability analysis is that networks and components are so reliable that large numbers of samples are required to observe failed network states, which significantly increases the cost of simulation for highly reliable networks. This research proposes using network reduction techniques to improve effectiveness and efficiency of simulation in estimating network reliability. Theoretical and empirical results are presented.

3 — New Approaches in Multistate Reliability Modeling & Optimization
Jose Ramirez-Marquez, Rutgers University, Department of Industrial & Systems Engin, 96 Frelinghuysen Rd., Piscataway, NJ, 08854, United States, pollazo@eden.rutgers .edu

The binary assumption used to analyze and model system reliability is relaxed. Misidentifying a system as binary can lead to incorrect appraisals of the true system state. Methods for the reliability analysis and optimization of systems where components or systems have a range of degraded states are explored. Research efforts are focused on developing multistate two-terminal network reliability computation methods so real applications can efficiently apply them.

4 — Quality-Oriented-Maintenance for Multiple Interactive Components
Yong Chen, Assistant Professor, University of IOWA, Dept. of Mechanical and Industrial Engr., Iowa City, IA, United States, chenyz@umich.edu, Judy Jin

In contrast to traditional maintenance practices where product quality is typically ignored, a general quality-oriented-maintenance methodology is proposed in this paper to minimize the overall production costs including product quality loss due to the process drift, productivity loss due to catastrophic failures, and the maintenance costs.

■ SB21

Westin-Tower 1204, 12th Floor

Optimization Services on the Internet

Sponsor: Computing
Sponsored Session

Chair: Robert Fourer, Professor, Northwestern University, Dept of Industrial Eng & Mgmt Sciences, 2145 Sheridan Rd, Evanston, IL, 60208-3119, United States, 4er@iems.northwestern.edu

1 — Optimization in Distributed Applications: How New Technologies Let OR Provide Web-Based Service
Bjarni Kristjansson, President, Maximal Software Inc., 2111 Wilson Boulevard, Suite 700, 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 — New Developments in the Design and Operation of the NEOS Server
Robert Fourer, Professor, Northwestern University, Dept of Industrial Eng & Mgmt Sciences, 2145 Sheridan Rd, Evanston, IL, 60208-3119, United States, 4er@iems .northwestern.edu, Jason Sarich, Jorge More', Todd Munson

Enhancements to the NEOS Server are making optimization methods available over the Internet to an increasingly large audience. New utilities assist users in problem analysis and solver selection, and perform benchmark tests automatically. Submissions can be made from a growing variety of modeling environments to an increasingly varied lineup of general and specialized solvers. We survey these developments as well as others currently underway.

3 — Web Enabled Optimization: OSP to WEBOPT
Gautam Mitra, Professor, Head of Research Group, Brunel University, Department of Mathematical Sciences, Uxbridge, UB8 3PH, United Kingdom, Gautam.Mitra@brunel.ac.uk, Chandra Poojari, Patrick Valente

The optimization service provider project (OSP) is a recently concluded project for the delivery of optimization tools and applications across the web. In a follow up project 'WEBOPT' distributed components for creating web based DSS applications are under development. We discuss the context ('why') of these developments as well as 'what' is planned and 'how' we set out to achieve these.

■ SB22

Westin-Tower 1205, 12th Floor

USMA ORCEN I

Sponsor: Military Applications
Sponsored Session

Chair: William Klimack, Director, ORCEN, USMA, Department of Systems Engineering, United States Military Academy, West Point, NY, 10996, United States, William.Klimack@usma.edu

1 — The ORCEN at USMA
William Klimack, Director, ORCEN, USMA, Department of Systems Engineering, United States Military Academy, West Point, NY, 10996, United States, William.Klimack@usma .edu

A brief introduction to how research is conducted by the US Military Academy Operations Research Center of Excellence. The following presentations are ORCEN research projects.

2 — Creating a Center for Homeland Defense Research and Training
LTC Timothy Trainor, Deputy Director, ORCEN, Department of Systems Engineering, United States Military Academy, West Point, NY, 10996, United States, timothy .trainor@usma.edu, Ronald Welch

Military and civilian agencies must work together to deter, prepare for and respond to terrorist incidents on US soil. Key to this is integrating the capabilities of disparate agencies involved with preparing for, and responding to incidents. For this, the military is considering creating a joint-use research and training center, similar to its training centers for warfighting. This talk describes the process of determining the requirements for such a center, and the master plan development.

3 — The Installation Vulnerability Assessment Tool (IVAT)
MAJ Patrick Magras, Assistant Professor and Systems Analyst, Department of Systems Engineering, Operations Research Center of Excellence, United States Military Academy, West Point, NY, 10996, United States, patrick.magras@us.army.mil, LTC Timothy Trainor

The Installation Vulnerability Assessment Tool (IVAT) is a SIPRnet web-based decision support system that provides installation staffs with a simple means to perform installation vulnerability assessments based on the FORSCOM Force Protection Assessment Team (FPAT) assessment process. The IVAT is linked to a secure database for retrieving assessment questions, capturing vulnerability assessments and providing local and global information for use in force protection resource prioritization.

4 — Experimenting with Interactive Multimedia Instruction for Military Science Education
Christopher M. Farrell, Major, USA, Instructor and Operations Research Analyst, Operations Research Center of Excellence, Department of Mathematical Sciences, United States Military Academy, West Point, NY, 10996, United States, Chris .Farrell@usma.edu, William Klimack

The United States Military Academy at West Point is revolutionizing the way that tomorrow's Army leaders are taught. A distance learning pilot was conducted using Interactive Multimedia Instruction with simulation embedded in the courseware to educate cadets on tasks that support land navigation. The overall goal is to provide cadets with web-based course materials that fully engage them, both cognitively and emotionally. An effectiveness study of the IMI was conducted and results are discussed.

5 — Taking a Bite of the Apple: Examining Jaguar OS in a WINTEL World
William Klimack, Director, ORCEN, USMA, Department of Systems Engineering, United States Military Academy, West Point, NY, 10996, United States, William.Klimack@usma .edu, MAJ Patrick Magras

The Apple Macintosh is capable of, with an application, running Windows-based software and should be capable of being networked with Wintel machines. We examined the ability of Macs to operate in a Wintel network.

■ SB23

Westin-Tower 1206, 12th Floor

Utility, Probability, and U-Values

Sponsor: Decision Analysis
Sponsored Session

Chair: Ali Abbas, Stanford University, Dep't of Mgmt Science and Engineering, Terman Engineering Center, Stanford, CA, 94305, United States, aliabbas@stanford.edu

1 — Utility - Probability Duality
Ali Abbas, Stanford University, Dep't of Mgmt Science and Engineering, Terman Engineering Center, Stanford, CA, 94305, United States, aliabbas@stanford.edu, James Matheson

We introduce duality between probability and normalized utility. By reversing the roles of the two functions, we introduce the aspiration equivalent, the dual of the certain equivalent, which links normative and descriptive formulations and suggests a new basis for setting and revising targets. We also introduce utility-dominance and saddle-point properties.

2 — Value-Based Utility
James Matheson, Chairman and CFO, SmartOrg Inc., 2440 Sand Hill Road, Menlo Park, CA, 94025, United States, jmatheson@smartorg.com, Ali Abbas

Value-based utility means placing a utility function over a multiattribute value function to derive a chain rule for risk attitude. We also introduce utility transversality, which relates and constrains risk attitude between attributes through knowledge of the value function, and introduce value-based notions of probability, certain equivalents, stochastic dominance, etc.

3 — Toward a Precise Decision Language
Ronald A. Howard, Professor, Stanford University, Dept of Management Sci and Engineering, Terman Engineering Center 420, Stanford, CA, 94305-4026, United States, rhoward@sdg.com

This presentation discusses the evolution of a language for teaching and practicing decision analysis designed to avoid confusion for students, clients, and ourselves. Many terms currently used are inaccurate, arcane, or unnecessary. Restricting decision language to terms that are accurate, familiar, and fundamental contributes to clarity of thought and understanding.

■ SB24

Westin-Tower 1207, 12th Floor

Perspectives in IS Outsourcing Research

Sponsor: Information Systems
Sponsored Session

Chair: Manish Agrawal, Assistant Professor, University of South Florida, Tampa, 4202 E. Fowler Ave. CIS 1040, Tampa, FL, 33620-7800, United States, magrawal@coba.usf.edu

1 — The Value of IT Outsourcing Arrangements: An Event Study Approach
Vijay Gurbaxani, Professor, University of California, Irvine, United States, VGurbaxa@uci.edu, Philippe Jorion

This paper examines the value of IT outsourcing arrangements to clients and vendors by examining the stock market returns of these firms when deals are announced. Using standard event study methodology, we find that stock markets react positively to the announcement of these deals for both clients and vendors.

2 — Networks of Capital or Networks of Influence: Understanding IT Decision-Making in the Public Sector
Shaila Miranda, Associate Professor, University of Oklahoma, Division of MIS, College of Business, Norman, OK, 73072, United States, shailamiranda@ou.edu, Yong-Mi Kim

We contrast two social network perspectives in examining IT outsourcing investments: (1) outsourcing is driven by intellectual capital that emerges from social capital underlying client/provider networks; (2) outsourcing is driven by isomorphic pressures originating from the comprehensive organizational network. These perspectives are explored in a survey of 139 city government managers. Findings provide partial support for isomorphism, but are unexpected in regard to intellectual capital.

3 — Not Just Services Now: Issues in Offshoring Information Product Development
Manish Agrawal, Assistant Professor, University of South Florida, Tampa, 4202 E. Fowler Ave. CIS 1040, Tampa, FL, 33620-7800, United States, magrawal@coba.usf.edu, H.R. Rao, V. Sridhar, Vivek Gupta

IT services outsourcing to offshore locations has been popular for some time. Of late, firms have also begun to test the waters for software product development. This paper is an initial comparison of issues that affect successful offshoring of services and products.

■ SB25

Westin-Tower 1208, 12th Floor

Ballistic Missile Defense and Weapons of Mass Destruction

Sponsor: Military Applications
Sponsored Session

Chair: Julian Palmore

1 — US Ballistic Missile Defense and China
Julian Palmore, Professor, University of Illinois at Urbana - Champaign, Department of Mathematics and Program in Arms Control, Disarmament and International Security, 1409 W. Green St., Urbana, IL, 61801, United States, palmore@uiuc.edu

We will discuss various potential problems in our relations with China over US National Missile Defense and US regional ballistic missile defense in East Asia involving Taiwan, Japan, South Korea, and the South China sea routes. There will be a presentation and an open discussion on these topics. In particular an upcoming special edition of Defense & Security Analysis, 19:4 (December 2003), will consider many aspects of these issues from a game theory point of view. We will also refer to a previous special edition of D&SA, 18:3 (September 2002), on Missile Defense Systems, in which game theory was used extensively for analysis.

■ SB26

Westin-Tower 1401, 14th Floor

Leading Software in Data Mining and Knowledge Discovery

Cluster: Data Mining and Knowledge Discovery
Invited Session

Chair: Wei Jiang, INSIGHT,AT&T, Morristown, Morristown, NJ, 07960, United States, wjg@insight.att.com

1 — High-Dimensional Data Mining Techniques
David Duling, Data Miner, SAS, SAS Campus Dr., Cary, NC, 27743, United States, David.Duling@sas.com, Leonardo Auslender

A typical genomics microarray observation may contain ten to twenty thousand attributes. Applications such as computer network monitoring, and digital intelligence produce similar sized data. Without clever strategies, this data stretches the capabilities of traditional linear algrebra-based models. This presentation will examine techniques for building predictive models from such data including data aggregation, variable selection and pattern recognition, and distributed processing.

2 — Utilizing Linguistic-Based Text Mining with Decision Trees for Churn Modeling
Laura Squier, Clementine Product Manager, SPSS, 2000 N. 14th Street, Suite 320, Arlington, VA, 22102, United States, lsquier@spss.com

This session explores utilizing natural language processing in addition to data mining routines to build better models. This session will 1) Discuss the various types of text mining available, including the method selected for this project 2) Discuss the various methods of concept reduction that may be utilized 3) Show the various routines that could be utilized for model building 4) Show the resultant decision tree generated with C&RT and 5) evaluate the model's performance.

3 — Supervised and Unsupervised Learning Analyses of Microarray Data
Michael O'Connell, Director BioPharm Solutions, Insightful Corp, 2505 Meridian Pkwy, Durham, NC, United States, michaelo@waratah.com

Microarrays measure the expression of genes in clinical samples for thousands of genes simultaneously. A common data analysis involves the determination of differentially expressed genes across experimental conditions e.g. tissue samples of different phenotype and drug conditions of interest. Supervised and unsupervised learning models are often used to explore expression results and relate these to clinical outcomes for groups of genes. Examples include clustering of genes and samples, identification of genes related to clinical outcomes, and class prediction. Both hierarchical and partitioning cluster analyses are used extensively with two main goals: (a) representing distances among high dimensional expression profiles in a concise, visually effective way, and (b) to identify candidate subgroups in complex data. This presentation surveys modern supervised and unsupervised learning models in the analysis of gene expression. Examples in the classification and prediction of subtypes of cancers are described, and analyses of multi-chip experiments using S-PLUS, S+ArrayAnalyzer and Insightful Miner are presented.

■ SB27

Westin-Tower 1402, 14th Floor

Advances in Commercial IP Solvers

Sponsor: Optimization/Integer Programming
Sponsored Session

Chair: Eva Lee, Assistant Professor, Georgia Institute of Technology, School of Industrial and, Systems Engineering, Atlanta, GA, 30332-0205, United States, eva.lee@isye.gatech.edu

1 — The Latest Developments in CPLEX MIP
Mary Fenelon, ILOG, Inc., 889 Alder, Suite 201, Incline Village, NV, 89451, United States, mfenelon@ilog.com

The latest developments in the CPLEX MIP solver are discussed, especially those that apply to difficult MIP problems.

2 — Advances in Xpress-MP's MIP Optimizer
Bob Daniel, Dash Optimization, Blisworth House, Blisworth, Northampton, No, NN7 3BX, United Kingdom, bob.daniel@dashoptimization.com

We present some of the major advances that have recently been made in Dash Optimization's MIP Optimizer.

3 — Exploiting Problem Structure in Integer Programs, with Applications to Global Optimization
Linus Schrage, LINDO Systems, P. O. 148231, Chicago, IL, United States, linus .schrage@gsb.uchicago.edu, Tony Gau

When a combinatorial optimizer is generalized to include not just integer variables but also other discontinuous or nonconvex functions, the search tree algorithms, such as choosing the branching "variable" must be generalized accordingly. We discuss how we have done this generalization.

■ SB28

Westin-Tower 1403, 14th Floor

Large-Scale Nonlinear Programming

Cluster: Nonlinear Programming
Invited Session

Chair: Samuel Burer, Assistant Professor, University of Iowa, S346 Pappajohn Business Building, Iowa City, IA, 52242-1000, United States, samuel-burer@uiowa.edu

1 — A Modified Nearly Exact Method for Solving Some Specialized Trust Region Subproblem(TRS)
Zhaosong Lu, School of Industrial and Systems Engineering, Georgia Tech, Atlanta, GA, 30332, United States, zhaosong@isye.gatech.edu, Renato Monteiro

A specialized TRS is considered, whose objective Hessian is positive diagonal matrix plus explicit lower-rank update, subject to an ellipsoidal constraint, whose scaling matrix has the same structure as the objective Hessian. The nearly exact method given by Morse and Sorensen is modified to solve this TRS without using Cholesky factorization. It theoretically gurantees to produce a nearly optimal solution in a few iterations. Some computational results are reported to show the performance.

2 — Local Minima and Convergence in Low-Rank Semidefinite Programming
Samuel Burer, Assistant Professor, University of Iowa, S346 Pappajohn Business Building, Iowa City, IA, 52242-1000, United States, samuel-burer@uiowa.edu, Renato Monteiro

The low-rank semidefinite programming problem is a restriction of the semidefinite programming problem in which a bound is imposed on the rank of the matrix variable. We classify local minima and prove the optimal convergence of a slight variant of the algorithm proposed by Burer and Monteiro. In addition we describe a practical technique for obtaining lower bounds on the optimal solution value. Computational results are presented.

3 — A Limited Memory Variable Metric Method for Bound Constrained Optimization Problems
Steven Benson, Argonne National Laboratory, 9700 S. Cass Avenue, Argonne, IL, 60439, United States, United States, benson@mcs.anl.gov, Jorge More'

We describe an algorithm for solving nonlinear optimization problems with lower and upper bounds that constrain the variables. The algorithm uses projected gradients to construct a limited memory BFGS matrix and determine a step direction. The algorithm has been implemented and distributed as part of the Toolkit for Advanced Optimization (TAO). We include numerical results demonstrate is effectiveness on a set of large test problems and its scalability to multiple processors.

■ SB29

Westin-Tower 1404, 14th Floor

Economics and Network Design

Sponsor: Optimization/Network
Sponsored Session

Chair: Daniel Bienstock, Professor, Dept. of IEOR, Columbia University, 500 West 120th St., New York, NY, 10027, United States, dano@ieor.columbia.edu

1 — Service Pricing and Network Design
Daniel Bienstock, Professor, Dept. of IEOR, Columbia University, 500 West 120th St., New York, NY, 10027, United States, dano@ieor.columbia.edu, Iraj Saniee, Qiong Wang, Olga Raskina

We present a multi-period network design model that seeks to maximimize the discounted value of profit resulting from operating a network, where the operator sets service prices, resulting on demands that follow a fixed-elasticity demand-price relationship (and hence, revenues) but which then must be serviced by installing capacities (and hence, incurring cost). The resulting nonlinear programs are massive and difficult — we present an effective solution method.

2 — A Dynamic Modeling Approach for Network Design with Service Guarantees
Anant Balakrishnan, Red McCombs Endowed Chair in Business, The University of Texas at Austin, 1 University Station B6500, MSIS Department, CBA 5.202, Austin, TX, 78712, United States, anantb@mail.utexas.edu, Prakash Mirchandani, Bo Zhang

Network design models emphasizing only cost minimization result in solutions that, though cost-effective, provide poor customer service (long delays and low reliability). We investigate the network design problem with end-to-end service

guarantees, and propose and test a novel, dynamic reformulation paradigm that exploits the complementary strengths of arc- and path-flow formulations.

3 — Optimal Replication and Location of Objects in a Peer-to-Peer Network
Jay Sethuraman, Columbia University, 500 W 120th St., Rm 331, New York, NY, 10027, United States, jay@ieor.columbia.edu

We consider the problem of pptimal replication and location of objects in a peer-to-peer network. We formulate this problem as a mathematical program, and propose exact algorithms as well as natural heuristics for solving it.

■ SB30

Westin-Tower 1405, 14th Floor

Multistage Stochastic Programming and Pricing Problems

Sponsor: Optimization/Stochastic Programming
Sponsored Session
Chair: Shabbir Ahmed, Assistant Professor, ISyE, Georgia Tech, Atlanta, GA, 30332, United States, sahmed@isye.gatech .edu

1 — Dynamic Programming Approximation Techniques for Multi-stage Resource Allocation under Uncertainty
Huseyin Topaloglu, Assist. Prof., Cornell University, School of ORIE, Ithaca, NY, United States, topaloglu@orie.cornell.edu, Warren Powell

We present a class of dynamic programming approximation techniques that are applicable to resource allocation problems under uncertainty. The techniques are especially suitable for discrete problems that arise in the context of allocation indivisibles. We show convergence results for certain classes of problems and show that our methods perform very well even in the cases where the convergence results do not apply. We numerically compare our approach with Benders decomposition based methods.

2 — Solving Multistage Stochastic Linear Programs on the Computational Grid
Jeff Linderoth, Lehigh University, Industrial & Systems Enginnering, Bethleham, PA, 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 — Equity Valuation and Interactions of Production and Financing Decisions via Stochastic Programming
Xiaodong Xu, PH.D. Student, Northwestern University, Industrial Engineering & Management Scie, 2145 Sheridan Road C210, Evanston, IL, 60208, United States, xdxu@northwestern.edu, John Birge

This paper provides a method to price the equity of a company facing demand uncertainty and financial constraints. Models are developed to analysis the interactions between the production and financial decisions. Our results indicate these decisions should be made simultaneously in a integrated corporate planning framework.

4 — Optimization Based Derivative Pricing in Incomplete and Imperfect Markets
Jorgen Blomvall, Linkoping University, Linkoping, Sweden, johan@mai.liu.se

With an optimization based framework, derivatives can be priced in a general setting by using utility functions. Within this framework pricing algorithms can be developed. We will present some preliminary results from pricing in both incomplete and imperfect markets.

■ SB31

Westin-Tower 1406, 14th Floor

Network Location

Sponsor: Location Analysis
Sponsored Session
Chair: Zvi Drezner, Professor, California State University-Fullerton, College of Business and Economics, California State University-Fullerton, Fullerton, CA, 92834, United States, zdrezner@fullerton.edu

1 — An Efficient Approach for Flow Intercepting Spatial Interaction Model
Robert Aboolian, Assistant Professor of Operations Management, CSU San Marcos, San Marcos, CA, 92096, United States, raboolia@csusm.edu, Oded Berman, Dmitry Krass

Consider the problem of locating competitive facilities that derive their demand from both special—purpose trips and from "intercepting" facilities while en route to other destination on the network. Efficient exact and approximate solutions for this problem are developed.

2 — MiniSum Location Problem with Unreliable Facilities and Imperfect Information
Mozart Menezes, Ph.D. Candidate, University of Toronto, 105 St. George st., Toronto, ON, M5S 3E6, Canada, Mozart.Menezes99@Rotman.Utoronto.Ca, Oded Berman, Dmitry Krass

This paper is an extension of the p-Median problem on a network. Customers may find a facility unavailable and have to travel to the next close facility from the current location in order to obtain service. The problem in a tree network is discussed, and a heuristic solution is presented for the general network.

3 — Various Attempts at Solving a Very Difficult 20-blade Turbine Balancing Problem
Peter Hahn, Electrical and Systems Engineering Department, Rm 278,Towne, University of Pennsylvania, Philadelphia, PA, 19104-6315, United States, hahn@seas.upenn.edu, Zvi Drezner, Van-Dat Cung, Darwin Choi

Balancing a turbine rotor with N blades is directly formulated as a Quadratic Assingment Problem of size N. A 20-blade balancing problem posed by Eric Taillard has so far defied exact solution, despite the symmetries involved. We report here on both heuristic and exact methods attempted for its solution.

4 — CVaR P-Median Regret: A New Model For Strategic Facilities Locations
Gang Chen, University of Florida, 324 University Village South, Apt.#5, Gainesville, FL, 32603, United States, cgang@ufl.edu, Stanislav Uryasev, Zuo-Jun Max Shen, Mark Daskin

We study a strategic facilities location problem under uncertainty. The uncertainty associated with future events is modeled by defining alternative future scenarios with probabilities. We present a new model that minimizes the CVaR regret (expected worst-case regret) with a pre-specified confidence level. We demonstrate the effectiveness of this new approach by comparing it to the 'alpha-reliable p-minimax regret' model and by presenting computation results for large-scale problems.

■ SB32

Westin-Tower 1407, 14th Floor

Scheduling Supply Chains

Cluster: Scheduling
Invited Session
Chair: Marc Posner, Professor, The Ohio State University, Industrial Engineering, 1971 Neil Ave, OH, 43210, United States, posner.1@osu.edu

1 — Asymptotically Optimal Algorithms for 100% Reliable Due Date Quotation
Philip Kaminsky, Associate Professor, Department of IEOR, University of California at Berkeley, Berkeley, CA, 94720, United States, kaminsky@ieor.berkeley.edu, Zu-Hsu Lee

We present a model for due date quotation. Jobs arrive at a server over time. Upon arrival, due dates must be quoted for each job. We present an on-line heuristic that minimizes the average quoted due date, and sequences jobs to meet quoted due dates. We develop analytical bounds for this heuristic

2 — Production Scheduling for Suppliers in Extended Manufacturing Enterprise Systems
Leyuan Shi, Professor, Univ. of Wisconsin-Madison, 1513 University Ave., IE Dept., Madison, WI, 53706, United States, leyuan@engr.wisc.edu, Yunpeng Pan

The bicriterion problem considered minimizes the sum of weighted completion times subject to job release and due dates. It is a relaxation of many multi-machine problems with WIP-related objectives. We propose the first branch-and-bound algorithm. Our method is effective on a wide range of instances with up to 50 jobs

3 — Integrated Scheduling of Production and Distribution Operations
Zhi-Long Chen, Associate Professor, R.H. Smith School of Business, University of Maryland, College Park, MD, 20742, United States, zchen at rhsmith.umd.edu, George Vairaktarakis

We study a scheduling model that integrates production and distribution operations. For several problems with this model, we discuss complexity results, dynamic programming algorithms, and worst-case and asymptotic analysis of some heuristics. Value of production-distribution integration will also be discussed.

4 — The Coordination of Scheduling and Batch Deliveries
Nicholas G. Hall, Professor, Ohio State University, 2100 Neil Avenue, Columbus, OH, 43210-1144, United States, hall.33@osu.edu, Chris Potts

This paper considers scheduling problems where the scheduling cost of a job is determined by the delivery time of the batch which contains it. Various objectives and environments are considered. For most problems, we provide an efficient algorithm to minimize total cost, or show that the problem is intractable.

■ SB33

Westin-Tower 1408, 14th Floor

Data Envelopment Analysis II

Cluster: Data Envelopment Analysis
Invited Session

Chair: Paul Rouse, University of Auckland, New Zealand, p.rouse@auckland.ac.nz

1 — Improving Efficiency in Health-Care Provision: A Case Study Employing DEA
Trishit Bandyopadhyay, Professor ≠ Operations Management, Goa Institute of Management, Ribandar, Goa, 403006, India, tbandyo@yahoo.co.in

A pertinent question facing all administrators of State Health Center(SHC) Directorate is how to improve the efficiency of the SHC-units under their supervision. In order to improve efficiency one needs to first measure it and then identify Benchmark units for emulation. DEA is employed to analyze these for a SHC-Directorate.

2 — Validating DEA as a Ranking Tool: An Application of DEA to Assess Performance in Higher Education
Marie-Laure Bougnol, Visiting Assistant Professor of MIS/POM, University of Mississippi, United States, mbougnol@bus.olemiss.edu, Jose H. Dula

There is a great interest in ranking schemes applied to complex entities described by multiple attributes. Published rankings for universities are in great demand but are also highly controversial. DEA has a role to play as a rankings tool if used properly and if there is confidence in its results. We demonstrate DEA's utility for ranking by comparing an implementation to an accepted expert evaluation of institutions of higher education, the "Top American Universities Research" Annual Report from UFL's TheCenter.

3 — Using DEA to Set Prices for Healthcare Delivery in New Zealand Hospitals
Paul Rouse, University of Auckland, New Zealand, p.rouse@auckland.ac.nz

DEA has been used twice previously in the NZ health sector to determine efficient levels of expenditure and nation-wide prices for DRGs and non-inpatient services. Current proposals are to use DEA again to update the National Pricing Framework and formalize this into benchmarking arrangements. This paper describes a number of refinements to this process including (i) the use of DEA virtual weights to set prices for output classes resulting in a "closer fit" of expenditure to hospital providers than alternative methods such as regression (ii) tiered DEA in conjunction with sustainability indexes to set sustainable prices (iii) the use of DEA slack to price premia for hospital specific characteristics such as tertiary services and rurality.

4 — Evaluations of Long- and Short-Run Efficiencies of Digital vs. Physical Product "DOT COM" Companies
Anitesh Barua, Distinguished Teaching Professor, The Red McCombs School of Business, University of Texas at Austin, Austin, TX, 78712-1174, United States, barua@mail .utexas.edu, P.L. Brockett, W.W. Cooper, Honghui Deng, Andrew Whinston, T.W. Ruefli

This paper applies DEA to determine the relative efficiencies between internet dot com companies which produce only physical products and those which produce only digital products.

■ SB34

Mart-Room A

Supply Chain Security

Sponsor: Transportation Science & Logistics
Sponsored Session

Chair: Alan Erera, Assistant Professor, Georgia Institute of Technology, Industrial and Systems Engineering, 765 Ferst Dr., Atlanta, GA, 30332-0205, United States, alerera@isye.gatech.edu

1 — Securing Shipping Containers from Nuclear Weapons
Lawrence Wein, Professor, Stanford University, Graduate School of Business, 518 Memorial Way, Stanford, CA, 94305-5015, United States, wein_lawrence@gsb.stanford .edu, Stephen Flynn, Alex Wilkins

We develop a mathematical model to compare various inspection strategies for preventing a nuclear or radiological weapon from being smuggled by terrorists into the US in a shipping container. Strategies are identified that maximize the detection probability subject to constraints on port congestion and an overall budget.

2 — Optimizing Security Manipulation in Seaports using Genetic Algorithms
Der-Horng Lee, Assistant Professor, NUS, Department of Civil Engineering,, 1 Engineering Drive 2,, Singapore, sg, 117576, Singapore, dhl@nus.edu.sg, Liying Song

This paper evaluates the influence of security inspections on port throughput by calculating the optimal percentage of containers to undergo inspection and determining the exact container movemmetn sequence in order to minimize delays of out-bound vessels with a dynamic schedule. Risk index and size-related weight are considered. A multi-layered inspection system is developed. A heuristic Genetic Algorithm is presented for the solution of this NP-hard problem .

3 — Security Challenges to Global Supply Chain Productivity
Chelsea C. White, III, ISyE Chaired Professor in Transportation and Logistics, Georgia Institute of Technology, Industrial and Systems Engineering, 765 Ferst Dr., Atlanta, GA, 30329, United States, cwhite@isye.gatech.edu, Brian Lewis, Alan Erera

This research investigates the impacts of new security practices on the productivity of a global supply chain. We model a single item inventory system as a sequential decision problem with stochastic demand and order leadtimes. We compare system performance and optimal policy structure under different security delay scenarios.

■ SB35

Mart-Room B

Marketing, Remarketing and Product Return Issues Regarding Remanufactured Products

Cluster: Reverse Supply Chains
Invited Session

Chair: Karen R. Chinander, Assistant Professor, Florida Atlantic University, Dept. of Info. Tech. & Oper. Management, 5353 Parkside Drive, Jupiter, FL, 33458, United States, kchinand@fau.edu

1 — The Optimal Pricing of Refurbished Products
Tuo Wang, Ph.D. Candidate in Marketing, Univ. of Pittsburgh, Room 351 Mervis Hall, University of Pittsburgh, Pittsburgh, PA, 15260, United States, twang@katz.pitt.edu, Rabikar Chatterjee

This paper revised Katz's extension of the Mussa-Rosen model and apply this model to the pricing of refurbished products. We use this model to explore the cannibilzation problem of refurbished products and the optimal pricing of refurbished products. Implications of refurbished product on consumer welfare and product quality are also discussed in this paper.

2 — A New Disposition Algorithm for Catalog Returns
Julie Ann Stuart, Assistant Professor, Purdue University, School of Industrial Engineering, 315 N. Grant Street, West Lafayette, IN, 47907-2023, United States, stuart@ecn.purdue.edu, Sarah Loehr, Winston Bonawi-tan, Joyce Gates

Although return rates from catalog sales are frequently 10%-30% of shipped orders, returns are open area for operations management research. In this paper, we present an algorithm to evaluate disposition options for returns and a validation study with a catalog distributor.

3 — The Impact of the Internal Valuation of Returned Products
Beril Toktay, INSEAD, Boulevard de Constance, Fontainebleau, 77305, France, beril .TOKTAY@insead.edu, Donna Wei

We analyze the impact of the internal transfer pricing of returned products on the choice of remanufacturing/remarketing activities.

4 — Limiting Factors in Increasing the Market for Remanufactured Products
Karen R. Chinander, Assistant Professor, Florida Atlantic University, Dept. of Info . Tech. & Oper. Management, 5353 Parkside Drive, Jupiter, FL, 33458, United States, kchinand@fau.edu

We apply previous research in the marketing and behavioral decision theory areas in developing hypotheses around what may cause consumers to increase the chance of purchasing/ using remanufactured products, and also returning products after use. Suggestions are made as to how firms can develop larger markets for remanufactured goods.

■ SB36

Mart-Room C

Order Promising and Fulfillment

Sponsor: Manufacturing and Service Operations Management
Sponsored Session

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

1 — Integrated Demand Volume and Production Planning Models for Dynamic Pricing and Order Selection
Joseph Geunes, Assistant Professor, University of Florida, 303 Weil Hall, Gainesville, FL, 32611, United States, geunes@ise.ufl.edu, H. Edwin Romeijn, Kevin Taaffe

We present a single-stage production planning model that implicitly decides, through dynamic pricing decisions, what demand levels a producer should satisfy in every period in order to maximize contribution to profit from production. The model and solution approaches can alternatively address an equivalent class of order selection decisions, where the firm must select which orders to fulfill from a set of outstanding customer orders, each of which provides a unique net revenue per unit.

2 — Real-Time Order Promising for Complex Product Structures
Scott Moses, Assistant Professor, University of Oklahoma, 202 W Boyd, Room 124, Norman, OK, 73019, United States, moses@ou.edu, Andres Lucas, Kai-Pei Chen

In this talk we present a highly scalable computational approach for dynamic real-time promising by discrete build-to-order environments making products with multi-level bills of material. To compute a due date, the approach considers: (1) dynamic time-phased availability of resources, (2) dynamic time-phased availability of materials, and (3) individual order-specific characteristics.

3 — Control Tower: Collaboration Brokering System for Value Chain Integration
Roger Gung, Research Staff Member, IBM T.J. Watson Research Center, P.O. Box 218, Yorktown Heights, NY, 10598, United States, rgung@us.ibm.com

This research aims to develop a collaboration brokering system that integrates back-end value chain decision support systems with front-end web-based order management system so as to establish the linkage between customer collaboration and supplier collaboration, and distribute derived and core data to various parties for all routes to market.

4 — Resource Planning and Order Commitment Decision Making in the Presence of Pseudo-Orders
Susan Xu, Professor, Penn State University, United States, shx@psu.edu, Michael Ball, Zhenying Zhao

We study an order commitment and resource allocation decision problem that considers a mix of firm orders and pseudo-orders. The pseudo-orders, which are individually characterized using discrete probability distributions, arise from sales personnel based on their tracking of current sales prospects. The first stage decision problem determines which of the firm orders to accept and reserves resources for pseudo-orders. In a second stage, commitments are made to realized pseudo-orders.

■ SB37

Mart-Room D

Multi-Echelon Inventory Models

Sponsor: Manufacturing and Service Operations Management
Sponsored Session

Chair: Fernando Bernstein, Duke University, 1 Towerview Dr., Durham, NC, 27708, United States, fernando@mail.duke.edu

1 — Optimal Inventory Placement in Networks with Clusters of Commonality
Sean Willems, United States, willems@bu.edu, Salal Humair

We present an algorithm to optimize inventory levels and locations in networks with commonality . A cluster is a subgraph of k nodes that can have more than k-1 arcs in the subgraph. This work extends the framework in Graves and Willems (2000) which optimizes inventory placement in spanning tree networks.

2 — Inventory Management in Assembly Systems with Stochastic Leadtimes
Alp Muharremoglu, United States, alp2101@columbia.edu

We show that the problem of optimal inventory management in an assembly system with non order crossing stochastic leadtimes can be decomposed into a series of subproblems, each of which consists of a single kit of parts and a single customer. A kit of parts is a set of components, acquired from outside suppliers, that can be assembled together to make one unit of the final product. Through this decomposition, we characterize some structural properties of optimal policies.

3 — Competing for Shelf Space under a Buyback Contract
Rodney Parker, Assistant Professor of Operations Management, Yale University, United States, rodney.parker@yale.edu

Multiple suppliers compete (via buyback contracts) to supply a single retailer offering limited shelf space. The suppliers optimize over the buyback terms and the retailer optimizes over quantities ordered. Fully integrated, semi-integrated, and fully decentralized systems are considered under general circumstances, for the symmetric case, and for a specific demand distribution.

4 — Inventory Policies in a Decentralized Assembly System
Gregory DeCroix, Duke University, Fuqua School of Business, Durham, NC, 27708-0120, United States, decroix@mail.duke.edu, Fernando Bernstein

Inventory Policies in a Decentralized Assembly System New Abstract: We investigate equilibrium base-stock levels in a decentralized assembly system where finished goods and component inventories are all controlled by different players. We then examine the impact on system performance of sharing information about pipeline inventories. We compare the performance of these systems to that of a centrally controlled system.

■ SB38

Mart-Room E

Transportation Infrastructure Management

Sponsor: Transportation Science & Logistics
Sponsored Session

Chair: Pablo Durango-Cohen, Assistant Professor, Northwestern University, 2145 Sheridan Road, Technological Institute, A335, Evanston, IL, 60208-3109, United States, pdc@northwestern.edu

1 — Optimal Infrastructure System Maintenance and Repair Policies with Performance Model Updating
Sejung Park, University of California, Berkeley, 114 McLaughlin Hall, Berkeley, CA, 94720-1712, United States, sejpark@hotmail.com, Samer Madanat

The objective of this research is to develop optimization methods to select optimal maintenance, repair, and rehabilitation policies that incorporate updating of infrastructure deterioration models. Based on the inspection results, the transition probability matrices can be updated to express deterioration process better, and more appropriate maintenance policies will be selected.

2 — Modeling Infrastructure Deterioration as a Stationary Markov Process Through Introduction of a State
Zhanmin Zhang, Assistant Professor, University of Texas, Austin, Department of Civil Engineering, ECJ 6.100 (C1761), Austin, TX, 78712, United States, z .zhang@mail.utexas.edu, Ivan Damnjanovic

The paper discusses characterizing the state of an infrastructure system with a state vector so that the infrastructure deterioration process can be transformed from “non-stationary” to “stationary.” The use of a state vector also allows the effect of a maintenance and rehabilitation action on deterioration to be taken into account more accurately.

3 — Exploration of Portfolio Theory Applications in Bridge Security Management
Adjo Amekudzi, Assistant Professor, Georgia Institute of Technology, Civil and Environmental Engineering, 790 Atlantic Drive, Atlanta, GA, 30332-0355, United States, adjo.amekudzi@ce.gatech.edu, Pannapa Herabat

The objective of this paper is to explore applications of portfolio theoretical concepts in bridge security management. The authors introduce a framework that uses Portfolio theoretical concepts to incorporate uncertainty in prioritizing bridges for security improvements. The framework is applied in a case study to assess bridges in a metropolitan area in the State of Washington for their relative risks and disutilities in a fatal event. The case study results demonstrate that Markowitz Theory can be used to identify highrisk/high-exposure facilities for security enhancements and that demand variability can reverse the riskbased rankings of facilities. This study demonstrates the importance of incorporating uncertainty in prioritizing facilities for investment and also explains why congestion ought to be considered an issue of national security. It suggests that travel demand management measures are a potentially effective tool for risk management to enhance bridge security. This paper is potentially useful to researchers and agencies interested in addressing security concerns for civil infrastructure facilities.

4 — A Time Series Framework for Transportation Infrastructure Management
Pablo Durango-Cohen, Assistant Professor, Northwestern University, 2145 Sheridan Road, Technological Institute, A335, Evanston, IL, 60208-3109, United States, pdc@northwestern.edu

Recent developments in sensing and communication technologies allow agencies to install sensors in infrastructure facilities, such as pavement segments and bridges, in order to collect condition-related data. We present a framework that

will allow agencies to process and exploit the data to support maintenance and repair decision-making.

■ SB39

Mart-Room F

Freight Rail Applications

Sponsor: Railroad Applications
Sponsored Session

Chair: David Hunt, Senior Associate, Cambridge Systematics, P.O. Box 816, Pennington, NJ, 08534-0816, United States, dth@verizon.net

1 — The Use of Dynamic Car Scheduling to Improve Freight Railroad Service Reliability
Bruce Patty, Exostrategy Partners, 200 Gate Five Road, Suite 200, Sausalito, CA, 94965, United States, bpatty@exostrategy.com

An impediment to railroads garnering a larger share of the freight transportation market has been poor reliability. The inability to deliver a shipment on-time can be caused by events such as lack of adequate locomotive power, oversubscription of scheduled trains, weather, as well as by poor planning. We discuss the benefits of dynamic car scheduling as well as the necessary changes to business processes needed in order to take advantage of multiple routing options.

2 — Estimation of the Potential Demand for Rail Services Through Total Logistics Cost Modeling
Michael Gorman, Assistant Professor, University of Dayton, 300 College Park, Dayton, OH, 45469, United States, michael.gorman@udayton.edu

We evaluate the potential demand for Intermodal service in the Western U.S. from aggregate freight flow data. We base our analysis on the shipper's objective of minimizing total logistics (transportation and inventory) costs. We find that shippers often seem to choose freight transportation mode suboptimally. We hypothesize the reason for this apparent paradox and discuss its implications.

3 — Quantifying Public Benefits of Freight Rail Investments: Modeling Issues and Challenges
David Hunt, Senior Associate, Cambridge Systematics, P.O. Box 816, Pennington, NJ, 08534-0816, United States, dhunt@camsys.com, Bengt Mutén

Freight volumes are projected to double by the year 2020 and policy makers are faced with a crucial decision. Can the investment of public funds in freight rail help mitigate roadway congestion and lower highway costs? To help make this decision, there is a need for improved methods to quantify the expected public benefits. This work describes existing tools and methods used to estimate benefits accruing from investments in rail, and then discusses outstanding issues and modeling challenges.

■ SB40

Mart-Room G

Collaborative Supply Chains

Cluster: Supply Chain Management
Invited Session

Chair: Feryal Erhun, Assistant Professor, Stanford University, Management Science&Engineering, Stanford, CA, 94305, United States, ferhun@stanford.edu

1 — Supplier Positioning and Contracts in New Product Introduction
Mark Wilkinson, PhD Candidate, Stanford University, Stanford, CA, 94305-4026, United States, mawilkin@stanford.edu

We examine a new product introduction (NPI) and collaboration problem for an OEM and a component supplier (CS). The OEM and CS make individual NPI investments in period one; their actions result in a unique equilibrium cost-sharing contract. However, the OEM eliminates the sole-source contract and fosters supplier product/price competition in the second selling period. We examine a multiple period game-theoretic setting to demonstrate a subgame-perfect equilibrium within the supply chain.

2 — Collaborative Inventory Management - Capacity and Flexibility Considerations
Yossi Aviv, Associate Professor of Operations Managament, Washington University, Campus Box 1133, 1 Brookings Drive, St. Louis, MO, 63130, United States, AVIV@olin .wustl.edu

Results in the inventory management literature show that value of demand information is minimal for manufacturers that work under fixed and tight capacity constraints. In this presentation, we discuss the value of collaborative forecasting (CF) in settings where capacity can be changed periodically, or when a variety of products share the same capacity.

3 — Radio-Frequency Identification and the Retail Supply Chain
Gary Gaukler, PhD Candidate, Stanford University, 380 Panama Way, Office 375, Stanford, CA, 94305, United States, Gaukler@Stanford.EDU, Ralf Seifert, Warren Hausman

We investigate the effects of item-level RFID within the context of the retail supply chain. We view the implementation of RFID as a collaborative effort by the supply chain partners. Tension arises in our analytical model from the fact that costs and benefits from item-level RFID are not symmetrically distributed among the partners. We examine how the cost of the RFID implementation should be shared among the partners, and we identify coordinating contracts for the RFID-enabled supply chain.

4 — Collaborative Procurement
Secil Savasaneril, Georgia Institute of Technology, United States, secil@isye .gatech.edu, Pinar Keskinocak

We study the interaction between two firms who collaborate on procurement, but produce independently and remain competitors in a product market characterized by price-sensitive demand. Using a game-theoretic approach, we analyze the underlying economics behind collaborative procurement, examine the effects of collaboration on buyer and supplier profitability, and determine the conditions under which collaboration is beneficial to each participant.

■ SB41

Mart-Room H

Models for Coordinating Pricing and Production-Inventory Decisions

Cluster: Supply Chain Management
Invited Session

Chair: Candace Yano, UC Berkeley, Haas School of Business, S545 Student Services Bldg, Berkeley, CA, 94720-1900, United States, yano@ieor.berkeley.edu

1 — Dynamic Pricing for Multiple Customer Classes through Customer Discounts
Panos Kouvelis, Washington University in St. Louis, Olin School of Business, Campus Box 1133 1 Brookings Drive, St. Louis, MO, 63130-4899, United States, Kouvelis@olin .wustl.edu, Qing Ding, Joseph Milner

We study the tactical problem of allocating inventory over a horizon to demand from several classes of customers when partial backlogging of unfulfilled demand, influenced by the offering of discounts, is possible. We present a solution approach to the problem of determining the inventory allocation, the customer discounts and the prioritization of demand over the planning horizon. For the continuous time demand case, we provide an efficient and robust heuristic for its solution in real time.

2 — Decentralized Pricing and Capacity Decisions in a Multi-tier System with Modular Assembly
Fernando Bernstein, Duke University, Fuqua School of Business, Box 90210, Durham, NC, 27708, United States, fernando@duke.edu, Gregory DeCroix

We consider a modular assembly system facing uncertain demand for the final product. We characterize the equilibrium price and capacity choices and derive results to guide the assembler in making higher-level structural choices. We also compare the performance of the system to that of a traditional assembly system.

3 — The Effect of Rebates on the Supply Chain under Price-Dependent Demand
Goker Aydin, Stanford University, Management Science & Engineering Dept., Stanford, CA, 94305-4026, United States, goker@stanford.edu, Evan Porteus

We consider a single-retailer, single-manufacturer supply chain where the single-period, stochastic demand depends on the retail price. The manufacturer may offer rebates either to the retailer or to the consumer; either way, rebates will be proportional to the number of units sold to the customer. Under each rebate policy, the retailer chooses the retail price and the inventory level, whereas the manufacturer determines the size of the rebate. We analyze the resulting equilibria.

4 — Optimizing Prices and Inventories when Strategic Stockouts are Desirable
Candace Yano, UC Berkeley, Haas School of Business, S545 Student Services Bldg, Berkeley, CA, 94720-1900, United States, yano@ieor.berkeley.edu, Ursula Kraus

Most decision models for joint pricing and inventory decisions are based on the assumption that the seller aims to supply each customer his most-preferred product. We formulate and analyze a multi-product model that begins to answer the question of when strategic stockouts by the supplier are optimal.

■ SB42

Mart-Room I

Pricing and Revenue Management

Sponsor: Revenue Management & Dynamic Pricing
Sponsored Session

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

1 — Airline Revenue Management Under Imperfect Market Segmentation
Sanne de Boer, PhD Student, Operations Research Center, MIT, 1 Amherst Str, Cambridge, MA, 02139, United States, sanne@mit.edu

We study the single-leg dynamic seat allocation problem under imperfect market segmentation. Customers book the lowest available class whose restrictions they can meet and whose fare they are willing to pay. We derive theoretical properties of the value functions and optimal policy for a generic revenue management problem, of which this is a special case. Numerical examples show that incorporating imperfections of the market segmentation in the booking policy leads to significant revenue gains.

2 — Simulation-Based Optimization of Virtual Nesting Controls for Network Revenue Management
Garrett van Ryzin, Columbia University, 412 Uris Hall, New York, NY, United States, gjv1@columbia.edu, Gustavo Vulcano

In this talk, we analyze a variation of a simulation-based optimization proposed by Bertsimas and de Boer for optimizing virtual nesting controls for network revenue management. Our approach is based on a continuous model of capacity and demand that allows for simple and exact subgradient computations and has provable convergence gaurantees. The method is tested on several realistic networks.

3 — Dynamic Pricing Under Competition when Demand is Stochastic
Anshul Sood, Student, ORC, MIT, 1 Amherst Street, E40-130, Cambridge, MA, 02139, United States, anshul@mit.edu, Georgia Perakis

In this talk we present a dynamic pricing model for perishable products in a competitive market where demand is stochastic. We present a dynamic optimization model and study the Nash equilibrium policies it gives rise to for the sellers. We present a dynamic programming algorithm for computing such equilibrium pricing policies and discuss its convergence. We illustrate our results through some numerical examples.

■ SB43

Mart-Room J

Supply Chains and Marketplaces

Cluster: Auctions
Invited Session

Chair: Elena Katok, Assistant Professor, Penn State University, 509H BAB, University Park, PA, 16802, United States, ekatok@psu.edu

1 — On Dominant Strategy Implementation
Rudolf M¸ller, Professor, University of Maastricht, P.O. Box 616, Maastricht, Netherlands, R.Muller@KE.unimaas.nl, Rakesh V. Vohra

An allocation rule maps agent reports of their types to allocations of resources. For quasi-linear utilities and multidimensional types, we characterize the allocation rules that can be supported by transfers that make truth-telling a dominant strategy. Unlike an earlier result of Roberts, we do not assume an unrestricted preference domain.

2 — Allocative (in-)efficiency of Online Auctions - An Experimental Approach via Internet
Carsten Schmidt, Research Associate, Max Planck Institute for Research into Economic Systems, Kahlaische Str. 10, Jena, D-07745, Germany, cschmidt@mpiew-jena .mpg.de

The fixed end ascending auction, the open end ascending auction (both first price), and the dutch auction are compared in a controlled online experiment with induced values. It turned out that allocative efficiency of online auctions, especially when they last a couple of days, is surprisingly low.

3 — Behavioral Causes of the "Bullwhip" Effect in Supply Chains
Elena Katok, Assistant Professor, Penn State University, 509H BAB, University Park, PA, 16802, United States, ekatok@psu.edu, Karen Donohue, Rachel Croson, John Sterman

The bullwhip effect refers to the tendency of orders to increase in variation as one moves up a supply chain. The effect is costly because it causes excessive inventories, poor customer service, and unnecessary capital investment. Most recent attempts at understanding the causes of the bullwhip effect focus on its operational causes, including demand signal processing, inventory rationing, order batching, and price. In this research we find evidence for behavioral causes of the bullwhip effect.

4 — Incentive Compatible Compensation Schemes for Reverse Auction Market Makers
Srikant Vadali, Pennsylvania State University, 701C BAB, University Park, PA, 16802, United States, sxv163@psu.edu, Gary Lilien

Market makers in reverse auctions often provide important qualification services to their buyer-clients. We show how the incentive scheme the buyer offers affects that qualification process and demonstrate how the optimal incentive scheme differs, depending on the observability of the quality of the procured items. In particular, we show that with unobservable quality, the optimal incentive scheme should, surprisingly, be increasing in contract price.

■ SB44

Mart-Room K

Joint Session AAS/TSLS: Robust Airline Scheduling & Recovery II

Sponsor: Aviation Applications, Trans. Science & Logistics
Sponsored Session

Chair: John-Paul Clarke, Professor, MIT Aeronautics & Astronautics, 77 Massachusetts Ave 33-314, Cambridge, MA, 02139, United States, johnpaul@MIT.EDU

1 — Degradable Airline Schedule
Laura S Kang, MIT, Operations Research Center, One Amherst St. E40-130, Cambridge, MA, 02139, United States, lsmkang@mit.edu, John-Paul Clarke

We propose a methodology for deriving airline schedules that are robust to disruptions caused by bad weather. In this methodology, the schedule is partitioned into independent prioritized sub-schedules. The resulting degradable airline schedule enables passenger choice based on preference for reliability. We show that this approach can decrease the passenger recovery cost especially during the bad weather. Tabu search algorithm is applied for aircraft routing.

2 — Robust Aircraft Miantenance Routing and Flight Schedule Retiming
Shan Lan, Center for Transportation and Logistics, MIT, room 5-012, cambridge, ma, 02139, United States, slan@mit.edu, Cynthia Barnhart, John-Paul Clarke

Airlines typically construct schedules based on the assumption that every flight departs and arrives as planned. Because this optimistic scenario rarely occurs, these plans are frequently disrupted. We propose new approaches to reduce delay propagations by intelligently routing aircraft, and to minimize the number of disrupted passengers by re-timing flight departure times within a small time window. Formulations, algorithmic solution approaches and computational results are presented.

3 — Robust Airline Scheduling: Minimizing Passenger Delay
Sepehr Sarmadi, Candidate for Master of Science in Transportation, MIT, Room 35-217, 77 Mass Ave, Cambridge, MA, 02139, United States, sepehr@mit.edu

In this paper, we present planning approaches to improve the robustness of airline operations. Specifically, our goal is to minimize delay propagation and passenger disruptions. To this end, we develop different models, one selecting aircraft departure times and routings and another maximizing the number of recovery options. Using data from a major airline, we evaluate and compare our approaches.

■ SB45

Mart-Room L

Dynamic Control in Semiconductor Wafer Fabs

Cluster: Semiconductor Manufacturing
Invited Session

Chair: Jim Dai, Georgia Institute of Technology, School of Industrial and Systems, Engineering, Atlanta, GA, 30332, United States, dai@isye.isye.gatech.edu

1 — Workload Relaxations for Resource Allocation and Performance Evaluation in Pull Models
Sean Meyn, United States, meyn@uiuc.edu

This talk concerns demand-driven production systems. An optimal policy restricts the workload process to a region containing the associated monotone set for the effective cost. We demonstrate how an affine approximation of this region may be constructed, and examine properties of the resulting affine policy. New approaches to performance evaluation under an affine policy are also described.

2 — Throughput Optimality of Manufacturing Systems with Material Handling Systems
Tolga Tezcan, PhD Candidate, Georgia Institute of Technology, 765 Ferst Drive, Atlanta, GA, 30332, United States, gte778y@mail.gatech.edu, Jim Dai

This paper studies the throughput optimality of manufacturing systems with discrete material handling systems (MHS). MHS is responsible to transfer jobs from one station to another. A new material handling dispatching policy called the Follow-the-Flow (FF) policy is presented. By using a multiclass queueing network model that integrates the MHS and the processing stations, we show that FF policy with generalized head of line policy maximizes the throughput.

3 — A Heuristic Method for Scheduling and Dispatching of Fab Production Using Multiclass Fluid Networks
Ron Billings, Assistant Professor, Georgia Institute of Technology, School of Industrial & Systems Engrg., 765 Ferst Drive, Atlanta, GA, 30332, United States, ron.billings@isye.gatech.edu

Production flow is modeled as a multiclass fluid queueing network: a non-integer relaxation of the deterministic factory scheduling problem and a limit of the stochastic queueing model. By solving a finite series of quadratic (or linear) programs, a control policy is found for this fluid relaxation problem (with a weighted holding cost objective). Production in the discrete factory network is then scheduled by minimizing the deviation of the production from the optimal fluid control policy.

4 — Performance Control of Capacitated Re-entrant Lines
Spyros Reveliotis, Associate Professor, Georgia Tech, School of Industrial & Systems Eng., 765 Ferst Drive, Atlanta, GA, 30332, United States, spyros@isye .gatech.edu, Jin Young Choi

We consider the re-entrant line throughput maximization problem, under the constraint of finite buffering capacity at the line workstations. A formal modeling framework is developed, and it is applied on a small system configuration. The obtained results indicate that the nature of optimality in this new operational context is different from that applying to the case of uncapacitated re-entrant lines. The last part of the talk addresses some complexity issues.

■ SB46

Mart-Room M

Security and Utility of Confidential Data 2

Cluster: Security and Utility of Confidential Data
Invited Session

Chair: Sumitra Mukherjee, Professor, Nova Southeastern University, 6100 Griffin Road, Fort Lauderdale, FL, 33314-4416, United States, sumitra@nova.edu

1 — Secure and Useful Data Sharing - Some Approaches
Rathindra Sarathy, Department of MSIS, Oklahoma State University, Stillwater, Ok, 74078, United States, sarathy@okstate.edu, Han Li, Krishnamurty Muralidhar

Sharing data while retaining the confidentiality and privacy of individuals, is an important problem faced by many organizations. We discuss issues underlying sharing of confidential, numerical data and the applicability of certain disclosure limitation methods in this context.

2 — Cyclic Perturbation: Protecting Confidentiality in Tabular Data
George T. Duncan, H. John Heinz III Schools of Public Policy and Management, Carnegie Mellon University, 5000 Forbes Av. Pittsburg, Pittsburg, PA, 15213-3890, United States, gd17@andrew.cmu.edu, Stephen F. Roehrig

We describe cyclic perturbation, which is a new method for protecting sensitive data in categorical tables. We perturb the true table values in a way that preserves the table's marginal totals, and then publish the altered table. What is new is the stochastic procedure used to produce the perturbed table. Our method is unbiased in the sense that the expected value of each published cell equals its true value. Further, our method permits publicly announcing the details of the procedure, so that data user can determine not only the range of values that a table cell may have had in the original table, but also the exact posterior distribution over those possible values, given the user's prior probabilities over a small set of possible true tables. Thus we propose a Bayesian approach that a user may employ in analyzing the published table. An important consequence of the technique is that every published cell value is in fact equal to the mode of the posterior distribution for that cell. Thus a user not wishing to perform the computations required to find the complete distribution can still perform valid statistical analyses on the table. We compare cyclic perturbation with the standard alternatives of cell suppression and controlled rounding, on the basis of disclosure risk and data utility. Finally, we offer some strategies for determining the cyclic patterns that can be used for protecting tables of various sizes and dimensions.

3 — Microaggregation Techniques for Disclosure Limitation with Minimum Information Loss
Sumitra Mukherjee, Professor, Nova Southeastern University, 6100 Griffin Road, Fort Lauderdale, FL, 33314-4416, United States, sumitra@nova.edu

Microaggregation is a widely used disclosure limitation technique used by statistical agencies to protect sensitive microdata. Under microaggregation, records are aggregated into groups and attribute values are replaced by group averages. Optimal microaggregation involves finding a partition that minimizes information loss due to aggregation, subject to constraints on minimum group size. Heuristic microaggregation methods based on hierarchical clustering and genetic algorithms have been proposed, since no polynomial time algorithms are known to microaggregate optimally. In this paper we discuss an efficient polynomial time algorithm for univariate microaggregation and investigate the use of this algorithm in identifying good solutions to the multivariate microaggregation problem.

■ SB47

Westin - Atlanta G, 7th Floor

Software Demonstration

Cluster: Software Demonstrations
Invited Session

1 — Duxbury - Using JMP INO® 5.1 in Data Analysis Courses
Curt Hinrichs, Duxbury Press, 10 Davis Drive, Belmont, CA 94002, United States, curt.hinrichs@duxbury.com

JMP INO® 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 studentsto learn statistical concepts quickly, and for instructors to spend lesstime on teaching how to use the software.

2 — Dash Optimization - Fast Track Development of Optimization Applications
Nikhilesh Khotekar, Dash Optimization, 560 Sylvan Ave., Englewood Cliffs, NJ, United States, nikhilesh@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.

Sunday 1:30pm - 3:00pm

■ SC01

Westin-Intl. A, 6th Floor

Network Design

Sponsor: Telecommunications
Sponsored Session

Chair: Bernard Gendron, University of Montreal, C.P. 6128, succ. Centre-ville, Montreal, QC, Canada, bernard@crt .umontreal.ca

1 — Location Models: A Reformulation by Discretization
Luis Gouveia, DEIO-CIO, Bloco C2, Campo Grande, Lisbon, Portugal, legouveia@fc .ul.pt, Francisco Saldanha da Gama

The known location models contain a set of binary variables Yi indicating whether or not, a facility is built at location i. We discuss models using binary variables Ziq indicating whether a facility is built at location i AND is serving q clients. We present a set of inequalities generated by the Chvatal-Gomory rounding method and discuss variations of the problem with nonlinear costs at the facilities (as these are easily modelled by the new variables.

2 — A Note on Eswaran and Tarjan's Strong Connectivity Augmentation Algorithm
S. Raghavan, The Robert H. Smith School of Business, 4352 Van Munching Hall, University of Maryland, College Park, MD, 20742-1815, United States, raghavan@umd .edu

We point out an error in Eswaran and Tarjan's (1976) linear time algorithm for the strong connectivity augmentation problem. Consequently, the application of their algorithm may result in a network that is not strongly connected. We discuss the remedy, yielding a corrected linear time algorithm for the strong connectivity augmentation problem.

3 — A Branch-and-Price-and-Cut Algorithm for Multifacility Nonbifurcated Network Loading
Bernard Gendron, University of Montreal, C.P. 6128, succ. Centre-ville, Montreal, QC, 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.

■ SC02

Westin-Intl. B, 6th Floor

Financial Engineering

Cluster: Financial Engineering
Invited Session

Chair: Andrew Lim, Assistant Professor, IEOR Department, University of California, Berkeley, CA, United States, lim@ieor.berkeley.edu

1 — Static Arbitrage Bounds on Basket Option Prices
Laurent El Ghaoui, Associate Professor, Dept of Electrical Engineering and computer Science, University of California, Berkeley, CA, 94720, United States, elghaoui@eecs.berkeley.edu, Alexandre d'Aspremont

We consider the problem of computing upper and lower bounds on the price of a European basket call option, given prices on other similar baskets. We show that in some instances the upper and lower bounds can be computed via simple closed-form expressions, or linear programs. We also introduce an efficient linear programming relaxation of the general problem based on an integral transform interpretation of the call price function.

2 — On the Modelling of Option Processes
Sophie Shive, Department of Finance, University of Michigan Business School, Ann Arbor, MI, 48109, United States, sshive@bus.umich.edu, Jussi Keppo, Xu Meng, Michael Sullivan

We consider the effect of stochastic parameters on the modelling of option prices. Assuming a jump-diffusion process for the underlying asset, we solve for the corresponding option prices by using transformation analysis, and analyze the parameter processes with S&P 500 put options .

3 — Dynamic Pricing in the Framework of Stochastic Control
Xin Guo, Assistant Professor, ORIE Department, Cornell University, Ithaca, NY, United States, xinguo@orie.cornell.edu, Andrew Lim

We consider the problem of dynamic pricing via a simple stochastic control model. Closed form solutions and insights into this problem will be discussed.

4 — Number of Basis Functions Versus Number of Paths in American Option Pricing
Paul Glasserman, Professor, Graduate School of Business, Columbia University, 403 Uris Hall, New York, NY, United States, pg20@columbia.edu, Bin Yu

We investigate the convergence of regression-based methods for pricing American options by simulation, as both the number of basis functions used for regression and the number of replications increase. We analyze the use of polynomials for regression when the underlying process is Brownian motion or geometric Brownian motion. We show that worst-case convergence requires that the number of paths grow exponentially with the number of polynomials in the first case, faster in the second.

■ SC03

Westin-Intl. C, 6th Floor

Demand Forecasting and Risk Management

Cluster: Practice Track
Invited Session

Chair: Roger Tsai, IBM T. J., Watson Research Center, Yorktown Heights, NY, 10598, United States, rtsai@us.ibm .com

1 — A Forecasting Tool for Predicting Semiconductor Demand
Ying Tat Leung, IBM T. J., Watson Research Center, Yorktown Heights, NY, 10598, United States, ytl@us.ibm.com, Aliza Heching, Jonathan Hosking, Sarah Hood, Jonathan Wong

We develop a system to forecast demand for several thousand types of IBM semiconductor chips at various levels of the product hierarchy. Accurate forecasting is complicated by highly volatile demand, short product lifecycles, frequent introduction of new products, and a dynamic product hierarchy. Additional challenges include appropriately defining customer demand and devising useful forecast accuracy metrics. The system has been tested by the worldwide demand management team and is currently being incorporated into the demand and capacity planning processes.

2 — A Framework for Managing Demand Risks
William Grey, Program Director, IBM T. J. Watson Research Center, 1101 Kitchawan Road, Yorktown Heights, NY, 10598, United States, wgrey@us.ibm.com, Dailun Shi

In this paper, we describe risks derived from demand fluctuation, and ways to manage them. In particular, we present ideas on how firms can manage demand risks through business processes (e .g., forecasting and inventory policies), partner coordination, and using options.

3 — Supply Decision Optimization for a Computer Manufacturer
Roger Tsai, IBM T. J., Watson Research Center, Yorktown Heights, NY, 10598, United States, rtsai@us.ibm.com, Feng Cheng, Young M. Lee, M. Ettl, Tom Ervolina, John Konopka

Manufactuers and high tech merchants make quarterly Sales and Operations Planning (SOP) decisions. The supply quantity, or SOP decision, is based on many factors: revenue target, sales forecast, profit margin, life cycle of each product, commonality of components and manufacturing flexibility. We have developed a new model that computes an optimal SOP decision. Our study indicates that substantial financial benefit can result from the optimization model.

■ SC04

Westin-Intl. D, 6th Floor

Panel: The OR Consulting Business

Sponsor: CPMS, The Practice Section of INFORMS
Sponsored Session

Chair: Frederic Murphy, Professor, Temple University, School of Business and Management, Philadelphia, PA, 19122, United States, fmurphy@sbm.temple.edu

1 — Panel: The OR Consulting Business
Moderator:Frederic Murphy. Panelists: Harlan Crowder, Richard Larson, Douglas Samuelson, and Jack Theurer.

This session complements the previous panel. Here the panelists are experienced consultants. What differentiates this business from the tools business is that the customers are buying people and their expertise rather than a product with some added customization. Find out how you can get into this business and/or offer your experiences.

■ SC05

Westin-Intl. E, 6th Floor

Planning and Optimization in Call Centers

Sponsor: Applied Probability
Sponsored Session

Chair: Ger Koole, Department of Mathematics, Vrije Universiteit, De Boelelaan 1081a, 1081 HV Amsterdam, Netherlands, koole@cs.vu.nl

1 — Analyzing the Retrial Phenomenon in Call Centers
Zeynep Aksin Karaesmen, Koc University, Rumeli Feneri Yolu, Sariyer, Istanbul, 34450, Turkey, zaksin@KU.EDU.TR, Fikri Karaesmen, Fabrice Chauvet, Salah Aguir

We explore the retrial phenomenon in a call center with balking and abandonments. Using a fluid model it is shown that the retrial rate is insensitive to certain model parameters. For a multi-period problem, a fluid approximation leads to estimates of the retrial rate that are tested using simulation.

2 — Markov Chain Models of a Call Center
Thanos Avramidis, University of Montreal, Montreal, Canada, avramidi@IRO.UMontreal .CA, Alexandre Deslauriers, Juta Pichitlamken, Pierre L'Ecuyer

We consider a call center with two types of traffic and two types of agents. Outbound calls are served only by blend agents, whereas inbound calls can be served by either inbound-only or blend agents. We allow abandonment and reneging of inbound calls. We present continuous-time Markov chain models that parsimoniously capture these and other real-world characteristics. We also explore the tradeoffs between model fidelity and efficacy by comparing against a more realistic simulation model.

3 — A Stochastic Fluid Approximation for Telephone Call Center Staffing
J. Michael Harrison, Stanford University, Graduate School of Business, Stanford, CA, United States, harrison_michael@gsb.stanford.edu, Assaf Zeevi

We consider a call center model with several input flows and several pools of agents. The vector of instantaneous arrival rates is allowed to be time-dependent and to vary stochastically. Seeking to optimize the trade-off between personnel costs and abandonment penalties, we develop and illustrate a practical method for sizing the agent pools.

4 — Call Center Staffing by Means of the Multi-Dimensional Newsvendor Model
Achal Bassamboo, Student, Stanford University, 38027 Village Common Apt.202, Fremont, CA, 94536, United States, bassamboo_achal@gsb.stanford.edu, Assaf Zeevi, J. Michael Harrison

Harrison and Zeevi have proposed an approximate method that reduces telephone call center staffing to a multi-dimensional newsvendor problem (MDNP). Here we describe and illustrate non-parametric methods for solving the MDNP that are computationally feasible for systems of practical interest.

■ SC06

Westin-Intl. F, 6th Floor

Forecasting

Contributed Session

Chair: Hisham Choueiki, Senior Energy Specialist, PUCO, 180 East Broad Street, Third Floor, Columbus, OH, 43215, United States, hisham.choueiki@puc.state.oh.us

1 — Forecasting Account Balances by Dynamic Models
Sheng-Pen Wang, Associate Professor, Chang Gung University, Dept of Business Administration, Kwei-San, Taoyuan, /, 333, Taiwan, wangsp@mail.cgu.edu.tw

Going beyond the traditional regression methods, this article built a dynamic model of the bank 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 factors. While providing greater accuracy than previous techniques, the model also provides greater insight into why events are happening.

2 — Effects of Source-Framing on Judgmental Adjustment of Forecasts
Dilek Onkal-Atay, Associate Dean, Bilkent University, Faculty of Business Administration, Ankara, 06800, Turkey, onkal@bilkent.edu.tr, Paul Goodwin, Mary Thomson, Andrew Pollock

This research focuses on judgmental adjustments of external predictions when the presented forecasts are depicted as originating from statistical techniques versus experts. Using point forecast, 70% prediction intervals and 95% prediction intervals, we investigate the effects of such source-framing with and without the elicitation of initial predictions from participants. We discuss the implications of our findings for forecasting support systems.

3 — Modeling Stream Flow Rate using Regression and Neural Networks
Monal Chand, Graduate Student, Operations Research Program, University of Delaware, 223 Townsend Hall,, Univ. of Delaware, NEWARK, DE, 19717, United States, monal@udel .edu, John Bernard, Palaniappa Krishnan, William Ritter

Stream flow forecasting is important in the prediction of floods and better water resource management. Regression and neural networks have been used to model the prediction of stream flow as a function of rainfall, snowfall, solar radiation, soil type, and temperature. The data from selected catchments in Delaware and Maryland have been used in the model. Results from both these techniques will be discussed in the paper presentation.

4 — Forecasting Bulk Power Market Prices Using Simple Recurrent Neural Nets
Hisham Choueiki, Senior Energy Specialist, PUCO, 180 East Broad Street, Third Floor, Columbus, OH, 43215, United States, hisham.choueiki@puc.state.oh.us

We use Elman's simple recurrent neural network to forecast the One-Day-Ahead /One-Week-Ahead bulk power market prices at the Into Cinergy delivery hub. The methodology, preliminary results, and our remarks will be presented.

■ SC07

Westin-Intl. G, 6th Floor

Energy Market Equilibria

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@eng.umd.edu

1 — Pool-Based Electricity Market Equilibrium under Locational Marginal Pricing
Antonio Conejo, Professor, Univ. Castilla-La Mancha, Electrical Engineering, ETSI Industriales, Ciudad Real, 13071, Spain and Canary Islands, Antonio.Conejo@uclm.es, Steve Gabriel, Raquel Garcia-Bertrand

This paper analyzes the equilibrium of an electricity market that works under locational marginal pricing. In equilibrium, generating and consumption companies maximize their respective profits. An independent operator clears the market maximizing social welfare. A detailed representation of the transmission network is used. Conditions that ensure minimum profit for each generator are included. Demands are taken to be non-constant. The equilibrium is obtained solving a mixed LCP.

2 — A Numerical Method to Calculate Nash-Cournot Equilibria in Electric Markets
Javier Contreras, Associate Professor, Universidad de Castilla - La Mancha, E.T.S. de Ingenieros Industriales, Campus Universitario s/n, Ciudad Real, 13071, Spain and Canary Islands, Javier.Contreras@uclm.es, Jacek B. Krawczyk

A numerical method based on a relaxation algorithm and the Nikaido- Isoda function is presented for the calculation of Nash-Cournot equilibria in electricity markets. The Nash equilibria include "coupled constraint equilibria", which are useful to model a government intervention in electricity markets. Nash equilibrium is attained through a relaxation procedure applied to an objective function, the Nikaido-Isoda function, which is derived from the existing profit maximization functions calculated by the generating companies.

3 — US NOx Permits and BE-NL Market Integration: Applications of Complementarity Oligopoly Power Models
Yihsu Chen, The Johns Hopkins University, DoGEE, Baltimore, MD, United States, yschen@jhu.edu, Fieke Rijkers, Ben Hobbs

Two applications of complementarity-based models of oligopolistic power markets are presented. First, emissions allowances are a key input to generation, and a large generator might be able to manipulate this market to the disadvantage of its rivals. Cournot and Stackelberg solutions are given for a transmission constrained market (PJM). Second, market integration has been proposed for northwest Europe. We assess the benefits of improved access and more efficient transmission pricing.

4 — Equilibrium Analysis for the US Southeastern Natural Gas Market
Steve Gabriel, Assistant Professor, University of Maryland, Dept. of Civil& Env. Engineering, 1143 Martin Hall, College Park, MD, 20742, United States, sgabriel@eng .umd.edu, Jifang Zhuang, Supat Kiet

We analyze the results of a competitive market equilibrium model as applied to the southeastern US natural gas system.

■ SC08

Westin-Intl. H, 6th Floor

Lies, Damn Lies, and OBP + SLG: OR Models for Baseball Strategy

Cluster: Sports, Games, and Recreational OR
Invited Session

Chair: Eli Olinick, Assistant Professor, Southern Methodist University, EMIS Department, PO Box 750123, Dallas, TX, 75275-0123, United States, olinick@engr.smu.edu

1 — Sorry, Yogi: Good Pitching Does Beat Good Hitting
Joel Sokol, Georgia Institute of Technology, School of ISyE, Atlanta, GA, 30332-0205, United States, jsokol@isye.gatech.edu

A traditional baseball maxim states "Good pitching beats good hitting." We show that this is generally true, and propose an underlying model to explain why.

2 — Relief Pitching: Current, Improved, and Optimum Strategies.
Carl Morris, Professor, Harvard, Statistics Department, Science Center, Cambridge, MA, 02138, United States, morris@stat.harvard.edu, Christopher Avery

The top relief pitchers on Major League Baseball teams typically pitch about 65 innings and in 65 games for their teams, perhaps 1/3 the innings of top starters, and usually in "save" situations. Is this justifiable, and how valid are save situations for governing the use of these stars? We investigate these questions using probabilistic models appropriate for typical MLB play.

3 — The Cost of Competitiveness in Major League Baseball
Thomas R. Sexton, Director, Harriman School/Stony Brook University, 306 Harriman Hall, Stony Brook, NY, 11794-3775, United States, Tsexton@notes.cc.sunysb.edu, Herbert Lewis, Kathleen Lock

The dramatic growth in player salaries since the advent of free agency in 1975 has caused great concern about the ability of some teams to compete. We use a two-stage Data Envelopment Analysis model as part of a larger analysis to study competitiveness in MLB since 1985. We examine the trends in the minimum total player salary required to be competitive and the number of noncompetitive teams in each year. We find little support for the argument that small market teams cannot be competitive.

■ SC09

Westin-Vinings 1, 6th Floor

Active Learning Design and Introductory Courses

Cluster: Active Learning in Education
Invited Session

Chair: Rene Villalobos, Arizona State University, Dept of Industrial Engineering, P.O. Box 5906, Tempe, AZ, United States, rene.villalobos@asu.edu

1 — The Use of Active/Cooperative Learning for Teaching Operations Research for Undergraduates
Rene Villalobos, Arizona State University, Dept of Industrial Engineering, P.O. Box 5906, Tempe, AZ, United States, rene.villalobos@asu.edu, Paul Griffin, Gary Hogg

In this presentation we discuss the experiences and results obtained from teaching undergraduate Operations Research using active and cooperative learning techniques. The materials and strategies used for the conversion of the course from a traditional lecture style to a participative, team-based approach will be presented. Our experience will show that in order to succeed in implementing active learning techniques careful planning should take place before the preparation of the course' materials.

2 — Active Learning in an Industrial Design Course
Cesar Malave, Professor, Texas A&M University, Industrial Engineering Department, Room 241 Zachry, College Station, TX, 77845-3131, United States, malave@tamu.edu, Andy Banerjee

This presentation addresses important pedagogical strategies implemented in a senior industrial design course. Issues related to team training, active participation in the classroom, and the development of a code of cooperation for design projects will be addressed. Strategies for dealing with team problems and student-sponsor interactions will be presented as well as a mechanism for determining individual grades while promoting positive interdependence and individual accountability.

3 — IME, Inc.: A New Course for Integrating Design, Manufacturing, and Production into the Engineering Curriculum
Timothy W. Simpson, Associate Professor, Departments of Mechanical & Nuclear and Industrial & Manufacturing Engineering, The Pennsylvania State University, University Park, PA, 16802, United States, tws8@psu.edu, D. J. Medeiros, Amine Lehtihet, Gregory R Pierce, Sanjay Josh, Richard Wysk, Thomas A. Litzinge

We have developed a new two-semester undergraduate course, IME, Inc., wherein multidisciplinary student teams design and develop a marketable product while considering all aspects of manufacturing — including process planning, tooling, assembly, outsourcing, and final costs. The objective in the course is to improve manufacturing engineering education by providing students with manufacturing and production experiences analogous to those obtained by journalism students working on a student-run newspaper.

■ SC10

Westin-Vinings 2, 6th Floor

Technology Acceptance

Sponsor: Social Science Applications
Sponsored Session

Chair: Thad Usowicz, Professor, San Francisco State University - CoB, 1600 Holloway Avenue, College of Business - ISBA, San Francisco, CA, 94132, United States, usowicz@sfsu.edu

1 — Technology Transfer Indicators in Small Businesses
Myron Hatcher, Professor and Chair, Information Systems and Decision Sciences, Craig School of Business, California State University, Fresno, CA, 93740, United States, myronh@csufresno.edu

A survey has been administrated to a convenient sample of small businesses in the San Joaquin Valley. Questions that relate to current usage of information technology and future usage are discussed. Success factors for technology transfer will also be outlines.

2 — Use of the Internet for Scientific and Professional Research: A Case Study
Thad Usowicz, Professor, San Francisco State University - CoB, 1600 Holloway Avenue, College of Business - ISBA, San Francisco, CA, 94132, United States, usowicz@sfsu .edu

Although the Internet has been extensively popularized for information retrieval for personal, journalistic, political, and business objectives, its use in scientific research has largely an esoteric subject area. The importance of openly available software tools and open government sponsored databases for significantly impacting the effectiveness of scientific and professional research is discussed through a case study.

3— Social Structures and the Effectiveness of Public Health Monitors and Controls for Disease Outbreak
Lik Mui, Professor, San Francisco State University, 1600 Holloway Avenu, College of Business - IS, San Francisco, CA, 94132, United States, lmui@sfsu.edu, Mojdeh Mahtashemi

We describe a multi-agents model with heterogeneous groups of individuals, each with distinct parameters for disease transmission dynamics. Our preliminary results show that social structures (in terms of size of cliques and their interactivity) significantly affect the effectiveness of public health controls that we simulated. We define a clique as a subpopulation that has a high interactivity within it. We characterize the critical values for the success in controlling the spread of a disease outbreak for the following variables: intervention delays, population clique sizes, and probabilities of quarantine, interaction reduction, and infection masking. As the public health interventions that we considered weaken, they are only effective in populations with smaller clique sizes. Weakened intervention refers to longer intervention delay, lower probability of quarantine, lower probability of interaction reduction with infectious individuals, and lower masking among infectious individuals.

■ SC11

Westin-Augusta 1, 7th Floor

Tutorial: Hybrid Approaches to Model-Free Reinforcement Learning Controllers

Cluster: Tutorials
Invited Session

1 — Hybrid Approaches to Model-Free Reinforcement Learning Controllers
Warren E. Hearnes II, Intelligent Systems and Controls Laboratory, School of Industrial and Systems Enginee, Georgia Institute of Technology, Atlanta, GA, 30332-0205, United States, whearnes@west-point.org, Augustine Esogbue

Complex processes are characterized by uncertainties in behavior or measurement. Model-free reinforcement learning methods are potent and capable approaches for intelligent control. We examine the hybrid approach our laboratory developed using asynchronous dynamic programming and fuzzy sets to learn effective control laws for several terminal-control problems. Simulated demonstrations are shown.

■ SC12

Westin-Augusta 2, 7th Floor

Flexible Servers and Control of Queues I

Cluster: Workforce Flexibility and Agility
Invited Session

Chair: Hyun-soo Ahn, Assistant Professor, University of California, 4185 Etcheverry Hall, Berkeley, CA, 94720, United States, ahn@ieor.berkeley.edu

1 — Throughput Maximization for Tandem Lines with Two Stations and Flexible Servers
Sigrun Andradottir, Georgia Institute of Technology, School of ISyE, 765 Ferst Drive, Atlanta, GA, 30332-0205, United States, sa@isye.gatech.edu, Hayriye Ayhan

For a Markovian queueing network with two stations in tandem, finite intermediate buffer, and M flexible servers, we study how the servers should be assigned dynamically to stations in order to obtain optimal long-run average throughput. We completely characterize the optimal policy for systems with three servers. We also provide a conjecture for the structure of the optimal policy for systems with four or more servers that is supported by extensive numerical evidence .

2 — Structural Flexibility and its Application to Manufacturing and Service Operations
Seyed Iravani, Assistant Professor, Department of IEMS, Northwestern Unversity, Evanston, IL, United States, s-iravani@nwu.edu, Mark Van Oyen, Katharine Sims

We present a framework for measuring flexibility created by the use of multipurpose resources. We quantify the flexibility inherent in the system's structure as an index, and we show how this index can be used as a predictor of system behavior in the face of uncertainty.

3 — Scheduling Flexible Servers in Failure-Prone Networks
Douglas Down, McMaster University, Department of Computing and Software, Hamilton, ON, Canada, downd@mcmaster.ca, Sigrun Andradottir, Hayriye Ayhan

We study the problem of maximizing throughput in a queueing network with flexible servers. The stations and servers are subject to breakdowns. We provide a general model for the breakdown process and examine the resulting system using associated fluid models. We determine that computing the maximum throughput is equivalent to solving a deterministic optimization problem and show how to use the solution to construct scheduling policies for the original network.

■ SC13

Westin-Augusta 3, 7th Floor

Pharmaceutical Marketing I

Sponsor: Marketing Science
Sponsored Session

Chair: Murali Mantrala, Walton Professor of Marketing, University of Missouri, Department of Marketing, 438 Cornell Hall, Columbia, MO, 65211, United States, mantralam@missouri.edu

1 — From Pipeline to Portfolio
Min Ding, Assistant Professor, Pennsylvania State University, 701A BAB, University Park, PA, 16802, United States, mqd9@psu.edu, Jehoshua Eliashberg

This paper extends recent research done on new product pipeline optimization (Ding and Eliashberg, 2002). We move from a single business opportunity to a entire basket of business opportunities, and address the portfolio optimization problem at the senior management level. We use the rich context of ethical drug industry as the background and take into considerations of key elements of portfolio optimization such as information spillover, risk-hedging.

2 — Market Structure Analysis: A Portfolio Management Tool
Bekia Fosam, Manager, ZS Associates, 100 College Road West, Suite 250, Princeton, NJ, 08540, United States, bekia.fosam@zsassociates.com, Murali Mantrala

This paper presents and illustrates a new approach to derive pharmaceutical therapeutic market structure in terms of market choice sets characterized by brand features, usage situations, customers' characteristics and other factors that influence physician's prescription choice. The results can be used to (a) develop effective strategies for new product positioning or r e-positioning existing brands; (b) drive product portfolio expansion strategies; and (c) effectively target relevant customers.

3 — Multi-Category Prescription Behavior: An Empirical Analysis
Puneet Manchanda, Assistant Professor, University of Chicago, 1101 East 58th Street, Chicago, IL, 60637, United States, puneet.manchanda@gsb.uchicago.edu, Xiaojing Dong, Pradeep Chintagunta

PCPs are a major focus of marketing activity in the pharmaceutical industry as they write prescriptions across many product categories. In order to target PCPs, it is important to understand the prescription writing differences across physicians. We use a multi-category correlated count data model to capture the number of prescriptions written. We estimate our model on a new physician-level dataset. We discuss the implications of our findings for resource allocation and physician targeting.

4 — Developing A Call Attractiveness Model: A Disaggregate Negative Binomial Model Applied to the Pharm
Franklin Carter, Assistant Professor, Saint Joseph's University, 244 Mandeville Hall, 5600 City Avenue, Philadelphia, PA, 19131, United States, fcarter@mailhost .sju.edu

We present a negative binomial model to describe the purchase rate in the physician population . To describe the rate, we use the following covariates as regressors: (1) time invariant covariates, such as individual characteristics reported by a panel; and (2) time variant covariates, such as advertising, promotional activities, and pricing. We calibrate the proposed model on a physician panel of eight new products introduced competitively in the pharmaceutical industry.

■ SC14

Westin-Peachtree A, 8th Floor

Managing New Product Variety

Cluster: New Product Development
Invited Session

Chair: Kamalini Ramdas, Associate Professor, Univeristy of Virginia, 100 Darden Boulevard, Charlottesville, VA, United States, ramdask@darden.virginia.edu

1 — How does Component Standardization Impact Product Quality? An Empirical Study in the Auto Industry
Taylor Randall, University of Utah, David Eccles School of Business, Salt Lake City, UT, United States, acttr@business.utah.edu, Kamalini Ramdas

Component standardization is widely practiced as a means to offer high variety at low cost. We examine the impact of standardization on product quality, using data on automotive braking systems. We seek to identify what constitutes appropriate use of standardization, and to highlight the risks of inappropriate use of this design strategy.

2 — The Dynamics of Product Variety
Karl Ulrich, Professor, Wharton School, Huntsman Hall, Philadelphia, PA, United States, ulrich@wharton.upenn.edu, Taylor Randall, Karthik Balasubramanian

How should we think about changes in the level of product variety over the lifecycle of a category? We provide theoretical and empirical evidence for the role of product variety in explaining industry lifecycle dynamics. The empirical work examines the laserprinter category over the period 1980-2000.

3 — Modular Design and Sequential Product Introduction
Vish Krishnan, Professor, University of Texas at Austin, TX 78712-5921, Austin, TX, United States, vish.krishnan@bus.utexas.edu, Karthik Ramachandran

Sequential Introduction of rapidly improving products can cause consumers to regret their earlier purchases. We find that a modular design strategy that localizes stable components in a standard module can alleviate consumer regret. We identify dominant pricing strategies over the range of competitive prices of the open source module factors.

4 — The Impact of Product Life-Cycle Management (PLM) Software on New Product Design and Development
Indranil Bardhan, Assistant Professor, The University of Texas at Dallas, School of Management, 2601 North Floyd Road, Richardson, TX, 75083, United States, bardhan@utdallas.edu, Rajiv Banker

PLM software has enabled companies to collaborate during product design and development. We investigate the impact of collaboration software on product development outcomes such as quality, cycle time, cost, and user satisfaction. Based on a study of 71 companies, we find that collaboration software has significant impact on time to market, quality and development costs.

■ SC15

Westin-Peachtree F, 8th Floor

Technology & Strategy: Managing the Firm Knowledge Base

Sponsor: Technology Management
Sponsored Session

Chair: Francisco Veloso, Carnegie Mellon University, Department of Eng. and Public Policy, 5000 Forbes Av., Pittsburgh, PA, 15232, United States, fveloso@cmu.edu

1 — R&D, Organization Structure, and the Development of Corporate Technological Knowledge
Nicholas Argyres, Associate Professor, Boston University, 595 Commonwealth Avenue, Boston, MA, 02215, United States, nargyres@bu.edu, Brian Silverman

We draw on transaction cost theory and theories of innovation to explore the link between a firm's choice of a centralized or decentralized R&D structure and the type of innovation it produces. We find that firms with centralized R&D generate innovations that have a larger and broader impact on later technological development than decentralized R&D. We find mixed evidence that centralized R&D leads to broader search, and evidence that R&D budgets can substitute for authority relations.

2 — When Does Corporate Venture Capital Investment Create Firm Value?
Gary Dushnitsky, Stern School of Business, New York University, 44 West 4th St. Suite 750, New York, NY, 10012, United States, gdushnit@stern.nyu.edu, Michael Lenox

Scholars have observed that established firms face underlying challenges when investing in entrepreneurial ventures, i.e., investing corporate venture capital (CVC). However, the structural deficiencies inherent in CVC may be offset by other indirect benefits from investing — primarily by providing a window onto novel technology. We propose that a significant relationship between CVC investment and firm value creation arises when firms explicitly pursue corporate venture capital as a window on technology. Using a panel of CVC investment over a thirty-year period, we present evidence consistent with our proposition. Our results have important implications for corporate venture capital, in particular, and technology strategy, in general.

3 — Giving up Competitive Advantage? The Role of Learning in the Expiration of Real Options
Atul Nerkar, Columbia University, 721 Uris Hall, 3022 Broadway, New York, NY, 10027, United States, aan19@columbia.edu

Do firms give up competitive advantage that emanates from the ownership of real options in the technology sector? Using a path dependent approach, I suggest that firms give up of competitive advantage when the uncertainty underlying the real option is reduced via learning. Empirical evidence based on patent data is presented.

4 — Technology Diversification and Economic Performance: A Within Industry Perspective
Francisco Veloso, Carnegie Mellon University, Department of Eng. and Public Policy, 5000 Forbes Av., Pittsburgh, PA, 15232, United States, fveloso@cmu.edu, Claudio Wolter, Patrick Steinemann

This paper examines the relation between diversification and performance. While most diversification studies look across industries and consider market diversification measures, we focus on a panel of firms in a single sector, automotive suppliers, and address technology diversification. Using a new measure of technological coherence, we show that firms with stronger coherence are able to better exploit corporate synergies and therefore achieve superior economic performance.

■ SC16

Westin-Peachtree G, 9th Floor

Modelling Applications II

Sponsor: Health Applications
Sponsored Session

Chair: Michael Carter, Professor, University of Toronto, Mechanical & Industrial Eng, 5 King's College Rd, Toronto, ON, M5S3G8, Canada, carter@mie.utoronto.ca

1 — Why the Family Physician is Tired because of His/Her Schedule
Sophie Lapierre, Professor, Ecole Polytechnique, Mathematics and Industrial Engineering, C.P. 6079, succ. CV, Montreal, QC, H3A 3A7, Canada, Sophie .Lapierre@polymtl.ca, Javad Sadr

We analyse the typical schedule of physicians found in family practice settings in Montreal. We performed an analysis of the scheduling problems and its recommendations.

2 — Why the Obstetrician Could Not Break His/Her 24 Hour Shift
Javad Sadr, Ecole Polytechnique, Mathematics and Industrial Engineering, C.P. 6079, succ. CV, Montreal, PQ, H3A 3A7, Canada, Javad.Sadr@polymtl.ca, Sophie Lapierre

We analyse the typical schedule of obstetricians-gynecologists that we found in Montreal, Canada. We performed an analysis of the scheduling problems and its recommendations. We discuss the implementation of a new schedule.

3 — Redesigning the Medication Ordering, Dispensing and Administration Process in an Acute Care Hospital
Carolyn Busby, PhD Student, University of Toronto, 5 King's College Road, Toronto, ON, M5S3G8, Canada, busby@mie.utoronto.ca, Michael Carter, Cathy Wong, Glen Geiger, Yaron Derman

Two simulation models of a medication ordering, dispensing and administration process in an acute care hospital, will be presented. One model represents the current manual system, and has been validated against observed data, while the other represents the proposed electronic medication ordering, dispensing and administration system. The results show that there is a potential to significantly reduce the turnaround time from when the drug is ordered to its delivery to the ward.

■ SC17

Westin-Peachtree H, 9th Floor

Operations Research in Health Care

Cluster: Public Health & Health Economics
Invited Session

Chair: Natalya Zlobin, Georgia Institute of Technology, 327106 Georgia Tech Station, Atlanta, GA, 30332, United States, nzlobin@isye.gatech.edu

1 — Patient Compliance as a Basis for Kidney Allocation Decisions
Xuanming Su, Graduate School of Business, Stanford University, 518 Memorial Way, Stanford, CA, 94305, United States, xuanming@stanford.edu, Stefanos Zenios

Recipients of kidney transplants face the risk of acute graft rejection if they do not adhere to a rigorous course of immunosuppressive drugs. In this paper, we consider making kidney allocations based on assessments of patient compliance, addressing the following questions: Should high-compliance patients receive organs of higher quality? Should they experience shorter waiting times? Using a mechanism design framework, we explore how these results change when patient compliance is unobservable.

2 — Attaining Situational Awareness from Early Symptomatic Data After an Airborne Anthrax Attack
Joe Wu, Los Alamos National Laboratory, MS K710, Los Alamos National Laboratory, Los Alamos, NM, 87545, United States, tkwu@mit.edu, Lawrence M. Wein, Edward Kaplan

An effective emergency response to an airborne anthrax attack requires a rapid and accurate estimate of the size of the afflicted population. We develop a simple statistical method that inputs data from people who are the first to report symptoms or die as a result of the attack, and estimates the future rate of symptomatic cases and fatalities in the absence of prophylactic intervention, as well as the time of the attack.

3 — Information Asymmetries in Dental Insurance Market
Natalya Zlobin, Georgia Institute of Technology, 327106 Georgia Tech Station, Atlanta, GA, 30332, United States, nzlobin@isye.gatech.edu, Paul Griffin, Susan Griffin, Julie Swann

Motivation for exploring the issue of information asymmetries in the dental insurance market comes from trying to solve a more fundamental problem of designing a financing mechanism to make dental insurance provision possible under government health care programs, such as Medicare. In this study we look at adverse selection and moral hazard effects in the dental insurance market. Differences in health and dental insurance provision and consumption, relevant to the results, are also discussed.

4 — Trends in Dental Health Status Among Black and White American Adults (1971-1994)
W. Brad Jones, Georgia Institite of Technology, School of Industrial and Systems Eng, Atlanta, GA, United States, wbrad@isye.gatech.edu

The focus of this research project is to analyze the trends in dental health status among Black and White American adults that occurred from 1971-1994. The results from this research will ultimately be used to develop a mathematical model that will project the future dental health status of American adults.

■ SC18

Westin-Tower 1201, 12th Floor

Recent Advances in Reliability and Quality

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: Yong Chen, Assistant Professor, University of IOWA, Dept. of Mechanical and Industrial Engr., Iowa City, IA, United States, chenyz@umich.edu

1 — Multistate Network Reliabilty and Infrastructure Applications
Sarintip Satitsatian, Doctoral Student, University of Washington, Box 35260, Seattle, WA, 98195-2650, United States, sarintip@u.washington.edu, Kailash Kapur

Many of the infrastructure problems in communications, transportation, supply-chain, and Internet can be modeled as a network. The traditional network reliability analysis is based on binary model for the state of nodes and the network itself. In this paper we propose models using multi-states which are more realistic. The components degrade continuously and can be approximated by multi-state behavior based on the preferences of the customer. Some examples and analysis procedures are given.

2 — Integrative Learning and Forgetting Models for Quality and Productivity Improvement Analysis
Adedeji Badiru, Professor & Department Head, University of Tennessee, Department of Industrial Engineering, 412 East Stadium Hall, Knoxville, TN, 37996, United States, abadiru@utk.edu, Femi Omitaomu

This paper presents integrative models of learning curves and forgetting functions for quality and productivity improvement analysis. Learning curves have been used for many decades as a tool for assessing productivity. In recent times, models have been developed to represent the interrelationships of productivity and product quality. The forgetting component of productivity has received less attention both in the literature and actual practice.

3 — Cost-Variability-Sensitive Preventive Maintenance Considering Management Risk
Yong Chen, Assistant Professor, University of IOWA, Dept. of Mechanical and Industrial Engr., Iowa City, IA, United States, chenyz@umich.edu, Judy Jin

Traditional preventive maintenance policies are mostly studied based on the expected cost criteria without considering the management risk due to cost variability. A new maintenance methodology is proposed in this paper to consider the effects of both cost expectation and cost variability. Based on the proposed framework, three traditional preventive maintenance policies have been reinvestigated and the effect of the variability sensitivity on the optimal policies is further analyzed.

4 — Risk Aversion and the Uncertain Supply Problem
Russ Garber, Ph.D. Candidate, Management Science and Engineering Stanford University, 736 Escondido Road Apt 736, Stanford, CA, 94305, United States, rgarber@stanford.edu, John William Hatfield, Robert C Carlson

We consider the problem of choosing an optimal production quantity (Q*) when the supply process is stochastic and the agent is risk-averse. Modeling the supply process as a Bernoulli process, we find conditions under which these problems will be concave. Thus, the first order conditions characterize the optimum, and numerical techniques can find Q* easily. We also expand our results to include uncertainty in both the demand and supply parameters and how the degree of risk aversion influences Q*.

■ SC19

Westin-Tower 1202, 12th Floor

Statistical Diagnosis and Modeling

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: Qiang Huang, Assistant Professor, University of South Florida, Department of IMSE, Tampa, FL, 33620, United States, huangq@engin.umich.edu

1 — Stream of Variation Modeling and Analysis of Serial-Parallel Multistage Manufacturing Systems
Qiang Huang, Assistant Professor, University of South Florida, Department of IMSE, Tampa, FL, 33620, United States, huangq@engin.umich.edu, Jianjun (Jan) Shi

In a Serial-Parallel Multistage Manufacturing System (SP-MMS), parts could go through different process routes. This study extends the state space modeling approach from single process route to the SP-MMS. Several model reduction techniques are proposed to reduce dimensions of system model. Properties of these techniques are studied from the perspectives of system representation and diagnosability.

2 — Root Cause Identification for Quality Improvement of Multistage Machining Processes
Shiyu Zhou, Assistant Professor, University of Wisconsin-Madison, 1513 University Ave., Madison, WI, 53706, United States, szhou@engr.wisc.edu, Yong Chen, Jianjun (Jan) Shi

The root cause identification for quality-related problems is a key issue in manufacturing processes. In this paper, the root cause identification is formulated as a problem of estimation and hypothesis test of a general linear mixed model. The algorithms developed for general linear mixed model are adopted to estimate the mean and variance. A hypothesis testing method is developed to determine if process faults exist in terms of statistical significance. A detailed experimental study is given.

3 — Enhanced Fault Diagnosis Using Quantitative Relationships between Process Variables and a Fault
Hyun-Woo Cho, Doctoral Student, Pohang University of Science and Technology (POSTECH), Division of Mechanical & Industrial Eng., San 31, Hyoja-dong, Nam-gu, Pohang, 790-784, South Korea, hwcho@postech.ac.kr, Kwang-Jae Kim

This work proposes a data-driven method for effectively incorporating on-line quantitative information from monitoring into diagnosis. An index to capture the quantitative relationship between process variables and a specific fault is developed. Based on the index, the process variables having major effects on a fault can be identified. A systematic procedure to produce reduced cause candidates is also developed. The performance of the method is demonstrated using a real batch process.

4 — Applying Multivariate Statistical Methods to Fraud Detection Problems
Zhihong Zhou, Hongkong University of Sci. & Tech., TowerA 701A, HKUST, Hongkong, Clear Water Bay, Kowloon, Hong Kong, zzhxs@ust.hk, Fugee Tsung

Fraud detection is an important issue in today's society associated with the rapid development of our modern economics. For example, in telecommunications, it is required to detect the fraud calling cases as soon as possible to save the associated loss. However, it may not be easy to use conventional statistical methods to handle this problem, mainly because of the complex multivariate time series patterns in the customer information. In this paper, we apply standard batch process techniques to the problem by regarding the information of different customers in a certain period as different batches. Especially, prediction techniques using batch library for incomplete batches are applied, and run length study for misclassification in the customer batch library is discussed.

■ SC20

Westin-Tower 1203, 12th Floor

Joint Session—QSR/Computing: Statistical Methods for Stochastic Dynamic Programming

Sponsors: Quality, Statistics and Reliability; Computing
Sponsored Session

Chair: Victoria Chen, University of Texas at Arlington, Industrial & Manufacturing Systems Eng., Campus Box 19017, Arlington, TX, 76019, United States, vchen@uta.edu

1 — Variants of Multivariate Adaptive Regression Splines in Solving Continuous-State Stochastic DP
Julia Tsai, Purdue University, Krannert School of Management, 403 West State Street, West Lafayette, IN, 47907, United States, jctsai@mgmt.purdue.edu, Victoria Chen

The development of a parallel version of multivariate adaptive regression splines (MARS) improves the computational performance for the OA/MARS stochastic dynamic programming method. In addition, an automatic way of determining a difficult-to-select MARS parameter is developed. To cope with the high-order interaction of a MARS model, an approach that provides an alternative to lower the order of interaction is presented. Results are demonstrated on an inventory forecasting application.

2 — Regression Dynamic Programming for Optimal Control of High-Dimensional Continuous-State Stochastic Problems
Christine Shoemaker, Ripley Professor, Cornell University, 210 Hollister Hall, Ithaca, NY, 14853, United States, cas12@cornell.edu, David Ruppert, Daisy Fan

A Regression Dynamic Programming approach is developed to solve efficiently high-dimensional, continuous-state, stochastic dynamic programming problems. We found that with the penalized regression spline, the use of Latin hypercube sampling gives much higher accuracy than Orthogonal Arrays for the same computational effort. The approach is applied to a nonlinear stochastic reservoir problem with up to thirteen continuous decision variables.

3 — A Decision-Making Framework for Studying Ozone Pollution in Urban Atlanta
Zehua Yang, UTA Department of IMSE, Box 19017, Univ. of Texas at Arlington, Arlington, TX, 76019, United States, zxy7348@exchange.uta.edu, Victoria Chen, Michael Chang

In order to design more sustainable urban environments, a method for evaluating the possibilities must be developed. A preliminary decision-making framework for studying ground-level ozone pollution in urban Atlanta will be presented. The EPA's Urban Airshed Model was employed to construct the transition of ozone and nitrogen oxide concentrations over time.

4 — Optimization of a Large-Scale Water Reservoir Network by Stochastic Dynamic Programming
Victoria Chen, University of Texas at Arlington, Industrial & Manufacturing Systems Eng., Campus Box 19017, Arlington, TX, 76019, United States, vchen@uta.edu, Cristiano Cervellera, Aihong Wen

A numerical solution to a 30-dimensional water reservoir network optimization problem, based on stochastic dynamic programming, is presented. Experimental results show how dimensionality issues, given by the large number of basins and realistic modeling of the stochastic inflows, can be mitigated by employing neural approximators for the value functions, and efficient discretizations of the state space.

■ SC21

Westin-Tower 1204, 12th Floor

Open-Source Interfaces for Optimization

Sponsor: Computing
Sponsored Session

Chair: Robin Lougee-Heimer, IBM Research, 1101 Kitchawan Road, Yorktown Heights, NY, 10598, United States, robinlh@us.ibm .com

1 — Stochastic Modeling Interface for COIN
Alan King, Mathematical Sciences, IBM Research, POB 218, Yorktown Heights, NY, 10598, United States, kingaj@us.ibm.com, Leonardo B. Lopes

We discuss progress on architecting and implementing a modeling interface for stochastic programming in the COIN system.

2 — New Developments in the COIN-OR Open Solver Interface
Matthew Saltzman, Associate Professor, Clemson University, Mathematical Sciences Dept., Martin Hall, Box 340975, Clemson, SC, 29634-0975, United States, mjs@math .clemson.edu

The COIN-OR Open Solver Interface (OSI) is a uniform API for accessing a variety of commercial and open-source callable solver libraries. This presentation describes new features in the latest version of the OSI.

3 — COIN-OR Open-Source Coding Contest
Robin Lougee-Heimer, IBM Research, 1101 Kitchawan Road, Yorktown Heights, NY, 10598, United States, robinlh@us.ibm.com, Michael Trick, Alexander Martin, John Forrest, Gabrielle Grun, Yan Xu

Winners of the COIN-OR Open-Source Coding Contest will present their work The contest was a joint effort of INFORMS, MPS, and COIN-OR. Winners were announced at ISMP 2003. Prizes were donated by IBM Research.

■ SC22

Westin-Tower 1205, 12th Floor

USMA ORCEN II

Sponsor: Military Applications
Sponsored Session

Chair: William Klimack, Director, ORCEN, USMA, Department of Systems Engineering, United States Military Academy, West Point, NY, 10996, United States, William.Klimack@usma.edu

1 — Agent Based Models: Insights for Unattended Ground Sensors and Land Warrior Power Management
Dave Sanders, MAJ, ORCEN, Department of Systems Engineering, USMA, West Point, NY, 10996, United States, david.m.sanders@us.army.mil

Situational Awareness in combat, and the use of that knowledge by technology and soldiers, is one of the more difficult aspects of combat modeling. Combat equipment today is designed under the assumption of such usage, but our ability to model that capability is extremely tenuous. This work describes the use of Agent Based Models at the USMA to explore two areas: the benefit of the Land Warrior equipment in enhancing combat outcome and the ability to analyze disposable sensor technology.

2 — Modeling and Analysis in Support of Unit Manning Initiative for the United States Army
Dave Sanders, MAJ, ORCEN, Department of Systems Engineering, USMA, West Point, NY, 10996, United States, david.m.sanders@us.army.mil, Paul Thornton, Mike McGinnis

The U.S. Army personnel system is transitioning from an Individual Replacement System to a Unit Manning System. This works incorporates analysis which identifies issues and point to policy changes necessary to ensure unit readiness. In particular, the synchronization of this transition with the Army transformation to the Objective Force and increasing operational requirements is discussed and a scheduling tool is illustrated to identify friction points.

3 — FCS Unit Set Fielding
William Klimack, COL, Departemtn of Systems Engineering, mahan Hall, West Point, NY, 10996, United States, william.klimack@usma.army.mil

The Future Combat System (FCS) Units of Action (UA) will be equipped in a radically different fashion than current units. This requires that the UAs be fielded as unit sets. Decision Analysis was employed to quantify the tradeoffs of various courses of action.

4 — The Deployment Scheduling Analysis Tool
LTC Timothy Trainor, Deputy Director, ORCEN, Department of Systems Engineering, United States Military Academy, West Point, NY, 10996, United States, timothy .trainor@usma.edu, Thom Hodgson, Barbara Melendez, Michael Williams, Kristin Thoney

The time to deploy forces is important to the Army as it transforms to a lighter force. The Deployment Scheduling Analysis Tool generates quickly a schedule by creating individual equipment routings and then repetitively simulating the deployment to determine the schedule that minimizes any lateness of units. Through scheduling and sensitivity analysis, DSAT will support the analysis of future strategic lift assets needed to fulfill the requirements articulated in the National Military Strategy.

■ SC23

Westin-Tower 1206, 12th Floor

Perspectives on Decision Analysis

Sponsor: Decision Analysis
Sponsored Session

Chair: Donald L. Keefer, Associate Professor, Arizona State University, Department of Supply Chain Management, W. P. Carey School of Business, Tempe, AZ, 85287-4706, United States, Don.Keefer@asu.edu

1 — The Evolution of Decision Analysis Practice
Ronald A. Howard, Professor, Stanford University, Dept of Management Sci and Engineering, Terman Engineering Center 420, Stanford, CA, 94305-4026, United States, rhoward@sdg.com, James Matheson

Decision analysis practice has evolved since the 1960s from individual consulting through the creation of consulting groups, consulting companies, and groups internal to companies. The challenges of each stage created the next phase. Despite this substantial total growth of practice, few important decisions currently receive the help our profession could offer.

2 — Perspective on Decision Analysis and Behavioral Research
Detlof von Winterfeldt, Professor of Public Policy and Management, University of Southern California, RGL 312, University Park, Los Angeles, CA, 90089, United States, winterfe@usc.edu, Ward Edwards, Ralph F. Miles

This presentation examines behavioral decision research from a normative perspective. We argue that certain behavioral assumptions (transitivity, sure thing, additive probabilities) are critical to normative modeling, while others are less critical. We also distinguish between serious and spurious behavioral violations of normative models.

3 — Perspective on Decision Analysis Applications in the Operations Research Literature
Donald L. Keefer, Associate Professor, Arizona State University, Department of Supply Chain Management, W. P. Carey School of Business, Tempe, AZ, 85287-4706, United States, Don.Keefer@asu.edu, Craig W. Kirkwood, James L. Corner

We identify trends and developments in decision analysis applications published in operations research journals. We conclude that the overall rate of publication of decision analysis applications has increased over time and that both the mix of application areas and the methodologies emphasized have shifted somewhat. We highlight award-winning applications, and discuss issues for the future.

■ SC24

Westin-Tower 1207, 12th Floor

Economics of Information Systems

Sponsor: Information Systems
Sponsored Session

Chair: Haldun Aytug, Assistant Professor, University of Florida, PO Box 117169, Gainesville, FL, 32611, United States, aytugh@ufl.edu

1 — Free Trial or No Free Trial: Optimal Software Product Design with Network Externalities
Qian Tang, Doctoral Candidate, University of Florida, Dept. of Decision & Info Sciences, Gainesville, FL, 32611-7169, United States, qtang@ufl.edu, Hsing Cheng

Software free trial is a common practice that has both positive and negative effects. On the one hand, it helps firms to exploit the positive network externalities by building up the total user base; on the other hand, it cannibalizes partial demand for the commercial software. We analyze the conditions under which the firms should introduce the free trial and how to design the quality of the free trial optimally.

2 — Resource Allocation with QoS Measures in Telecommunication Networks
Nihat Kasap, Ph.D. Student, University of Florida, DIS department, PO Box 117169, Gainesville, FL, 32611, United States, nkasap@ufl.edu, Haldun Aytug

We present a model that investigates Quality of Service (QoS) performance measures and resource allocation in telecommunication networks. QoS is modeled as a function of loss probability, delay and jitter. We model the customer's cost minimization problem with heterogeneous jobs subject to different minimum QoS and due-date requirements and resource availability. We investigate the customer's optimal behavior in a variety of pricing scenarios.

3 — Pure vs Mixed Bundling: Why does AOL Force Proprietary Software with Internet Access?
Hemant Bhargava, Professor, University of California at Davis, Graduate School of Management, One Shields Avenue, Davis, CA, 95616, United States, hbhargava@computer .org, Juan Feng

Some firms create barriers for certain classes of customers. For example, AOL forces proprietary software with dial-up access, turning off many computer-savvy users. Why not adopt a mixed bundling approach, with software-access bundle for naive users and Internet-access-only service for experts? We propose alternative explanations for such willfully created barriers.

4 — Segmented Pricing with Incomplete Information
Kutsal Dogan, Assistant Professor, University of Texas at Dallas, School of Management, JO44, 2601 N Floyd Rd, Richardson, TX, 75080, United States, kutsal .dogan@utdallas.edu

Vast amounts of data collected about consumers allow firms to target consumers and choose customized pricing over fixed pricing. Previous research explored a firm's decision between these two pricing schemes. This paper analyzes the middle ground and proposes a model where the mixture of the two pricing alternatives is employed.

■ SC25

Westin-Tower 1208, 12th Floor

New Challanges for OR from the New Warfare and Transformation-I

Sponsor: Military Applications
Sponsored Session

Chair: James Taylor, Professor of Operations Research, Naval Postgraduate School, Naval Postgraduate School, Monterey, CA,

93943-5000, United States, jtaylor@nps.navy.mil

1 — John Boyd and 21st Century Warfare
Grant Hammond, Director, Center for Strategy and Technology, Air University, 325 Chennault Circle, Maxwell AFB, AL, 36112, United States, strategoi@aol.com

This paper examines the ideas of the late USAF Col John Boyd and their impact on the US military and its transformation toward Joint Vision 2020. Boyd's concepts of the Observation, Orientation, Decision, Action (OODA) Loop, his focus timing, shaping the battlespace, the adversary's perceptions, and on maneuver warfare and its attributes (variety, rapidity, harmony and initiative) as well as others he championed have infected all the services and the notion of joint effects-based operations.

2 — Towards a Theory of Joint Operations
Jon Czarnecki, Naval War College Monterey, Monterey, CA, 93943-5000, United States, jeczarne@nps.navy.mil

This paper provides a basis for developing a integated theory of joint military operations. It focuses on three correlated independent variables: training, combat power, and decision space,and demonstrates a means of testing the theoretical concepts.

3 — New Challenges for OR from the New Warfare and Transformation
John Hanley, Assistant Director for Risk Management, OSD, Force Transformation, 10063 Maclura Court, Fairfax, VA, United States, John.Hanley@osd.pentagon.mil

This paper addresses past transformations in Operations Research and prospects for its future practice. Both the character of armed conflict and techniques for exploring it are placing demands upon and presenting opportunities for the discipline of Operations Research. This paper provides a framework for relating Operations Research techniques to different classes of problems and will suggest areas for the development of OR techniques and practices.

■ SC26

Westin-Tower 1401, 14th Floor

Clustering and Categorization Applications

Cluster: Data Mining and Knowledge Discovery
Invited Session

Chair: Shane Pederson, Bank One Card Service, Inc., Elgin, IL, United States, Shane_Pederson@bankone.com

1 — Assigning UPCs into Product Hierarchies using Categorization Trees
Mary Dowling, Optimization Consultant, Marketing Analytics, Inc., 500 Davis St., Suite 1010, Evanston, IL, 60201, United States, marydowling@marketinganalytics.com

Retailers make product-related decisions using information from data vendors that compares their sales to total markets where they compete. Recent work customizes this data to better align with the product hierarchies used internally by each retailer. Automation tools are helpful due to the large number of items and high retailer variability. We will discuss the use of categorization trees for constructing rules to automatically assign items into a retailer's product hierarchy structure.

2 — Clustering in the Presence of Errors, with an Application to Sales Forecasting in Retail
Mahesh Kumar, MIT, 305 Memorial Drive, #404 C, Cambridge, MA, 02139, United States, maheshk@mit.edu, Jim Orlin, Nitin Patel

The sales parameters (price elasticity and product life cycle, for example) are often estimated using a linear regression. In the event of insufficient sales data, the estimates of these parameters have large errors. We propose the use of error based clustering that simultaneously determines the clusters of items and estimates the sales parameters for each cluster of items. We show empirically that the new estimates of the parameters have smaller errors, which results in improved sales forecast.

3 — Between-Cluster Relationship for Microarray Data
Greg Dyson, University of Michigan, 437 West Hall, 550 East University, Ann Arbor, MI, 48105, United States, gdyson@umich.edu, Jeff Wu

For microarray data, two genes clustered into the same group tend to have a similar expression profile. It will be interesting to ascertain the between-cluster relationship for gene expression data. We will determine and quantify the amount of co-regulation between clustered sets of genes, using the existing structure obtained from clustering. Also a procedure is proposed to allow the identification of negatively correlated groups of genes, which may be an indication of repression or regulation.

■ SC27

Westin-Tower 1402, 14th Floor

Nicholson Student Paper Prize Competition, I

Cluster: Nicholson Student Paper Prize
Invited Session

Chair: David Morton, The University of Texas at Austin, Graduate Program in Operations Research, Austin, TX, 78712-0292, United States, morton@mail.utexas.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.

■ SC28

Westin-Tower 1403, 14th Floor

Cutting Plane Approaches to Cone Programming Problems

Cluster: Nonlinear Programming
Invited Session

Chair: John Mitchell, Rensselaer (RPI), Math Sciences, Troy, NY, 12180, United States, mitchj@rpi.edu

1 — An Analytic Center Cutting Plane Method in Conic Programming
Vasile Basescu, Rensselaer (RPI), Math Sciences, Troy, NY, 12180, United States, basesv@rpi.edu, John Mitchell

We analyze the problem of finding a point strictly interior to a bounded, fully-dimensional set from a finite dimensional Hilbert space. We generalize the results obtained for the LP, SDP and SOCP cases. We provide upper bounds for the number of Newton steps required to compute an approximate analytic center and for the total number of cuts added to solve the problem. The bounds depend on the quality of cuts, the dimensionality of the problem and the 'thickness' of the set we are considering.

2 — A Non-Polyhedral Primal Active-Set Approach to SDP
Kartik Krishnan, Rice University, Computational and Applied Mathematics, Houston, TX, 77005, United States, kartik@caam.rice.edu, Yin Zhang, Gabor Pataki

We present a non-polyhedral primal active set approach to semidefinite programming which exploits the low rank of optimal primal extreme point solutions. The goal is to find a proper superset of the range space of an optimal primal extreme point solution. Under a nondegeneracy assumption, the algorithm generates a sequence of primal iterates with strictly decreasing objective values. We will also discuss the convergence of the approach, and present some preliminary computational results.

3 — Properties of a Cutting Plane Method for Semidefinite Programming
John Mitchell, Rensselaer (RPI), Math Sciences, Troy, NY, 12180, United States, mitchj@rpi.edu, Kartik Krishnan

A semidefinite program is a nonsmooth optimization problem, so it can be solved using a cutting plane approach. We show that such a method has complexity comparable with that of a direct interior point solver. We show that cutting planes can always be found efficiently that support the feasible region. Further, we characterize the cutting planes that give high dimensional tangent planes, and show how such cutting planes can be found efficiently.

■ SC29

Westin-Tower 1404, 14th Floor

Network Optimization: Models and Methods

Sponsor: Optimization/Network
Sponsored Session

Chair: Richard Barr, Ao. Professor, Southern Methodist University, PO Box 750123, EMIS Department, Dallas, TX, 75275, United States, barr@engr.smu.edu

1 — Capacity Expansion of WDM Networks Under Demand Uncertainty
Manuel Laguna, University of Colorado, Boulder, CO, United States, Manuel .Laguna@Colorado.EDU, José A. Moreno-Pérez, Belén Meli·n

We develop models and methodologies for the wavelength division multiplexing and optical cross-connect routing and provisioning problem under demand uncertainties. Uncertain demands are modelled by a set of scenarios. Our design algorithm relies on the application of the scatter search optimization metaheuristic. We present some realistic test instances to illustrate the proposed procedure.

2 — Preprocessing Mixed Integer Programs
Mark Lewis, University of Mississippi, Room 221, Holman Hall, University, MS, 38677, United States, mlewis@bus.olemiss.edu

A new preprocessing technique for mixed integer programs having binary and continuous variables is presented. The technique, named Guided Design Search, is based on a strict sampling of the solution space which is used to guide the variable selection and branching direction in a branch-and-bound tree. Application of this technique to capacitated multi-commodity network design problems with over 8000 binary variables resulted in faster, higher quality solutions (vs. default CPLEX).

3 — A New Heuristic for O-D Integer Multicommodity Network Flows
Richard Barr, Ao. Professor, Southern Methodist University, PO Box 750123, EMIS Department, Dallas, TX, 75275, United States, barr@engr.smu.edu, Thomas McLoud

Origin-destination integer multicommodity flow problems differ from classic multicommodity models in that each commodity has one source and one sink, and each commodity must be routed along a single path. A new Invisible-Hand heuristic, which mimics economic markets' behavior, is presented and tested on large-scale telecommunications problems, with excellent results.

■ SC30

Westin-Tower 1405, 14th Floor

Cooperative and Noncooperative Markov Decision Processes

Sponsor: Optimization/Stochastic Programming
Sponsored Session

Chair: Tapas K. Das, Professor, University of South Florida, 4202 E. Fowler Avenue, ENB 118, Tampa, FL, 33647, United States, das@eng.usf.edu

1 — Function Approximation for Reinforcement Learning Via A Regenerative Method
Abhijit Gosavi, Assitant Professor, State University of New York, Buffalo, 342 Bell Hall, Box 602050,, Buffalo, NY, 14620, United States, agosavi@buffalo.edu

Reinforcement Learning is a simulation-based alternative to classical dynamic programming for solving Markov and semi-Markov decision problems. It is used on large-scale problems, whose value function has to be approximated with regression or neural networks. The open literature has focussed on the use of "incremental" methods of function approximation. We present a new "regenerative" approach to function approximation.

2 — Improved Basis Selection for Approximate DP on Networks
Michael Veatch, Professor, Gordon College, Department of Mathematics and Computer S, Wenham, MA, 01984, United States, veatch@gordon.edu

The approximate linear programming approach has shown some promise for controlling stochastic networks. We seek to improve its accuracy by designing basis functions to approximate the value function that are accurate and that allow the number of constraints in the approximate LP to be reduced.

3 — Dynamic Power Control in Wireless Communication
Baris Ata, Stanford University, Graduate School of Business, Stanford, CA, 94305-5015, United States, bata@stanford.edu
Abstract not supplied

4 — Learning Average Reward Irreducible Stochastic Games
Jun Li, PhD Candidate, University of South Florida, Department of Industrial & Mgmt systems, 4202 E. Fowler Av. ENB118, Tampa, FL, 33620, United States, jli7@eng.usf .edu, Tapas K. Das

We develop auxiliary matrix games having equivalent equilibrium points and values to average reward irreducible stochastic games. A Nash-R reinforcement learning algorithm is developed for obtaining the equivalent auxiliary matrices. The asymptotic behavior of its two time scale stochastic approximation scheme, and the stability of the associated ODEs are analyzed. The Nash-R algorithm is tested and benchmarked with MDP based learning methods using a grid game.

■ SC31

Westin-Tower 1406, 14th Floor

Location Modeling

Sponsor: Location Analysis
Sponsored Session

Chair: Richard Francis, Dept. Industrial & Systems Engineering, 303 Weil Hall, University of Florida, Gainesville, FL, 32611, United States, francis@ise.ufl.edu

Co-Chair: Timothy Lowe, University of Iowa, United States, tlowe@blue.weeg.uiowa.edu

1 — Planar Facility Location and Placement in the Presence of Generalized Congested Regions
Avijit Sarkar, Department of Industrial Engineering, University at Buffalo (SUNY), Buffalo, NY, 14260, United States, asarkar@buffalo.edu, Rajan Batta, Rakesh Nagi

There exist a finite number of generalized congested regions (GCRs) where placement is prohibited and travel is permitted at a possible additional cost, known as the congestion factor. We consider the planar facility location and placement problem in the presence of GCRs, with deterministic and time- dependent congestion factors.

2 — Integrated Service, Location and Inventory Planning
Zuo-Jun Max Shen, University of Florida, Dept. of Industrial and Systems Engr., Gainesville, FL, 32611, United States, maxshen@ufl.edu, Mark Daskin

We present a new model that allows planners to explore tradeoffs between the quality of service provided to customers and the combined location and inventory costs of operating the system. A model formulation is outlined. Algorithms for solving the multi-objective problem are sketched and computational results are provided.

3 — An Application of Row-Column Aggregation
Brenda Rayco, University of Miami, Coral Gables, FL, 33124, United States, brayco@exchange.sba.miami.edu

Row-Column aggregation techniques have been used for demand point aggregation in the approximation of location models. We discuss the application of such methodologies for the solution of large-scale stochastic programming problems.

4 — Aggregation Decomposition and Aggregation Guidelines for a Class of Minimax and Covering Location Models
Richard Francis, Dept. Industrial & Systems Engineering, 303 Weil Hall, University of Florida, Gainesville, FL, 32611, United States, francis@ise.ufl.edu, Arie Tamir, Hulya Emir-Farinas, Timothy Lowe

We consider some minimax location models requiring demand point aggregation. We treat the aggregation as a second-order location problem, and use error bounds as aggregation error measures. We give "squareroot" error bound formulas to assist in the aggregation process. Our approach facilitates aggregation decomposition for location problems involving multiple communities.

■ SC32

Westin-Tower 1407, 14th Floor

Scheduling with Logistics Issues

Cluster: Scheduling
Invited Session

Chair: Nicholas G. Hall, Professor, Ohio State University, 2100 Neil Avenue, Columbus, OH, 43210-1144, United States, hall.33@osu.edu

1 — Decomposition of Railway Scheduling Problems
Peter Brucker, Professor, University of Osnabrueck, Germany, Peter .Brucker@mathematik.uni-osnabrueck.de, Christian Strotmann

Railway scheduling problems can be modeled as generalized job-shop problems. Within such a framework the decomposition of a large railway network into subnetworks and a coordination network is discussed. Local search methods for solving the problem are presented which are based on such a decomposition.

2 — Increasing Throughput for Robotic Cells with Parallel Machines and Multiple Robots
Neil Geismar, Professor, University of Texas, Dallas, School of Management, SM30, P .O. Box 830688, Richardson, TX, 75083-0688, United States, ngeismar@yahoo.com, Chelliah Sriskandarajah

We schedule robots' moves in a cell with parallel machines and multiple robots with general travel-times. We propose a set of sequences of robot moves that is optimal for many practical cases. Through simulation, we demonstrate that our scheme is superior to the heuristic used by a Dallas-area semiconductor manufacturer.

3 — Logistics Scheduling under Disruptions
Chung-Yee Lee, Head and Professor, Department of IEEM, Hong Kong U of Sci & Tech, Clear Water Bay, Kowloon, Hong Kong, HK, Hong Kong, cylee@ust.hk, Gang Yu

In this paper, we study a new scheduling problem that arose under disruption environment. Our purpose is to reschedule jobs and also select a transportation mode so that an objective function, including original cost function, possible transportation cost and the disruption cost is minimized.

4 — Routing Point-to-Point Freight Delivery Systems
Marc Posner, Professor, The Ohio State University, Industrial Engineering, 1971 Neil Ave, OH, 43210, United States, posner.1@osu.edu, Joseph Chao

Point-to-point delivery systems ship freight over networks with multiple origins and destinations, where breakbulks can consolidate smaller freight into larger flows. Intuitive and easy-to-implement heuristic procedures that find shipping routes for unary NP-hard multiple breakbulk problems are proposed. Experimental and analytical analyses establish that these methods work well in practice.

■ SC33

Westin-Tower 1408, 14th Floor

Data Envelopment Analysis III

Cluster: Data Envelopment Analysis
Invited Session

Chair: John Ruggiero, University of Dayton, United States, john.ruggiero@notes.udayton.edu

1 — DEA with Negative Inputs and/or Outputs Revisited
Ole Olesen, Associate Professor, University of Southern Denmark, Campusvej 55, Odense M, DK, DK-5230, Denmark, ole@sam.sdu.dk, Niels Chr. Petersen

Negative input and output data in DEA has been discussed for the past ten years. Recently, a decomposition of (negative) interval scale data has been suggested. How well this approach provides a solution is analyzed. We discuss the problem of how to address negative data entries on both the input and the output side. Use of facial information from the cone or convex hull of the data for formulating alternatives to translation of data are explored.

2 — Data Envelopment Analysis with Unbalanced Data
Timo Kuosmanen, Assistant Professor, Wageningen University, Hollandseweg 1, Wageningen, 6707JB, Netherlands, Timo.Kuosmanen@wur.nl

We present a first attempt to use unbalanced data containing blank entries in DEA. Admitting unbalanced data in the reference set can only improve estimation of the best-practice frontier. DEA automatically excludes missing data if blank data entries are coded by appropriate numerical values. The approach is illustrated by an application to international sustainable development indices.

3 — Methods for Construction of Three-Dimensional Cross-Sections of the Multi-dimensional Frontier in DEA and Productivity Analysis of Russian Banks
Vladimir E. Krivonozhko, Global S. Consulting Company, Moscow, Russian Federation, vladimir@dol.ru, Oleg B. Utkin, Andrei V. Volodin, Dmitri A. Ryzhikh

A family of parametric optimization methods is proposed which allows us to construct sections of the frontier with three-dimensional affine space. With the help of this approach we can visualize the frontier in DEA and investigate production units behavior locally and globally. We apply our approach to efficiency analysis of Russian banks.

4 — Measurement Error and Deterministic Models of Technical Efficiency
John Ruggiero, University of Dayton, United States, john.ruggiero@notes.udayton.edu

The stochastic frontier model was developed to decompose efficiency and statistical noise. While it has been shown that the cross sectional frontier model does not work, simulation analyses have shown that panel data provides the necessary information to decompose the errors. In this paper, I analyze panel data deterministic models.

■ SC34

Mart-Room A

Real Time Fleet Management

Sponsor: Transportation Science & Logistics
Sponsored Session

Chair: Amelia Regan, Associate Professor, Information and Computer Science and Civil Engineering, University of California, Social Science Tower 559, Irvine, CA, 92797-3600, United States, aregan@uci.edu

1 — The Inventory Routing Problem with Continuous Movements
Martin Savelsbergh, Professor, Georgia Institute of Technology, 765 Ferst Drive, Atlanta, GA, 30332, United States, martin.savelsbergh@isye.gatech.edu, Jin-Hwa Song

In the traditional Inventory Routing Problem (IRP) there is a single depot and all vehicles return to the depot at the end of the day. We study an IRP with continuous movements, in which there are multiple depots and vehicles move continuously between depots and customers. A time indexed multi-commodity flow formulation is used to find a cost effective distribution plan.

2 — Dynamic Column Generation for Dynamic Vehicle Routing with Time Windows
Zhi-Long Chen, Associate Professor, R.H. Smith School of Business, University of Maryland, College Park, MD, 20742, United States, zchen at rhsmith.umd.edu

We propose a column generation based approach for solving a dynamic vehicle routing problem with time windows. Computational results will be reported.

3 — Adaptive Learning Algorithms for the Dynamic Assignment Problem
Warren Powell, Professor, Princeton University, Dept of Opns Res and Financial Eng'g, Princeton, NJ, 08540, United States, powell@princeton.edu, Abraham George

We propose an approximate dynamic programming algorithm for the dynamic assignment problem which learns the value of resources in the future. Due to the complexity of resource attributes, we propose a method which estimates the value of a resource at different levels of aggregation and combines these. We present optimal weights and compare their performance against other weighting schemes.

■ SC35

Mart-Room B

Gaming with Inventory/Product Flexibility

Cluster: Reverse Supply Chains
Invited Session

Chair: Hui Zhao, Purdue University, Krannert School of Management, West Lafayette, IN, 47907, United States, zhaoh@purdue.edu

1 — Sharing Forecast Information: Incentives and Credibility
Justin Z. Ren, The Wharton School, University of Pennsylvania, 3730 Walnut Street, 500 JMHH, Operations and Information Management De, Philadelphia, PA, 19104-6340, United States, justinren@wharton.upenn.edu, Morris Cohen, Christian Terwiesch, Teck Ho

In this paper we investigate, from an analytical point of view, as to why forecast sharing often does not deliver its expected results. Buyers often have an incentive to inflate their forecasts to over-reserve capacity, and as a rational response suppliers trust those buyers who over-forecast less. However, we find that under certain conditions a long-term supply relationship can provide the right incentive for truthful forecast sharing, even without a coordinating contract.

2 — Competitive Product Variety Selection with Newsvendor Costs
Yi Xu, Wharton School, 500 Jon M Huntsman Hall, 3720 Walnut Street, Philadelphia, PA, 19104, United States, xuyi@wharton.upenn.edu

We examine how competing manufacturers strategically make their product variety and pricing decisions. The manufacturers face newsvendor type of cost structures that reflect economies of scale. We find that under competition manufacturers will over provide varieties in order to mitigate the price competition.

3 — Dynamic Inventory Compeition between Two Capacitated Make-to-Stock Manufacturers
Pu Huang, Carnegie Mellon Univ., Pittsburgh, PA, 15217, United States, pu@andrew .cmu.edu, Alan Scheller-Wolf

We consider a direct market competition between two manufacturers: If one's inventory drops to zero, all its customers will switch to the other one, and vice versa. This problem is modeled as a dynamic stochastic game; in contrast to previous studies that address similar problems in a static newsboy setting. We show that there exists a unique pure-strategy Markov equilibrium in this game. Further numerical study reveals that the structure of the equilibrium could be very complex.

4 — Equilibrium Solutions to Inventory Sharing and Rationing in Decentralized Distribution Systems
Hui Zhao, Purdue University, Krannert School of Management, West Lafayette, IN, 47907, United States, zhaoh@purdue.edu, Vinayak Deshpande, Jennifer Ryan

We consider an inventory game in a decentralized distribution network in which dealers have the flexibility to share inventory. We use a two-dimensional state variable to explicitly capture the interactions between the dealers through inventory sharing and take a game theoretic approach to characterize the equilibrium behavior of the individual dealers. A comprehensive computational study highlights the impact of manufacturer's incentives on dealers' sharing behavior in a decentralized system.

■ SC36

Mart-Room C

Models for Joint Financial and Operational Decisions

Sponsor: Manufacturing and Service Operations Management
Sponsored Session

Chair: John Birge, Northwestern University, Industrial Engineering & Management Scie, Evanston, IL, United States, jrbirge@northwestern.edu

1 — On Credit Risk in Supply Chains: Is Negative Default Correlation Among Suppliers Desirable?
Volodymyr Babich, University of Michigan, IOE Department, 1205 Beal Avenue, Ann Arbor, MI, 48109, United States, vob2@weatherhead.cwru.edu, Peter Ritchken, Apostolos Burnetas

We study effects of credit risk in a supply chain where one retailer deals with competing risky suppliers. The suppliers set wholesale prices whereas the retailer attempts to diversify credit risk by ordering from several suppliers. The decreasing default correlation dampens competition among the suppliers, increasing the equilibrium wholesale prices and benefiting suppliers. In contrast, the retailer prefers suppliers with positively correlated defaults.

2 — Impact of Asset-Based Financing on a Firm's Profitability
Rachel Zhang, Cornell University, 364 Sage Hall, Ithaca, NY, 14853, United States, rqz2@cornell.edu, John Buzacott

We explore the motivation for asset-based financing by examining the decision making at a bank and retailer. Although there exists an interest rate optimal to the bank mathematically, this interest rate is likely to be too high in practice. Asset-based limits are a means of preventing the retailer from ordering too much at low interest rates and improving the bank's return.

3 — The Effect of Implementation Time Lag on Real Options Valuation
Harriet Nembhard, University of Wisconsin-Madison, 1513 University Ave, Madison, WI, 53562, United States, hbnem@engr.wisc.edu, Leyuan Shi, Mehmet Aktan

Financial options can be exercised instantly. Exercising real options, however, often involves factors, which require an implementation time. Neglecting the implementation time needed to exercise a real option causes an overvaluation of that option. We develop lattice and Monte Carlo simulation procedures to value real option problems under an implementation time lag. We present the application of the procedures on a global supply chain network problem with exchange rate uncertainty.

4 — A Real Asset Martingale Valuation Approach to the Newsvendor Problem
John Buzacott, York University, Schulich School of Business, Toronto, ON, M3J 1P3, Canada, jbuzacot@schulich.yorku.ca, Jack S.K. Chang, Terry H.F. Cheuk

Inventory is valued as a real asset under the equivalent martingale measure in an economy with internally consistent jump-diffusion, stochastic interest rates and stochastic volatility. Inventory decisions are determined by optimizing the inventory valuation. Numerical studies show the optimal policy is robust with respect to key parameters.

■ SC37

Mart-Room D

Gaming the Supply Chain

Sponsor: Manufacturing and Service Operations Management
Sponsored Session

Chair: John J. Bartholdi, III, The Manhattan Associates Professor of Supply Chain Management, Georgia Institute of Technology, School of Industrial and Systems Enginee, Atlanta, GA, 30332, United States, john .bartholdi@isye.gatech.edu

1 — Inventory Management for a Supply Chain with Coalition-Forming Players
Eda Kemahlioglu Ziya, School of Industrial and Systems Engineering, Georgia Tech, 765 Ferst Drive, Atlanta, GA, 30332, United States, kemahlio@isye.gatech.edu, John J. Bartholdi, III

We analyze inventory holding and profit sharing policies for single supplier - multiple customer supply chains, where the supplier bears the inventory risk. We model the problem as a cooperative game among the supplier and the customers and use the Shapley value to allocate the extra profit due to pooling.

2 — Supplier Price Competition for Retail Business
Serguei Roumiantsev, The Wharton School, University of Pennsylvania, 3730 Walnut St . Suite 500, Philadelphia, PA, 19104-6340, United States, roumiant@wharton.upenn .edu, Serguei Netessine

We analyze competition among suppliers for the share of business of a single retailer facing uncertain demand. Suppliers can set prices for their products thus affecting the allocation of retailer's constrained inventory investment. We analyze equilibrium of this game and comment on the retailer's incentives to reveal/conceal his constraints to the suppliers.

3 — Stable Farsighted Coalitions in Competitive Markets
Greys Sosic, Marshall School of Business, University of Southern California, Los Angeles, CA, United States, sosic@marshall.usc.edu, Mahesh Nagarajan

We develop a two-stage model for N retailers selling substitutable goods. In stage 1, players form coalitions, and in stage 2, coalitions set prices. We predict the dynamic equilibrium market structure as a function of the level of substitution.

4 — Allocation of Supply Contracts with Service Guarantees
Francis de Vericourt, The Fuqua School of Business, Duke University, Durham, NC, United States, fdv1@duke.edu, Fernando Bernstein

We address the problem of allocating a set of firms among two suppliers. Each firm needs to process a certain volume of work at a given price, and each supplier's ability to process the customers' requests is constrained by a production capacity. The suppliers compete by offering late delivery penalties

■ SC38

Mart-Room E

Urban Transportation Planning Models I: Networks and Activity Systems

Sponsor: Transportation Science & Logistics
Sponsored Session

Chair: Jim Moore, Professor, University of Southern California, KAP 210, MC-2531, 3620 S. Vermont Ave, Rm 210, Los Angeles, CA, 90089-2531, United States, jmoore@usc.edu

1 — A Land Use-Transportation Problem with Equity Issues
Der-Horng Lee, Assistant Professor, NUS, Department of Civil Engineering,, 1 Engineering Drive 2,, Singapore, sg, 117576, Singapore, dhl@nus.edu.sg, Wu Lan, Qiang Meng

This paper proposes the problem of maximizing the traffic generation from each residential zone subject to equity constraints, meanwhile quantitatively analyzing the residential potential of each zone and modeling the distribution of benefits and equity issues in land development given deterministic user equilibrium on the transportation network.

2 — Introducing Trip Chaining and Departure Time Choice into Combined Urban Travel Forecasting Models
David Boyce, Visiting Professor, Department of Electrical and Systems Engineering, University of Pennsylvania, 2149 Grey Avenue, Private Bag 4800, Evanston, IL, 60201, United States, dboyce@uic.edu

Urban travel forecasting models (sequential or combined) generally represent trips (origin-destination flows by mode and class) during a time period (morning peak period, or 24-hour day). This talk explores how to introduce trip chains and choice of departure time period, by applying the concepts used to formulate combined models.

3 — Credit-Based Congestion Pricing: Transportation, Land Use and Welfare Impacts
Sukumar Kalmanje, Graduate Student Researcher, U.T. Austin, 6.9 ECJ, Austin, TX, 78712, United States, sukumar@mail.utexas.edu, Kara Kockelman

This work investigates the transportation, land use, and welfare impacts of a new congestion pricing policy. Models of location choice and travel patterns for different demographic groups in Austin, Texas, produce welfare measures for various policy simulations.

4 — Cities and Satellite Imagery: Models for Regional Change
Chris Frazier, U.T. Austin, 6.9 ECJ, Austin, TX, United States, stanforth@mail .utexas.edu, Kara Kockelman

Cities are constantly evolving, complex systems. In this paper, we develop a methodology to spatially model urban areas based on a grid system of data largely derived from satellite images. The work integrates land use/cover and U.S. Census of population data for the Austin, Texas, region and several land use and demographic models are run.

5 — Congestive Feedbacks and Land Use Constraints for Random-Utility-Based Multizonal Input-Output Model
Natalia Ruiz-Juri, Graduate Student Researcher, U.T. Austin, 6.9 ECJ, Austin, TX, 78712, United States, nruizjuri@mail.utexas.edu, Kara Kockelman, Sukumar Kalmanje

This work enhances and applies an existing Random-Utility-Based Multizonal Input-Output model of Texas' inter-county trade, travel, and production patterns. The multimodal trade network is made congestible, land use restrictions are imposed by zone, and the model is driven by both interstate and foreign demands for Texas products. Results include long-run predictions of location,

output, consumption, trade and travel patterns across industries and households for various scenarios.

■ SC39

Mart-Room F

Panel: The Use of OR Techniques in Rail Policy Development

Sponsor: Railroad Applications
Sponsored Session

Chair: Andreas Aeppli, aaeppli@reebie.com

1 — The Use of OR Techniques in Rail Policy Development
Panelists: Andreas Aeppli, Raphael Kedar, Charles A. Spitulnik

We will conduct a panel discussion on the use of OR techniques in rail policy development from the perspective of both the public and private sectors. Analytical tools have a long record of use within public and private entities for evaluating the efficacy of proposed investments and impacts of policy decisions. In recent years, efforts by the public sector to encompass all modes of transport to address mobility and environment issues has greatly increased the demand for and use of analytical tools to assess investment and policy strategies. This session will emphasize the perspective of the consumer of quantitative analysis for rail policy development among agencies, carriers and consultants. Panelist Raphael Kedar will present " The FRA's use of modelling tools in developing FRA policy on rail freight". Panelist Charles A. Spitulnik will present " The means by which the potential investments in Cross Harbor studies are being analyzed. " Other panelist will round out the session.

■ SC40

Mart-Room G

Leadtime and Customer Service Strategies to Improve the Supply Chain

Cluster: Supply Chain Management
Invited Session

Chair: Pinar Keskinocak, Georgia Institute of Technology, School of Industrial and Systems Enginee, Atlanta, GA, 30332, United States, pinar@isye.gatech.edu

Co-Chair: Julie Swann, Assistant Professor, Georgia Institute of Technology, School of Industrial and Sys Engineering, 765 Ferst Drive, NW, Atlanta, GA, 30332, United States, julie.swann@isye.gatech.edu

1 — Coordinating Sales and Raw Material Discounts in a Global Supply Chain
Gilvan Souza, Assistant Professor, University of Maryland, Smith School of Business, College Park, MD, 20742, United States, gsouza@rhsmith.umd.edu, Michael Ball, Zhenying Zhao, Maomao Chen

We build a mathematical program around Toshiba's global notebook supply chain to study the effect of a temporary price discount for a critical component on the chain's production, distribution and marketing activities. Unlike most models, we employ path variables, which allow for direct manipulation of profitable and non-profitable products.

2 — Inventory Rationing under Leadtime Differentiation when Sales are Lost and Discretionary
Julie Swann, Assistant Professor, Georgia Institute of Technology, School of ISyE, 765 Ferst Dr., Atlanta, GA, 30332-0205, United States, jswann@isye.gatech.edu, Serhan Duran

Inventory rationing can be a tool to manage demand when multiple products or customer classes compete for the same limited resources. We study rationing when customers classes are differentiated according to leadtime, under the assumption that excess demand is lost and sales are discretionary, that is, a manufacturer may save product to satisfy future demand while incurring lost sales. We focus on production and sales threshold policies when demand is a general stochastic function.

3 — Managing Warranty Repair Lead Times
Jayashankar Swaminathan, Kenan-Flagler School of Business, University of North Carolina, Chapel Hill, NC, United States, msj@unc.edu, Wei Huang

In recent years firms have been aggresively promoting the warranty services and lead times in the electronics industry. In this research, using a stylized model we study optimal lead times and prices that firms should use in monopoly and competitive settings.

4 — Product Differentiation and Capacity Cost Interaction in Time and Price Sensitive Markets
Saibal Ray, Faculty of Management, McGill University, Canada, saibal.ray@mcgill.ca, Tamer Boyaci

We analyze a firm dealing in "two products", differing only in their prices and delivery times and being processed by two separate facilities, for a price-and-time-sensitive market. The objective of the firm is to maximize its profit by suitable selection of the price for both the products and the length of the delivery time for the "faster product". The firm has to take into account substitutability of the products, capacity constraint, and delivery reliability. We look into different capacity structures that the firm might face and provide a number of useful managerial insights regarding optimal product differentiation strategy for the firm.

■ SC41

Mart-Room H

Integrated Production and Demand Planning

Cluster: Supply Chain Management
Invited Session

Chair: Joseph Geunes, Assistant Professor, University of Florida, 303 Weil Hall, Gainesville, FL, 32611, United States, geunes@ise.ufl.edu

1 — Channel Coordination for Transportation Contract Value Assesment
Fatih Mutlu, Texas A&M University, United States, fmutlu@neo.tamu.edu, Sila Cetinkaya

We consider the coordination problem of a transporter in a single buyer, single vendor, single item environment. We analyze the case where transporter's cost structure provides incentives for her to change the requested delivery quantities so that truck utilization is increased. We develop a cost minimization approach that leads to a win-win-win solution for the three parties and provides an estimate for the contract value under different pricing policies for LTL and FTL deliveries.

2 — A Capacitated Continuous-Time Single-Sourcing Problem with Capacity Expansion Opportunities
Wei Huang, University of Florida, Gainesville, FL, 32611, United States, hw@ufl.edu, H. Edwin Romeijn, Joseph Geunes

We study a multi-facility multi-retailer problem where deterministic retailer demands for a single product must be satisfied while minimizing total production, inventory, and transportation costs. Facilities face production and inventory capacities, and the possibility of capacity expansion at a certain cost. We propose a column generation method that provides a tight lower bound on optimal costs, study the associated pricing problems, and present efficient greedy and local search heuristics.

3 — Delivery Date Commitment with Adaptive Scheduling
Hari Natarajan, Doctoral Candidate, Management Science and Information Systems, Smeal College of Business, Penn State University, University, PA, 16802, United States, nhprasad@psu.edu, Anant Balakrishnan

As manufacturers strive to become more customer-oriented, they are re-examining their order negotiation systems and processes to ensure responsive but realistic delivery date commitments to customers. We examine an approach that integrates the sales and production functions of the firm and model an embedded optimization-based model to support delivery date commitment.

4 — Target Market Selection with Demand Uncertainty: The Selective Newsvendor Problem
Kevin Taaffe, University of Florida, 303 Weil Hall, Gainesville, FL, 32611, United States, taaffe@ufl.edu, Joseph Geunes, H. Edwin Romeijn

We consider a firm that markets and delivers a good with a single selling season. The revenue obtained for the good varies by market, as do the demand and required advertising effort. Given that the firm faces a long procurement lead time for producing the item at low cost (e.g., overseas), we present models for the firm to concurrently decide, in advance of the selling season, the markets it will commit to satisfying and the corresponding material order quantity to request from its supplier.

■ SC42

Mart-Room I

Frontiers of Revenue Management

Sponsor: Revenue Management & Dynamic Pricing
Sponsored Session

Chair: Kevin Geraghty, VP, GMAC, 715 Denards Mill, Marietta, GA, 30067, USA, Kevin.Geraghty@GMACInsurance.com

1 — Revenue Management: Back to the Basics
Warren Lieberman, President, Veritec Solutions, Suite 325, 285 Hamilton Avenue, Palo Alto, CA, 94301, United States, warren@veritecsolutions.com

Even as the underlying decision support models supporting revenue management programs become more complex, senior management is becoming more skeptical of the benefits claimed by Revenue Management departments. Further, as revenue management continues to spread into a greater number of industries,

the need to provide revenue management education and training is ever more important. This talk focuses on what can be done to meet these challenges.

2 — Revenue Management in the Automotive Industry
Charles H. Rosa, Ph.D., Staff Research Engineer, General Motors Corporation, United States, charles.rosa@gm.com

The Automotive Industry has seen rapid expansion in the use of Revenue Management tools and techniques. An extremely competitive environment, high fixed costs, and the sensitivity of profitability to supply chain issues create conditions for highly successful Revenue Management implementation.

3 — Industry-Wide Airline Traffic Forecast
Sung-Ho Chang, Director of Business Support Systems, USAirways, United States, Sung-Ho_Chang@usairways.com

Setting the load factor on closed flights to accommodate revenue management practices.

4 — Optimal Release and Distribution Policies in the Motion Pictures Industry
Moez Hababou, Manugistics, United States, mhababou@manu.com

Timing of release and scope of distribution are very critical to the commercial success of a film especially in light of the increased competition for distribution space and the significance of the opening weekend box-office towards the overall gross of a movie. In this paper, we empirically investigate optimal policies in film distribution and release so that studios can minimize own-genre as well as overall cannibalization effects for upcoming films.

■ SC43

Mart-Room J

Auction Theory and Experiments

Cluster: Auctions
Invited Session

Chair: Elena Katok, Assistant Professor, Penn State University, 509H BAB, University Park, PA, 16802, United States, ekatok@psu.edu

1 — Entry in Auctions: An Experimental Investigation
Richard Engelbrecht-Wiggans, Professor, University of Illinois, Champaign, IL, United States, eplus17@uiuc.edu, Elena Katok

This talk reports on a series of ongoing experiments in which bidders get to choose whether to participate in an oral or sealed-bid first price auction.

2 — Discriminatory Auctions with One-sided Incomplete Information: The Two-bidder Case
Octavian Carare, Assistant Professor, University Of Texas at Dallas, Dallas, TX, United States, carare@utdallas.edu

We compute the equilibrium in a discriminatory auction with one-sided incomplete information and asymmetric demands. As the probability that the informed bidder's valuation is higher that the uninformed valuation increases, the first price auction becomes efficient, while the inefficiency of the discriminatory auction persists. We show by means of an example that the expected revenue ranking of the discriminatory and Vickrey auctions is ambiguous.

3 — Multi-Attribute Auctions
Douglas Thomas, Assistant Professor, The Pennsylvania State University, University Park, PA, 16802, United States, dthomas@psu.edu

Typically reverse auctions for procurement use a single dimension (price) while providing constraints on non-price attributes. We develop an auction mechanism for a buyer with a known utility function of three attributes (price, quality, delivery time) and present experimental results on the efficacy of this multi-attribute approach.

■ SC44

Mart-Room K

Air Traffic Management: Models and Algorithms

Sponsor: Aviation Applications
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 — MIT Extensible Air Network Simulation (MEANS)
John-Paul Clarke, Professor, MIT Aeronautics & Astronautics, 77 Massachusetts Ave 33-314, Cambridge, MA, 02139, United States, johnpaul@MIT.EDU, Terran Melconian

MEANS is an event driven network queueing simulation of the national airspace system (NAS) in which the movement of every aircraft and every passenger in the system may be tracked. We present the details of the simulation and the results of several simulation runs to evaluate different strategies for traffic flow management, air traffic control, airline scheduling and airline recovery.

2 — Airspace Planning and Collaborative Decision Making Model and Analysis
Raymond Staats, Assistant Professor of Operations Research, Air Force Institute of Technology, 2950 P Street, Wright Patterson AFB, OH, 45433, United States, tooey734@yahoo.com, Hanif Sherali, Antonio Trani

This paper presents an Airspace Planning and Collaborative Decision Making (APCDM) model under probabilistic collision risk, sector workload, and airline equity considerations. Some classes of valid inequalities are derived to tighten the model formulation, and computational results are presented.

3 — Dynamic Air-Route Pricing and Air Traffic Assignment: Multi-agents Systems Approach
Dusan Teodorovic, Professor, Virginia Tech, Dept of CEE, VPI&SU, 7054 Haycock Road, Falls Church, VA, 22043, United States, duteodor@vt.edu, Denis Gracanin

In recent decades, congestion has appeared in some elements of the air traffic control system. The basic idea behind the concept of congestion pricing is to force airlines to use airports and air routes more during off-peak hours and less during peak hours. The agent-based model for air traffic control under the dynamic air routes pricing has been developed in this paper.

■ SC45

Mart-Room L

Scheduling Semiconductor Wafer Fabs

Cluster: Semiconductor Manufacturing
Invited Session

Chair: Scott J. Mason, Assistant Professor, University of Arkansas, 4207 Bell Engineering Center, Fayetteville, AR, 72701, United States, mason@uark.edu

1 — Toolgroup Blackboxing Approaches for Complex Job Shop Scheduling
Scott J. Mason, Assistant Professor, University of Arkansas, 4207 Bell Engineering Center, Fayetteville, AR, 72701, United States, mason@uark.edu, Chris Wessels, Oliviana Zakaria

Scheduling semiconductor wafer fabrication facilities is arguably one of the most complex production scheduling problems in practice today. Previously, we developed a modified Shifting Bottleneck-based scheduling approach for these complex job shops. We investigate the trade-off between computation time and solution quality when "blackboxing" various non-critical toolgroups within the fab. We present both static and adaptive blackboxing approaches for complex job shop scheduling.

2 — Subproblem Solution Procedures for a Modified Shifting Bottleneck Heuristic
John Fowler, Professor, Arizona State University, Dept. of Industrial Engineering, Tempe, AZ, 85287-5906, United States, john.fowler@asu.edu, Michele Pfund, Lars Moench

The Modified Shifting Bottleneck (MSB) Procedure developed for scheduling wafer fabs decomposes the overall scheduling problem into a group of parallel machine scheduling problems, one for each workstation. In this presentation, we discuss several procedures developed to solve these subproblems.

3 — Effectiveness of Statistical Triggers for Rescheduling Wafer Fab Operations
Esma S. Gel, Assistant Professor, Arizona State University, Dept. of Industrial Engineering, P. O. Box 5906, Tempe, AZ, 85287-5906, United States, esma.gel@asu.edu, Cem Vardar, George Runger, Rajesh Swaminathan

We present evidence on the effectiveness of different decision rules to trigger rescheduling in semiconductor wafer fabrication facilities. We compare the performance of periodic rescheduling to that of statistical triggers that initiate rescheduling and discuss various factors that influence the results.

4 — Application of the Shifting Bottleneck Heuristic for Scheduling Semiconductor Wafer Fabs
Lars Moench, TU Ilmenau, Institut f¸r Wirtschaftsinformatik, Ilmenau, xx, 98684, Germany, Lars.Moench@tu-ilmenau.de, Oliver Rose

The Shifting Bottleneck Heuristic (SBH) is one of the few approaches suitable for scheduling large and complex factories like semiconductor wafer fabrication facilities. We present several case studies with factory models of different sizes where the performance of an SBH scheduler prototype is compared against dispatching approaches. In all cases the scheduler outperforms the dispatching approaches with respect to on-time delivery measures while showing a practically tolerable computation time.

■ SC46

Mart-Room M

Security and Utility of Confidential Data 3

Cluster: Security and Utility of Confidential Data
Invited Session

Chair: Rathindra Sarathy, Department of MSIS, Oklahoma State University, Stillwater, Ok, 74078, United States, sarathy@okstate.edu

1 — A Unified Approach for Measuring Identity and Value Disclosure
Rathindra Sarathy, Department of MSIS, Oklahoma State University, Stillwater, Ok, 74078, United States, sarathy@okstate.edu, Krishnamurty Muralidhar

Confidential data that is released by government agencies such as the Census Bureau is often deidentified and additionally protected, prior to release. Two types of disclosure risk are relevant when assessing the vulnerability such confidential data: identity disclosure and value disclosure. Identity disclosure occurs when it is possible to infer that a certain record in the released data belongs to some individual with a certain degree of confidence or probability . Value disclosure occurs when it is possible to estimate the value of a confidential variable with a certain degree of accuracy. Prior research has treated the evaluation of each type of risk independent of the other. In this presentation we present a measure based on canonical correlation analysis that simultaneously provides an effective measure of the risk of both identity and value disclosure.

2 — Protecting Confidentiality by Releasing Synthetic Microdata
Jerry Reiter, Institute of Statistics and Decision Sciences, Duke University, Box 90251, Durham, NC, 27708-0251, United States, jerry@stat.duke.edu

To avoid disclosures when releasing public-use microdata, statistical agencies and other data producers can release synthetic data sets comprised of simulated rather than actual values. In this talk, I present methods of generating and analyzing fully synthetic datasets and partially synthetic datasets (i.e. datasets with a mix of real and synthetic values). I also present results of simulation studies that illustrate the benefits and limitations of synthetic data approaches.

3 — Balancing Data Quality and Confidentiality for Tabular Data
Lawrence H. Cox, US National Center for Health Statistics, Hyattsville, MD, United States, lgc9@cdc.gov

Controlled tabular adjustment (CTA) is a new disclosure limitation method for tabular data that can be used in lieu of cell suppression. CTA can be formulated precisely as an integer linear program (Cox 2000). Linear programming constraints preserve means, but fall short of preserving nonlinear statistics such as variance, correlation or regression coefficients.We explore strategies and limitations on preserving such nonlinear statistics using simulated data.

■ SC47

Atlanta G, 7th Floor

Software Demonstration

Cluster: Software Demonstrations
Invited Session

1 — Responsive Learning Technologies, Inc. - Web-Based Exercises and Cases for Operations and IT Management Courses
Sam Wood, Responsive Learning Technologies, Inc., 1072 S. DeAnza Blvd. #A107392, San Jose, CA, 95129, United States, wood@responsive.net

Littlefield Technologies is a competitive web-based factory simulator designed for assignments in operations and industrial engineering courses. The HP NADO case is a multimedia web-based case that describes the implementation of an ERP system at Hewlett-Packard. The demonstration of these two products will include technical and pedagogical issues.

2 — Syncopation Software Limited - DPL: From Discounted Cash Flow to Decision Analysis in 20 Minutes
Chris Dalton, Syncopation Software Limited, 11 West Temple Sheen, London SW14 7RT, United Kingdom, cdalton@syncopationsoftware.com

See how quickly and easily DPL takes you from a cash flow spreadsheet to a full decision analysis. The demonstration covers influence diagrams, Excel linking, sensitivity and decision analysis. The demonstration concludes with a pharmaceutical R&D case study, using a decision tree to illustrate the importance of the "fail fast" concept.

Sunday 4:30pm - 6:00pm

■ SD01

Westin-Intl. A, 6th Floor

Provisioning for Guaranteed QoS Multimedia Delivery

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 — Traffic Estimation and Capacity Assignment in Multimedia Distribution Networks with Guaranteed Quali
Joakim Kalvenes, Assistant Professor, Cox School fo Business/SMU, P.O. Box 750333, Dallas, TX, 75275, United States, kalvenes@tecom.cox.smu.edu, Neil Keon

Video on demand service is subject to strict quality of service requirements in terms of packet loss, packet errors, packet delay and start-up latency. In this simulation-based work, we study the characteristics of multimedia traffic and estimate transmission buffer and bandwidth needs necessary to provide adequate service.

2 — Market Structure in Bandwidth on Demand Services
Anand Anandalingam, Robert H. Smith School of Business, University of Maryland, College Park, MD, 20742, United States, ganand@rhsmith.umd.edu, Neil Keon, Joakim Kalvenes

In multimedia distribution networks, there is a local distribution segment which is characterized by competition between two providers with different cost structures, and a backbone segment which is operated by the multimedia content provider. We investigate the competition and cooperation between the local service providers and the multimedia service provider.

3 — Competition in Local Access Networks for Multimedia Distribution
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

Due to different network technologies, cable and phone companies have different cost structure in the provisioning of high-speed Internet and multimedia content services. Based on empirical measures of multiplexing gains in local distribution networks, we analyze the competitiveness of the two types of service providers for multimedia distribution.

■ SD02

Westin-Intl. B, 6th Floor

Capital Growth Theory and Practice

Cluster: Financial Engineering
Invited Session

Chair: Leonard MacLean, Professor, Dalhousie University, Canada, lmaclean@mgmt.dal.ca

1 — Capital Growth with Security
Leonard MacLean, Professor, Dalhousie University, Canada, lmaclean@mgmt.dal.ca, William Ziemba, Yonggan Zhao

This paper discusses the allocation of capital over time with several risky assets. The capital growth log utility approach is used with conditions requiring that specific goals are achieved with high probability. The stochastic optimization model uses a disjunctive form for the probabilistic constraints, which identifies an outer problem of choosing an optimal set of scenarios, and an inner (conditional) problem of finding the optimal investment decisions for a given scenarios set.

2 — Time to Wealth Goals in Capital Accumulation
William Ziemba, Professor, University of British Columbia, Canada, ziemba@interchange.ubc.ca, Leonard MacLean

This paper considers the problem of continuous investment of capital in risky assets in a dynamic capital market. The information filtration process is based on a Bayesian model for asset prices. Given the conditional price dynamics, investors allocate wealth to achieve their financial goals efficiently over time. The strategy minimizes the expected time to the upper wealth limit while maintaining a high probability of reaching that goal before falling to a lower wealth limit.

3 — A Process Control Approach to Investment Risk
Yonggan Zhao, Nanyang Technological University, Singapore, aygzhao@ntu.edu.sg, William Ziemba, Leonard MacLean

Investing in assets in a volatile financial market can present significant downside risk to accumulated capital. The problem of misdirected investment strategies based on erroneous forecasts is the motivation for a Process Control (PC) approach to volatility and risk. Upper and lower limits on the capital accumulation process are used to determine if the current investment strategy continues.

4 — Portfolio Investment with the Exact Tax Basis via Nonlinear Programming
Angel-Victor DeMiguel, Assistant Professor, London Business School, Regents Park, London, LO, NW1 4SA, United Kingdom, avmiguel@london.edu, Raman Uppal

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 price at which the security was purchased, the problem is path dependent and its size grows exponentially with the number of 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.

■ SD03

Westin-Intl. C, 6th Floor

OR Research and Applications

Cluster: Overseas Collaborations
Invited Session

Chair: Ileana Castillo, ITESM Campus Toluca, Eduardo Monroy C·rdenas No. 2000, TOLUCA, EM, 50110, Mexico, ileana .castillo@itesm.mx

1 — A Simulation Model of Guinea Worm Disease in Sudan
David Goldsman, Professor, GA Tech, School of Industrial and Systems Enginee, Atlanta, GA, 30332, United States, sman@isye.gatech.edu, Paul Goldsman, Jean-Marie Roue, Gamze Tokol, James Zingeser

The devastating civil war in Sudan may end in 2003, allowing displaced persons to return to their villages. This migration could greatly increase incidence of Guinea worm, a debilitating parasitic disease. In preparation, we simulate the propagation of the disease and control measures as 4.5 million transients journey home.

2 — Single Knapsack Problem with Multiple Resources: Valid Inequalities and Facets
Victor Segura, Professor, ITESM Campus Monterrey, C.P. 64849, Monterrey, NL, Mexico, vsegura@itesm.mx, Salvador Garcia, Alberto Garcia-Diaz

A 0-1 knapsack problem which we call Single Knapsack Problem with Multiple Resources (SKPMR) assigns a set of projects to a set of developmental options, including the do-nothing option. If chosen for development, each project results in a benefit, and causes known amount of a set of resources to be used. The measure of effectiveness of the assignments is defined as the maximization of the total amount of benefits. A strongly minimal cover inequalities approach is developed to solve SKPMR.

3 — A GRASP with Scatter Search for the Capacitated Multicommodity Network
José Luis Gonzalez, Professor, ITESM Campus Monterrey, C.P. 64849, Monterrey, NL, Mexico, gonzalez.velarde@itesm.mx, Ada Alvarez, Karim de Alba

The capacitated multicommodity network design problem presents a major challenge. At the present time there exists no algorithm that can solve large instances, in a reasonable amount of time. A heuristic procedure to find approximate solutions for the problem based on GRASP with adaptive memory features combined with Scatter Search is presented. Extensive experimentation shows that this approach is capable of finding high quality solutions in a very short period of time.

4 — Course Timetabling in a Mexican University Applying Tabu Search
Leovigildo López-Garcìa, Jefe del Departamento de Actuaria y Estadistica, Universidad de las Américas, Ex-Hacienda Santa Catarina Martir, Cholula, PU, 72820, Mexico, leolopez@mail.pue.udlap.mx, Adela Posada-Bolivar, Lizbeth Pérez-delaTorre

A common problem that many universities around the world face is to assign classrooms to courses every term. The Universidad de las Americas, Puebla, Mexico has to assign over 2000 courses in less than 200 classrooms every term. The process that is currently used requires around three weeks to generate an initial assignment, which is far from an ideal assignment. In this paper we present an application of the Tabu Search metaheuristic to approach the solution to this difficult problem.

5 — Tabu Search for Min. Total Tardiness Parallel Machines with Splitting Jobs and Set-Up Times
Eduardo Dìaz, Professor, ITESM Campus Estado de México, Carretera lago de Guadalupe km 3.5, Atizapan de Zaragoza, Mexico, edudiaz@itesm.mx, Ricardo Thierry, Cesar Malave, Carmen M. Lòpez-Rosas

We applly a tabu search to find a schedule that minimizes total tardiness for the problem of n independent jobs non-preemptively on m parallel machines without idle time. It may be possible to split jobs into lots and to process each lot on a different machine. There are sequence-dependent set-up times among jobs. This problem is NP-hard. This research implemented tabu search in order to get optimal or near- optimal solutions for this problem.

■ SD04

Westin-Intl. D, 6th Floor

Towards a Theory of the Practice of OR/MS

Sponsor: CPMS, The Practice Section of INFORMS
Sponsored Session

Chair: Peter Bell, Professor, Richard Ivey School of Business, 1151 Richmond Street, London, ON, N6A 3K7, Canada, pbell@ivey.uwo.ca

1 — Problem Structuring in OR Revisited
Mike Pidd, Professor of Management Science, Lancaster University, Department of Management Science, The Management School, Lancaster, LA2 6AG, United Kingdom, m.pidd@lancaster.ac.uk

In the late 1970s, Bob Woolley and I undertook some empirical research in the UK. We investigated how OR practitioners went about their problem structuring. We visited several practitioner groups and found that people were not using formal methods, but there was a definite pattern in what they did. We wrote this up in 3 papers that are still cited. Now that there are well-established problem structuring methods it seems a good time to revisit this research.

2 — What Makes OR Projects Successful. Are there Recipies?
Andres Weintraub, Professor, Department of Industrial Engineering, University of Chile, P.O. Box 2777, Santiago, Chile, aweintra@dii.uchile.cl, Rafael Epstein

Based on the experience of many projects carried out, and observation in others, we try to develop a framework that may lead to better development of projects. Rather than lists of dos and don'ts, we try to focus on a few issues that may be vital.

3 — Strategic OR/MS: A Review of the First Five Years
Peter Bell, Professor, Richard Ivey School of Business, 1151 Richmond Street, London, ON, N6A 3K7, Canada, pbell@ivey.uwo.ca

"Strategic OR/MS" defined as OR/MS work that creates a substantial and sustainable competitive advantage emerged about five years ago. This presentation reviews current research on the practice of OR/MS and on strategic OR/MS in particular, and suggests some directions for future work.

■ SD05

Westin-Intl. E, 6th Floor

Numerical Methods for Performance Analysis and Control of Brownian Queueing Models

Sponsor: Applied Probability
Sponsored Session

Chair: Amy Ward, Georgia Tech, United States, amy@isye.gatech.edu

Co-Chair: Assaf Zeevi, Columbia University, NY, 10027, United States, assaf@gsb.columbia.edu

1 — Brownian Control Problems for Queueing Networks and Approximate Dynamic Programming
Sunil Kumar, Associate Professor, Stanford University, Graduate School of Business, 518 Memorial Way, Stanford, CA, 94305, United States, skumar@stanford.edu, Benjamin Van Roy

Using dynamic programming to obtain the optimal controls for Markovian queueing networks is computationally infeasible in general. We use the Brownian approximation approach to set up an approximate dynamic programming problem that can be solved efficiently to yield good suboptimal controls for queueing networks.

2 — Variance Reduction and Gradient Estimation in Simulation of Processing Networks
Shane G. Henderson, Cornell University, 230 Rhodes Hall, School of Operations Research and Indust, Ithaca, NY, 14853, United States, shane@orie.cornell.edu, Sujin Kim

Controlled random walk models of stochastic-processing networks are particularly amenable to simulation analysis. We describe how one can apply certain variance reduction techniques based on fluid workload models. We also discuss the estimation of gradients of system performance with respect to safety-stock threshold parameters, which is important when tuning policies parameterized by safety-stock levels.

3 — Computing the Stationary Distribution of Multidimensional Reflected Ornstein-Uhlenbeck Processes
Amy Ward, Georgia Tech, United States, amy@isye.gatech.edu, Joshua Reed

Motivated by diffusion approximations of queueing networks with reneging, we consider a multidimensional, reflected Ornstein-Uhlenbeck process in a bounded, convex, polyhedral domain. Specifically, we (1) provide a numerical algorithm for computing the process's stationary distribution and (2) establish necessary and sufficient conditions for the stationary distribution to be of Gaussian form.

4 — An LP Algorithm for Computing the Stationary Distribution of RBM
Assaf Zeevi, Columbia University, NY, 10027, United States, assaf@gsb.columbia.edu, Peter Glynn

We will describe a linear programming-based algorithm for computing the stationary distribution of positive recurrent reflected Brownian motion on the non-negative orthant. The algorithm takes advantage of a priori Lyapunov bounds to enforce tightness of the approximations, and can be shown to be suitably convergent.

■ SD06

Westin-Intl. F, 6th Floor

Tutorial: Ethical Issues in Operations Research

Sponsor: Women in OR/MS
Sponsored Session

Chair: Robin Lougee-Heimer, IBM Research, 1101 Kitchawan Road, Yorktown Heights, NY, 10598, United States, robinlh@us.ibm .com

1 — Tutorial: Ethics in OR
John Hooker, Professor, GSIA, Carnegie Mellon Univ, Pittsburgh, PA, 15213, United States, jh38@andrew.cmu.edu

This tutorial begins with a brief treatment of ethical theory and applies it to some OR-related issues, such as relations with clients, intellectual property, job hunting, academic promotion and tenure, and teaching. The possibility of optimization models for ethical as opposed to purely profit-maximizing decisions will be discussed. Ample discussion time will be provided for the audience to raise issues.

■ SD07

Westin-Intl. G, 6th Floor

Market Design I

Sponsor: Energy, Natural Resources and the Environment
Sponsored Session

Chair: Hung-po Chao, EPRI, 3412 Hillview Avenue, Palo Alto, CA, United States, hchao@epri.com

1 — Contingent Transmission Rights in the Standard Market Design
Ross Baldick, Professor, University of Texas at Austin, ECE Department, Austin, TX, 78712, United States, Ross.Baldick@engr.utexas.edu

We define transmission rights that provide flexibility in the points of receipt or delivery under FERC's proposed Standard Market Design (SMD). These rights provide a method for defining SMD-compatible rights for transmission customers having current transmission rights over multiple points. They may be traded in transmission rights auctions under SMD.

2 — Locational Marginal Pricing of Reserves in Single Contingency Electricity Markets
William Stewart, Professor, Graduate School of Business Administration, College of William and Mary, Williamsburg, VA, United States, william.stewart@business.wm.edu, Wedad Elmaghraby, Richard O'Neill, Michael Rothkopf, Udi Helman, Ross Baldick

This paper addresses the problem of scheduling and pricing reserves in an electric power network to meet the requirements that arise when a single element (generator/transmission) fails. The problem is formulated as a two stage stochastic model, and the solution produces locational marginal prices for reserve generation and reserve transmission.

3 — Relations Among Nodal Prices in an Electricity Transmission Network
J. David Fuller, Professor, Dep't of Management Sciences, University of Waterloo, Waterloo, ON, N2L 1J7, Canada, dfuller@engmail.uwaterloo.ca

The talk will discuss an apparently new result, concerning relationships among nodal prices in an optimal power flow calculation. The price at a node is a weighted average of the prices at adjacent nodes, modified by any congestion-related charges and losses on the links to the adjacent nodes.

4 — Risk Management in Electricity Market Design
Hung-po Chao, EPRI, 3412 Hillview Avenue, Palo Alto, CA, United States, hchao@epri .com

Market design must recognize the interactions between private risks (financial) and the public risks, (e.g. system reliability and market power), for their impacts on market efficiency, investments, resource adequacy, and market power. In the traditional utility system, vertical integration provides hedges by pooling the risks along the supply chain. Vertically unbundling causes a large reallocation of risks. This calls for fundamental rethinking of the regulatory compact.

■ SD08

Westin-Intl. H, 6th Floor

Joint Session SIM/QSR: Rare Event Simulation and Finance

Sponsors: Simulation; Quality, Statistics & Reliability
Sponsored Session

Chair: Bruce Shultes, Assistant Professor, University of Cincinnati, PO Box 210072, Cincinnati, OH, 45221-0072, United States, bruce.shultes@uc.edu

1 — Simulation Methods for Portfolio Credit Risk
Paul Glasserman, Professor, Graduate School of Business, Columbia University, 403 Uris Hall, New York, NY, United States, pg20@columbia.edu, Jingyi Li

Simulation is widely used to estimate losses due to default and other credit events in financial portfolios. The challenge in doing this efficiently results from (i) rare-event aspects of large losses and (ii) complex dependence between defaults of multiple counterparties . We develop variance reduction techniques to address this problem, with emphasis on importance sampling. The dependence between counterparties significantly affects the implementation and effectiveness of the methods.

2 — Hazard Function Transformation for Heavy-Tailed, Rare-event Simulations with Applications to Finance
Zhi Huang, Department of Industrial Engineering and Operations Research, Columbia University, 500 West 120th Street, New York, NY, 10027-6699, United States, zh52@columbia.edu, Perwez Shahabuddin

We first show that an importance sampling idea introduced recently for heavy-tailed, rare-event stochastic simulations, namely hazard-rate twisting, is equivalent to doing exponential twisting on a transformed version of the heavy-tailed random-variable. Using this fact, the paper develops efficient importance sampling methods for estimating value-at-risk(VAR) when changes in the underlying risk factors are correlated and have the multivariate Laplace distribution.

3 — Efficient Estimation of Steady-State Performance for Highly Dependable Non-Markovian Systems
Xudong Yang, University of Cincinnati, PO Box 210072, Cincinnati, OH, 45221-0072, United States, yang_sheldon@yahoo.com, Bruce Shultes

Efficient simulation techniques are critical for estimating the performance of highly dependable non-Markovian systems. Earlier research relied on uniformization to support importance sampling. However, many systems are not uniformizable. We propose a new approach that relaxes the uniformizable assumption and readily accommodates importance sampling. Combined with balanced likelihood ratio importance sampling and batch means, the new approach performs well in practice.

■ SD09

Westin-Vinings 1, 6th Floor

Active Learning and Globalization in Engineering Education

Cluster: Active Learning in Education
Invited Session

Chair: Jorge Leon, Texas A&M University, ETID and Industrial Engineering, College Station, TX, 77843-3367, United States, leon@entc.tamu.edu

1 — Globalization and Engineering Education
Jorge Leon, Texas A&M University, ETID and Industrial Engineering, College Station, TX, 77843-3367, United States, leon@entc.tamu.edu, Carlos Acosta

Today's businesses require an engineering and scientific workforce that can take full advantage of the ubiquitous nature of communication networks and the ever increasing globalization of world economies. This presentation will describe three models underway at universities in Germany, Japan, Mexico, and the USA aimed at incorporating globalization issues in the engineering curriculum.

2 — Learning Communities in Engineering
Cesar Malave, Professor, Texas A&M University, Industrial Engineering Department, Room 241 Zachry, College Station, TX, 77845-3131, United States, malave@tamu.edu, Marsha Lee, Jan Rinehart

The Look College of Engineering at TAMU developed Learning Communities for all the entering first year students. The working definition of LC is groups of stu-

dents, faculty and industry with common interests who work as partners to improve the engineering educational experience. Most of these LC cluster students are in common sections of math, engineering, and science; other cluster students are in common residence halls.

3 — The Foundation Coalition - Ten Years of Educational Innovation
Jeff Froyd, Director, Foundation Coalition, Texas A&M University, Division of Education Program Research, Room 204 Zachry, College Station, TX, 77843-3127, United States, froyd@ee.tamu.edu, Debra Fowler

The Look College of Engineering at TAMU has been part of the NSF Foundation Coalition for the past ten years. The primary FC thrust areas are integration, teaming, active learning, technology, and assessment and evaluation. Each of these thrusts contributed to the goal of producing the following attributes in our graduates: profound understanding of the importance of teamwork; curiosity and desire to learn - for life; ability to think both critically and creatively.

■ SD10

Westin-Vinings 2, 6th Floor

Expert Choice (AHP) Applications

Sponsor: Social Science Applications
Sponsored Session

Chair: Myron Hatcher, Professor and Chair, Information Systems and Decision Sciences, Craig School of Business, California State University, Fresno, CA, 93740, United States, myronh@csufresno.edu

1 — Appropriate Applications for AHP
Myron Hatcher, Professor and Chair, Information Systems and Decision Sciences, Craig School of Business, California State University, Fresno, CA, 93740, United States, myronh@csufresno.edu

Real problems are there to be solved. The question is what approach leads to the best solution . AHP is a method of ranking alternatives or may be rating alternatives depending upon your view. Actually the applications somewhat determines the answer based upon the problem being solved, quality of data, and purpose of the solution.

2 — Resource Alignment with Strategic Objectives
Ernest Forman, George Washington University and Expert Choice, School Of Business and Public Administra, Washington, DC, 20052, United States, forman@gwu.edu

This paper illustrates how numerous organizations are now aligning their resources with their strategic objectives, using a process that includes: informed consensus from relevant personnel on which objectives best drive the business; accountability and increased credibility of investments through a systematized decision process; and budgets with a rational balance across departments and accurate alignment of funding with corporate strategy.

■ SD11

Westin-Augusta 1, 7th Floor

Tutorial: Fuzzy Probabilities/Sets in OR/MS

Cluster: Tutorials
Invited Session

1 — Fuzzy Probabilities and Fuzzy Sets in OR/MS
James J. Buckley, Department of Mathematics, University of Alabama, Birmingham, AL, 35294, United States, buckley@math.uab.edu

We first discuss how to obtain fuzzy sets for probabilities and other parameters used in models in OR/MS. The fuzzy set captures the uncertainty in the estimator when its exact value is unknown and is estimated from data or from expert opinion. We then propagate these uncertainties, using fuzzy sets and standard fuzzy operations, through the OR/MS model. When the model is an optimization problem the fuzzy problem produces max/min[fuzzy set}, where this fuzzy set could represent profit/cost. We also discuss how we might solve the fuzzy optimization problems.

■ SD12

Westin-Augusta 2, 7th Floor

Sizing the Agile Workforce

Cluster: Workforce Flexibility and Agility
Invited Session

Chair: Chuck Schmidt, Prof. of Management Science, University of Alabama, Box 870226, Tuscaloosa, AL, 35487, United States, cschmidt@cba.ua.edu

Co-Chair: Steven Nahmias, Santa Clara University, Santa Clara, CA, 90503, United States, snahmias@scu.edu

1 — A Control Rule for Recruitment Planning in Knowledge-Intensive Engineering Consultancy
Sanjeev Bordoloi, Asst. Prof. of Operations & Information Technology, College of William & Mary, School of Business, Williamsburg, VA, 23187, United States, skbord@business.wm.edu

Owing to high labor turnover, staffing decision is very critical for professional service firms . We emphasize the importance of developing "knowledge stock" of skilled consultants in an engineering consulting firm in a planned manner. Our model is designed to determine the steady-state number of consultants that should be maintained at different knowledge levels so as to meet demand at a desired service level. We do so through the use of control theory and chance constrained programming.

2 — Optimal Server Mix Decisions in Service Systems with Two Types of Customers
Sal Agnihothri, Prof., Binghamton University, SUNY, School of Management, Binghamton, NY, 13902, United States, agni@binghamton.edu, Srinivas Chakravarthy

When the job types are heterogeneous, cross-training workers increase worker flexibility as well as service costs. We consider a service system with two job types and flexible and dedicated servers. Using matrix-analytic methods, we investigate the impact of various system parameters on server mix decisions. We develop guidelines for managers that would help them decide number and type of servers to be used so as to minimize the total expected cost per unit time.

3 — Stochastic Workforce Planning with Multiple Labor Types
Chuck Schmidt, Prof. of Management Science, University of Alabama, Box 870226, Tuscaloosa, AL, 35487, United States, cschmidt@cba.ua.edu, Steven Nahmias

We consider service facilities with random job arrivals and workforce turnover. Results on the structure of the optimal hiring/layoff policy when the expected net revenue is a concave function of workforce levels will be presented. We propose various models for the expected net revenue function, some of which are not concave, and explore their impact on the optimal policy . We illustrate how our model can be used to quantify the benefits of worker cross-training.

■ SD13

Westin-Augusta 3, 7th Floor

Pharmaceutical Marketing II

Sponsor: Marketing Science
Sponsored Session

Chair: Murali Mantrala, Walton Professor of Marketing, University of Missouri, Department of Marketing, 438 Cornell Hall, Columbia, MO, 65211, United States, mantralam@missouri.edu

1 — The Impact of DTC Advertising and Detailing on Visit, Brand Request, and Physician Compliance
Ying Xie, Northwestern University, 2001 Sheridan Road, Evanston, IL, 60208, United States, y-xie@kellogg.northwestern.edu, Lakshman Krishnamurthi

Two sequential decisions are involved in the prescription process. First, an individual decides whether to visit a doctor, and second, the doctor decides which drug to prescribe. The effects of DTC advertisingand detailing on these two decisions, i.e., the category expansion effect, and the market share effect, are explicitly modeled in this paper. By using brand request and compliance data for the same category, we decompose the market share effect into the effect on stimulating patients' requests for a certain brand, as well as the effect on physician compliance to these requests.

2 — ROI Implications for Pharmaceutical Promotional Expenditures: The Role of Marketing Mix Interactions
Ramarao Desiraju, Associate Professor, Department of Marketing, University of Central Florida, College of Business Administration, P.O. Box 161400, Orlando, FL, 32816-1400, United States, rdesiraju@bus.ucf.edu, Sridhar Narayan, Pradeep Chintagunta

In recent years, pharmaceutical companies have increased their promotional expenditures, particularly on direct to consumer advertising (DTC) and detailing. In that context, we empirically explore the following questions: "Given the large amounts of dollars involved, what is the likely impact of these expenditures on a firm's revenues?" and "What is the nature of the interaction between the effects of these promotional expenditures?" Using data from a sub-category of pharmaceutical products, we first characterize the single- and multi-period impact (on sales as well as ROI) of detailing and DTC expenditures. Next we empirically characterize the interaction effect arising from using both detailing and DTC. In addition, we investigate the effects of interactions of these promotional expenditures with other marketing mix elements such as price.

3 — Controlling for Environmental Variables in a DEA Performance Study of a Pharmaceutical Sales Force
Leonard Parsons, Professor of Marketing Science, Georgia Institute of Technology, 1732 Trapnell Court, Dunwoody, GA, 30338-3514, United States, len.parsons@mgt .gatech.edu

The sales force of a large pharmaceutical manufacturer was benchmarked to assess representative performance using Data Envelopment Analysis (DEA). In assessing the relative efficiency of sales representatives, correctly taking into account the presence of uncontrollable environmental factors, such as market potential, is an important issue. Alternative multi-stage methods have been proposed to adjust the data for these factors. Results for the pharmaceutical sales force are presented.

4 — Pharmaceutical Marketing Mix: Results and Future Challenges
Andy Zoltners, Professor of Marketing, Northwestern University, Kellogg Graduate School of Management, 2001 Sheridan Road, Evanston, IL, 60208, United States, andy .zoltners@zsassociates.com, Murali Mantrala

Several studies attempting to assess the sales response to the various marketing instruments available to the pharmaceutical marketer have been conducted by ZS Associates. This presentation summarizes some of these findings. Critical marketing and sales issues that currently challenge the industry will also be presented.

■ SD14

Westin-Peachtree A, 8th Floor

Market and Performance Considerations in NPD

Cluster: New Product Development
Invited Session

Chair: Christian Terwiesch, Wharton School of Business, 1319 Steinber-Dietrich Hall, Philadelphia, PA, United States, terwiesch@wharton.upenn.edu

1 — User Design of Customized Product
Karl Ulrich, Professor, Wharton School, Huntsman Hall, Philadelphia, PA, United States, ulrich@wharton.upenn.edu, Taylor Randall, Christian Terwiesch

"User Design" has been proposed by many as a way to meet user needs more directly. However, user design presents cognitive and information processing challenges. Focusing on notebook computers at Dell, we demonstrate a new interface for user design and outline a planned experiment to test its effectiveness.

2 — Product Development Performance in the Global Automotive Industry
Stefan Thomke, Associate Professor, Harvard Business School, United States, sthomke@hbs.edu

In many fields, the economics of prototyping are being radically affected by new technologies. Indeed, these technologies seem to be affecting everything, from the development process itself, including its performance and structure. I will present empirical evidence for some of these changes from an empirical study on global automotive development.

3 — Competitive New Product Diffusion and the Economics of Launch Time Decisions
Sergei Savin, Assistant Professor, Columbia Business School, 3022 Broadway, 404 Uris Hall, New York, Ny, 10027, United States, svs30@columbia.edu, Christian Terwiesch

We present a model describing the demand dynamics of two new products competing for a limited target market. The demand trajectories of the two products are driven by a market saturation effect and an imitation effect reflecting the product experience of previous adopters. In this general setting, we provide analytical results for the sales trajectories and lifecycle sales of the competing products. We use these results to study the impact of launch time delay on overall lifecycle sales.

4 — Component Specifications, Product Performance, and Causal Knowledge in High-Performance Design
Roger Bohn, Associate Professor, University of California at Santa Barbara, United States, rbohn@ucsd.edu

Higher component specifications allow higher product performance, but the link is not 1:1 and designs avoid expensive components when feasible. The link is through detailed quantitative knowledge about component and subsystem behavior, often embodied in product simulators. Such knowledge complements higher specifications. Sharing specific knowledge with suppliers becomes critical.

■ SD15

Westin-Peachtree F, 8th Floor

Technology and Strategy II

Sponsor: Technology Management
Sponsored Session

Chair: Aleda Roth, Kenan Flagler Business School, University of North Carolina at Chapel Hill, McColl Building, CB 3490, Chapel Hill, NC, 27599, United States, aleda_roth@unc.edu

1 — Seller-Buyer Relationships and Environmental and Contextual Factors in the B2B Arena
Eve Rosenzweig, Assistant Professor, Emory University, 1300 Clifton Road, Atlanta, GA, 30322, United States, Eve_Rosenzweig@bus.emory.edu

Internet-based business-to-business (B2B) marketspaces enable the development and exchange of goods and services among businesses. Consistent with contingency theory, we develop a model that links three distinct types of seller-buyer relationships in the B2B arena with various market, supply chain and product characteristics. The model is empirically tested using data collected from a carefully designed web-based survey.

2 — Strategic Indicators of B2B eMarketplace Financial Performance
Timothy Laseter, Assistant Professor, University of Virginia, 100 Darden Boulevard, Charlottesville, VA, 22903, United States, LaseterT@Darden.virginia.edu

The population of B2B eMarketplaces—like the speculative bubble which triggered them—progressed through a rapid cycle of growth and decline with over half failing in a few short years. This paper employs a conceptual model drawing upon Industrial Organization Economics and the Resource-Based View of the Firm to explain financial success. To test the model, we surveyed 273 surviving B2B eMarketplaces and achieved a 22% percent response rate which provided some clear indicators of performance.

3 — Contract Design in the Freight Forwarding Industry
Stefan Spinler, The Wharton School, United States, sspinler@wharton.upenn.edu

In this study, we examine the determinants of contract design in the freight forwarding industry. In particular, we show that flexibility contracts lead to higher capacity utilization and improved return on assets, both through analytical and simulation based results. Strategic implications resulting from contingency contracts in the context of integrated vs. non-integrated supply-chain set-ups in freight transportation are discussed.

4 — Adaptive Supply Chain Networks From Theory To Application
Murat Kristal, Doctoral Student, UNC-Chapel Hill, Kenan-Flagler Business School, Chapel Hill, NC, United States, kristal@unc.edu, Aleda Roth

Based on complexity theory, a complex adaptive systems (CAS) refers to a system that emerges over time into a coherent form and adapts itself without any singular entity purposely managing it (Holland, 1995). We perceive supply chain networks as CASs, which are loosely coupled group of organizations that work together to enhance network competitiveness (Choi et al, 2001). In this paper we study the antecedents of adaptive supply chain networks, and show their impact on supply chain performance.

5 — Dynamic Investments in Knowledge for IT-Worker Systems
Cheryl Gaimon, Professor, Georgia Institute of Technology, DuPree College of Management, 755 Ferst Drive, Atlanta, GA, 30332-0520, United States, cheryl .gaimon@mgt.gatech.edu, Karen Napoleon

We introduce a model for the long-term planning of an IT-worker system. The firm determines the timing of a series of IT upgrades in an environment where technological change occurs such that the level of knowledge embedded in the IT offered by vendors increases over time. We examine how the firm's level of worker knowledge (skill, training, and forgetting) impacts profit and the IT investment decision.

■ SD16

Westin-Peachtree G, 9th Floor

Identifying, Modeling, and Allocating Healthcare Resources

Sponsor: Health Applications
Sponsored Session

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

1 — Scheduling and Routing Home Healthcare Nurses
Kurt Bretthauer, Indiana University, Operations & Decision Technologies Dept, Kelley School of Business, Bloomington, IN, 47405, United States, kbrettha@indiana .edu, P. Daniel Wright

With any fixed capacity service organization one way to increase that capacity is to serve customers off-site. In this paper, we explore the home healthcare problem for nurses. A basic vehicle routing problem is modified to accommodate several home healthcare policies. In addition, we discuss combining the routing problem with a nurse scheduling problem.

2 — Strategies for Hospitals to Increase Market Capture of Inpatient Perioperative Services
Liam O'Neill, Assistant Professor, Cornell University, 105 MVR Hall, PAM Dept., Ithaca, NY, 14853, United States, LO22@cornell.edu, Franklin Dexter

We introduce a method to measure "market capture" of inpatient, elective surgery for non-profit hospitals. Data envelopment analysis (DEA) is used to measure the efficiency of the market capture for Perioperative Services. Eight procedures are studied, representing a wide spectrum of elective, scheduled, inpatient surgery. The results demonstrate DEA's potential as a valuable tool for O.R. managers' strategic decision-making.

3 — Location Modeling of Traumatic Brain Injury Treatment Units
Siddhartha Syam, Associate Professor, Marquette University, 606 N.13th St., Straz Hall, Milwaukee, WI, 53201-1881, United States, syams@mu.edu, Murray J. Côté, W. Bruce Vogel, Diane Cowper

We present an optimization-based location modeling tool for traumatic brain injury (TBI) treatment units for the Veteran's Administration (VA) facilities in south Georgia and Florida. Patient treatment, patient travel, and facility fixed operating costs are explicitly included in the model while service criteria are implicitly observed. Implications of polices regarding treatment unit capacity, location, and patient retention issues are explored.

4 — A Cognitive Decision Theory with Application to Help-Seeking Among the Elderly
Peter Veazie, Research Assistant Professor, University of Florida, Dept. of Health Services Administration, 101 S. Newell Drive, Room 4151, Gainesville, FL, 32611, United States, pveazie@hp.ufl.edu

In the context of the elderly seeking care, we propose a model of decision making based on the assessment of distinct sets of information. Compared with models based on the aggregation of information, this model provides a better explanation of decision behavior. Individual characteristics that differentiate the models are identified and the implications for decision theory and misutilization of health care services are discussed.

■ SD17

Westin-Peachtree H, 9th Floor

Planning and Preparing for a Catastrophic Infectious Event

Cluster: Public Health & Health Economics
Invited Session

Chair: Jacquelyn Mason, Ph.D., CDC/NCEH/EEHS, 4770 Buford Hwy. NE F30, Atlanta, GA, 30341-3717, United States, zao4@cdc .gov

1 — A Simulation-Based Consequence Management System
Stephen Eubank, Ph.D., EpiSims project lead, Los Alamos National Laboratory, CCS-5, MS-M997, Los Alamos, NM, United States, eubank@lanl.gov

EpiSims is an epidemiological simulation system that estimates the spread of disease and the consequences of responses through a large urban population at the level of individuals. It is based on realistic contact patterns among demographically identified individuals. The simulation generates data useful for comparing response strategies under a variety of cost functions. This talk will outline the assumptions in the model and illustrate its use in evaluating responses.

2 — The Role of Modeling in Planning and Preparing for a Catastrophic Infectious Event
Ellis McKenzie, Ph.D., Senior Research Scientist, Fogarty International Center, National Institutes of Health, Bethesda, MD, 20892, United States, mckenzel@mail .nih.gov

Models that integrate approaches and insights from multiple disciplines - including biology, epidemiology, operations research, and social sciences - can be of great help to policy-makers, and can be of the greatest help when based on substantive, continuing communications among modelers and between modelers and policy-makers.

3 — Risk and the Economics of Planning and Preparedness
Martin Meltzer, Ph.D., Senior Health Economist, CDC/NCID, 1600 Clifton Rd. NE D59, Atlanta, GA, 30333, United States, qzm4@cdc.gov

I will present 2 simple economic models examining the economics of responding to an anthrax attack and planning for the next influenza pandemic. The simplicity of the models also helps reduce the "black box" syndrome, allowing users to readily appreciate what the models do and don't analyze. This can start a dialog between modelers and policy makers, allowing the introduction of more and more sophisticated models into the decision making process.

■ SD18

Westin-Tower 1201, 12th Floor

Highlights of NSF-Sponsored Research in QSR

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: Janet Twomey, Program Director, National Science Foundation, 4201 Wilson Blvd. Room 590, Arlington, VA, 22230, United States, jtwomey@nsf.gov

1 — Identifying Spatial Variation Patterns in Multivariate Manufacturing Processes
Daniel Apley, Assistant Professor, Texas A&M University, Dept. of Industrial Engineering, College Station, TX, 77843-3131, United States, apley@tamu.edu

The availability of large sets of information-rich multivariate measurement data creates tremendous potential for manufacturing variation reduction. We discuss the use of blind source separation techniques (originally developed for sensor-array signal processing) for identifying the nature of each distinct spatial variation pattern from the data. We also discuss enhancements to these algorithms that result in a powerful, versatile tool for diagnosing root causes of manufacturing variation.

2 — Reliability Characterization and Prediction of High-k Dielectric Thin Films
Way Kuo, Wisenbaker Chair of Engineering in Innovation, Texas A&M University, MS 3131, 238 Zachry Engineering, College Station, TX, 77843-3131, United States, way@tamu.edu, Wen Luo, Yue Kuo

The National Technology Roadmap for Semiconductors points out that we are rapidly moving into a nano world where reliability is quite uncertain. This multi-disciplinary project investigates the intrinsic reliability of some newly designed high-k thin films which are potential candidates to replace the gate oxide of MOSFETs. We identify the failure mode and develop an empirical Bayesian approach to project the intrinsic lifetime.

3 — Procedures for Efficient Cycle Time-Throughput (CT-TH) Curve Generation
John Fowler, Professor, Arizona State University, Dept. of Industrial Engineering, Tempe, AZ, 85287-5906, United States, john.fowler@asu.edu, Bruce Ankenman, Barry Nelson, Gerald Mackulak

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.

■ SD19

Westin-Tower 1202, 12th Floor

Statistical Applications of Time-Frequency Analysis using Wavelets

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: Tapas K. Das, Professor, University of South Florida, 4202 E. Fowler Avenue, ENB 118, Tampa, FL, 33647, United States, das@eng.usf.edu

1 — Wavelet-Based SPC Procedures for Complicated Functional Data
Jye-Chyi Lu, Professor, Georgia Institute of Technology, Groseclose Building, Room 335, 765 Ferst Drive, Atlanta, GA, 30332, United States, JCLU@isye.gatech.edu, Myong K. Jeong

Traditional multivarite control charts are inefficient to handle complicated functional data. This presentation shows advantages of wavelet-based SPC tools in handling complicated data patterns. Thresholding-based dimension reduction procedure is proposed to limit the number of monitored variables for keeping the SPC procedures efficient. Several simulations compare procedures developed from most powerful tests and known engineering procedures.

2 — Wavelets, Packets and the Detection of Anomalies in Signals
Marina Vannucci, Associate Professor, Texas A&M University, Department of Statistics, College Station, TX, 77843-3143, United States, mvannucci@stat.tamu.edu

We present wavelet-based techniques for the detection of anomalies (change-points) in a signal. We extend the definition of wavelet variance to wavelet packets (a redundant transformation) and explore algorithms for detecting change points in the variance. We apply the methodology to the detection of network traffic anomalies, where we look at traffic volumes such as byte counts and correlations of IP addresses.

3 — End Point Detection of Chemical Mechanical Planarization using Time Frequency Analysis
Tapas K. Das, Professor, University of South Florida, 4202 E. Fowler Avenue, ENB 118, Tampa, FL, 33647, United States, das@eng.usf.edu, Rajesh Ganesan, Arun K. Sikder, Ashok Kumar

Acoustic emission signal provided an excellent means to detect delamination defect in chemical mechanical planarization. In this talk we discuss the results of our experimentation in using AE data to identify end point in CMP.

4 — Statistical Modal Analysis for Product Form Error/Tolerance Modeling
Wenzhen Huang, Doctoral Student, Department of Industrial Engineering, University of Wisconsin-Madison, 1513 University Avenue, Madison, WI, 53706-1572, United States, huang@cae.wisc.edu, Dariusz Ceglarek

Based on image processing technique a Statistical Modal Analysis methodology is proposed which includes mode representation of form error field, mode significance test, mode truncation criteria, and sampling strategy. It is expected to serve two purposes: 1) statistically represent a population of form or surface variations; 2) mode representation of major error patterns to provide an easy interpretation for fault diagnosis in manufacturing.

■ SD20

Westin-Tower 1203, 12th Floor

Joint Sesson QSR/Computing: Computational Statistical Methods for Optimization

Sponsors: Quality, Statistics and Reliability; Computing
Sponsored Session

Chair: Victoria Chen, University of Texas at Arlington, Industrial & Manufacturing Systems Eng., Campus Box 19017, Arlington, TX, 76019, United States, vchen@uta.edu

1 — Sustainability, Options Theory and Quality Control
Jeevan Duggempudi, Student, University of Illinois at Chicago, 901 S Ashland Ave # 310A, Chicago, IL, 60607, United States, jdugge1@uic.edu, Urmila Diwekar

Cabezas and Fath hypothesized that constant Fisher Information is a necessary condition for the persistence,i.e., sustainability, of a dynamic regime of a system. They developed the beginning steps in this theory using simple ecological models. The aim of this research is to use concepts from economic option theory to enhance the applicability of the theory further by including time dependent uncertainties and coupling it with an off-line quality control method to obtain optimal decisions.

2 — A Radial Basis Function Method for Nonlinearly Constrained Global Optimization
Rommel Regis, Ph.D. candidate, Cornell University, 296 Rhodes Hall, Ithaca, NY, 14853, United States, rregis@orie.cornell.edu, Christine Shoemaker

We present a new method for the global optimization of costly nonconvex functions with nonlinear constraints that utilizes a radial basis function (RBF) model. The method converges to the global minimizer of an arbitrary continuous function on a compact set and computational experiments suggest that it is competitive with the RBF method developed by Gutmann.

3 — Reliability Based Design Optimization Using Design Explorer
Martin Meckesheimer, The Boeing Company, P.O. Box 3707 MS 7L-21, Seattle, WA, 98124-2207, United States, martin.meckesheimer@boeing.com, Andrew Booker

The objective of this talk is to demonstrate the use of Design and Analysis of Computer Experiment (DACE) methods and design optimization on reliability optimization problems. By maximizing reliability, or minimizing the probability of failure, we attempt to achieve a minimum cost design that is affected minimally by the variability in the design variables. DACE methods are applied to two example problems treating the mean values of the design parameters as independent variables.

4 — A Service Based Architecture for Information and Asset Use in Distribute Product Realization
Jitesh Panchal, Graduate Research Assistant, Systems Realization Laboratory, GWW School of Mechanical Engineering, Georgia Institute of Technology, Atlanta, GA, 30332, United States, gtg558c@prism.gatech.edu, Farrokh Mistree, Janet Allen, Victoria Chen, Haejin Choi

We present the development of a web-based online library of available modules from which a designer can then customize a design method to suit the task at hand. In this work, we focus on integrating multivariate adaptive regression splines (MARS) into the distributed development environment. For a collaboration on product platform design, researchers at Georgia Tech are running MARS via the University of Texas at Arlington.

■ SD21

Westin-Tower 1204, 12th Floor

New Perspectives on Routing and Scheduling

Sponsor: Computing
Sponsored Session

Chair: Bruce Golden, Robert H. Smith School of Business, University of Maryland, Van Munching Hall, College Park, MD, 20742, United States, BGolden@rhsmith.umd.edu

1 — The Synchronized Vehicle Dispatching Problem
Michel Gendreau, Centre de recherché sur les transports, Université de Montréal, C.P. 6128, succ. “Centre-ville”, Montréal, QC, H3C 3J7, Canada, michelg@crt .umontreal.ca, Louis-Martin Rousseau, Gilles Pesant

This paper addresses a particular class of the Real Time Vehicle Dispatching Problem where there is need to service some customers with multiple resources subject to synchronization constraints. Real world applications are presented and flexible solution methods, based on Constraint Programming, are proposed. Results on benchmark problems show that the solutions are sensitive to the number of synchronization constraints as well as the request arrival rate .

2 — Real Time Dispatching and Routing of Emergency Response Vehicles
Saini Yang, Department of Civil & Environmental Engineering, University of Maryland, College Park, MD, 20742, United States, snyang@glue.umd.edu, Ali Haghani

This paper deals with real time fleet management in emergency response systems. Given real time traffic information, location and priority of incidents, location and availability of emergency response vehicles and the route restrictions for those vehicles we formulate an optimization model that dynamically assigns emergency response vehicle to incidents and determines the routes for those vehicles. Model formulation, a solution algorithm and some results are presented.

3 — D-Ants Divide and Conquer VRPs
Marc Reimann, University of Vienna, Bruennerstrasse 72, Vienna, A, 1210, Austria, marc.reimann@univie.ac.at, Richard Hartl, Karl Doerner

This paper presents an algorithm for VRPs that is based on an Ant System. The main feature of the algorithm is problem decomposition and our computational study and statistical analysis shows that this feature does not only improve the effciency, but also improves the effectiveness of the algorithm particularly for real world sized Vehicle Routing Problems.

4 — Analysis of the Noisy Euclidean Traveling Salesman Problem
Bruce Golden, Robert H. Smith School of Business, University of Maryland, Van Munching Hall, College Park, MD, 20742, United States, BGolden@rhsmith.umd.edu, Feiyue Li, Edward Wasil

In the noisy Euclidean traveling salesman problem, the number of customers to be visited each day is fixed, but their precise locations are not. They can vary according to a normal distribution. We examine some previous work on this problem, perform experiments of our own, and reach some preliminary conclusions.

■ SD22

Westin-Tower 1205, 12th Floor

US Army Units and Installations

Sponsor: Military Applications
Sponsored Session

Chair: Robert Dell, Associate Professor, Operations Research Department, Naval Postgraduate School, Monterey, CA, 93943, United States, dell@nps.navy.mil

1 — The Military Value of Army Installations
Gregory Parnell, Professor of Systems Engineering, US Military Academy, Department of Systems Engineering, West Point, NY, 10996, United States, gregory.parnell@usma .edu, John Bott, William Tarantino

Army installations provide facilities and maneuver space to organize, train and equip the United States Army. Periodically, the Army must assess the military value of each installation to insure that it has a portfolio of installations that will enable the Army to perform its current and future missions. We have developed the Military Value Analyzer, a multiple objective decision analysis model to evaluate the value of an Army installation and the value of a portfolio of Army installations.

2 — How Optimization Guides Army Stationing
William Tarantino, Center for Army Analysis, 6001 Goethals Street, Fort Belvoir, VA, 22060, United States, bill.tarantino@cox.net, Robert Dell

The Army frequently plans adjustments to the stationing of its force structure as weapon systems, missions, and operations change over time. On any given day, the Army has up to 100 units moving to meet new stationing requirements and our integer linear program, Optimal Stationing of Army Forces (OSAF), has recently helped guide some of these decisions. We present OSAF and discuss its recent use.

3 — Funding Environmental Cleanup at Army Installations
Robert Dell, Associate Professor, Operations Research Department, Naval Postgraduate School, Monterey, CA, 93943, United States, dell@nps.navy.mil

We present BAEC (Budget Allocation for Environmental Cleanup) an integer linear program used by the Army for the last three years to help plan over $620 million in environmental cleanup at over 600 sites on 41 current and former Army installations.

■ SD23

Westin-Tower 1206, 12th Floor

Decision Analysis Society Practice Award Competition

Sponsor: Decision Analysis
Sponsored Session

Chair: L. Robin Keller, Professor and Area Coordinator, Operations & Decision Technologies, University of California - Irvine, Graduate School of Management, 350 GSM, Irvine, CA, 92697-3125, United States, LRKeller@uci.edu

1 — Decision Analysis to Evaluate Proof-of-Principle Trial Design for a New Drug: Value of Information in a Complex Drug Trial using a Bayesian Approach
Vish Viswanathan, Ph.D., Director, Decision Analysis, Johnson & Johnson Pharmaceutical Research & Development, L.L.C., Mailstop K305, 1125 Trenton-Harbourton Road, Titusville, NJ, 08560, United States, VViswana@PRDUS.JNJ .com, Richard Bayney

We present a Bayesian model that we developed to assist the development team for a new drug compound with an important decision — whether to do a proof-of-principle trial before making a bigger investment in full clinical development, and what type of trial design is appropriate from a risk-benefit perspective.

2 — Managing Potential Health Risks from Electric Powerlines: A Decision Analysis Caught in Controversy
Detlof von Winterfeldt, Professor of Public Policy and Management, University of Southern California, RGL 312, University Park, Los Angeles, CA, 90089, United States, winterfe@usc.edu, Raymond Neutra, Thomas Eppel, Vincent Del Pizzo

We describe a multi-year project for the California Department of Health Services (CDHS) to evaluate alternatives for reducing electromagnetic fields (EMF) from electric powerlines. The CDHS staff and stakeholders concerned with potential health effects and property value impacts and the CDHS used the model to formulate policy recommendations.

3 — De-Coupling Supply from Demand to Make an Informed Business Decision
Jeffrey Stonebraker, Manager, Strategic Planning, Bayer Biological Products, 4101 Research Commons, 79 T.W. Alexander Dr., Research Triangle Park, NC, 27709, United States, jeff.stonebraker.b@bayer.com

Since 1997, Bayer has struggled with deciding the strategic direction of its billion-dollar hemophilia drug. Rather than accepting demand estimates from previous analyses that closely reflected historical supply, we used an uncertainty-embracing method to de-couple supply from demand. From this, Bayer clarified its strategic direction and made a confident choice.

4 — Basic Combat Training Program of Instruction Review
William Klimack, Director, ORCEN, USMA, Department of Systems Engineering, United States Military Academy, West Point, NY, 10996, United States, William.Klimack@usma .edu, Jack M. Kloeber, Jr

A multidimensional value model was used to determine the overall value of each US Army Basic Combat Training task. The analysis led to the adoption of a number of recommendations. It also improved the definition of the objectives, highlighted training areas for increased command emphasis, and improved communication.

■ SD24

Westin-Tower 1207, 12th Floor

Versioning Digital Information Products

Sponsor: Information Systems
Sponsored Session

Chair: Hemant Bhargava, Professor, Graduate School of Management, University of California Davis, Davis, CA, United States, bhargava@computer.org

1 — Pricing and Versioning of Digital Information Goods under the Threat of Piracy
Shinyi Wu, University of Pennsylvania, United States, shinwu@wharton.upenn.edu, Pei-yu Chen

While technologies have lowered the cost of reproducing and distributing information goods, these information goods can be pirated easily and cheaply using the same technologies. We propose a model to help assist providers of digital information goods to sell their digital information goods under the threat of piracy.

2 — Vertical Differentiation with Multi-dimensional Preferences
Kartik Hosanagar, Carnegie Mellon University, Pittsburgh, PA, United States, kartikh@andrew.cmu.edu

Second degree price discrimination in the context of information goods has been studied by several researchers. I extend the study of vertical differentiation among information goods by considering goods with multi-dimensional quality attributes with independent customer preferences for the two attributes. I extend the insights from the model to discuss desirability of vertical differentiation among bundled information goods.

3 — Contingency Pricing Enables Versioning of Broadband Internet Access Services
Daewon Sun, Pennsylvania State University, United States, dxs414@psu.edu, Hemant Bhargava

Quality-of-service (QoS) pricing is problematic in best-effort shared resource environments because the provider cannot offer absolute QoS levels. We demonstrate that contingency pricing is profitable for such environments, and can enable the creation of user segments when users are heterogeneous in their traffic patterns. Our research is set in the context of broadband Internet access service.

■ SD25

Westin-Tower 1208, 12th Floor

New Challenges for OR from the New Warfare and Transformation-II

Sponsor: Military Applications
Sponsored Session

Chair: James Taylor, Professor of Operations Research, Naval Postgraduate School, Naval Postgraduate School, Monterey, CA, 93943-5000, United States, jtaylor@nps.navy.mil

1 — Some Challenges for OR from the New Warfare and Transformation
James Taylor, Professor of Operations Research, Naval Postgraduate School, Naval Postgraduate School, Monterey, CA, 93943-5000, United States, jtaylor@nps.navy.mil

The author will give his take on new challenges for OR arising from the new warfare (recently conducted in Iraq) and from Secretary Rumfeld's approach for transforming DoD. Implications for new methdology (especially for mathematical modeling of combat and the treatment of uncertainties) will be emphasized.

2 — The Fundamentals of Information Age Warfare
Jeff Cares, Alidade Incorporaated, 31 Bridge Street, Newport, RI, 02840, United States, jeff@alidade.net

A dialogue continues in the American military about changes that predicted to military operations in the Information Age. Network Centric Warfare, Effects-Based Operations, and Maneuver Warfare have emerged as Information Age operational concepts. Opinions about these concepts, pro and con, abound but are often not grounded in theory or fact. This presentation provides a comprehensive framework for understanding Information Age Warfare.

3 — Panel Discussion: New Challenges for OR from the New Warfare and Transformation
James Taylor, Professor of Operations Research, Naval Postgraduate School, Naval Postgraduate School, Monterey, CA, 93943-5000, United States, jtaylor@nps.navy.mil, Grant Hammond, John Hanley, Russell Vane

A distinguished panel will try to summarize the ideas discussed (both explicitly and implicitly) in the above presentations. They will try to identify and assess such new challenges for OR. Panel Members: 1. Grant Hammond, Air University 2. John Hanley, OSD, Force Transformation, 3. Russell Vane, Veridian.

■ SD26

Westin-Tower 1401, 14th Floor

Process Data Mining

Cluster: Data Mining and Knowledge Discovery
Invited Session

Chair: George Runger, Professor, Arizona State University, Industrial Engineering Dept, PO Box 875906, Tempe, AZ, 85287-5906, United States, runger@asu.edu

1 — Multivariate Deadband Process Adjustment
Nirmal Govind, Ph.D. Student, Pennsylvania State University, Industrial and Manufacturing Engineering, 310 Leonhard Bldg, University Park, PA, 16802, United States, nirmalg@psu.edu, Enrique Del Castillo, George Runger

Multivariate process adjustment in the presence of fixed adjustment costs is investigated. A fixed adjustment cost leads to a trade-off between adjusting a process continuously and allowing the process to drift until a bound is violated. A State-Space model is formulated and a Kalman Filter based controller is used. With the help of simulation, the optimal bounded adjustment parameter is computed for two shapes of the dead region.

2 — Multivariate Statistical Process Control of a Large Database
Duangporn Jearkpaporn, Arizona State University, Industrial Engineering Dept, PO Box 875906, Tempe, AZ, 85287-5906, United States, duang@asu.edu, George Runger, Douglas Montgomery, Connie Borror

With an improvement in technology, data collection system can generate large volumes of data. These data contain valuable information, which can be used to improve performance. The objectives of this talk are to (re-) introduce generalized linear model (GLM) and illustrate its application in data mining framework via a quality control problem. An example with multiple count and gamma distributed data is used to illustrate the methodology. Other potential applications will also be discussed.

3 — Data Mining for Cycle Time Prediction
Mani Janakiram, Intel Corp., CH3-113, 5000 W. Chandler Blvd, Chandler, AZ, United States, mani.janakiram@intel.com, Phillip Backus, Shahin Movafagh, George Runger

Cycle time prediction for complex processes has been a well-documented industrial problem. Simulation is the most common tool used to form predictions. When trying to predict at the unit or lot level, simulation becomes difficult due to the complexity of the process and the number of possible scenarios. We provide a data mining technique that relies on historical data. Complexities arise from the objective to predict at an arbitrary time and predict an arbitrary future point in the process.

4 — Process Data Mining
George Runger, Professor, Arizona State University, Industrial Engineering Dept, PO Box 875906, Tempe, AZ, 85287-5906, United States, runger@asu.edu

An intelligent partition of a massive historical data set is needed to model a process. There are extensive methods available in the statistical and data mining literature, and in commercial software. Still, process data has some distinctive characteristics that lead to selective methods to partition. The advantages of a partition, and the objectives of such as analysis are described. Process data characterisitcs and a few methods will be discussed.

■ SD27

Westin-Tower 1402, 14th Floor

Nicholson Student Paper Prize Competition, II

Cluster: Nicholson Student Paper Prize
Invited Session

Chair: David Morton, The University of Texas at Austin, Graduate Program in Operations Research, Austin, TX, 78712-0292, United States, morton@mail.utexas.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.

■ SD28

Westin-Tower 1403, 14th Floor

Robust Optimization

Cluster: Nonlinear Programming
Invited Session

Chair: Reha Tutuncu, Associate Professor, Carnegie Mellon University, 6113 Wean Hall, Pittsburgh, PA, 15213, United States, reha@cmu.edu

1 — Adjustable Robust Linear Programming
Elana Guslitser, PhD student, Stanford Graduate School of Business, PhD Program, Stanford Graduate School of Business, Stanford, CA, 94305, United States, guslitser@stanford.edu

We consider linear programs with parameters,lying in a given uncertainty set. Part of the variables must be determined before the realization of the uncertain data, while the other part can be adjusted to the realization. We associate with such an LP its Adjustable Robust Counterpart. In the cases where the above problem is intractable,we restrict the adjustable variables to be affine functions of the uncertain data, ensuing, in many cases, a problem that is tractable or admits a tight approximation.

2 — A Robust Minimax Approach to Classification
Gert Lanckriet, Ph.D. Candidate, EECS, U.C. Berkeley, 262M Cory Hall, U.C. Berkeley, Berkeley, CA, 94720, United States, gert@eecs.berkeley.edu, Laurent El Ghaoui, Michael Jordan

Consider a binary classification problem where only mean and covariance matrix of each class are assumed to be known. We construct a linear classifier by explicitly minimizing the maximum probability of misclassification of future data points, for all choices of class-conditional densities with given mean/covariance, yielding an SOCP. We address robustness issues with respect to estimation errors in means/covariances and show how to obtain powerful nonlinear classifiers by using Mercer kernels.

3 — Robust Statistics and Robust Optimization
Garud Iyengar, Columbia University, Rm. 331, S. W. Mudd Bldg., 500W 120th St., New York, NY, 10027, United States, garud@columbia.edu

In this talk we explore the relation between robust optimization and robust statistics. We show that robust location and scale estimates are, in fact, solutions of an appropriately defined robust optimization problem. Reformulating robust estimates as solutions of optimization problems opens up the possibility of computing estimates that satisfy other side constraints.

■ SD29

Westin-Tower 1404, 14th Floor

Telecommunications Network Design

Sponsor: Optimization/Network
Sponsored Session

Chair: Cynthia Barnhart, Professor, MIT, Center for Transportation and Logistics, room 1-229, Cambridge, MA, 02139, United States, cbarnhar@MIT.EDU

1 — Optimization-Based Design Strategies for DWDM Networks: Opaque Versus All-Optical Networks
Jeff Kennington, Professor, Southern Methodist University, EMIS Dept., School of Engineering, Dallas, TX, 75275, United States, jlk@engr.smu.edu

Regeneration involves an expensive optical/electrical/optical conversion requiring a combination of regenerators, multiplexers, demultiplexers, and optical amplifiers. The DWDM design problem is to determine the number, size, and location of these components such that a set of point-to-point traffic demands can be satisfied while simultaneously meeting the technological restrictions on signal amplification and regeneration. Two design strategies are compared in this investigation.

2 — A Metaheuristic Approach for Survivable Network Design
Prakash Mirchandani, Professor, University of Pittsburgh, 358 Mervis Hall, Pittsburgh, PA, 15260, United States, PMIRCHAN@katz.pitt.edu, Anant Balakrishnan, Karolina Glowacka, Mihai Banciu

Designing low-cost networks for survivability—notoriously difficult for large-scale instances—requires judiciously selecting edges that guarantee communication between important nodes even when some network edges fail. Our approach, integrating ideas from tabu search, simulated annealing and randomized algorithms and implemented using an intuitive graphical interface, appears to be promising.

3 — Solving the Inverse Shortest Path Length Problem
Cheng-Huang Hung, Industrial and System Engineering, Georgia Institute of Thchnology, Atlanta, GA, 30332, United States, ehung@isye.gatech.edu, Shabbir Ahmed, Ozlem Ergun, Joel Sokol

The inverse shortest path length problem (ISPL) is to find cost coefficients that satisfy given shortest path length constraints in a network. ISPL has an important application in telecommunication pricing. In general, ISPL is NP-complete; we explore its complexity on specific network types (tree, cycle, and complete graph). We also propose some heuristic algorithms to solve ISPL. The algorithms are tested both on randomly generated instances and on data from a real telecommunications problem.

■ SD30

Westin-Tower 1405, 14th Floor

Methodology for Stochastic Optimization

Sponsor: Optimization/Stochastic Programming
Sponsored Session

Chair: Tito Homem-de-Mello, Northwestern University, Department of IE&MS, 2145 Sheridan Rd., Evanston, IL, 60208, United States, tito@northwestern.edu

1 — Risk Modeling in Stochastic Programming
Shabbir Ahmed, Assistant Professor, ISyE, Georgia Tech, Atlanta, GA, 30332, United States, sahmed@isye.gatech.edu, Andrzej Ruszczynski

This talk addresses risk modeling paradigms for two-stage stochastic programming. We show that traditional mean-variance approach may lead to intractable non-convex optimization models. On the other hand, many risk paradigms that are consistent with second order stochastic dominance lead to tractable convex programs. Furthermore, the original decomposability property of the stochastic program is preserved. A computational comparison of several risk modeling paradigms will be presented.

2 — Sampling Approach to Two and Multi-stage Stochastic Programming
Alexander Shapiro, Georgia Tech, Ferst Street, Atlanta, GA, 30332, United States, ashapiro@isye.gatech.edu

In this talk we discuss the Monte Carlo sampling approach to solving stochastic programming problems. Recently it was shown that large scale two-stage stochastic programs, with an astronomically large number of scenarios, can be solved efficiently by Monte Carlo sampling techniques with a proven accuracy and in some cases exactly. On the other hand little is known about multistage stochastic programming problems. This motivates the question of complexity of stochastic programming problems.

3 — A Methodology for Probabilistic Production-Distribution Problems
Miguel Lejeune, Rutgers University, 180 University Avenue, Ackerson Hall, 2nd Floor, #30, Newark, NJ, 07102, United States, mlejeune@pegasus.rutgers.edu, Andrzej Ruszczynski

We construct a probabilistic production-distribution model for a three-stage supply chain, subject to a stochastic demand. The resulting mixed-integer stochastic program contains joint probabilistic constraints that enforce that the probability of the joint fulfillment of a system of linear inequalities with random variables must be above a probability level p, i.e. the cycle service level. We propose a modular solving methodology for handling the manifold challenges linked to the model.

4 — On the Convergence Rate of Non-Independent Sampling for Stochastic Optimization
Tito Homem-de-Mello, Northwestern University, Department of IE&MS, 2145 Sheridan Rd ., Evanston, IL, 60208, United States, tito@northwestern.edu

We discuss sample average approximations of stochastic optimization problems, where the samples are not necessarily i.i.d.. We show that the exponential rate of convergence, known to hold in the i.i.d. case, is still valid in the non-independent case under proper assumptions. More specifically, we show that if the proposed sampling scheme yields exponential rate of convergence for pointwise estimates, then the convergence of optimal solutions will also have an exponential rate.

■ SD31

Westin-Tower 1406, 14th Floor

P-median and Related Models: New Directions

Sponsor: Location Analysis
Sponsored Session

Chair: Dmitry Krass, Professor, University of Toronto, 105 St. George St., Toronto, ON, M5S 3E6, Canada, krass@rotman.utoronto.ca

1 — The p-Median Model Revisited
Zvi Drezner, Professor, California State University-Fullerton, Fullerton, CA, 92834, United States, zdrezner@Exchange.FULLERTON.EDU, Tammy Drezner

We propose a new model for the p-median problem. In the standard p-median problem it is assumed that each demand point gets its services from the closest facility. We assume that customers divide their patronage among the facilities according to the gravity model. The probability that a customer patronizes a facility is proportional to the attractiveness of that facility and to a decreasing utility function of the distance to the facility.

2 — The Minisum Collection Depots Location Problem with Multiple Facilities on Networks
Rongbing Huang, Ph.D. Candidate, University of Toronto, 105 St. George st., Toronto, ON, M5S 3E6, Canada, Rong.Huang00@Rotman.Utoronto.Ca, Oded Berman

We investigate the Collection Depots Location Problem of siting multiple facilities on networks. The properties of the solution on a general network, on a tree and on a cylce are discussed. We suggest a Lagrangian Relaxation imbeded branch-and-bound algorithm. Computational results are reported.

3 — The Median Problem and Reliability of Facilities
Mozart Menezes, Ph.D. Candidate, Univeristy of Toronto, 105 St. George st., Toronto, ON, Canada, menezes@Rotman.Utoronto.Ca, Oded Berman, Dmitry Krass

This paper generalizes the p-Median problem on a network by considering facilities that may fail. Consequently, a consumer may have to be served by a facility which is not the closest one. Algorithm and heuristic solutions are provided when the facilities reliability are uniform. The special case of a tree network is discussed.

4 — Competitive Facility Location and Design Problem
Robert Aboolian, Assistant Professor of Operations Management, CSU San Marcos, San Marcos, CA, 92096, United States, raboolia@csusm.edu, Oded Berman, Dmitry Krass

Consider the problem of locating and determining design of competitive facilities. The complexity of the problem is discussed and efficient exact and approximate solutions for special cases of this problem are developed. A tight worse-case error bound for one special case is also developed.

■ SD32

Westin-Tower 1407, 14th Floor

Panel: Publishing Research on Scheduling

Cluster: Scheduling
Invited Session

Chair: Nicholas G. Hall, Professor, Ohio State University, 2100 Neil Avenue, Columbus, OH, 43210-1144, United States, hall.33@osu.edu

1 — Panel: Publishing Research on Scheduling
Panelists: Nicholas G. Hall, Marc Posner, Dorit Hochbaum, William Lovejoy, Michael Pinedo, Steef van de Velde

Journal editors representing Operations Research, Management Science, Journal of Scheduling, Operations Research Letters, IIE Transactions, M&SOM, NRL discuss issues related to the publication of scheduling research. These issues include editorial policy priorities, choice of journal, emerging and declining topics, examples of publishable content, and differences in writing style

■ SD33

Westin-Tower 1408, 14th Floor

Data Envelopment Analysis IV

Cluster: Data Envelopment Analysis
Invited Session

Chair: Timothy Anderson, Associate Professor, Portland State University, Department of Engineering and Technology, Portland, OR, United States, tima@etm.pdx.edu

1 — Egoist's Dilemma: A DEA Game
Kaoru Tone, National Graduate Institute for Policy Studies, 2-2 Wakamatsu, Shinjuku-ku, Tokyo, 162-8677, Japan, tone@grips.ac.jp, Ken Nakabayashi

This paper deals with problems of consensus-making among individuals or organizations with multiple criteria for evaluating their performance when the players are supposed to be egoistic . We analyze this situation within the framework or concept developed in DEA and cooperative game theory.

2 — Bonds vs. Ruth: A Comparison of Dominating Baseball Batters
Timothy Anderson, Associate Professor, Portland State University, Department of Engineering and Technology, Portland, OR, United States, tima@etm.pdx.edu, Keith Hollingsworth, Lane Inman

Recently Barry Bonds broke the single season MLB home run record and there

was great discussion of how this offensive season compared to Babe Ruth. Various DEA methods including super-efficiency and cross-efficiency were used to lend insight to both this debate and further the understanding of subtleties of these methods.

3 — A Comparison Construction Project Delivery Systems using DEA
Gerald H. Williams, Jr., PE, Construction & Engineering Management Research, 2300 Southwest First Avenue,, Suite 102, Portland, OR, 97201, United States, gerry@cemresearch.com, Timothy Anderson

Over $1 Billion dollars have been spent recently on over 100 state construction projects in Oregon using methods other than lump sum low bid. DEA was used to compare these projects against lump sum low bid state projects to provide insights to the comparative advantages of these delivery systems.

4 — Detailed Data Envelopment Analysis: A Framework for Incorporating Engineering Knowledge into Non Parametric Productivity Analyses
David Moore, Assistant Professor, Economics and Business Division, Colorado School of Mines, United States, dmoore@mines.edu

Data envelopment analysis utilizes mathematical structure consisting of regularity conditions plus properties common to long run, aggregate economic models of production. We identify engineering properties of low-level production activities consistent with Shephard's axioms. We develop the detailed DEA framework for estimating productive efficiency, and introduce associated models and computational techniques.

■ SD34

Mart-Room A

Transportation Network Vulnerability

Sponsor: Transportation Science & Logistics
Sponsored Session

Chair: Srinivas Peeta, Purdue University, School of Civil Engineering, West Lafayette, IN, 47907-2051, United States, peeta@purdue.edu

1 — A Bi-Level Formulation for Vulnerable Link Identification in a Transportation Network and ITS Application
Pamela M. Murray-Tuite, University of Texas at Austin, 1 University Station C1761, Civil Engineering-Transportation, Austin, TX, 78712-0278, United States, p.murray@mail.utexas.edu, Hani Mahmassani

A bi-level optimization problem is formulated to identify vulnerable links in a transportation network. The upper level emulates an "evil-entity" with limited resources, which maximizes network disruption. At the lower level is a system-optimal traffic assignment. Vulnerable link identification can support planning, design and deployment of ITS technologies to support emergency operations in the event of actual damage.

2 — Reducing the Vulnerability of a Network through Investment: Decision Dependent Link Failures
Kannan Viswanath, Purdue University, West Lafayette, IN, 47907-2051, United States, kannan.viswanath.1@purdue.edu, Srinivas Peeta, F. Sibel Salman

We consider a problem that arises in disaster-related strategic planning: investing in the links of a stochastic network to improve its expected post-disaster performance. We are given a network whose links are subject to random failures, where the failure probability of any link is dependent on the investment decision for that link.

3 — Modeling Infrastructure Interdependencies using Generalized Transportation Networks
Pengcheng Zhang, Purdue University, School of Civil Engineering, West Lafayette, IN, 47907-2051, United States, zhangp@purdue.edu, Srinivas Peeta, Terry Friesz

This study investigates the nature and magnitude of interdependencies that exist among various infrastructure networks (such as transportation, telecommunication, energy, and water systems) that can be viewed as coupled layers of a generalized transportation network in which the goods, passenger, message, data, water, and energy flows are the commodities in the different layers . Spatial computable general equilibrium modeling, coupled with a game theoretic approach and agent-based simulation, are used to study these interdependencies.

4 — Genetic Algorithms for a Minimum Time, Stochastic, Time-Dependent, Dynamic Evacuation Problem
Sathaporn Opasanon, University of Maryland, Department of Civil and Environmental Engineering, 1173 Glenn Martin Hall, College Park, MD, 20742, United States, sxo151@psu.edu, Elise Miller-Hooks

We present a genetic algorithmic approach to addressing the minimum time dynamic evacuation problem in stochastic, time-varying (STV) networks, i.e. arc travel times, arc capacities and supply at the source nodes vary with time and are known a priori only probabilistically. In such dynamic networks, flow moves through the network over time, and thus, arc capacities can be recaptured.

■ SD35

Mart-Room B

Reverse Production Systems Design and Analysis

Cluster: Reverse Supply Chains
Invited Session

Chair: Matthew Realff, Dr., Georgia Tech, School of Chemical Engineering, Atlanta, GA, United States, matthew .realff@che.gatech.edu

1 — Semi-Continuous Robust Approach for Strategic Infrastructure Planning of Reverse Production System
Tiravat Assavapokee, Graduate Assistant, Georgia Tech, School of ISYE, Atlanta, GA, 30332, United States, gt6518a@mail.gatech.edu, Jane Ammons, Matthew Realff

This paper develops a new semi-continuous robust algorithm for making robust strategic decisions (deviation robustness) for forward and reverse production systems under uncertainty in model parameters' values when each parameter takes its value from a real compact interval or a set of specific discrete values. The potential for correlations among parameters is also considered.

2 — Simulation and Optimization studies of An Inventory Coupled Forward-Reverse Production System
Sriram Iyer, Graduate Research Assistant, Georgia Tech, School of ISYE, Atlanta, GA, 30332, United States, gtg761c@prism.gatech.edu, Matthew Realff, Mandar Rahatekar

This paper studies using a simulation model combined with heuristic optimization for modeling the interaction between a forward and reverse production system. The important decisions are the inventory of new parts that should be established for a product prior to closing down the forward manufacturing system and switching to using recovered parts to maintain the product fleet.

3 — A Repackaging Model for Inventory Management of Returns
Julie Ann Stuart, Purdue University, 315 N. Grant Street, West Lafayette, IN, 47907-2023, United States, stuart@purdue.edu, Sudaratana Wongweragiat

We address the problem of selecting which salvageable pre-sale returns to store when they are retrieved from boxes of goods partially damaged in forward distribution operations. The problem is constrained by packaging availability, a storage space constraint, and an exact number of salvageable products to complete a repackaged box. We introduce a new decision tool for repackaging and recycling operations and show that our tool increases repackaging of salvageable pre-sale returns.

4 — Assessing the Value of Installed Base Information for Servicing Purposes
Rob Zuidwijk, Netherlands, rzuidwijk@fbk.eur.nl, Jo van Nunen, Roelof Kuik

Value of information is created by pro-active operations and coordination. We discuss a situation in which products positioned at customers require servicing. It is assumed that the technical condition of the products can be measured remotely providing information on whether maintenance, repair or product take-back is required within a certain time interval. This prevents emergency service calls. Methods are presented that assess the value obtained from installed base information.

■ SD36

Mart-Room C

Flexibility and Pricing Issues in Operations Management

Sponsor: Manufacturing and Service Operations Management
Sponsored Session

Chair: Ebru Bish, Assistant Professor, Virginia Tech, Dept. of Industrial and Systems Engg., 250 Durham Hall, Blacksburg, VA, 24061-0118, United States, ebru@tioli.ise.vt.edu

1 — Component Commonality Strategies: Value Drivers and Equivalence
Jan Van Mieghem, Stuart Professor, Northwestern University, Kellogg School of Management (MEDS), Evanston, IL, 60201, United States, VanMieghem@kellogg .northwestern.edu

This talk discusses analytic conditions and insights into when, and if so how, commonality strategies should be adopted and which factors drive their value. The concept of a "revenue maximization option" is introduced as a benefit of commonality that is independent of the traditional "risk pooling" benefit. The equivalence to the flexible capacity problem of Van Mieghem (1998) directly provides a simple yet general analytic condition specifying when commonality should be adopted.

2 — Spackling: Smoothing Make-to-Order Production of Custom Products
Kyle Cattani, Operations Technology and Innovation Management Faculty, The University Of North Carolina at Chapel Hill, The Kenan-Flagler Business School, CB# 3490, McColl Building, Chapel Hill, NC, 27599-3490, United States, Kyle_cattani@unc.edu, Glen Schmidt, Ely Dahan

With spackling, a firm uses flexible resources to first manufacture custom products as demanded each period, and then fills in, or spackles, the production schedule with make-to-stock output of standard products to restock inventory. We evaluate the trade-off between the use of more expensive flexible production resources under spackling, versus a focused strategy that uses efficient production resources for make-to-stock demand and flexible resources for make-to-order demand.

3 — Dynamic Pricing Strategies
Lap Mui Ann Chan, Assistant Professor, University of Toronto, School of Management, 105 St. George Street, Toronto, ON, M5S 3E6, Canada, achan@rotman.utoronto.ca, Julie Swann, David Simchi-Levi

We examine the problem of coordinating dynamic and fixed pricing strategies with production scheduling decisions in a manufacturing firm where demand is assumed to be a general stochastic function. We consider partial planning strategies, where one decision is made at the beginning of the horizon and a second decision is delayed until the beginning of each period. We develop several heuristics for the strategies based on deterministic approximations and analyze the worst-case performance.

4 — Optimal Investment Strategies for Flexible Resources, Considering Pricing
Ebru Bish, Assistant Professor, Virginia Tech, Dept. of Industrial and Systems Engg ., 250 Durham Hall, Blacksurg, VA, 24061-0118, United States, ebru@tioli.ise.vt.edu, Qiong Wang

We study the resource investment decision faced by a firm that offers two demand-classes (i.e., products, services), considering that the firm uses ex-post pricing in a monopolistic situation . The firm can invest in dedicated resources, which can only satisfy a specific demand-class, and/or in a more expensive, flexible resource, which can satisfy both demand-classes. Our analysis provides the structure of the firm's optimal resource investment strategy.

■ SD37

Mart-Room D

Queueing Applications in Operations Management

Sponsor: Manufacturing and Service Operations Management
Sponsored Session

Chair: Tarja Joro, Assistant Professor, University of Alberta School of Business, 3-40F Business Building, Edmonton, AB, T6G2R6, Canada, Tarja.Joro@ualberta.ca

1 — Workforce Scheduling with Employee Preferences
Yong Yue Li, PhD Student, University of Alberta School of Business, PhD Program, University of Alberta School of Business, Edmonton, AB, T6G2R6, Canada, yongyue@ualberta.ca, Ignacio Castillo, Tarja Joro

A workforce scheduling approach that takes into account various measures for service quality as well as employees' preferences over various shifts is proposed. The approach combines the traditional scheduling with employee rostering. The approach uses a novel simulation and efficiency analysis procedure to avoid strong assumptions.

2 — Management of Supply Information and Other Operational Incentives
Apurva Jain, Assistant Professor, University of Washington Business School, Box 353200, Seattle, WA, 98195, United States, apurva@u.washington.edu, Kamran Moinzadeh

We study a manufacturer-retailer supply chain where manufacturer can share its private inventory availability information with the retailer. We show how this can result in increasing the manufacturer's revenue by providing the retailer with an incentive to increase its order-rate. We compare selective sharing of information with broadcasting it and with other operational incentives, such as, scheduling priority.

3 — Locating Production Facilities When Demand is Uncertain
Ignacio Castillo, Assistant Professor, University of Alberta School of Business, 3-30G Business Building, Edmonton, AB, T6G2R6, Canada, ignacio.castillo@ualberta.ca, Armann Ingolfsson, Thaddeus Sim

We present and analyze models to optimally design single-echelon networks of production facilities serving stochastic demand with random service times. Motivating applications include automotive and electronics industries. Our results provide insight about the interaction of facility location, inventories, lead times, congestion, and capacity utilization .

4 — Managing Congestion at the Edmonton International Airport
Tarja Joro, Assistant Professor, University of Alberta School of Business, 3-40F Business Building, Edmonton, AB, T6G2R6, Canada, Tarja.Joro@ualberta.ca, Ignacio Castillo, Vinod Viswalingam

A study was undertaken to manage congestion at the Edmonton International Airport during the time when part of the departure level of the airport was under construction. This study combines lessons from queueing theory and behavioral aspects of queueing to reduce the congestion and improve customer satisfaction.

■ SD38

Mart-Room E

Urban Transportation Planning Models II: Network Applications

Sponsor: Transportation Science & Logistics
Sponsored Session

Chair: Jim Moore, Professor, University of Southern California, KAP 210, MC-2531, 3620 S. Vermont Ave, Rm 210, Los Angeles, CA, 90089-2531, United States, jmoore@usc.edu

1 — Recent Advances in Computing Congestion Tolls
Lihui Bai, PhD Candidate, University of Florida, Department of Industrial and Systems Eng, 303 Weil Hall, P.O. Box 116595, Gainesville, FL, 32611-6595, United States, LBai@cao.ise.ufl.edu, Siriphong Lawphongpanich, Donald Hearn

We describe recent theoretical and computational developments in and present numerical results from solving congestion toll pricing problems. These problems find tolls that generate the system optimal (or equivalent) solution while minimizing, e.g., the number of toll facilities or the toll revenue and allowing restrictions on toll facility locations.

2 — Application of Dynamic Traffic Assignment Methodology for Homeland Security Emergencies
Hani Mahmassani, Professor, University of Maryland, Department of Civil & Environmental Engi, 1173 Glenn L. Martin Hall, College Park, MD, 20742, United States, masmah@wam.umd.edu, Hayssam Sbayti, Henry Lieu

We illustrate the use of DYNASMART-P, a simulation-based DTA model, to assess the temporal evolution of network traffic flows under extreme events, and develop related contingency plans. A hypothetical attack scenario that disables a bridge in the Knoxville, TN road network is examined. Several management schemes (traffic re-routing, evacuation, and use of information strategies) are investigated for their effectiveness in minimizing the adverse traffic impacts .

3 — Formulating of Learning Process in Route Search Behavior in Transportation Networks
Toshihiko Miyagi, Professor, Gifu University, 1-1 Yanagido, Gifu, GF, 501-1193, Japan, miyagi@cc.gifu-u.ac.jp

The paper presents a model describing drivers' learning behavior in route selection in transportation networks. Our approach is based on reinforcement learning with profit sharing where drivers are characterized as autonomous agents who seek their optimal routes. The method realizes an equilibrium state similar to stochastic user equilibrium. However, our approach does not need a variance parameter included in the usual stochastic assignment model, nor supervised data.

4 — Stochastic Shortest Path Problem with Correlated Link Travel Times
Yue Yue Fan, Assistant Professor, University of California at Davis, Department of Civil and Environmental Engineering, KAP 210, MC-2531, University of Southern California, Los Angeles, CA, 90089-2531, United States, yueyuefa@usc.edu, Robert Kalaba, Jim Moore

This paper addresses the shortest path problem in congestible networks with correlated link travel costs. Conditional probability density functions for link travel times are known for congested and uncongested links. Travelers take experience into account when determining which link to traverse next. Bellman's principle of optimality is applied to formulate the model. Proof of existence and uniqueness of the solution and the procedure of obtaining the solution are provided.

■ SD39

Mart-Room F

Panel: The Use of OR Techniques in Rail Policy Development (Continued)

Sponsor: Railroad Applications
Sponsored Session

Chair: Andreas Aeppli, aaeppli@reebie.com

1 — The Use of OR Techniques in Rail Policy Development
Panelists: Andreas Aeppli,Raphael Kedar, Charles A. Spitulnik

We will conduct a panel discussion on the use of OR techniques in rail policy development from the perspective of both the public and private sectors. Analytical tools have a long record of use within public and private entities for evaluating the efficacy of proposed investments and impacts of policy decisions. In recent years, efforts by the public sector to encompass all modes of transport to address mobility and environment issues has greatly increased the demand for and use of analytical tools to assess investment and policy strategies. This session will emphasize the perspective of the consumer of quantitative analysis for rail policy development among agencies, carriers and consultants. Panelist Raphael Kedar will present " The FRA's use of modelling tools in developing FRA policy on rail freight". Panelist Charles A. Spitulnik will present " The means by which the potential investments in Cross Harbor studies are being analyzed. " Other panelist will round out the session.

■ SD40

Mart-Room G

New Directions in Inventory Management

Cluster: Supply Chain Management
Invited Session

Chair: Guillermo Gallego, Professor, Columbia University, 500 West 120th Street, 324 Mudd Bldg, New York, NY, 10027, United States, gmg2@columbia.edu

1 — When to Underpromise and Over-deliver in a Capacitated Environment?
Tamer Boyaci, Professor, Faculty of Management,McGill University, Canada, tamer .boyaci@mcgill.ca

We study a make-to-order manufacturing or service system operating in a delivery time and customer service sensitive market. The firm offers uniform delivery time guarantees to attract customers and incurs capacity costs to satisfy the resulting customer demand at the desired level of service. We investigate conditions under whih it is optimal to underpromise and over-deliver to its customers and relate these conditions to capacity requirements and costs.

2 — Dual Purchase Contract under Forecast Update
Ozalp Ozer, Assistant Professor, Stanford University, 314 Terman, Stanford, CA, 94305, United States, ozalp.ozer@stanford.edu, Wei Wei

We study a decentralized supply chain in which a manufacturer sells to a retailer who can obtain a forecast update. A dual purchase contract extends the wholesale price contract and offers a discount for orders before the forecast update. We show that it achieves Pareto-improvement under a variety of settings.

3 — Risk Analysis in Supply Contracts
David Simchi-Levi, Professor, MIT, 77 Massachusetts Ave, Bldg 1-171, Cambridge, MA, United States, dslevi@mit.edu, Victor Martinez de Albeniz

We present a risk analysis of supply contracts by studying the trade-offs faced by a manufacturer signing a portfolio of option contracts with its suppliers and having access to a spot market. This manufacturer incurs inventory risk when purchasing too many options and spot price risk when buying too few.

4 — Quantity Flexible Contracts: Optimal Decisions with Information Updates
Suresh Sethi, Professor, School of Management, Univ of Texas at Dallas, SOM, JO 4.7,, 2601 N. Floyd Rd, Richardson, TX, 75080, United States, sethi@utdallas.edu, Houmin Yan, Hanqin Zhang

We analyze a multi-period quantity flexible contract involving demand forecast updates and the spot market. We characterize ordering decisions before the update and purchases on contract and in the spot market following the update. We also discuss the impact of the information quality and the flexibility level on the optimal decisions.

■ SD41

Mart-Room H

Emerging Topics in Supply Chain Analysis

Cluster: Supply Chain Management
Invited Session

Chair: David Wu, Iacocca Professor and Chair, Lehigh University, Dept. of Industl & Sys Eng., 200 W. Packer Ave., Bethlehem, PA, 18017, United States, david.wu@lehigh.edu

1 — Product Variety and Supply Chain Choice
Nils Rudi, Assistant Professor, University of Rochester, Simon School of Business, Rochester, NY, 14627, United States, rudi@simon.rochester.edu, Harry Groenevelt, Praneet Singh

We compare a traditional channel, in which retailers make the stocking and assortment decisions with a drop-shipping channel, where the wholesaler makes these decisions. After characterizing the structure of the optimal assortment we determine the conditions under which one channel supports higher product variety than the other. We study the sensitivity of the optimal assortment to the channel and demand parameters and examine the effect of product variety in influencing channel choice.

2 — Managing Retail Promotions and Inventory under Unobserved Lost Sales and Learning
Jayashankar Swaminathan, Kenan-Flagler School of Business, University of North Carolina, Chapel Hill, NC, United States, msj@unc.edu, Hans Heese

In a stochastic dynamic inventory problem with perishable goods and unobserved lost sales, we analyze the informational dynamics associated with joint ordering and promotional decisions using a Bayesian approach. We demonstrate the negative impact of promotions on the accuracy of demand estimates and discuss related managerial implications.

3 — Warranty Cost Share Mechanisms and Supply Chain Product Quality
Canan Savaskan, Assistant Professor of Operations Management, Kellogg School of Management, 2001 Sheridan Road, Evanston, IL, 60208, United States, r-savaskan@kellogg.nwu.edu

In this paper, we examine the use of warranty charge-backs to suppliers to minimize total cost (product cost plus warranty cost) across the value chain. Using the principal-agent framework, we discuss different warranty cost sharing mechanisms (i.e. fixed share rate, incentive system and supplier responsible rate)taking into consideration the uncertainty in responsibility determination process.

4 — High-Tech Capacity Reservation with Buyer Competition
David Wu, Iacocca Professor and Chair, Lehigh University, Dept. of Industl & Sys Eng., 200 W. Packer Ave., Bethlehem, PA, 18017, United States, david.wu@lehigh.edu, Murat Erkoc

We consider capacity reservation in a high-tech environment where multiple buyers compete for the supplier's capacity. Depending on how the supplier set the reservation fee, the buyers may enter two distinctly different modes of competition: a fixed-capacity, or a variable-capacity game. We discuss buyer behaviors and optimal strategies under both games. We propose an uplifting contract which coordinate the supply chain by introducing a spot market fee.

■ SD42

Mart-Room I

Modeling and Methodology

Sponsor: Revenue Management & Dynamic Pricing
Sponsored Session

Chair: William L. Cooper, Assistant Professor, University of Minnesota, Department of Mechanical Engineering, 111 Church Street S.E., Minneapolis, MN, 55455, United States, billcoop@me.umn.edu

1 — Internal Transfer Pricing for a Decentralized Operation with a Shared Supplier
Dan Adelman, Associate Professor of Operations Management, University of Chicago, Graduate School of Business, Chicago, IL, 60637, United States, dan.adelman@gsb .uchicago.edu

We consider an operation comprised of multiple autonomous agents that satisfy external stochastic demand using locally managed inventory. Each agent orders replenishments over time from a common internal supplier having a general cost structure, and pays internal transfer prices as a function of order quantity. We consider how to set the internal transfer prices so as to maximize profits.

2 — Toward Robust Revenue Management: A Competitive Analysis of On-Line Booking
Michael Ball, Professor, University of Maryland, R H Smith School of Business, Van Munching Hall, College Park, MD, 20742, United States, MBall@rhsmith.umd.edu, Maurice Queyranne

We develop revenue management policies by viewing the problem from the perspective of online algorithms. This approach eliminates the need for demand

forecasts and a risk neutrality assumption. The policies that emerge from our analysis have worst-case performance guarantees and appear to be appealing from a practical standpoint.

3 — Revenue Management for Parallel Flights with Customer Choice Behavior
Dan Zhang, PhD Candidate, University of Minnesota, Department of Mechanical Engineering, 111 Church Street S.E., Minneapolis, MN, 55455, United States, zdan@me .umn.edu, William L. Cooper

We consider the simultaneous seat inventory control of a set of related (parallel) flights between a common origin and destination with dynamic customer choice among the flights. We derive easily-computable upper and lower bounds for the value function, and propose several heuristics for solving the problem. Numerical examples are given.

4 — Models of the Spiral-Down Effect
William L. Cooper, Assistant Professor, University of Minnesota, Department of Mechanical Engineering, 111 Church Street S.E., Minneapolis, MN, 55455, United States, billcoop@me.umn.edu, Anton Kleywegt, Tito Homem-de-Mello

When determining an airline booking policy, the use of incorrect assumptions can, in certain cases, cause a gradual decrease in protection levels, high-fare ticket sales, and revenues. We discuss analytical models that demonstrate how misapplication of the well-known EMSR formula induces this undesirable spiral-down effect.

■ SD43

Mart-Room J

Optimal Auctions and Mechanism Design

Cluster: Auctions
Invited Session

Chair: Giuseppe Lopomo, Fuqua School of Business, United States, glopomo@mail.duke.edu

Co-Chair: Luca Rigotti, Fuqua Business School, United States, rigotti@duke.edu

1 — Multi-Attribute Auctions
Estelle Cantillon, Harvard Business School, United States, ecantillon@hbs.edu, John Asker

In multi-attribute auctions sellers care about other attributes of the resulting contract than just prices. They can use a scoring rule to allocate the object among bidders and decide on payments and non monetary attributes of the contract. Drawing on the economics literature on multi-dimensional screening, we study the properties of these scoring rules. We prove a revenue equivalence theorem and characterize the properties of the scoring rule that maximizes the seller's expected payoff.

2 — Sequential Auctions with Affiliated Values
Claudio Mezzetti, University of North Carolina, United States, mezzetti@email.unc .edu, Aleksandar Pekec, Ilia Tsetlin

We study uniform and discriminatory sequential auctions. If prices from early rounds are not revealed to the remaining bidders, in the uniform auction revenue is higher when all objects are sold in one round. With discriminatory pricing, selling objects sequentially raises revenues. The more information (winning bids) is revealed from prior rounds, the higher is revenue in both auctions. We also study the optimal number of objects to sell in each round.

3 — Uncertainty in Mechanism Design
Luca Rigotti, Fuqua Business School, United States, rigotti@duke.edu, Giuseppe Lopomo, Chris Shannon

We study mechanism design when agents face Knightian Uncertainty, modelled using incomplete preferences as in Bewley (1986). We show that, under mild restrictions which do not include independence, the English auction is optimal for the seller. Similar results can be obtained in more general settings. This approach aims at providing a theory of robust mechanism design in which simple mechanisms may turn out to be optimal.

■ SD44

Mart-Room K

Joint Session AAS/TSLS: Revenue Issues for Airlines

Sponsor: Aviation Applications; Trans. Science & Logistics
Sponsored Session

Chair: Judy Pastor, Sr. Manager, OR, Continental Airlines, 1600 Smith Street, MailCode HQSRT, Houston, TX, 77002, United States, jpasto@coair.com

1 — Optimal Airline Seat Allocation Using Expected Rev Max (ERM)
Hossein Tavana, Manager, Operations Research, Continental Airlines, 1600 Smith Street, Mail Code HQSRT, Houston, TX, 77002, United States, htavan@coair.com

A probabilistic linear programming formulation is introduced to determine the optimal seat allocation on a flight leg. The initial formulation assumes stochastic and independent demands for fare buckets, but is further extended to the cases with correlated demand. The dual value of one of the constraints provides the expected marginal seat revenue (EMSR-x).

2 — Passenger Dynamics in Near Departure Capacity Changes
Jonathan Drexler, Lead OR Analyst, Continental Airlines, 1600 Smith Street, Mail Code HQSRT, Houston, TX, 77002, United States, jdrexl@coair.com

Demand Driven Dispatch is a growing strategy for swapping aircraft after the crew bids have been finalized. The primary role of this linear optimization system is to recommend intra-fleet swaps, post-crew bid, to the Network group. In this talk, we analyze the expected vs. actual performance of these swaps from which we will gain some insight on the passenger dynamics that occur when we relax/constrain aircraft capacity close to the departure date.

3 — Agent Simulations and Partical Swarm Intelligence for Development of Profitable Airline Schedule
Roger Parker, Chief of Technology, Mkting, Boeing Corporation, Seattle, WA, United States, roger.a.parker@boeing.com

Emerging techniques from complexity theory have shown promise in attacking large-scale network issues. This presentation explores work in the application of a hybrid of two approaches — agent simulations and particle swarm methods—to the problem of developing maximally profitable airline networks. With these methods, we "grow" schedules and they "share their knowledge" to accelerate profitability with each simulation iteration. Results are presented, and opportunities and obstacles discussed.

4 — Dynamic Pricing - A Future Business Model?
Beat Burger, Sales Project Support, Swiss International Air Lines, Ltd., P.O. Box, Zürich Flughafen, ZH, 8056, Switzerland, Beat.Burger@swiss.com

I believe that a heuristic that dynamically charges different fares in relation to the demand, available space and remaining time to departure would partially capture buy-up and buy-down behavior. Such a Dynamic Pricing Model would decide which fare is offered at each point in time before departure.The open fare then effects the purchase probabilities for the remaining seats. Dynamic Pricing Model would simplify revenue management processes and will lead to a new Airline business model.

■ SD45

Mart-Room L

Design of Automated Material Handling Systems in the Semiconductor Factory of the Future

Cluster: Semiconductor Manufacturing
Invited Session

Chair: Douglas Bodner, Research Engineer, Georgia Institute of Technology, School of Industrial & Systems Eng., 765 Ferst Drie, Atlanta, GA, 30332, United States, dbodner@isye.gatech.edu

1 — A Workshop on Building an Icon Based Stochastic Simulation Model of an AMHS for an 8-inch Wafer FAB
Donald W. Collins, Ph.D. & Professor, Arizona State University, 7442 East Tillman Ave., Simulator Building, Mesa, AZ, 85212, United States, donald.collins@asu.edu, Luc D'Arcy Collins

This workshop will demonstrate the construction of an Icon based AMHS Simulation Model, to the participants, using the Extend Simulation Software plus the ACADZ Automated Material Handling System Libraries. The DOE (From-To Tables) were taken from an eight-inch wafer semiconductor FAB. The excel database will be provided for the model has been modified to protect the client. This workshop will concentrate on constructing the Simulation Model and include the ability to make what-if scenarios.

2 — Robust Dynamic Vehicle Routing in AGV Systems
Spyros Reveliotis, Associate Professor, Georgia Tech, School of Industrial & Systems Eng., 765 Ferst Drive, Atlanta, GA, 30332, United States, spyros@isye .gatech.edu, Douglas Bodner

The presented research program seeks to develop a rigorous methodology that will support logically correct and efficient traffic management in contemporary AGV systems, by taking advantage of emerging results in discrete event systems (DES) theory. The developed policies are required to be robust to the system stochasticities, effectively exploiting the alternative vehicle routes, and of polynomial-complexity, so that they are real-time implementable.

3 — Formulating the AMHS Design Problem for the 300mm Fab
Dima Nazzal, Graduate Research Assistant, Georgia Institute of Technology, School of Industrial & Systems, 765 Ferst Dr. NW, Atlanta, GA, 30332-0205, United States, dnazzal@isyc.gatech.edu, Douglas Bodner

Designing automated material handling systems for semiconductor manufacturing involves a variety of requirements, iterative and hierarchical decision-making, and methods for prototyping performance. This paper focuses on the design

problem formulation, including how requirements are characterized. The goal is to formulate the problem in a way that is amenable to application of a scientific design methodology. We also briefly discuss our work to date in developing such a methodology.

4 — Network Design of Multi-Carrier Overhead Material Handling Systems
Yen-Tai Wan, Georgia Tech, School of ISyE, mc 0205, Atlanta, GA, 30332, United States, ytwan@isye.gatech.edu, Leon F. McGinnis, Gunter P. Sharp, Douglas Bodner

We address the flow network design problem of automated multi-carrier overhead material handling technology in a discrete parts manufacturing facility. For applications in a manufacturing facility with limited floor space, e.g. semi-conductor fabrication, overhead technology is favored. The design problem can be modeled as a variation of the fixed-charge capacitated network design problem. Two heuristics are provided for obtaining feasible solutions and computational results are reported.

■ SD46

Mart-Room M

Convexity Analysis and Convexification in Nonlinear Programming

Sponsor: Computing
Sponsored Session

Chair: John Chinneck, Professor, Carleton University, Systems & Computer Engineering, 1125 Colonel By Drive, Ottawa, ON, K1S 5B6, Canada, chinneck@sce.carleton.ca

1 — A Two-Step Procedure for Convexification of Lower Semicontinuous Functions
Nick Sahinidis, Professor, University of Illinois, Dept. of Chemical & Biomolecular Engg., 600 South Mathews Avenue, Urbana, IL, 61801, United States, nikos@uiuc.edu, Mohit Tawarmalani

We have recently proposed a two-step approach to convexification whereby identification of the generating set of convex/convex envelopes is followed by disjunctive techniques to produce the envelopes. We have also developed an exclusion result to help identify the generating set. We demonstrate this convexification strategy on a number of applications.

2 — Analyzing Submissions to the NEOS Server for the Purpose of Recommending Solvers
Robert Fourer, Professor, Northwestern University, Dept of Industrial Eng & Mgmt Sciences, 2145 Sheridan Rd, Evanston, IL, 60208-3119, United States, 4er@iems .northwestern.edu, Dominique Orban

The NEOS Server has made optimization methods widely available over the Internet, but it continues to rely on individual users to select solvers appropriate to their problems. We describe new utilities that can assist in solver selection, by analyzing a submitted problem prior to optimization. A problem analyzer checks properties ranging from size and sparsity to linearity and convexity, then compares the results to a database of solver characteristics to produce a list of recommended solvers.

3 — Function Shape Analysis in MProbe
John Chinneck, Professor, Carleton University, Systems & Computer Engineering, 1125 Colonel By Drive, Ottawa, ON, K1S 5B6, Canada, chinneck@sce.carleton.ca

MProbe is a software tool for analyzing mathematical programs. It uses a sampling approach to estimate the shape (convex, concave, almost concave, etc.) of nonlinear functions of many variables. The estimated shape may vary depending on where the function is sampled, so significant effort is put into tightening the variable bounds prior to analysis. Finally, the information about constraint shapes is assembled into conclusions about the shape of the entire constrained region.

■ SD47

Atlanta G, 7th Floor

Software Demonstration

Cluster: Software Demonstrations
Invited Session

1 — Catalyze Ltd. - A Brief Introduction to Hiview and Equity MCDA Tools
Adrian Stock, Catalyze Ltd., Yew Tree Cottage, Main Road, Colden Common, Winchester SO21 1RR, United Kingdom, adrianstock@catalyze.co.uk

We will quickly describe the basics of Hiview and Equity and then focus on two main areas. Firstly, in Hiview, verbal judgments using MACBETH will demonstrate the ability to create a model without numerical input. Secondly, in Equity, we will show how trade-offs are used for portfolio tuning.

2 — MINITAB, Inc. - MINITAB Release 13 and Quality Companion
Mary McCarty, MINITAB, Inc., 1829 Pine Hall Rd., State College, PA, 16801, United States, mmccarty@minitab.com

We will present a basic introductory demo of MINITAB Release 13 and Minitab Quality Companion. MINITAB is statistical analysis software, whereas the Quality Companion is more of a project management tool. The Quality Companion contains some soft tools like Process Mapping, FMEA, etc . that MINITAB doesn't contain. Quality Companion is a fairly new package that just came out this year.

Monday 8:00am - 9:30am

■ MA01

Westin-Intl. A, 6th Floor

Management Issues in Telecommunications

Sponsor: Telecommunications
Sponsored Session

Chair: Steven Powell, Professor, CIS Department, California State Polytechnic University, Pomona, 3801 West Temple Avenue, Pomona, CA, 91768, United States, srpowell@csupomona.edu

1 — Expanding Internationally: Lessons Learned From The Telecommunications Industry
Steven Powell, Professor, CIS Department, California State Polytechnic University, Pomona, 3801 West Temple Avenue, Pomona, CA, 91768, United States, srpowell@csupomona.edu

International expansion can increase a company's growth and profitability, while decreasing its risk. The strategies to achieve these objectives vary. This paper investigates some of the international expansion strategies used by telecommunications service providers and analyzes their effectiveness.

2 — Economic Impact of Market liberalization on Telecommunications Services
Carlos Navarrete, Associate Professor, CIS Department, California State Polytechnic University, Pomona, 3801 West Temple Avenue, Pomona, CA, 91768, United States, cjnavarrete@csupomona.edu, Hamid Falatoon

Proponents of free enterprise state that liberalization promotes availability and cheaper telecommunication services due to market competition. On the contrary, some governments argue that privatization triggers increases in service cost and loss of industry control. Based on six cases, this paper studies the impact of liberalization on telecommunications services.

3 — VoIP Technology: Management and Applications
Vijay Deokar, Professor, CIS Department, California State Polytechnic University, Pomona, 3801 West Temple Avenue, Pomona, CA, 91768, United States, vdeokar@csupomona.edu

VoIP can become the Internet's "killer application," providing the bridge between the public switched network and the Internet. Since VoIP's cost is a fraction of traditional telephony's, VoIP is especially appealing to large companies migrating to Virtual Private Networks. This paper focuses on VoIP application, QoS, and deployment issues.

4 — CORBA in the Organization: Some Management Issues
Benjamin Khoo, Assistant Professor, CIS Department, California State Polytechnic University, Pomona, 3801 West Temple Avenue, Pomona, CA, 91768, United States, bskhoo@csupomona.edu

Organizational knowledge is often captured in different departments. The distributed and disparate nature of these knowledge systems needs coherent integration of component re-use, which is possible through the Common Object Request Broker Architecture (CORBA) specifications. This paper discusses management issues related to the use of CORBA in the organization.

■ MA02

Westin-Intl. B, 6th Floor

Risk Management and Option Pricing

Cluster: Financial Engineering
Invited Session

Chair: Steven Kou, Associate Professor, Columbia University, Department of IEOR, New York, NY, United States, sk75@columbia.edu

1 — Behavioral Modeling for Healthcare Financing and Investment Decisions for Retirement Planning
Aparna Gupta, Assistant Professor, Rensselaer Polytechnic Institute, 110 8th Street, Troy, NY, 12180, United States, guptaa@rpi.edu, Lepeng Li

Securing to meet the financial needs and planning for the costs of healthcare in the advanced years of life are both important components of retirement planning. We develop an integrated framework for addressing saving, investment and

healthcare financing decisions for retirement planning. An additional objective of the framework is to remove restrictions on the preferences to be normative. This requires the approach to be robust to less well-behaved problem characteristics.

2 — Optimal Bank Capital with Costly Recapitalization
Jussi Keppo, Assistant Professor, University of Michigan, IOE Department, 1205 Beal Avenue, Ann Arbor, MI, 48109, United States, keppo@umich.edu, Samu Peura

We study optimal bank capital holdings in a dynamic setting where the bank has access to external capital, but this access is subject to a fixed cost and a delay. We calibrate the model to data on actual bank returns.

3 — Pricing American Options on Jump-Diffusion Processes
Vadim Linetsky, Northwestern University, Department of IEMS, 2145 Sheridan Rd, Evanston, IL, 60202, United States, linetsky@iems.nwu.edu, Liming Feng

We present a new approach to optimal stopping of jump-diffusion processes based on an application of the Galerkin finite element method to partial integro-differential equations. As an application, we consider pricing of American options in a number of popular jump-diffusion models. Joint work with Liming Feng, Ph.D. student, Northwestern University

4 — Pricing & Design of Employee Stock Options
Ronnie Sircar, Assistant Professor, Princeton University, Dept of Oper Res & Fin Eng, E-Quad, Princeton, NJ, 08544, United States, sircar@princeton.edu, Wei Xiong

We study compensation given to employees by the granting of stock options. Instead of looking at single options in isolation, we consider the the flow of options an employee can expect to receive throughout his/her employment. This includes features such as vesting, possibility of reset if the firm stock value diminishes, suboptimal exercise, and reload potential. The design issue is to optimize over these features the lifetime incentive of the employee per unit cost to the firm.

■ MA03

Westin-Intl. C, 6th Floor

INFORMS Publications

Cluster: INFORMS Publications
Invited Session
Chair: Mirko Janc

1 — Technical Preparation of OR Manuscripts: Dos and Don'ts
Mirko Janc, Publishing Technologist, INFORMS, 901 Elkridge Landing Road, Suite 400, Linthicum, MD, 21090-2909, United States, mirko.janc@informs.org, Patricia Shaffer, Midori Baer-Price

In the era of electronic publishing author-supplied files both for text and figures play a significant role. We discuss a series of common problems that INFORMS encounters in using authors' files in the process of production and composition of its 11 journals. We clarify where and how files are used and present a number of easy hints ("dos and don'ts") that can substantially improve the electronic processing of articles.

■ MA04

Westin-Intl. D, 6th Floor

Panel: Industry and Academic Collaboration

Cluster: Practice Track
Invited Session
Chair: Laurie Dutton, Praxair, Tonawanda, NY, United States, Laurie_Dutton@praxair.com

1 — Roundtable Companies and Universities Join Forces: How We Avoid Disappointment and Share Success
Moderator: Laurie Dutton. Panelists: Russ Labe, Irv Salmeen, William J. Browning, Ranga Nuggehalli

It's not easy but it's possible and even profitable. The INFORMS Roundtable presents members from leading companies who will share their personal experiences related to company/university interactions. Each panelist will illustrate the types of OR/MS focused relationships their company has with academia, how these associations have evolved over the years, and the lessons they have learned along the way. Gather useful tips and guidelines on how to create a win-win relationship between industry and academia.

■ MA05

Westin-Intl. E, 6th Floor

Diffusion Models of Stochastic Networks

Sponsor: Applied Probability
Sponsored Session
Chair: Otis B. Jennings, Assistant Professor, Duke University, The Fuqua School of Business, Duke University, Durham, NC, 27708-0120, United States, otisj@duke.edu

1 — Optimal Leadtime Differentiation in Assemble-to-Order Systems via Diffusion Approximations
Amy Ward, Georgia Tech, United States, amy@isye.gatech.edu, Erica Plambeck

Consider a system in which two classes of customers, having different delay tolerances, arrive to purchase (possibly distinct) finished products that can be rapidly assembled from one base component. We show how to maximize average profit by using dynamic priority scheduling policies that exploit this customer delay tolerance differentiation.

2 — On the Asymptotic Optimality of Proportional Fair and other Gradient Based Scheduling Algorithms
Alexander Stolyar, Bell Labs Lucent Technologies, Rm. 2C-322, 600 Mountain Av., Murray Hill, NJ, 07974-0636, United States, stolyar@research.bell-labs.com

We consider the model where N users are served in discrete time by a 'switch.' The switch 'state' is random and it determines the set of possible service rate choices (scheduling decisions). We seek a scheduling strategy maximizing a concave utility function H(u_1,...,u_N), where u_n are average service rates of the users, assuming users always have data to be served. We prove asymptotic optimality of the Gradient scheduling algorithm (generalizing Proportional Fair algorithm).

3 — A Heavy Traffic Limit Theorem for Tandem Polling Stations
Otis B. Jennings, Assistant Professor, Duke University, The Fuqua School of Business, Duke University, Durham, NC, 27708-0120, United States, otisj@duke.edu

Consider a critically loaded, tandem network of N unique polling stations. Each station operates under exhaustive service. As is usually the case, the heavy traffic limit of the N-dimensional total workload process is a regulated N-dimensional Brownian motion. However, the reflective boundary for the k-th dimension is a non-trivial function of dimensions one through k-1; that is, the process does not live in a cone. Oscillating fluid trajectories reveal the form of the reflective surface.

4 — Heavy Traffic Analysis of Open Processing Networks with Complete Resource Pooling: Asymptotic Optimality of Discrete Review Policies
Baris Ata, Stanford University, Graduate School of Business, Stanford, CA, 94305-5015, United States, bata@stanford.edu, Sunil Kumar

We consider a class of stochastic networks which satisfy the so-called complete resource pooling assumption, and therefore has one dimensional approximating Brownian control problems. We propose a simple discrete review policy for controlling such networks and prove its asymptotic optimality under mild assumptions.

■ MA06

Westin-Intl. F, 6th Floor

Mathematical Models for Musical Design I

Cluster: OR in the Arts: Applications in Music
Invited Session
Chair: Thomas Noll, Technical University of Berlin, Sekr. FR 6-10, Franklinstr. 28/29, Berlin, D-10587, Germany, noll@cs.tu-berlin.de

1 — The Grammar of Musical Chord Sequences
Mark Steedman, Professor, University of Edinburgh, 2 Buccleuch Place, Edinburgh, EH8 9LW, United Kingdom, steedman@informatics.ed.ac.uk

The paper shows that chord sequences of the kind that form the harmonic backbone of western tonal music can be characterized by a syntax and semantics of a kind that is standard in natural language. The harmonic semantics is model-theoretic and compositional. The syntax is of low ("mildly context sensitive") expressive power (although it is highly ambiguous), allowing standard polynomial parsing algorithms and techniques of statistical modeling to be applied.

2 — Slicing It All Ways: Mathematical Models for Tonal Segmentation
Elaine Chew, Assistant Professor, University of Southern California, 3715 McClintock Avenue GER 240 MC:0193, Los Angeles, CA, 90089-0193, United States, echew@usc.edu

Tonal music consists of organized sounds that form vertical (synchronous) and

horizontal (sequential) structures. Segmentation by tonality is an important precursor to proper labeling of these components for analysis and characterization. The Spiral Array model (Chew, 2000) clusters tonally important entities and allows tonal contexts to be determined computationally. We illustrate by separating bi-tonal compositions, determining key changes and characterizing tonal patterns.

3 — Experiments with Lerdahl's Tonal Pitch Space Model
Thomas Noll, Technical University of Berlin, Sekr. FR 6-10, Franklinstr. 28/29, Berlin, D-10587, Germany, noll@cs.tu-berlin.de

Fred Lerdahl's (2000) harmonic configuration space consists of 24 major and minor regions and chords within these regions. Harmonic pathways are calculated with respect to a principle of shortest path. The underlying distance combines a weakened hierarchical model and a shortest path principle in a mathematically problematic way. Therefore we experimentally compare two versions of this space: Lerdahl's original one, which does not satisfy the triangle inequality and a proper metric one.

■ MA07

Westin-Intl. G, 6th Floor

Market Design II

Sponsor: Energy, Natural Resources and the Environment
Sponsored Session

Chair: Hung-po Chao, EPRI, 3412 Hillview Avenue, Palo Alto, CA, United States, hchao@epri.com

1 — A Stochastic Game Model for Power Markets with Multi-Settlement and Transmission Rights
Jun Li, PhD Candidate, University of South Florida, Department of Industrial & Mgmt systems, 4202 E. Fowler Av. ENB118, Tampa, FL, 33620, United States, jli7@eng.usf .edu, Tapas K. Das, Sanket Gupta

A stochastic game theoretic approach for modeling deregulated power markets is presented. Market features considered are multi-settlement (bilateral, day ahead, and spot markets), transmission rights and demand elasticity. The model objective is to aid market designers in assessing performances of various design alternatives including market rules. A machine learning based computational approach is used which is tested on sample power networks.

2 — Agent-Based Simulation of Electricity Market Designs
Robert Entriken, Manager Policy Analysis, EPRI, 3412 Hillview Avenue, Palo Alto, CA, 94304, United States, rentrike@epri.com, Steve Wan

We describe experiments with computer-based agents to simulate aspects of the California ISO's new market design. These agents play the role of market participants by formulating bids to maximize their profits. They exercise their skills to maximize their individual profits under a number of scenarios. The results of these experiments reveal that this form of simulation can be a valuable tool for gaining insights into market design changes before they are implemented.

3 — Transaction Costs Across Electricity Markets: Does Restructuring Help or Hurt?
James Reitzes, Senior Economist & Principal, The Brattle Group, 1133 20th Street, NW, Suite 800, Washington, DC, 20036, United States, james.reitzes@brattle.com, Andrew Kleit

FERC's restructuring policy was intended to lessen trade barriers between electricity producing regions. This paper examines how inter-regional electricity trading costs in the eastern US were affected by ISO formation and increased use of market-based pricing. Our analysis uses maximum-likelihood estimation to distinguish among autarky, transmission-constrained trade, and unconstrained trade.

■ MA08

Westin-Intl. H, 6th Floor

Joint Session Simulation/QSR: Rare Event Simulation Techniques

Sponsors: Simulation; Quality, Statistics and Reliability
Sponsored Session

Chair: Bruce Shultes, Assistant Professor, University of Cincinnati, PO Box 210072, Cincinnati, OH, 45221-0072, United States, bruce.shultes@uc.edu

1 — Importance Sampling and Control Variates for Extreme Quantile Estimation
Paritosh Desai, Management Science and Engineering, Stanford University, Stanford, CA, 94305-4026, United States, paritosh.desai@stanfordalumni.org, Roberto Szechtman

We develop a new approach for the Monte Carlo estimation of extreme quantiles using control variates with importance sampling. Using large deviations ideas, we propose an adaptive algorithm for the calculation of the parameters of a twisted version of the control variable. Convergence of the proposed estimator is discussed.

2 — Rare Event Simulation and Perfect Sampling for Infinite Horizon Discounted Rewards
Jose Blanchet, Management Science and Engineering, Stanford University, Stanford, CA, 94305-4026, United States, jblanche@stanford.edu, Peter Glynn

Infinite horizon discounted rewards arise in risk theory, life insurance, finance, and time series analysis. We show (surprisingly) that these objects can frequently be exactly generated in finite time despite the presence of the infinite horizon nature. We also describe the efficient computation of "rare event" tail probabilities when the discount rate is close to zero - a setting that often arises in applications.

3 — Adaptive Importance Sampling Technique for Markov Chains Using Stochastic Approximation
Sandeep Juneja, Academic Member, School of Technology and Computer Science, Tata Institute of Fundamental Research, Homi Bhabha Road, Colaba, Mumbai, MH, 400005, India, juneja@tifr.res.in, Vivek Borkar, Imthias Ahamed

An adaptive importance sampling technique is developed for a DTMC with one step transition costs for estimating the expected total cost till termination. This updates the change of measure at every transition using constant step-size stochastic approximation and concentrates asymptotically in a neighbourhood of the desired zero variance estimator. Through simulation experiments on Markovian queues we observe that this technique performs very well in estimating rare events.

■ MA09

Westin-Vinings 1, 6th Floor

INFORMS 2003 Annual Case Competition - Presentations of Finalists 1&2

Sponsor: Education (INFORM-ED)
Sponsored Session

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

1 — Presentations of Finalists 1&2

During this special open session, the first two of the four finalists in INFORMS 2nd Annual Case Competition will deliver 30-minute presentations of their entries before a panel of judges . The judges will select the winning entry from the cases presented during this session and the following session.

■ MA10

Westin-Vinings 2, 6th Floor

Public Programs

Contributed Session

Chair: Robert Dyson, Professor, University of Warwick, Warwick Business School, Coventry, WM, CV4 7AL, United Kingdom, R.G.Dyson@warwick.ac.uk

1 — Kentucky Voter Redistricting Problem
Susan Norman, Assistant Professor, Northern Arizona University, PO Box 15066, Flagstaff, AZ, 86011, United States, Susan.Norman@nau.edu, Jeff Camm

The goal of the voter-redistricting problem is to partition a state into districts so that the districts have equal populations, are contiguous and compact. We focus on this problem as defined in the state of Kentucky after the 1990 census. The goal is to minimize the number of times that the counties must be divided subject to equal population districts, district contiguity, and district compactness. Computational experience and alternative models will be discussed.

2 — OR, Warwick and the Community
Robert Dyson, Professor, University of Warwick, Warwick Business School, Coventry, WM, CV4 7AL, United Kingdom, R.G.Dyson@warwick.ac.uk

Coventry City Council has identified thirty one priority neighbourhoods as a focus for neighbourhood renewal activity. Four of these are close to the University of Warwick, UK. The talk describes a project concerned with how the University can employ its skills, facilities, students and employees to support the community. The project involved exploring approaches to community involvement and support as employed by the community OR and Business in the Community movements.

■ MA11

Westin-Augusta 1, 7th Floor

Tutorial: Looking for a Job? Sounds Like an OR Problem — The Workshop

Cluster: Tutorials
Invited Session

1 — Looking for a Job? Sounds Like an OR Problem — The Workshop
Richard Hewitt, Ph.D, Founder, High Impact Career Products, 748 Locust Street, Denver, CO, 80220, United States, hewitt17@msn.com, Scott Ferguson

Most people have never been shown how to run an effective job search campaign. Consequently, they follow the herd and wonder why they can't differentiate themselves from the masses. 9.4 million Americans are unemployed and 100% of them are sending resumes, networking, and responding to job ads. It worked in the past, but it's not working now. In this workshop you'll learn why the old methods aren't working now. You'll learn the 9-steps of an effective job search and how to apply those steps to land a new job and move up in your company. You'll also learn how you can apply the 9-steps to market the skills of your OR group . Have you ever applied for a job and thought you were a perfect fit? Most people believe they get hired because they have the right skills, the right experience, and the right attitude. We debunk that myth. This 9-step process was developed by Richard Hewitt, Ph.D., an OR practitioner, who through job assignments in HR and recruiting, and being on the receiving end of several downsizings, learned firsthand what goes on behind the employment curtain. As a result of these experiences, Hewitt developed High Impact Job Search™, a software-based system to get hired, stay employed, and move up in a company. Hewitt used an earlier version of this 9-step process to secure millions of dollars of OR project work for the OR group of a regional phone company. Hewitt will be leading the workshop along with former military intelligence officer Scott Ferguson. Ferguson, a veteran corporate learning director, has a wealth of HR experience focused on adult learning, and curriculum development and delivery. Ferguson has developed and delivered mission critical training materials for the US Marine Corps.

■ MA12

Westin-Augusta 2, 7th Floor

Worker Cross-training in Production and Service Systems

Cluster: Workforce Flexibility and Agility
Invited Session

Chair: Eylem Tekin, Assistant Professor, University of North Carolina-Chapel Hill, Department of Operations Research, Chapel Hill, NC, 27599, United States, eylem@unc.edu

1 — Design and Control of Cellular Production Systems with Automation
Biying Shou, PhD Student, Northwestern University, United States, b-shou@northwestern.edu, Seyed Iravani, Wallace Hopp

This paper investigates the design and control issues of production lines with automatic equipments and agile (cross-trained) worker. In particular, we study a three-station CONWIP line with a mixture of manual and automated machines and one cross-trained worker. Via MDP models, we characterize the structure of the optimal worker-allocation policy. Then we evaluate the position and concentration of the automation and the performance of CONWIP vs. push strategy.

2 — Throughput Maximization for Tandem Lines with Dedicated and Shared Servers
Hayriye Ayhan, Georgia Institute of Technology, School of Industrial and Systems Eng., 765 Ferst Drive, Atlanta, GA, 30332-0205, United States, hayhan@isye.gatech .edu, Sigrun Andradottir, Douglas Down

We consider a tandem queueing network with two stations and three servers. There is an infinite supply of jobs in front of station 1, infinite room for completed jobs after station 2 and the size of the buffer between stations 1 and 2 can be either finite or infinite. We study the dynamic allocation of servers to the stations in order to maximize the long-run average throughput under the constraint that both stations have one dedicated server and the third server is a shared server.

3 — Cross-Training and Distributed Routing in Services
Robert Shumsky, Associate Professor, University of Rochester, Carol Simon Hall 3-349, William E. Simon Graduate School of Busi, Rochester, NY, 14627, United States, SHUMSKY@simon.rochester.edu, Pranab Majumder

We consider a firm that provides customized goods or services and employs workers with heterogeneous skills. We examine systems in which employees decide upon each job's routing, given the job's attributes, the employees' own skills, and incentives offered by the firm. We consider the design of such decentralized systems as well as their relative advantages and disadvantages when compared with centralized systems.

■ MA13

Westin-Augusta 3, 7th Floor

Direct Marketing

Sponsor: Marketing Science
Sponsored Session

Chair: Chaim Ehrman, United States, cehrman@wpo.it.luc.edu

1 — Customer Satisfaction and Benefit Information Presentation Strategy
Nenad Jukic, Loyola University Chicago, United States, njukic@wpo.it.luc.edu, Boris Jukic, Laurie Memaber

Polyinstantiation is a term that originated in the area of database security and it describes an occurrence of multiple versions of a record (representing a piece of information) in one table. We investigate how this approach can be used as a direct marketing strategy by enhancing customers' perception of the unique benefits of their (explicit or implicit) membership in a particular consumer constituency by the use of the polyinstantiation - based approach to data presentation. Our hypothesis is that rewarded customers will have stronger awareness of the benefits of their special customer status if explicitly exposed, through the use of polyinstantiated information, to the their level of benefits relative to the benefits of others.

2 — Patterns of Repeat-Buying in Direct Marketing
Richard Colombo, Fordham University, 113 W 60 Street, New York, NY, 10023, United States, richard.colombo@verizon.net

When customers purchase a frequently bought packaged good (fpcg) such as detergent, instant coffee, soda or a candy bar, it is the customer who determines the timing of the purchase (influenced, of course, by advertising, coupons, price reductions, etc.) In direct marketing, customers respond to offers whose timing is determined by the marketer. Does this difference, as well as other differences, result in patterns of repeat buying that are dissimilar in the two contexts? This paper compares and contrasts repeat buying behaviour for fpcg's and direct marketing.

3 — Measure for Measure: Difficulties in Capturing Americans' Changing Attitudes to Shopping Channels in the Face of Terrorism
Marcia Flicker, Assoc. Prof. of Marketing, Fordham Business of Fordham University, 113 West 60 Street, New York, NY, 10023, United States, flicker@fordham.edu, Meryl P. Gardner

In the face of mall-based crime in the early 1990s, direct marketers promoted the advantages of shopping in the safety of one's home. Five waves of research by the authors since September 11, 2001, attempted to determine whether consumers would perceive a difference in the safety of three different channels of distribution (catalogs, the Internet, stores) in the face of terrorism and crime, only to find that the short-term nature of any reaction, as well as age, geographic and situational influences, made the measurement task extremely difficult. The study presented here investigates the measurement errors surrounding this issue, as well as the factors that affect the magnitude of these errors.

■ MA14

Westin-Peachtree A, 8th Floor

Coordinating NPD and Technology Supply Chains

Cluster: New Product Development
Invited Session

Chair: Edward Anderson, Assistant Professor, University of Texas at Austin, 1 University Station, Austin, TX, United States, edward.anderson@bus.utexas.edu

1 — Opening Proprietary Code
Geoffrey Parker, Assistant Professor, Tulane University/Freeman School of Business, New Orleans, LA, 70118, United States, geoffrey.parker@tulane.edu, Marshall Van Alstyne

We articulate a balance of incentives and openness to promote the creation of new information products. We show that environmental parameters such as the size of the market, the value of the code base, and network effects can affect the optimal choice of time to release and degree of openness.

2 — Impact of Alternative Selection Policies on Product Devlopment Project Value
David Ford, Assistant Professor, Texas A&M University, Civil Engineering Dept., College Stations, TX, 77843-3136, United States, DavidFord@tamu.edu, Durward Sobek II

Effectively and efficiently policies for converging on a final product design are investigated with a dynamic model of system development at Toyota. Generic alternative descriptions are developed and used to describe alternative spaces, initial alternative consideration sets, and design convergence speeds and strategies. Results suggest how product development managers may improve alternative selection and management

3 — Design Integration: Who Should Go Back and Redo Their Work?
Jovan Grahovac, Assistant Professor, Tulane University/ Freeman School of Business, New Orleans, LA, 70118, United States, Jovan.Grahovac@tulane.edu, Thomas Roemer

We view new product development as an iterative process in which the overall task is partitioned and subsequent individual efforts of team members are integrated. We analyze various decision rules that can be used in deciding which individual tasks, if any, should be redefined and retried in order to perform another design iteration.

4 — Preliminary Results from an Empirical Analysis of Outsourced Product Design Across Firm Boundaries
Edward Anderson, Assistant Professor, University of Texas at Austin, 1 University Station, Austin, TX, United States, edward.anderson@bus.utexas.edu, Alison Davis-Blake, Geoffrey Parker

We present preliminary hypotheses and evidence from a survey studying how firms outsource portions of their core product development process in environments characterized by rapid technological and market change. In particular, we discuss the role of supply chain integrators whose job is to maintain product coherence across firm boundaries.

■ MA15

Westin-Peachtree F, 8th Floor

Managing the R&D Process

Sponsor: Technology Management
Sponsored Session

Chair: Melissa Appleyard, Ames Professor in the Management of Innovation and Technology, Portland State University, School of Business Administration, P.O. Box 751, Portland, OR, 97207, United States, appleyard@virginia.edu

1 — The Influence of Risk Perspectives on Project Teams
Lynne Cooper, Jet Propulsion Laboratory, 4800 Oak Grove Drive, MS 303-310, Pasadena, CA, 91109, United States, lynne.p.cooper@jpl.nasa.gov

Risk is an intrinsic part of the ambitious work pursued by project teams. There are, however, multiple ways of defining risk. This research proposes the concept of "risk perspectives" — an orientation toward risk that influences how a person conceives of, communicates about, and makes decisions concerning risk. It identifies three perspectives with the potential to influence project teams: financial, societal, and technical, and presents propositions for how they may influence project teams.

2 — Integrating Game-Theoretic and Real Options Analysis in Strategic Decision-Making
Nile Hatch, BYU, Marriott School, 790 TNRB, Provo, UT, 84602, United States, nile@byu.edu, Douglas Johnson

Game theory and real option analysis represent two complementary, yet distinct, approaches to understanding the strategic behavior of firms in R&D investments. This paper develops an analytical approach that integrates game theory and real options and then applies our approach to the decision facing Airbus and Boeing in investing in the emerging superjumbo jet segment of the aircraft industry. This application illustrates how managers can practically implement this approach to R&D investments.

3 — Design Iterations and Transaction Cost Accrual: Evidence from Distributed Software Development
Paulo Gomes, Assistant Professor, Universidade Nova de Lisboa, Rua Marquês da Fronteira, 20, 1099, Lisbon, PT, Portugal, pgomes@fe.unl.pt, Nitin Joglekar

We present a Design Structure Matrix (DSM) and associated transaction cost data to study the relationship between task dependencies and the amount of coordination effort, i.e., the amount of hours spent managing the development tasks. We deploy these data to observe modularity at two distinct sets of interfaces across a software development project: internal and external. Observed modularity is used to develop tests for the relation between uncertainty and accrual of coordination costs.

4 — Insights on Predicting the Productivity of Project Managers in Service Operations
Tonya Boone, College of William & Mary, School of Business, Williamsburg, VA, 23185, United States, tonya.boone@business.wm.edu, Ram Ganeshan

Making efficient resource-allocation decisions, especially with respect to professional knowledge workers, has long been a critical issue with service organizations. Using fifteen years of data collected on projects with varying complexity completed by managers with a wide range experience, this talk attempts to provide insights on how the productivity of project managers (and/or the organizations they are in) can be accurately measured.

■ MA16

Westin-Peachtree G, 9th Floor

Scheduling and Logistics in Health Care

Sponsor: Health Applications
Sponsored Session

Chair: Anne Davey, Northeastern State University, 700 N Grand Ave, Tahlequah, OK, 74464, United States, davey@nsuok.edu

1 — Scheduling Logistic Activities to Improve Hospital Supply Systems
Sophie Lapierre, Professor, Ecole Polytechnique, Mathematics and Industrial Engineering, C.P. 6079, succ. CV, Montreal, QC, H3A 3A7, Canada, Sophie .Lapierre@polymtl.ca, Angel Ruiz

This paper presents an innovative approach for improving hospital logistics by coordinating procurement and distribution operations while respecting inventory capacities. Our approach, which puts the emphasis on the scheduling decisions, requires the elaboration of coordinated schedules that balance the activities through the purchasing cycle. We developed a tabu search metaheuristic and tested it on a real case: our tests show that we can generate efficient and well balanced supply schedules.

2 — The Impact of Nurse-to-Patient Ratio Legislation on Nurse Staffing and Scheduling
Murray J. Côté, Assistant Professor, University of Florida, Dept. of Health Services Administration, Gainesville, FL, 32610-0195, United States, mjcote@ufl.edu, P. Daniel Wright, Kurt Bretthauer

An ongoing challenge of daily hospital operations is determining appropriate nurse staffing and scheduling. The current nursing shortage in the U.S. exacerbates this challenge. Through an integrative modeling approach to workforce management, we examine the impact of recent state legislation on nurse-to-patient ratios on nursing workforce management decisions.

3 — Using an ILP Model in a Simulation Decision Support System
Martha Centeno, Associate Professor, Florida International University, 10555 W. Flagler St, Miami, Fl, 33174, United States, centeno@fiu.edu, Abdullah M. Ismail

Healthcare facilities have been under medical pressure to control cost: One element that affects cost significantly is staff. We present a heuristic for Emergency Departments staff scheduling. It integrates a simulation model and an integer linear program (ILP). The simulation model established the staffing requirements for each period, and the ILP produces a calendar schedule for the staff. The two models are fully integrated, under a Visual Basic interface that allows a non expert user of the heuristic to interact with it on a repetitive planning basis.

■ MA17

Westin-Peachtree H, 9th Floor

Methods for Designing Vaccination Strategies

Cluster: Operations Research for Medical Applications
Invited Session

Chair: Eva Lee, Assistant Professor, Georgia Institute of Technology, School of Industrial and, Systems Engineering, Atlanta, GA, 30332-0205, United States, eva.lee@isye.gatech.edu

1 — Preventing Second Generation Infections in a Smallpox Bioterror Attack
Edward Kaplan, Professor, Yale School of Management Department of Epidemiology and Public Health, Yale University, Box 208200, New Haven,, CT, 06520-8200, United States, edward.kaplan@yale.edu

In the event of a smallpox bioterror attack, the first infections that can be prevented are those transmitted from the initial attack victims to their contacts. From the perspective of a contact of someone unknowingly infected in an attack, vaccination is equivalent to reducing the index's duration of infectiousness. We develop a reasonably general probability model that reports the percentage of second generation infections that can be prevented under alternative vaccination strategies.

2 — The Prioritized Vaccination Approach for Smallpox
Moshe Kress, Professor, Naval Postgraduate School, Operations Research Department, Monterey, CA, 93943, United States, mkress@nps.navy.mil

We present a dynamic difference-equations model that expands and generalizes previous vaccination models. It is shown that while mass vaccination is more effective than trace vaccination in most of the realistic scenarios, a third policy — prioritized vaccination — is significantly more effective than both policies.

3 — Optimizing the Choice of Influenza Vaccines
Joe Wu, Los Alamos National Laboratory, MS K710, Los Alamos National Laboratory, Los Alamos, NM, 87545, United States, tkwu@mit.edu, Lawrence M. Wein, Alan Perelson

The WHO makes annual influenza vaccine strains recommendation to countries around the globe. Recent results from theoretical immunology suggest that vaccine efficacy can be enhanced by taking into account the immunization history of vaccinees. In this work, we formulate the vaccine selection problem as a stochastic dynamic program. We discuss the techniques for solving this dynamic program, and compare the performance of various vaccine selection policies within the context of our model.

4 — Maxi-Vac: A Online Tool for Large-scale Smallpox Vaccination Clinic Design
Jacquelyn Mason, Ph.D., CDC/NCEH/EEHS, 4770 Buford Hwy. NE F30, Atlanta, GA, 30341-3717, United States, zao4@cdc.gov, Michael Washington, Martin Meltzer, Ph.D.

We created a tool (Maxi-Vac, Version 1.0) based on a simulation model that was created to optimally allocate staff in a smallpox vaccination clinic. Maxi-Vac and its accompanying manual are available on the Centers for Disease Control and Prevention web site: http://www.bt.cdc .gov/agent/smallpox/vaccination/maxi-vac/index.asp. Based on user-selected inputs, Maxi-Vac provides users with estimates of numbers of people that can be vaccinated, staff utilizations, and patient time spent at each station. Maxi-Vac may be helpful to smaller health departments with little or no experience in mass vaccinations.

■ MA18

Westin-Tower 1201, 12th Floor

Recent Advances in Statistical Process Control (I)

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: Fugee Tsung, Associate Professor, Hong Kong University of Science & Technology, IEEM, HKUST, Kowloon, 852, Hong Kong, season@ust.hk

1 — Multistage Process Control and Monitoring
Fugee Tsung, Associate Professor, Hong Kong University of Science & Technology, IEEM, HKUST, Kowloon, 852, Hong Kong, season@ust.hk

As quality and Six Sigma excellence has become a decisive factor in global market competition, statistical process control techniques are becoming popular in industries. 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 SPC methods. This talk will discuss several technical challenges in this area and present some recent extensions.

2 — Process Monitoring in Detecting Mean Shift for Multiple Stage Processes
Duangporn Jearkpaporn, Arizona State University, Industrial Engineering Dept, PO Box 875906, Tempe, AZ, 85287-5906, United States, duang@asu.edu, George Runger, Douglas Montgomery, Connie Borror

This paper develops a monitoring scheme for detecting a mean shift of a multi-stage process for a mixture of normally and non-normally distributed responses. The procedure is based on a deviance residual obtained from a generalized linear model (GLM). The advantages over use of control chart based on individual observations and T2 chart are provided and illustrated by a simulation study. A possibility of modeling the process variation for multistage processes based on GLM is also discussed.

3 — Process Control Under Regulatory Process Variables and Product Performance Characteristics
Amit Mitra, Associate Dean & Professor, Auburn University, College of Business, Suite 516, Auburn, AL, 36849-5240, United States, mitra@business.auburn.edu

In most processes, for certain process variables desirable operational levels may be indentifiable and thereby regulated. However, variation due to unknown factors also influences the output product performance characteristics. Here, we identify the impact of the two sources of variability and propose a scheme to analyze out-of-control conditions.

4 — Adaptive Improvement of Statistical Control Chart Design
Richard Marcellus, Northern Illinois University, Engineering Building 240, Industrial Engineering Department, DeKalb, IL, 60115, United States, marcelus@ceet .niu.edu

The economic consequences of control chart policies are difficult to clarify without experience with the production process and its interaction with control charting. This paper proposes that information about economic factors be collected during the operation of the process. This will enable managers to progressively adapt their policies to achieve more desirable economic tradeoffs.

■ MA19

Westin-Tower 1202, 12th Floor

Recent Advances in Multi-Response Systems

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: Kwang-Jae Kim, Associate Professor, Pohang University of Science and Technology (POSTECH), Division of Mechanical & Industrial Eng., San 31, Hyoja-dong, Nam-gu, Pohang, 790-784, South Korea, kjk@postech.ac.kr

1 — A Goal Attainment Approach to Multiresponse Systems Optimization
Kai Xu, Research Fellow, National University of Singapore, Department of Industrial and Systems, Engineering Drive 2, 117576, Singapore, kaixu@nus.edu.sg, Dennis Lin, L C Tang, M Xie

A goal attainment approach to optimize multiresponse systems is presented. This approach aims to identify the settings of control factors to minimize the overall weighted maximal distance measure with respect to individual response targets. Based on a nonlinear programming technique, sequential quadratic programming (SQP) algorithm, the method is proved to be robust and can achieve good performance for multi-response optimization problems with multiple conflicting goals.

2 — A Utility Function Approach to Multi-response Optimization Problems
Rassoul Noorossana, Associate Professor, Iran University of Science and Technology, Industrial Engineering Department, Tehran, 16844, Iran, rassoul@iust.ac.ir

The performance of a manufactured product is usually evaluated by several interrelated quality characteristics. Process optimization with respect to any single response will not necessarily lead to optimization of the remaining responses. In this paper, we provide a methodology to help decision maker to systematically arrive at an appropriate utility function while considering the interrelationship among responses.

3 — Ridge Analysis for Multi-response Surfaces
Dennis Lin, Professor, Pennsylvania State University, University Park, PA, United States, lin@net04pc234.smeal.psu.edu

Ridge analysis in response surface methodology has received extensive discussion in the literature and has became a useful tool for the practitioners to explore optimal experiment settings. Little is known for ridge analysis in the multire-sponse case, however. In this paper, ridge path is investigated for the multi-response surface based on a desirability function approach. Large sample simultaneous confidence intervals for the ridge path are developed.

4 — Assessing the Relative Weights of Bias and Variance in Dual Response Surface Problem
In-Jun Jeong, Ph.D. candidate, POSTECH, South Korea, mrking@postech.ac.kr, Kwang-Jae Kim, Soo Y. Chang

Mean squared error (MSE) is an effective criterion to combine the mean and the standard deviation responses in the dual response surface approach. MSE is the sum of bias and variance, which need to be weighted under certain circumstances. This paper proposes a novel method to assess the relative weights of bias and variance in MSE. The proposed method utilizes the concept of an efficient frontier in the bias-variance space for the weight assessment.

■ MA20

Westin-Tower 1203, 12th Floor

Joint Session QSR/Simulation: Statistical Methods for Simulation Experiments

Sponsors: Quality, Statistics and Reliability; Simulation
Sponsored Session

Chair: Bruce Ankenman, Associate Professor, Northwestern University, Dept. of Ind. Eng., 2145 Sheridan Rd., Evanston, IL, 60208, United States, ankenman@northwestern.edu

1 — Controlled Sequential Bifurcation
Hong Wan, Graduate Student, Northwestern University, Dept. of Ind. Eng., 2145 Sheridan Rd., Evanston, IL, 60208, United States, hwa633@hecky.acns.nwu.edu, Bruce Ankenman, Barry Nelson

Sequential bifurcation (SB) is a method for factor screening. The existing SB method cannot control the overall error level of the procedure. We propose Controlled Sequential Bifurcation, a new method which utilizes two-stage testing at each step to control type I error and power. Some experimental results are demonstrated.

2 — Simultaneous Perturbation Stochastic Approximation Using Deterministic Perturbation Sequences
Michael Fu, Professor, University of Maryland, Smith School of Business, Van Munching Hall, College Park, MD, 20742, United States, mfu@rhsmith.umd.edu, Shalabh Bhatnagar, Steven Marcus

We consider deterministic sequences of perturbations for two-timescale simultaneous perturbation stochastic approximation (SPSA) algorithms. Two constructions for the perturbation sequences are considered: complete lexicographical cycles and much shorter sequences based on normalized Hadamard matrices. Numerical experiments performed on queueing systems indicate significant improvements over the corresponding randomized algorithms.

3 — Efficient Generation of Cycle Time-Throughput (CT-TH) Curves through Simulation and Metamodeling
Feng Yang, Graduate Student, Northwestern University, Dept. Of Ind. Eng., 2145 Sheridan Rd., Evanston, IL, 60208, United States, fya287@lulu.it.northwestern.edu, Bruce Ankenman, Barry Nelson

We discuss the fitting of metamodels for cycle time-throughput curves from simulation models of semiconductor manufacturing facilities. We focus on a model family that is appropriate for the mean, the variance, and higher moments of the CT-TH curve. These metamodels together allow for quick evaluation of (what if" production scenarios.

4 — Variance-based Sampling for the Simulation of Cycle Time-Throughput Curves
Sonia Leach, Graduate Student, Arizona State University, Department of Industrial Engineering, P. O. Box 875906, Tempe, AZ, 85287-5906, United States, sonia .leach@asu.edu, John Fowler, Gerald Mackulak

Generating cycle time-throughput curves requires simulation at several throughput values. Equal sampling at these values will likely result in widely varying confidence intervals along the simulated curve. Expending a percentage of total effort as a function of cycle time variance at each throughput value results in more consistent confidence intervals.

■ MA21

Westin-Tower 1204, 12th Floor

Capital Budgeting and Planning: Applications and Technology

Sponsor: Computing
Sponsored Session

Chair: Harlan Crowder, Principal, Dieselbrain Partners, 897 Humewick Way, Sunnyvale, CA, 94087, United States, hpc@acm .org

1 — Applying Capital Budgeting within a Corporate Setting
Karla Hofffman, George Mason University, Mail Stop 4A6, 4400 University Drive, Fairfax, VA, 20124, United States, khoffman@gmu.edu

Most corporations still use a winnowing process for determining future budgets. This process results in many projects being bundled together to create a few very large packages for management to review. We describe a successful re-engineering of the capital budgeting process for a fortune 100 company. We describe how this process altered the way in which all involved approached issues of timing, scaling, risk, interdependence and the consequences of altering various constraints.

2 — Optimization Models for Military Capital Planning
Robert Dell, Associate Professor, Operations Research Department, Naval Postgraduate School, Monterey, CA, 93943, United States, dell@nps.navy.mil, Alexandra Newman, Gerald Brown

The United States military carefully plans and justifies its materiel procurements. Mathematical optimization has long played a key role in unraveling the complexities of such capital planning, and the U.S. military has lead the development and use of such models. We present optimization models for Air Force, Army, and Navy capital planning with emphasis on ways to render these models more useful for real-world decision support.

3 — Combining Judgment and Data to Optimize Healthcare Enterprise Capital Budgeting
Don Kleinmuntz, Professor, U of Illinois Urbana-Champaign, Dept of Bus Admin, 1206 S Sixth St, Champaign, IL, 61820, United States, dnk@uiuc.edu, Catherine Kleinmuntz

We have used multiobjective decision analysis and optimization to prioritize capital expenditures in over 400 healthcare organizations. Critical issues in successful implementation include: combining financial with qualitative/strategic criteria; using information technology to support the evaluation process; making modeling choices to limit complexity without unduly compromising quality; and getting senior management actively involved in the process.

■ MA22

Westin-Tower 1205, 12th Floor

Advances in Decision Analysis

Sponsor: Decision Analysis
Sponsored Session

Chair: Jayavel Sounderpandian, Professor, University of Wisconsin-Parkside, 900 Wood Road, Kenosha, WI, 53141-2000, United States, Sounderp@uwp.edu

Co-Chair: L. Robin Keller, Professor and Area Coordinator, Operations & Decision Technologies, University of California - Irvine, Graduate School of Management, 350 GSM, Irvine, CA, 92697-3125, United States, LRKeller@uci.edu

1 — The Clairvoyant Test, Quantum Physics, Support Theory and Savage's Probability Theory
Robert Bordley, General Motors, 585 South Boulevard, Pontiac, MI, 48265-1000, United States, robert.bordley@gm.com

Probabilities, whether assessed using subjective approaches, frequency approaches or maxent approaches, vary with the basis, i.e. with how the set of possible outcomes were described. Howard's clairvoyant test suggests a normative basis-dependent variant of Savage's utility theory. This may explain the Allais Paradox. Conditions on certain likelihood functions specify that probabilities vary across bases according to support theory and quantum physics.

2 — Utility for Decisions involving Sequences of Monetary Outcomes
Jeffery L. Guyse, California State Polytechnic University Pomona, Technology and Operations Management, College of Business Administration, 3801, Pomona, CA, 91768, United States, JLGuyse@csupomona.edu

Experimental results on individuals' preferences for temporal sequences of monetary outcomes are discussed and compared to results on preferences for outcome/timing pairs. Anomalies that have surfaced in experiments using pairwise matching (gain/loss asymmetry, long/short asymmetry and the absolute magnitude effect) are investigated with the relative valuation of sequences elicitation technique.

3 — Time-Weighted Utility for Multiobjective Multistakeholder Perspectives for Environmental Problems
Xiaona Zheng, Duke University and University of California, Irvine, Fuqua School of Business, GSM, Irvine, CA, 92697-3125, United States, xz17@duke.edu, Dipayan Biswas, L. Robin Keller, Tianjun Feng

We examine the pollution problem at Huntington Beach through a two-step process. First, we model the multiobjective multistakeholder perspectives for two epochs in the pollution problem saga. In the second step, we analyze how beachgoers' time-weighted utility of various activities can be related to their behaviors, intentions, and attitudes.

4 — Neural Network Capabilities and Cardinal Utility
Jayavel Sounderpandian, Professor, University of Wisconsin-Parkside, 900 Wood Road, Kenosha, WI, 53141-2000, United States, Sounderp@uwp.edu

Different shades of cardinality of utility can be characterized by different forms of invariance with respect to transformations of input data. Neural networks are capable of exact implementation of continuous multivariate functions and their derivatives. The implications of these capabilities on how well neural networks can implement various shades of cardinal utility are examined.

■ MA23

Westin-Tower 1206, 12th Floor

Advanced Applications in Decision Analysis

Sponsor: Decision Analysis
Sponsored Session

Chair: Mazen Skaf, Sr. Engagement Manager, Strategic Decisions Group, 2440 Sand Hill Rd, Menlo Park, CA, 94025, United States, MSkaf@sdg.com

1 — High-Dimensional Stochastic Programming with Applications to Revenue and Resource Management
Paul Dagum, Chief Science Officer, Rapt Inc., 625 2nd Street, 2nd Floor, San Francisco, CA, 94107, United States, Paul.dagum@rapt.com

I present an algorithm to a broad class of stochastic programming problems that scales polynomially with the dimensionality of the solution space. The solution method relies on a conjugate mapping of the bounding constraints. We have applied this solution method to optimize resource utilization and revenue generation of large complex product portfolios in high-technology OEM companies. I discuss the application details and resulting revenue improvement.

2 — The Value of Reservoir Simulation
Eric Bickel, Sr. Consultant, Strategic Decisions Group, Waterway Plaza Two, 10001 Woodloch Forest Drive, Suite 325, The Woodlands, TX, 77380, United States, ebickel@sdg.com

We will demonstrate the use of value of information to help a leading upstream oil and gas company reach consensus on the decision of whether to build a reservoir simulator. New development technologies introduced increased risk of oil recovery. In spite of ample empirical data from a demonstration project, the decision to build a reservoir simulation model was not clear. Using decision analysis we were able to build consensus and buy-in around the appropriate use of simulation.

3 — The Use of Financial Engineering and Payoff Replication in Agreement Design
Mazen Skaf, Sr. Engagement Manager, Strategic Decisions Group, 2440 Sand Hill Rd, Menlo Park, CA, 94025, United States, MSkaf@sdg.com

We introduce an approach to agreement design that builds on the concepts of side payments, contingent claims, and replicating portfolios. The separation method allows one party in a venture to offer each of the other parties the payoff profile of their preferred alternative. The method is applicable in a large class of negotiations involving any number of partners negotiating over multiple alternatives. We conclude with a comparison of decision analytic and game theoretic approaches.

■ MA24

Westin-Tower 1207, 12th Floor

Auctions and the Supply Chain

Sponsor: Information Systems
Sponsored Session

Chair: Joni Jones, Assistant Professor, University of South Florida, Information Systems and Decision Science, 4202 East Fowler, CIS 1040, Tampa, FL, 32620-7800, United States, jonij@umich.edu

1 — Coordinating Multi-Attribute Procurement Bid Selection Subject to Finite Capacity Considerations
Jiong Sun, Graduate School of Industrial Administration, Carnegie Mellon University, 5000 Forbes Ave, Pittsburgh, PA, 15213, United States, jiongs@andrew.cmu.edu, Norman Sadeh

We introduce a procurement model and techniques for capacitated, make-to-order manufacturers that have to fulfill a number of customer orders, each with its own delivery date and tardiness penalty. The manufacturer has to select among multiple supplier bids for each of the components required by orders. Bids differ in prices and delivery dates.

2 — Combinatorial Auction Based Method for Supply Chain Management
Roy Kwon, University of Toronto, Mechanical and Industrial Engineering, 5 King's College Road, Toronto, On, M5S 3G8, Canada, rkwon@mie.utoronto.ca, Lyle Ungar

Production and manufacturing inherently entails communication and negotiations to coordinate interdependent activities. We show how a canonical example of manufacturing can be scheduled when different agents, with potentially conflicting goals are responsible for their individual tasks. combinatorial auction sets prices on bundles of interdependent resources, using local optimization to solve their local problems. Intelligent mechanism design reduces computation required with max efficiency.

3 — The Supply Chain Trading Agent Competition
Raghu Arunachalam, Research Engineer, Institute For Software Research International, Carnegie Mellon University, 5000 Forbes Avenue, Pittsburgh, PA, 15213, United States, raghua @ cs.cmu.edu, Norman Sadeh

For the past 4 years, the trading agent competition has been bringing together some of the best researchers in trading technologies to compete in the context of different scenarios. In 2003, the authors designed a simulation game revolving around a supply chain scenario where agents have to compete against one another for both customer orders and supplies. In this presentation, we present the simulation game, report on the results of the competition and lessons learned.

4 — Information Revelation and Preference Elicitation in B2B Multi-Attribute Auctions
Joni Jones, Assistant Professor, University of South Florida, Information Systems and Decision Science, 4202 East Fowler, CIS 1040, Tampa, FL, 32620-7800, United States, jonij@umich.edu

Work-in-progress investigation of information revelation and preference elicitation techniques in B2B auctions. This research looks at the approaches prescribed by current literature and those executed in practice. Value formulation and revelation of preferences is a vital detail in mechanism design and has become more complicated with the advent of multi-attribute and combinatorial auctions.

■ MA25

Westin-Tower 1208, 12th Floor

Alternative Modeling Approaches

Sponsor: Military Applications
Sponsored Session

Chair: W. Charles Mylander, Professor, US Naval Academy, Math Dept, 572C Holloway Road, Annapolis, MD, 21402, United States, wcm@usna.edu

1 — Use of Agent-Based Simulation for Modeling Unconventional Conflict
Arnold Buss, Assistant Professor, Naval Postgraduate School, Mail Code : OR/Bu, Dept of OR, Monterey, CA, 93943, United States, ABuss@nps.navy.mil

Agent-based simulation has enjoyed rapid growth in the past few years. Some recent uses of agent-based simulation models are presented, including operations other than war, peacekeeping scenarios, and homeland defense. These examples will illustrate how agent models can be thought of as particular forms of more traditional discrete-event simulation models.

2 — Simulation and Mathematical Models
Christopher Cook, OR Analyst, Systems Planning and Analysis, Math Dept, USNA, Annapolis, MD, 21402, United States, ccook@usna.edu, Thomas Sanders

The General Campaign Analysis Model (GCAM) created by Systems Planning and Analysis, Inc (SPA) is a model-building application that is often used for creating models used in trade-off analysis. We used it to simulate a P-3 searching for a surface ship, using both random search and a parallel (ladder) search. The results were then statistically compared to the theoretical search models.

3 — Agent Based Models and Markov Chains
Thomas Sanders, Professor, US Naval Academy, Math Dept, 572 Holloway Road, Annapolis, MD, 21402, United States, tjs@usna.edu, Christopher Cook, Douglas Rosenstock

Agent Based Models and Absorbimg Markov Chains can both be used to investigate outcomes of combat models. Some of the time they provide similar results, while other times one can provide results that are difficult to obtain from the other. This will present some of the results obtained by Rosenstock in his Mathematics Honors' Thesis.

4 — Models: A Shaper or Predictor of Behavior in Playing a Campaign Game
W. Charles Mylander, Professor, US Naval Academy, Math Dept, 572C Holloway Road, Annapolis, MD, 21402, United States, wcm@usna.edu, Lucas Martin

The Campaign Game was developed by Dahl and Halck for use in studying military decision making. (See Dahl&Bakken in Mil. Opns. Res. 7(2).) It is a multi-stage two-person zero sum game. It has been used in experiments to study the decision making behavior business students and jr officers. The optimal strategy reported is not a good predictor of players' behavior. We found optimal strategies using two different MOEs. Do optimal strategies predict behavior, or are they guides for behavior?

■ MA26

Westin-Tower 1401, 14th Floor

Data Mining Applications in Telecommunications

Cluster: Data Mining and Knowledge Discovery
Invited Session

Chair: Shane Pederson, Bank One Card Service, Inc., Elgin, IL, United States, Shane_Pederson@bankone.com

1 — Pattern Detection and Discovery, Applications to Telephone Service Data
Zhiguang Qian, United States, qianz@umich.edu, Wei Jiang

Pattern detection is concerned with defining and detecting local anomalies within massive and noisy data sets. It is solely based on internal data vectors, when a classification label is absent. This work surveys recent development in this research field and explores some related statistical issues. In conclusion, we illustrate our ideas by analyzing a telephone service data. In this case, "disconnect" pattern and "add" pattern are successfully detected. Joint work with Wei Jiang.

2 — Data Mining and Event Data Mining in Telecommunications
Colin Goodall, AT&T Labs, 200 S Laurel Ave, D4 3D28, Middletown, NJ, 07748, United States, cgoodall@att.com

Data mining in a complex environment such as at AT&T involves many choices. Some are: data mining algorithms vs. statistical algorithms; in-house techniques for massive data vs. packaged techniques; software for data mining vs. software for data and tool integration; hands-on analysis vs. automated analysis; visual analysis vs. algorithmic analysis; and data mining vs. event data mining. For illustration I will draw on experiences with billing, call detail, and provisioning data.

3 — Survival Models for Forecasting Calling Card Fraud
Sylvia Halasz, AT&T Labs, 200 S. Laurel Ave, D4-3D30, Middletown, NJ, 07748, United States, halasz@att.com

AT&T provides a variety of telecommunications services for residential and business customers. Despite the penetration of wireless services, charging calls to AT&T cards and commercial credit cards continues to be a flourishing business - with a generous sprinkling of fraudulent usage. In order to help prevent fraud, decision trees have been applied to find possible predictors (covariates), then a Cox survival model has been used to calculate the probability that a calling card will become fraudulent within k days given its present characteristics. The motivation for this type of model was the objective to be able to forecast fraud rather than alert to it once it has happened. The method can be applied to the behavior of any card, if sufficiently detailed and up-to-date statistics are kept.

■ MA27

Westin-Tower 1402, 14th Floor

Advances in Mixed-Integer Programming

Sponsor: Optimization/Integer Programming
Sponsored Session

Chair: Daniel Bienstock, Professor, Dept. of IEOR, Columbia University, 500 West 120th St., New York, NY, 10027, United States, dano@ieor.columbia.edu

1 — Polyhedral of Constrained Single Machine Scheduling
Ismael de Farias, SUNY Buffalo, 403 Bell Hall, Department of Industrial Engineering, Buffalo, NY, 14260-2050, United States, defarias@buffalo.edu

We study the convex hull of the feasible set of schedules of single machine with deadlines, release times, and order dependent setup. We show how lifting can be used to derive strong inequalities valid for this polyhedron, and how to use them computationally.

2 — Decomposition and Dynamic Cut Generation in Integer Programming
Ted Ralphs, Assistant Professor, Lehigh University, 200 West Packer Avenue, Bethlehem, PA, 18015, United States, tkralphs@lehigh.edu, Matthew Galati

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, such as branch and cut. We discuss methods for integrating dynamic cut generation and decomposition techniques in a number of different contexts. Computational results will be presented.

3 — Multi-Supplier Procurement: Dual LP Separation and Economic Equilibria
Andrew Miller, Assistant Professor, University of Wisconsin, Department of Industrial Engineering, Madison, WI, 53706, United States, amiller@ie.engr.wisc.edu, Debasis Mishra, Dharmaraj Veeramani

We study mechanism design for production economies involving multiple items, a single customer, and multiple suppliers, and in which the Single Improvement condition is satisfied. To solve the underlying optimization problem, we propose a pseudo-polynomial time algorithm based on an analysis of the separation problem of the dual linear program. This algorithm can be used to discover an efficient allocation and Vickrey-Clarke-Groves prices; it has other important economic advantages as well.

4 — On Path-Set Polyhedra of Capacitated Fixed-Charge Networks
Alper Atamturk, Assistant Professor, University of California, Berkeley, Berkeley, CA, United States, atamturk@ieor.berkeley.edu, Simge Kucukyavuz

We discuss strong inequalities for the capacitated fixed-charge network flow problem based on the underlying path structures. We give polynomial time separation algorithms for certain special cases and report a summary of computational experiments.

■ MA28

Westin-Tower 1403, 14th Floor

Nonlinear Programming: Theory and Applications

Cluster: Nonlinear Programming
Invited Session

Chair: Michael Wagner, Assistant Professor, Cincinnati Children's Hospital Med. Center, 3333 Burnet Ave, MLC 7024, Cincinnati, OH, 45229, United States, mwagner@cchmc.org

1 — Solving General Quadratic Programs by Gradient Projection
Sven Leyffer, Argonne National Laboratory, 9700 South Cass Ave, Argonne, IL, 60439, United States, leyffer@mcs.anl.gov

Quadratic programs (QPs) arise as subproblems in SQP methods and are an important class of problems in their own right with many applications. We develop a new approach for QPs based on gradient projection ideas. A gradient projection step is used to identify the active constraints followed by an approximate solution of the first order conditions in a subspace. We present numerical results and comment on the suitability of our approach for SQP methods.

2 — Nonlinear Programming Techniques for Mathematical Programs with Complementarity Constraints
Mihai Anitescu, Argonne National Laboratory, MCS, Building 221, 9700 South Cass Avenue, Argonne, IL, 60430, United States, anitescu@mcs.anl.gov

Sequential quadratic programming with an elastic mode safeguard has been recently proved to converge locally to the solution of mathematical programs with complementarity constraints (MPCC). In this talk we discuss conditions under which the elastic mode approach is superlinearily convergent to a solution of MPCC.

3 — Preprocessing Optimization Problems with Complementarity Constraints
Todd Munson, Enrico Fermi Scholar, Argonne National Laboratory, 9700 S. Cass Ave, MCS Division, Argonne, IL, 60439, United States, tmunson@mcs.anl.gov

Optimization problems with complementarity constraints can cause numerical problems for nonlinear optimization routines. The preprocessor tailored to this problem class is used to simultaneously reduce the number of complementarity conditions and eliminate redundant variables and constraints from problem. The resulting preprocessor works on both traditional nonlinear programs and optimization problems with complementarity constraints.

■ MA29

Westin-Tower 1404, 14th Floor

Very Large Scale Neighborhood Search

Sponsor: Optimization/Network
Sponsored Session

Chair: Jim Orlin, MIT, E40-147, Cambridge, MA, 02139, United States, jorlin@mit.edu

1 — Solving Scheduling Problems with Very Large Scale Neighborhood Search
Richa Agarwal, GA Tech, ISyE, Atlanta, GA, United States, ragarwal@isye.gatech.edu, Jim Orlin, Chris Potts, Ozlem Ergun

We demonstrate the use of improvement graphs for designing and efficiently searching large-scale neighborhoods for various single and parallel machine scheduling problems. We present the results of a computational study on the parallel machine scheduling problem where the objective is to minimize the weighted sum of completion times.

2 — Neighborhood Structures with Approximation Guarantees
Dushyant Sharma, Assistant Professor, University of Michigan, Department of Ind. and Operations Eng., Ann Arbor, MI, 48109, United States, dushyant@umich.edu, Jim Orlin

We present a set of necessary and sufficient conditions under which every locally optimal solution for a combinatorial optimization problem is guaranteed to be no more than epsilon from optimum. We use our methodology to unify several results that have appeared in the approximation literature.

3 — The Contractive Simplex Method for the Multicommodity Flow Problem
Agustin Bompadre, MIT, 77 Massachusetts Ave E40 - 130, Cambridge, MA, 02139, United States, abompadr@MIT.EDU, Jim Orlin

We present a new efficient approach for solving the multicommodity flow problem as a sequence of subproblems, each on a very sparse but connected network. We show that each subproblem can be contracted to a problem on a much smaller graph. We then solve these problems using the simplex method.

■ MA30

Westin-Tower 1405, 14th Floor

Stochastic Network Optimization

Sponsor: Optimization/Stochastic Programming
Sponsored Session

Chair: David Morton, The University of Texas at Austin, Graduate Program in Operations Research, Austin, TX, 78712-0292, United States, morton@mail.utexas.edu

1 — A Stochastic Programming Approach to GAP with Forecasted Resource Capacities
Joyce Yen, University of Washington, Box 352650, Seattle, WA, United States, joyceyen@u.washington.edu, Zelda B. Zabinsky, Berkin Toktas

In this study, we address the Collectively Capacity Multi-Resource Generalized Assignment Problem (CCP) with uncertain resource capacities. We propose four stochastic programming-based formulations to solve this problem, and provide solution techniques for the resulting models. We also present numerical results for a variety of test cases.

2 — A Stochastic Generalized Assignment Problem
David Spoerl, Operations Research Dept., Naval Postgraduate School, Monterey, CA, 93943, United States, drspoerl@nps.navy.mil, Kevin Wood

We develop two new deterministic equivalent models for a stochastic generalized assignment problem with penalized resource-constraint violations and normally distributed resource-consumption coefficients. This is a stochastic integer program with simple recourse. The two models differ in allowed mean-to-variance relationships. Generalizations are discussed and computational results are presented for a petroleum-product delivery problem.

3 — Stochastic Network Interdiction of Nuclear Material Smuggling
David Morton, The University of Texas at Austin, Graduate Program in Operations Research, Austin, TX, 78712-0292, United States, morton@mail.utexas.edu, Feng Pan, Bill Charlton

We describe a stochastic network interdiction model for identifying locations for installing detectors sensitive to nuclear material. A nuclear material smuggler selects a path through a network that maximizes the probability of avoiding detection. An interdictor installs sensors to minimize that maximum probability. We describe an application of our model to help strengthen the overall capability of preventing the illicit trafficking of nuclear materials.

■ MA31

Westin-Tower 1406, 14th Floor

SOLA Dissertation Competition

Sponsor: Location Analysis
Sponsored Session

Chair: H.A. Eiselt, Professor, Faculty of Administration, University of New Brunswick, P.O. Box 4400, Fredericton, NB, E3B 5A3, Canada, haeiselt@unb.ca

1 — A New Lagrangian Heuristic for the Task Allocation Problem
Mohan Krishnamoorthy, Science and Industry Manager, CSIRO, Mathematical and Information Sciences, Private Bag 10, Clayton South MDC, Clayton, VIC, VI, 3169, Australia, Mohan.Krishnamoorthy@CSIRO.AU, Andreas Ernst, Houyuan Jiang

The task allocation problem (TAP) arises in distributed computing systems. The goal is to assign tasks to processors to minimize processor communication costs. We formulate TAP as a hub location problem and present a Lagrangian heuristic for solving a column generation formulation of TAP. Numerical results are reported.

2 — A Competitive Location Problem with Regions
H.A. Eiselt, Professor, Faculty of Administration, University of New Brunswick, P.O . Box 4400, Fredericton, NB, E3B 5A3, Canada, haeiselt@unb.ca

Consider a linear space that is separated into two disjoint regions. Each of the regions can offer a subsidy to facilities that attempt to located on the market. Duopolists now sequentially locate on the market so as to maximize their income. Optimal subsidy levels & location patterns are determined.

3 — Location of Landfills
H.A. Eiselt, Professor, Faculty of Administration, University of New Brunswick, P.O . Box 4400, Fredericton, NB, E3B 5A3, Canada, haeiselt@unb.ca

The paper considers the location of landfills. Given the population distribution in a given state, optimal locations of landfills are determined by using a cost-minimization criterion. The resulting locations are then compared with the existing locations, & procedures for the transition are discussed.

■ MA32

Westin-Tower 1407, 14th Floor

Effective Scheduling Algorithms

Cluster: Scheduling
Invited Session

Chair: Lisa Fleischer, GSIA, Carnegie Mellon University / IBM Watson Research, Pittsburgh, PA, 15213, United States, lkf@andrew.cmu.edu

1 — Scheduling to Simultaneously Optimize Two Metrics
Cliff Stein, Columbia University, IEOR Dept., 500 W. 120th St., MC 4704, New York, NY, 10027, United States, cliff@ieor.columbia.edu

Scheduling algorithms are designed to optimize many different optimality criteria in a wide variety of scheduling models. We give very general results about the existence of schedules which simultaneously minimize two criteria, focusing on results that apply to almost any scheduling environment, and apply to many of the basic scheduling metrics. This talk contains results from several papers, done jointly with J.Aslam, A. Rasala, E.Torng, P.Uthaisombot, J.Wein and N. Young.

2 — Scheduling a System with Tasks, Facilities, and Workers
David Phillips, Columbia University, New York, NY, United States, djp80@columbia .edu, Eyjolfur Asgeirsson, Cliff Stein

We will present simulation and theoretical results based on a real scheduling problem. This problem is complicated as it has two types of "machines," called facilities and workers. Other features of the problem include precedence constraints, release and due dates, and a new type of objective. Our simulation results compare different types of approximation algorithms for randomly generated instances of this problem. Our theoretical results are based on the new type of objective.

3 — Improved Approximation Algorithms for the Joint Replenishment Problem
Retsef Levi, PHD Student, Cornell University, School of Operations Research, Rhodes 206, Cornell University, Ithaca, NY, United States, levi@orie.cornell.edu, David Shmoys, Robin Roundy

Consider the following joint replenishment problem. Each of N items and T time periods has a given demand to be satisfied on time. In each period we can order any subset of the items, paying a joint fixed cost plus a fixed cost for each item ordered. Items may be held while incurring an item-dependent linear cost. We wish to minimize the overall fixed and holding costs.We will show how LP-based methods give signficantly improved approximation algorithms with constant performance guarantees.

■ MA33

Westin-Tower 1408, 14th Floor

DEA Supply Chain Applications

Cluster: Data Envelopment Analysis
Invited Session

Chair: Roger Gung, Research Staff Member, IBM T.J. Watson Research Center, P.O. Box 218, Yorktown Heights, NY, 10598, United States, rgung@us.ibm.com

Co-Chair: Chun-Che Huang, Associate Professor, National Chi-Nan University, Dept/University: Department of Informati, University Road, Puli, Nantou, Taiwan, chuang@im.ncnu.edu.tw

1 — Modified DEA Approach to Supplier Ranking
Teresa Wu, Assistant Professor, Industrial Engineering Department, Arizona State University, PO Box 875906, Tempe, AZ, 85287, United States, Teresa.Wu@asu.edu, Rajendra Appall

DEA is briefly discussed along with its advantages and disadvantages and our new approach to eliminate the poor discriminatory power and inability of DEA to rank the suppliers is explained. A case study is given and results are shown to be in comparison with that of the cross-efficiency method.

2 — Asynchronous Policy Cycles and the Efficiency Frontier Dynamic: A Simulation Framework
S. Claudina Vargas, Assistant Professor of Operations Management, Niagara University, School of Business Administration, Perboyre Hall, P.O. Box 2037, Niagara University, NY, 14109-2037, United States, scvargas@niagara.edu

This research aims to develop a tool for studying the effects of asynchronous policy cycles on the dynamics of the efficiency frontier, considering learning and imprecision. The model integrates Data Envelopment Analysis, Malmquist productivity indexes, and process learning into a discrete-dynamic stochastic simulation framework. It analyzes the entire system of decision making units to determine the effects of asynchronous policies which are based upon production efficiency as measured by DEA.

3 — A Non-Parametric Frontier Approach To Benefit-Cost Analysis
Marie-Laure Bougnol-Potter, Western Michigan University, United States, ml .bougnol-potter@wmich.edu, Jose H. Dula, Donna Retzlaff-Roberts, N. Keith Womer

Benefit-cost analysis is a widely used technique that is even required by law throughout the federal government. However, it has been criticized for three shortcomings. We develop a method for benefit-cost analysis that is derived from DEA that overcomes each of the shortcomings.

4 — A DEA Study to Evaluate the Relative Efficiency and Efficiency Change of the Thermal Power Plants
Chen-Fu Chien, Associate Professor, Department of Industrial Engineering and Engineering Management, National Tsing Hua University, 101 Sec. 2 Kuang Fu Road, Hsinchu, T, 300, Taiwan, cfchien@mx.nthu.edu.tw, Yi-Chiech Lin, Fen-Yu Lo

DEA models were applied to evaluate the relative efficiencies of power plants of the Taiwan Power Company. This paper investigated the efficiency changes of the plants and proposed specific improvement directions for the relative inefficient plants to improve their efficiencies.

■ MA34

Mart-Room A

Freight Transportation

Sponsor: Transportation Science & Logistics
Sponsored Session

Chair: Amelia Regan, Associate Professor, Information and Computer Science and Civil Engineering, University of California, Social Science Tower 559, Irvine, CA, 92797-3600, United States, aregan@uci.edu

1 — Improving Port Operations Using Double Cycling
Anne Goodchild, Graduate Student, University of California at Berkeley, 416 G McLaughlin Hall, Berkeley, CA, 94720, United States, anne_g@uclink.berkeley.edu, Carlos Daganzo

Double-cycling, the process by which a standard crane is used to load a container and unload another one in a single cycle, can be used to improve port operations. Efficiencies can be gained, for example, by reducing the number of cycles necessary to turn around a ship, or reducing chassis requirements. The problem is formulated and analyzed as a scheduling problem. We also analyze various productivity gains from double-cycling using simple loading/unloading sequencing algorithms.

2 — The Weighted Container Movements with Machine Availability Constraints
Liying Song, Research Scholar, National University of Singapore, CE Dept,Traffic Lab,Engineering Drive 2, 117576, Singapore, g0201962@nus.edu.sg, Der-Horng Lee, Bo Huang

Storing containers in yard, allocating resources in terminal, and scheduling vessel loading and unloading are major concerns in container terminal operations. The paper deals with allocation of yard resources such as gantry cranes, straddle cranes, fork lifters to the handling of containers. We consider crane allocation to weighted containers in the yard with deterministic machine availability constraint. The problem is formulated as an NP-hard one. A genetic algorithm is presented for problem solution.

3 — Convergence Properties of Two Time Window Discretization Methods for the Traveling Salesman Problem with Time Window Constraints
Amelia Regan, Associate Professor, Information and Computer Science and Civil Engineering, University of California, Social Science Tower 559, Irvine, CA, 92797-3600, United States, aregan@uci.edu, Xiubin Wang

In this paper, we discuss the convergence of two time window discretization methods for the traveling salesman problem with time window constraints. The first method provides a feasible solution for the minimization problem while the second, provides a lower bound.

4 — A Network Design Problem in Freight Transportation with Non-Linear, Cross-Arc Costs
Amy Cohn, U of Michigan, 2797 IOE Building, 1205 Beal Avenue, Ann Arbor, MI, 48109-2117, United States, amycohn@umich.edu, Melinda Davey, Lisa Schkade

Many network design problems in freight transportation are difficult to solve due to non-linear cost functions. We consider a special case of this problem, which is further complicated by the fact that the cost on an arc is not only a non-linear function of the quantity of freight on that arc, but depends on freight moving over other arcs as well.

■ MA35

Mart-Room B

Recycling Network Models

Cluster: Reverse Supply Chains
Invited Session

Chair: Anna Nagurney, John F. Smith Memorial Professor, University of Massachusetts - Amherst, Dept of Finance & Operations Management, Isenberg School of Management, Amherst, MA, 01003, United States, nagurney@gbfin.umass.edu

1 — Electronic Waste Management and Recycling: A Mutitiered Network Equilibrium Framework
Anna Nagurney, John F. Smith Memorial Professor, University of Massachusetts - Amherst, Dept of Finance & Operations Management, Isenberg School of Management, Amherst, MA, 01003, United States, nagurney@gbfin.umass.edu, Fuminori Toyasaki

We focus on a problem of increasing environmental concern — that of electronic waste — and present an integrated framework for the management of such waste which includes recycling. We describe the behavior of the suppliers, recyclers, processors, and consumers, derive the governing variational inequality formulation, and provide both qualitative and numerical results.

2 — Planning the e-Scrap Reverse Production System under Uncertainty in the State of GA: A Case Study
Matthew Realff, Dr., Georgia Tech, School of Chemical Engineering, Atlanta, GA, United States, matthew.realff@che.gatech.edu, Jane Ammons, Tiravat Assavapokee, I-Hsuan Hong, Ken Gilliam

This paper develops a scenario-based robust optimization model for making strategic decisions under uncertainty. A case study for the e-scrap reverse production system containing televisions, monitors, and computer CPUs in the state of Georgia is considered. The experiment design is conducted with three factors of participation, e-scrap re-usability, and CRT recycling option.

3 — Modeling Electronics Recycling Processes: Mixed versus Separated Plastics
Julie Ann Stuart, Assistant Professor, Purdue University, School of Industrial Engineering, 315 N. Grant Street, West Lafayette, IN, 47907-2023, United States, stuart@ecn.purdue.edu, Pedro Rios, Edward Grant

We build discrete-event simulation models to investigate two different electronics recycling processes. In the first process, equipment undergoes bulk processing to separate metals but the plastics output is mixed. In the second process, equipment is disassembled and plastics are separated for identification with Raman Spectroscopy while the remaining equipment undergoes bulk processing for metals separation.

■ MA36

Mart-Room C

Managing Distribution Systems

Sponsor: Manufacturing and Service Operations Management
Sponsored Session

Chair: Jeannette Song, Professor, University of California, Irvine, Graduate School of Mgmt, UC Irvine, Irvine, CA, 92697, United States, jssong@uci.edu

1 — Optimal "Position-Based" Warehouse Ordering in Divergent Two-Echelon Inventory Systems
Johan Marklund, Assistant Professor, University of Colorado, 419 UCB, Boulder, CO, 80309-0419, United States, Johan.Marklund@colorado.edu, Sven Axs‰ter

A continuous review two-echelon inventory system with a central warehouse and a number of non-identical retailers is considered. The retailers face independent Poisson demand and apply standard (R, Q) policies. We present a state dependent "order-to" policy for warehouse ordering, which is optimal in the broad class of "position-based" policies relying on complete information about the inventory positions and cost structures at all facilities. This class encompass both the traditional installation-stock and echelon-stock (R,Q) policies as well as the more sophisticated policies recently analyzed in Moinzadeh (2002) and Marklund (2002). The value of more carefully incorporating the richer information structure into the warehouse ordering policy is illustrated in a numerical study.

2 — Replenishment and Allocation Policies for Supply Chains with Cross-Docking
Kamran Moinzadeh, Professor, University of Washington, Mackenzie Hall, PO Box 353200, Seattle, WA, 98195, United States, kamran@u.washington.edu, Mustafa Gurbuz

We consider a centralized distribution system consisting of N identical retailers and a warehouse employing cross docking. The retailers face Poisson demand. Whenever the inventory position at any retailer drops to "s", the warehouse places an order at the outside supplier to increase the inventory position of all the retailers to the order-up-to level "S". Upon arrival of the order, the warehouse allocates the stock accordingly. This policy is compared to two other more traditional policies.

3 — Promised Leadtime Contracts and Renegotiation Incentives Under Asymmetric Cost Information
Holly Lutze, Stanford University, Stanford, CA, 94305, United States, hlutze@stanford.edu, Ozalp Ozer

Consider a manufacturer that promises a demand leadtime to a retailer with private cost information. We propose contracts that elicit buyer cost information while maximizing the manufacturer's expected profit. When supply chain parameters change over time, we explore incentives for mutually beneficial renegotiation.

4 — Simple Approximations for Distribution Systems
Kevin Shang, Assistant Professor, Duke University, Fuqua School of Business, Duke University, Durham, NC, 27708, United States, khshang@duke.edu, Jeannette Song

We consider a one-warehouse, multi-retailer system with random demand. We assume linear transportation, inventory-holding and backorder costs and complete backlogging. Each location follows a base-stock policy, and the central warehouse uses a myopic allocation rule for stock allocation. We develop simple, closed-form bounds and approximations for the optimal base-stock levels and discuss various insights.

■ MA37

Mart-Room D

Service Parts Management

Sponsor: Manufacturing and Service Operations Management
Sponsored Session

Chair: Kathryn Caggiano, Assistant Professor, University of Wisconsin-Madison, 975 University Avenue, Madison, WI, 53706, United States, kcaggiano@bus.wisc.edu

1 — The Impact of Alternative Service Metrics on Optimal After-Sales Service Supply Chain Planning
Morris Cohen, Professor of Operations and Information Management and Systems Engineering, The Wharton School, University of Pennsylvania, 546 JMHH, Philadelphia, PA, 19104-6340, United States, cohen@wharton.upenn.edu, Vipul Agrawal, Naren Agrawal, Vinayak Deshpande

Many companies recognize that opportunities for enhancing revenue, profit and market share entail satisfying customer needs throughout the product ownership life cycle and, accordingly, have implemented systems to optimize resource deployment for their after-sales service supply chains. We report on the impact of selecting two alternative performance metrics in solving this problem. The first is based on product availability. The second uses location or region-based average part fill rate.

2 — Spare Parts Management for the Nuclear Power Industry
Charles Sox, Professor of Management Science, University of Alabama, Box 870226, 300 Alston Hall, Tuscaloosa, AL, 35487-0226, United States, csox@cba.ua.edu, Chuck Schmidt

This talk addresses some of the important issues related to the management of spare parts inventories in the nuclear power industry and is based on a current project with a regional nuclear power operating company. The unique safety and service requirements of the nuclear power industry provide a wide range of issues and modeling challenges for managing spare parts in a single plant or across a set of plants.

3 — Multi-item Spare Parts Inventory Control with Customer Differentiation
Geert-Jan van Houtum, Associate Professor in Operations Management, Technische Universiteit Eindhoven, P.O. Box 513, Eindhoven, 5600 MB, Netherlands, G.J.v .Houtum@tm.tue.nl, Bram Kranenburg

We consider a single-stage, multi-item inventory model for spare parts, with multiple customer classes and a target overall fill rate per customer class. We derive an efficient solution method for the minimization of the total inventory investment. The method is based on Lagrange relaxation. Computational results are shown for a real-life situation at ASML, a leading manufacturer of wafer scanners.

4 — An Investigation into Resupply Network Configurations for Service Parts
Peter Jackson, Associate Professor, School of Operations Research and Industrial Engineering, Cornell University, Ithaca, NY, 14853, United States, pj16@cornell.edu, Jack Muckstadt, Andy Huber

A resupply network configuration to support field service engineers consists of a set of inventory stocking locations, a transportation network, and a set of dispatching and allocation rules. The choice of network configuration can have a dramatic impact on customer service, inventory investment, and transportation and operating costs. This paper describes a simulation and optimization-based methodology for assessing the operational and financial consequences of alternative system designs.

■ MA38

Mart-Room E

Urban Transportation Planning Models III: Intermodal and Transit Applications

Sponsor: Transportation Science & Logistics
Sponsored Session

Chair: Jim Moore, Professor, University of Southern California, KAP 210, MC-2531, 3620 S. Vermont Ave, Rm 210, Los Angeles, CA, 90089-2531, United States, jmoore@usc.edu

1 — A Case Analysis of Memphis Light Rail Corridor and Route Selection with Analytic Hierarchy Process
Reza Banai, Professor of City and Regional Planning, University of Memphis, 226 Johnson Hall, Memphis, 38152, United States, rbanai@memphis.edu

We use an Analytic Hierarchy Process to assess light rail transit corridor and route alternatives. This multicriteria method shows how to unify complex layers of transit decision making to account for federal and local criteria, different participants, trade-offs, and choice of alternatives. The focus is an LRT corridor in Memphis, TN. The best alternative is identified by a composite, ratio-scale score. Changes in the importance of the criteria or group priority influence outcomes.

2 — Micro-Assignment of Activity-Based Travel Demand in Intermodal Transportation Networks
Hani Mahmassani, Professor, University of Maryland, Department of Civil & Environmental Engi, 1173 Glenn L. Martin Hall, College Park, MD, 20742, United States, masmah@wam.umd.edu, Ahmed Abdelghany, Khaled F. Abdelghany

We present a dynamic traffic assignment-simulation model for intermodal urban transportation networks with activity-based travel demand. The model represents travelers' route-mode choice decisions to complete a sequence of pre-planned activities, considering available intermodal travel options. Operational planning applications of the model are illustrated.

3 — Using Simulation to Forecast Transportation Demand Using Structural Equations
Julian Benjamin, Professor, North Carolina A&T State University, Department of Economics, Greensboro, NC, 27408, United States, benjamin@ncat.edu

Forecasting travel demand has traditionally been a two-stage process. However, structural equation methods have been used to analyze demand when there is feedback. The structural equation models however cannot be used to forecast. Simulated forecasts based on the relationships in the structural equation model are developed and evaluated.

4 — Chaotic Systems Modeling: Applications for Transportation
Chris Frazier, U.T. Austin, 6.9 ECJ, Austin, TX, United States, stanforth@mail .utexas.edu, Kara Kockelman

Chaos describes unpredictable yet deterministic behavior. Various transportation systems, with their many interacting physical and human elements, can exhibit such behavior. This paper presents techniques to analyze traffic flow data as chaotic, including selection of delay parameters, discerning fractal dimensions and evaluation of Lyapunov exponents. Analyzing chaotic systems is not straightforward, and special techniques are required to extract useful information.

■ MA39

Mart-Room F

Railroad Blocking and Scheduling Approaches

Sponsor: Railroad Applications
Sponsored Session

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

1 — Deriving Tag Tables from Algorithmic Blocking in First Class
Carl Van Dyke, MultiModal Applied Systems, Inc., 125 Village Blvd - Suite 270, Princeton, NJ, United States, Carl@multimodal-inc.com, Erika Yazid, David Friedman

Most railways route railcars using a table lookup scheme that involves 400K+ business rules. Algorithmic routing of railcars uses far fewer business rules, decreases car miles and intermediate handlings, simplifies blocking plans and eases analysis. The FirstClass project between CSX and MultiModal developed a tool to translate algorithmic routing rules to the lookup rules. Hence railways can gain the benefits of algorithms without a major redesign of their legacy train operating systems.

2 — A Decision Support System for Train Scheduling
Ravindra Ahuja, Professor, University of Florida, 303, Weil Hall, P O Box 116595, Gainesville, FL, 32608, United States, ahuja@ufl.edu, Krishna Jha, Pooja Dewan, Dharma Acharya

We are developing a decision support system for train scheduling which will take as an input a blocking plan, a set of origin-destination shipments, and a given train schedule, and will allow us to assess the impact of adding trains, removing trains, changing train itinerary and its time schedule. The decision support system can also suggest a zero-based train schedule or some specific changes with maximum cost savings.

3 — Solving Real-Life Railroad Blocking Problems
Jian Liu, University of Florida, 303 Weil Hall, Gainesville, FL, 32608, United States, liujian@ufl.edu, Ravindra Ahuja, Pooja Dewan, Dharma Acharya

Blocking problem is one of the most important problems in railroad scheduling. In this talk, we will give an overview of a very-large scale neighborhood search algorithm to solve this problem which is very robust, flexible and can easily incorporate a variety of practical constraints. We will also present computational results on solving these problems at CSX Transportation and BNSF Railway.

■ MA40

Mart-Room G

Topics in Supply Chain Management

Cluster: Supply Chain Management
Invited Session

Chair: Ananth Iyer, Professor, Purdue University, Krannert School of Management, 1310 Krannert Building, West Lafayette, IN, 47907, United States, aiyer@mgmt.purdue.edu

1 — A Model to Design an International Assembly System and its Supply Chain
Sharath Bulusu, Texas A&M University, Department of Industrial Engineering, TAMUS 3131, College Station, TX, United States, sharath@tamu.edu, Wilbert Wilhelm, Dong Liang, Brijesh Rao, Xiaoyan Zhu

This paper presents a prototypical, mixed integer program to design an international assembly system (selecting facility locations, technologies, and capacities) and its supporting supply chain (integrating material flow through suppliers, production, assembly, distribution), maximizing after-tax profits. The model integrates generic, enterprise-wide decisions but focuses on the U.S. and Mexico under NAFTA. A numerical example demonstrates how managers might use the model.

2 — Designing a Digital Marketplace for Supplier Aggregation
Amiya Chakravarty, Professor, Tulane University, A. B. Freeman School of Business, New Orleans, LA, 70118, United States, akc@tulane.edu, Geoffrey Parker

Typical decisions in an E-marketplace include how much it should charge the vendors and customers, and how much it should invest in context services to attract customers to the site (traffic). A high transaction or entry fee decreases the number of participants, which can be partly or fully made up by increasing context services. In this paper we study the Nash equilibrium solution that determines the transaction (subscription) fee, vendor's unit price, and the investment in context-services.

3 — Improving Supply Chain Performance using Part Age Information
Ananth Iyer, Professor, Purdue University, Krannert School of Management, 1310 Krannert Building, West Lafayette, IN, 47907, United States, aiyer@mgmt.purdue.edu, Vinayak Deshpande, Richard Cho

We describe and model the spare parts management at the US Coast Guard Central Inventory Location. Analysis of transactional data is used to develop and run a model to value the benefit of advance orders based on part age. Results suggests significant benefits to coordinating supplier lead times to advance order triggers.

4 — Contingency Management under Asymmetric Information
Zhengping Wu, Singapore Management University, 469 Bukit Timah Road, Singapore, 259756, Singapore, Zhengping_Wu@mgmt.purdue.edu, Ananth Iyer, Vinayak Deshpande

Consider a supplier with multiple buyers. The supplier experiences a supply disruption and actions (with associated costs) are required to restore the supply. During the disruption phase, buyers do not have access to supply and thus experience stock-outs. Buyers incur a backorder cost, which is private information not known to the supplier. We explore the supplier's strategy to prepare for and react to such contingencies, and the impact of contingencies on all parties in the supply chain.

■ MA41

Mart-Room H

Simulation and Control of Supply Chains via PDE-Models

Cluster: Supply Chain Management
Invited Session

Chair: Christian Ringhofer, Arizona State University, Department of Mathematics, Tempe, AZ, United States, ringhofr@mozart.la.asu.edu

1 — Simulation and Control of Supply Chains
Dieter Armbruster, Arizona State University, Department of Mathematics, Tempe, AZ, 85287, United States, armbruster@asu.edu, Karl Kempf

Fast, scalable simulation models for high volume, multi stage continuous production flows through linear and re-entrant factories are developed. The resulting models are nonlinear nonlocal hyperbolic conservation laws similar to gas kinetic models or traffic flow models. Quasi steady state, dynamic and diffusive models are presented. They reflect increasingly accurate description of transient and stochastic influences on the dynamic of the production flow.

2 — Optimal Control of Supply Chains with Variable Product Mixes
Matthias Kawski, Arizona State University, Department of Mathematics, Tempe, AZ, United States, kawski@asu.edu, Eric Gehrig

We consider supply chains with load-dependent delays, product mixes that share finite capacities and stochastic yields. We determine the best mix of inputs so that the output mix will closely match market demands while maintaining desirable minimal inventory levels. Higher grade product may be sold at a lower price to satisfy demand for lower grade product. We use optimal control theory and present both theoretical results and simulations for optimal inventory and reorder policies.

3 — Validation of PDE Models for Supply Chain Modeling and Control
Erjen Lefeber, Eindhoven University of Technology, Systems Engineering, Eindhoven, Netherlands, A.A.J.Lefeber@tue.nl

An important class of supply chain and/or manufacturing control problems asks for proper balancing of both throughput and cycle time for a large nonlinear dynamical system that never is in steady state. Recently, PDE models emerged as a new modeling and control paradigm. The validity of these models will be addressed, e.g. when describing ramp up of a manufacturing system.

4 — Dynamically Updated Throughput Times for Discrete Event Simulation and Relations to Fluid Limits
Christina Ringhofer, Arizona State Univ., Dept. of Mathematics, Tempe, AZ, United States. ringhoft@mozart.la.asu.edu, Dieter Armbruster

We present a new approach to computing throughput times for discrete event simulation based on a "random clock" approach. In this approach the estimated time of completion of all the lots in the system is continuously updated, taking into account dynamic changes of the WIP. The continuous product - long time average limit of these models results in a diffusion equation for the product flow.

■ MA42

Mart-Room I

Applications of Dynamic Pricing in Telecom, Retail, Commodity Markets and Supply Chain Networks

Sponsor: Revenue Management & Dynamic Pricing
Sponsored Session

Chair: Soulaymane Kachani, Assistant Professor, Columbia University, Dept. IEOR, New York, NY, United States, sk2267@columbia.edu

1 — Static Pricing for a Network Service Provider
David Simchi-Levi, Professor, MIT, 77 Massachusetts Ave, Bldg 1-171, Cambridge, MA, United States, dslevi@mit.edu, Felipe Caro

We consider the case of a network service provider with a given bandwidth and facing different types of customer classes. For each class the service provider has a limit on the maximum number of customers that can be served as well as a limit on the total number of customers across all types. The provider's objective is to determine a static price (per unit of time) for each class so as to maximize expected profit.

2 — Dynamic Pricing in a Multi-Product Retail Market
Soulaymane Kachani, Assistant Professor, Columbia University, Dept. IEOR, New York, NY, United States, sk2267@columbia.edu, Georgia Perakis

In this talk we present a model of dynamic pricing for multiple products in a capacitated supply chain market. We take a fluid dynamics approach and incorporate the element of competition. A key characteristic of this model is that it directly accounts for the delay of price and level of inventory in affecting sales.

3 — Commodity Spot Pricing with Discount Offer in a Weak Fencing Environment
Viroj Buraparate, Senior Scientist, Manager, PROS Revenue Management, 3100 Main Street, Suite 900, Houston, TX, 77002, United States, vburaparate@prosrm.com, Navin Aswal

A method to generate multiple price points for a commodity product is presented. We include the effects of the fencing environment on the price selection process. Example from downstream petroleum industry is used to illustrate the implementation details.

4 — Fluid Models for Dynamic Pricing and Inventory Management
Georgia Perakis, Sloan Career Development Associate Professor, Sloan School MIT, 50 Memorial Drive, Sloan School, E53-359, Cambridge, MA, 02139, United States, georgiap@mit.edu, Elodie Adida

In this talk we present nonlinear fluid models for dynamic pricing and inventory management in make-to-stock systems. We consider a multi-class, capacitated, dynamic setting. We discuss a variety of demand based models that differ through their cost structure. We propose production and pricing policies and discuss some insights.

■ MA43

Mart-Room J

Online Auction Strategies

Cluster: Auctions
Invited Session

Chair: Jayant Kalagnanam

RSM, IBM Watson Research, PO Box 218, Yorktown Hts, NY, 10598, United States, jayant@us.ibm .com

1 — Strategic Bidding in Multi-unit Online Auctions: Insights and Analysis
Paulo Goes, Professor, Business School, University of Connecticut, Storrs, CT, 06269, United States, Paulo.Goes@business.uconn.edu, Ravi Bapna, Alok Gupta

We analyze several non-trivial bidding strategies in the context of multi-unit online auctions using an agent-based simulation model. These include jump bidding, strategic-at-margin bidding, and the buy-it-now option. The simulation tool exploits the extensive multi-unit auction bidding behavior data that is captured online, to structurally replicate the original tracked auctions.

2 — Effect of Information Revelation Policies on Cost Structure Uncertainty
Karthik Kannan, Assistant Professor of MIS, Purdue University, 403 West State Street, West Lafayette, IN, 47907, United States, kkarthik@cmu.edu, Ramayya Krishnan

Geographically dispersed sellers in electronic reverse-marketplaces such Freemarkets are uncertain about their opponents' cost-structure. Over the course of several market-sessions, they learn about the nature of their market. Their ability to learn is dictated by the revelation-policy adopted. In this paper, we use game-theory to compare revelation-policies using a consumer-surplus metric.

3 — Efficient Online Mechanisms
David Parkes, Asst. Prof., Harvard University, 33 Oxford Street, Cambridge, MA, 02138, United States, parkes@eecs.harvard.edu

We consider the efficient online mechanism design problem in which agents arrive dynamically, bringing temporal considerations into an agent's strategy space. Truthful and immediate revelation is a Bayesian-Nash equilibrium in an online VCG-based mechanism, that makes dynamic resource-allocation decisions. We formulate the winner-determination and payment problem as a Markov Decision Process, and present theoretical and experimental results.

4 — Polyhedral Methods for Multiattribute Preference Elicitation
Jayant Kalagnanam, RSM, IBM Watson Research, PO Box 218, Yorktown Hts, NY, 10598, United States, jayant@us.ibm.com, Souymadip Ghosh

Sequential pairwise bid comparisons are common in multiattribute auction settings for bid ranking. We introduce efficient polyhedral techniques to identify the next comparison to optimize information revelation. Two central computations: (i) centroid computation, and (ii) bisecting hyperplane are handled efficiently in high dimensions by sampling on a polytope.

■ MA44

Mart-Room K

The FAA Strategy Simulator, Part 1

Sponsor: Aviation Applications
Sponsored Session

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

Co-Chair: Norm Fujisaki, Dep Dir, System Architecture & Investment Analysis, FAA, 800 Independence Ave, SW, Washington, DC, 20591, United States, norman.fujisaki@faa.gov

1 — FAA NAS Strategy Simulator
David Peterson, Ventana Systems, Inc., 60 Jacob Gates Road, Harvard, MA, 01451, United States, davidpeterson@vensim.com, Dan Goldner, Norm Fujisaki, Ron Suiter

Overview of a top-down strategy simulator for the National Airspace System (NAS), including passengers, airlines, aircraft, airports, and air traffic control. Key inputs are policy options and infrastructure investments. Outputs are performances and costs and organizational impacts system-wide. The structure of the model will be presented, with discussion of three sources of data for calibration and validation: historical data, expert thought experiments, and offline detailed simulations.

2 — The Economic Impact of Aviation in the FAA Strategy Simulator Model
Virginia Stouffer, Research Fellow, LMI, 2000 Corporate Ridge, McLean, VA, 22102, United States, VSTOUFFER@lmi.org, Earl Wingrove, Jing Hees

We discuss the impact of aviation on the national economy modeled in the FAA Strategy Simulator . The model uses well-quantified inputs such as enplanements or aviation revenues and estimates impacts on GDP. We base our estimates on RIMS II. The relationship of aviation activity to GDP through time is explored; there are signs of an impact of industry age on the multiplier. Other aviation multipliers such as the DRI-WEFA study and airport economic impact studies are also compared.

3 — Air Transportation Demand Model for the National Airspace System Simulator
Antonio Trani, Associate Professor, Virginia Tech, Dept of CEE, VPI&SU, Blacksburg, VA, 24061, United States, vuela@vt.edu, Hojong Baik, Senanu Ashiabor, Dusan Teodorovic

A methodology to study intercity travel in the U.S. is presented. The model uses a combination of adjusted trip rate tables to derive intercity demand across the country and a nested multinomial logit formulation to predict mode choice among travelers. Results of a microscopic-level model are aggregated at the national level and then fed into the Federal Aviation Administration (FAA) NAS Strategy Simulator - a Systems Dynamics Model.

■ MA45

Mart-Room L

Economic Analysis of Semiconductor Manufacturing

Cluster: Semiconductor Manufacturing
Invited Session

Chair: Robert Leachman, University of California at Berkeley, Dept. of Industrial Engineering and Oper, Berkeley, CA, 94720-1777, United States, leachman@ieor.berkeley.edu

1 — The Economics of Speed
Robert Leachman, University of California at Berkeley, Dept. of Industrial Engineering and Oper, Berkeley, CA, 94720-1777, United States, leachman@ieor .berkeley.edu

Prices for high-technology products decline rapidly. Improvements that compress the elapsed times for product development and manufacturing can offer great economic benefits in the form of increased lifetime sales revenues. Analytical methodology is introduced for computing the economic value of speed improvements ex ante and ex post.

2 — Revenue-Oriented Scheduling
Shengwei Ding, Ph.D. student, UC Berkeley, 4174 Etcheverry Hall, Berkeley, CA, 94720, United States, dingsw@ieor.berkeley.edu, Robert Leachman

We consider scheduling fabrication releases when the objective is revenue maximization and prices decline with time differentially for various products. A hybrid approach involving integer programming and queuing theory is developed to determine a revenue-optimized fab loading schedule accounting for the impact of cycle times on product revenue.

3 — Economic Analysis of Alternative Metrology Methods in Photolithography
Payman Jula, University of California at Berkeley, Dept. of Industrial Engineering and Oper, Berkeley, CA, 94720-1777, United States, payman@ieor.berkeley.edu

Comparisons are made between in-situ, in-line and off-line metrology methods. The cost components of the metrology methods are analyzed and discussed with respect to steady state process control as well as their effect on time to yield. Monte Carlo simulation models are used to study each method under different scenarios.

4 — A Mathematical Programming Framework for Identifying Best Practices and Managing Equipment and Process Efficiency Improvements in Semiconductor Manufacturing
David Moore, Assistant Professor, Economics and Business Division, Colorado School of Mines, United States, dmoore@mines.edu

A mathematical programming framework is described which may be implemented as an automated decision support system for managing throughput and efficiency improvements in semiconductor manufacturing. A real-world example is presented to underscore the practical applications of this research for semiconductor manufacturers and the potential gains in competitive advantage .

■ MA46

Mart-Room M

Optimization Software - The State of the Art

Sponsor: Computing
Sponsored Session

Chair: Hans Mittelmann, Professor, Arizona State University, Box 871804, Tempe, AZ, 85287-1804, United States, mittelmann@asu.edu

1 — Benchmarking of NLP Software
Hande Benson, Drexel University, Decision Sciences, Philadelphia, PA, United States, hbenson@usna.edu

We will present a talk on how to benchmark nonlinear programming soft ware, including discussions on types of algorithms, convergence criteria and how to display the results.Detailed numerical results on a library of problems will be presented

2 — The State of the Art in Software for SDP&SOCP Problems
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 ten submitted codes. The results appeared in early 2003 in Mathematical Programming B. Several of the codes have not been updated since. The others, however, are under development. As part of our ongoing benchmarking effort we are evaluating those, especially on large and/or sparse problems. Several authors have been using our benchmark problems to improve their codes. We will report on the current state.

3 — Conic Programming in GAMS
Armin Pruessner, GAMS Development Corporation, 1217 Potomac Street, NW, Washington, DC, 20007, United States, apruessner@gams.com, Steven Dirkse, Alex Meeraus, Michael R. Bussieck

There has been much activity in the area of Second Order Cone Programming (SCOP) with the Seventh DIMACS Implementation Challenge featuring SOCP. Recently, conic programming capabilities have been added to GAMS using the MOSEK solver. We discuss modeling of cone programs in the GAMS modeling language framework and give an overview of the syntax and modeling of conic constraints using theoretical and application-oriented models. Finally, we give performance results using conic formulations.

■ MA47

Atlanta G, 7th Floor

Software Demonstration

Cluster: Software Demonstrations
Invited Session

1 — Resampling Stats
Peter Bruce, Resampling Stats, 612 N. Jackson St., Arlington, VA, 22201, United States, pbruce@resample.com

XLMiner: data mining in Excel. CART, neural networks, discriminant analysis, naÔve Bayes, k-nearest neighbors, logistic regression and multiple linear regression, association rules, principal components, clustering, boxplots, histograms, matrix plots and dendrograms, and more. Sampling from and scoring to databases and random partitioning of data into training, validation and test data sets.

2 — Frontline Systems, Inc. - Premium Solver Platform V5.5 and KNITRO Solver Engine
Daniel H. Fylstra, Frontline Systems, Inc., PO Box 4288, Incline Village, NV, 89450, United States, dfylstra@frontsys.com

Frontline Systems, developers of the Microsoft Excel Solver, will demonstrate new, faster linear mixed-integer methods in Version 5.5 of the Premium Solver Platform, Large-Scale SQP Solver, and XPRESS Solver; new global optimization methods in our Evolutionary Solver; and the all-new KNITRO Solver, a very large scale interior point nonlinear optimizer.

Monday 10:00am - 11:30am

■ MB01

Westin-Intl. A, 6th Floor

Tree Network Design

Sponsor: Telecommunications
Sponsored Session

Chair: S. Raghavan, The Robert H. Smith School of Business, 4352 Van Munching Hall, University of Maryland, College Park, MD, 20742-1815, United States, raghavan@umd.edu

1 — A 2-Path Approach for Odd-Diameter-Constrained Spanning Trees
Luis Gouveia, DEIO-CIO, Bloco C2, Campo Grande, Lisbon, Portugal, legouveia@fc .ul.pt, Thomas Magnanti, Cristina Requejo

We provide an alternate modeling approach for situations when the tree diameter D is odd that views the diameter constrained minimum spanning tree as being composed of a variant of a directed spanning tree together with two constrained paths, a shortest and longest path, from the root node to any node in the tree. The linear programming gaps are usually one third to one tenth of the previous best gaps.

2 — Heuristic Search for the Generalized Minimum Spanning Tree Problem
Daliborka Stanojevic, Robert H. Smith School of Business, University of Maryland, College Park, MD, 20742-1815, United States, dstanoje@rhsmith.umd.edu, S. Raghavan, Bruce Golden

Given a graph with its node set partitioned into nonoverlapping clusters, the generalized minimum spanning tree problem seeks a minimum cost tree spanning exactly one node from each cluster. We describe a local search heuristic and a genetic algorithm that provide high quality solutions and outperform some previously suggested heuristics.

3 — Solving the Minimum Labeling Spanning Tree Problem
Bruce Golden, Robert H. Smith School of Business, University of Maryland, Van Munching Hall, College Park, MD, 20742, United States, BGolden@rhsmith.umd.edu, Yupei Xiong, Edward Wasil

Given a graph where each edge has a label, the minimum labeling spanning tree problem is to find a spanning tree with the minimum number of labels. We compare a genetic algorithm (GA) with four other heuristics. The computational results indicate that the GA obtains better results, but requires more time.

4 — Improved Heuristics for the Multi-level Capacitated Minimum Spanning Tree Problem
Ioannis Gamvros, University of Maryland, R. H. Smith School of Business, 4334 Van Munching Hall, College Park, MD, 20742-1815, United States, igamvros@rhsmith.umd .edu, S. Raghavan, Bruce Golden

We consider the Multi-Level Capacitated Minimum Spanning Tree Problem (MLCMST), a generalization of the well-known CMST Problem. We describe a construction heuristic and a local search procedure for large scale MLCMST problems. Computational results for different problem types will be presented.

■ MB02

Westin-Intl. B, 6th Floor

Computational Problems in Financial Engineering

Cluster: Financial Engineering
Invited Session

Chair: Thomas Coleman, Professor, Cornell University, Computer Science & Applied Mathematics, United States, coleman@tc.cornell.edu

1 — Asset-Liability Management for Pension Funds: Optimization Strategies Using Sample-Paths
Stanislav Uryasev, University of Florida, PO Box 116595, 303 Weil Hall, Gainesville, FL, 32608, United States, uryasev@ufl.edu, H. Edwin Romeijn

The paper studies formal optimal decision approaches for a multi-period Asset/Liability Management model for a pension fund. The model is based on sample-path simulation of the fund liabilities and returns of financial instruments included in the portfolio. The same optimal decisions are made for groups of sample-paths which exhibit similar performance characteristics.

2 — Exact Simulation of Stochastic Volatility and other Affine Jump Diffusion Processes
Ozgur Kaya, Ph.D. Candidate, Columbia University, IEOR Department Mudd 331, 500 West 120th Street, New York, NY, 10027, United States, ok94@columbia.edu, Mark Broadie

We suggest a method for exact simulation of the stock price and variance under Heston's stochastic volatility model and other affine jump diffusion processes.

The method is based on Fourier inversion techniques and provides unbiased estimators of derivative prices. We compare our method with the more conventional Euler discretization method and demonstrate the faster convergence rate of the error in our method with some numerical results.

3 — Minimizing CVaR and VaR for a Portfolio of Derivatives
Siddharth Alexander, Graduate Student, Center for Applied Math, 657 Rhodes Hall, Cornell University, Ithaca, NY, 14853, United States, alexande@cam.cornell.edu, Thomas Coleman, Yuying Li

We illustrate that the value-at-risk (VaR) and conditional VaR (CVaR) minimization problems for derivative portfolios are typically ill-posed. By including cost as a preference criterion in the CVaR optimization problem, we demonstrate that it is possible to compute an optimal CVaR derivative portfolio with fewer holdings and comparable risk. We propose a computational method for solving a simulation based CVaR optimization problem, and compare it with the standard linear programming methods.

■ MB03

Westin-Intl. C, 6th Floor

Outsourced Supply Chains

Cluster: Practice Track
Invited Session

Chair: Sue Rothberg, Vice President, Raleigh Site Operation, Sanmina-SCI, 3020 S. Miami Blvd., Durham, NC, United States, Sue.Rothberg@Sanmina-SCI.com

Co-Chair: Grace Lin, Associate Partner, IBM Global Services; Member, IBM Academy of Technology; VP Practice, INFORMS, United States, gracelin@us.ibm.com

1 — Optimizing Customer Serviceability, Manufacturing Efficiency and Cost by Leveraging Customer/Supplier Collaboration Across the Our Source Supply Chain Model
Sue Rothberg, Vice President, Raleigh Site Operation, Sanmina-SCI, 3020 S. Miami Blvd., Durham, NC, United States, Sue.Rothberg@Sanmina-SCI.com, Renee Ure

IBM and Sanmina-SCI have delivered unprecedented out source supply chain results through close business-to-business collaboration across all aspects of the manufacturing out source model.

2 — Leveraging Worldwide Demand Planning and Supply Availability to Optimize Customer Serviceability
Adam Komorner, Sanmina-SCI, Materials Manager, United States, adam .komorner@sanmina-sci.com, Scott Gardner

In order to optimize end-to-end order cycle time, IBM and Sanmina-SCI continuously leverage worldwide supply positioning to meet unplanned orders or to minimize the impacts of industry-wide material shortages. The most common rebalancing of supply is executed between sites in like geographies, for example RTP leverages Americas supply availability with Monterrey and Guadalajara, Mexico before rebalancing from Europe or Asia. This approach simultaneously minimizes transit time and transportation costs.

■ MB04

Westin-Intl. D, 6th Floor

Daniel H. Wagner Prize Competition

Sponsor: CPMS, The Practice Section
Sponsored Session

Chair: Joseph H. Discenza, President and CEO, SmartCrane, LLC, 2 Eaton Street Suite 500, Hampton, VA, 23669, United States, joeh@discenza.com

1 — GE Plastics Optimizes Two-Echelon Global Fulfillment Network At High Performance Polymers Division
Rajesh Tyagi, Information and Decision Technologies, GE Global Research Center, Niskayuna, NY, 12309, United States, Tyagi@research.ge.com, Glenn Munshaw, Peter Kalish, Kunter Akbay

To achieve the highest customer satisfaction at the lowest costs, GE Plastics recently adopted a global approach to its manufacturing operations. Unlike the previous pole-centric approach where demand in one geographic pole (i.e., a continent) was met with production from that pole only, the global approach ensures most economic order fulfillment. A decision support system (DSS) was developed to optimize the two-echelon global manufacturing supply chain for the High Performance Polymers division. The DSS uses a math-programming model to maximize contribution margin while taking into consideration product demands and prices, plant capacities, production costs, distribution costs, and raw material costs. The results of the model are the optimal production quantities by plant, and the total contribution margin. The DSS is implemented in Excel, and uses LINGO to solve the optimization model. After successful implementation at the High Performance Polymers division, GE Plastics is now rolling out this system to other divisions.

2 — Optimization under Extreme Weather
Chih-Cheng Hsu, Operations Research Department, General Motors, 585 South Boulevard, Pontiac, MI, 48341, United States, chihcheng.hsu@gm.com, Yvan de Blois

We present a scheduling solution for the General Motors Cold Weather Development Center. The center is responsible for executing vehicle road tests under excessive cold weather conditions, where test vehicles are required to complete tests under various temperatures and following required sequences. A decision support tool with a specialized heuristic was developed to maximize vehicle test efficiency while assigning tests to vehicles without violating test operation constraints. Dramatic throughput improvements and vehicle warranty savings are achieved after the tool's

■ MB05

Westin-Intl. E, 6th Floor

Numerical Problems in Queueing Theory

Sponsor: Applied Probability
Sponsored Session

Chair: John Shortle, Assistant Professor, George Mason University, 4400 University Dr., MS 4A6, Fairfax, VA, 22030, United States, jshortle@gmu.edu

Co-Chair: Andrew Ross, Lehigh University, Industrial and Systems Eng., 200 West Packer Ave, Bethlehem, PA, 18015, United States, amr5@lehigh.edu

1 — Numerical Inversion of Generating Functions - A Computational Experience
Mohan Chaudhry, DND, Dept. of Math and Compt. Sci., RMC, Kingston, ON, Canada, chaudhry-ml@rmc.ca, Nam Kim

This paper considers the numerical inversion of generating functions (GFs) that arise in engineering and non-engineering fields. Three classes of GFs are taken into account: probability generating functions (PGFs) that are given in rational and non-rational forms, and GFs that are not PGFs.

2 — Scaling for Erlang-Loss Laplace Transforms in Limited Precision
Andrew Ross, Lehigh University, Industrial and Systems Eng., 200 West Packer Ave, Bethlehem, PA, 18015, United States, amr5@lehigh.edu

We want to compute transient probabilities for Erlang loss systems with unchanging arrival and service rates. Numerical inversion of the Laplace transform is a good candidate method, and there is a fast way to calculate values of the transform. However, the method uses numbers larger than double-precision will allow. We discuss a method of automatic scaling that avoids the problem.

3 — Finding the Assymptotic Variance of Estimators in Markovian Event Systems Simulation
Winfried Grassmann, University of Saskatchewan, Dept. of Computer Science, 57 Campus Drive, Saskatoon, S7N 5A9, Canada, grassman@cs.usask.ca

Finding the variances of time averages is importatn for both risk analysis and simulation. In ergodic Markov chains, these variances are proportional to the reciprocal to the time horizon, provided the time horizon is long enough. The factor of proportionality can be found by solving sets of euqations that are very similar to the equilibrium equations. Applications to run length determination in simulation will be discussed.

4 — Piecewise Polynomial Approximations for Heavy-Tailed Distributions
John Shortle, Assistant Professor, George Mason University, 4400 University Dr., MS 4A6, Fairfax, VA, 22030, United States, jshortle@gmu.edu, Martin Fischer, Denise Masi, Donald Gross

A difficulty in analyzing queues with heavy-tailed distributions is that, in general, they do not have closed-form Laplace transforms. A recently proposed method, the Transform Approximation Method (TAM), overcomes this by numerically approximating the transform. In this talk, we discuss recent improvements which significantly speed up the method. We also compare TAM with existing methods for approximating heavy-tailed distributions.

■ MB06

Westin-Intl. F, 6th Floor

Mathematical Methods for Musical Design II

Cluster: OR in the Arts: Applications in Music
Invited Session

Chair: Charlotte Truchet, Laboratoire d'Informatique de Paris 6, 8 rue du Capitaine Scott, Paris, France, Charlotte.Truchet.95@normalesup.org

1 — Investigations in Metric Structure Based on a Mathematical Model
Anja Volk, United States, anja@cs.tu-berlin.de

This paper discusses a notion of metric coherence based upon a mathematical model describing the inner metric structure of a piece of music. Inner metric analysis studies the metric structure of the notes without considering the time signature and bar lines. It is opposed to outer metric analysis which refers to a presupposed regular structure of musical time. The notion of metric coherence describes the correspondences of varying degrees between the outer and inner metric structure.

2 — Tempo Induction, Beat Tracking and Periodicity-Based Music Classification
Simon Dixon, Austrian Research Inst. for AI, Freyung 6/6, Vienna, 1010, Austria, simon@oefai.at

We review our recent research in audio analysis, starting with two approaches to tempo induction: autocorrelation of the band-limited audio signal, and onset detection followed by clustering of inter-onset intervals. We then describe three systems using these methods: a beat tracker with a multi-agent architecture; a real time performance visualisation system, using a modified tempo induction algorithm; and a genre recognition system for dance music based on periodicity patterns.

3 — Musical Application of Adaptive Search, a Tabu Search Method for Solving CSPs
Charlotte Truchet, Laboratoire d'Informatique de Paris 6, 8 rue du Capitaine Scott, Paris, France, Charlotte.Truchet.95@normalesup.org, Gerard Assayag, Philippe Codognet

We present a new application area of constraint programming : music, precisely the field of Computer Assisted Composition. It deals with any symbolic representation of music, for instance at the score level. We have worked with contemporary composers on a dozen of musical CSPs, using a new heuristic method called Adaptive Search. For many reasons, local search techniques are well adapted to musical purposes. We have then designed and implemented a constraint programming system for musicians.

■ MB07

Westin-Intl. G, 6th Floor

Energy Trading and Risk Management

Sponsor: Energy, Natural Resources and the Environment
Sponsored Session

Chair: Chung-Li Tseng, Assistant Professor, University of Maryland, Department of Civil & Environmental Engi, College Park, MD, 20742, United States, chungli@eng.umd.edu

1 — Managing Un-commoditized Risks in Power Markets
Glen Swindle, Managing Director, Constellation Power Source, 111 Market Place, Suite 500, Baltimore, MD, 21202, United States, Glen.Swindle@constellation.com

Power asset portfolios have embedded risks at short time-scales which are not directly hedgeable in commodities markets (e.g. unit constraints in generating assets). Forwards and options contracts, if traded at all, are at the daily or monthly time-scale. We will first discuss the resulting limitations of risk-neutral valuation, and then describe an alternative approach of direct modeling of the physical (spot) measure and appropriate hedge construction.

2 — Robust Valuation and Hedging of Real Assets in Energy Markets
Krzysztof Wolyniec, Director of Research, Mirant, Inc., 1155 Perimeter Center West, Atlanta, GA, 30338, United States, krzysztof.wolyniec@mirant.com

The paper presents the analysis of the valuation and hedging of physical assets with various operational constraints. I introduce a new methodology based on non-linear recursive representation of the relevant stochastic dynamic programs. The methodology enables one to achieve a clear insight into the interaction between the relevant price distributions and physical constraints, which, in turn,allows a robust determination of value and hedging strategies.

3 — Pricing and Hedging Electricity Tolling Contracts as Real Options
Zhendong Xia, United States, dengie@isye.gatech.edu, Shijie Deng

A tolling agreement entitles its buyer to take the output of a merchant power plant by paying a predetermined rent to the owner of the power plant. A real options approach is proposed to value the tolling contracts incorporating major operational characteristics and contractual constraints. We also propose a heuristics for constructing the corresponding delta-hedging portfolios and examine the hedging performance of the heuristics

4 — Risk Metrics for Regulated Utilities
Jonathan Jacobs, PA Consulting Group, 390 Interlocken Crescent, Suite 410, Broomfield, CO, 80021, United States, Jon.Jacobs@paconsulting.com

Risk management is an established discipline in the energy industry, but is generally discussed in the context of the risk faced by unregulated merchants. Regulated utilities face risks even though they are somewhat shielded by their native customer bases. In this talk we will present a general framework for measuring procurement and market risk, and discuss considerations that are specific to the regulated sector.

■ MB08

Westin-Intl. H, 6th Floor

Advances in Simulation Methodology

Sponsor: Simulation
Sponsored Session

Chair: Micheal Freimer, Smeal College of Business, The Pennsylvania State University, University Park, PA, 16802, United States, mbf10@psu.edu

1 — Modifying the NORTA Method for Better Performance in Higher Dimensions
Souymadip Ghosh, Cornell University, 206 Rhodes Hall, School of Operations Research and Indust, Ithaca, NY, 14853, United States, sdghosh@orie.cornell.edu, Shane G. Henderson

The NORTA method for multivariate generation has been shown to fail to work with many correlation matrices for which valid joint-distributions can be constructed. Simulation results have shown that this method fails for increasingly larger proportions of correlation matrices as the dimension of the random vector is increased. In Ghosh and Henderson (2002), we have proposed a modified NORTA procedure, augmented by a semidefinite program (SDP), that aims to generate a correlation matrix "close" to the desired one. We find that though the performance of this modified NORTA method is satisfactory as the dimension increases, we are required to solve increasingly harder SDP problems. We discuss other heuristic NORTA-modification procedures that seem to perform satisfactorily while scaling very well with dimension.

2 — A Kernel Approach to Estimating the Density of a Conditional Expectation
Samuel G. Steckley, Cornell University, 206 Rhodes Hall, School of Operations Research and Indust, Ithaca, NY, 14853, United States, steckley@orie.cornell.edu, Shane G. Henderson

We estimate the density of a conditional expectation using kernel density estimation techniques. We present a result on rates of convergence and examine a few numerical examples. The motivation for this problem stems from simulation input uncertainty where the conditional expectation reflects expected system performance conditional on a selected model and parameters.

3 — Integrating Model Simulation & Data Collection
Paul Hyden, Clemson University, Department of Mathematical Sciences, O-326 Martin Hall, Clemson, SC, 29634-0975, United States, hyden@clemson.edu, Micheal Freimer

Currently, simulation studies are often viewed as three independent stages: data collection, model simulation and analysis and decision making. However, the need for quick decisions often overwhelms independent analysis of each stage and inevitably sacrifices are necessary. The inherent dependencies between these stages can be exploited to offer effective decisions based on the nature of the resources available.

4 — Unbiased Gradient Estimates in a Two-Stage Stochastic Optimization Problem
Micheal Freimer, Smeal College of Business, The Pennsylvania State University, University Park, PA, 16802, United States, mbf10@psu.edu, Douglas Thomas

We consider a gradient optimization technique for a stochastic optimization problem comprised of two stages. At the first stage, values are chosen for a set of design variables. For example, we may be optimizing the line capacities in a production planning setting. The objective function of the design problem requires us to evaluate the expected value of the solution to a linear program, some of whose parameters are stochastic. Furthermore, the design variables from the first stage appear in the constraints of the second-stage LP. We provide conditions under which the shadow prices from a realization of the LP serve as unbiased estimates for the gradient in the design problem.

■ MB09

Westin-Vinings 1, 6th Floor

INFORMS 2003 Annual Case Competition — Presentations of Finalists 3&4

Sponsor: Education (INFORM-ED)
Sponsored Session

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

1 — Presentations of Finalists 3&4

During this special open session, the second two of the four finalists in INFORMS 2nd Annual Case Competition will deliver 30-minute presentations of their entries before a panel of judges . The judges will select the winning entry from the cases presented during this session and the following session.

■ MB10

Westin-Vinings 2, 6th Floor

Advances in Metaheuristics for Combinatorial Optimization

Cluster: Optimization
Invited Session

Chair: Cesar Rego, University of Mississippi, Hearin Center for Enterprise Science, School of Business Administration, University, MS, United States, crego@bus.olemiss.edu

Co-Chair: Colin Osterman, Graduate Student, University of Mississippi, PO Box 2763, University, MS, 386877, United States, cjosterm@olemiss.edu

1 — The Satellite List and New Data Structures for Traveling Salesman Problems
Colin Osterman, Graduate Student, University of Mississippi, PO Box 2763, University, MS, 386877, United States, cjosterm@olemiss.edu, Cesar Rego

We advance the state of the art in metaheuristic search algorithm performance for the Traveling Salesman Problem and related problems. 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 — An Enhanced Tabu Search Algorithm for the Protein-Folding Problem
Hao Tao Li, The University of Mississippi, Hearin Center for Enterprise Science, School of Business Administration, University, MS, 38677, United States, hli@bus .olemiss.edu, Cesar Rego

We describe a tabu search algorithm for solving the lattice protein-folding problem, or the hydrophobic-hydrophilic (HP) problem introduced by Dill (1985). A specialized data structure, incorporating a dynamic coordinate system is designed to ease the modeling of the complex neighborhood structure. Computational results on a set of benchmark problems are provided.

3 — Surrogate Constraints for the Multi-Resource Generalized Assignment Problem
Lutfu Sagbansua, The University of Mississippi, Hearin Center for Enterprise Science, School of Business Administration, University, MS, 38677, United States, lsagbansua@bus.olemiss.edu, Cesar Rego, Bahram Alidaee

We propose a new algorithm for solving large scale Multi-Resource Generalized Assignment Problems (MRGAP). A surrogate constraint relaxation approach is used to solve the problem. Computational results and comparisons with alternative algorithms demonstrate the viability of our approach.

4 — An Adaptive Surrogate Constraint Algorithm for the Set Covering Problem
Jie Zhang, The University of Mississippi, Hearin Center for Enterprise Science, School of Business Administration, University, MS, 38677, United States, Cesar Rego, Fred Glover

We describe an adaptive surrogate constraint approach for solving set covering problems. We examine a variety of normalization rules, adaptive weighting strategies and discuss the computational results obtained on standard testbed cases from OR-Library.

5 — Adaptive Search Multi-Start Heuristics for the Set Covering Problem
Yuehua She, The University of Mississippi, Hearin Center for Enterprise Science, School of Business Administration, University, MS, 38677, United States, yshe@bus .olemiss.edu, Cesar Rego, Fred Glover

In this study we examine surrogate constraints as a foundation to creating adaptive search multi-start approaches for solving set covering problems. We highlight normalization rules, as well as memory structures and diversification mechanisms. Experimental results are provided.

■ MB11

Westin-Augusta 1, 7th Floor

Tutorial: Developing Spreadsheet-Based Decision Support Systems

Cluster: Tutorials - Atlanta2003
Invited Session

1 — Developing Spreadsheet-Based Decision Support Systems
Ravindra Ahuja, Professor, University of Florida, 303, Weil Hall, P O Box 116595, Gainesville, FL, 32608, United States, ahuja@ufl.edu, Michelle M. Hanna

This tutorial will describe how features in Excel and VBA (Visual Basic for Applications) can be used to develop decision support systems, which take data from spreadsheets, use optimization or simulation models and algorithms to process data, and package it with attractive and user-friendly graphical user interface. The tutorial will highlight the need of teaching these technologies to IE/OR/Management students and will provide the teaching material for a complete course on a CD to interested attendees.

■ MB12

Westin-Augusta 2, 7th Floor

Flexible Servers and Control of Queues II

Cluster: Workforce Flexibility and Agility
Invited Session

Chair: Hyun-soo Ahn, Assistant Professor, University of California, 4185 Etcheverry Hall, Berkeley, CA, 94720, United States, ahn@ieor.berkeley.edu

1 — Optimal Worksharing in Systems with Hierarchical Cross-training
Esma S. Gel, Assistant Professor, Arizona State University, Dept. of Industrial Engineering, P. O. Box 5906, Tempe, AZ, 85287-5906, United States, esma.gel@asu.edu, Wallace Hopp, Mark Van Oyen

We study systems in which workers have increasing or decreasing skill sets along a flowline. Using sample path arguments, we characterize the optimal policy for two station ConWIP systems with general processing times, which leads us to the "fixed-before-shared" principle for the scheduling of flexible workers.

2 — Partial Pooling in Tandem Lines with Cooperation and Blocking
Nilay Tanik Argon, Assistant Professor, University of Wisconsin-Madison, Department of Industrial Engineering, 1513 University Avenue, Madison, WI, 53706, United States, nilay@engr.wisc.edu, Sigrun Andradottir

For a tandem line of finite, single-server queues, we study the effects of pooling several adjacent stations and the associated servers into a single station with a single team of servers. We provide sufficient conditions on the service times and sizes of the input and output buffers at the pooled station under which pooling will decrease the departure time of each job from the system, and also the holding cost of each job in the system incurred before any given time.

3 — Dynamic Load Balancing with Flexible Workers
Hyun-soo Ahn, Assistant Professor, University of California, 4185 Etcheverry Hall, Berkeley, CA, 94720, United States, ahn@ieor.berkeley.edu, Rhonda Righter

Increasing worker agility through cross-training has become an efficient way to allocate limited resouce. We characterize the structure of optimal policies for dynamically assigning workers to tasks. In many situations simple rules should be followed, and we give conditions under which commonly used heuristics are optimal. When optimal policies are more complex we show how to reduce the range of policies that need be considered.

■ MB13

Westin-Augusta 3, 7th Floor

Spatial Marketing

Sponsor: Marketing Science
Sponsored Session

Chair: Gerard Cliquet, Professor, CREREG Univ. of Rennes 1, 11 rue Jean Macé, CS 70803, Rennes, 35590, France, gerard.cliquet@univ-rennes1.fr

1 — The Gravity Polygons Method. An Operationalisation of the Central Places Theory in Marketing.
Michel Calciu, Associate Professor, IAE, University of Lille 1, 104 Av. du Peuple Belge, Lille, 59000, France, mihai.calciu@free.fr

This paper presents and applies an original method that evaluates and divides the market area among retail outlets, based on concepts and structures from the central places theory. It draws on a geometrical approximation of market areas, the "gravity polygons", that produces attractiveness sensitive partitions of the market

space. The methodology that has been developed introduces flexibility and measurement in the central places approach.

2 — An Application of Signal Processing Combined with the p-Median Model for Micro-Facilities Location
Jérôme Baray, Crereg - Univ. Paris 2, 7 rue de Soissons, Paris, Pa, France, jbaray@noos.fr

The present paper uses the p-median model combined with an aggregation method of spatial filters. The originality of the research lies in the fact of taking for representation of the aggregated clients set in the p-median network, some sample elements from these clusters to increase the precision of the facilities optimized locations. The method has been tested successfully to locate micro-facilities e.g. newspaper and drink distributors in subway stations in Paris.

3 — Building a Store Location Model for Retail and Service Plural Form Networks
Gerard Cliquet, Professor, CREREG Univ. of Rennes 1, 11 rue Jean Macé, CS 70803, Rennes, 35590, France, gerard.cliquet@univ-rennes1.fr

Statutory considerations in multiple location have been taken into account recently, including franchising aspects. But now retail and service store networks are plural form organized, which means that franchised and company-owned units can be found within the same chain. The problem is now to build a model which could enable decision makers to locate either a franchised or a company-owned unit in a specific area. This paper proposes a MNL model nested in a p-median model.

4 — Evaluating Alternative Geodemographic Segmentation Schemes
John Totten, SVP-Trade Analytics Dev., Spectra, 200 West Jackson St, Chicago, Il, 60606, United States, John_Totten@spectramarketing.com

We report on research in progress examining projection of consumer panel sales results across a variety of products and stores. Consumer purchase data on 200 products was summarized into consumption and penetration indices by demographic group. Average weekly sales by product was calculated for about 25000 stores. Store sales indices were compared to panel indices weighted by trading area composition. This comparison was done for major demographics, and for several compound schemes.

5 — Optimal Location in the Geographic and Perceptual Space using Attractiveness and Market Share.
Gregory Veermersch, IT Engineer, IAE, University of Lille 1, 104 Av. du Peuple Belge, Lille, 59000, France, michel.calciu@univ-lille1.fr, Michel Calciu

The paper builds upon an optimal location method in the continuous two-dimensional space, proposed by Drezner (1994) adapting a weighted Euclidian distances minimisation procedure by Weiszfeld (1937) to market-share maximisation. Based upon the conceptual similarity between the geographic and perceptual space we extend the method to situations. As Weiszfeld's original algorithm tends to converge into local optima, several procedures are suggested in order to search for the global optimum.

■ MB14

Westin-Peachtree A, 8th Floor

Complexity and Ambiguity in Project Management

Cluster: New Product Development
Invited Session

Chair: Christoph Loch, Professor of Technology Management, INSEAD, Boulevard de Constance, Fontainebleau, FR, France, christoph.loch@insead.edu

1 — Incentives and Monitoring in Projects with Ambiguity
Svenja Sommer, INSEAD, Boulevard de Constance, Fontainebleau, FR, France, svenja .sommer@insead.edu, Christoph Loch

Incentive setting and progress monitoring are well understood in routine projects, but not in projects with ambiguity. We study in a model and empirically how incentive setting and monitoring need to be adjusted in projects that exhibit ambiguity.

2 — Hierarchies and Problem Solving Oscillations in Complex Projects
Jurgen Mihm, WHU, Burgplatz 2, Vallendar, 56179, Germany, jumihm@whu.edu, Christoph Loch, Bernardo Huberman

Complex projects are characterized by the inability to solve the overarching problem in one piece. Rather, problem solving is distributed across components, which are then integrated. This often leads to oscillations, or cycling through the solution space with slow convergence to a system solution. We show that hierarchies can help to dampen such oscillations (apart from their well known role of control).

3 — The Role of Ambiguity in (Incomplete) Contracts
Sudheer Gupta, Assistant Professor, Michigan Business School, 701 Tappan St., Ann Arbor, MI, 48109, United States, sudheer@umich.edu

Ambiguity — the inability to probabilistically know what you don't know for sure — is a common occurrence in business situations. We analyze the role of ambiguity in contractual relations with a formal game-theoretic framework. Incomplete contracts can endogenously emerge as rational responses to ambiguity. We discuss applications to supply chain contracting and project management.

4 — Process, Practice and Politics: Relationship Between Documentation, Deployment and Work
Nelson Repenning, Associate Professor, MIT Sloan, 50 Memorial Drive, Cambridge, MA, 02142, United States, nelsonr@mit.edu

We present an empirical study of a product development process initiative at Xerox Corporation focused on the use of standard processes. The more novel the project, the more rigid was the enforcement of the standard process. Our analysis provides insight into the challenges when using standard processes to manage innovation in both traditional and new markets and technologies.

■ MB15

Westin-Peachtree F, 8th Floor

Technology Management Section Dissertation Award

Sponsor: Technology Management
Sponsored Session

Chair: Glenn Dietrich, The University of Texas-San Antonio, 6900 N. Loop 1604 West, Information Systems, San Antonio, TX, 78249, United States, GDietrich@utsa.edu

■ MB16

Westin-Peachtree G, 9th Floor

Applications in Health Care II

Sponsor: Health Applications
Sponsored Session

Chair: Ruth Davies, Professor, University of Warwick, Warwick Business School, Coventry, UK, CV4 7AL, United Kingdom, rmd@socsci.soton.ac.uk

1 — Measuring the Efficiency of Public Sector Hospitals
Adolf Stepan, Professor, Technische Universität, Abt. f. Industr. BWL, Theresianumg . 27, Wien, A, 1040, Austria, stepan@ibab.tuwien.ac.at, Margit Sommersguter

In 1997 an activity-based hospital financing was introduced in Austria. These serious changes have been motivated by the necessary enhancement in hospital efficiency. This paper suggests a framework using DEA for assessing the evolution of public sector hospital performance. The results indicate that the incentives inherent in the activity-based financing system have to be seriously reconsidered and that the intended enhancement in hospital efficiency has not yet taken place.

2 — Using Simulation for Evaluating Resource Requirements and Cost-Utility for End-Stage Renal Failure
Ruth Davies, Professor, University of Warwick, Warwick Business School, Coventry, UK, CV4 7AL, United Kingdom, rmd@socsci.soton.ac.uk

Patients with end-stage renal failure need expensive treatments. A discrete event simulation describes the transfers between treatment modalities. Future acceptance rates for England were estimated from population projections and comparisons with other countries. Survival curves were derived from patient databases. Results show that numbers can be expected to increase by 50%-75% over 15 years. Cost utility calculations facilitate comparisons with treatments for other diseases.

3 — When Does "Advanced Access" Make Sense?
Linda Green, Armand G. Erpf Professor, Columbia Business School, 3022 Broadway, 423 Uris Hall, New York, NY, 10027, United States, lvg1@columbia.edu, Sergei Savin, Gabi Kimyagarov

The "advanced" or "open" access model, in which patients are offered an appointment the same day they call, has been touted for its ability to significantly reduce waiting times without increasing resources. In this talk, we present a model which captures one of the key assumptions behind this success and examine under what conditions the advanced model works. More generally, we address the issue of finding the optimal appointment scheduling window for any outpatient facility.

4 — The Use of Discrete-Event Simulation to Evaluate Strategies for the Prevention of Mother-to-Child Transmission of HIV in Developing Countries
Marion S. Rauner, University of Vienna, Institute of Business Studies, Department of Innovation and Technology, Bruenner Str. 72, A-1210, Vienna, Austria, marion .rauner@univie.ac.at, Sally C. Brailsford, PhD, Steffen Flessa, PhD

In this paper, we present the first discrete-event simulation model which evaluates the relative benefits of two potentially affordable interventions aimed at preventing mother-to-child transmission of HIV, namely anti-retroviral treatment at childbirth and/or bottlefeeding strategies. The model uses rural Tanzanian data and compares different treatment policies. Our results demonstrate that strategic guidelines about breastfeeding are highly dependent on the assumed increase in infant mortality due to bottlefeeding, the efficacy of anti-retroviral treatment at childbirth, and the maternal health stage.

■ MB17

Westin-Peachtree H, 9th Floor

OR Methods for Therapeutic Treatment for Cancer

Cluster: Operations Research for Medical Applications
Invited Session

Chair: Eva Lee, Assistant Professor, Georgia Institute of Technology, School of Industrial and, Systems Engineering, Atlanta, GA, 30332-0205, United States, eva.lee@isye.gatech.edu

1 — Beam Geometry and Intensity Map Optimization in Intensity-Modulated Radiation Therapy via MIP
Eva Lee, Assistant Professor, Georgia Institute of Technology, School of Industrial and, Systems Engineering, Atlanta, GA, 30332-0205, United States, eva.lee@isye .gatech.edu

In this talk, we describe the use of mixed integer programming 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.

2 — Optimal Treatment Plans for Radiofrequency Ablation of Liver Tumors
Ariela Sofer, George Mason University, MS4A6, 4400 University Dr., Fairfax, VA, 22030, United States, asofer@gmu.edu, Bradford Wood

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.

3 — Integrating Beam Orientation Optimization with Intensity Modulation in Radiation Therapy
James Dempsey, Assistant Professor, University of Florida, J. Hillis Miller Health Center, P.O. Box 100385, Gainesville, FL, 32610, United States, dempsey@ufl.edu, Ravindra Ahuja, Arvind Kumar, H. Edwin Romeijn, Jonathan Li

Radiation therapy treatment planning for cancer patients requires the determination of beam orientations and the intensity modulation of these beams. Currently, the problems of finding beam orientations and intensity modulations are solved separately. We propose several methods to integrate these problems, and present computational results on clinical cases.

■ MB18

Westin-Tower 1201, 12th Floor

Panel: Design of Experiments in Engineering Practice and Engineering Curriculum

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: Bruce Ankenman, Associate Professor, Northwestern University, Dept. of Ind. Eng., 2145 Sheridan Rd., Evanston, IL, 60208, United States, ankenman@northwestern.edu

1 — Design of Experiments in Engineering Practice and Engineering Curriculum
Moderator: Bruce Ankenman. Panelists: Jeff Wu, Soren Bisgaard, Kwok-Leung Tsui, G. Geoffrey Vining

Design of Experiments has become a crucial part of engineering practice. Questions remain about how to deploy DOE expertise. What level of expertise in DOE is expected from an engineer with a Bachelor's degree? What training should be done on the job? A panel of experts will discuss the topic.

■ MB19

Westin-Tower 1202, 12th Floor

Industrial Statistics in Design and Manufacturing

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: Jye-Chyi Lu, Professor, Georgia Institute of Technology, Groseclose Building, Room 335, 765 Ferst Drive, Atlanta, GA, 30332, United States, JCLU@isye.gatech.edu

1 — Reponse Surface Methodology in Engineering Design
Jye-Chyi Lu, Professor, Georgia Institute of Technology, Groseclose Building, Room 335, 765 Ferst Drive, Atlanta, GA, 30332, United States, JCLU@isye.gatech.edu, Farrokh Mistree

This presentation uses several examples to show the potential of applying response surface methods (RSM) in product designs, where there are choices of material types and product parameters (e.g., dimension, layout, part-strength) with distinct cost, functionality and performance measures. The model built in the RSM is useful in locating optimal design and in supporting system level product/process performance simulations.

2 — Quality Loss Functions for Nonnegative Variables and Their Applications
Roshan Vengazhiyil, Assistant Professor, Georgia Institute of Technology, The School of Industrial and Systems Eng, Campus Box 0205, Atlanta, GA, 30332-0205, United States, roshan@isye.gatech.edu

Loss functions play a fundamental role in every quality engineering method. A new set of loss functions is proposed based on Taguchi's societal loss concept. Its applications to robust parameter design are discussed in detail. The loss functions are shown to posses some interesting properties and lead to theoretical results that cannot be handled with other loss functions.

3 — Reliability Analysis of Uncertainties in Logistics Networks Under Contingency
Ni Wang, Georgia Institute of Technology, Atlanta GA 30332, United States, gtg586c@mail.gatech.edu, Paul Kvam, Jye-Chyi Lu

This paper proposes a new method to find optimal rerouting strategy after contingency using continuum approximation approaches. A service reliability measurement of logistics systems is introduced. A numerical example provides insights of the strategy in designing a robust logistics network to counter potential contingencies, e.g., 2003 Northeast electricity blackout.

4 — Data Reduction and Data Mining for Multiple Curves of Functional Data
UK Jung, Ph.D. Student, Georgia Institute of Technology, The School of Industrial and Systems Eng, Campus Box 0205, Atlanta, GA, 30332-0205, United States, freeuk91@hotmail.com, Jye-Chyi Lu

As data sets increase in size, exploration, manipulation, and analysis become resource consuming in many fields including intelligent manufacturing. This presentation shows procedures for "reducing the size of data'" in a mathematical rigorous framework. Then, we provide examples of applying procedures to the reduced-size data for various decision-making purposes. An objective function is formulated to balance the requirements of modeling accuracy and data reduction for multiple data curves.

■ MB20

Westin-Tower 1203, 12th Floor

Statistical Quality Control

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: Magdy Helal, University of Central Florida, Industrial Eng & Management Systems Dept, 4000 Central Florida Blvd, Orlando, FL, 32816, United States, mhelal@mail.ucf.edu

1 — Combined Double Sampling Plan in Six Sigma Age
You-Dong Won, Associate Professor, Kyungnam University, Wolyoung-Dong #449, Kyungnam University, College of Business, Masan, Kyungnam, KR, 631-701, Korea Repof, wonyd@kyungnam.ac.kr

The developmenet of chain sampling by Dodge led to the successive development of an entire family of conditional attribute acceptance sampling procedures. In this paper,combined double sampling is introduced. Combined double sampling is similar in concept to regular double sampling plans. They are operationally different. Combined double sampling plan has several attractive features such as smaller sample sizes and similar response charcteristics.

2 — An Excel Add-in for Estimating Complex Systems Reliability via Monte Carlo Simulation
Javier Faulin, Associate Professor, Public University of Navarra, Department of Statistics and OR, Campus Arrosadia, Pamplona, NA, 31008, Spain and Canary Islands, javier.faulin@unavarra.es, Angel Juan, Vicente Bargueno, Alejandro Garcia del Valle

In this paper we introduce SREMS, an Excel Add-In developed using Visual Basic for Applications (VBA) which is designed for estimating complex systems reliability via Monte Carlo simulation techniques. SREMS adds to Excel significant improvements both in versatility and in statistical analysis capabilities when working with Monte Carlo simulation to study complex systems behavior.

3 — Improving the Quality of a Continuous Production Process using Statistical Methods
Ramachandran Radharamanan, Professor, Mercer University, 1400 Coleman Avenue, Macon, GA, 31207-0001, United States, radharaman_r@mercer.edu

In this paper, statistical methods such as factorial design experiments, analysis of variance, and Taguchi methods have been used to monitor the quality of the incoming raw material, product quality during processing, and the final product quality of a process industry. The results obtained are presented and discussed. The analysis made on the experimental results provided information to improve the quality of the process industry in all three phases with cost effectiveness.

4 — Integrated Modeling of Variation Propagation for Machining and Assembly Systems
Weiping Zhong, Quality Assurance Engineer, Ph.D., Bayer Corporation, 430 South Beiger, Mishawaka, IN, 46544, United States, weiping.zhong.b@bayer.com, Yujing Feng, Carol Drummond

Since machining and assembly operations are often applied to one product, an integrated model would be more advantageous than separated models in terms of variation propagation analysis, tolerance synthesis and fault diagnosis. This paper presents such an integrated model for machining and assembly using CAD model, Monte Carlo simulation and Homogeneous Transformation Matrix methods. A simulated mechanical device is presented to illustrate the modeling.

5 — Are the Process Capability Indices Capable?
Magdy Helal, University of Central Florida, Industrial Eng & Management Systems Dept, 4000 Central Florida Blvd, Orlando, FL, 32816, United States, mhelal@mail.ucf .edu, Yasser Hosni

Process capability is an important area within the quality profession. The aims of conducting capability analysis is estimating, monitoring, and possibly reducing variability in production processes. Measures being used are the process capability indices. However, the use of such indices has been subject to much criticism. A large gap between theory and practices has been observed. The question then becomes: are the available process capability indices capable? This paper addresses that question

■ MB21

Westin-Tower 1204, 12th Floor

Open-Source Linear and Mixed-Integer Programming Tools

Sponsor: Computing
Sponsored Session

Chair: Robin Lougee-Heimer, IBM Research, 1101 Kitchawan Road, Yorktown Heights, NY, 10598, United States, robinlh@us.ibm .com

1 — Checking for Rank 2 Chvatal-Gomory Inequalities
Brady Hunsaker, Assistant Professor, University of Pittsburgh, School of Engineering, 1036 Benedum Hall, Pittsburgh, PA, 15261, United States, hunsaker@engr .pitt.edu, Craig Tovey, Ellis Johnson

We present algorithms and corresponding implementations that check for rank 2 C-G inequalities and that optimize over all rank 1 C-G inequalities. We discuss computational issues and plan to make the software available online under an open-source license.

2 — A Framework for Scalable Parallel Tree Search
Yan Xu, Lehigh University, 200 West Packer Avenue, Bethlehem, PA, 18015, United States, yax2@lehigh.edu, Matthew Saltzman, Laszlo Ladanyi, Ted Ralphs

We discuss the Abstract Library for Parallel Search, a framework for implementing parallel search algorithms. ALPS is designed to facilitate scalable implementations of methods such as branch and cut in which large amounts of "knowledge," such as cuts, are generated and must be shared. ALPS provides a framework for defining new types of knowledge, along with methods for storing and sharing this knowledge efficiently. We present computationsl results using ALPS for solving large integer programs.

3 — The COIN-OR Linear Program Solver (CLP)
John Forrest, IBM, T. J. Watson Research Center, Yorktown Heights, NY, 10598, United States, jjforre@us.ibm.com

CLP is a high-quality, open-source, simplex-based solver. Source code is available at www .coin-or.org. CLP uses sparse techniques, and has been tested on problems sizes of up to 1.5 million constraints. This talk surveys the design of CLP, including the conscious trade-offs made between performance and extensibility by the OR community. Benchmark results will be presented.

■ MB22

Westin-Tower 1205, 12th Floor

Panel: What Makes for a Successful Decision Analysis?

Sponsor: Decision Analysis
Sponsored Session

Chair: James Felli, Senior Research Scientist, Eli Lilly & Company, Lilly Research Laboratories, Lilly Corporate Center, Indianapolis, IN, 46285, United States, jcfelli@lilly.com

1 — Panel: What Makes for a Successful Decision Analysis?
Panelists: James Felli, Michael Rothkopf, Jeffrey Stonebraker, Donald L. Keefer, Detlof von Winterfeldt, Charles LaCivita, Gregory Parnell

The criteria by which a decision analysis is judged useful may vary depending upon the character and requirements of the sponsoring individual's organization. What plays well for an academic audience, for example, may be unpalatable for an industrial or military sponsor. The panelists will discuss various elements of value in decision analyses and comment upon whether these elements tend to have limited appeal to specific audiences or are broadly appreciated across organizations.

■ MB23

Westin-Tower 1206, 12th Floor

Decision Analysis Arcade

Sponsor: Decision Analysis
Sponsored Session

Chair: Dana Clyman, The Darden School, Charlottesville, VA, United States, clymand@darden.virginia.edu

1 — Investments in Competing Standards
Laura Kornish, The Fuqua School of Business, Duke University, Durham, NC, 27708-0120, United States, kornish@duke.edu

I investigate optimal allocation of funds between projects in which there can be non-constant returns to scale, probabilistic dependence, and opportunities for information gathering. In particular, I explore the case of projects that depend on competing standards and look at when allocations are balanced vs. all-or-nothing.

2 — Inference in Hybrid Bayesian Networks with Mixtures of Truncated Exponentials
Barry Cobb, Ph.D. Student in Business Administration, The University of Kansas School of Business, 1300 Sunnyside Ave., Summerfield Hall, Lawrence, KS, 66045-7585, United States, brcobb@ku.edu, Prakash Shenoy

Mixtures of truncated exponentials (MTE) potentials are an alternative to discretization for solving hybrid Bayesian networks with discrete and continuous nodes. Any probability density function can be approximated by an MTE potential. MTE potentials are closed under combination and can be easily marginalized, allowing exact propagation using the Shenoy-Shafer architecture.

3 — Evaluating Investments in Health and Safety
Ralph L. Keeney, Fuqua School of Business, Duke University, 101 Lombard St., 704W, San Francisco, CA, 94111, United States, keeney@duke.edu, James E. Smith

We develop a model to evaluate personal investments of money and time in health and safety. The model considers uncertainties about the time of death, the quality of life, and the impact of the investment on optimal consumption. We discuss theoretical properties of the model as well as specific examples.

4 — Combining Operational Options and Financial Hedging in an Electric Power Plant
Samuel Bodily, John Tyler Professor of Business Administration, Darden Graduate Business School, 100 Darden Boulevard, Charlottesville, VA, 22903, United States, BodilyS@Darden.virginia.edu, Miguel Palacios

Our model combines operational options with financial hedging. A decision tree for operating decisions is embedded in a Monte Carlo spreadsheet simulation, which treats hedging of fuel and electricity prices. We conclude that the amount and value of hedging depends on operational decisions, and that optimizing jointly adds significant value.

■ MB24

Westin-Tower 1207, 12th Floor

Measurement of Digital Supply Chain Collaboration & Its Impacts

Sponsor: Information Systems
Sponsored Session

Chair: Arun Rai, Professor, Georgia State University, 35 Broad Street, N.W., Atlanta, GA, 30303, United States, arunrai@gsu.edu

1 — A Framework for Aligning IT Value with Supply Chain Performance
Rich Klein, Assistant Professor - Clemson University, Clemson University, College of Business and Behavior Science, Department of Management, Clemson, SC, 29634, United States, rklein@clemson.edu

The popular trade press has noted that "while the idea of sharing information such as forecasting data, inventory levels, and order status with business partners is not altogether unique, today's Web technology is helping to create tighter partnerships and greater overall value." (p.193) (Stein, 1998). The evolving nature supply chain relationships calls for a re-conceptualization of the information sharing construct.

2 — A Framework for Aligning IT Value with Supply Chain Performance
V. Sambamurthy, Eli Broad Professor of Information Technology, Eli Broad Graduate School of Management, Michigan State University, East Lansing, MI, 48824, United States, smurthy@msu.edu

Contemporary firms are making significant investments in enabling and enhancing their supply chain systems for adaptive supply demand synchronization. How should the value of information technologies be assessed for their impacts on supply chain performance? This presentation describes a framework for thinking about the different bases of IT value and for linking them with metrics of supply chain performance. The framework will be used to describe directions for research on IT value.

3 — Third-Party Gainsharing
Michael Jordan, CEO - Trade Dynamics, Trade Dynamics, 3020 S. Meadow Ct., Marietta, GA, 30062, United States, info@tradedynamics.com

Third-Party Gainsharing (3P-Gainsharing) is a method whereby two or more companies share in the financial gains of a business improvement initiative. 3P-gainsharing is a timely solution to the supplier improvement dilemma because it enables a buyer (or third-party consulting firm acting on behalf of buyer and/or supplier) to fund a supplier improvement initiative with the short-term financial windfalls that are produced from the improvement itself.

■ MB25

Westin-Tower 1208, 12th Floor

Information and Architecture

Sponsor: Military Applications
Sponsored Session

Chair: Bruce Fowler, Chief Sceintist, Advanced Systems Directorate, Aviation Missile Research, Development, and Engineering Center, U. S. Army Research, Development, and Engineering Command, AMSAM-RD-AS-CS, Redstone Arsenal, AL, 35898, United States

1 — An Analytical Architecture to Guide Army Logistics Transformation
Greg Parlier, Director for Transformation and Principal Assistant Deputy to the Commander for Systems Support, U. S. Army Aviation and Missile Command, DCSS, Redstone Arsenal, AL, 35898, United States, gregory.parlier@us.army.mil

The United States Army has embarked upon the most comprehensive "reengineering" endeavor in its history: "Army Transformation". The early intellectual stages of this effort revealed a crucial prerequisite need to transform the Army's logistics concepts and organization to enable enhanced strategic responsiveness and force projection. This paper summarizes a comprehensive study effort culminating in the development of an "analytical architecture" to guide Army Logistics Transformation.

2 — The Cognitive Gap in Information Warfare
John Ballenger, Program Manager, Raytheon Missile Systems, 675 Discovery Drive, Suite 102, Huntsville, AL, 35806, United States, JP_Ballenger@raytheon.com

This study examines the current lack of understanding of the cognitive process in Information Warfare (i.e., The Cognitive Gap) and examines how that cognitive gap hinders the quantification of information value and the development of useful models of information warfare . New metrics for information value are considered, an approach to cognitive modeling is postulated, and a prescription for cognitive research is presented.

3 — Management Science + Entropy = Military Model?
Bruce Fowler, Chief Sceintist, Advanced Systems Directorate, Aviation Missile Research, Development, and Engineering Center, U. S. Army Research, Development, and Engineering Command, AMSAM-RD-AS-CS, Redstone Arsenal, AL, 35898, United States

Attrition models have been overextended to simulate non-attrition phenomena in combat. This approach had some validity in the expected capital war (NATO versus Warsaw Pact) environment in Europe, legacy simulations are now often seen as inappropriate to modern combat. Recent efforts at simulation development have considered an entropic approach to modeling modern combat. We explore an organizational theory architecture, incorporating entropy naturally, as a general approach to military modeling.

■ MB26

Westin-Tower 1401, 14th Floor

Modeling and Data Mining in Bioinformatics

Cluster: Data Mining and Knowledge Discovery
Invited Session

Chair: Mark Borodovsky, Georgia Institute of Technology, School of Biomedical Engineering, Atlanta, GA, 30332-0230, United States, mark.borodovsky@biology.gatech.edu

1 — Mathematical Models for Structural and Functional Characterization of Proteins Encoded by Newly Sequenced Genomes.
Zafer Aydin, School of Electrical Engineering, Georgia Institute of Technology, Atlanta, GA, United States, gtg109j@mail.gatech.edu

Secondary structure prediction has important application in predicting function of hypothetical proteins. The sequence is input to a prediction algorithm whose variables are trained using PDB entries. If the sequence is detected to be a real protein then the function is estimated from proteins with similar secondary structure.

2 — Improving Gene Identification by Interpolation Methods of Model Training
Rajeev Azad, School of Biology, Georgia Institute of Technology, Atlanta, GA, 30332, United States, rajeev@amber.gatech.edu

Interpolation methods combine models of different orders in the Markov model training in order to achieve better accuracy of prediction. We apply these techniques in GeneMark, a frequently used gene finding algorithm to assess their performance in gene identification. Our results show that for genomes with a mid-range GC content, the model built by `deleted interpolation' slightly outperformed other models under several conditions. For genomes with high or low GC content, we observed that fixed order model performs better in some important cases.

3 — Predicting Genes in Prokaryotic Genomes: Typical and Atypical Genes
John Besemer, School of Biology, Georgia Institute of Technology, Atlanta, GA, 30332, United States, john@amber.gatech.edu

Algorithmic methods for gene prediction have been developed and successfully applied to many different prokaryotic genome sequences. As the set of genes in a particular genome is not homogeneous with respect to DNA sequence composition features, the GeneMark.hmm program utilizes two Markov models representing distinct classes of protein coding genes denoted "typical" and "atypical." Models representing the typical class of genes are generated via an iterative self-training method called GeneMarkS. Atypical genes make up approximately 10% of the gene pool for a particular organism, and are not thought of as a homogeneous set as they represent a collection of genes largely comprised of those genes that have been hypothesized relatively recently acquired through lateral gene transfer (LGT). Identifying bona fide LGTs is an important biological question as it sheds light on how much this process has shaped the evolution of prokaryotic genomes. To answer this question, we have built a bioinformatic analysis pipeline to rigorously test each of the gene candidates within an explicit phylogenetic framework. We are utilizing this pipeline to estimate the extent and pattern of LGT in a selection of genomes, both complete and nearly complete, with the long-term goal of analyzing all genomes.

■ MB27

Westin-Tower 1402, 14th Floor

Recent Advances in Integer Programming I

Sponsor: Optimization/Integer Programming
Sponsored Session

Chair: Diego Klabjan, Assistant Professor, University of Illinois at Urbana-Champaign, 1206 West Green Street, Urbana, IL, United States, klabjan@uiuc.edu

1 — Polyhedral Approaches to Solving Nonconvex QP's
Dieter Vandenbussche, Assistant Professor, University of Illinois at Urbana-Champaign, 140 Mech. Eng. Bldg MC-244, 1206 West Green Street, Urbana, IL, 61801, United States, dieterv@uiuc.edu, George Nemhauser

By reformulating quadratic programs using necessary optimality conditions, we present a branch-and-cut approach intended to solve nonconvex instances. For the bound constrained case, we study a relaxation based on a subset of the optimality conditions. By characterizing its convex hull, we obtain a large class of valid inequalities. These inequalities are tested within a branch-and-cut scheme and contribute to significant computational success.

2 — A Polyhedral Approach to Piecewise Linear Optimization
Ahmet Keha, Arizona State University, PO Box 875906, Department of Industrial Engineering, Tempe, AZ, 85287-5906, United States, Ahmet.Keha@asu.edu, Ismael de Farias, George Nemhauser

We discuss a polyhedral approach to nonconvex piecewise linear optimization problems. We present a polyhedral study of single constraint relaxations of the problem modelled without auxiliary binary variables. We then present a branch-and-cut algorithm without auxiliary binary variables, and computational results that demonstrate the practicality of this model.

3 — Cutting Planes from Simplex Tableaux
Jean-Philippe Richard, Assistant Professor, Purdue University, School of Industrial Engineering, 315 N. Grant Street, West Lafayette, IN, 47907, United States, jprichar@ecn.purdue.edu, George Nemhauser

Since the early work of Gomory in the 1960's, it is known that mixed integer programs can be solved by using cutting planes derived from simplex tableaux. In this talk we present different families of cutting planes that can be used as tableau cuts. We show that, theoretically, they are strong enough to solve integer programs to optimality. Moreover, we report on their computational performance in comparison to Gomory mixed integer cuts on a test set of integer programs.

4 — Polyhedral Aspects of the Stochastic Lot-Sizing Problem
Yongpei Guan, Ph.D student, Georgia Institute of Technology, 328402 Georgia Tech Station, Atlanta, GA, 30332, United States, guanyp@isye.gatech.edu, George Nemhauser, Shabbir Ahmed

We consider a multi-stage stochastic integer programming formulation of the stochastic lot-sizing problem. We generalize the classic (l,s) inequalities used in solving deterministic lot-sizing problems to the stochastic case. The computational efficacy of these inequalities is demonstrated.

■ MB28

Westin-Tower 1403, 14th Floor

Applications of Nonlinear Optimization

Sponsor: Optimization/NonLinear Programming
Sponsored Session

Chair: Igor Griva, Princeton University, United States, igriva@Princeton.EDU

1 — On Designing NASA's Terrestrial Planet Finder Space Telescope
Robert Vanderbei, Professor, Princeton University, United States, rvdb@princeton .edu

NASA plans to launch a space telescope in 2014 which will be capable of directly imaging Earthlike planets around nearby stars. Currently, the telescope is in its early design phase. In this talk, I will be explain what is hard about making such a telescope and I will present some optimization models, and their solutions, that are being used to aid the design process.

2 — Case Studies in Shape and Trajectory Optimization: Catenary Problem
Igor Griva, Princeton University, United States, igriva@Princeton.EDU, Robert Vanderbei

We present a case study in modern large-scale constrained optimization to illustrate how recent advances in algorithms and modeling languages have made it easy to solve difficult problems using optimization software. We consider the shape of a hanging chain, which, in equilibrium, minimizes the potential energy of the chain. We emphasize the importance of the modeling aspect, present several models of the problem and demonstrate differences in iteration numbers and solution time.

3 — Equilibrium and Pricing in Linear Exchange Model
Roman Polyak, Professor, George Mason University, United States, rpolyak@gmu.edu

We consider a market with a fixed vector of goods and customers with linear utility functions. By fixing the prices for goods each customer defines his demand vector by maximizing his utility function within his fixed budget. The existence of prices for which the total demand is equal to the supply vector and finding such prices as well as optimal demands of the customers are two basic questions we will be concerned within our presentation.

■ MB29

Westin-Tower 1404, 14th Floor

Network Routing 1

Sponsor: Optimization/Network
Sponsored Session

Chair: Lisa Fleischer, GSIA, Carnegie Mellon University / IBM Watson Research, Pittsburgh, PA, 15213, United States, lkf@andrew.cmu.edu

1 — Efficient Algorithms for SCLP: the Multicommodity Flow Problem with Holding Cost and Extensions
Lisa Fleischer, GSIA, Carnegie Mellon University / IBM Watson Research, Pittsburgh, PA, 15213, United States, lkf@andrew.cmu.edu, Jay Sethuraman

We give the first polynomial time and space solutions for finding provably close solutions to a broad class of separated continuous linear programs (SCLP), which include fluid relaxations to multiclass queueing networks. We discuss the multicommodity flow problem with holding costs and extensions. Existing algorithms for SCLP do not have polynomial time or space guarantees.

2 — Effective Routing and Scheduling in Adversarial Queueing Networks
Jay Sethuraman, Columbia University, 500 W 120th St., Rm 331, New York, NY, 10027, United States, js1353@columbia.edu, Chung-Piaw Teo

Adversarial queueing networks serve as a convenient tool for modeling packet injections in modern communication networks. This model combines important elements of two traditional ways of modeling input traffic: the stochastic model, and the online model. In this talk we discuss simple discrete review policies to route and sequence packets so as to minimize the total number of packets in the system.

3 — A Faster, Better Approximation Algorithm for the Minimum Latency Problem
Aaron Archer, Cornell University, Operations Research Department, Ithaca, NY, 14853, United States, aarcher@orie.cornell.edu, Asaf Levin, David Williamson

We give deterministic and randomized 7.18-approximation algorithms for the min latency problem that run in O(n^3 log n) and O(n^2 log^2 n) time. This improves the previous best algorithms in both performance guarantee and run time. These used an approximation algorithm for the k-MST problem as a black box. Our algorithm instead uses Lagrangean relaxation to get multiple k-MST lower bounds at once, while allowing us to exploit special cases when we obtain improved approximate k-MST's.

■ MB30

Westin-Tower 1405, 14th Floor

Computational Approaches for Stochastic Integer Programming

Sponsor: Optimization/Stochastic Programming
Sponsored Session

Chair: Andrew Schaefer, Assistant Professor, University of Pittsburgh, 1048 Benedum Hall, Pittsburgh, PA, 15261, United States, schaefer@ie.pitt.edu

1 — A Stochastic Edge Partition Problem
Shabbir Ahmed, Assistant Professor, ISyE, Georgia Tech, Atlanta, GA, 30332, United States, sahmed@isye.gatech.edu, Andrew Schaefer, Cole Smith

We introduce the Stochastic Edge Partition Problem (STEPP), which generalizes the SONET edge partition problem. The problem is a two-stage stochastic program with integer recourse. We describe several cutting plane approaches and give classes of valid inequalities. We provide preliminary computational results and give directions for future research.

2 — Resolving the Inconsistency between Stochastic Programming and Decision Analysis
Steve Pollock, Professor, University of Michigan, 1205 Beal Avenue, Ann Arbor, Mi, United States, spollock@umich.edu, Robert Bordley

Chance-constrained programming focuses on formulating (and solving) optimization problems when uncertainties appear in the constraints. A target-oriented interpretation of utility leads naturally to an alternative decision-theoretic representation of the problem, and shows that the conventional CCP, which constrains the probability of satisfying the constraints, addresses a different problem and, in general, requires randomized strategies.

3 — Stochastic Programs with Binary First Stage: A Regularized Decomposition Approach
Oguzhan Alagoz, Graduate Research Assistant, University of Pittsburgh, 1048 Benedum Hall, Pittsburgh, PA, 15261, United States, oga1@pitt.edu, Andrew Schaefer, Cole Smith

We consider a class of two-stage stochastic programs where the first-stage decision variables are binary and the second-stage decision variables are continuous. In this study, we describe and discuss the results of a modified version of the regularized decomposition algorithm of Ruszczynski (1986). Because the first-stage decision variables are binary, the quadratic terms become linear. We provide some preliminary computational results.

■ MB31

Westin-Tower 1406, 14th Floor

Equity in Facility Location

Sponsor: Location Analysis
Sponsored Session

Chair: Tammy Drezner, Professor, California State University-Fullerton, College of Business and Economics, Fullerton, CA, 92834, United States, tdrezner@Exchange.FULLERTON.EDU

1 — Subsidy Design for Facility Location under Price-Sensitive Demands
Steve Peng, CSU Hayward, College of Business and Economics, Hayward, CA, 94541, United States, speng@csuhayward.edu, Joy Bhadury

Study of classical location-pricing problems has mainly focused on optimizing the facility location and selling prices in a centralized setting. We extend the classic location-pricing problem to a decentralized setting, and study a model where a social planner influences a firm's location and pricing decisions by offering subsidies. The objective is to design an optimal subsidization agreement that can maximize the social planner's objective under the Principle-Agent framework.

2 — Optimal Location with Equity
Zvi Drezner, Professor, California State University-Fullerton, College of Business and Economics, California State University-Fullerton, Fullerton, CA, 92834, United States, zdrezner@fullerton.edu, Oded Berman, George Wesolowsky

The problem is to find p locations for p facilities such that the weights attracted to each facility will be as close as possible to one another. We model this problem as minimizing the maximum among all the total weights attracted to the various facilities. We propose solution procedures for the problem on a network, and for the special cases of the problem on a tree or on a path. Heuristic algorithms are proposed for its solution. Extensive computational results are presented.

3 — Location of Casualty Collection Points Using Multiobjective Criterion
Tammy Drezner, Professor, California State University-Fullerton, College of Business and Economics, Fullerton, CA, 92834, United States, tdrezner@Exchange .FULLERTON.EDU

The best location of casualty collection points (CCPs) is analyzed. These CCPs are expected to become operational in case of a high magnitude earthquake or any other man-made or natural disaster with mass casualties. A multiobjective criterion is proposed. Metaheuristic solution procedures are suggested and tested.

■ MB32

Westin-Tower 1407, 14th Floor

The Theory and Practice of Rescheduling

Cluster: Scheduling
Invited Session

Chair: Jeffrey Herrmann, Associate Professor, University of Maryland, Department of Mechanical Engineering, College Park, MD, 20742, United States, jwh2@umd.edu

1 — Aversion Scheduling Under Risky Jobs
Gary Black, Tennessee Technological University, Industrial & Manufacturing Engineering D, 126 Prescott Hall, Cookeville, TN, 38505, United States, GBlack@tntech.edu, Kenneth McKay, Thomas Morton

Real schedulers have been observed to avoid scheduling "risky" jobs on highly loaded machines, preferring instead to hold them until quieter periods or to offload them to otherwise less desirable machines to mitigate the disruptive impacts on subsequent jobs. In doing so, the scheduler behaves as if he/she had inflated the planning processing time for the risky job. We will demonstrate that it is often useful to add a certain amount of "safety stock" to job processing times.

2 — Repair Algorithms for Complex Job Shop Rescheduling
Scott J. Mason, Assistant Professor, University of Arkansas, 4207 Bell Engineering Center, Fayetteville, AR, 72701, United States, mason@uark.edu, Song Jin, Oliviana Zakaria

Semiconductor manufacturing presents one of the most difficult scheduling/rescheduling environments in practice today. Our previous research developed a Shifting Bottleneck scheduling approach for these complex job shops. We extend our previous work to develop repair algorithms capable of rescheduling or repairing complex job shop schedules within a simulation-based scheduling framework.

3 — Reactive Scheduling in Workflow Management Systems: A Branch-and-Price Approach
Rakesh Nagi, Associate Professor, University at Buffalo (SUNY), Department of Industrial Engineering, 342 Bell Hall, Buffalo, NY, NY 14260, United States, nagi@buffalo.edu, Abhay Joshi

Workflow Management Systems provide visibility, control and automation of business processes and their elemental tasks. Achieving time and cost reduction through optimal assignment and scheduling of workflows is the focus of this research. A snapshot of the workflow scheduling problem is modeled as a Mixed Integer Program and solved using a Branch-and-Price algorithm. Dynamic changes are addressed by reactive scheduling strategies that reuse and repair previously generated solutions.

4 — Classifying and Mapping Production Scheduling Decisions
Jeffrey Herrmann, Associate Professor, University of Maryland, Department of Mechanical Engineering, College Park, MD, 20742, United States, jwh2@umd.edu

This talk describes production scheduling decisions at a specific manufacturing facility. We use a rescheduling framework to classify these activities. We discuss the objectives of each activity and show how they collectively form a dynamic network of information flow and decision-making

■ MB33

Westin-Tower 1408, 14th Floor

Panel: Teaching Data Envelopment Analysis

Cluster: Data Envelopment Analysis
Invited Session

Chair: Timothy Anderson, Associate Professor, Portland State University, Department of Engineering and Technology, Portland, OR, United States, tima@etm.pdx.edu

1 — A Panel Session: Teaching DEA
Panelists: Timothy Anderson, David Moore, John Ruggiero, Lawrence M. Seiford

Over the years there have been a number of books published on DEA but little discussion as to how classes are structured and fit within curricula. This session will be for both business and engineering faculty to share experiences with teaching DEA as a significant part of graduate classes.

■ MB34

Mart-Room A

Collaborative Logistics

Sponsor: Transportation Science & Logistics
Sponsored Session

Chair: Martin Savelsbergh, Professor, Georgia Institute of Technology, 765 Ferst Drive, Atlanta, GA, 30332, United States, martin.savelsbergh@isye.gatech.edu

1 — The Impact of Sharing Order Information on Forecasting Accuracy in a Multi-Stage Distribution System
David Simchi-Levi, Professor, MIT, 77 Massachusetts Ave, Bldg 1-171, Cambridge, MA, United States, dslevi@mit.edu, Yao Zhao

We consider a distribution system with a single manufacturer, a single distribution center and multiple non-identical retailers in infinite time horizon. The retailers place orders periodically and use order-up-to policy to control their inventory. The distribution center serves as a cross docking point and transfers the aggregated orders from the retailers to the manufacturer. We analyze the impact of information sharing on the manufacturer's forecast accuracy.

2 — Collaborative Logistics: The Shipper Collaboration Problem
Ozlem Ergun, GAtech, ISyE, Atlanta, GA, United States, oergun@isye.gatech.edu, Martin Savelsbergh, Gultekin Kuyzu

When shippers consider collaborating, their goal is to identify sets of lanes that can be submitted to a carrier as a bundle, requiring little or no asset repositioning, in the hope that this results in more favorable rates. The shipper collaboration problem can be stated as: given a set of lanes, find a set of tours that covers all lanes and that minimizes the asset repositioning. We present various theoretical and computational results for the core optimization models arising in this context.

3 — Competitive Performance Assessment of Dynamic Vehicle Routing Technologies using Sequential Auctions
Miguel Figliozzi, University of Maryland-College Park, Dept. of Civil and Env. Engineering, 1173 Glenn L. Martin Hall, College Park, MD, 20742, United States, figlioma@wam.umd.edu, Hani Mahmassani, Patrick Jaillet

Real-time freight transportation marketplaces create a new environment characterized by the repeated interaction of competing carriers. Fleet deployment strategies have a significant impact on costs (empty distance) and profits. We model and analyze different vehicle routing strategies using a game theoretic framework. Simulation is used to evaluate the impact of routing technologies on profits and service levels.

■ MB35

Mart-Room B

Operations Management I

Contributed Session

Chair: Yan Zou, PhD Candidate, Stanford University, Terman Engineering Center, Management Science and Engineering, Stanford, CA, 94305, United States, yzou@stanford.edu

1 — Using Echelon Capacity to Manage Capacity Expansions and Deferrals
Alexandar Angelus, Principal, Integral Strategic Solutions, 1912 Camino Verde, Suite D, Walnut Creek, CA, 94597, United States, aangelus@integralstrategicsolutions.com, Evan Porteus

We introduce echelon capacity to manage capacity expansions when production requires multiple resources, each with a leadtime. The firm responds to changes in the economy by placing orders for new resources and/or deferring previously placed orders. We find conditions that allow the original problem, where the state space dimension is the sum of the leadtimes over all the resources, to be reduced to that of a single resource. The optimal capacity policy is contingent on the state of the economy.

2 — A Resource-Based Corollary of the Team in the Context of TQM and JIT
C.J. Duan, Clemson University, Department of Management, 101 Sirrine Hall, Clemson, SC, 29631, United States, dcj@dcj.us

We extend the resource-based theory of firm to the situation within a firm in an effort to rationalize team formation widely adopted in TQM. We construe that the formation of a team among employees enrich and enhance the original proposed knowledge substitution and flexibility effect due to the emergence of reciprocal knowledge substitution and team adaptability. The corollary is finally used to explicate the conditions for effective and successful team formation in the context of TQM and JIT.

3 — Demand Bubbles and Phantom Orders in Supply Chains
Paulo Goncalves, Assistant Professor, University of Miami, 422 Bargello Ave, Coral Gables, FL, 33146, United States, paulog@miami.edu, John Sterman

This paper explores demand bubbles - customers' placement of multiple orders with multiple suppliers to hedge against sort-supply - dynamics by providing a comprehensive causal map of supplier-customer relationships and a formal mathematical model of a subset of those relationships. It provides closed form solutions for dynamics when supplier has fixed capacity and simulation analysis when it is flexible. Supply chain stability is promoted with longer customer perception delays.

4 — Understanding Variability in White-Collar Work
Susan Owen, General Motors R&D, Mail Code 480-106-256, 30500 Mound Rd, Warren, MI, 48090, United States, susan.owen@gm.com, William Jordan

We examine the role of variability in white-collar work, highlighting key features that differentiate this type of work from manufacturing work. We then discuss new modeling techniques that generalize manufacturing-based methods to better capture characteristics of white-collar work.

5 — The Informational Role of the Secondary Market in a Supply chain
Yan Zou, PhD Candidate, Stanford University, Terman Engineering Center, Management Science and Engineering, Stanford, CA, 94305, United States, yzou@stanford.edu, Seungjin Whang

The informational role of secondary market is studied with a two period model, where retailers place orders based on prior demand estimates, update demand forecasts after the first period, trade in a secondary market for leftovers and then sell in another period. We build Bayesian updating and Rational Expectations models, and show that only the latter leads to a stable equilibrium. The secondary market acts as a surrogate mechanism for truthful information sharing among competing retailers.

■ MB36

Mart-Room C

Measuring the Value of Supply Chain Management

Sponsor: Manufacturing and Service Operations Management
Sponsored Session

Chair: Mark Ferguson, Assistant Professor, DuPree College of Management, Georgia Institute of Technology, 755 Ferst Drive, Atlanta, GA, 30332, United States, Mark.Ferguson@mgt.gatech.edu

1 — Business Performance Impact of Integrated IT Systems: An Analysis of ERP, SCM & CRM Adoption
Kevin Hendricks, Richard Ivey School of Business, University of Western Ontario, 1151 Richmond Street N, London, ON, N6A 3K7, Canada, khendricks@ivey.uwo.ca, Vinod Singhal, Jeff Stratman

In recent years, information systems that integrate elements of the supply chain have enjoyed widespread popularity. The benefits of these systems are examined through an analysis of stock market returns and operating performance improvements from a sample of firms who have adopted ERP, SCM and/or CRM software.

2 — Retail Inventory Productivity: Analysis and Benchmarking
Vishal Gaur, Stern School of Business, NYU, Rm 8-72, 44 West 4th St., New York, NY, 10012, United States, vgaur@stern.nyu.edu

We present empirical models to investigate the association of inventory turnover with gross margin, capital intensity and sales forecast error using public accounting panel data for retailing firms. Our method gives techniques for evaluating inventory productivity in the retailing industry.

3 — Linking Operations Performance with Financial Performance
Mark Ferguson, Assistant Professor, DuPree College of Management, Georgia Institute of Technology, 755 Ferst Drive, Atlanta, GA, 30332, United States, Mark.Ferguson@mgt.gatech.edu

We investigate the relationship between operational metrics such as cash-to-cash cycle and inventory turns to the financial performance of companies within the computer and office equipment industry sectors.

4 — Long Term Contracts - The Effect of Secondary Market
Oded Koenigsberg, Assistant Professor, Columbia University, 505 Uris Hall, 3022 Broadway, New York, NY, 10027, United States, ok2018@columbia.edu, Preyas Desai, Devavrat Purohit

The paper deals with a durable product that has an active secondary market, and thus faces competition between new and used products. In the case of durable products, how should a manufacturer structure its contract with the retailer so that it can coordinate the channel and manage the competition from the secondary market? Our analysis shows that selling can be as profitable as leasing and that a firm can be better off selling through a retailer rather than selling directly.

■ MB37

Mart-Room D

Organizational Structures in Operations Management

Sponsor: Manufacturing and Service Operations Management
Sponsored Session

Chair: David Huff, New York University, 44 West 4th Street, New York, NY, United States, dhuff@stern.nyu.edu

1 — Interdependencies between Supply Level Choice and Sales-force Incentives: Asymmetric Sales Agents
David Huff, New York University, 44 West 4th Street, New York, NY, United States, dhuff@stern.nyu.edu, Phillip J. Lederer

We examine the interactions between inventory level choice and sales-force compensation in a newsvendor environment. We consider a two agent double-sided moral hazard principal-agent model. We look at variations of this model to determine at what cost inventory decisions can be delegated to the agents. Optimal inventory levels and compensation parameters are found.

2 — Information and Cross Selling in Call Centers
Reynold Byers, Assistant Professor, University of California, Irvine, Operations and Decision Technologies Gro, Graduate School of Management, Irvine, CA, 92697, United States, rbyers@uci.edu, Rick So

Customer service representatives in service-based call centers can use information to determine when and if to cross sell additional services. We consider the use of customer-specific information and queue length information. We create queuing models with control policies incorporating different sets of information and compare their relative performance.

3 — Complementarities in Improvement Programs
Phillip J. Lederer, University of Rochester, Rochester, NY, 14627, United States, lederer@simon.rochester.edu

This research studies the impact of combinations of improvement activities on firm performance. We study three types of improvement programs: operational, marketing and accounting. We show that operational improvement programs are often complements to the other types of programs. However, we show that in general, marketing and accounting programs may be substitutes for each other.

■ MB38

Mart-Room E

Algorithmic Issues in Dynamic Traffic Assignment

Sponsor: Transportation Science & Logistics
Sponsored Session

Chair: Henry X. Liu, Utah State University, Civil & Environmental Engineering, Logan, UT, 84322, United States

1 — Study of the Mathematical Properties of a Relaxed Discrete Dynamic Traffic Assignment Model
Henry X. Liu, Utah State University, Civil & Environmental Engineering, Logan, UT, 84322, United States, Xuegang Ban, Bin Ran

Due to the dynamic nature of the dynamic traffic assignment (DTA) problem, especially the dynamic flow propagation constraints, the discrete DTA model is usually formulated as Quasi-Variational Inequality (QVI). In order to study the discrete DTA model more rigorously while still keeping the model as realistic as possible, we focus on the Relaxed Discrete Dynamic Traffic Assignment (RDDTA) model, which is a sub-problem of the original discrete DTA model by temporarily relaxing the dynamic flow propagation constraints. Although RDDTA has been investigated partially in the solution algorithm of various DTA models, neither of the existence and uniqueness conditions nor its other properties has been fully exploited, in spite of the fact that RDDTA is indeed a crucial component of the original DTA problem. Our studies aim to fill in this gap and provide the some directions for the development of efficient solution algorithms to solve the RDDTA problem.

2 — Traffic Equilibrium with Recourse
S Travis Waller, University of Texas at Austin, Dept. of Civil Eng., ECJ 6.204, Austin, TX, 78712, United States, stw@mail.utexas.edu, Satish V S K Ukkusuri

This presentation deals with network equilibrium where all users have the ability to update their paths given limited local information. In such a problem, each user should follow their least expected cost online shortest path (shortest path with recourse) at equilibrium. For this, a linear programming formulation for the online shortest path is required for the sub-problem and will be discussed. We introduce several examples and a problem formulation. Fundamental problem properties and preliminary results will also be discussed.

3 — A Simplicial Decomposition Algorithm for a Simulation Based Dynamic User Equilibrium Problem
Athanasios K. Ziliaskopoulos, Northwestern University, Evanston, IL, 60208, United States, a-z@northwestern.edu

Traffic network equilibrium models, commonly used by planning agencies, assume link travel time functions monotonically increasing with flow; this makes these models unsuitable for congested networks for which such a relationship does not hold. This paper introduces a Variational Inequality (VI) formulation for computing equilibrium flows that circumvents this drawback by relying on traffic flow theoretical models and non-steady state demand inflow. A Simplicial Decomposition (SD) algorithm is put forward that efficiently solves the VI formulation; the formulation and the algorithm can solve large networks for steady state or time varying origin-destination demand. The SD equilibrium algorithm relies on a traffic simulator to evaluate the link travel times; we demonstrate that under some mild assumptions, the algorithm converges to a user equilibrium solution. Computational experiments on large networks, such as the Chicago's six-county network, indicate reasonable convergence in acceptable CPU times.

4 — Decomposition Techniques for the User Optimal Dynamic Traffic Assignment Problem
S Travis Waller, University of Texas at Austin, Dept. of Civil Eng., ECJ 6.204, Austin, TX, 78712, United States, stw@mail.utexas.edu, Syed Hasan, Satish V S K Ukkusuri

We present a methodology for solving the User Optimal Dynamic Network Design problem employing a known analytical LP model for UO DTA. Through the decomposition approach, DTA is extracted as a sub-problem which allows it to be solved through numerous other means (combinatorial, simulation, etc.). We discuss preliminary numerical results, the methodology and exploitation of the special structure of the problem, and suggest where such methods are most effective in large scale traffic networks including other applications beyond network design.

■ MB39

Mart-Room F

RASIG Student Paper Contest

Sponsor: Railroad Applications
Sponsored Session

Chair: Edwin Kraft, Director- Operations Planning, Transportation Economics & Management Systems, Inc., 116 Record St, Frederick, Md, 21703, United States, ChipKraft@aol.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. Cash Awards: $500 First Place, $250 Second Place RASIG will cover the conference registration fees for all primary authors who are asked to present their papers at the INFORMS Annual Meeting. Railway Age will publish summaries of the First Place and Second Place entries.

■ MB40

Mart-Room G

Strategic Capacity Management

Cluster: Supply Chain Management
Invited Session

Chair: Jan Van Mieghem, Stuart Professor, Northwestern University, Kellogg School of Management (MEDS), Evanston, IL, 60201, United States, VanMieghem@kellogg.northwestern.edu

1 — Near-Optimal Control of an Assemble-to-Order System with Expediting and Fixed Transport Costs
Erica Plambeck, Assistant Professor of Operations, Information and Technology, Stanford Graduate School of Business, 518 Memorial Way, Stanford, CA, 94305-5015, United States, plambeck_erica@gsb.stanford.edu, Amy Ward

The manager of an assemble-to-order system buys component production capacity then dynamically controls component production and transportation, and sequences customer orders for assembly. Each shipment of components incurs a fixed cost. Component production is expedited as needed to fill orders within the target leadtime. As the arrival rate of customer orders becomes large, the problem reduces to a 1-D diffusion control problem for each component. This yields a simple near-optimal policy.

2 — Managing Operational and Financial Risks
Nils Rudi, Assistant Professor, University of Rochester, Simon School of Business, Rochester, NY, 14627, United States, rudi@simon.rochester.edu, Jiri Chod, Jan Van Mieghem

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 — Some Modularity Properties of Linear Programs
Paul Zipkin, Professor, Duke University, Fuqua School of Business, Durham, NC, United States, Paul.Zipkin@Duke.Edu

This paper explores when certain linear programs enjoy important modularity properties. Such properties determine whether the key resources in the model are complements, or substitutes, or neither. We apply the results to a stochastic-program formulation of an assemble-to-order system.

4 — Risk-Averse Newsvendor Networks: Mean-variance Analysis of Operational Hedging
Jan Van Mieghem, Stuart Professor, Northwestern University, Kellogg School of Management (MEDS), Evanston, IL, 60201, United States, VanMieghem@kellogg .northwestern.edu

Risk-neutral newsvendor networks unbalance their portfolio of optimal inventory and capacity levels. Risk aversion increases the optimal degree of imbalance and may even increase investment levels, reinforcing resource imbalance as an operational hedge. Mathematical results for the efficient risk-return frontier, the optimal risk-hedging resource portfolio, and the value of hedging are formulated in terms of statistical quantities and thus allow direct computation by simulation.

■ MB41

Mart-Room H

Warehousing & Order Fulfillment

Cluster: Supply Chain Management
Invited Session

Chair: Kevin Gue, Associate Professor, Naval Postgraduate School, Monterey, CA, 93943, United States, krgue@nps .navy.mil

1 — What IS a Warehouse?
Leon F. McGinnis, Georgia Institute of Technology, ISYE, Atlanta, GA, United States, leon.mcginnis@isye.gatech.edu

Powerful integrated computational tools for analyzing and designing warehouses require a comprehensive reference model. This talk describes the approach used and resulting model developed in the Keck Virtual Factory Lab at Georgia Tech.

2 — Minimizing Picking and Restocking Costs in Multi-Tier Inventory Systems
Stephanie Jernigan, Georgia Institute of Technology, 1316 Stillwood Dr. NE, Atlanta, GA, 30306, United States, jernigan@isye.gatech.edu, John J. Bartholdi, III

In the warehouse of a large cosmetics company, a mechanized order picker is restocked from nearby flow rack, and the flow rack is restocked from bulk storage, forming a three-tier inventory system. We consider such multi-tier inventory systems and determine where to store items, and in what quantities to store them, in order to minimize the total cost of picking items and restocking storage locations.

3 — Very High Density Storage Systems
Kevin Gue, Associate Professor, Naval Postgraduate School, Monterey, CA, 93943, United States, krgue@nps.navy.mil

A Very High Density system is characterized by frequently having to move items in a storage area in order to gain access to desired items. This characteristic increases the storage density, which is a good thing, but increases the retrieval time, which is a bad thing. We investigate the nature of this tradeoff, propose a simple heuristic for very dense designs, and discuss applications in ship-based warehouses for the U.S. Navy, container yards in ports, and automated warehousing systems.

4 — Crossdocking Operation in a Supply Chain System as an Instrument for Just-in-Time
Pius Egbelu, Dean of Engineering, Louisiana State University, College of Engineering, 3304 CEBA Building, Baton Rouge, LA, 70803, United States, pegbelu@eng .lsu.edu, Wooyeon Yu

Increasing global competition in the manufacturing and service sectors is driving companies to seek ways to improve customer service while reducing operation cost. In this paper, the problem of crossdocking in warehousing as a tool for just-in-time operation will be presented. The paper will also present different crossdocking models and the techniques for analyzing such systems.

■ MB42

Mart-Room I

Pricing and Revenue Management in Practice

Sponsor: Revenue Management & Dynamic Pricing
Sponsored Session

Chair: Pinar Keskinocak, Georgia Institute of Technology, School of Industrial and Systems Enginee, Atlanta, GA, 30332, United States, pinar@isye.gatech.edu

Co-Chair: Amelia Regan, Associate Professor, Information and Computer Science and Civil Engineering, University of California, Social Science Tower 559, Irvine, CA, 92797-3600, United States, aregan@uci.edu

1 — Contract Optimization in Hospital Managed Care Contracting
Kirk Abbott, PROS, United States, kabbott@prosrm.com

Much of a hospital's revenue is controlled through contracts between the hospital and insurance companies. We provide background on the contract design problem in healthcare and describe a contract optimization methodology, which focuses on product design, demand and resource consumption forecasting and optimization of product prices. These techniques have been successfully implemented and used to generate large revenue increases for hospitals.

2 — Demand Based Management Science: Theory and Practice
Krishna Venkatraman, Chief Scientist & Co-Chairman of the Science Advisory, Demand Tec. Inc., 1 Circle Star Way, Suite 200, San Carlos, CA, 94070, United States, krishna.venkatraman@demandtec.com.

DBM is the application of econometric, financial and optimization theory to complex real-world business decisions. DemandTec's DBM software models consumer demand, then searches billions of price and promotion combinations to determine the impact of merchandising decisions on business performance. DemandTec's software has resulted in dramatic revenue and profit increases for major retailers including Longs, Radio Shack and H-E-B.

3 — The Proliferation of Revenue Management Techniques
Maarten Oosten, PROS Revenue Management, 3100 Main Street, # 900, Houston, TX, 77002, United States, moosten@prosrm.com

In this presentation we will discuss several revenue management techniques that are general enough to be applied outside of the industries where revenue management is traditionally practiced. Besides being general, the techniques must meet technical challenges and additional business needs in order to be valuable.

4 — Practical Revenue Management for the Manufacturer
Mitchell Burman, CEO, Analytics Operations Engineering, Inc, United States, mburman@nltx.com

Using revenue management, manufacturers can significantly boost profits by setting prices for different customer segments in response to real-time changes in available capacity, demand and service requirements. Burman presents a case study of a paper-production facility with fixed capacity that must decide which incoming orders to accept and under which conditions.

■ MB43

Mart-Room J

Large-Scale Combinatorial Auction Design

Cluster: Auctions
Invited Session

Chair: Karla Hofffman, George Mason University, Mail Stop 4A6, 4400 University Drive, Fairfax, VA, 20124, United States, khoffman@gmu.edu

1 — Bidding Languages and the Winner Determination Problem in Combinatorial Auctions
Melissa Dunford, Decisive Analytics Inc, 1235 Jefferson Davis Highway, Suite 400, Arlington, VA, 22202, United States, mdunford@fcc.gov, Thomas Wilson, Dinesh Menon, Karla Hofffman, Andrew David, David Johnson

A bidder participating in a combinatorial auction is faced with the problem of communicating an exponential number of combinations in order to express its interests. A variety of bidding languages have been presented in the literature. We discuss some of these and evaluate them in terms of their expressiveness, compactness, simplicity, and finally in terms of their computational effect on the winner determination problem. Finally, we present an idea for a bidding tool to assist bidders.

2 — Combinatorial Exchanges
Dinesh Menon, Decisive Analytics, Inc, 1235 Jefferson Davis Highway, Suite 400, Arlington, VA, 22202, United States, dmenon@fcc.gov, Karla Hofffman

We examine design issues associated with a combinatorial exchange where both buy and sell-side aggregation is allowed. That is, all of the bundle must be bought/sold or none of it, but the bundle can be assigned to more than one seller/buyer. We assume items for sale are unique but that both complementarities and substitutes exist within the auction. We propose an iterative double-auction design and describe its associated properties including an algorithm for setting bid and ask prices.

3 — Price Estimates in Ascending Combinatorial Auctions
Karla Hofffman, George Mason University, Mail Stop 4A6, 4400 University Drive, Fairfax, VA, 20124, United States, khoffman@gmu.edu, Dinesh Menon, Melissa Dunford, Thomas Wilson, Andrew David, David Johnson

Ascending package-bidding auctions require that the minimum bid prices be announced each round. We compare various linear and non-linear price estimates for such auctions. For each of the pricing schemes tested, we compare auction outcomes, speed of completion, volatility, and efficiency. The pricing schemes compared include RAD pricing, FCC smoothed anchoring, iBundle, pure epsilon increment and nucleolus calculations and compare the results to the VCG outcome and Ausubel-Milgrom proxy.

■ MB44

Mart-Room K

The FAA Strategy Simulator, Part 2

Sponsor: Aviation Applications
Sponsored Session

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

Co-Chair: Norm Fujisaki, Dep Dir, System Architecture & Investment Analysis, FAA, 800 Independence Ave, SW, Washington, DC, 20591, United States, norman.fujisaki@faa.gov

1 — MIT Airline Scheduling Module
John-Paul Clarke, Professor, MIT Aeronautics & Astronautics, 77 Massachusetts Ave 33-314, Cambridge, MA, 02139, United States, johnpaul@MIT.EDU, Flora Garcia

The MIT Airline Scheduling Module of the NAS Strategy Simulator is an optimization tool that determines the schedule changes that best meets demand given available resources. We use a newly developed model to simultaneously determine frequency, departure times, fleet assignment, passenger loads and revenue within a competitive environment.

2 — NAS Performance Models
Michael Ball, Professor, University of Maryland, R H Smith School of Business, Van Munching Hall, College Park, MD, 20742, United States, MBall@rhsmith.umd.edu, Yung Nguyen, Ravi Sankararaman, Paul Schonfeld

In the paper, we describe models and analysis whose objective is to predict the performance of the National Airspace System (NAS) from a small number of

input parameters. This work was carried out in support of the development of the FAA "Strategy Simulator". The outputs of the models include measures of airport and airspace capacity and three NAS-wide metrics: average flight delay, flight cancellation probability and average passenger delay.

3 — National Airspace System Strategy Simulator: From Origin Destination Demand to Fleet Mix
Mark Hansen, Prpfessor, University of California, Berkeley, 107 McLaughlin Hall, Berkeley, CA, 94720, United States, mhansen@ce.berkeley.edu, Chieh-Yu Hsiao

This research develops four econometric models to capture the relationships between origin-destination (O-D) demand and fleet mix — an important issue in air transportation system planning. For given O-D demands, the numbers of passengers and flights by categories can be estimated by the models. The validations show that the models have good explanatory capabilities, especially for the aggregated (airport) level.

■ MB45

Mart-Room L

Seminconductor Industry

Contributed Session

Chair: Cem Vardar, Research Associate, Arizona State University, 1205 E. Apache Blvd #118, Tempe, AZ, 85287, United States, cvardar@asu.edu

1 — eKanban Daily Target Control System
Prayoon Patana-anake, Senior Engineer-Development, SONY Semiconductor, 1 Sony Place, San Antonio, TX, 78245, United States, prayoon_pat@rocketmail.com, Rodolfo Chacon

We have faced the scenario of missing the connection between Supply Chain Management(SCM) system—Top down—and the Manufacturing Execution Systems(MES)—bottom up. Our eKanban Daily Target Control System links these together. We use the concept of electronic Kanban, Automatic Dispatcher and Planning to calculate & project the number of daily production that must be met for FAB within the FAB capability. We also use kanban to limit number of possible WIP for each section of the process flow.

2 — A Hybrid Decision Tree Approach for Mining Semiconductor Data
Chen-Fu Chien, Associate Professor, Department of Industrial Engineering and Engineering Management, National Tsing Hua University, 101 Sec. 2 Kuang Fu Road, Hsinchu, T, 300, Taiwan, cfchien@mx.nthu.edu.tw, Jen-Chieh Cheng

We proposed a hybrid decision tree approach to analyze the semiconductor manufacturing data for yield enhancement. An empirical study was conducted in a fab and the results showed the practical viability of this approach.

3 — Designing A Field Service System For Semiconductor Manufacturing Systems For Remote Diagnostics Era
Cem Vardar, Research Associate, Arizona State University, 1205 E. Apache Blvd #118, Tempe, AZ, 85287, United States, cvardar@asu.edu, Esma S. Gel, John Fowler

With the advances in information technologies, service activities for expensive equipment used in semiconductor manufacturing can be performed from a remote location. In this study we develop a queueing-location model to analyze the capacity and location problem of after sales service providers considering the effects of remote diagnostics technology. For solving this model, we use simulation optimization with evolutionary heuristics and analytical approximations.

■ MB46

Mart-Room M

ICS Prize Tutorial

Sponsor: Computing
Sponsored Session

Chair: David Woodruff, Professor, University of California, Grad. School of Mgt., Davis, CA, United States, dlwoodruff@ucdavis.edu

1 — Constraint-Based Architectures for Combinatorial Optimization
Pascal Van Hentenryck, Professor, Department of Computer Science, Box 1910, Brown University, Providence, RI, 02912, United States, pvh@cs.brown.edu

Combinatorial optimization problems arise in many application areas. They often lead to intricate programs, indicating a strong need for high-level software tools. This tutorial describes Comet, a constraint-based language for neighborhood search, its application to scheduling, resource allocation, and routing, and its relationships to other constraint-based architectures.

■ MB47

Atlanta G, 7th Floor

Software Demonstration

Cluster: Software Demonstrations
Invited Session

1 — Imagine That, Inc. - Extend Simulation Software
Dave Krahl, Imagine That, Inc., 6830 Via Del Oro Ste. 230, San Jose, CA, 95119, United States, davek@imaginethatinc.com

Use the simulation tool professionals use most, Extend. The rich modeling environment allows you to introduce simulation concepts to novices and scholarly solution techniques to more advanced students. After all, developing an understanding of process dynamics is as important to students as it is to seasoned modelers. ExtendÖ the software of choice for academia.

2 — Palisade Corp. - Overview of @RISK and StatTools
Shawn Harahush, Palisade Corp., 31 Decker Rd., Newfield, NY, 14867, United States, sharahush@palisade.com

We will give an overview of two powerful Excel add-ins: @RISK and StatTools. @RISK uses Monte Carlo simulation to show you nearly all possible outcomes and account for uncertainty in your spreadsheets. StatTools replaces Excel's statistics with new robust statistical functions and allows you to easily write your own custom statistical procedures.

Monday 1:30pm - 3:00pm

■ MC - Poster Session

Mart- Exhibit Hall

OR in Practice Poster Session

Chair: Keith Hollingsworth, Morehouse College, khollingsworth@morehouse.edu

Poster presenters will be available to discuss their projects during the MC session. You can also view the posters at any time during the meeting when the exhibit hall is open.

1 — Optimizing Dynamic Repair Decisions in the Site Imbalance Problem of Semiconductor Testing Machine
Chen-Fu Chien, Dept. of Industrial Engineering and Engineering Management, National Tsing Hua University, Hsinchu 20013, Twiwan R.O.C., chchien@mx.nthu.edu.tw; Jei-Zheng Wu, National Tsing Hua University; Chung-Jen Juo, Taiwan Semiconductor Manufacturing Company

2 — Interaction Value Analysis
Walid Nasrallah, Assistant Professor, Engineering Management Program, Faculty of Engineering and Architecture, American University of Beirut, Beirut 1107-2020, Lebanon, walid.nasrallah@aub.edu.lb

3 — Probabilistic Modeling of Population-based Epidemiology and Treatment Modalities to Determine Global Therapeutic Demand for Hemophilia A
Jeff Stonebraker, PhD. Portfolio Management, Bayer Biological Products, 79 T.W. Alexander Drive, 4101 Research Commons, Research Triangle Park, NC 27709

4 — Reducing Airplane Boarding Time at America West Airlines
Menkes H. L. van den Briel, Department of Industrial Engineering, Arizona State University, Tempe, AZ 85287-5906, menkes@asu.edu; J. Rene Villalobos, Gary L. Hogg, Arizona State University; Tim Lindemann, America West Airlines.

5 — Internet Development Standards: Current Practices and a Case Study Of Development and Accessibility Standards
John W. Stamey, Jr., Department of Computer Science, Coastal Carolina University, jwstamey@coastal.edu; Andrew Pavlica, Coastal Carolina University.

6 — Constructing A System with Hybrid Data Mining Algorithm for Wafer Bin Map Clustering and Classification
Chen-Fu Chien, Dept. of Industrial Engineering and Engineering Mangement, National Tsing Hua University, Hsinchu 30013, Taiwan, R.O.C., cfchien@mx.nthu.edu.tw; Saho-Chung Hsu, National Tsing Hua University; Cheng-Yung Peng, Ding-Hao Lin, Macronix International Company.

7 — Combination of Operations Research, Geographic Information System and the Internet for Waste Collection Vehicle Routing Problems

Surya Sahoo, Institute of Information Technology Inc., The Woodlands, TX 77380, surya@e-itt.com; Seongbae Kim, Byung-In Kim, Institute of Information Technology; Jason Marshall, Waste Management, Inc.

8 — A Bi-Criterion Formulation for Designing Logistics Networks: Case Study

Poornachandra Rao Panchalavarapu, Schneider Logistics Inc., 3101 South Packerland Drive, Green Bay, WI 54306, panchalavarapur@schneider.com

9 — Build Plan Optimization in a Push/Pull Production Environment

Feng Cheng, IBM, fcheng@us.ibm.com; Markus Ettl, Grace Lin, Yingdong Lu, IBM; David D. Yao, Columbia University.

10 — Dynamic Capacity Allocation During New Product Introduction

Pu Huang, IBM Research, puhuang@us.ibm.com; Alan Scheller-Wolf, Carnegie Mellon University; Sridhar Tayur, Carnegie Mellon University.

■ MC01

Westin-Intl. A, 6th Floor

Telecommunications I

Contributed Session

Chair: Emmanuelle Wallach, The Pennsylania State University, Department of Industrial Engineering, 310 Leonhard Building, University Park, PA, 16802, United States, ejw169@psu.edu

1 — Proactive Monitoring of Performance In Stochastic Communication Networks

Yupo Chan, Professor & Chair, University of Arkansas at Little Ro, 2801 South University, Little Rock, AR, 72204-1099, USA, yxchan@ualr.edu, John Van Hove

This research proposes several models for communication networks with failing components. The focus is on placing bounds on the expected values of some dynamic performance measures. This is useful in proactive performance monitoring and in defining level-of-service agreements with network users. Control charts were built based on standards, which were subsequently used in monitoring network degradation.

2 — Implementing Software Metrics at a Telecommunications Company - A Case Study

David Heimann, Professor, University of Massachusetts Boston, Management Science & Information Systems, 100 Morrissey Blvd, Boston, MA, 02125, United States, heimann@world.std.com

This study explores a metrics program to track and analyze the quality development of an updated version of the major voicemail product of a telecommunications company. It addresses the evolution of the company's organizational structure that led to adopting the program, the components of the program, its implementation, its effects on quality and timeliness, and what happened thereafter. The study also raises questions on maintaining an organization where a metrics program can flourish.

3 — Designing Wireless Local Area Networks Using Multiple Types of Access Points

Frederick Kaefer, Assistant Professor, Loyola University Chicago, 25 E. Pearson Room 1324, Chicago, Il, 60611, United States, fkaefer@luc.edu

Wireless Local Area Networks (WLANs) use access points to enable connectivity to mobile devices . This approach enables mobility while reducing wiring costs, but also requires a different set of decisions than faced when designing wired Local Area Networks. Decisions become more complex when a variety of access point types which provide various types of coverage are considered. This research develops a model for solving the WLAN design problem when considering multiple types of access points.

4 — An Efficient Technique for Grooming Traffic in Optical Networks

Sanjeewa Naranpanawe, PhD Candidate, The University of Texas at Dallas, 2601 N. Floyd Road, SM33, Richardson, TX, 75083, United States, sanjeewa@student.utdallas .edu, Chelliah Sriskandarajah, Rakesh Gupta

We consider the problem of grooming in all-optical networks with the objective of traffic maximization. We present an integer programming formulation which addresses this objective while constraining the number of optical transreceivers at each node, the link load and the capacity of each lightpath. We develop an efficient upper and lower bounding techniques for this problem and demonstrate their effectiveness by an extensive computational study.

5 — Robust Multi-Cass Network Design and Capacity Assignment with Guarantees on Quality of Service

Emmanuelle Wallach, The Pennsylania State University, Department of Industrial Engineering, 310 Leonhard Building, University Park, PA, 16802, United States, ejw169@psu.edu, Natarajan Gautam

We consider the strategic problem of designing the network for a domain in the Internet. We formulate and solve an optimization problem for planning the capacities of the links of the multi-class network to insure robustness and quality of service (QoS). The QoS constraint's complexity rules out standard optimization techniques. We develop a two-stage heuristic that first solves the routing problem without QoS, then adds QoS to find capacities. The heuristic performs remarkably.

■ MC02

Westin-Intl. B, 6th Floor

Modeling of Price Dynamics and Hedging

Cluster: Financial Engineering

Invited Session

Chair: Jussi Keppo, Assistant Professor, University of Michigan, IOE Department, 1205 Beal Avenue, Ann Arbor, MI, 48109, United States, keppo@umich.edu

1 — Hedging Default Risk in an Incomplete Market

Andrew Lim, Assistant Professor, IEOR Department, University of California, Berkeley, CA, United States, lim@ieor.berkeley.edu

It is widely accepted that default is a significant source of risk that should not be ignored. In the "reduced form" approach, default corresponds to the arrivals of a doubly stochastic Poisson process. In such a setting, the prices of default-sensitive assets can be calculated. In this talk, I shall present some recent work on the complementary problem of hedging default under the assumption that the price of the underlying hedging instruments are default sensitive .

2 — Conditional Moment Computations for Discrete Dynamic Hedges

James Primbs, Assistant Professor, Stanford University, 444 Terman Engr. Ctr., Management Science and Engineering, Stanford, CA, 94305-4026, United States, japrimbs@stanford.edu, Yuji Yamada

In this work we develop an efficient numerical algorithm to compute moments of the error in a discrete dynamic hedge when the underlying asset finishes in a specified price range at expiration. This algorithm is used to analyze the performance of hedging strategies under scenarios for the underlying asset.

3 — Optimal Static-Dynamic Hedges for Barrier Options

Aytac Ilhan, Princeton University, Dept. of Oper. Res. & Fin. Eng., Princeton, NJ, 08544, United States, ailhan@princeton.edu, Ronnie Sircar

We study optimal hedging of barrier options using a combination of a static position in vanilla options and dynamic trading of the underlying asset. We discuss computational approaches within the context of stochastic volatility models. Under exponential utility, the problem reduces to analyzing the indifference price of barrier options.

4 — A Tale of Two Growths: Modeling Stochastic Endogenous Growth and Growth Stocks

Steven Kou, Associate Professor, Columbia University, Department of IEOR, New York, NY, United States, sk75@columbia.edu, Samuel Kou

The stochastic model proposed in this paper provides an understanding of the links between economic growth, monopolistic competition in R&D, and the valuation of growth stocks. The model implies that the value of growth stocks should be very volatile, and the long-run average return is roughly equal to the growth rate of R&D labor. The model also explains an empirical size distribution puzzle observed for the cross-sectional study of growth stocks.

■ MC03

Westin-Intl. C, 6th Floor

New Primal-Dual Methods for Linear and Convex Optimization

Sponsor: Optimization/Linear Programming and Complementarity

Sponsored Session

Chair: Kees Roos, Delft University of Technology, 2628 CD Delft, Netherlands, C.Roos@ewi.tudelft.nl

1 — ''Cone-Free" Primal-Dual Path-Following and Potential Reduction Polynomial Time Interior-Point Methods

Arkadi Nemirovski, Georgia Institute of Technology, School of Industrial and Systems Enginee, Atlanta, GA, United States, nemirovs@ie.technion.ac.il, Levent Tuncel

We present a framework for primal-dual interior-point methods for convex optimization. We assume that a self-concordant barrier for the convex domain of interest and the Legendre transformation of the barrier are given. We directly apply the theory and techniques of interior-point methods to the given good formulation of the problem (as is, without a conic reformulation) using the very usual primal central path concept and a less usual version of a dual path concept. We show that many of the advantages of the primal-dual interior-point techniques are available in this framework and therefore, they are not intrinsically tied to the conic reformulation and the logarithmic homogeneity of the underlying barrier function.

2 — What is Special with the Logarithmic Barrier Function in Optimization?
Kees Roos, Delft University of Technology, 2628 CD Delft, Netherlands, C.Roos@ewi .tudelft.nl, Yanqin Bai

The logarithmic barrier function (LBF) has played a major role in optimization. Search directions in all state-of-the-art interior-point-solvers are explicitly or implicitly based on an LBF. Other barrier functions have been proposed, but LBF's always were winning, at least surviving. We present alternative barrier functions that provide the same or better theoretical complexity results than the LBF. The results can be extended to other conic optimization problems; it is an open question if the new barrier functions can be adapted to primal methods and dual methods, respectively.

3 — A New Class of Barrier Functions for Primal-Dual Interior-Point Algorithms in Linear Optimization
Yanqin Bai, Delft University of Technology, on leave from Department of Mathematics, Shanghai University, Shanghai, China, Netherlands, Y.Bai@its.tudelft.nl, Kees Roos

In this paper we present a new class of barrier functions based on univariate kernel functions. One of the advantages of the new barrier functions is that their kernel function has a simple expression. We use the new barrier functions to define new search directions for primal-dual path-following interior-point algorithms for linear optimization. We deal with the complexity analysis for algorithms based on the new barrier functions, both for large- and small-update methods. The resulting bounds are as good as the currently best known bounds for large- and small-update methods.

■ MC04

Westin-Intl. D, 6th Floor

Daniel H. Wagner Prize Competition

Sponsor: CPMS, The Practice Section
Sponsored Session

Chair: Joseph H. Discenza, President and CEO, SmartCrane, LLC, 2 Eaton Street Suite 500, Hampton, VA, 23669, United States, joeh@discenza.com

1 — Statistical Inventory Management - Process Methodology & Implementation
Alex Bangash, Lucent Technologies, 101 Crawfords Corner Road, Holmdel, NJ, United States, Ramesh Bollapragada, Narayan Raman, Herbert B. Shulman, Donald R Smith, Rachelle Klein

The Statistical Inventory Management methodology and process described here is intended to achieve high shipping performance goals of product units within Lucent Technologies. This is achieved through the recommendations of the inventory planning models and through institutionalizing the underlying processes, through the Inventory Requirements Planning (IRP) System developed within Bell Labs. This decision support methodology has been recognized through the Bell Labs President's Silver Award; it has also been a significant contributor to Lucent receiving the INFORMS prize and the Malcolm Baldrige Award.

2 — Scarce Drug Distribution for the MedPin Program
Jayashankar Swaminathan, Kenan-Flagler School of Business, University of North Carolina, Chapel Hill, NC, United States, msj@unc.edu, Kathryn Duke

The Public Health Institute was given the responsibility to disburse $150 million worth of free drugs to non profit clinics and hospitals in California in 1999. In this research, we describe the successes and challenges encountered in the development and execution of a decision support system that enabled a fair distribution of these drugs to the various clinics and hospitals.

■ MC05

Westin-Intl. E, 6th Floor

Pricing in Networks and Service Systems

Sponsor: Applied Probability
Sponsored Session

Chair: Serhan Ziya, University of North Carolina, Department of Operations Research, 210 Smith Building, CB #3180, Chapel Hill, NC, 27599-3180, United States, ziya@isye.gatech.edu

Co-Chair: Hyun-soo Ahn, Assistant Professor, University of California, 4185 Etcheverry Hall, Berkeley, CA, 94720, United States, ahn@ieor.berkeley.edu

1 — Determining Minimum Bandwidth and Prices in a Multi-class High-speed Network
Natarajan Gautam, Associate Professor, Penn State University, 310 Leonhard Building, University Park, PA, 16801, United States, ngautam@psu.edu

We consider a high-speed network where users belong to N different classes where each class is guaranteed a minimum bandwidth. Further, any remaining bandwidth is shared according to the ratio of the minimum bandwidths. Assuming that the service prices are proportional to minimum bandwidths, we determine the optimal minimum bandwidth for each class so that revenue is maximized, subject to satisfying a request-blocking performance guarantee.

2 — Pricing and Congestion Management in a Network with Heterogeneous Users
Shaler Stidham, Jr., Emeritus Professor, University of North Carolina, Department of Operations Research, CB #3180, Smith Building, Chapel Hill, NC, 27599-3180, United States, sandy@email.unc.edu

We present an economic model for a communication network with utility-maximizing elastic users who adapt to congestion by adjusting their flows. Users are heterogeneous with respect to both utility of flow and sensitivity to congestion. This introduces a fundamental non-convexity into the congestion-cost functions. As a result, the standard dynamical-system rate-control algorithm may converge to a local rather than global maximum, depending on the starting point.

3 — Pointwise Stationary Approximations for the Dynamic Control of Non-Stationary Queues
Seungwhan Yoon, University of Michigan, 1205 Beal Avenue, Ann Arbor, MI, 48105, United States, syoon@engin.umich.edu, Mark Lewis, Hyun-soo Ahn

Building on the recent work of Yoon and Lewis (2003), we examine the usefulness of the pointwise stationary approximation for dynamic control of a non-stationary queueing system. We compare via simulation several mechanisms for choosing points to approximate optimal policies when the arrival and service processes have periodic rate functions.

4 — Precision Pricing for a Service Facility
Serhan Ziya, University of North Carolina, Department of Operations Research, 210 Smith Building, CB #3180, Chapel Hill, NC, 27599-3180, United States, ziya@isye .gatech.edu, Hayriye Ayhan, Robert D. Foley

We consider a service facility modeled as a queueing system with either a finite or an infinite capacity waiting area. The decision-maker sets the prices customers must pay for service. We analyze precision pricing policies according to which the decision-maker charges different prices to different customer types. Under certain conditions, we develop methods to find optimal prices and investigate the relationships between the optimal prices and system parameters.

■ MC06

Westin-Intl. F, 6th Floor

Interactive Music Systems

Cluster: OR in the Arts: Applications in Music
Invited Session

Chair: Belinda Thom, Assistant Professor, Harvey Mudd College, 1241 Olin Hall, Claremont, CA, United States, Belinda_Thom@hmc.edu

1 — A Machine Learning Based Computational Model for Interactive Musical Improvisation
Belinda Thom, Assistant Professor, Harvey Mudd College, 1241 Olin Hall, Claremont, CA, United States, Belinda_Thom@hmc.edu

We present a melody representation scheme and machine learning framework for tightly coupling musicians with interactive software agents. A probabilistic model provides musician-specific perception, automatically mapping solos onto user "playing modes" that differentiate between various pitch class, intervallic, and melodic contour content. Random-walks through probabilistic graphs invert this perception procedure, automatically generating melodic responses to a user's solos in real-time.

2 — Design for Real-Time Interactive Systems
Alexandre Francois, Research Associate, University of Southern California, PHE-222 MC-0273, Los Angeles, CA, 90089-9273, United States, afrancoi@usc.edu, Elaine Chew

Performer-centered systems require real-time processing and seamless interaction. We introduce SAI, a new framework for the design, implementation and analysis of real-time interactive applications. An open source architectural middleware, MFSM, complements SAI. We illustrate their use with MuSA.RT, an interactive environment for content-based music visualization.

3 — What is the Title of that Piece of Music? An Application of Query by Humming
Maverick Shih, ALi Microelectronics Corp., USA, 8105 Irvine Center Drive, #550, Irvine, CA, 92618, United States, hshih@aliusa.com

Most people have had the experience of trying to find a piece of music in a music store with only salient tunes in mind. They typically do not have any information about the name of the composers and/or the performers. Humming and singing provide the most natural means for the music database retrieval. Can today's technologies help us to fine the pieces that we are looking for? The technologies used by "Query by Humming" will be discussed in the presentation.

■ MC07

Westin-Intl. G, 6th Floor

Scheduling in Electricity Markets

Sponsor: Energy, Natural Resources and the Environment
Sponsored Session

Chair: Antonio Conejo, Professor, Univ. Castilla-La Mancha, Electrical Engineering, ETSI Industriales, Ciudad Real, 13071, Spain and Canary Islands, Antonio.Conejo@uclm.es

1 — New Computational Methods for the Economic Dispatch of Thermal Power Plants
Matt Thompson, Industrial Research Fellow, Ontario Power Generation Inc., 700 University Avenue H9, Toronto, Ontario, M5G1X6, Canada, matt_thompson@sympatico.ca

We discuss a new computational technique for calculating optimal dispatch for thermal power plants. By representing operational states as continuous dynamic processes, we make use of derivative information to achieve second order accurate operating state representation. Any jump-diffusive process for the underlying uncertainties is allowed. Price spikes are explicitly addressed.

2 — A Chance Constrained Programming Approach for Solving the Stochastic Unit Commitment Problem
U. Aytun Ozturk, University of Pittsburgh, 1072 Benedum Hall, Pittsburgh, PA, United States, uaost2@pitt.edu, Bryan A. Norman, Mainak Mazumdar

This work proposes a chance constrained programming formulation of the Unit Commitment problem with the objective of insuring sufficient power production with a specified probability level. Uncertainties both on the demand and supply sides are considered in the model. The effectiveness of the model is demonstrated using simulation.

3 — Optimal Response of a Thermal Unit Subject to Ramp Constraints and Price Uncertainty
Chung-Li Tseng, Assistant Professor, University of Maryland, Department of Civil & Environmental Engi, College Park, MD, 20742, United States, chungli@eng.umd.edu, Wei Zhu

We show the optimal response of a thermal unit to price uncertainty of a spot market can be solved by an efficient algorithm whose complexity is a polynomial of the problem size. Price uncertainty is introduced via scenarios generated by the Monte Carlo method. We show that the effects of the ramp constraints to a thermal unit under price uncertainty can be identified in terms of reductions of fuel economy, heat-electricity transformation efficiency, and available generation capacity.

4 — Using DEA Models to Evaluate Relative Efficiencies of State-Owned and IPP Thermal Power Plants in Taiwan
Chen-Fu Chien, Associate Professor, Department of Industrial Engineering and Engineering Management, National Tsing Hua University, 101 Sec. 2 Kuang Fu Road, Hsinchu, T, 300, Taiwan, cfchien@mx.nthu.edu.tw, Shi-Lin Chen, Shang-Yi Chi

This research applies and compares different DEA models to evaluative efficiencies of state-owned and IPP thermal power plants in Taiwan. This study also performs scale analysis, multiplier analysis, slack analysis, and sensitivity analysis for discussions.

■ MC08

Westin-Intl. H, 6th Floor

Panel: Operational Modeling and Simulation of Semiconductor Manufacturing

Sponsor: Simulation
Sponsored Session

Chair: John Fowler, Professor, Arizona State University, Dept. of Industrial Engineering, Tempe, AZ, 85287-5906, United States, john.fowler@asu.edu

1 — Panel Discussion: Operational Modeling and Simulation of Semiconductor Manufacturing
Panelists: John Fowler, Oliver Rose, Scott J. Mason, Leon F. McGinnis

The use of operational modeling and simulation in the semiconductor industry was very uncommon a decade ago. Since that time, their use has steadily increased. However, there are still issues in using simulation to analyze semiconductor manufacturing operations. In this session, we discuss the current state of operational modeling of semiconductor manufacturing and challenges for the future.

■ MC09

Westin-Vinings 1, 6th Floor

INFORMS Case and Teaching Materials: Dialog with Authors and Teachers

Sponsor: Education (INFORM-ED)
Sponsored Session

Chair: Thomas Grossman, United States, Thomas.Grossman@Haskayne.UCalgary.ca

1 — INFORMS Case and Teaching Materials: Dialog with Authors and Teachers
Thomas Grossman, United States, Thomas.Grossman@Haskayne.UCalgary.ca

INFORMS is funding an ambitious program to peer-review, publish and distribute cases, mini-cases, classroom exercises, modeling problems, projects, game kits, and other teaching materials. We discuss our existing Edelman Prize cases, materials we want publish, and the peer review process. In this session we seek feedback from faculty about their needs, and existing materials they want to submit. This session will also provide valuable information to those who are considering applying to become Associate Editors and members of the Editorial Board.

■ MC10

Westin-Vinings 2, 6th Floor

Exploring Ways to use Spreadsheets

Sponsor: Spreadsheet Productivity Research
Sponsored Session

Chair: Jeffrey Keisler, Assistant Professor of Management Science & Information Systems, University of Massachusetts, Boston, M/5-230, 100 Morrissey Boulevard, Boston, MA, 02125, United States, jeff_keisler@hotmail.com

1 — Spreadsheet Model Documentation Macros
Roger Grinde, Associate Professor of Management Science, University of New Hampshire, Whittemore Sch. of Business & Economics, 15 College Road/McConnell Hall, Durham, NH, 03824, United States, roger.grinde@unh.edu

A quick demo of several Excel macros and functions created over the years to aid students in producing better and more consistent documentation for their models — and to reduce my number of headaches grading spreadsheets.

2 — Slick Spreadsheets
Lawrence Robinson, Cornell University, Johnson Graduate School of Management, Ithaca, NY, 14853, United States, lwr2@cornell.edu

This presentation will demonstrate a few quick and impressive techniques that make it easy to make changes in your spreadsheets. These techniques are especially helpful for spreadsheets that will be used in presentations, or be used by other people. Topics covered will include graphical controls (e.g., scroll bars and radio buttons), scenarios and the offset function, and data validation.

3 — Spreadsheet-Based Geographic Information Systems: What, Why and How
Jeffrey Keisler, Assistant Professor, University of Massachusetts Boston, M/5-230, 100 Morrissey Boulevard, Boston, MA, 02125, United States, Jeff.Keisler@umb.edu, Carter Irvine

Spreadsheets can be used as GIS, by treating cells as pixels and coloring them using conditional formatting. Bringing spreadsheets to this domain facilitates a number of applications. Some of these applications are discussed along with challenges in this approach and solutions to them. More broadly, this is an example of the use of spreadsheets as a flexible platform for developing decision support tools.

4 — Maximize Your Spreadsheet Knowledge With This "Excel Array Tour"
Cliff Ragsdale, Professor, Virginia Tech, Dep't of Business Info Tech, 1007 Pamplin Hall, Blacksburg, VA, 24061, United States, crags@vt.edu

Array formulas are one of Excel's most powerful and least understood features. This session provides an introduction to array formulas and shows how they can be used to easily accomplish a number of otherwise difficult modeling tasks.

■ MC11

Westin-Augusta 1, 7th Floor

Tutorial: Developing Web-Enabled Decision Support Systems

Cluster: Tutorials
Invited Session

1 — Developing Web-Enabled Decision Support Systems
Ravindra Ahuja, Professor, University of Florida, 303, Weil Hall, P O Box 116595, Gainesville, FL, 32608, United States, ahuja@ufl.edu, Abhijit Pol

The ability to extract data from databases and embed analytical decision models within larger systems are some of the most valuable skills required for students entering today's IT dominated workplace. This tutorial will show how to use IT tools to develop decision support systems arising in the practice of IE/OR/Management and to make them web-enabled. It will also describe how to teach courses imparting these skills and will provide the required course material on a CD to interested attendees.

■ MC12

Westin-Augusta 2, 7th Floor

Dynamics and Performance of Bucket Brigade Production Lines

Cluster: Workforce Flexibility and Agility
Invited Session

Chair: Esma S. Gel, Assistant Professor, Arizona State University, Dept. of Industrial Engineering, P. O. Box 5906, Tempe, AZ, 85287-5906, United States, esma.gel@asu.edu

1 — Performance of Hybrid Dynamic Worksharing Systems under Labor Turnover
Rene Villalobos, Arizona State University, Dept of Industrial Engineering, P.O. Box 5906, Tempe, AZ, United States, rene.villalobos@asu.edu, Marco Gutierrez, Omar Ahumada

Dynamic worksharing systems with active operator replacement policies have been shown to work well in systems with labor turnover and task learning. However, traditional balanced systems tend to outperform bucket brigades in situations where all the operators are fully trained and their speed is the same. We present an adaptable system that under high labor turnover tends to behave as a bucket brigades system and under low labor turnover it tends to behave as a traditional balanced line.

2 — Bucket Brigade Assembly with Walk-Back and Hand-off Times
John J. Bartholdi, III, The Manhattan Associates Professor of Supply Chain Management, Georgia Institute of Technology, School of Industrial and Systems Enginee, Atlanta, GA, 30332, United States, john.bartholdi@isye.gatech.edu, Don Eisenstein

We describe an implementation of bucket brigades in a manufacturing environment in which there were significant delays during walk-back and hand-off. A model suggests why, despite these delays, productivity improved by over 10%.

3 — Bucket Brigades Revisited: Are they Always Effective?
Esma S. Gel, Assistant Professor, Arizona State University, Dept. of Industrial Engineering, P. O. Box 5906, Tempe, AZ, 85287-5906, United States, esma.gel@asu.edu, Dieter Armbruster

We consider bucket brigade systems where the ordering of workers with respect to their speeds changes depending on their specialization. For two-worker bucket brigade systems we characterize the system dynamics as a function of various parameters and provide several useful insights for managers considering bucket brigade mode of production.

■ MC13

Westin-Augusta 3, 7th Floor

Marketing Models and Industry Practice

Sponsor: Marketing Science
Sponsored Session

Chair: Ed Brody, Associated Scholar, NYU/Ed Brody Inc, 66 Pinecrest Drive, Hastings-on-Hudson, NY, 10706, United States, edibro@earthlink.net

1 — Are Your Models Killing Your Brands: Why Traditional Modeling Techniques Understate Advertising
Howard Finkelberg, SVP & Director, Marketing Sciences, BBDO, 1285 Sixth Ave., New York, NY, 10019, United States, howard.finkelberg@bbdo.com

Most marketing mix models contain a lagged sales term, or "base." The author will demonstrate that this causes the model to minimize long-term effects, understating the impact of variables, such as advertising, that work long term, and overstating the impact of variables with short-term effects. Following these models leads to an under-investment in advertising, weakening the brand's image, and an over-investment in promotion, hurting the brand's profitability.

2 — Toward a Greater Integration of Behavioral and Attitudinal Modeling
Mike Hess, Senior VP, TNS-Intersearch, Three Westbrook Corp. Center, Westchester, IL, 60154, United States, michaelhes@aol.com

Behavioral Research and Attitudinal Research have become arenas for enormous progress in modeling efforts in the past decade. The integration of these two growth areas hasn't been achieved yet, however. Such a synthesis could bring even more interpretive power to both kinds of analyses as better aids to brand management decision-making. The basic paradigm should become: Scanner data tells "what" happened; panel data "how" it happened; and survey data, "why" it happened.

3 — Using Dynamic Regression to Model Consumer Demand
Charlie Chase, Market Strategy Manager, SAS Institute, Inc., SAS Campus Drive, Cary, NC, 27513, United States, Charlie.Chase@sas.com, Mary Crissey

The accurate prediction of consumer demand has been cited as the most critical factor in the improvement of supply chain efficiencies. This paper will outline how to model consumer demand using dynamic regression; suggest how simulation capabilities can be used for strategic market planning, and finally show brand/product managers how linear programming and optimization techniques can be applied to maximize their volume potential.

■ MC14

Westin-Peachtree A, 8th Floor

Joint Session NLP/TM: Panel—The Interface Between the Management of Technology and New Product Development

Clusters: New Product Development, Technology Management
Invited Session

Chair: Cheryl Gaimon, Professor, Georgia Institute of Technology, DuPree College of Management, 755 Ferst Drive, Atlanta, GA, 30332-0520, United States, cheryl.gaimon@mgt.gatech.edu

1 — The Interface Between the Management of Technology and New Product Development
Panelists: Cheryl Gaimon, Mihkel Tombak, Thomas Roemer, Vish Krishnan, Kingshuk Sinha, Christoph Loch

A five-member panel will discuss the interface between the management of technology and new product development including elements relevant to research and practice. The panel members are: Vish Krishnan, University of Texas at Austin; Christoph Loch, INSEAD; Thomas Roemer, MIT; Kingshuk Sinha, University of Minnesota; and Mikhel Tombak, Queen's University.

■ MC15

Westin-Peachtree F, 8th Floor

Management of Technology

Contributed Session

Chair: Mark Krankel, Graduate Student, University of Michigan, 1205 Beal Avenue, IOE Building, Ann Arbor, MI, 48109-2117, United States, krank@engin.umich.edu

1 — Application of DEA for CRM Performance Evaluation
Sanjeev Bordoloi, Asst. Prof. of Operations & Information Technology, College of William & Mary, School of Business, Williamsburg, VA, 23187, United States, skbord@business.wm.edu, Amit Karkoon

Even though CRM is a household word today, there is absolutely no consensus about the exact depth and breadth of the CRM concept across a wide array of enterprises. This paper identifies a comprehensive list of performance measurements for the operation of CRM units, and then uses DEA to compare the performances of a selected set of CRM units for call center operations. The results provide several managerial insights that will assist CRM managers in effective decision making.

2 — Managerial Incentives and Reputational Herding in Strategic Information Technology Adoption
Xiaotong Li, University of Alabama in Huntsville, Department of Accounting and IS, Huntsville, AL, United States, lixi@uah.edu, Robert Kauffman

Our paper studies managers' herd behavior in IT adoption in a rational herding model. It investigates the role of career-concerned managers' implicit incentives in fostering IT investment herding. It demonstrates how information technology market dynamics may be affected by agency problems and information asymmetries. The issues of incentive-alignment and strategic signaling (or signal jamming) are also discussed.

3 — An Experiment in Managing Human Capital in a Defense Department Laboratory
William Leonard, Principal Research Engineer, University of Alabama In Huntsville, 301 Sparkman Drive, Huntsville, AL, 35899, United States, leonardw@email.uah.edu

This paper will discuss the results to date of a congressionally authorized experiment to improve the ability of a selected Defense Department Laboratory to attract and retain high quality employees. The successful management of technology in a government laboratory involves many elements, which includes quality human capital. This experiment in managing human capital is in its 6th year. Statistics will be presented on the evaluation of the experiment to date.

4 — Analyzing an Innovation Group NetWork
R. Ruth, General Motors R&D, MC 480-106-256, 30500 Mound Rd., Warren, MI, 48090-9055, United States, rjean.ruth@gm.com, Hallie Kintner

Tools are needed to assess, visualize, and analyze work processes for "creative" work. As a test case, we observed a group of analysts and designers working on product concept development . We assessed the group's information flow and interactions by using ethnographic and social network tools and developed schematics visualizing the process. The group reorganized its work area based on the findings. We identified opportunities for new OR tools for process design and resource allocation.

5 — Timing Successive Product Introductions with Demand Diffusion and Stochastic Technology Improvement
Mark Krankel, Graduate Student, University of Michigan, 1205 Beal Avenue, IOE Building, Ann Arbor, MI, 48109-2117, United States, krank@engin.umich.edu, Izak Duenyas, Roman Kapuscinski

We consider a monopolistic firm's decisions on introduction timing for successive product generations. We examine the case where demand is characterized by an innovation diffusion process and available product technology improves stochastically. We specify a state-based model of demand diffusion and construct a decision model to solve the introduction time problem . Analysis focuses on characterization of the optimal introduction policy with a comparison to past conclusions in the literature.

■ MC16

Westin-Peachtree G, 9th Floor

Modeling and Analysis to Support Optimization of the Military Health System

Sponsor: Health Applications
Sponsored Session

Chair: George Miller, The Altarum Institute, PO Box 134001, Ann Arbor, MI, 48113-4001, United States, george .miller@altarum.org

1 — Discrete Event Simulation Initiatives in the Military Health System
Thomas Mihara, PhD, Dir, Systems Analysis & Evaluation, TRICARE Management Activity OSD, 5111 Leesburg Pike, Suite 810, Health Programs Analysis & Evaluation, Falls Church, VA, 22041-3206, United States, Thomas.Mihara@tma.osd.mil

As an introduction to a series of contracted initiatives sponsored by Congress, the use of simulation models helps managers to achieve population health and business goals. The efforts by a number of analysts address the impact of facility size and bed mix, operating policies, and staff deployment in terms of measures such as occupancy, cost, and training needs. An overarching view is provided to demonstrate a broad range of modeling studies.

2 — Automated Data Collection in a Primary Care Clinic
Timothy Ward, Principal, Health Services Engineering, Inc., PO Box 231, Cabin John, MD, 20818, United States, tward@hseinc.biz, Mark Isken, Dan Minds

To obtain information needed to populate a simulation model, infrared sensors were placed throughout a primary care clinic. Patients and staff members wore small infrared tags that identified the location of each person every four seconds. During a 12-week period, location data for over 9,000 patient visits was captured. The data was used to define simulation model parameters such as exam time distribution, provider and support staff requirements for specific patient/disease categories.

3 — Models for Optimizing the Military Health System: A Case Study in an Intensive Care Unit
George Miller, The Altarum Institute, PO Box 134001, Ann Arbor, MI, 48113-4001, United States, george.miller@altarum.org

This paper illustrates the use of models to help "optimize" healthcare delivery (improve processes to reduce impediments to care) in the Military Health System. In a study designed to improve performance of the intensive care unit (ICU) at the US Air Force's Wilford Hall Medical Center, we used discrete-event simulation to analyze the impact of ICU size and bed mix, operating policies, and the deployment of ICU staff on measures of occupancy, congestion, cost, and physician training needs.

4 — A Model for Assessing the Medical Risks and Consequences of Blood Product Shortages
Daniel Frances, University of Toronto, Mechanical and Industrial Engineering, 5 King's College Road, Toronto, ON, M5S 3G8, Canada, frances@mie.utoronto.ca, Somayeh Sadat, Renata Kopach

This simulation study predicts the risk of hospitals not meeting patient needs for red blood cell and platelets, and the resulting medical impacts. Bleeding (B) patients were assigned level 1 impact, non-bleeding (NB) patients levels 2 and 3. During blood shortage periods, demand for NB patients is gradually curtailed as inventories drop, and unsatisfied NB patients in time escalate to become B patients. Blood type matching restrictions and preferences must be satisfied.

■ MC17

Westin-Peachtree H, 9th Floor

Service Industry I

Contributed Session

Chair: Seong-Jong Hong, Ph.D. Candidate, Virginia Tech, Dept. of Industrial and Systems Eng., Durham 210, Blacksbrug, VA, 24061, United States, sehong1@vt.edu

1 — Contingency Planning at Qwest Communications
Dennis Dietz, Qwest Communications, 1801 California Street, Denver, CO, 80202, United States, dennis.dietz@qwest.com

We develop and implement a sequential linear programming algorithm for assigning managerial employees to critical occupational positions in the event of a work stoppage. The objective is to maximize a summative suitability score (weighted combination of skill compatability and travel cost avoidance) while enforcing job type priorities.

2 — Service Co-Production, Customer Efficiency and Market Competition
Mei Xue, Assistant Professor, Boston College, 350 Fulton Hall, 140 Commonwealth Avenue, Chestnut Hill, MA, 02467, United States, xueme@bc.edu, Patrick Harker

Customers' participation in service co-production processes has been increasing with the rapid development of self-service technologies and business models using self-service as the main service delivery channel. However, little is known about how the level of customers' participation in service delivery processes influences the competition among service providers. In this paper, a game-theoretic model is developed to study the competition among service providers when self-service is an option.

3 — Is Service Quality Enough to Satisfy Your Customers? An Empirical Examination of Service Experience
Rungting Tu, University of North Carolina at Chapel Hill, Campus Box 3490, McColl Building, Kenan-Flagler Business School, Chapel Hill, NC, 27599, United States, tur@bschool.unc.edu

The concept of delivering quality service to customers to ensure customer satisfaction has always been well recognized, and accepted. Research also shows better service quality doesn't necessarily guarantee better satisfaction. We argue that three stages of emotions (pre-, during-, and post-consumption emotions) combined with expectation, disconfirmation, and perceived service quality determine a customer's service experience, and this experience determines the customer satisfaction.

4 — Sustainable Growth Rate for Service Firms
Rogelio Oliva, Harvard Business School, Soldiers Flied Rd., Boston, MA, 02163, United States, roliva@hbs.edu

Investors have funded aggressive-growth strategies that push firms beyond their sustainable growth rate (growth without issuing additional equity). Accelerated growth overstretches firms' resources, frequently resulting in reinforcing processes that take firms out of business. To identify alternative limits to how fast a firm can grow, I find the steady state conditions for various firm sectors, and use the model to find the growth rates that maximize productivity, output, and income growth.

5 — Benefits of a Delayed Resource Allocation Strategy in the Service Industry
Seong-Jong Hong, Ph.D. Candidate, Virginia Tech, Dept. of Industrial and Systems Eng., Durham 210, Blacksbrug, VA, 24061, United States, sehong1@vt.edu, Ebru Bish

We study the benefits of a delayed decision making strategy under demand uncertainty, considering a service environment that satisfies demands for two service types with two capacitated and flexible resources. Resource flexibility allows the firm to delay the resource allocation decision to a time when partial information on demands is obtained and demand uncertainty is reduced. We characterize the structure of the firm's optimal delayed resource allocation strategy.

■ MC18

Westin-Tower 1201, 12th Floor

Panel: New Developments in Statistical Process Monitoring and Diagnosis for Multistage Manufacturing Processes

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 — New Developments in Statistical Process Monitoring and Diagnosis for Multistage Manufacturing Processes
Panelists: Shiyu Zhou, Susan Albin, George Runger, Jianjun (Jan) Shi, Kwok-Leung Tsui, Russell Barton

A multistage manufacturing process, which refers to a process that involves multiple operation steps, is very common in practice. Because of the development of sensing and information technology, the current manufacturing has become a data rich environment. The abundance of measurement data provide great opportunities to develop new process monitoring and diagnosis methodologies for multistage processes. Significant advancements have been made in this direction in recent years. This panel discussion will focus on these new developments in this field. The technical topics will include, but not limited to, (1) new developments in multivariate statistical monitoring, (2) statistical monitoring techniques with root cause identification capability, and (3) new monitoring and diagnosis technologies for complicated multistage manufacturing processes.

■ MC19

Westin-Tower 1202, 12th Floor

Engineering Design Optimization

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: Kurt Palmer, Assistant Professor, Univ of Southern California, DJ Epstein Dept of Indus & Sys Engr, 3715 McClintock Ave, GER 240, Los Angeles, CA, 90089-0193, United States, kpalmer@usc.edu

1 — A Statistically-Based Stopping Rule for Cluster Agglomeration
Kurt Palmer, Assistant Professor, Univ of Southern California, DJ Epstein Dept of Indus & Sys Engr, 3715 McClintock Ave, GER 240, Los Angeles, CA, 90089-0193, United States, kpalmer@usc.edu

Cluster analysis techniques can be used to identify families of raw material sources and define process input variability. However, most clustering references offer little guidance regarding selection of the final number of clusters. We describe a new heuristic for hierarchical agglomeration that bases the partitioning on distributional characteristics of the squared Pearson distance measure.

2 — Latin Hyper-Rectangle Sampling for Computer Experiments
David Mease, NSF Postdoctoral Research Fellow, University of Pennsylvania, Wharton School, Statistics Dept, Philadelphia, PA, United States, dmease@umich.edu, Derek Bingham

Latin hypercube sampling (LHS) is a popular method for evaluating the expectation of functions that are outputs of computer experiments. However, if the integral of interest is taken with respect to a non-uniform density, the equal probability cells of LHS sample too few points in areas of low probability. In this talk we introduce Latin hyper-rectangle sampling which allows non-equal cell probabilities. Examples are given illustrating the improvement of this methodology over LHS.

3 — Constructing Optimal Design of Computer Experiments
Wei Chen, Associate Professor, Northwestern University, Dept of Mechanical Engr, 2145 Sheridan Road, Evanston, IL, 60208-3111, United States, weichen@northwestern .edu

The accuracy of metamodels is directly related to the experimental designs used. The high cost in constructing optimal experimental designs (OEDs) has limited their use. In this work, a new algorithm for constructing OEDS is developed. It is shown that compared to the existing algorithms, the proposed algorithm is much more efficient and very flexible in that it can be used to construct various classes of optimal designs to retain certain structural properties.

4 — Decomposition Strategies for Reliability-Based Multidisciplinary Design Optimization
John Renaud, Professor, University of Notre Dame, IN, United States, John.E.Renaud .2@nd.edu, Harish Agarwal

In this research, decomposition strategies for multidisciplinary systems are used to reduce the computational cost associated with existing reliability-based design optimization (RBDO) formulations. Traditionally, RBDO formulations are extremely expensive and the problem is aggravated when applied to multidisciplinary problems which are likewise computationally intensive. Decomposition methodology for RBDO will be illustrated in application to multidisciplinary test problems.

■ MC20

Westin-Tower 1203, 12th Floor

Quality Issues

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: Germaine Saad, Professor of Management, School of Business Administration, Widener University, One University Place, Chester, Pa, 19013, United States, Germaine.H.Saad@widener.edu

1 — Minimization of Construction Project Cost through Quality Management
Tarek Shaalan, Graduate Research Assisstant, University of Central Florida, P.O.Box 160000, Orlando, FL, 32816, United States, tshaalan@mail.ucf.edu

Seven cases were studied with the objective of assessing the effect of hidden poor quality costs in the overall budget of construction projects. Quality Cost calculations illustrate the common huge failures that are wrongly estimated as overhead costs & how they impact the overall performance. Results point clearly to the need for Prior job quality failure risk assessment & benefits that can be realized by integrating quality costs concepts in construction projects.

2 — The Military Institution and the Improvement Key-Techniques
Sérgio Luìs Delamare, Capitao-de-Corveta (T) - M.Sc., Center for Naval Systems Analysis, Barao de Ladàrio s/n, Ilha das Cobras, Ed. 8 do AMRJ 3º andar, Rio de Janeiro, RJ, 20091-0, Brazil, s.delamare@globo.com

The main purpose of this survey is to verify how far a military organization that has joined to of Public Administration Quality Program fits the excellence requirements established by the Federal Government Quality Award. Based upon information from a specific military organization, the Center for Naval Systems Analysis, and using Structural Equation Modeling, one has measured the relations of cause-and-effect based upon the criteria, in order to check its level of adjustment to the model.

3 — Comparison between Ranking Method and Analytic Hierarchy Process in Feedback Sheet Analysis
Yuji Sato, Professor, Graduate School of Policy Science, Matsusaka University, 1846 Kubo,, Matsusaka, Mie, Mi, 515-8511, Japan, ysatoh@matsusaka-u.ac.jp

The purpose of this study was to examine the relative effectiveness of a ranking method for measuring human perception. Specifically, the correlation between answers from feedback sheet for English evaluation test and actual test scores are compared. Each question was formatted in a different way: one was formatted using a ranking format and the other using AHP format. The results offered some evidence that the AHP format was superior to the ranking format in representing human perceptions.

4 — Process Improvement: Methodologies and Extensions
Samia Siha, Associate Professor of Operations Management, Kennesaw State University, 1000 Chastain Road, Kennesaw, GA, 30144, United States, Siha@coles2 .kennesaw.edu, Germaine Saad

This paper surveys and analyses current process improvement approaches in the literature. We will look at the contribution and success factors of each as well as their pitfalls. We will then extend these approaches in a new integrated framework. The framework proposed synthesizes behavioral and analytical concepts in a way that provides both conceptual extensions and practical advantages for implementation.

■ MC21

Westin-Tower 1204, 12th Floor

All Things Scheduled I

Sponsor: Computing
Sponsored Session

Chair: Carol Trekoff, ILOG, 1080 Linda Vista Avenue, Mountain View, CA, 94043, United States, ctretkoff@ilog.com

1 — Scheduling the NFL with Constraint Programming
Irv Lustig, Manager, Technical Services, ILOG Direct, ILOG, Inc., 25 Sylvan Way, Short Hills, NJ, 07078, United States, ilustig@ilog.com

The National Football League (NFL) consists of 32 teams, with each team playing a predetermined set of 16 games and one bye over 17 weeks. The NFL has to schedule these games to meet the demands of the teams as well as the television networks. We describe how constraint programming has been successfully applied to solve this problem.

2 — Together Again for the First Time: Scheduling and Routing
Ken McAloon, Chief Scientist, Elogex, Suite 2000, 200 South College Street, Charlotte, NC, 28202, United States, kmcaloon@elogex.com

The classical algorithmic machinery for scheduling (postponing strategies, edgefinding etc) is very different from that for routing (savings heuristics, local search, etc). However, when side constraints on routes are complex and cost functions are more than functions of time or distance, the distinction starts to blur; conversely when schedules involve multiple locations routing considerations enter the scheduling process. We will discuss hybrid methods developed to deal with these issues.

3 — Applying Hybrid Optimization Techniques to Project Scheduling
Thomas Dong, Product Manager, ILOG, 1080 Linda Vista Avenue, Mountain View, CA, United States, tdong@ilog.com

Project and program management are indispensable disciplines in helping organizations effectively balance trade-offs between and within projects, manage where investments and efforts are placed, and once they are committed, determine how resources and operations are managed over time. We apply several branches of optimization, including MIP, CP and LS, in decomposing and tackling various scheduling decisions throughout the project/program lifecycle .

4 — Using Constraint Programming for Incremental Scheduling
Carol Trekoff, ILOG, 1080 Linda Vista Avenue, Mountain View, CA, 94043, United States, ctretkoff@ilog.com

Many scheduling applications involve incremental scheduling where one, or at most a few, jobs can be scheduled at one time. Technician dispatching is a classic example. However, incremental scheduling may be rather complex because a job may require that a configuration of resources be available at the same time. Constraint Programming has been used in a number of successful applications of this type to "keep the books". Examples will be given and algorithmic issues will be discussed.

■ MC22

Westin-Tower 1205, 12th Floor

Redstone Practice

Sponsor: Military Applications
Sponsored Session

Chair: Ron Saylor, Operations Research Analyst, U.S. Army Aviation and Missile Research, Development, and Engineering Center, AMSAM-RD-SS-AE, Redstone Arsenal, AL, 35898, United States, SaylorRS@rdec .redstone.army.mil

1 — Drawing Tools Using: Natural Cubic Splines, Cubic Bezier Splines, and Cubic Bsplines.
Doug Horacek, Operations Research Analyst, US Army Aviation and Missile Command, Sparkman Center, Building 5300 Rm 5250 2nd Floor, Redstone Arsenal, AL, 35898-5000, United States, doug.horacek@redstone.army.mil

Presentation will discuss and demonstrate the use of spline tools for quickly making texture maps and geometric figures for pasting into Technical reports or using them as backgrounds for pictures in studies, or simply making two dimensional graphs or simply drawing two dimension figures or three dimensional figures in two dimensions. The presentation will cover some of the mathematics and implementation of these drawing tools.

2 — Old Lamps with New Wicks: Adding the Information Dimension to Aggregate Attrition Models
Bruce Fowler, Chief Sceintist, Advanced Systems Directorate, Aviation Missile Research, Development, and Engineering Center, U. S. Army Research, Development, and Engineering Command, AMSAM-RD-AS-CS, Redstone Arsenal, AL, 35898, United States

Considerable criticism has been vented that legacy simulations implementing sound models do not adequately portray the information aspects of modern warfare. Recent combat in Iraq has shown that close combat is and probably still will be a central component of Twenty-First Century Warfare. We present an extension of existing conjugate attrition theory that incorporates the informational dimension naturally.

3 — Simulating The Networked Fires Process
Ron Saylor, Operations Research Analyst, U.S. Army Aviation and Missile Research, Development, and Engineering Center, AMSAM-RD-SS-AE, Redstone Arsenal, AL, 35898, United States, SaylorRS@rdec.redstone.army.mil

This presentation will discuss a portion of the Networked Fires Process (engineering level analysis) using the Non-Line-of-Sight Launch System Full System Simulation experiment. Various sensor, effector, and Battle Command technologies were represented in a classified distributed M&S environment, in order to identify and test NLOS-LS C3 requirements (network load and mission manager applications). The Networked Fires analysis was conducted in a Future Combat Systems context.

4 — Design Point Criteria for Rotary Wing Aircraft using United States Air Force Climatology Data
Jim O'Malley, Aerospace Engineer US Army, Operations Research Branch of the Command Analysis Directorate, United States Army, Aviation and Missile Command Redstone Ar, Redstone Arsenal, AB, United States, james.omalley@rdec.redstone.army.mil, Doug Horacek

Presentation will discuss and demonstrate methods for estimating Design Point Criteria. We use this data with Hover out of ground effect curve to determine over what percentage of the country a particular helicopter system can sustain lift of a certain load or weight in pounds. The United States Air Force Climatology Center in Ashville North Carolina provided detailed data for both one kilometer and 10 kilometer grid data for different altitudes over various countries around the world. The first development has been done completely with excel spread sheets. Python and ProspectV2 are going to be used to have the calculations performed with a Graphical User Interface and do the graphics automatically. We are looking for alternate software that is available to the greater community.

■ MC23

Westin-Tower 1206, 12th Floor

Managing Petroleum Resources with DA and Real Options

Sponsor: Decision Analysis
Sponsored Session

Chair: Michael Walls, Associate Professor, Colorado School of MInes, 1500 Illinois Street, Golden, CO, 80401, United States, mwalls@mines.edu

1 — Selling and Managing Offshore Oil Leases: A Real Options Analysis
Graham A. Davis, Associate Professor, Colorado School of Mines, Division of Economics and Business, 1500 Illinois St., Golden, CO, 80401, United States, gdavis@mines.edu, Radford Schantz

Real option valuation is applied to offshore oil and gas properties leased by the US Government. The current leasing program has been criticized as destroying resource value due to the program's diligence requirements and per acre rental fees. We estimate the extent of the wealth destruction, and make recommendations as to how the lease terms might be altered while maintaining diligence incentives.

2 — Robust Simulation Methods for Valuation of Real Options
Warren J. Hahn, The University of Texas at Austin, United States, Warren.Hahn@phd .mccombs.utexas.edu

The various types of underlying stochastic processes and exercise characteristics in real option valuation problems suggest the need for a general approach to dynamic optimization. Simulation-based valuation methods have been used extensively for problems that can be modeled as European-type options. However, due to the difficulty of specifying the value function required for early exercise decisions, application of these methods to options with American-type characteristics has been limited. We will discuss the application of a modified simulation-based algorithm to real option valuation problems, and demonstrate its use for an example with early exercise and a mean-reverting stochastic process.

3 — Separation of Market-Correlated and Private Uncertainties in Real Option Valuation
James Dyer, Professor, University of Texas at Austin, MSIS Department, Austin, TX, United States, Jim.Dyer@bus.utexas.edu, Joe Hahn, Luiz Brandao

Although risk-neutral approaches can be used to value real options uncertainties that exist in complete markets, many problems include private uncertainties, which are risks that cannot be hedged in markets. Where multiple market-correlated risks exist, these can be combined into one underlying uncertainty in project value. We also discuss how more involved cases where separation is not trivial and correlation between uncertainties exists can be solved with use of a modified probability measure.

4 — Financial Risk Tolerance in the Petroleum Industry — A 20 Year Look at Risk Taking and Performance
Michael Walls, Associate Professor, Colorado School of MInes, 1500 Illinois Street, Golden, CO, 80401, United States, mwalls@mines.edu

Since 1998 the mega-merger trend among major oil companies has led to fundamental changes in the structure of the petroleum industry. In light of these changes, we extend the original E&P risk tolerance study (Walls and Dyer, 1996) and examine the changes in risk taking behavior by firms in this new competitive environment. In addition, we examine the relationship between firm performance and corporate risk tolerance and discuss the implications to managers for setting corporate risk policy.

■ MC24

Westin-Tower 1207, 12th Floor

Information Security Applications

Sponsor: Information Systems
Sponsored Session

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

1 — The Analysis of Configuration Issue in Classification and Detection Systems
Huseyin Cavusoglu, Assistant Professor, Tulane University, 7 Mc Alister Drive, New Orleans, LA, 70118, United States, huseyin@tulane.edu, Srinivasan Raghunathan

In this paper, we compare the decision and game theoretic approaches to the classification and detection system configuration problem when firms are faced with strategic users. We find that under most circumstances firms incur lower costs when they use game theory as opposed to decision theory because decision theory approach frequently either over- or under-configures the detection software.

2 — Economic Analysis of the Software Vulnerability Disclosure Market
Karthik Kannan, Assistant Professor of MIS, Purdue University, 403 West State Street, West Lafayette, IN, 47907, United States, kkarthik@cmu.edu, Rahul Telang, Hao Xu

Organizations like CERT have been acting as central repositories for reporting software vulnerabilities. They then contact the vendors for patches. They also disclose these vulnerabilities publicly after an optimal time. In this scheme, reporting vulnerabilities is voluntary with no explicit monetary gains to identifiers. Of late, firms like iDefense employ a market based scheme to induce identifiers into providing vulnerability information to them. We compare these schemes game-theoretically.

■ MC25

Westin-Tower 1208, 12th Floor

Decision Analysis in the Military

Sponsor: Military Applications
Sponsored Session

Chair: Jeffery Weir

Assistant Professor, Air Force Institute of Technology, 2950 Hobson Way Bldg 640, Wright-Patterson AFB, OH, 45433, United States, Jeffery.Weir@afit.edu

1 — Decision Aids and Decision Support - MORS Workshop
Patrick McKenna, Deputy Branch Chief, USSTRATCOM/PR123, 901 SAC BLVD, STE: 2E9, Offutt AFB, NE, 68113-6500, United States, MckennaP@stratcom.mil, Roy Rice

The purpose of the workshop is to identify analytic approaches that might be used to enhance the JOPES planning functions of Strategy Determination and Course of Action Development. Specific Objectives include examining techniques of facilitating information from decision makers and displaying information back to decision makers and the implications of time on the level of detailed analysis possible and how tools/techniques can address time/detail scaling issues

2 — A Template for Deliberate and Crises Action Planning using Value Focused Thinking
Dave Taylor, Consultant, Toffler Associates, 302 Harbor's Point, 40 Beach Street, Manchester, MA, 01944, United States, dtaylor@toffler.com, Gregory Parnell

Joint doctrine publications reflect the fundamental principles, objectives, and constraints that are important to the combatant commander in this value model. Three dominant, top-level functions, with subordinate objectives were developed into a Logical Decisions for Windows model. The distinguishing features are its application to a user base as a "template" for decision making, and its ability to contrast a wide range of disparate alternatives (e.g., kinetic, non-kinetic and IO options).

3 — The Air Warrior's Value of National Security Space
J. D. Loftis, Space Analyst, 17th Test Squadron, Space Warfare Center, 730 Irwin Ave., Ste. 83, Schriever AFB, CO, 80912-6723, United States, john.loftis@schriever .af.mil, T.S. Kelso, Stephen Chambal, Dick Deckro

This analysis applied Value-Focused Thinking (VFT) to model national security space appreciation from the perspective of air warriors from 3 military services. Through facilitated discussion a Gold Standard model was modified by experienced experts. The strategic objective was hierarchically decomposed into measures, for which value functions were identified. Key results include thresholds for some measures and separation of communication and navigation values into pre- and in-flight components.

4 — Valuation of Security Benefits from Back-up Power Generation on Military Installations
Jeffery Weir, Assistant Professor, Air Force Institute of Technology, 2950 Hobson Way Bldg 640, Wright-Patterson AFB, OH, 45433, United States, Jeffery.Weir@afit.edu, Gregory Schanding

This on-going research uses a value focus thinking (VFT) model to evaluate alternatives that provide back-up power to military installations. The VFT model provides a valuation of each alternative which is then used as the objective coefficient for a 0-1 integer programming model that selects a subset of the alternatives based on various constraints. These constraints include overall cost, ability to cover mission critical loads, use of renewable energy sources and others.

■ MC26

Westin-Tower 1401, 14th Floor

Emerging Research Problems in Data Mining

Cluster: Data Mining and Knowledge Discovery
Invited Session

Chair: Xiaoming Huo, Assistant Professor, Georgia Institute of Technology, Georgia Tech. School of ISyE, 765 Ferst Drive, Atlanta, GA, 30332, United States, xiaoming@isye.gatech.edu

1 — Feature Selection via Penalized Support Vector Machines
Jihong Chen, student, Georgia Institute of Technology, 328246 GaTech Station, Atlanta, GA, 30332, United States, chenjh@isye.gatech.edu, Xiaoming Huo

We show that the VC dimension of separating hyperplanes is related to the dimensionality of the feature subspace as well as the margin. From this motivation, we introduce a new approach Penalized Support Vector Machines, which use penalized approach to suppress the dimensionality. The proposed methods do feature selection and coefficients estimation simultaneously. The experiment results are very promising.

2 — Deriving Tree-Structured Networks from Technical Text using Association Rule Mining
Alisa Kongthon, Georgia Institute of Tech., 765 Ferst Drive, Atlanta, GA, 30332, United States, kongthon@isye.gatech.edu

This paper presents the use of Association Rule Mining (ARM) to effectively discern tree-structured networks from a set of technical documents. Most standard information retrieval and bibliometric analysis approaches are able to identify relationships but not hierarchy. The proposed method is applied to science and technology (S&T) publication abstracts toward the objective of enhancing research management. ARM promises to offer richer structural information on relationships in text sources.

3 — Learning to Crawl: Classifier Guided Topical Crawlers
Gautam Pant, The University of Iowa, Department of Management Sciences, Iowa City, IA 52242, gautam-pant@uiowa.edu, Filippo Menczer, Padmini Srinivasan

The large size and the dynamic nature of the Web highlight the need for continuous support and updating of Web based information retrieval systems. Crawlers facilitate the process by following the hyperlinks in Web pages to automatically download a partial snapshot of the Web. While some systems rely on crawlers that exhaustively crawl the Web, others incorporate bias or "focus" within their crawlers to harvest application or topic specific collections. We experiment with a number of classifier algorithms such as the naïve Bayes, the support vector machines and the neural networks to provide topical bias to a Web crawler.

■ MC27

Westin-Tower 1402, 14th Floor

Solving Difficult Combinatorial Optimization Problems

Sponsor: Optimization/Integer Programming
Sponsored Session

Chair: Andrew Miller, Assistant Professor, University of Wisconsin, Department of Industrial Engineering, Madison, WI, 53706, United States, amiller@engr.wisc.edu

1 — A Nested Partitions Approach to Large-Scale Multicommodity Supply Chain Design
Andrew Miller, Assistant Professor, University of Wisconsin, Department of Industrial Engineering, Madison, WI, 53706, United States, amiller@ie.engr.wisc.edu, Robert R. Meyer, Mehmet Bozbay, Leyuan Shi

Large-scale multicommodity supply chain design problems are generally intractable for general-purpose branch-and-cut solvers such as CPLEX. We consider alternative formulations and decomposition methods for these difficult integer programs and show that a nested partitions (NP) approach that takes advantage of problem structure outperforms other methods in terms of efficiently generating very high quality solutions. We also discuss links between NP and other decomposition approaches.

2 — Facet-defining Inequalities for the Problem of Scheduling Jobs with Uniform Resource Requirements
Jill Hardin, Ph.D, Assistant Professor, Virginia Commonwealth University, Department of Statistical Sciences & Operations Research, Richmond, VA, 23284, United States, jrhardin@vcu.edu, George Nemhauser, Martin Savelsbergh

We consider the resource-constrained scheduling problem where for each job the resource requirements are constant over its processing time. We present facet-defining inequalities for a projected problem, along with lifting results. We also show how these results generalize known inequalities for both scheduling and knapsack problems.

3 — Performance of a Generalized Greedy Algorithm
Amr Farahat, Operations Research Student, MIT, E40-130, 77 Massachusetts Avenue, Cambridge, MA, 02139, United States, afarahat@mit.edu, Cynthia Barnhart

We consider the problem of maximizing a submodular function over an independence system. A greedy algorithm that incrementally augments the current solution by adding subsets of elements of prespecified maximum cardinality is considered. We derive a worst-case bound on the quality of the solution produced. This work generalizes and sharpens some previously known Rado-Edmonds type results. We examine implicatons of such an algorithm for some practical combinatorial problems.

4 — Clique Partition Problem with Minimum Clique Size
Xiaoyun Ji, Rensselaer (RPI), Math Sciences, Troy, NY, 12180, United States, jix@rpi.edu, John Mitchell

Given a complete graph with edge weights, the Clique Partition with Minimum Clique Size problem requires partitioning the vertices into subcliques that each have at least S vertices, so as to minimize the total weight of the edges within the cliques. We investigate the polyhedral structure of an integer programming formulation and introduce cutting planes. We report computational results with a branch-and-cut algorithm confirming the strength of these cutting planes.

■ MC28

Westin-Tower 1403, 14th Floor

Global Optimization — Graphs and Networks

Sponsor: Optimization/Global Optimization
Sponsored Session

Chair: Carlos Oliveira, PhD Student, University of Florida, Department of Industrial and Systems Engineering, 303 Weil Hall, P.O. Box 116595, Gainesville, FL, 32611, United States, oliveira@grove.ufl.edu

1 — The SAT01 Framework for NP problems
Stanislav Busygin, University of Florida, Dept. of Industrial and Systems Engineering, 303 Weil Hall, P.O. Box 116595, Gainesville, FL, 32603, United States, busygin@ufl.edu

SAT01 is an NP-complete problem that may be seen as a subclass of the weighted independent set problem, where the required independent set weight equals the largest possible value of the weighted Lovasz number. This way, SAT01 may be decided by means of the theta-function and its strengthenings. Many NP problems (e.g. SAT, HCP, graph isomorphism, QCP, extended 15-puzzle) may be reduced to it without excessive dimensionality growth. This provides for all of them a unified semidefinite relaxation.

2 — GRASP with Path-Relinking for the Linear Ordering Problem
Bruno Chiarini, University of Florida, Dept. of Industrial and Systems Engineering, 303 Weil Hall, P.O. Box 116595, Gainesville, FL, 32611, United States, chiarini@ufl .edu, Wanpracha Chaovalitwongse, Panos Pardalos

Given a complete directed graph, the Linear Ordering Problem (LOP) consists in finding an acyclic tournament of maximum weight. It can also be interpreted as the problem of finding a permutation of the rows and columns of a square matrix that maximizes the sum of the elements above the diagonal. One of its many applications is the triangulation of input-output matrices in economics. We propose a GRASP with Path Relinking for the LOP. Several specific improvements and their results are discussed.

3 — A New Algorithm for the Minimum Connected Dominating Set Problem in Ad Hoc Networks
Carlos A.S. Oliveira, PhD Student, University of Florida, Dept. of Industrial and Systems Engineering, 303 Weil Hall, P.O. Box 116595, Gainesville, FL, 32603, United States, oliveira@ufl.edu, Sergiy Butenko, Panos Pardalos

Given a graph G(V,E), a Dominating Set D is a subset of V such that any node not in D is adjacent to some node in D. Computing the minimum connected dominating set (MCDS) is a NP-hard problem, with applications in Ad Hoc networks. Wireless Ad Hoc networks are used in mobile commerce, search and discovery and military battlefield applications. In this paper we propose an approximation algorithm for the MCDS. We also show a distributed version for the proposed algorithm.

4 — Graphs, Planarity, and Facets!! Oh My!
Illya Hicks, Assistant Professor, Texas A&M University, Dept. of Industrial Engineering, 237K Zachry Engineering Research Center, College Station, TX, 77843, United States, ivhicks@tamu.edu

The maximum planar subgraph problem is an NP-hard problem with applications in facility layout design and network visualization. New facets for the planar subgraph polytope are presented. In addition, computational results from a branch-and-cut approach are presented to illustrate the effectiveness of the facets.

■ MC29

Westin-Tower 1404, 14th Floor

Network Routing 2

Sponsor: Optimization/Network
Sponsored Session

Chair: Lisa Fleischer, GSIA, Carnegie Mellon University / IBM Watson Research, Pittsburgh, PA, 15213, United States, lkf@andrew.cmu.edu

1 — A Faster Algorithm for Bipartite Matching and for the Maximum Flow on Closure Graphs
Dorit Hochbaum, United States, dorit@hochbaum.IEOR.Berkeley.EDU, Bala Chandran

We show that the pseudoflow algorithm runs on simple bipartite networks in time O(nn_1 log n) for bipartite networks on n nodes with n_1 nodes on the smaller side of the bipartition. This algorithm uses bit operations to identify a "merger". Tighter analysis improves it to O(n_1 ^2), or O(M^2) for M the value of the max-matching. Without bit operations, it is O(M^{2.5}). For closure graphs the complexity is O(n^2 log n log U), or +O(mn) without the use of bit operations.

2 — System Optimal Routing of Traffic Flows with User Constraints in Networks with Congestion
Nicolas Stier Moses, Massachusetts Institute of Technology, 77 Massachusetts Avenue, Office E40-130, Cambridge, MA, 02139, United States, nstier@mit.edu, Olaf Jahn, Rolf Moehring, Andreas S. Schulz

We discuss a fresh approach to route guidance that combines the advantages of user equilibrium and system optimum. In fact, minimizing the total travel time subject to bounds on the lengths of allowable paths w.r.t. their travel times in equilibrium yields substantial improvements. For several real-world instances, we compute traffic assignments of notably smaller total travel time than in equilibrium; at the same time, they possess fairness attributes unrivaled by the ordinary system optimum.

3 — Selfish Routing in Networks with Capacities
Andreas S. Schulz, Massachusetts Institute of Technology, 77 Massachusetts Avenue, Office E53-361, Cambridge, MA, 02139, United States, schulz@mit.edu, Nicolas Stier Moses, José R. Correa

We offer extensions of recent positive results on the efficiency of Nash equilibria in traffic networks. In contrast to prior work, we present results for networks with capacities and for latency functions that are non-convex, non-differentiable and even non-continuous. In this more general model, multiple Nash equilibria may exist and an arbitrary equilibrium does not need to be efficient. Yet, our main result shows that the best equilibrium is as efficient as in the model without capacities.

■ MC30

Westin-Tower 1405, 14th Floor

Stochastic Integer Programming

Sponsor: Optimization/Stochastic Programming
Sponsored Session

Chair: Suvrajeet Sen, SIE Department, University of Arizona, Tucson, AZ, 85721, United States, sen@sie.arizona.edu

1 — SPAR: Stochastic Programming with Adversarial Recourse
Andrew Schaefer, Assistant Professor, University of Pittsburgh, 1048 Benedum Hall, Pittsburgh, PA, 15261, United States, schaefer@ie.pitt.edu, Matthew Bailey, Steven Shechter

We consider multi-stage problems where future stages are decided by an adversary. The decision maker must choose a system configuration so as to minimize the long-run damage inflicted by the adversary. We formulate this problem as a stochastic integer program with Markov-decision-process recourse. We provide examples and preliminary computational results.

2 — DP Approximation Techniques for Multi-stage Resource Allocation under Uncertainty
Huseyin Topaloglu, Assist. Prof., Cornell University, School of ORIE, Ithaca, NY, United States, topaloglu@orie.cornell.edu, Warren Powell

We present a class of dynamic programming approximation techniques that are applicable to resource allocation problems under uncertainty. The techniques we present are especially suitable for discrete problems that arise in the context of allocation indivisibles. We show convergence results for certain classes of problems and show that our methods perform very well even in the cases where the convergence results do not apply.

3 — On a Class of Discrete Lot Sizing Problems Under Uncertainty
Shabbir Ahmed, Assistant Professor, ISyE, Georgia Tech, Atlanta, GA, 30332, United States, sahmed@isye.gatech.edu, Kai Huang

We study a class of multi-stage stochastic integer programs corresponding to lot-sizing under uncertainty. By exploiting problem structure, we develop efficient algorithms for this class of problems. Some preliminary numerical results are presented.

4 — Stochastic Mixed-Integer Programming for Server Location Problems under Uncertainty
Suvrajeet Sen, SIE Department, University of Arizona, Tucson, AZ, 85721, United States, sen@sie.arizona.edu, Lewis Ntaimo

We present a model for the server location problem in which demand uncertainty has two components: locational uncertainty and magnitude uncertainty. These uncertainties lead to a stochastic mixed-integer (0-1) problem. We will report on the performance of several algorithms for SMIP.

■ MC31

Westin-Tower 1406, 14th Floor

Public Sector Location Models

Sponsor: Location Analysis
Sponsored Session

Chair: Michael Johnson, Assistant 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 — Neighborhood Effects and Drug Treatment Outcomes: Implications for Facility Location Models
Jerry Jacobson, Doctoral candidate, RAND Graduate School, 1700 Main Street, PO Box 2138, Santa Monica, CA, 90407-2138, United States, jerryojacobson@runbox.com

Location of facilities providing social services has traditionally focused on intra-facility separation rather than influences of neighborhood characteristics on client outcomes. We apply a regression model to estimate effects of neighborhood characteristics on drug treatment center success rates. We discuss use of these estimates to improve public-sector facility location policy.

2 — Location Problems in Forest Harvesting
Andres Weintraub, Professor, Department of Industrial Engineering, University of Chile, P.O. Box 2777, Santiago, Chile, aweintra@dii.uchile.cl

We discuss two location problems associated with forest harvesting: positioning of harvesting machinery and simultaneously sequencing harvest areas and building access roads. The first incorporates plant location and network design; the second becomes difficult when addressing environmental spatial constraints. We discuss solution algorithms and operational impacts.

3 — A p-Center Location Problem Minimizing Maximum Travel Time Plus Waiting Time
P. M. Dearing, Professor, Clemson Univ., Dept of Mathematical Sciences, P.O.340975, Clemson, SC, 29634-0975, United States, pmdrn@CLEMSON.EDU, Minsang Chan

Customers are assigned to service centers in order to minimize inconvenience. Given stochastic demands, the objective is to minimize the maximum travel time to service centers plus expected waiting times. A linear zero-one model is developed and an associated set covering model is solved using column generation.

4 — Location of Community Corrections Centers
Michael Johnson, Assistant 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

Community corrections centers (CCCs) provide alternatives to incarceration and are usually located in residential neighborhoods. They are usually treated as "objectionable". We present competing methods for CCC: multi-criteria decision models and multi-objective math programming. We evaluate model outcomes for data from Pittsburgh, PA and compare the efficacy of the methods .

■ MC32

Westin-Tower 1407, 14th Floor

Scheduling I

Contributed Session

Chair: Siqun Wang, Assistant professor, Singapore Management University, Singapore Management University, Singapore, SG, Singapore, siqun@wharton.upenn.edu

1 — Job Selection and Throughput Maximization in Single-Resource Scheduling
Joseph Geunes, Assistant Professor, University of Florida, 303 Weil Hall, Gainesville, FL, 32611, United States, geunes@ise.ufl.edu, Bibo Yang

We consider single-resource scheduling when candidate jobs may be accepted (producing job-specific profit) or rejected (resulting in job-specific rejection penalties). Our solution approaches seek to minimize schedule cost under various assumptions, including job-specific tardiness costs, reducible processing times (at a cost), and a penalty for violating a target makespan. We present a Compress and Relax algorithm that minimizes schedule cost for a given selection and sequence of jobs.

2 — Scheduling Two-Machine Flow Shop with Time Windows To Minimize Makespan
Byung-Jun Joo, Ph.D. Student, Korea Advanced Institute of Science and Technology (KAIST), Dept. of Industrial Engineering, KAIST, Guseong-dong, Yuseong-gu, Daejeon, NA, 305-701, Korea Repof, joobj@kaist.ac.kr, Yeong-Dae Kim, Sang-Oh Shim, Seong-Woo Choi

A branch-and-bound algorithm and several heuristic algorithms are suggested for two-machine flow shop problems with time windows at the second machine. These time windows are generated when jobs are completed on the first machine. These algorithms can be applied to etching and diffusion in semiconductor wafer fabrications.

3 — Maximum Profit Job Shop Problem
Tal Raviv, Technion Haifa, Technion City, Haifa, Ha, 36007, Israel, talraviv@tx .technion.ac.il, Michal Penn

We consider an infinite horizon production model where the products are to be produced according to a Job Shop setting. The planner has to determine simultaneously the production mix and the schedules in order to maximize the expected steady state profit. We present a fluid based dispatching rule that solves the problem and show how to reduce the amount of WIP.

4 — Developing A Diagram Of Dispatching Policies To Problems
Michelle Squire, North Carolina Agricultural &Technical State University, 1601 East Market Street/Room 419 McNair, Greensboro, NC, 27411, United States, michellesquire@aol.com

Many researchers have developed learning systems as an alternative to traditional methods because they ultimately generate a near optimal scheduling policy that best satisfies the scheduling objective for a given environment. However, if the scheduling policy is lengthy and challenging to implement, an alternative strategy is desired. In this research, we develop an approach for grouping like dispatching rules together for mapping rules to problems.

5 — Hybrid Method for Batch Sizing and Scheduling with Clean-Up Requirement
Siqun Wang, assistant professor, Singapore Management University, Singapore Management University, Singapore, SG, Singapore, siqun@wharton.upenn.edu, Monique Guignard

We hybrid discrete- and continuous-time MILP formulations related to minimizing makespan in capacitated batch sizing and scheduling problems in process industries. Using each model in turn, we construct good feasible solutions in reasonable computational time, step by step in a modular fashion for the Blˆmer-Günther benchmark data with or without clean-up requirements.

■ MC33

Westin-Tower 1408, 14th Floor

Data Envelopment Analysis V

Cluster: Data Envelopment Analysis
Invited Session

Chair: Keith Hollingsworth, Associate Professor, Morehouse College, 830 Westview Dr. SW, Atlanta, GA, 30314, United States, khollingsworth@morehouse.edu

1 — Measuring Telemarketing Regulation's Impact on the Telesurveying Industry: A Modified Malmquist DEA Approach
William Eisenhauer, Portland State University, Department of Systems Science, United States, wde@pdx.edu

Recent regulatory changes in telemarketing are expected, albeit unintended, to effect telesurveying. A DEA with modified Malmquist analysis focused on the technology frontier change was done to evaluate the unintended effects of regulation. Use of non-parametric statistical methods for analyzing observed frontier change is included.

2 — A Data Envelopment Analysis Approach to Study the Efficiency of US Commercial Airlines
Massoud Bazargan, Associate Prof., ERAU, 600 S. Clyde - Morris Blvd., Daytona Beach, FL, 32114, United States, bazargam@erau.edu, Bijan Vasigh, Notis Pagiavlas

In this paper, we compiled detailed information on more than 30 US commercial airlines, such as assets, number of passengers, movements, employees, load factors, revenues and fleet diversity. We adopt DEA to analyze the efficiency and performance measures of airlines within each group by comparing and cross-referencing them with each other and we provide recommendations on how these inefficient airlines can improve utilization of their existing resources (inputs) to be more efficient

3 — Simulation Tests of Chance Constrained DEA Models
Janice Forrester, President, JAFO Research and Consulting, 4318 NE Glisan Street, Portland, OR, 97213, United States, jfr@speakeasy.net

Previous Chance Constrained DEA approaches are surveyed followed with a new approach to Chance Constrained DEA. An example is given of calculating a confidence band for the estimated production function such that we can specify with a predetermined level of confidence, an interval containing the most likely production function.

4 — Output-Input Ratio Benchmarking Performance Gap Analysis
Wen-Chih Chen, ISYE, Georgia Tech, ISYE, Georgia Tech, Atlanta, GA, 30332, United States, wenchih@isye.gatech.edu, Leon F. McGinnis

There is a gap between conventional ratio benchmarking approaches and DEA. We study the theoretical relationship between the efficiency scores computed by DEA and output-input ratios. The relationship can then be used to diagnose the ratio analysis results.

■ MC34

Mart-Room A

Operations Research Applications in Trucking

Sponsor: Transportation Science & Logistics
Sponsored Session

Chair: Jeff Day, IT Research, Schneider National, Inc., 3101 S. Packerland Drive, Green Bay, WI, 54313, United States, dayj@schneider.com

1 — Solving a Large-Scale Driver Management Problem using Informational Decomposition and Data Pattern Matching
Hugo Simao, Research Staff, CASTLE Lab, Department of Operations Research and Fi, Princeton University, Princeton, NJ, 08544, United States, hpsimao@princeton.edu, Jeff Day, Warren Powell

We solve an ultra-large driver management problem from a major motor carrier using decomposition of decisions and information. Different levels of aggregation are for resources, helping overcome massive degeneracy. Data pattern matching is used to formulate optimization subproblems where complex rules are modeled accurately and compactly. Numerical experiments are reported.

2 — An Optimization Methodology for Scheduling Truck/Rail Drayage
Yetkin Ileri, Georgia Institute of Technology, School of ISyE, Atlanta, GA, 30332, United States, yetkin@isye.gatech.edu, Mokhtar Bazaraa, George Nemhauser, Joel Sokol, Erick Wikum

We present an optimization methodology for finding cost effective and robust schedules for regional daily drayage operations. We evaluate resultant schedules using simulation. Drayage operations move loaded and empty equipment between rail ramps, shippers, and consignees. The drayage decision environment encompasses both dynamic and stochastic elements.

3 — Academia and the Transportation Industry: Keys to a Successful Marriage
Jeff Day, IT Research, Schneider National, Inc., 3101 S. Packerland Drive, Green Bay, WI, 54313, United States, dayj@schneider.com

Collaborative research projects, while offering huge potential benefits for both industry and academia, are often difficult to manage. Based on testimonials from practitioners and professors, and our first-hand experience, we set forth guidelines for successful joint research. In addition, we describe pitfalls and challenges commonly encountered in collaborative research.

■ MC35

Mart-Room B

Operations Management II

Contributed Session

Chair: David Alderson, Postdoctoral Scholar, California Institute of Technology, 1200 E. California Blvd., MC 107-81, Pasadena, CA, United States, alderd@cds.caltech.edu

1 — The Control of a Stochastic Production-Inventory System with Job Shop Routings
Pieter Van Nyen, PhD Student, Technische Universiteit Eindhoven, Den Dolech 2, Eindhoven, NL, 5600 MB, Netherlands, p.v.nyen@tm.tue.nl, J. Will M. Bertrand, Henny Van Ooijen

We investigate a multi-product multi-workcenter production-inventory system with job shop routings and stochastic arrival and processing times. The stock points and the production system are controlled integrally by a centralized decision maker. We present a procedure to determine the control parameters that minimize overall relevant costs while satisfying prespecified customer service levels. The procedure is tested in an extensive simulation study and the results are discussed.

2 — The Impact of Returns on the Stochastic Performance of Supply Chains
Li Zhou, Dr., Cardiff university, LSDG, Cardiff business school,Cardiff U., Aberconway building, Colum Drive, Cardiff, UK, CF10 3EU, United Kingdom, Zhoul@cardiff.ac.uk, Stephen Disney

We study the effect of remanufacturing lead-time and the return rate on the bullwhip and the variance of net stock in the reverse supply chain. We then optimize return rate and remanufacturing lead-time parameters. Our results show that returns can be used to absorb demand fluctuations. But remanufacturing lead-time has less impact at reducing bullwhip. Within our specified system, we conclude that with returns, bullwhip is always less than without returns, which is verified with simulation.

3 — Satisfying Customer Preferences via Mass Customization and Mass Production
Kai Jiang, Stanford University, MS&E Dept. Rm #379, Stanford, CA, 94305, United States, kaijiang@stanford.edu, Hau Lee, Ralf Seifert

Two operational formats - mass customization and mass production - can be implemented to satisfy preference-based customer demand. The company makes decisions on the number of initial product variants, product specifications, and product pricing. Under uniform customer preference distribution, the optimal number of base product variants has the form of the famous economic order quantity (EOQ) solution, and the optimal product specifications are equally spaced. We also compare the two systems.

4 — Spot Market and Channel Coordination
Natalia Golovachkina, PhD student, Cornell University, 401 Sage Hall, Ithaca, NY, United States, nig2@cornell.edu, James Bradley

We show that channel coordination is achieved by a contract for options when a manufacturer is the leader, a quantity discount contract, and a contract for options with renegotiation. We also demonstrate that renegotiation is a powerful way to achieve channel coordination even when the supplier and the manufacturer have asymmetric information about the manufacturer's demand.

5 — Avoiding Collapse in Congestion-Sensitive Input-Output Systems
David Alderson, Postdoctoral Scholar, California Institute of Technology, 1200 E. California Blvd., MC 107-81, Pasadena, CA, United States, alderd@cds.caltech.edu

We introduce a class of congestion-sensitive processing systems in which the instantaneous throughput rate changes with the total amount of work in the system. In particular, we consider systems that are susceptible to congestion-induced collapse, in the sense that their throughput rate tends toward zero as their system workload gets large. We develop a stochastic model which shows that collapse in these systems is unavoidable unless one can impose admission control on newly arriving work.

■ MC36

Mart-Room C

Production Systems with Stochastic Demand

Sponsor: Manufacturing and Service Operations Management
Sponsored Session

Co-Chair: Roman Kapuscinski, University of Michigan Business School, 701 Tappan St, Ann Arbor, MI, 48109-1234, United States, kapuscin@bus.umich.edu

Co-Chair: Izak Duenyas, United States, duenyas@umich.edu

1 — Inventory, Service, and Information Tradeoffs in a Newsvendor Model for Dependent Demand Items
Douglas Thomas, Assistant Professor, The Pennsylvania State University, University Park, PA, 16802, United States, dthomas@psu.edu, Xueyi (Stuart) Zhang, Donald Warsing

Using a two-component newsvendor model, this paper studies optimal component ordering policies under three scenarios characterized by different levels of demand information revelation between component purchase decision points. We also explore how cost and service vary with changes in demand uncertainty, component cost ratio, product margin, and component salvage value.

2 — Stochastic Quantity Discount Problem
Nihat Altintas, PhD Candidate, Carnegie Mellon University, Pittsburgh, PA, 15213, United States, nihat@andrew.cmu.edu, Feryal Erhun, Sridhar Tayur

We provide theoretical and numerical analysis of the stochastic quantity discount problem. For a single period problem, we derive the optimal policy, which we call three-index policy. We extend our results to finite and infinite horizon cases and evaluate the performance of the three-index policy.

3 — Managing an Assemble to Order System with Component Obsolescence
Zhaolin Li, The Pennsylvania State University, Pennsylvania State University, Dept. of, Smeal College of Business and Admin., University Park, PA, 16802, United States, zxl110@psu.edu, Susan Xu

We consider a single product, periodic reviewed ATO system with generation and age dependent cost parameters. We formulate the technology upgrading and inventory replenishment problem as a dynamic programming problem and develop an efficient algorithm to solve the myopic policy. We provide sufficient conditions under which the myopic policy is optimal.

4 — Cooperation Between Suppliers with Production Variability and Transshipment
Xinxin Hu, University of Michigan, Ann Arbor, MI, United States, huxinxin@umich.edu, Izak Duenyas, Roman Kapuscinski

We consider the cooperation between two manufacturers that produce the same product to satisfy two different markets. Both of them face demand and capacity uncertainties. They can cooperate with each other by transshipping some surplus between them. The paper examines the structure of optimal production and transshipment policies for such manufacturers under a centralized setting.

■ MC37

Mart-Room D

JFIG Paper Competition II

Sponsor: Junior Faculty Informs Group
Sponsored Session

Chair: Philip Kaminsky, Associate Professor, Department of IEOR, University of California at Berkeley, Berkeley, CA, 94720, United States, kaminsky@ieor.berkeley.edu

1 — JFIG Paper Competition II

This session features some of the finalists in the first annual INFORMS Junior Faculty Interest Group paper competition. It represents an opportunity for conference attendees to see some of the best research being done by junior faculty. All are welcome.

■ MC38

Mart-Room E

Traffic Flow Theory and Modeling

Sponsor: Transportation Science & Logistics
Sponsored Session

Chair: R. Jayakrishnan, University of California at Irvine, Civil & Environmental Engineering, Irvine, CA, 92697, United States, rjayakri@uci.edu

1 — The Impact of Heavy Vehicles and Roadway Geometry on Highway Capacity: An Analytic Approach
Jorge Laval, University of California at Berkeley, 416 McLaughlin Hall, Berkeley, CA, United States, jlaval@uclink.Berkeley.edu, Carlos Daganzo

This paper applies a recently developed numerical method for simulating moving bottlenecks with kinematic wave theory in order to capture the effects of roadway geometry on traffic streams. A numerical method and approximate solutions are presented. An application of the procedure to predict the capacity of uphill grades disagrees significantly with the recommendations in the Highway Capacity Manual, which were obtained with microsimulation.

2 — Stochastic Microscopic Simulations and Speed Distribution Dynamics
Riju Lavanya, University of California at Irvine, Civil & Environmental Engineering, Irvine, CA, 92697, United States, rlavanya@uci.edu, R. Jayakrishnan, Jun-Seok Oh

Speed distributions in traffic and their dynamic properties have been a subject of study in Kinetic theory of vehicular traffic flow. Several conclusions from the theory have been found reasonable and several hypotheses have been criticized as well. Only very few studies have attempted to validate the theory with real-world data, due to the difficulty in obtaining stochastically significant numbers of data points on individual car speeds for model calibration. In this study we examine the dynamics of speed distributions resulting from microscopic simulation models from a kinetic theory perspective.

3 — Assessment of the Impact of Incidents Near Bottlenecks: Strategies to Reduce Delay
Monica Menendez, University of California at Berkeley, 416 McLaughlin Hall, Berkeley, CA, United States, acinom76@yahoo.com, Carlos Daganzo

This study evaluates how the location and duration of an incident affect delays near bottlenecks. The results are used to develop and implement new strategies to significantly reduce delay. The value of fault-free surveillance is analyzed as part of an optimization problem for the location of roadside assistance vehicles.

4 — A Simulation Model of Pedestrian Movement in Crowds: Application to Pilgrimage in Makkah
Ahmed Abdelghany, Information Services Division, United Airlines, 826 Hadley Run ln ., Schaumburg, IL, 60173, United States, Ahmed.Abdelghany@ual.com, Khaled F. Abdelghany, Saad A.H. AlGadh, Hani Mahmassani

A simulation model of pedestrian movement in crowds is presented. The model integrates the cellular automata approach and a path finder module to represent pedestrian dynamics in a crowded area. The model is applied to the pilgrims' movements during the "Tawaf" rituals in Makkah.

5 — Periodic Kinematic Waves in a Road Network
Wen Long Jin, University of California, Department of Mathematics, Davis, CA, 95616, United States, wjin@ucdavis.edu, H. Michael Zhang

In this presentation, we will report periodic traffic oscillations formed on an initially empty road network with a diverge and a merge under certain route choice conditions. The formation and structure of this new type of kinematic waves will be discussed in details with the help of a Multi-Commodity Kinematic Wave simulation model of network traffic flow.

■ MC39

Mart-Room F

Applying Supply-Chain in Developing Countries

Cluster: Overseas Collaborations
Invited Session

Chair: Juan Gaytán, Profesor Titular, ITESM Campus Toluca, Av. Eduardo Monroy 2000, San Antonio Buenavista, Toluca, Me, 50110, Mexico, jgaytan@itesm.mx

1 — Customer Segmentation Based on Logistics Costs
Pilar Arroyo, Professor, ITESM campus Toluca, Eduardo Monroy 2000, San Antonio Buenavista, Toluca, MX, 50110, Mexico, pilar.arroyo@itesm.mx

Customer profitability is an actual and relevant concept that industries are applying for an efficient customer relationship management. This work uses Activity Base Costing (ABC) to classify the customers of a transnational firm based on the logistics costs incurred when the firm acts as a distributor. The ABC analysis reveals that net sales are not a good indicator of the customer's profitability because logistics costs go between 7.6-14.2% and in some cases exceed the break even point.

2 — Impact of Changing the Replenishment System in a Food Enterprise in the Bullwhip Effect
Ileana Castillo, ITESM Campus Toluca, Eduardo Monroy Cardenas No. 2000, TOLUCA, EM, 50110, Mexico, ileana.castillo@itesm.mx, Omar Vazquez

We measured the bullwhip effect before and after implementing a replenishment system for the distribution centers of a company in the processed food industry. The company is global and has operations in Mexico. We selected a product family for the analysis, based on sales volume . The results and some conclusions, including changes in the forecasting technique will be discussed.

3 — The Impact of Inventory Policies on the Bullwhip Effect of a Bottling Company
Manuel Robles, Professor, Tecnologico de Monterrey, Dept. of Industrial and Systems Eng., Eduardo Monroy Cardenas 2000, Toluca, MX, 50110, Mexico, mrobles@itesm.mx, Marco Antonio Vazquez

We evaluated the impact of two inventory policies on the bullwhip effect of a bottling company using simulation and design of experiments. The results of the experiments show that the inventory policies do not have a significant impact and that the family types have a significant impact on the bullwhip effect. Some possible explanations of these phenomena are suggested.

4 — Robust Supplier Base Design
Neale Smith, Professor, ITESM Campus Monterrey, Monterrey, MX, Mexico, nsmith@itesm .mx, John Hasenbein, Dagoberto Garza

Although single sourcing has received considerable attention as a viable sourcing strategy, it exposes the buyer to the risk of supply failure. We document several cases of supply failure and their catastrophic effects on the supply chain. We then propose a way to model the risk of supply failure and describe two robust supplier base design problems. Solution approaches based on deterministic and stochastic dynamic programming are presented as are suggestions for further research.

5 — Evaluating the Outsourcing Strategy in a Reverse Logistics Chain through a Markov Decision Process
Marco Serrato, Asistant professor, ITESM Campus Toluca, Eduardo Monroy Cardenas 2000, San Antonio Buenavista, Toluca, MX, 50110, Mexico, mserrato@itesm.mx

By considering the volume of returns during the life cycle of a product, we propose an analytical model to be used when deciding whether or not to follow an outsourcing strategy for the RL activities. This model can be applied to a firm that manufactures a defined set of products and faces the problem of managing the RL flow for all of them. Several scenarios are analyzed, according to the length of the product's life cycle and the variability on the amount of returns per period.

■ MC40

Mart-Room G

Supply Chain Disruption: Network Management

Cluster: Supply Chain Management
Invited Session

Chair: Mike Magazine, University of Cincinnati, College of Business, Cincinnati, OH, 45221, United States, mike .magazine@uc.edu

Co-Chair: Michael Fry, Assistant Professor, University of Cincinnati, QAOM Department, College of Business, Cincinnati, OH, 45221, United States, mike.fry@uc.edu

Co-Chair: Uday Rao, Associate Professor, University of Cincinnati, QAOM Department, College of Business, Cincinnati, OH, 45221, United States, uday.rao@uc.edu

1 — Reliability Models for Facility Location
Lawrence V. Snyder, Lehigh University, 200 West Packer Ave, Dept. of Industrial and Systems Eng, Bethlehem, PA, 18015-1582, United States, lvs2@lehigh.edu, Mark Daskin

Reliability location problems seek to minimize location and transportation cost while protecting the system in case one or more of the facilities become unusable. We formulate two reliability models, suggest solution algorithms, and discuss some of the issues faced by decision makers using these models.

2 — Studies on Adaptive Supply Chain Operations and The Bullwhip Effect
Li Chen, Ph.D. Candidate, Stanford University, Stanford University, Stanford, CA, 94305-4026, United States, skychen@stanford.edu, Hau Lee, Bala Ramachandran, Steve Buckley

We study the relation between adaptive supply chain operations and the Bullwhip effect under various demand conditions. The bullwhip effects and the overall system performances are quantified for a single-echelon base model and a two-echelon model. We investigate several ways to mitigate the bullwhip effect and improve the overall system performance. Simulations are also carried out to study assembly/distribution networks.

3 — The Impact of Supply Disruptions on Supplier Selection
Brian Tomlin, Assistant Professor, University of North Carolina, Kenan-Flagler Business School, Mc Coll Building, Chapel Hill, NC, 27599-3490, United States, brian_tomlin@unc.edu

In this talk we investigate a supplier selection problem when suppliers are subject to random disruptions.

4 — Variability in Supply Chain Leadtimes: The Impact of Customs Compliance Activities
Ted Klastorin, Professor, University of Washington, Department of Management Science, Seattle, WA, United States, tedk@u.washington.edu, Yong-pin Zhou

We study a two-echelon supply chain where a wholesaler produces a product in one country but supplies a retailer in another country who faces constant demand. As a result of customs compliance activities, the time to get a shipment across the border is an exogeneous random variable. The wholesaler has a contract to supply a fixed number of units to the retailer at specified times; penalty costs are specified for both late and early delivery. In which country should the wholesaler locate a warehouse? We describe a model to analyze this problem and describe resulting managerial implications.

■ MC41

Mart-Room H

Capacity and Pricing in Supply Chains

Cluster: Supply Chain Management
Invited Session

Chair: Hyun-soo Ahn, Assistant Professor, University of California, 4185 Etcheverry Hall, Berkeley, CA, 94720, United States, ahn@ieor.berkeley.edu

1 — Optimal Production and Capacity Policy in a Make-to-Stock System with Multi-class Demand
Maria Mayorga, Ph.D. Student, Department of IEOR, Berkeley, CA, 94720, United States, maria_mayorga@hotmail.com, Hyun-soo Ahn, George Shanthikumar

We consider a capacity acquisition, production, and inventory decision in a make-to-stock environment for multiple demand classes when an option to add a temporary capacity is available . While temporary capacity is widely used in practice (e.g., flexible workforce and subcontracting), little work has been done on how to account for the fluctuation of capacity when making operational decisions. We characterize the structure of the optimal policies and discuss managerial insights.

2 — Coordinating Inventory Control and Pricing Strategies: Continuous Review
David Simchi-Levi, Professor, MIT, 77 Massachusetts Ave, Bldg 1-171, Cambridge, MA, United States, dslevi@mit.edu, Xin Chen

We analyze an infinite horizon, single product, continuous review model in which pricing and inventory decisions are made simultaneously. Ordering cost includes fixed and variable costs and the objective is to maximize expected discounted, or expected average profit over the infinite planning horizon. We show that a stationary (s,S,p) policy is optimal for both discounted and average profit models for general demand-price functions and inter-arrival time distribution.

3 — Sequential Capacity Procurement and Horizontal Competition
Feryal Erhun, Assistant Professor, Stanford University, Management Science&Engineering, Stanford, CA, 94305, United States, ferhun@stanford.edu, Sridhar Tayur

We study sequential capacity procurement in a two-stage supply chain with a single supplier and two manufacturers. The supplier has limited capacity, which he sells to the downstream manufacturers. The manufacturers compete not only for the limited capacity but also in the demand market. We observe how sequential procurement affects each party - supplier, manufacturers and the end-consumers - in this two-stage supply chain.

4 — Pricing and Manufacturing Decisions when Demand is a Function of Prices in Multiple Periods
Hyun-soo Ahn, Assistant Professor, University of California, 4185 Etcheverry Hall, Berkeley, CA, 94720, United States, ahn@ieor.berkeley.edu, Mehmet Gumus, Philip Kaminsky

We consider a joint production and pricing problem where demand realized at each period is influenced by the current price as well as prices at previous periods. We formulate a mathematical program for the general case, characterize the property of an optimal policy in special cases, and propose algorithms to obtain solutions. A numerical study demonstrates that the additional profit resulting from considering demand interactions can be significant.

■ MC42

Mart-Room I

Combinatorial Auctions

Sponsor: Revenue Management & Dynamic Pricing
Sponsored Session

Chair: Pinar Keskinocak, Georgia Institute of Technology, School of Industrial and Systems Enginee, Atlanta, GA, 30332, United States, pinar@isye.gatech.edu

1 — Bid Valuation and Construction for Carriers Facing Combinatorial Auctions
Amelia Regan, Associate Professor, Information and Computer Science and Civil Engineering, University of California, Social Science Tower 559, Irvine, CA, 92797-3600, United States, aregan@uci.edu, Jiongjiong Song, Li Pan Gan

The bid valuation and construction problem for carriers facing combinatorial auctions for the procurement of freight transportation contracts involves the computation of a number of NP-hard sub problems. We develop computationally tractable approximation methods for estimating carrier values and constructing bids and also discuss the limits of these methods.

2 — Robot Exploration with Combinatorial Auctions
He Huang, Georgia Tech, School of ISYE, Atlanta, GA, 30332, United States, huanghehe@yahoo.com, Marc Berhault, Sven Koenig, Pinar Keskinocak, Wedad Elmaghraby, Paul Griffin, Anton Kleywegt

We study how to coordinate a team of mobile robots to visit a number of given targets in partially unknown terrain with combinatorial auctions. We propose different bidding strategies and compare their performance with each other, as well as to single-item auctions and an optimal centralized mechanism. Our computational results show that combinatorial auctions generally lead to superior performance compared to single-item auctions, and generate good results compared to the centralized mechanism.

3 — Industrial Procurement Auctions with Expressive Competition
Tuomas Sandholm, Chairman and Chief Technology Officer, CombineNet, Inc, Fifteen 27th St, Pittsburgh, PA, 15213, United States, TSandholm@CombineNet.com, David Levine, Yuri Smirnov, Rob Shields, Bryan Bailey, Sam Hoda, David Parkes, Subhash Suri, Andrew Gilpin, John Heitmann, Tom Kuhn, Andrew Fuqua

CombineNet has gained substantial experience operating and analyzing real-world procurement auctions for over two years. We summarize our experience to date with these activities, in which we apply best techniques from both OR, AI, Economics, and Software Engineering. We have found that expressiveness on both sides is key to market efficiency.

4 — Combinatorial Bidding Applications for Transportation Procurement
Matthew Harding, Business Development Manager, Manhattan Associates, 23 Third Avenue, Burlington, MA, 01803, United States, MHarding@manh.com

Carriers responding to bidding opportunities with shippers for new contracts face potential operational risks relative to final contract awards. In response, shippers are helping carriers mitigate this risk by allowing themto respond with “package bids”. Package bidding allows Carriers to lock in pricing to a guaranteed level of volume across multiple segments of transportation that provide them potential operational efficiencies. This presentation will focus on the benefits, challenges and potential pitfalls associated with this aspect of the procurement process, as well as, the hurdles associated with execution, and how some shippers are obtaining real value in transportation.

■ MC43

Mart-Room J

Supply Chain Management VIII

Contributed Session

Chair: Burak Eksioglu, Assistant Professor, Mississippi State University, Department of Industrial Engineering, PO Box 9542, Mississippi State, MS, 39762, United States, beksioglu@ie.msstate.edu

1 — Two-Step Game Structures for a Two-Stage Supply Chain
Gurdal Ertek, Sabanci University, Faculty of Engineering & Natural Science, Orhanli, Tuzla, Istanbul, 34956, Turkey, ertekg@sabanciuniv.edu, Paul Griffin

We investigate the situation where an owner firm is interested in achieving coordination along its supply chain through appropriately setting the transfer price among its subsidiaries. We describe cooperative and competitive games and compare their solutions to the optimal solution where the firm directly controls operational policies. Introducing two-step games, where the two parameters of the inventory policy are determined in two successive plays, can bring significant savings to the firm.

2 — Operating Policies for Remnant Inventory Systems
Zhouyan Wang, PhD student, Univ of Pitt, 1048 Benedum Hall, Pittsburgh, PA, 15261, United States, zhw12@pitt.edu, Jayant Rajgopal, Andrew Schaefer

This research considers a dynamic remnant inventory allocation and distribution problem that exists in industries such as steel, cable, paper and lumber. We model this network problem and use dual prices to derive operating policies. Perturbation is used to ensure non-degenerate dual prices. New theoretical and computational results are provided.

3 — New Critical Level Policies in Multi-Echelon Systems
Ton de Kok, Professor, Technische Universiteit Eindhoven, Den Dolech 2 Pav. E, Postbus 513, Eindhoven, -, 5600 MB, Netherlands, A.G.d.Kok@tm.tue.nl

We consider a one-warehouse/multi-retailer system under periodic review control, i.i.d. demand in subsequent review periods. Assuming linear holding and penalty costs, echelon base-stock policies are optimal. Since the associated optimal rationing policy is intractable, we propose a class of linear allocation policies that contains both existing linear rationing policies and a specific class of critical level policies. We compare the performance of these policies with optimal rationing policies.

4 — A GRASP for Computing Approximate Solutions to Production-Inventory-Distribution Problems
Burak Eksioglu, Assistant Professor, Mississippi State University, Department of Industrial Engineering, PO Box 9542, Mississippi State, MS, 39762, United States, beksioglu@ie.msstate.edu, Panos Pardalos

We provide subroutines to find approximate solutios to production-inventory-distribution (PID) problems. The PID problem falls under the category of minimum concave cost network flow problems which are NP-hard problems with applications in supply chain optimization. A greedy randomized adaptive search procedure is developed to produce the solutions and computational experiments are reported.

5 — Supply Chain Planning Software Review
Yasemin Aksoy, Associate Professor, Tulane University, A.B. Freeman Sch of Bus, New Orleans, LA, 70118, United States, yaksoy@tulane.edu

This session presents a review of supply chain planning software. An earlier version of this presentation is available in OR/MS Today June 2003 issue, and can be accessed online at http://www.lionhrtpub.com/orms/surveys/scm/scm-survey.html.

■ MC44

Mart-Room K

Optimization in Airline Industry I

Sponsor: Aviation Applications
Sponsored Session

Chair: Diego Klabjan, Assistant Professor, University of Illinois at Urbana-Champaign, 1206 West Green Street, Urbana, IL, United States, klabjan@uiuc.edu

1 — Integrated Airline Planning
Rivi Sandhu, University of Illinois at Urbana-Champaign, 140 Mechanical Engineering Building, MC-244, 1206 West Green Street, Urbana, IL, 61801, United States, sandhu@uiuc.edu, Diego Klabjan

The airline planning process is extremely complex and therefore it is solved in several dependant phases, where the output of the previous phase is part of the input to the next phase . Such an approach yields suboptimal solutions. We present a model and solution methodologies for an integrated approach that simultaneously addresses various trade-offs and all of the constraints. Our algorithm finds the most promising solution to the entire planning problem. We present computational results.

2 — Robust Fleet Assignment
Ellis Johnson, Professor, Georgia Institute of Technology, Atlanta, GA, United States, ellis.johnson@isye.gatech.edu, Barry Smith

Fleet Assignment (FAM) assigns aircraft types to a schedule. A decomposition that we call station decomposition is used to get FAM solutions that are robust with respect to demand, crew planning and operations. We focus on station purity: restricting the number of different fleet types at smaller stations and the patterns of fleeting.

3 — The Crew Recovery Problem in a Point-to-Point and a Hub-and-Spoke Systems
Julian Pachon, Operations Research Scientist, Caleb Technologies Corp., 9130 Jollyville Rd, Austin, TX, 78759, United States, julian.pachon@calebtech.com

Perturbations in the flight schedule occur during day-to-day airline operations due to unexpected factors. Airlines must quickly repair the broken crew pairings

resulting from operational disruptions in a cost-effective manner while covering all the remaining flights in the schedule. We will describe the crew recovery problem, present its technological and optimization challenges, and point out key differences when solving this problem in a point-to point system and in a hub-and spoke system.

■ MC45

Mart-Room L

Logistics Applications

Contributed Session

Chair: Leyla Ozsen, Student, Northwestern University, Dept. of IE/MS, 2145 Sheridan Road, Evanston, IL, 60208, United States, leyla@iems.nwu.edu

1 — Managing the Workload at Depots in Retail Distribution Using Customer Allocation.
Rob Broekmeulen, Dr., TU Eindhoven, P.O. Box 513, Pav. E10, Eindhoven, NB, 5600 MB, Netherlands, r.a.c.m.broekmeulen@tm.tue.nl, Derrien Jansen

In the execution of their large scale distribution processes, retailers face tight time windows at the outlets, short order lead times and limited order picking capacities at the depots. This workload problem is modeled as an extension of the Multiple Depot Vehicle Routing Problem with Time Windows (MDVRPTW). We propose solution techniques based on a novel problem decomposition and local search heuristics.

2 — Asset Management with Reverse Product Flows and Environmental Considerations
Manu Sharma, Georgia Institute of Technology, School of Industrial and Systems Engg ., 765 Ferst Drive, Atlanta, GA, 30332, United States, manu@isye.gatech.edu, Jane Ammons, Joseph Hartman

This research develops a new mixed integer linear programming model to facilitate better leasing and forward/reverse logistics decisions for an electronic equipment leasing company. A case study with representative industry data validates the approach. Insights include understanding the impacts of state-sponsored environmental initiatives on the leasing decisions and end-of-life product flows.

3 — Minimizing Multi-zone Orders in the Correlated Storage Assignment Problem
Maurice Garfinkel, Georgia Institute of Technology, School of ISyE, (Graduate student mailbox), Atlanta, GA, 30332, United States, mag@isye.gatech.edu, Joel Sokol, Gunter P. Sharp

In the correlated storage assignment problem, we assign products to storage/pick zones in a warehouse. The objective is to minimize the number of zones that must be visited to fill orders. The integer programming formulation of this model contains millions of variables and constraints, so heuristic methods are developed to find solutions and bound their quality. We report computational results for our methods compared to others from the literature.

4 — A Production-Distribution Model of a Fertilizer Company
Hugo Yoshizaki, Associate Professor, University of Sao Paulo, CP 61548 - Cidade Universitaria, Dept. Eng. Producao - Escola Politecnica, Sao Paulo, SP, 05508-900, Brazil, hugo@usp.br, Celso M Hino, Jorge L. Biazzi

Demand, raw material prices, and freight have highly seasonal variation in the fertilizer industry. To design the logistic network, a multi-period, MILP model was developed to evaluate transportation, inventory and capacity tradeoffs, as well as the advantage of postponement by locating forward positioned, light manufacturing facilities.

5 — Capacitated Facility Location Model with Risk Pooling
Leyla Ozsen, Student, Northwestern University, Dept. of IE/MS, 2145 Sheridan Road, Evanston, IL, 60208, United States, leyla@iems.nwu.edu, Collette Coullard, Mark Daskin

We formulate a two-echelon capacitated location-inventory model. Key decisions include the location of distribution centers (DCs), the assignment of demands to DCs and the inventory policy at each DC. A Lagrangian-based algorithm is outlined and computational results are presented. We also discuss some of the properties of the model.

■ MC46

Mart-Room M

Global Optimization Software in GAMS: Performance and Applications

Sponsor: Computing
Sponsored Session

Chair: Leon Lasdon, Professor, McCombs College of Business, MSIS Department, University of Texas, Austin, TX, 78712, United States, lasdon@mail.utexas.edu

1 — OQNLP/GAMS: A Multi-start Approach to Global Optimization
Leon Lasdon, Professor, McCombs College of Business, MSIS Department, University of Texas, Austin, TX, 78712, United States, lasdon@mail.utexas.edu

OQNLP calls any GAMS NLP solver from a set of starting points generated by the OptQuest scatter search algorithm. These are filtered to eliminate points too close to local solutions already found, and points whose exact penalty function value is too large. No lower bound is provided, but global solutions are found for over 90% of a large test problem set. Mixed integer NLPs can be handled by fixing the integer variables before each solver call.

2 — GAMS/LGO Solver Engine for Global and Convex Optimization
János D. Pintér, President, PCS Inc. & Adjunct Prof., PCS Inc. / Dalhousie U., 129 Glenforest Drive, Halifax, NS, B3M 1J2, Canada, jdpinter@hfx.eastlink.ca, Alex Meeraus, Steven Dirkse, Armin Pruessner

The LGO solver suite integrates algorithms of global and local scope. It is capable of handling complex nonlinear models under 'minimal' analytical assumptions. The recent GAMS implementation has led to several new feaures, and improved functionality. We review the usage and options of GAMS/LGO, and discuss its performance based on standard test models and applications.

3 — Global Optimization with GAMS/BARON
Nick Sahinidis, Professor, University of Illinois, Dept. of Chemical & Biomolecular Engg., 600 South Mathews Avenue, Urbana, IL, 61801, United States, nikos@uiuc.edu, Mohit Tawarmalani

The BARON global optimization system for the solution of nonconvex NLPs and MINLPs has recently been made available under the GAMS modeling framework. We present computational experience with GAMS/BARON on a variety of problems.

4 — Global Optimization with GAMS - Applications and Performance
Michael R. Bussieck, GAMS Development Corp., 1217 Potomac Street, NW, Washington, DC, 20007, United States, mbussieck@gams.com, Leon Lasdon, Nick Sahinidis, János D. Pintér

Mixed integer nonlinear optimization problems can be formulated and solved with GAMS for more than a decade. Users of nonlinear models had to cope with the limits of available local solvers. Recent advances made the introduction of three solid GO solvers into the GAMS system possible: BARON, LGO, and OQNLP. In this talk we will discuss modeling requirements for local and global codes. We will focus on differences between the three solvers, present favored application, and compare performance.

■ MC47

Atlanta G, 7th Floor

Software Demonstration

Cluster: Software Demonstrations
Invited Session

1 — LINDO Systems, Inc. - Efficient Tools for Optimization Modeling
Mark Wiley, LINDO Systems, Inc., 1415 North Dayton St., Chicago, IL, 60622, United States, mwiley@lindo.com

LINDO Systems will demonstrate the latest enhancements to their popular linear, integer, quadratic and general nonlinear optimization tools including the powerful new Global Solver. 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 — Paragon Decision Technology B.V. - AIMMS for Building (End-User) Optimization Applications and/or Components
Johannes Bisschop, Paragon Decision Technology B.V., Julianastraat 30, Haarlem, Netherlands, johannes.bisschop@paragon.nl

Get familiar with the extended possibilities of optimization modeling in AIMMS. The intuitive modeling environment allows you to create a complete end-user application, build strategic decision models, or create optimization components to be embedded within your own application or from within your Excel spreadsheet using the Spreadsheet Add-In. The latest development of Outer Approximation, combining MIP and NLP programs, will be demonstrated.

Monday 4:30pm - 6:00pm

■ MD01

Westin-Intl. A, 6th Floor

Telecommunications II

Contributed Session

Chair: Hui Liu, Member of Technical Staff, Verizon, 40 Sylvan Road, Waltham, MA, 02451, United States, hui .liu@verizon.com

1 — Base Station Topology and Configuration Optimization of 3G Mobile Communication Systems
Orhan Dengiz, Graduate Student, Auburn University, 207 Dunstan Hall, Auburn University, Auburn, AL, 36849, United States, dengior@eng.auburn.edu, Alice E. Smith

The third generation (3G) mobile communication systems offer high data rates to the users, making a wide range of better services possible. Design of 3G systems includes base station location and configuration. Finding the best base station topology and configuration is an NP-hard problem and it directly affects the performance of entire network. A problem specific meta-heuristic algorithm is presented for the base station location and configuration problem, optimizing cost and performance.

2 — A Heuristic Algorithm for Optimally Allocating Sub-Carriers in OFDMA Based Wireless Cellular Systems
Ray M. Chang, Research Engineer, New Tech. Team, SK Telecom, Sunaedong 9-1, Pundanggu, Seongnam City, Kyonggido, 463-784, Korea, Seongnam, NA, South Korea, cmr@sktelecom.com, Sihoon Ryu, Kang-Il Koh, Dong-Hahk Lee, Won-Suk Chung

In the operation of OFDMA(Orthogonal Frequency Division Multiple Access) based wireless cellular systems, it makes a trade-off to maximize total data rates experienced by the variously distributed users in the network while minimizing the inter-cell interferences when all the cells use the same frequency. To cope with this problem, we propose a heuristic algorithm which adaptively allocates OFDM sub-carriers and bits to users. A mathematical model and simulation analysis have been presented.

3 — The Marginal Cost of Coverage in Cellular Communication Networks
Roger Whitaker, Lecturer, Cardiff University, Computer Science Department, Cardiff, Wales, UK, CF24 3XF, United Kingdom, r.m.whitaker@cs.cf.ac.uk

In cellular communication networks, base station locations must be selected and configured to provide wide area coverage for mobile services. In this study, we present and apply a framework for assessing the marginal cost of service coverage for mobile communication networks. This represents the estimated lowest rate at which infrastructure cost must increase to facilitate higher levels of service coverage. A sample of synthesised test problems are used to estimate average performance.

4 — Processor Scheduling with Switching Times
Kevin Ross, Stanford University, Terman Engineering Center, Room 324, Stanford, CA, 94305-4026, United States, kross@stanford.edu, Nicholas Bambos

We consider scheduling a generalized processing system with switching times. The system can be set to several service configurations with down time required to change configuration. We show that despite delays a class of adaptive batch scheduling algorithms ensure that throughput is maximized under general conditions. One application is sending data in an optical network. Down time is required for bursts to transmit across a wide area in order to avoid contention on internal links.

5 — Wavelength Assignment in Hierarchical Optical Linear Systems
Hui Liu, Member of Technical Staff, Verizon, 40 Sylvan Road, Waltham, MA, 02451, United States, hui.liu@verizon.com, Peter Kubat

Recently, a concept of waveband routing has emerged as a technique to simplify switching elements in a DWDM system, and thus reduce cost. A waveband is a block of contiguous wavelengths that have the same source and destination. Network nodes have the option of routing each wavelength separately, or as a part of a waveband. With the objective of minimizing cost, we formulate a wavelength assignment problem in a linear system. This problem is then solved to optimality via dynamic programming.

■ MD02

Westin-Intl. B, 6th Floor

Quantitative Methods in Finance Applications

Cluster: Financial Engineering
Invited Session

Chair: Stanislav Uryasev, University of Florida, PO Box 116595, 303 Weil Hall, Gainesville, FL, 32608, United States, uryasev@ufl.edu

1 — Classification Using Optimization: Application to Credit Ratings of Bonds
Vladimir Bugera, Univeristy of Florida, United States, bugera@ufl.edu, Stanislav Uryasev, Grigory Zrazhevsky

We consider an approach for classification of objects. It is based on optimization of a set of utility functions characterizing quality of classification. The approach is demonstrated with evaluating credit ratings of bonds.

2 — Portfolio Analysis with General Deviation Measures
Michael Zabarankin, Ph.D. student, University of Florida, 303 Weil Hall, PO Box 116595, ISE Dept., University of Florida, Gainesville, FL, 32611-6595, United States, zabarank@ufl.edu, Stanislav Uryasev, R.Tyrrell Rockafellar

The paper considers generalized measures of deviation in the framework of classical portfolio theory. Such measures, for example "deviation conditional value-at-risk," reflect different attitudes of investors. These measures have nice mathematical properties including the expanded one-fund theorem and CAPM formulas.

3 — Scenario Generation for Financial Stochastic Programs Using Mahalanobis Distance Metric
Chanaka Edirisinghe, Associate Professor, University of Tennessee, Management Science Program, School of Business, Knoxville, 37922, United States, chanaka@utk .edu, Ike Patterson

Sampling multivariate historic returns, coupled with Mahalanobis-metric based summarization, are used to genereate stock return scenarios that capture extreme outcomes as well as central tendencies to specify dynamic investment strategies . Theoretical and computational results will be provided.

■ MD03

Westin-Intl. C, 6th Floor

2003 Dantzig Dissertation Award Finalists

Cluster: Dantzig Dissertation Prize
Invited Session

Co-Chair: Robert Smith, Professor, University of Michigan, Industrial and Operations Engineering, 1205 Beal Ave., Ann Arbor, MI, 48109, United States, rlsmith@umich.edu

1 — The Dance of the Thirty-Ton Trucks: Demand Dispatching in a Dynamic Environment
Martin Durbin, Director, Optimization Solutions Group, United States, martin .durbin@dac.us

The planning, scheduling, dispatching, and delivery of perishable items in a time-constrained environment are recognized as one of the most challenging problems in manufacturing. In the concrete industry, the challenge is dramatically increased due to a dynamic environment, overbooking, and the need to complete multi-truck orders once started. This presentation describes the optimization models required to implement a decision-support tool for planning and execution, the implications of imperfect data, and implementation issues associated with real-time requirements.

2 — Sharing Forecast Information in a Supply Chain
Justin Z. Ren, The Wharton School, University of Pennsylvania, 3730 Walnut Street, 500 JMHH, Operations and Information Management De, Philadelphia, PA, 19104-6340, United States, justinren@wharton.upenn.edu

This doctoral dissertation is centered around sharing forecast information within a supply chain. Based on a research study of the semiconductor equipment industry, this thesis examines the benefit and cost of sharing forecast information in the supply chain. It has three parts. First, I investigate the supplier's cost trade-offs in order fulfillment using an "imputed cost" approach. Next, I empirically test the effectiveness of forecast sharing measured by supplier delivery performance. I then go on to study the underlying incentives to share forecasts in the supply chain using a game-theoretic framework. It is found that sharing risky and volatile forecast information may not improve supply chain performance. Moreover, the customer has an incentive to inflate order forecasts. However, I demonstrate that truthful information sharing is achievable in a long-term supply chain relationship without recourse to explicit contracting mechanisms. This is because a long-run relationship gives supply chain parties opportunities to evaluate each other's credibility and punish untruthful behavior, and therefore provides the right incentive for truthful forecast sharing. It is also found that such a

long-run communicative equilibrium is more likely to form when the industry landscape is stable, firms value long-term relationships, and overforecasting is relatively easy to detect. These results are consistent with the empirical findings for the semiconductor equipment industry.

3 — A Non-Parametric Approach to Multi-Product Pricing
Paat Rusmevichientong, Cornell University, 3821 14th Ave W, #C406,, Seattle, WA, 98119, United States, paatrus@orie.cornell.edu

Developed by General Motors (GM), the Auto Choice Advisor website (http://www.autochoiceadvisor.com) recommends vehicles to consumers based on their requirements and budget constraints. Through the website, GM has access to large quantities of data that reflect consumers' preferences. Motivated by the availability of such data, we formulate a non-parametric approach to multi-product pricing, and develop efficient algorithms that compute revenue-maximizing prices based on the data. Experiments on the data from the website validate the performance of the algorithms.

4 — A Robust Optimization Approach to Reserve Crew Manpower Planning in Airlines
Milind Sohoni, Sr. OR Specialist, Delta Technology Inc., Research, Modeling and Design, Department 709,, 1001 International Blvd., A3 Bldg.,, 9th Floor, United States, Milind.Sohoni@delta.com

Planning reserve staffing, in airlines using a bidline system to assign crew work schedules, is complex due to the nature of reserve demand. In this presentation, we discuss a three-pronged approach to estimate reserve staffing and control utilization. We discuss a new integrated model that estimates staffing by constructing utility functions using operational models. We then present new models to control reserve availability and utilization by controlling operational reserve demand.

5 — Real Options Valuation and Optimization of Energy Assets
Matt Thompson, Industrial Research Fellow, Ontario Power Generation Inc., 700 University Avenue H9, Toronto, Ontario, M5G1X6, Canada, matt_thompson@sympatico.ca

In this thesis we present algorithms for the valuation and optimal operation of natural gas storage facilities, hydro-electric power plants and thermal power generators in competitive markets. Real options theory is used to derive non-linear partial-integro-differential equations (PIDEs) for the valuation and optimal operating strategies of all types of facilities . The equations are designed to incorporate a wide class of spot price models that can exhibit the same time-dependent, mean-reverting dynamics and price spikes as those observed in most energy markets. Particular attention is paid to the operational characteristics of real energy assets.

■ MD04

Westin-Intl. D, 6th Floor

2003 Edelman Second Place: UPS Optimizes its Air Network

Sponsor: CPMS, The Practice Section of INFORMS
Sponsored Session

1 — UPS Optimizes its Air Network
Keith A. Ware, Manager, United Parcel Service, Operations Research, 8001 Ashbottom Rd 2nd Flr, Louisville, KY, 40213-2503, United States, air2kaw@ups.com, Alysia M. Wilson, Cynthia Barnhart, Andrew P. Armacost

Operations Research specialists at UPS and the Massachusetts Institute of Technology (MIT) created a system to optimize the design of service networks for express package delivery. The system simultaneously determines aircraft routes, fleet assignments and package routings to ensure overnight delivery at minimal cost. It has become central to the UPS planning process, fundamentally transforming the process and underlying planning assumptions. Planners now use both solutions and insights generated by the system to create improved plans. UPS management credits the system with identifying operational changes that have saved over $87 million to date, with anticipated savings in the hundreds of millions of dollars.

■ MD05

Westin-Intl. E, 6th Floor

Queueing Models: Asymptotics and Approximations

Sponsor: Applied Probability
Sponsored Session

Chair: John Hasenbein, Assistant Professor, University of Texas at Austin, Dept. of Mechanical Engineering, 1 University Station, C2200, Austin, TX, 78712, United States, jhas@mail.utexas.edu

1 — Scheduled Traffic with Heavy-Tailed Perturbations
Victor Araman, NYU, Stern School of Business, 44 W. 4th street KMC 8-74, New York, NY, 10012, United States, varaman@stern.nyu.edu, Peter Glynn

A "scheduled" arrival process is one in which the n'th arrival is scheduled for time n, but instead occurs at n + xn, where the xn's are iid. We describe here the behavior of queues in which the xn's have infinite mean and the processing times are deterministic. We describe a heavy-traffic limit theorem in which the limit process is a regulated fractional Brownian motion with Hurst parameter H < 1/2. The unusual H describes a queue with long-range negative autocorrelations.

2 — Exact Asymptotics of a Queueing Network with a Cross-Trained Server
Robert D. Foley, Georgia Institute of Technology, School of Industrial and Systems Eng., 765 Ferst Drive, Atlanta, GA, 30332-0205, United States, rfoley@isye.gatech .edu, David McDonald

Consider a modified, two node Jackson network where Server two helps Server one when Server two is idle. The probability of a large deviation at Node one can be calculated using the theory of Schwartz and Weiss. Surprisingly, these calculations show that the proportion of time spent on the boundary, where Server two is idle, may be zero. This is in contrast to the unmodified network. We extend our earlier work to cover this case.

3 — Asymptotic Expansions of Geometric Sums with Applications to Corrected Diffusion Approximations
Jose Blanchet, Stanford University, Dept. MS&E, Stanford, CA, United States, jblanchet@stanford.edu, Peter Glynn

A geometric sum S of i.i.d. r.v. arises in such application contexts as queuing theory, risk theory and reliability. We develop an Edgeworth-type expansion for the distribution of S (in which the exponential law replaces the normal distribution). We then apply this expansion to establish a corrected "heavy traffic" approximation to the distribution of the steady-state waiting time for the GI/G/1 queue.

4 — Workload Process, Waiting Times, and Sojourn Times in a Discrete Time MMAP[K]/SM[K]/1/FCFS Queue
Qi-Ming He, Associate Professor, Dalhousie University, Department of Industrial Engineering, Dalhousie University, Halifax, NS, B3J 2X4, Canada, Qi-Ming.He@DAL.CA

We consider the total workload process and waiting times in a queueing system with multiple types of customers and a first-come-first-served service discipline. An M/G/1 type Markov chain, which is closely related to the total workload in the queueing system is constructed. A method is developed for computing the steady state distribution of that Markov chain. Then the distributions of the total workload, batch waiting times, and waiting times of individual types of customers are obtained.

■ MD06

Westin-Intl. F, 6th Floor

Biological Heuristics

Cluster: OR in Biology
Invited Session

Chair: Todd Easton, IMSE/Kansas State University, 237 Durland Hall, Manhattan, KS, 66506, United States, teaston@ksu.edu

1 — Honey Bee Foraging and Internet Service Resource Allocation
Craig Tovey, Professor, ISYE/ Georgia Institute of Technology, School of ISyE, Georgia Tech, Atlanta, Ga, 30345, United States, ctovey@isye.gatech.edu, Sunil Nakrani

We apply the honey bee colony's heuristic method of forager allocation among flower patches to the problem of dynamically allocating computing resources for an internet service. We discuss the suitability of the method in this context and assess its performance on simulated and actual traffic data.

2 — Solving Large Instances of the Longest Common Subsequence
Todd Easton, IMSE/Kansas State University, 237 Durland Hall, Manhattan, KS, 66506, United States, teaston@ksu.edu, Abhilash Singireddy

From a set of k input strings, the k-Longest Common Subsequence problem (k-LCS) seeks a subsequence of maximum length that is present in each of the input strings. The k-LCS problem has applications to the Multiple Alignment problem in molecular biology. This talk computationally compares 3 methods (dynamic programming, integer programming and branching) that solve k-LCS to optimality. A heuristic is also presented based upon these findings.

■ MD07

Westin-Intl. G, 6th Floor

Retail Electric Power Risk

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@eng.umd.edu

1 — Optimal Electric Energy Procurement for Large Consumers in Electricity Markets
Antonio Conejo, Professor, Univ. Castilla-La Mancha, Electrical Engineering, ETSI Industriales, Ciudad Real, 13071, Spain and Canary Islands, Antonio.Conejo@uclm.es, Natalia Alguacil

The paper considers a consumer that procures electricity in a market, involving both pool and bilateral transactions. Additionally, the consumer operates a self-production facility. To minimize its electricity bill, the consumer should determine the energy bought from bilateral contracts, the energy purchased from the pool, and the energy self-produced. The contract framework used is flexible enough to accommodate real-world bilateral agreements. A medium-term decision horizon is considered.

2 — Optimal Retailer Forward Load Estimates for the Texas Market Using Stochastic Dynamic Programming
Steve Gabriel, Assistant Professor, University of Maryland, Dept. of Civil& Env. Engineering, 1143 Martin Hall, College Park, MD, 20742, United States, sgabriel@eng .umd.edu, Swaminathan Balakrishnan, Prawat Sajakij

In this presentation we describe a stochastic dynamic programming methodology for determining optimal forward load estimates for electric power retailers to their suppliers. This work describes both a model as well as results based on real data for the ERCOT (Texas) market and provides insights useful for planning purposes for electric power retailers in the face of uncertain market prices and end-user loads.

3 — Optimal Production and Hedging Strategies in Electricity Markets with Large Agents
Xu Meng, PhD student, University of Michigan, 1205 Beal Avenue, Ann Arbor, MI, 48109, United States, xmeng@engin.umich.edu, Jussi Keppo

We consider optimal production and hedging strategies in electricity markets. The agents affect the demand-supply equilibrium in both electricity spot and financial markets and, therefore, the prices in these markets.

■ MD08

Westin-Intl. H, 6th Floor

Adaptive Simulation

Sponsor: Simulation
Sponsored Session

Chair: Shane G. Henderson, Cornell University, 230 Rhodes Hall, School of Operations Research and Indust, Ithaca, NY, 14853, United States, shane@orie.cornell.edu

1 — Using the Cross-entropy Method in Combinatorial Optimization
Tito Homem-de-Mello, Northwestern University, Department of IE&MS, 2145 Sheridan Rd ., Evanston, IL, 60208, United States, tito@northwestern.edu, Krishna Chepuri

The cross-entropy method can be viewed as an adaptive simulation technique to estimate rare event probabilities. However, it has been observed that the same concepts can be used to derive a heuristic method for combinatorial optimization problems. We discuss these ideas and illustrate them with an application to a vehicle routing problem with stochastic demands.

2 — An Adaptive Sampling Algorithm for Solving Markov Decision Processes
Michael Fu, Professor, University of Maryland, Smith School of Business, Van Munching Hall, College Park, MD, 20742, United States, mfu@rhsmith.umd.edu, Hyeong Soo Chang, Jiaqiao Hu, Steven Marcus

Based on recent results for multi-armed bandit problems, we propose an adaptive sampling algorithm that approximates the optimal value of a finite horizon Markov decision process. To illustrate the algorithm, computational results are reported on simple examples from inventory control.

3 — Adaptive Simulation Using Perfect Control Variates
Shane G. Henderson, Cornell University, 230 Rhodes Hall, School of Operations Research and Indust, Ithaca, NY, 14853, United States, shane@orie.cornell.edu, Burt Simon

We introduce adaptive-simulation schemes for estimating performance measures for stochastic systems based on the method of control variates. We consider several possible methods for adaptively tuning the control-variate estimators, and describe their asymptotic properties.

■ MD09

Westin-Vinings 1, 6th Floor

Cases in OR/MS Education

Sponsor: Education (INFORM-ED)
Sponsored Session

Chair: Peter Bell, Professor, Richard Ivey School of Business, 1151 Richmond Street, London, ON, N6A 3K7, Canada, pbell@ivey.uwo.ca

1 — Writing OR/MS Cases
Peter Bell, Professor, Richard Ivey School of Business, 1151 Richmond Street, London, ON, N6A 3K7, Canada, pbell@ivey.uwo.ca, Robert Carraway

At this session, writers of well-known OR/MS cases will discuss the case-writing process. This includes: identifying situtations that look like good cases, preparing the materials and researching the case, and writing the case and teaching note.

■ MD10

Westin-Vinings 2, 6th Floor

Spreadsheet Research

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 — "Mission Critical" Spreadsheets in a Large Public Urban University
Janet Wagner, Associate Dean, UMASS Boston, CM Dean's Office, 100 Morrissey Blvd, Boston, MA, 02125, United States, janet.wagner@umb.edu, Miriam Crandall

There has been little research on how spreadsheets are used, not by individuals, but comprehensively throughout an institution. This pilot study addresses that gap, by examining spreadsheet use in administering a large public urban university. Using a snowball sampling methodology, "mission critical" spreadsheet users were identified and interviewed in both administration and academic areas. Among other results, spreadsheets were found to be widely used for mission critical applications, mainly by those who are "second in command", with some interesting interactions of the "mission critical" spreadsheets with the on-going implementation of an academic enterprise resource management system.

2 — Multi-Stage Supply Chain Planning in a Spreadsheet
Tom Knowles, Professor, Illinois Institute of Technology, Stuart Graduate School of Business, 565 West Adams Street, Chicago, IL, 60661, United States, knowles@stuart .iit.edu

We show a mixed-integer linear spreadsheet optimization model that is not a toy problem, but rather a serious application. The application is supply chain planning for a multi-stage production process with production facilities at each stage located around the world and sales around the world. Binary variables are associated with whether a facility is open or closed, and if open, the scheduling of the number of days per week of operation. The amounts of each product processed at each facility are continuous decision variables. Scrap, transfer prices, shipping rates, local country taxes, and tariffs all complicate the problem. Maintaining a spreadsheet representing such a problem can be extremely difficult. What needs to be changed if a facility is added at one stage of production? What changes if we add different lanes to be considered? We show how VBA can be used to model and solve the problem; the user only needs to change the data file. The data and the model are in completely separate workbooks.

■ MD11

Westin-Augusta 1, 7th Floor

Tutorial: Credit Card Business Intelligence by using Linear Programming-based Data Mining Techniques

Cluster: Tutorials
Invited Session

1 — Credit Card Business Intelligence by Using Linear Programming-based Data Mining Techniques
Yong Shi, Professor, University of Nebraska-Omaha, 60th and Dodge Street, Omaha, NE, 68118, United States, yshi@unomaha.edu

This tutorial introduces an end-to-end real-world application of data mining technology, which is motivated by multiple criteria linear programming (MCLP), in credit card business intelligence. Credit card business has become a major power to stimulate the US and world economy growth in the last few decades. At the end of fiscal 1999, there are 1.3 billion payment cards in circulation and Americans made $1.1 trillion credit purchases. However, the increasing credit card delinquencies and personal bankruptcy rates are causing plenty of

headaches for banks and credit issuers. From 1980 to 2000, the number of individual bankruptcy filings in the US increased approximately 500%. How to predict bankruptcy in advance and avoid huge charge-off losses is a critical issue in credit card business intelligence. Traditionally, researchers in Operations Research have studied various methods by using linear programming (LP) to solve discriminate problems with a small sample size of data. These methods can be considered as LP approach to classification in data mining. Recently, the author and his industrial colleagues extended such a research idea into classification via multiple criteria linear programming (MCLP), which differs from statistics, decision tree induction, and neural networks. This new approach has been successfully applied in large real-life credit card databases of First Data Corporation, the world-leading credit card company. The real-life experimental studies show that this technology has outperformed the popular business models, such as (1) Behavior Score developed by Fair Isaac Corporation (FICO); (2) Credit Bureau Score also developed by FICO; and (3) First Data Corporation (FDC)'s Proprietary Bankruptcy Score in credit card business intelligence. The tutorial will first outline the development of both LP and MCLP techniques. Then, it will focus on the details of real-life experimental studies, including modeling, SAS algorithms, computations and knowledge representation in credit card portfolio management decisions.

■ MD12

Westin-Augusta 2, 7th Floor

Workforce Decision Making

Cluster: Workforce Flexibility and Agility
Invited Session

Chair: Mary Beth Kurz, Clemson University, Department of Industrial Engineering, 108 Freeman Hall, Clemson University, Clemson, SC, 29634, United States, mkurz@CLEMSON.EDU

1 — A Predictive Model for Determining Cognitive Turnover (CT) in engineers before physical departure
Erick Jones, Instructor, University of Nebraska, 175 Nebraska Hall, Lincoln, NE, 68588-0518, United States, ej06n9@yahoo.com, Christopher Chung

It is critical that companies know how productive their knowledge workers are. They must identify when a person has already mentally quit and is just showing up to pick up a check? This research focused on what causes them to mentally depart from their jobs before they physically leave, termed Cognitive Turnover. The method for measuring CT is Statistical Evaluation of Cognitive Turnover Control System. SECtCS identifies disturbed workers that may sabotage both the company and themselves.

2 — Throughput Maximization by Dynamic Worksharing in Unbalanced and Multistage Production Lines
Ronald G. Askin, Department of Systems & Industrial Engineering, The University of Arizona, Tucson, AZ, 85721, United States, ron@sie.arizona.edu, Jiaqiong Chen

Fixed tasked allocations can be inefficient in serial production systems with precedence constraints and discrete task times. We consider the case of partially cross-trained workers and small interstage buffers for unbalanced, multistage lines. Rules are proposed and evaluated for guiding real-time worker decisions concerning whether to continue on the next task or to pass the unit downstream.

3 — The Need for a Model of Rail Operations to Improve Engineer Schedules
Robert Randall, Clemson University, Department of Industrial Engineering, Clemson, SC, United States, rrandal@clemson.edu, Mary Beth Kurz, June J. Pilcher, Ph. D.

Intermodal trains can leave a depot when all required cargo has arrived and the trains have been assembled. Reasonably accurate estimates for completion of assembly are not currently in use. Thus, locomotive engineers work under an on-call schedule. This results in engineers living under a very irregular work, rest, and social schedule. This presentation focuses on the need for methods to provide a more stable work environment for locomotive engineers.

■ MD13

Westin-Augusta 3, 7th Floor

Marketing Productivity and Marketing Return-on-Investment

Sponsor: Marketing Science
Sponsored Session

Chair: Michael Wolfe, President, Bottom-Line Analytics, Marietta, GA, United States, BLAnalytics@aol.com

1 — Marketing Analytics is a Consultancy Specializing in Marketing Mix Models and Special Automated Approaches.
Ross Link, President, Marketing Analytics, Inc., 500 Davis Street, Suite 1010, Evanston, IL, 60201, United States, RossLink@MarketingAnalytics.com

Will discuss how his company has developed highly automated processes to 1) identify marketing investments that drive volume, 2) calculate ROI for each advertising and promotional campaign — traditional or online 3) calculate optimal price and volume/profit opportunity, 4) use regression analysis to predict sales based on marketing activities, pricing, competition, weather, etc. 5) measure marketing effectiveness by region or consumer segment, 6) how to best leverage sophisticated modeling techniques to avoid biases and stabilize estimates.

2 — Maximizing Marketing Performance Through Demand-Based Management
Craig Stacey, Dir Marketing Science, Coca-Cola Company, 1 Coca-Cola Plaza, Atlanta, GA, 30313, United States, cstacey@na.ko.com

Will discuss how demand based management systems can be used and leveraged by companies and retailers to optimize pricing and revenue management.

3 — Modeling with Focus on Media Effectiveness
K.K. Davey, Principal, Insight Partners Inc., 777 Third Avenue, 34th floor, New York, NY, 10017, United States, kkdavey@InsightPartner.com

This talk will focus on real life case examples of how marketing mix modeling has been successfully applied in media planning, addressing issues such as determining 1) the optimal media mix, 2) optimal media flighting and scheduling and 3) the optimal combination of :15s versus :30s spots. He will also share an application where this approach helps to continuously monitor and track how well media investments are performing.

4 — Competitive Interaction Assessment
Todd Kirk, Vice President, Analytical Development, Marketing Management Analytics (MMA), 15 River Road, Wilton, CT, 06897, United States, Todd.Kirk@mma.com

A portfolio management approach drives today's marketing budgets more often than the original brand management methods. Traditional marketing mix modeling continues to provide excellent insight into the allocation of budgets for brand planning. However, not all of a brand's volume due to marketing is truly incremental to the manufacturer's total portfolio. This suggests very different implications on marketing sales effectiveness and profit efficiency than the results for several brands viewed in isolation. An implemented modeling system simultaneously demonstrates these category-wide financial consequences of marketing as a whole. Empirical validation of this approach through a case study depicting various results across a number of popular competing brands are presented and discussed.

■ MD14

Westin-Peachtree A, 8th Floor

Empirical Perspective on NPD and Technology Management

Cluster: New Product Development
Invited Session

Chair: Manuel Sosa

Assistant Professor, INSEAD, Boulevard de Constance, Fontainebleau, FR, France, manuel .sosa@insead.edu

1 — Management Competence
Andreas Enders, WHU, Otto-Besheim Graduate School of Business, Koblenz, DE, Germany, aenders@whu.edu, Arnd Huchzermeier, Luk van Wassenhove

Based on an study in the German electronics industry with dyadic data from 168 companies, we have tested a multi-dimensional model to control for the effects of resource deployment and reconfiguration on plant performance. We deliver empirical evidence for the resource-based-view of the firm and the theory of dynamic capabilities.

2 — Knowledge Articulation, Genesis of IT Capabilities and NPD Effectiveness: An Empirical Investigation
Andrea Masini, Assistant Professor, London Business School, Regents Park, London, UK, United Kingdom, amasini@london.edu

This paper examines the efficacy of various knowledge generation strategies through which firms develop IT capabilities. We propose a model to identify configurations of IT adopters that undertake different cognitive efforts in different operational environments. The configurations are assessed particularly with respect to the effectiveness of their NPD activities

3 — Contracting, Directed Parts and Complexity in Automotive Outsourcing Decisions
Sharon Novak, Kellogg School of Management, United States, s-novak@kellogg.nwu.edu, Peter Klibanoff

We examine the outsourcing of interior systems for luxury automobiles using contracts obtained from both buyers and suppliers to construct a theoretical framework and to empirically evaluate the interaction of product complexity, contract structure and buyer involvement in supplier product development in determining program pricing and performance. We find that directed parts and complexity serve as strongly negative substitutes in the determination of the equilibrium bid price.

4 — Dynamic Alignment of Project and Organizational Structures in Complex Product Devlopment
Manuel Sosa, Assistant Professor, INSEAD, Boulevard de Constance, Fontainebleau, FR, France, manuel.sosa@insead.edu

This longitudinal study examines the alignment of project and organizational structures during the concept development phase of a complex system of an aircraft. We present preliminary results of the variation over time of technical project interfaces and actual communication patterns. We hypothesize causes for the observed dynamic behavior.

■ MD15

Westin-Peachtree F, 8th Floor

Technology Management Section Distinguished Speaker

Sponsor: Technology Management
Sponsored Session

Chair: Sarfraz Mian, State University of New York-Oswego, School of Business, 310 Rich Hall, Oswego, NY, 13126, United States, mian@oswego.edu

1 — Mastering the Knowledge Revolution: Highlights from the GW Forecast of Technology & Strategy
William Halal, The George Washington University, United States, Halal@gwu.edu

Professor Halal presents results of his GW Forecast Project, a sophisticated website that pools the knowledge of experts working online to forecast breakthroughs in all fields of science and technology. Forecasts of emerging technologies show advances in all fields that promise to transform life in 20 years. These remarkable developments are shown to driven by the Knowledge Revolution because science and technology are fundamentally knowledge, and the spreading of powerful IT systems is advancing the growth of knowledge as never before. Halal concludes by forecasting fundamental changes in business, government, and other institutions to manage this explosion of change and complexity.

■ MD16

Westin-Peachtree G, 9th Floor

Efficiency and Effectiveness in Healthcare

Sponsor: Health Applications
Sponsored Session

Chair: Sandra Potthoff, Associate Professor, University of Minnesota, Dept of Healthcare Mgmt, Carlson School, 321 19th Avenue South, Minneapolis, MN, 55455, United States, potth001@tc.umn.edu

1 — Measuring Military Medical Ttreatment Facility Efficiency Using DEA
Yasar Ozcan, Professor, Department of Health Administration, Virginia Commonwealth University, PO Box 980203, Richmond, VA, 23298-0203, United States, yaozcan@vcu.edu, M. Nicholas Coppola

This study reports on the technical efficiency of military medical treatment facilities (MMTF) using DEA windows analysis. A total of 390 MMTFs were evaluated from fiscal years 1998 through 2002 using DEA. Data for the study is received from the Pentagon. Results of a four input, five output, input oriented, variable returns to scale model indicate 30% of the MMTFs are efficient in at least one five-year window.

2 — Incorporating Quality in a DEA Evaluation of Nursing Home Performance
Melanie Lenard, Crystal Decision Systems, 1318 Beacon Street, Suite 2, Brookline, MA, 02446, United States, mlenard@crystaldecisionsystems.com, Ronald Klimberg, David Sherman, Daniel Shimshak

An evaluation of nursing home performance must take into account the quality of care provided. We discuss the merits and availability of various quality measures for nursing homes. We also explore several alternative approaches to incorporating quality into a DEA model, including Quality-Adjusted DEA and Multiple Objective DEA.

3 — Managing Queues for Cardiac Services
Diwakar Gupta, Associate Professor, University of Minnesota, 1100 Mechanical Engineering Bldg., 111 C, Minneapolis, MN, 55455, United States, guptad@me.umn.edu, Madhu Natarajan

This talk will describe how patient queues are managed at a regional tertiary diagnosis and treatment center in Ontario. We report statistical analysis of factors that influence wait times and procedure times, interpret these in clinical terms, and identify models for improvements in efficiency, effectiveness and fairness.

4 — Resource Allocation for HIV Prevention in a Multi-level Decision Making Framework
Arielle Lasry, Mechanical & Industrial Engineering, University of Toronto, Toronto, ON, Canada, arielle@mie.utoronto.ca, Gregory Zaric, Michael Carter

Funds spent on HIV prevention are commonly allocated based on equity criteria and traverse several levels of distribution. For example, funds allocated to regions may then be allocated to sub-regions or targeted risk groups. Decision makers at various levels make use of heuristics that may result in suboptimal allocation of resources. We examine the impact of equity based heuristic versus optimal allocation of HIV prevention funds, in an epidemic model with two levels of decision making.

■ MD17

Westin-Peachtree H, 9th Floor

Industry Applications

Contributed Session

Chair: Lucia Novaes Simoes, First, Fundaçao Nacional de Saùde, SAS Quadra 4 - Bloco N - 5 andar, Brasilia, DF, 70000-000, Brazil, lusimoes@zaz.com.br, Sérgio Luìs Delamare

1 — Two-Dimensional Vector Packing for Steel Product Container Cassettes
Sang Hyuck Park, RIST, P.O.Box 135, Pohang, KB, Korea Repof, munlover@postech.ac.kr, Hark Chin Hwang

We consider the problem of packing steel products, known as coils, into minimum number of special containers, called cassettes, where each cassette has capacity limits on both total payload weight and size. We model this problem as a two-dimensional vector packing problem and propose a heuristic algorithm and analyze its worst case performance under a special condition that the maximum weight and size of the coil is less than a fixed fraction of corresponding capacity limit.

2 — A Fuzzy Logic Paradigm for Industrial Economics Analysis
Kashani h. Saeid, Ph.D. Student in Industrial Economics, University of Rennes1, Kashani@caramail.com, Kashaniunivrennes1@yahoo.fr, Rennes, Re, 35000, France, saeid .hosseinpour-kashani@univ-rennes1.fr

Investment decision in assets with a high degree of “know-how” specificity under uncertainty in the sense of “adverse selection” is an important matter for policy-maker and enterprise managers. In this paper, I developed a new panoramic vision using “fuzzy logic” methodology. The model applied the real data obtained of 17 enterprises in French automotive industry. Finally, the fuzzy index estimated is compared with the real data about the levels of contracting by the enterprises.

3 — The Good Administration Minimizes Effects and Their Consequences in the Relationships
Lucia Novaes Simoes, First, Fundaçao Nacional de Saùde, SAS Quadra 4 - Bloco N - 5 andar, Brasilia, DF, 70000-000, Brazil, lusimoes@zaz.com.br, Sérgio Luìs Delamare

Organizations are made of persons and they should be permanently informed about the changes. Specific situations, where the undesirable effects appear, were considered. For example, the occurrence in isolated sectors of the organization. In this case, to preserve the transition process, a punctual intervention is recommended to minimize or to eliminate the problem. After that, the intervention should work as a new strategy of improvement of the organizational key-techniques.

4 — Managing the Exchange Services for Reusable Products
Murat Bayiz, PhD Student, The Anderson School of Management at UCLA, 110 Westwood Plz. Room # B501, Los Angeles, CA, 90095, United States, mbayiz@ucla.edu, Christopher Tang

We present an integrated system to manage the purchasing schedule for reusable products while balancing the customer service and inventory levels. The system is developed in the context of a major dosimetry service company, which leases reusable badges that are designed to record radioactive exposure over a time period. We ran our system by using the data provided by this company and found that our system can help to reduce the inventory level by 17.7% within a six-month period.

5 — Optimization Models for Wireles Sensor Network Design
Fernando Ordonez, Assistant Professor, ISE, USC, 3715 McClintock Ave, GER-247, Los Angeles, CA, 90089, United States, fordon@usc.edu

In the area of wireless sensor networks (WSN) there is still a significant gap between theory and practice: system designs and protocols are rapidly out-pacing mathematical understanding. We present optimization models of WSN and analyze the effect of various design parameters on the optimal operation of the WSN. We also study the optimal amount of information to extract for a given network topology. Finally, we compare the performance of simple protocols to the optimal solution.

■ MD18

Westin-Tower 1201, 12th Floor

Recent Advances in Statistical Process Control II

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: Paul Zantek, Assistant Professor, University of Maryland, Smith School of Business, College Park, MD, 20742, United States, pzantek@rhsmith.umd.edu

1 — Measurement System Anlysis (MSA) Techniques for Calculated Values
Karl Majeske, University of Michigan Business School, 701 Tappan Street, Ann Arbor, MI, 48105-1234, United States, kdm@bus.umich.edu, Chris Gearhart

This paper presents a methodology for measurement system analysis when the variable of interest is not directly measured. Rather, the manufacturer measures some other related variables to calculate or predict the quality characteristic. This research suggests three approaches to evaluating the measurement system: evaluating each measured value independently, evaluating the collection of measured values as a multi-variate response, and directly assessing the error in the calculated values.

2 — Using Profile Monitoring Techniques for a Data-Rich Environment with Huge Sample Size
Kaibo Wang, Hong Kong Univ. of Sci. & Tech., IEEM Department, HKUST, Room512, TowerB, HKUST, Kowloon, HK, Hong Kong, kbwang@ust.hk, Fugee Tsung

Rather than taking the average of subgrouped observations, the Q-Q plot forms a linear profile naturally and can characterize a sample with huge size. Three EWMA charts are employed to monitor the intercept, slope and residuals of the linear profile. Simulations are conducted to evaluate the performance of this method. A special phenomenon which occurs with huge sample size, i.e., the possible shift of only partial observations within one sample, is also investigated here.

3 — Run-Length Performance of Regression Control Charts with Estimated Parameters
Lianjie Shu, University of Macau, Taipa, Macau, Macau, MO, Macau, LJShu@umac.mo, Fugee Tsung, Kwok-Leung Tsui

The regression control chart is an effective statistical process control (SPC) tool in monitoring multistage processes. In practice, the regression model relating the output and the covariate is rarely known and needs to be estimated. In this paper, the run length performance of regression control charts with estimated parameters is studied.

4 — Analysis of Q-Statistic Monitoring Schemes
Paul Zantek, Assistant Professor, University of Maryland, Smith School of Business, College Park, MD, 20742, United States, pzantek@rhsmith.umd.edu

We study the performance of the Shewhart chart of Q statistics proposed by Quesenberry for startup processes and short runs. A fast, accurate, analytic approximation of the run-length distribution is proposed. Numerical results show there is a high likelihood that the chart will quickly detect large and moderately large step shifts in the mean. We illustrate the importance of reacting immediately to out-of-control signals from the chart as opposed to waiting for additional evidence of shifts.

■ MD19

Westin-Tower 1202, 12th Floor

Recent Advances in Design of Experiments

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: Abhyuday Mandal, Industrial and System Engineering, Georgia Institute of Technology, 765 Ferst Drive, Atlanta, GA, 30332-0205, United States, mandala@umich.edu

1 — Sequential Elimination of Levels in Design of Experiments Using Genetic Algorithms
Abhyuday Mandal, Industrial and System Engineering, Georgia Institute of Technology, 765 Ferst Drive, Atlanta, GA, 30332-0205, United States, mandala@umich.edu, Jeff Wu

Consider the problem of searching for an optimal design point in a relatively large search space. Wu, Mao, Ma (1990) suggested SEL-method to find an optimal setting of an experiment. Genetic algorithms (GA) can be used to improve upon this method. Relaxing the condition of orthogonality, GA is able to explore more design points which allows more flexibility and enhances the chance of getting the best setting in relatively few runs, particularly in presence of interaction effects.

2 — Design of Cost-Effective Experiments
Aleka Kapatou, George Washington University, Department of Statistics, Washington, DC, 20052, United States, aleka@gwu.edu, David Banks

Conventional experimental design theory ignores the fact that different observations have different costs. When some observations are much cheaper to make than others, then experimenters should seek the design which provides the most information at an affordable price . Such designs are typically unbalanced, but can be easily analyzed by modern software. This paper describes the issues that arise and points out how the results differ from those obtained under traditional optimality criteria.

3 — A New Class of Response Surface Designs for Systems Involving Quantitative and Qualitative Factors
Navara Chantarat, Ohio State University, 1971 Neil Avenue, Room #210, Columbus, OH, 43210-1271, United States, Chantarat.1@osu.edu, Theodore T. Allen, Ning Zheng

Often, practitioners desire to create response surface as a function of both quantitative and qualitative factors. Several methods have been proposed in the literature but prediction models may be expected to predict poorly due to model-misspecification or bias. This paper proposes the use of Expected Integrated Mean Squared Error (EIMSE) criterion to construct optimal response surface designs. We use discrete-event simulation and numerical study to compare performance of alternative methods.

4 — Organizational Improvement Using Design of Experiments Techniques
Fran Zenzen, QA Director, General Dynamics Decision Systems, 8220 E. Roosevelt St, MS R1108, Scottsdale, AZ, 85257, United States, fran.zenzen@gdds.com, Connie Borror, Bert Keats, Conley Davis

We describe the use of Design of Experiments (DOE) in identifying strategies necessary to meet business objectives through attention to customer demands. Quality Function Deployment (QFD) identified customer demands and the extent to which Software Quality Assurance (SQA) was meeting these demands. This study is believed to be the first published use of DOE with behavioral variables in an organization.

■ MD20

Westin-Tower 1203, 12th Floor

Statistical Quality Control

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: Sangmun Shin, Graduate Student, Clemson University, Department of Industrial Engineering, Clemson, SC, 29634, United States, ssangmu@clemson.edu

1 — Predictive Time Model of an Anglia Autoflow Mechanical Chicken Catching System
Saravanan Ramasamy, Research Assistant, University of Delaware, Department of Operations Research, 212 Townsend Hall, Newark, DE, 19716-2130, United States, rmsar@udel.edu, Eric Benson, John Bernard, Garrett Van Wicklen

In this project, predictive time models were developed for an Anglia Autoflow mechanical chicken harvesting system. A regression model relating distance to total time (sum of packing time, harvesting time, movement to harvesting and movement to packing) provided the best performance. The model was based on data collected from poultry farms on the Delmarva Peninsula during a six-month period. SAS and NeuroShell Easy Predictor were used to build the regression and neural network models.

2 — Multifractality of High Frequency Pupil-size Measurements
Bin Shi, ISyE, Georgia Tech, 765 Ferst Dr, Atlanta, GA, 30332, United States, bshi@isye.gatech.edu, Brani Vidakovic, Julie Jacko, Francois Sainfort, Kevin Moloney, Virginia Kemery

Multifractality present in the high frequency pupil-size measurements, usually connected with irregular scaling behavior and self—similarity, is modeled with statistical accuracy. Multifractal spectrum is used to discriminate the measurements from four different groups. The broadness and maximum of the spectrum are proposed as distinguishing features. Analysis based on descriptive statistics and kernel density estimation is provided to obtain the statistical description of the mulitfractality.

3 — Development of an Enhanced Analytical Approach on Tolerance Optimization and Synthesis
Sangmun Shin, Graduate Student, Clemson University, Department of Industrial Engineering, Clemson, SC, 29634, United States, ssangmu@clemson.edu, Madhumohan S Govindaluri, Jay-wan Kim

We explore the integration of the Lambert W function to a tolerance optimization problem with the assessment of costs incurred by both the customer and a manufacturer. By trading off manufacturing and rejection costs, and a quality

loss, we show how the Lambert W function can be efficiently applied to the tolerance optimization problem, which may be the first attempt in the literature related to tolerance optimization and synthesis.

■ MD21

Westin-Tower 1204, 12th Floor

All Things Scheduled 2

Sponsor: Computing
Sponsored Session

Chair: Samir Amiouny, ILOG Inc., 1080 Linda Vista Avenue, Mountain View, CA, 94043, United States, samiouny@ilog .com

1 — Advanced Planning and Scheduling Application for a Site with Multiple Resources
Thomas Kratzke, United States, tkratzke@yahoo.com, Didier Vergamini

We decompose and tackle various aspects of this probem: We first use linear programming to compute target "loads" for each resource, and then we use mixed integer programming to select lots to approximately fulfill these targets. We produce allocations to the customer demands of these loads, and define and compute the reasons behind the failures of fulfilling the customer demands. Finally, we use scheduling techniques to schedule the lots.

2 — Scheduling of Deliveries for Daily Inter-city Check Clearing Runs
Derek Bennett, Senior Consultant, ILOG Inc., 1080 Linda Vista Avenue, Mountain View, CA, 94043, United States, dbennett@ilog.com

We discuss an interesting check clearing optimization problem: determine daily aircraft routes and schedules to pick up and deliver all bundles, which must be delivered each day. The tradeoff is between aircraft costs, and the benefits obtained for delivering on time to reduce the floating of funds.

3 — Tester Assignment in Semiconductor Sort Operations
Jim Wuerfel, Optimization Program Coordinator, Intel Corporation, 5000 W. Chandler Blvd., CH3-113, Chandler, AZ, 85225, United States, james.r.wuerfel@intel.com

A MIP model, integrated with an online database system, has been developed to aid in managing tool setups in Sort manufacturing to better manage production and minimize unnecessary setups. This model identifies the number of tools to setup on each product type, and the projected weekly product production. The reduction in setups has improved tool utilization, while projected shortfall has been useful in prioritizing lots near the end of wafer fabrication to better meet weekly output targets.

4 — Scheduling the Production of Plastic Cards
Samir Amiouny, ILOG Inc., 1080 Linda Vista Avenue, Mountain View, CA, 94043, United States, samiouny@ilog.com

We present a machine scheduling problem that occurs in the production of plastic cards grouped into batches requiring the same machine states. Setup times, which are sequence dependent, are the main issue in this problem. We describe a constraint programming based approach for finding good solutions.

■ MD22

Westin-Tower 1205, 12th Floor

Analysis Support to the Warfighting Commander

Sponsor: Military Applications
Sponsored Session

Chair: David LaRivee, Colonel, Head, Department of Operational Sciences, United States Air Force, United States, dlarivee@afit.edu

1 — Analysis Support to the Warfighting Commander
David LaRivee, dlarivee@afit.edu

A review of the successes and failures of analysis during Operation Iraqi Freedom will be presented in an open discussion. Discussion will include the future role of analysis as it pertains to on-going operations and the ability to provide decision support under time constraints.

■ MD23

Westin-Tower 1206, 12th Floor

Decision Analysis Society Awards

Sponsor: Decision Analysis
Sponsored Session

Chair: Elisabeth Paté-Cornell, United States, mep@leland.stanford.edu

1 — Decision Analysis Society Awards
Elisabeth Paté-Cornell, United States, mep@leland.stanford.edu

The Decision Analysis Society of INFORMS will announce the recipients of the 2003 Ramsey Medal for lifetime contributions to decision analysis, the 2003 publications award for best publication in the year 2001 and the 2003 student paper award. Each winner will be invited to speak briefly. The winner of the Decision Analysis Practice Award will also be announced. The practice award competitors will make their presentations in an earlier session.

■ MD24

Westin-Tower 1207, 12th Floor

E-Business

Sponsor: Information Systems
Sponsored Session

Chair: Ram Kumar, Associate Professor, UNC-Charlotte, 9201 University City Boulevard, Charlotte, NC, 28223, United States, rlkumar@email.uncc.edu

1 — Modeling the Effects of IT on the Music Industry
Michael Smith, Assistant Professor, UNC Charlotte, BIS/OM Dept, 9201 University City Blvd, Charlotte, NC, 28223-0001, United States, masmith@email.uncc.edu

The digitization of music production, along with hardware advances, file compression, ubiquitous networking, and P2P software architecture has transformed the music industry supply chain. To aid analysis of this process, using data flow diagrams (DFDs), I have modeled cash, product, and information flows in parts of the industry. The model can be extended to other flows in the industry and the technique applied to similar industries such as video, book publishing, and software.

2 — An Investigation of the Impact of Electronic Marketplace on Supply Chain Performance
Sungjune Park, The University of North Carolina at Charlotte, Dept. of Business Information Systems, and Operations Management, Charlotte, NC, 28223, United States, supark@email.uncc.edu, Nallan Suresh

An appropriate model for electronic marketplace (EM) is developed in order to investigate the impact of EM on supply chain performance. Adopting a combined analytical-simulation model approach and conducting experiments for supply chains varying different supply chain environmental factors, this study not only investigates the performance improvement or deterioration but also finds factors and conditions that may motivate a firm to utilize EM within a supply chain.

3 — Modeling the Value of Knowledge Management
Ram Kumar, Associate professor, UNC-Charlotte, 9201 University City Boulevard, Charlotte, NC, 28223, United States, rlkumar@email.uncc.edu, Baba Prasad

We present a model of knowledge management based on mulitple theories of financial asset valuation, game theory and network externalities. This model helps to better understand the value of knowledge mangement in organizations.

■ MD25

Westin-Tower 1208, 12th Floor

OR at USMA

Sponsor: Military Applications
Sponsored Session

Chair: William Klimack, Director, ORCEN, USMA, Department of Systems Engineering, United States Military Academy, West Point, NY, 10996, United States, William.Klimack@usma.edu

1 — Estimating Number of Unseen Equipment Faults
Joseph Myers, COL, Dept of Mathematical Sciences, United States Military Academy, West Point, NY, 10996, United States, joseph.myers@usma.edu, Daniel Whitten, Elizabeth Schott

In reliability testing, you test until failure, each unique failure mode is noted and repaired, and testing resumes. At some point you assume you have seen all failure modes, then develop your maintenance plan (MOS', manuals, tool kits, Class IX). We analyze when you can stop testing: when you can be "sure" the population of failure modes is no larger than the number of distinct modes you have seen so far. We do this by applying the MLE to infinite populations with finite numbers of partitions.

2 — Next Generation Medium Caliber Weapons for the Infantry Fighting Vehicles
Rocky Gay, LTC, Department of Systems Engineering, mahan Hall, United States Military Aacdemy, West Point, NY, 10996, United States, ralph.gay@usma.edu, Patrick Downes, Michael Rybacki, Michael Goddard, Russell Schott, James Paine, Nathan Whitten

Medium Caliber weapon systems to upgrade the current 25mm in the Bradley and the Future Combat System are modeled, simulated and analyzed.

3 — A Method for Allocating Financial Resources to Combat Terrorism: Optimizing the Reduction of Consequences
Darrall Henderson, Academy Professor, Department of Mathematical Sciences, United States Military Academy, West Point, NY, 10996, United States, darrall@stanfordalumni.org, Tom J. Mackin, J.W. Jones

This presentation introduces a formalized method for allocating resources in a manner that optimizes the reduction in consequences of terrorist attacks. The approach involves vulnerability assessment, the development of cost-benefit models that describe each type of threat, and the optimization of a function we label 'the reduction of consequences' function. We present a general outline of this approach and present solutions using spreadsheet optimization.

4 — Optimal Distribution of Soldier Tactical Mission System (Land Warrior)
James Corrigan, CPT, Department Of Systems Engineering, Mahan Hall, United States Military Academy, West Point, NY, 10996, United States, james.corrigan@usma.edu, William Klimack

The Soldier Tactical Mission System offers greatly enhanced capabilities for individual infantry soldiers; however, the fielding level at which unit effectiveness will show the greatest gain is unknown. The objective is determining the number of STMS that maximize unit effectiveness while minimizing costs, both fiscal and human. Analysis compares the value gained against the aggregate costs for various fielding levels using a common tactical scenario modeled in an appropriate simulation.

5 — Classifying Threat Ground Force Weapons Systems in the Battle space
John Harris, CPT, Department of Systems Engineering, Mahan Hall, United States Military Academy, West Point, NY, 10996, United States, john.harris@usma.edu

The ability of an analyst to accurately classify a threat force weapon system is a difficult task. In many cases, data are missing, incomplete, intermittent, or deceptive. Contained in the radio transmissions are data fields from which inference to the type of equipment, and the type of unit of the weapon system can be made. This research develops a methodology and algorithm based on the theory of intelligent systems to automate the process of accurately classifying threat force weapon systems.

■ MD26

Westin-Tower 1401, 14th Floor

Data Mining Applications and Implementations

Cluster: Data Mining and Knowledge Discovery
Invited Session

Chair: Julia Tsai, Purdue University, Krannert School of Management, 403 West State Street, West Lafayette, IN, 47907, United States, jctsai@mgmt.purdue.edu

1 — Extracting Shape Information From 3D Laser Scans Of Geometry For Clustering
Mark Henderson, Professor, ASU, Dept. of Industrial Engineering, 502 Goldwater Center, Tempe, AZ, 85287-5906, United States, mark.henderson@asu.edu, Suraj Mohandas

Shape Matching has been attempted at different levels and has yielded mixed results. Shape in this paper refers to 3D regions on a scanned object. The generation of the regions on the object and the algorithm used will also be discussed in this paper. This paper discusses an approach to characterize shape and then classify them based on metrics,calculated off its geometry, using CLUSTER ANALYSIS. The metrics that are calculated are used as a vector that signifies the Shape Signature.

2 — Applicative Issues in Evaluation of Promotional Campaign Effects in Cross Sectional Data with Count Response Variable
Jimmy Cela, Six Continents, Three Ravinia Drive, Suite 100, Atlanta, GA, 30346, United States, Jimmy.Cela@6c.com, Zubin Dowlaty

Propensity score methods, applied in data with self-selection, are in practice non-parametric. Parametric estimation, suggested as regression solely on propensity scores, is not applied. We simulate many treatment assignment scenarios to show that this regression is not sufficient to mitigate bias. We consider propensity scores as omitted variable, add it to the model as a generated regressor to induce conditional independence in explanatories. This substantially alleviates estimation bias.

3 — Construction of Transition Functions for an Ozone Pollution Stochastic Dynamic Programming Model
Victoria Chen, University of Texas at Arlington, Industrial & Manufacturing Systems Eng., Campus Box 19017, Arlington, TX, 76019, United States, vchen@uta.edu, Terrence Murphy, Zehua Yang, Julia Tsai

In the development of a stochastic dynamic programming model for reducing ozone pollution, we require a transition function that models how the relevant air chemistry changes over time. Since the available ozone pollution data cannot consider the necessary "what if" scenarios, we utilize the EPA's Urban Airshed Model to generate data for scenarios that are specified by an experimental design. Then we construct regression model and MARS approximations to represent the transition functions.

■ MD27

Westin-Tower 1402, 14th Floor

Integer Programming I

Contributed Session

Chair: Shangyuan Luo, Lehigh University, 200 W. Packer Ave., ISE Dept. Bethlehem, PA 18015, United States, sh16@lehigh.edu

1 — A Theory for Good Formulations of Mixed Integer Linear Programs
Kent Andersen, Ph.D. Student, Carnegie Mellon University, United States, kha@andrew .cmu.edu

State-of-the-art algorithms for solving mixed integer linear programming problems use a combination of cutting planes and enumeration. Also included is a pre-processor, whichis a set of heuristic techniques for reducing the size and improving the strength of the formulation. In this work, we provide a general theory for pre-processing, i.e. we provide a general theory for finding good formulations of mixed integer linear programs. In contrast to cutting planes, we do \emph{not} allow the number of constraints in the formulation to increase. The main idea is to look for valid inequalities of the integer hull, which dominate the inequalities in the current formulation. This leads to the notion of a good formulation relative to a given set of inequalities. For valid inequalies for disjunctive sets derived from split disjunctions, we present an LP which, given a constraint in the current formulation, either 1) gives an improved inequality, 2) shows that no such inequality exists or 3) eliminates a non-empty subset of the variables. We call a formulation for which no split disjunction can be used to improve the formulation for a good formulation relative to the split closure.

2 — Sensitivity Range of Assignment Problem
Ue-Pyng Wen, Professor, National Tsing Hua University, Dept. IEEM, National Tsing Hua Univrsity, Hsinchu, TW, Taiwan, upwen@ie.nthu.edu.tw, Chi-Jen Lin

This paper focuses on two kinds of sensitivity analyses for the assignment problem. One is to determine the sensitivity range, over which the current optimal assignment, while perturbing the elements of one column (or row) in a cost matrix of the assignment problem simultaneously but dependently. The other is to perturb elements of one column (or row) in a cost matrix of the assignment problem simultaneously but independently. Numerical illustrations are presented

3 — Lifting Valid Inequalities for the SONET Ring Assignment Problem
Elder Macambira, PH.D Student, Universidade Federal do Rio de Janeiro, COPPE / PESC, Rio de Janeiro, RJ, Brazil, elder@cos.ufrj.br, Nelson Maculan, Cid C. de Souza

In this paper, we consider the SONET Ring Assignment Problem (SRAP). This problem is NP-hard. We present a integer linear programming formulation of the SRAP. More specifically, we are interesting in classes of valid inequalities which are facet-defining for the polytope associated to the SRAP. We study the complexity of obtaining these facets using the standard sequential lifting procedure. Computational experiments based on this formulation and new inequalities are presented.

4 — A Non-Linear Product Mixed Model with Interchangeable Components
Banhan Lila, Lecturer, Burapha Universiry, Faculty of Engineering, 169 Longhad Bangsean, Muang, Chonburi, Bangsean, Ch, 20131, Thailand, blila@buu.ac.th

This paper presents a non-linear product mixed model for a situation where components of finished products are interchangeable along with other restrictions on resources. The model was applied to a melting process of a steel manufacturing company in Thailand. Solver tool available in Microsoft Excel and the Genetic Algorithm (GA) were used to find a solution of the case problem. The results have shown that planning time and product cost can be reduced dramatically.

5 — A Branch-and-cut Approach to Parallel Replacement Problem with Economies of Scales
Shangyuan Luo, Lehigh University, 200 W. Packer Ave., ISE Department, Bethlehem, PA, 18015, United States, shl6@lehigh.edu, Joseph Hartman

In this talk, we will discuss the parallel replacement problem with Economies of Scales. Two kinds of valid inequalities are derived, based on the non-splitting rule in the literature. Experimental results show the effectiveness of these cuts in comparison to previous approaches.

■ MD28

Westin-Tower 1403, 14th Floor

Global Optimization — Scientific and Engineering Applications

Sponsor: Optimization/Global Optimization
Sponsored Session

Chair: János D. Pintér, President, PCS Inc. & Adjunct Prof., PCS Inc. / Dalhousie U., 129 Glenforest Drive, Halifax, NS, B3M 1J2, Canada, jdpinter@hfx.eastlink.ca

1 — MathOptimizer Professional: Introduction and Application Examples
János D. Pintér, President, PCS Inc. & Adjunct Prof., PCS Inc. / Dalhousie U., 129 Glenforest Drive, Halifax, NS, B3M 1J2, Canada, jdpinter@hfx.eastlink.ca, Frank J. Kampas

MathOptimizer Professional is a new Mathematica application package for solving global optimization problems. Models are formulated / documented in Mathematica, then solved by making use of a link to the external LGO solver engine. We illustrate this functionality by numerical examples, and review some current applications

2 — Developing High Fidelity Approximations to Expensive Simulation Models for Expedited Optimization
Larry Deschaine, Engineering Physicist, SAIC/Chalmers, Suite 200, 360 Bay Street, Augusta, GA, 30901, United States, Larry.M.Deschaine@saic.com, Sudip Regmi, János D. Pintér

Integrated simulation and optimization typically requires a sequence of 'expensive' function calls. While extremely valuable in concept, when the computation cost of simulations functions is high (hours / days) and or the optimization paradigm is inefficient (thousands of function calls), real-time or timely 'optimal' solutions are elusive. We discuss the use of machine learning to develop a high fidelity model of a process simulator that executes quickly (milliseconds). This function is then optimized using the LGO solver, thus enabling optimization in real-time.

3 — Optimization of Finite Element Models with MathOptimizer and ModelMaker
János D. Pintér, President, PCS Inc. & Adjunct Prof., PCS Inc. / Dalhousie U., 129 Glenforest Drive, Halifax, NS, B3M 1J2, Canada, jdpinter@hfx.eastlink.ca, Christopher J. Purcell

ModelMaker is a sophisticated Mathematica package for finite element modeling. The models are passed to external analysis engines for processing, and results are imported for interpretation . In this talk, we present design results obtained by using MathOptimizer, a native Mathematica nonlinear / global optimization solver suite.

■ MD29

Westin-Tower 1404, 14th Floor

Combinatorial Graph Algorithms

Sponsor: Optimization/Network
Sponsored Session

Chair: Lisa Fleischer, GSIA, Carnegie Mellon University / IBM Watson Research, Pittsburgh, PA, 15213, United States, lkf@andrew.cmu.edu

1 — Approximation Algorithms for Stochastic Network Optimization
Amitabh Sinha, GSIA, Carnegie Mellon University, 5000 Forbes Avenue, Pittsburgh, PA, 15213, United States, asinha@andrew.cmu.edu, R. Ravi

We study optimization problems under two-stage stochastic optimization with recourse and a finite number of scenarios. We first give a constant factor approximation algorithm for stochastic facility location, where (cheaper) first-stage facilities can be built before the demand is revealed and (expensive) second-stage facilities must be installed to completely serve the revealed demand. We extend our techniques to provide approximation algorithms for several other graph problems.

2 — A Polynomial Recognition Algorithm for Balanced Matrices
Giacomo Zambelli, Carnegie Mellon University, 5000 Forbes Avenue, Pittsburgh, PA, United States, giacomo@andrew.cmu.edu

A $0,\pm 1$ matrix is balanced if it does not contain a square submatrix with two nonzero elements per row and column in which the sum of all entries is 2 modulo 4. Conforti, Cornu\'ejols and Rao, and Conforti, Cornu\'ejols, Kapoor and Vu\v{s}kovi\'c, provided a polynomial algorithm to test balancedness of a matrix. In this paper we present a simpler polynomial algorithm, based in part on techniques introduced by Chudnovsky and Seymour for recognizing Berge graphs.

3 — Better Algorithms for Bisubmodular Function Minimization
S. Thomas McCormick, Professor, UBC Faculty of Commerce, 2053 Main Mall, Vancouver, BC, V6T 1Z2, Canada, stmv@adk.commerce.ubc.ca, Satoru Fujishige

Bisubmodularity is a "signed" version of submodularity where an element can belong to a set positively or negatively. Minimizing bisubmodular functions (BSFM) is a common generalization of minimizing submodular functions and membership in convex jump systems. Fujishige and Iwata extended the weakly polynomial IFF SFM algorithm to BSFM. We further extend their algorithm to BSFM over signed ring families,

■ MD30

Westin-Tower 1405, 14th Floor

Developments in Interior-Point Methods

Sponsor: Optimization/Linear Programming and Complementarity
Sponsored Session

Chair: Renato Monteiro, Professor, School of Industrial and Systems Engineering, Georgia Tech, Atlanta, GA, 30332, United States, monteiro@isye.gatech.edu

1 — An Interior-Point Linear Programming Algorithm Designed for Use with Iterative Solvers
Jerome O'Neal, student, Georgia Institute of Technology, School of Industrial and Systems Engr, Atlanta, GA, 30332, United States, joneal@isye.gatech.edu, Renato Monteiro

We present an interior-point algorithm for linear programming which, by design, is intended to be used with iterative solvers (e.g. steepest descent, conjugate-gradient methods). First, we show the number of iterations needed by the iterative solver to solve the normal equations to a desired accuracy level. Next, we discuss the impact an inexact solution of the normal equations has on the residuals in the problem, and we present a method for "correcting" the unwanted effects on one of the residuals. Finally, we show that our algorithm is globally and polynomially convergent in the number of "outer" iterations, and for the specific case where A is a node-arc incidence matrix, that our algorithm is polynomially convergent.

2 — Pre-conditioners for Reducing the Complexity of Linear and Conic Convex Optimization
Robert Freund, Professor, MIT, Building E53-357, 50 Memorial Drive, Cambridge, MA, 02142-1347, United States, rfreund@mit.edu

In linear and conic convex feasibility and optimization problems, the complexity of solving a problem instance is related to certain geometric features of the feasible region and the objective function level sets of the problem instance, both for interior-point methods and for the ellipsoid method. We develop a theory that shows how a priori changes in the norms used for initialization of both methods can potentially reduce the theoretical complexity.

3 — Error Bounds and Limiting Behavior of Weighted Paths Associated with a Certain SDP Central Path Map
Renato Monteiro, Professor, School of Industrial and Systems Engineering, Georgia Tech, Atlanta, GA, 30332, United States, monteiro@isye.gatech.edu, Zhaosong Lu

Under strict complementarity assumption, we study the asymptotic behavior of the weighted path and its implications to the superlinear convergence analysis of interior-point methods.

■ MD31

Westin-Tower 1406, 14th Floor

Facilities Planning & Design I

Contributed Session

Chair: José Ventura, Professor, Penn State, 356 Leonhard Building, University Park, PA, 16802, United States, jav1@psu.edu

1 — Developing An Hybrid Evolution Programming for the Euclidean Steiner Tree Problem
Byounghak Yang, Associate Professor, Kyungwon University,Department of Industrial Engineering, San 65, Bockjung-dong,Sujung-gu, Sungnam,Kyunggi, Korea Repof, byang@kyungwon.ac.kr, Dongjoon Kong

The Euclidean steiner tree problem(ESTP) is to find a minimum length euclidean interconnection of a set of points in the plane. We present a evolution programming (EP) for ESTP based upon the Prim algorithm and introduce local searching as hybrid strategy. The computational results show that the EP can generate better results than already known heuristic algorithms.

2 — A University Space use Evaluation and Allocation Model
Ed Mooney, Montana State University, M&IE Department, Bozeman, MT, 59717-3800, United States, emooney@ie.montana.edu, Michael Cole, Pamela Barrett

We develop a model-based approach to evaluate space use at a university. The model assesses teaching, research, administrative, and outreach activities according to measures based on the university's mission statement. The model will help administrators allocate and reconfigure space to efficiently meet evolving needs.

The model has been incorporated in a prototype decision support system and is currently under evaluation for implementation.

3 — Optimal Design of Dynamic Focused Storage Systems
Michael Cole, Montana State University, M&IE Department, Bozeman, MT, 59717-3800, United States, mcole@ie.montana.edu

We develop and test optimization and simulation models for the design of focused storage systems in dynamic production environments. The basic model considers operating costs, fill rate requirements, and scarcity of labor and space.

4 — A Line Based Tandem Segmentation for Automated Guided Vehicle Systems
Ardavan Asef-Vaziri, Assistant Professor, Department of Systems and Operations Management, California State, United States, aasef@uh.edu, Sylvana Saudale

We develop a two-phase integer programming model to design a line based segmented flow path for AGVS. Phase I designs a bidirectional line, and phase two partition it into nonoverlapping segments each served by a single vehicle. The objective of the optimization model is minimization of the total vehicle trip distances. The optimal segmentation is examined in a simulation environment to compute the fleet size of the vehicles

5 — A Dynamic Programming Algorithm to Locate Idle Vehicles in AGV Systems with Capacity Constraints
José Ventura, Professor, Penn State, 356 Leonhard Building, University Park, PA, 16802, United States, jav1@psu.edu, Brian Rieksts

The locations of idle vehicles in an AGV system, called dwell points, establish the response times for AVG requests. A dynamic programming algorithm to solve idle vehicle positioning problems in unidirectional single loop systems is proposed to minimize the maximum response time considering vehicle constraints on travel and load/unload times. This polynomial time algorithm finds optimal dwell points when all requests from a given pick-up station are handled by a single AGV.

■ MD32

Westin-Tower 1407, 14th Floor

Scheduling Applications

Contributed Session

Chair: Robert Russell, Professor, Univ. of Tulsa, College of Business, 600 S. College, Tulsa, OK, 74104, United States, rrussell@utulsa.edu

1 — Workforce Scheduling in a Product-Delivery Environment
Yu Dang, PhD Candidate, University of Alabama, Box 870226, Tuscaloosa, AL, 35487, United States, ydang@cba.ua.edu, John Mittenthal

The problem is to develop a work schedule for each driver satisfying various workload and days-off constraints, and on each day assign available drivers to routes subject to maintaining service quality. An IP formulation and a two-stage decomposition solution approach are presented.

2 — Scheduling Jobs on a Single Machine with Varying Performance
Emmett Lodree, Assistant Professor, North Carolina A&T State University, 1601 East Market Street, McNair 419, Greensboro, NC, 27411, United States, elodree@ncat.edu, Christopher Geiger

We address the problem of scheduling n jobs on a single machine whose performance varies over time. Previous versions of this problem consider deteriorating performance in which the machine's rate of deterioration is either linear, piecewise linear, or exponential. We model a generalized performance function that considers warm up, peak, and deteriorating periods.

3 — Robotic Cell Scheduling with Operational Flexibility
Selim Akturk, Assoc. Prof., Bilkent University, Dept. of Industrial Engineering, Ankara, 06800, Turkey, akturk@bilkent.edu.tr, Hakan Gultekin

We study two CNC machines, identical parts robotic cell scheduling problem in which both machines are capable of performing all of the required operations (denoted as operational flexibility). The problem is to find the optimal allocation of operations and the optimal robot move cycle that jointly minimize the cycle time. We prove that the optimal solution is either a 1-unit or a 2-unit robot move cycle and present the regions of optimality depending on the problem parameters.

4 — MIT Airline Scheduling Module - NAS Strategy Simulator
Flora Garcia, Research Assistant, Massachusetts Institute of Technology, 77 Massachusetts Avenue, Room 35-220, Cambridge, MA, 02139, United States, garciaf@mit .edu, John-Paul Clarke

The MIT Airline Scheduling Module of the NAS Strategy Simulator is an incremental optimization tool to determine schedule changes from one time step to another and best meet demand using available resources. We use a newly developed model ISD-FAM/FS-MS that combines the Integrated Schedule Design and Fleet Assignment and the Frequency Share-Market Share models. We simultaneously determine frequency, departure times, fleet assignment, passenger loads and revenue within a competitive environment.

5 — Scheduling Sports Competitions on Multiple Venues Constraint Programming
Robert Russell, Professor, Univ. of Tulsa, College of Business, 600 S. College, Tulsa, OK, 74104, United States, rrussell@utulsa.edu, Timothy Urban

We use constraint programming to solve the sports scheduling problem in which the objective is to achieve balanced competitions across multiple venues subject to certain constraints. Computational results are reported and compared to integer programming.

■ MD33

Westin-Tower 1408, 14th Floor

Recent Advances in Integer Programming II

Sponsor: Optimization/Integer Programming
Sponsored Session

Chair: Diego Klabjan, Assistant Professor, University of Illinois at Urbana-Champaign, 1206 West Green Street, Urbana, IL, United States, klabjan@uiuc.edu

1 — Decomposition Algorithm for Supply Chain Design
Udatta Palekar, Associate Professor, University of Illinois at Urbana-Champaign, Urbana, IL, United States, palekar@uiuc.edu, Gottfried Spelsberg-Korspeter, Geon Cho

We present a model for the allocation of production and assembly activities to capacitated locations in a supply chain that considers cost of production, transportation and inventory. It determines parts that must be buffered and their inventory levels. The model is solved using a decomposition strategy. The uncapacitated version of the master problem has the integrality property. The general master problem is solved using Branch and Price and the sub-problems are solved using a dynamic program.

2 — Strong Formulations and Separation for Multi-Level Lot-Sizing Problems
Andrew Miller, Assistant Professor, University of Wisconsin, Department of Industrial Engineering, Madison, WI, 53706, United States, amiller@ie.engr.wisc.edu, Kerem Akartunali

Much of the difficulty in solving practical lot-sizing problems arises because strong formulations for the underlying multi-level problems are usually not used. Such problems have been studied by Afentakis and Gavish, Tempelmeier and Derstroff, and Stadtler, among others. We discuss computational results obtained by using strong reformulations, including using efficient new methods to separate for strong valid inequalities.

3 — All Facets of the Knapsack Set with One Continuous and Two Integer
Alper Atamturk, Assistant Professor, University of California, Berkeley, Berkeley, CA, United States, atamturk@ieor.berkeley.edu, Deepak Rajan

We present valid inequalities for the general mixed-integer knapsack set based on its two integer-variable restrictions. Polynomial-time algorithms are given for a complete linear description of the two integer-variable and one continuous variable case and for lifting the facets of this case to higher dimensions. We also present computational results.

4 — Computational Experience in a General MIP Solver
Eva Lee, Assistant Professor, Georgia Institute of Technology, School of Industrial and, Systems Engineering, Atlanta, GA, 30332-0205, United States, eva.lee@isye .gatech.edu, Sid Maheshwary

Computational experiments with a general MIP solver (MIPSOL) will be described. New cutting plane tecniques based on hypergraphs have been implemented to facilitate solving dense MIP instances. An iterative cut strengthening procedure has also been implemented. Computational results on some intractable dense instances will be discussed.

■ MD34

Mart-Room A

Intermodal Container Management

Sponsor: Transportation Science & Logistics
Sponsored Session

Chair: Alan Erera, Assistant Professor, Georgia Institute of Technology, Industrial and Systems Engineering, 765 Ferst Dr., Atlanta, GA, 30332-0205, United States, alerera@isye.gatech.edu

1 — Global Intermodal Tank Container Management for the Chemical Industry
Juan Carlos Morales, Graduate Student, Georgia Institute of Technology, School of Industrial and Systems Eng, 765 Ferst Drive, Atlanta, GA, 30332-0205, United States, jmorales@isye.gatech.edu, Alan Erera, Martin Savelsbergh

Tank containers are a safe, intermodal and cost-effective way to transport liquid products for the chemical industry. Operational management of a global fleet of tank containers requires transportation mode/vendor selection, depot sourcing, cleaning, and repositioning decisions. We propose a MIP model for these decisions, and develop techniques to enable the solution of large instances with reasonable computation times.

2 — An Event-Based Approach to the Management of Empty Tank Containers
I A Karimi, National University of Singapore, 10 Kent Ridge Crescent, Singapore, Singapore, cheiak@nus.edu.sg, M Sharafali, H Mahalingam

Tank containers are increasingly being favored over other conventional modes of shipping chemicals such as drums. We present an event-based approach for generating a mathematical programming formulation for tank container management from the viewpoint of a container operator. An example that includes features such as the land and ocean transport, container cleaning, etc. is used to illustrate the proposed approach.

3 — Loading and Unloading Operations in Container Terminals
Chung-Lun Li, Professor, Hong Kong Polytechnic University, Department of Logistics, Hung Hom, Kowloon, Hong Kong, Hong Kong, msclli@polyu.edu.hk, George Vairaktarakis

We consider the problem of optimizing the time for loading and unloading containers to and from a ship at a container terminal, where containers are required to be transported by trucks between the ship and their designated locations in the container yard. Effective solution methods are developed and analyzed.

4 — The Optimal Planning of Container Terminals by Simulation
Peng Duan, Northwestern University, 2145 Sheridan Rd, Department of Civil Engineering, Evanston, IL, 60201, United States, p-duan@northwestern.edu, Athanasios K. Ziliaskopoulos, Karen Smilowitz

This paper is concerned with methods for optimizing planning decisions for Intermodal yards, such as the number of cranes and the amount of storage space. Cost models that consider terminal cost only and both terminal cost and trucks cost are presented. The models are stochastic and a simulation framework is developed to evaluate the costs. A heuristic solution procedure is provided to minimize the terminal cost and the total cost using a simulation model to evaluate decisions and establish feasibility. The solution procedure is illustrated by numerical examples for a simple import container terminal as well as a complex real intermodal terminal. Finally, the uncertainty associated with the cost models is briefly considered.

■ MD35

Mart-Room B

Operations Management III

Contributed Session

Chair: Richard Franza, Assistant Professor of Management, Kennesaw State University, Coles College of Business, 1000 Chastain Road, #0404, Kennesaw, GA, 30144-5591, United States, rfranza@coles2.kennesaw.edu

1 — Does Goldratt Understand the 'Theory' of Constraints? Evaporating the 'Do-Not-Balance' Cloud
Dan Trietsch, University of Auckland, MSIS, 7 Symonds Street, Auckland, NA, New Zealand, d.trietsch@auckland.ac.nz

Management by Constraints (MBC), because it is isomorphic to PERT/CPM, is a useful management and focusing technique. Inter alia, it calls for continuously elevating constrained resources. This leads to increased balance. But Goldratt, MBC's originator, strongly opposes such balance! I will prove that following Goldratt's advice is an extremely expensive mistake. Hence, the title. Also, a new graphic tool to show the balance status of an organization and drive CI projects will be presented.

2 — Advanced Analytics for Closed-Loop Enterprise Planning and Forecasting
Auroop Ganguly, Senior Product Manager, Analytics and Strategy, Demantra, Inc., 16 Royal Crest Dr., #4, Nashua, NH, 03060, United States, auroop@msn.com, Michael Aronowich

Business planners need to design and analyze product portfolios and promotional strategies, and utilize the results to influence demand, manage the supply chain and achieve strategic objectives. Advanced but scalable statistical methodologies can be combined with insights from the marketing and management sciences to provide powerful tools that can aid in these decision making processes. This is exemplified through a widely deployed and "best of breed" software solution.

3 — Optimal Policies for Sizing and Timing of Software Maintenance Projects
Qi Feng, University of Texas at Dallas, School of Management, JO4.7, 2601 N.Floyd Rd, Richardson, TX, 75080, United States, qxf011100@utdallas.edu, Vijay Mookerjee, Suresh Sethi

We present a model to determine the optimal point for maintaining a software application. We also address the question: should maintenance effort continue till the project is completed? We analyze two policies.In the time-based policy,a fixed amount of time is allocated and a random amount of work is completed. In the work-based policy,a fixed amount of work needs to be completed, but the time taken is random. We compare the two and provide insights to the management of software maintenance projects.

4 — Workforce Agility in Repair and Maintenance Environments
Vijayalakshmi Krishnamurthy, Student, Northwestern University, IE/MS Department, Tech C210, 2145 Sheridan Road, Evanston, IL, 60208, United States, viji@iems.nwu .edu, Seyed Iravani

In this paper, we investigate the design and control issues of repair/maintenance environments with heterogeneous machines and partially cross-trained repairmen. We introduce a set of repairmen assignment policies as well as machine priority rules and evaluate their performances. We also present a myopic approach that yields near-optimal training programs.

5 — Impact of Free Goods on the Performance of DBR Systems
Richard Franza, Assistant Professor of Management, Kennesaw State University, Coles College of Business, 1000 Chastain Road, #0404, Kennesaw, GA, 30144-5591, United States, rfranza@coles2.kennesaw.edu, Satya Chakravorty

Drum-Buffer-Rope (DBR), the Theory of Constraints scheduling system, develops a schedule for a system's primary resource constraint. Products not processed at this resource, known as free goods, are given very little attention. However, they have a direct impact on excess capacity in the operation, a key factor in DBR performance. This study analyzes free goods arrival rates as a method for changing the amount of excess capacity to gain insight into the relationship between free goods and DBR.

■ MD36

Mart-Room C

Economics of Supply Chain Management

Sponsor: Manufacturing and Service Operations Management
Sponsored Session

Chair: Serguei Netessine, Assistant Professor, University of Pennsylvania, United States, netessin@wharton.upenn.edu

1 — Fast Delivery Through Competing Suppliers.
Gerard Cachon, Associate Professor, University of Pennsylvania, 3730 Walnut St., Philadelphia, PA, 19104, United States, cachon@wharton.upenn.edu, Fuqiang Zhang

This paper studies the impact of supplier competition on the sourcing strategy of a downstream buyer. The buyer can either coordinate with a single supplier or induce multiple suppliers to compete. We study several mechanisms for the buyer to manipulate competition and compare the competition strategy with coordination under different information structures on suppliers' cost.

2 — An Empirical Investigation of Postponement Strategies
Taylor Randall, University of Utah, David Eccles School of Business, Salt Lake City, UT, United States, acttr@business.utah.edu, Leslie Morgan, Ruskin Morgan

This paper examines the use of postponement in the U.S. bicycle industry. We examine when postponement strategies are used in the context of the industry life cycle and whether the use of postponement strategies is associated with firm survival.

3 — The Economics of Capacity Allocation
Martin Lariviere, Kellogg School, Northwestern University, MEDS, 2001 Sheridan Rd, Evanston, IL, 60202, United States, m-lariviere@kellogg.nwu.edu, Gerard Cachon

When a supplier has limited capacity and sells through multiple retailers, how she chooses to allocate her capacity can impact how the retailers choose to act. Here we consider how the supplier's allocation policy affects the profitability of the supplier, the retailers, and the entire supply chain.

4 — Procurement in Supply Chains when the End-Product Exhibits the "Weakest Link" Property
Serguei Netessine, Assistant Professor, University of Pennsylvania, United States, netessin@wharton.upenn.edu, Stanley Baiman, Howard Kunreuther

We consider a supply chain with one manufacturer who assembles an end-product using components purchased from multiple suppliers. The end-product exhibits the weakest-link property: if any of the components fails, the end-product fails. We analyze three possible contractual agreements between the manufacturer and suppliers: Quality-Based Incentive Pricing, Acceptable Quality Level and Group Warranty.

■ MD37

Mart-Room D

JFIG Paper Competition I

Sponsor: Junior Faculty INFORMS Group
Sponsored Session

Chair: Philip Kaminsky, Associate Professor, Department of IEOR, University of California at Berkeley, Berkeley, CA, 94720, United States, kaminsky@ieor.berkeley.edu

1 — JFIG Paper Competition I

This session features some of the finalists in the first annual Junior Faculty INFORMS Group paper competition. It represents an opportunity for conference attendees to see some of the best research being done by junior faculty. All are welcome.

■ MD38

Mart-Room E

Modeling Issues in Dynamic Traffic Assignment

Sponsor: Transportation Science & Logistics
Sponsored Session

Chair: S Travis Waller, University of Texas at Austin, Dept. of Civil Eng., ECJ 6.204, Austin, TX, 78712, United States, stw@mail.utexas.edu

1 — An Analysis of Multi-Destination DynamicTraffic Equilibrium
Satish V S K Ukkusuri, University of Texas, Dept. of Civil Eng., Austin, TX, 78712, United States, ukkusuri@uiuc.edu, S Travis Waller

This presentation deals with equilibrium in dynamic multi-destination networks. We present an example that shows the possible non-existence of equilibrium in multi-destination traffic networks under certain traffic flow modeling assumptions. To circumvent this, we propose a game theoretic approach to analyze such problems. In particular, we show the difference between pure and mixed strategies for this problem, certain equilibrium properties are studied, and initial results from this approach are presented.

2 — Dynamic Queuing in an Analytical Network Loading Model
Michiel C.J. Bliemer, Delft University of Technology, Faculty of Civil Engineering and Geoscie, P.O. Box 5048, 2600 GA Delft, Netherlands, m.bliemer@ct.tudelft.nl

Dynamic queues and spillback effects are usually problems in an analytical network loading model. In this paper a formulation is presented to overcome these problems. Travel time functions are replaced by a combination of speed functions and exit flow functions, taking into account time-dependent capacities.

3 — Rolling-Horizon Dynamic OD-Flow Estimation using ITS Data for Dynamic Traffic Assignment
Hossein Tavana, Manager, Operations Research, Continental Airlines, 1600 Smith Street, Mail Code HQSRT, Houston, TX, 77002, United States, htavan@coair.com, Hani Mahmassani

Based on bi-level optimization, two different formulations, namely fixed and free initial-point, are presented. In the former, the initial boundary condition is fixed at the OD-flow values resulting from the previous estimation period. In the latter, the initial condition is imposed by the state of the system (traffic flow) at the start of each rolling estimation period.

4 — Dynamic Traffic Network Design Models: Formulations and Examples
Satish V S K Ukkusuri, University of Texas, Dept. of Civil Eng., Austin, TX, 78712, United States, ukkusuri@uiuc.edu, S Travis Waller

This presentation will address the development of an analytical approach for User Optimal Dynamic Network Design Model. The model is based on the UO DTA LP model developed earlier and guarantees optimality for the case of single destinations. A comparison with the System Optimal Network design model will be made and insights will be provided into the properties and differences between the UO and SO NDP models. Further, some other significant extensions of this work will be discussed such as accounting for demand uncertainty.

5 — An Analytical Model for Traffic Delays and the DUE Problem
Guillaume Roels, United States, roels@mit.edu, Georgia Perakis

We take a fluid dynamics approach to present a macroscopic model for analytically determining travel times in dynamic transportation networks. The model is based on the LWR approach and extends the existing literature by deriving an analytical closed form travel time function that applies to high-density systems but also incorporates shock phenomena. Furthermore, we will embed this approach in order to model the DUE problem. Finally, we will present some preliminary computational results.

■ MD39

Mart-Room F

Modelling and Deploying Strategic Organizational Forms

Cluster: Overseas Collaborations
Invited Session

Chair: Guillermo Granados, Director Center for Quality and Competitiveness, Monterrey Institute of Technology, DIA-Of 1-3 piso. ITESM-CCM, Calle del Puente 222 esq Periferico Sur, Tlalpan, DF, 14380, Mexico, guillermo .granados@itesm.mx

1 — Small T vs Big T Behavior of Knowledge Based Firms: An Empirical Study
Alejandro Ruelas Gossi, Professor Strategy and Management of Technology, United States, aruelas.gossi@ut.edu, Eliazar Gonzalez

The intention of this paper is to show empirical evidence between the firms that get their competitive advantage in the "small and big t economics". Meaning by "T" to the different dimensions that technology can take form. The study used a model called "knowledge-management-sequence" and was carried out using the methodology of partial least squares . The results of the study show that small t is more congruent with developed economies and big t fits better with emerging economies.

2 — A Systemic Approach to Process Improvement as a Way to Accelerate TQM Systems Maturity
Humberto Cantu, Director Quality Center, ITESM - Campus Monterrey, Ave. Eugenio Garza Sada 2501, Col. Tecnologico, Monterrey, NL, 64849, Mexico, hcantu@itesm.mx

The linearity of TQM models and how the continuous improvement is usually undertaken (improving systems individually) are an obstacle for QM systems to contribute to business performance, since it takes a long time for an organization to get TQM to make solid contributions. This paper analyses TQ award models and their assessment tools to prove that the lack of a systemic approach is answer to this hypothesis. The paper suggests how to introduce systems thinking in TQM modeling.

3 — Theoretical Structure behind Baldridge Quality Model
Guillermo Granados, Director Center for Quality and Competitiveness, Monterrey Institute of Technology, DIA-Of 1-3 piso. ITESM-CCM, Calle del Puente 222 esq Periferico Sur, Tlalpan, DF, 14380, Mexico, guillermo.granados@itesm.mx

Malcolm Baldridge Quality Model is a structured set of recommendations for any organization to achieve superior performance. Those recommendations are congruent with behavioral theory. A structured frame for Criteria using generative grammar can serve as a basis for further study of generic recommendations' selection logic.

■ MD40

Mart-Room G

Inventory Management and Supply Chain Coordination

Cluster: Supply Chain Management
Invited Session

Chair: Panos Kouvelis, Washington University in St. Louis, Olin School of Business, Campus Box 1133 1 Brookings Drive, St. Louis, MO, 63130-4899, United States, Kouvelis@olin.wustl.edu

1 — Market-Based Supply Chain Coordination in Supply Chains with Economies of Scale
Yu Xia, Department of Management and Decision Sciences, College of Business and Economics, Washington State University, Pullman, WA, 99164-4736, United States, xiayu@mail.wsu.edu, Bintong Chen, Panos Kouvelis

We study competitive supply markets with multiple suppliers of a single, non-differentiated product and multiple retailers. We devise a price-directed market mechanism, and suggest ways to implement it, to allocate retail orders to the right cost structure supplier. Our analysis identifies the market share of retail orders different suppliers could win and the price winning supplier offer.

2 — On the Benefits of Supply Chain Coordination in Supply Chains with Economies of Scale
Bintong Chen, Department of Management and Decision Sciences, College of Business and Economics, Washington State University, Pullman, WA, 99164-4736, United States, chenbi@mail.wsu.edu, Panos Kouvelis

We study a simple two echelon supply chain with one supplier and one retailer. The retailer faces a stable customer demand but orders at fixed time intervals. The supplier faces lumpy demand and orders in a way that reflects his economies of scale. We provide a tight bound on the magnitude of the maximum savings from coordinating inventory decisions between the supplier and the retailers.

3 — Strategic Outsourcing for Competing OEMs that Face Cost Reduction Opportunities
Yusen Xia, Doctoral Candidate, McCombs School of Business, The University of Texas at Austin, Austin, TX, 78712, United States, ysxia@uts.cc.utexas.edu, Gang Yu, Stephen M. Gilbert

We examine the strategic role of outsourcing in influencing the competition between competing OEMs who have opportunities to invest in technological innovation that would reduce their costs of production. We focus on how outsourcing at least a portion of production to a common supplier can dampen the intensity of competition between the OEMs and on the issue of what types of components should be outsourced vs. produced internally.

4 — Coordinating Production Planning with a Contract Manufacturer
Douglas Thomas, Assistant Professor, The Pennsylvania State University, University Park, PA, 16802, United States, dthomas@psu.edu, Donald Warsing, Xueyi Zhang

We consider a three-echelon system with two decision points: purchase components at Stage One and build product at Stage Two. To explore the effect of OEM-to-contract manufacturer coordination mechanisms on system performance, we analyze four scenarios, spanning a spectrum of coordination from "none" to "complete OEM control."

■ MD41

Mart-Room H

Pricing and Procurement Strategies II

Cluster: Supply Chain Management
Invited Session

Chair: David Simchi-Levi, Professor, MIT, 77 Massachusetts Ave, Bldg 1-171, Cambridge, MA, United States, dslevi@mit.edu

Co-Chair: Julie Swann, Assistant Professor, Georgia Institute of Technology, School of ISyE, 765 Ferst Dr., Atlanta, GA, 30332-0205, United States, jswann@isye.gatech.edu

1 — Strategic Interactions Between Channel Structure and Demand Enhancing Services
Yusen Xia, Doctoral Candidate, McCombs School of Business, The University of Texas at Austin, Austin, TX, 78712, United States, ysxia@mail.utexas.edu, Stephen M. Gilbert, Gang Yu

We first study the interaction between a manufacturer's investment in (service)quality improvement for its product line and a dealer's pricing strategy, and we show conditions under which a dealer can benefit from using decentralized, non-product-line pricing to induce a higher level of investment from the manufacturer. We then extend our analysis to consider the possibility that the manufacturer will outsource the provision of services to dealers.

2 — Delayed Production Strategies with Backlogged and Discretionary Sales
Tieming Liu, MIT, 77 Massachusetts Av, RM 5-014, Cambridge, MA, 02139, United States, tmliu@MIT.EDU, David Simchi-Levi

We consider the problem of determining production quantities in a multi-period horizon with limited production capacity and non-stationary stochastic demands. We analyze the Delayed Production Strategy with assumptions that sales may be backlogged or discretionary. We show that a modified order-up-to policy, the (S,R,B) policy, in which S is the base-stock level, R is the minimum amount of inventory to be reserved for the future and B is the maximum amount of demand to be backlogged, is optimal.

3 — Channel Coordination in Transportation Contracting: A Percent Deviation Approach
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 transportation contract structures to encourage information sharing and improve system performance. The carrier may preposition trucks at a low cost in response to an advance order from the shipper. The shipper finalizes the order and is charged a penalty for orders above or below a percent deviation from the forecast. We consider the best way to establish prices, penalties, and the deviation percentage to coordinate the channel under various compliance and information scenarios.

4 — Dynamic Pricing on the Internet
Alex X. Carvalho, University of British Columbia, Statistics Department, Vancouver, BC, Canada, carvalho@stat.ubc.ca, Martin Puterman

A potential buyer of a product arrives at a web site; the site posts a price for the product and the buyer decides whether or not to purchase the product based on the posted price. This talk describes a dynamic approach to setting prices in this environment assuming that the probability of purchase follows a logistic regression model with unknown parameters. The decision maker faces the trade-off between optimizing immediate revenues and learning the parameters to maximize future revenues in a short horizon. The proposed approach allows the decision maker to take into account information specific to the buyer. We show how the variance of the estimates can affect the expected revenue loss and propose a policy based on a Taylor series expansion to the value function.

■ MD42

Mart-Room I

New Applications of Pricing Optimization

Sponsor: Revenue Management & Dynamic Pricing
Sponsored Session

Chair: Jon A. Higbie, Senior Manager, Manugistics, 2839 Paces Ferry Road, Suite 1000, Atlanta, GA, 30339, United States, jhigbie@manu.com

1 — Optimal Pricing through Negotiation
Ahmet Kuyumcu, Director, Operations Research, Zilliant, Inc., 4301 Westbank Drive, Suite B-250, Austin, TX, 78746, United States, ahmet.kuyumcu@zilliant.com, Mehmet Karaaslan

Many companies including manufacturers and distributors commonly establish prices, margins, and other trade terms through negotiations. This presentation defines a bargaining process that utilizes the transactional data and gives statistical optimization procedures to identify optimal target and floor prices.

2 — Floor Pricing at Wholesale Auto Auctions
Thomas Qi, Vice President, JPMorgan Chase, Financial & Risk Management, Garden City, NY, United States, Thomas.Qi@chase.com

Wholesale automobile trade is conducted by ascending bid auctions. The sellers reject a winning bid if it is below a floor price. This presentation exploits a multi-period model that considers: 1) stochastic arrival of winning bids; 2) that unsold units are offered again at auctions at later dates; and 3) that vehicles depreciate over time, in determining an optimal floor pricing strategy that maximizes the seller's revenue from auction sales.

3 — Airline Revenue Management and Low-Fare Carriers
E. Andrew Boyd, Chief Scientist and Senior Vice President, PROS Revenue Management, 3100 Main Street, Suite 900, Houston, TX, 77002, United States, aboyd@prosrm.com

New low-fare carriers are having a tremendous impact on the airline industry. We discuss the impact of these low-fare carriers on airlines practicing traditional revenue management, and present alternative mathematical models for airlines operating with the simplified product structure used by many low-fare carriers.

4 — Interest Rate Response Modeling for Deposit Products
Jon A. Higbie, Senior Manager, Manugistics, 2839 Paces Ferry Road, Suite 1000, Atlanta, GA, 30339, United States, jhigbie@manu.com

For retail deposit products, the pricing problem becomes one of setting interest rates (of return) so as to maximize profit for the enterprise. In this paper, we examine methods for setting interest rates in a local (geographic market). Emphasis is on estimation of local market rates, and on the development of an interest rate response model. A process for applying these models to manage interest rates is also discussed.

■ MD43

Mart-Room J

Design of Auction Mechanisms

Cluster: Auctions
Invited Session

Chair: David Wu, United States, sdw1@lehigh.edu

1 — Efficient Auction Mechanisms for Supply Chain Procurement
Rachel Chen, Cornell University, 401 Sage Hall, Ithaca, NY, 14853, United States, rc72@cornell.edu, Rachel Zhang, Robin Roundy, Ganesh Janakiraman

We consider multi-unit Vickrey auctions for procurement in supply chain settings. This is the first paper that incorporates transportation costs into auctions in a complex supply network. We introduce three auction mechanisms that induce truth-telling from the suppliers. Two of them make simultaneous production and transportation decisions so that the supply chain is allocatively efficient, and the third determines the production quantities before making the shipment decision.

2 — Dominant Strategy Double Auction with Pair-Related Cost
Leon Y. Chu, University of Florida, Dept. of ISE, Gainesville, FL, United States, zhuyang@ufl.edu, Zuo-Jun Max Shen

We present a double auction mechanism that is strategy-proof, weakly budget-balanced and asymptotically efficient for exchange environment with pair-related (transportation) costs. The mechanism can be applied to inventory sharing systems.

3 — Anytime Strategyproof Mechanism Design
David Parkes, Asst. Prof., Harvard University, 33 Oxford Street, Cambridge, MA, 02138, United States, parkes@eecs.harvard.edu, Grant Schoenebeck

We consider the problem of anytime mechanism design. This provides a new paradigm for the solution of hard and inapproximable optimization problems in which private information must be elicited from self-interested agents (e.g. combinatorial auctions). An anytime strategyproof mechanism computes a better approximation given additional computational resources, and retains strategyproofness whenever it is terminated.

4 — Multi-Unit Auction with U-Shaped Cost Structures
David Wu, Iacocca Professor and Chair, Lehigh University, Dept. of Industl & Sys Eng., 200 W. Packer Ave., Bethlehem, PA, 18017, United States, david.wu@lehigh.edu, Mingzhou Jin

We study multi-unit auctions for industrial procurement where the suppliers' cost structure is U-shaped, as justified by the economy (diseconomy) of scale in their production (capacity) costs. The winner determination problem for this auction is known to be NP-Complete. We develop a specialized algorithm that significantly outperforms the commercial mix integer solver. We further investigate multi-unit sequential auctions under the assumptions of myopic best response and pricing dynamics.

■ MD44

Mart-Room K

Optimization in Airline Industry II

Sponsor: Aviation Applications
Sponsored Session

Chair: Amy Cohn, U of Michigan, 2797 IOE Building, 1205 Beal Avenue, Ann Arbor, MI, 48109-2117, United States, amycohn@umich.edu

1 — Dominance and Indifference in Airline Crew Scheduling
Amy Cohn, U of Michigan, 2797 IOE Building, 1205 Beal Avenue, Ann Arbor, MI, 48109-2117, United States, amycohn@umich.edu, Ko-Ming Liu, Shervin AhmadBeygi

A key difficulty encountered in airline planning is the combinatorial explosion that occurs with even fairly small problem instances. The enormous number of feasible solutions greatly impacts tractability. This can be particularly problematic when developing real-time recovery plans, integrating planning steps, or seeking more robust solutions. In today's talk, we present some preliminary ideas about how to exploit properties of dominance and indifference when solving these difficult problems.

2 — Solving Airline Planning and Operations Problems with a Special Purpose Modeling Language
Stefan Karisch, Carmen Systems, 1800 McGill College Avenue, Suite 2800, Montreal, QC, H3A 3J6, Canada, stefank@carmensystems.com

Airline planning and operations problems are complex and require detailed and accurate modeling to be solved efficiently and effectively. The challenge for optimization systems is to be able to adapt timely to a changing environment and to model and solve the changed problems accurately. We describe a special purpose modeling system and its application in airline planning and operations. We give concrete examples and thereby address various aspects of problem solving.

3 — Optimization Models for Dynamic Slot Exchange
Michael Ball, Professor, University of Maryland, R H Smith School of Business, Van Munching Hall, College Park, MD, 20742, United States, MBall@rhsmith.umd.edu, Thomas Vossen

We interpret the compression algorithm, currently used within the ground delay program (GDP) slot allocation process, as a mediated 1-for-1 exchange mechanism. Based on this interpretation, we develop an extension that employs 2-for-2 exchanges. An efficient integer programming model is developed to solve the mediator's problem. We also show that the 2-for-2 exchange mechanism can substantially improve the ability of airlines to optimize their internal cost functions.

■ MD45

Mart-Room L

Logistics Planning

Contributed Session

Chair: Karolina Glowacka, Ph.D. student, University of Pittsburgh, Department of Operations Research, 343 Mervis Hall, Pittsburgh, PA, 15260, United States, kaglowacka@katz.pitt.edu

1 — The Stochastic Load Planning Problem in Hub-and-Spoke Networks
Cheng-Chang Lin, Professor, National Cheng Kung University, 1 University Road, Tainan, tw, 701, Taiwan, cclin@mail.ncku.edu.tw

Time-definite common carriers, third-party logistics providers provide time commitment door-to-door services. The stochastic load planning in hub-and-spoke networks is to determine freight paths and a balanced trailer network to minimize the expected operating cost. The first-phase and recourse are pure integer programs if demands are discrete. We developed a heuristic based on its optimality conditions. The results showed a small fleet size with lower operating cost over the deterministic plan.

2 — An AI Planning Approach to the Vehicle Routing Problem with Stochastic Demands
Karolina Glowacka, Ph.D. student, University of Pittsburgh, Department of Operations Research, 343 Mervis Hall, Pittsburgh, PA, 15260, United States, kaglowacka@katz.pitt.edu

We present a new approach to solving the vehicle routing problem with multiple vehicles and stochastic demands at the destinations. Using an AI planning-type model, each vehicle is represented as an intelligent agent, working cooperatively with all the other agents to come up with a restocking policy. The strengths of this method as well as preliminary computational results will be discussed.

3 — Model and Algorithm for Multi-Period Sea Cargo Mix Problem
Chengxuan Cao, Research Fellow, National University of Singapore, The Logistics Institute - Asia Pacific, Blk AS6, Level 5, 11 Law Link, Singapore, SG, 119260, Singapore, tliccx@nus.edu.sg, James Ang, Hengqing Ye

We describe structure and characteristics of the cargo mix problem, and formulate as a Multi-Dimension Multiple Knapsack Problem (MDMKP). In particular, the MDMKP is an optimization model that maximizes the total profit in several periods, subject to the limited shipping capacity and the limited number of empty containers in the origin port, etc. Algorithm is proposed to obtain the near optimal solution for the problem. Numerical experiments demonstrate the efficiency of the algorithm.

4 — Polynomial-Time Algorithms for Capacitated Two-Level Lot-Sizing Problems with Backlogging
Zeynep Alisan, Graduate Student, University of Florida, Dept. of Industrial and Systems Eng, 303 Weil Hall, PO Box 116595, Gainesville, FL, 32611-6595, United States, zeynep@ufl.edu, H. Edwin Romeijn

We study lot-sizing problems where retailer demands should be satisfied at minimum production, transportation, inventory holding, and backlogging costs. Inventory can be held at the supplier level, and there is either backlogging only, or backlogging and inventory holding at the retailer level. Production costs are concave, production capacities are stationary, and inventory and backlogging costs are linear. We derive polynomial time algorithms for certain transportation cost structures.

5 — A Heuristic Algorithm for the Truckload VS Less-Than-Truckload Problem
Ching-Wu Chu, Associate Professor, National Taiwan Ocean University, Dept of Shipping and Transportation, 2 Pei-Ning Rd, Keelung, KL, 20224, Taiwan, cwchu@mail .ntou.edu.tw

In reality, we are facing the uncertainty of demand. When the total demand is greater than the whole capacity of owned vehicles, the logistics managers may consider using an outsider carrier . In this paper, we address the problem of routing limited vehicles from a central warehouse to customers with known demand. The objective is to route the private vehicles and to make a selection of less-than-truckload carriers by minimizing a total cost function.

■ MD46

Mart-Room M

Applied Research and Problem Solving: Practice and Theory

Sponsor: Computing
Sponsored Session

Chair: Jeff Kennington, Professor, Southern Methodist University, EMIS Dept., School of Engineering, Dallas, TX, 75275, United States, jlk@engr.smu.edu

1 — Solving Large Mixed Integer Network with Side Constraint problems with an Integer Version of EMNET
Richard McBride, United States, mcbride@usc.edu, John Mamer, Robert Brooks

EMNET has been shown to be very efficient in solving large embedded network with side constraints LP problems such as multi-commodity flow problems. We report on progress in developing an integer version of EMNET. We also report on solving LNG models with more than 300,000 general integer variables using a special transformation.

2 — Polynomial-Time Algorithms for the Conditional Covering Problem on Special Structures
Jennifer Horne, University of Arizona, PO Box 210020, Tucson, AZ, 85721, United States, jahorne@raytheon.com, Cole Smith

The Conditional Covering Problem (CCP) is a facility location problem on a graph, wherein facilities cannot cover the locations at which they are placed. Although the CCP is strongly NP-Hard on general graphs, there exist special graph structures that permit polynomial-time solutions to the CCP via dynamic programming. We discuss such algorithms and analyze their implications in constructing effective heuristic and exact solution procedures for the general CCP.

3 — University/ Industry Partnerships and Engagements
David Miller, United States, dmiller@cba.ua.edu

This paper focuses on a successful university outreach initiative that has provideD opportunities for over 300 graduates students to work on applied research and problem solving endeavors over the past 18 years. Several cases involving OR applications will be presented to illustrate the approach used and critical success factors.

■ MD47

Atlanta G, 7th Floor

Software Demonstration

Cluster: Software Demonstrations
Invited Session

1 — Maximal Software Inc. - Introducing New Release of MPL Modeling System for Optimization with New and Enhanced Features
Bjarni Kristjansson, President, Maximal Software Inc., 2111 Wilson Boulevard, Suite 700, Arlington, VA, 22201, United States, bjarni@maximalsoftware.com

We will be demonstrating 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.

2 — ILOG, Inc. - Special Release Preview - New CPLEX Version 9.0
Irv Lustig, Manager, Technical Services, ILOG Direct, ILOG, Inc., 25 Sylvan Way, Short Hills, NJ, 07078, United States, ilustig@ilog.com

The coming release of CPLEX 9.0 delivers new breakthrough performance enhancements to all the CPLEX optimizers, as well as other exciting new feature firsts. Learn about diagnosing and fixing infeasible models, solving new problem types, interacting with XML, using logical constructs to describe linear models and more. See it first, at INFORMS.

Tuesday 8:00am - 9:30am

■ TA01

Westin-Intl. A, 6th Floor

Stochastic Processes

Contributed Session

Chair: Minqing Gong, University of Alabama, Dept. of Mathematics, Tuscaloosa, AL, 35487, United States, gong@bama .ua.edu

1 — Time-Dependent Solutions to Queueing Systems
Jeff Griffiths, Professor, Cardiff University, Mathematics Institute, Senghennydd Road, Cardiff, CF24 4YH, United Kingdom, griffiths@cardiff.ac.uk, Janet Williams

Usable time-dependent solutions of queueing systems have received little attention in the literature, apart from a few specialised cases. In many applications the OR practitioner has to resort to simulation techniques to deal with problems where the queueing process evolves in time. In this paper new methodology is developed with the aim of presenting the practitioner with a simple set of expressions enabling time-dependent values to be determined for the usual summary measures of the queue.

2 — A Policy Iteration Algorithm for Solving Average Reward semi-Markov Decision Problems
Abhijit Gosavi, Assitant Professor, State University of New York, Buffalo, 342 Bell Hall, Box 602050,, Buffalo, NY, 14620, United States, agosavi@buffalo.edu

We present a modified policy-iteration algorithm for solving average reward semi-Markov decision problems. We also present some numerical results and a skeleton convergence analysis .

3 — Waiting Tme in a Combined First-Come-First-Served and Shortest-Time-First Queue
Minqing Gong, University of Alabama, Dept. of Mathematics, Tuscaloosa, AL, 35487, United States, gong@bama.ua.edu, Patrick Wang

In this paper, we study the regular M/G/1 queue with a combination of FCFS and STF queueing disciplines. The advantage of this combined discipline is the reduction of mean waiting time. Customers are divided into two groups: an FCFS group and an STF one. Customers are first put into FCFS group and then are moved into STF group. An embedded Markov chain is formulated at the times when the STF group is empty. Results are compared with regular M/G/1 queues of FCFS.

■ TA02

Westin-Intl. B, 6th Floor

Probabilistic Methods in Finance and Insurance

Cluster: Financial Engineering
Invited Session

Chair: Ioana Popescu, INSEAD, Decision Sciences, Fontainebleau, CE, 77300, France, ioana.POPESCU@insead.edu

1 — Variations on Some Long-Term Optimal Asset Allocation Techniques
Alex Collomb, PhD Candidate, Stanford University, Management Science & Engineering, Mountain View, CA, 94305-4026, United States, acollomb@leland.stanford.edu, Walter Murray

We investigate whether apparent patterns of market inefficiencies already documented in the existing literature (e.g. the formation of a "market bubble") can be detected early enough and hence exploited to improve performance in a multi-stage long-term asset allocation setting. We propose and test a few simple heuristics against historical data and discuss the statistical and structural limitations of our approach.

2 — Pricing American-Style Path-dependent Options with Early Exercise
Sungjoo Lee, Ph.D and Quantitative & Computational Finance student, School of Industrial and Systems Engineering / Georgia Institute of Technology, 353 Ferst Dr., Georgia Tech, Atlanta, GA, 30332, United States, goldconn@isye.gatech.edu, David Goldsman, Shijie Deng

We investigate the problem of pricing American-style path-dependent financial contingent claims (or options) via simulation. We parameterize the early exercise boundary of an American option and maximize the value of the option over the domain of the exercise boundary using regression. The price of the option is then obtained by simulation with respect to the optimized boundary.

3 — Upper Bounds on the Prices of a Class of Multi-Asset Options with Convex Payoffs
Karthik Natarajan, Singapore-MIT Alliance, United States, karthik_natarajan@yahoo .com, Dimitris Bertsimas, Chung-Piaw Teo

We consider the problem of computing the optimal upper bound on the price of a generic class of multi-asset European options with convex payoffs. Under the setting where only partial information on the individual asset prices is known, we show that optimal bounds can be computed efficiently with convex programming techniques. For two specific options - the outperformance option and the basket option, we propose efficient algorithms and bounds under this setting.

4 — Optimal Bounds for Sums of Positive Risks: Applications in Finance and Insurance.
Ioana Popescu, INSEAD, Decision Sciences, Fontainebleau, CE, 77300, France, ioana .POPESCU@insead.edu

We prove sharp bounds on the distribution of the sum of non-negative dependent risks, given their means and covariances. We apply these results to derive sharp upper and lower bounds on stop-loss premia in insurance and basket options in finance. More generally, we show how to derive sharp bounds on functional expectations of the sum of non-negative risks by solving a deterministic non-linear optimization problem in one or three variables.

■ TA03

Westin-Intl. C, 6th Floor

Panel: The August 14, 2003 Northeast Blackout

Sponsor: Energy, Natural Resources and the Environment
Sponsored Session

1 — Panel: The August 14, 2003 Northeast Blackout
Panelists: Jonathan Jacobs, PA Consulting Group, 390 Interlocken Crescent, Suite 410, Broomfield, CO, 80021, United States, Jon.Jacobs@paconsulting.com, Frank Felder, Michael Rothkopf, Hung-po Chao

On August 14, 2003, the Northeast and Midwest were struck by the first widespread bulk power system outage in twenty-five years. Since then, various potential causes have been suggested for the outage — both proximate causes, and underlying causes. Significant technical, economic and operational issues must be considered including: Measurement of reliability; assessment of reliability worth; expanding the grid optimally (if at all); improving operational protocols; tools for grid simulation and operation; impact of market restructuring on grid reliability; market-based approaches to enhance reliability; incentives and disincentives for distributed generation Operations research and management science will be critical to the resolution of these issues. This session will provide a forum to begin crafting OR/MS responses to the perceived requirements of grid reliability. An expert panel will provide some thoughts and background, but the session is anticipated to provide a public forum for general discussion.

■ TA04

Westin-Intl. D, 6th Floor

Daniel H. Wagner Prize Competition Awards

Sponsor: The Daniel H. Wagner Prize for Excellence in Operations Research
Sponsored Session
Chair: Joseph H. Discenza

President and CEO, SmartCrane, LLC, 2 Eaton Street Suite 500, Hampton, VA, 23669, United States, joeh@discenza.com

1 — Daniel Wagner Prize Ceremony

■ TA05

Westin-Intl. E, 6th Floor

Pricing in Queueing and Service Systems

Sponsor: Applied Probability
Sponsored Session
Chair: Serhan Ziya, University of North Carolina, Department of Operations Research, 210 Smith Building, CB #3180, Chapel Hill, NC, 27599-3180, United States, ziya@isye.gatech.edu

Co-Chair: Hyun-soo Ahn, Assistant Professor, University of California, 4185 Etcheverry Hall, Berkeley, CA, 94720, United States, ahn@ieor.berkeley.edu

1 — Pricing in a Single Queue with Two Customer Classes With and Without Price Discrimination
Antonis Printezis, Case Western Reserve University, Weatherhead School of Management, Cleveland, OH, United States, AntP@cwru.edu, Apostolos Burnetas

We consider the problem of admission pricing in a single server queueing system with two classes of customers differentiated according to their cost of waiting. We assume independent customer behavior with and without price discrimination, identify the optimal pricing policy in both cases and compare the system owner's profits.

2 — Demand Management in Delay-Sensitive Markets
Kristin Fridgeirsdottir, London Business School, Regent's Park, London, NW1 4SA, United Kingdom, kristin@london.edu, Sam Chiu

Pricing and marketing are two effective tools for managing demand. In this paper we will present models that capture pricing and marketing investments in a service facility servicing delay-sensitive customers. The expected delay cost plays an important role in this problem and we will analyze some of its structural properties.

3 — Warranty Outsourcing Among Competing Vendors
Wei Huang, University of North Carolina, CB#3180, Chapel Hill, NC, 27599, United States, whuang@email.unc.edu, Vidyadhar Kulkarni, Jayashankar Swaminathan

We consider a game-theoretic model of a warranty repair allocation problem with one manufacturer and multiple vendors where the vendors compete with each other in setting prices and repair rates for their services, and the manufacturer responds by optimally allocating its products to them for services to minimize the repair and waiting cost. We examine the pricing and capacity decisions facing vendors and study the Nash equilibrium.

■ TA06

Westin-Intl. F, 6th Floor

Joint Session OR in Biology/Computing: Computational Biology I

Clusters: OR in Biology, Computing
Invited Session
Chair: Harvey Greenberg, Mathematics Department, University of Colorado at Denver, Denver, CO, United States, Harvey .Greenberg@cudenver.edu

Co-Chair: Allen Holder, Trinity University, 715 Stadium Drive, San Antonio, TX, 78212, United States, aholder@trinity .edu

1 — A Graph-Theoretic Approach to Separation of y- and b-ions from Tandem Mass Spectrometry Data and Applications to de novo Sequencing
Ying Xu, Oak Ridge National Laboratory, P.O. Box 2008, 1060 Commerce Park, MS-6480, Oak Ridge, TN, 37830-6480, United States, xyn@ornl.gov, Victor Olman, Chongle Pan, Bo Yan

Identification of y- and b-ions in a tandem mass spectrometry spectrum represents a fundamental problem in mass spectrometry data interpretation of peptides. A capability for accurate separation between y- and b-ions will provide powerful tool to facilitate reliable ways of de novo sequencing, identification of post-translational modifications (PTMs) and allows more effective methods for peptide identification through combining database search based methods and de novo sequencing approaches. We have developed a highly effective method, based on graph-theoretic approach, to solve this problem. We have formulated the problem as a graph partitioning problem to optimize a nontrivial objective function, and developed a novel and efficient divide-and-conquer algorithm for solving the problem. Our test on a set of 20 peptides has demonstrated the method is highly effective.

2 — Solving Tangle Equations with KnotPlot.
Isabel Darcy, Assistant Professor, University of Iowa, Department of Mathematics, 14 MacLean Hall, Iowa City, IA, 52242, United States, idarcy@math.uiowa.edu, Robert Scharein, Stephen Levene

A tangle is a 3-dimensional ball containing a finite number of arcs. A protein can be modeled by a 3-d ball. If the protein binds to 2 segments of DNA, the 2 DNA segments can be thought of as 2 arcs embedded in the 3-d protein ball. KnotPlot is a computer visualization program created by Rob Scharein for manipulating knots. A new subroutine of KnotPlot which solves tangle equations which model protein action will be demonstrated.

3 — Palindromes in SARS and Other Coronavirus Genomes
Ming-Ying Leung, Professor, University of Texas at El Paso, Department of Mathematical Sciences, 500 W University Avenue, El Paso, TX, 79968, United States, mleung@utep.edu, Hans Heidner, Kwok Pui Choi, David Chew

Genome sequence analysis of the novel Severe Acute Respiratory Syndrome coronavirus (SARS-CoV) reveals sequence features relating to the number, lengths, and location distribution of palindromes. Statistical criteria for assessing these sequence features are obtained based on random sequence models using Poisson type approximations and scan statistics. In comparison to other coronaviruses, several unique features, implicated in secondary structures and protein binding, are observed in SARS-CoV.

■ TA07

Westin-Intl. G, 6th Floor

Pricing in Electricity Markets

Sponsor: Energy, Natural Resources and the Environment
Sponsored Session
Chair: Shi-Jie Deng, Assistant Professor, Georgia Institute of Technology, Industrial & Systems Engr, Atlanta, GA, 30332, United States, shijie.deng@isye.gatech.edu

1 — Modelling and Forecasting UK Spot Electricity Prices
Derek Bunn, Professor, London Business School, Sussex Place, Regents Park, London, NW1 4SA, United Kingdom, DBunn@london.edu, Nektaria Karakatsani

We present a structural analysis of the half-hourly spot prices in the UK, using a regime switching and TGARCH approach. Questions of market efficiency and agent behaviour emerge from the various drivers of price dynamics, even in a market with apparently low prices. The predictability of the data from this framework is also analysed.

2 — A System Approach to Modeling Stochastic Electricity Prices
Jorge Valenzuela, Assistant Professor, Industrial and Systems Engineering, Auburn University, United States, jvalenz@eng.auburn.edu

Knowledge of the statistical distribution of real-time electricity prices is useful in risk assessment and improved decision-making. In this talk, preliminary results of a bottoms-up systems based approach to modeling stochastic market prices of electricity under a deregulated market are discussed.

3 — Valuation and Optimal Interruption for Interruptible Electricity Contracts
Stathis Tompaidis, Assistant Professor, University of Texas at Austin, McCombs School of Business, MSIS Department, Austin, TX, 78712, United States, Stathis .Tompaidis@bus.utexas.edu, Sergey Kolos, Ross Baldick

We consider interruptible electricity contracts issued by a distributor of electricity and provide an equilibrium model to determine electricity prices, based on stochastic models of supply and demand. In the context of this model we quantify the value of interruptible contracts and describe the optimal interruption strategy. Our numerical results indicate that in a deregulated, competitive, market interruptible contracts can alleviate supply problems associated with spikes of price and demand.

4 — Optimal Hedging of Electric Power Supply Contracts under Default Risk
Shi-Jie Deng, Assistant Professor, Georgia Institute of Technology, Industrial & Systems Engr, Atlanta, GA, 30332, United States, shijie.deng@isye.gatech.edu, Youyi Feng

We investigate the problem of hedging a power supply contract in which a power marketer is obligated to fulfill an end user's total usage request at a predetermined fixed rate at the service time. The contract seller is exposed to both price and volumetric risks. We develop a hedging strategy for a power marketer to maximize the expected profit while keeping the probability of defaulting on the supply contract being small.

■ TA08

Westin-Intl. H, 6th Floor

Military Simulation Applications

Sponsor: Simulation
Sponsored Session

Chair: Keebom Kang, Naval Postgraduate School, Grad Sch of Bus and Pub Policy, Monterey, CA, United States, kkang@nps.navy.mil

1 — An Integrated Multi-criteria and Simulation Approach to Cost Benefit Analysis of Inventory Tracking
Kenneth Doerr, Naval Postgraduate School, Grad School of Bus & Pub Policy, Monterey, CA, United States, khdoerr@nps.navy.mil, William Gates, John Mutty

We will present the results of a cost-benefit study of an inventory tracking system for ordnance. The system is based on radio-frequency tags that also monitor environmental conditions. As many of the benefits of the system were difficult to quantify (e.g., reduced accidents, increased readiness) the financial simulation was supplemented by a multi-criteria analysis, which allowed the financial benefits to be understood in a broader context.

2 — Analysis Issues with Agent-Based Military Simulations
Ray Hill, Wright State University, Dep of Biomed, Ind & Human Factors Eng, Dayton, OH, 45424, United States, ray.hill@wright.edu, Lance Champagne

Multi-agent simulations are of great interest to the military modeling and simulation community due to their ability to represent complex situations based on the interactions among the agents . An intriguing aspect, "emergent behavior," arises due to the interactions among the agents within the model. We summarize four military-based agent-based simulation models examining and the emergent behavior uncovered within each model and discussing validation issues associated with emergent behavior.

3 — Simulation Analysis for Distribution Incentive Pay in the US Navy Enlisted Personnel Assignment
William Gates, Naval Postgraduate School, Grad School of Bus & Pub Policy, Monterey, CA, United States, brgates@nps.navy.mil, Karsten Logemann

This research examines the impact on US Navy enlisted assignments of using Assignment Incentive Pay to attract sailors to less attractive Navy billets. It develops a simulation model to test alternative assignment mechanisms (e.g., two sided matching and optimization) and alternative assignment business rules (e.g., number of preferences specified, factor weighting, frequency of assignment cycle). Assignment performance is measured by sailors matched, unstable matches, and social welfare.

4 — Agent-based Models for Expeditionary Logistics
Susan Sanchez, Naval Postgraduate School, Operations Research Dept, Grad School of Bus & Pub Policy, Monterey, CA, 93943-5219, United States, ssanchez@nps.navy.mil, Eric Wolf

While logistics support is often described in terms of hard numbers, such as the number of meals delivered or miles driven, logistical scenarios are exactly the type of loosely-defined problems that lend themselves to study using agent-based models. We use data-farming techniques to explore a humanitarian assistance/disaster relief simulation to identify those factors affecting the success of the logistics support mission.

5 — Military Supply Chain Analysis using Simulation Modeling
Keebom Kang, Naval Postgraduate School, Grad Sch of Bus and Pub Policy, Monterey, CA, United States, kkang@nps.navy.mil, Ira Lewis

A supply chain strategy to provide logistics support to military fighting forces is an important part of the military mission. The significant changes in potential combat scenarios in recent years mandate a substantially more flexible and more responsive supply chain logistics process. We will show how to apply simulation modeling techniques to study military-unique supply chain problems.

■ TA09

Westin-Vinings 1, 6th Floor

Education Applications

Contributed Session

Chair: Farzin Heidari, Associate Professor, Texas A&M University-Kingsville, 4610 Wales Drive, Corpus Christi, TX, 78413, United States, farzin.heidari@tamuk.edu

1 — Introduction to AutoMod Simulation Software
John S. Carson, Consulting Technical Manager - AutoMod, Brooks Automation, 1355 Terrell Mill Rd, Bldg 1482, Suite 200, Marietta, GA, 30067, United States, john .carson@brooks.com

AutoMod is one of the leading simulation software packages. This session is for those who might desire to teach AutoMod or use it in a research project. AutoMod offers complete control through its simulation language, material handling templates for conveyors and vehicle systems, and 3-D animation based on a scale drawing. It can handle a wide variety of applications and is especially well-suited for applications in material handling, manufacturing, distribution, and controls development.

2 — Models and Practices in Production and Inventory Management
Marco Aurélio Mesquita, Professor - PhD, Universidade de Sao Paulo, Av. Prof. Almeida Prado, trav. 2, n. 128, Depto de Engenharia de Produa, Sao Paulo, SP, 05508-900, Brazil, mamesqui@usp.br, Miguel Cezar Santoro

In this paper the reader will find a descriptive research, which aims to identify the reasons why people do not use operations research models in the production and inventory management. The results of the literature and field research reveal that both the complexity and the lack of experience with the O.R. approach prevent the development and use of decision support systems based on more sophisticated models. In order to bridge the gap between theory and practice, some actions are presented.

3 — Learning to Interact Through Simulated Education
Kelley Duncanson, Doctoral Student, Jackson State University, Ph.D. Program in Business, 1400 J. R. Lynch Street, Jackson, MS, 39217, United States, kelley.m .duncanson@jsums.edu

Learning how to interact with stakeholders can dramatically improve job performance. This business simulation case study explores the design and components of an application, the advantages and limitations of improving critical skills for human interaction in the workplace, and the evaluative assessment function of the program. Students as well as practitioners now have a way to develop and practice their stakeholder management skills in an exciting way.

4 — Information Technologies and Students' Satisfaction
Mercedes Marzo Navarro, University of Zaragoza, FAC. CC.EE.EE. Zaragoza, Zaragoza, Spain and Canary Islands, mmarzo@unizar.es, Ana Gargallo Castel, Luisa Esteban, Amador Marin

The main objective of this paper is to analyse how the new information technologies (IT) have affected the level of students' satisfaction, driving down some of the cost of education, solving problems related to time, distance, and location. On the other hand, we obtain that old technologies, such as telephone or traditional mail, also offer high value. The obtained results show that integral teaching, linking new and traditional technologies, brings with it a greater satisfaction.

5 — Industrial Robot Safety Standards
Farzin Heidari, Associate Professor, Texas A&M University-Kingsville, 4610 Wales Drive, Corpus Christi, TX, 78413, United States, farzin.heidari@tamuk.edu

Industrial robots are programmable multifunctional mechanical devices which are designed to move materials, parts, tools or specific devices. Robots can be programmed to perform variety of tasks. Implementation of an effective robotic

safeguarding system should be based on a careful analysis of the robot system, work envelope,and its uses. The focus of this presentation will be on the safety considerations related to robotic workstations and preventative measures to avoid injuries to personnel.

■ TA10

Westin-Vinings 2, 6th Floor

Panel: On-Line Delivery of Management Science and Statistics

Sponsor: Education (INFORM-ED)
Sponsored Session

Chair: John Lawrence, Department of Information Systems and Decision Sciences, California State University, Fullerton, Fullerton, CA, 92834, United States, jlawrence@fullerton.edu

1 — Panel Discussion: On-Line Delivery of Management Science and Statistics
Panelists: John Lawrence, Gary Waissi, Scott Stevens

Three approaches to on-line delivery of management science/statistics will be demonstrated. Successes and failures, observations and suggestions for improvement will be discussed.

■ TA11

Westin-Augusta 1, 7th Floor

Tutorial: A Structure of Spatial Information Metadata for Web Searching: Fuzzy Set Theoretic Approach

Cluster: Tutorials
Invited Session

1 — A Structure of Spatial Information Metadata for Web Searching: Fuzzy Set Theoretic Approach
E. A. Shyllon, University of Melbourne, Department of Geomatics, Victoria, 3010, Australia, eashyllon@sunrise.sli.unimelb.edu.au, Gary J. Hunter

The current free-text method of reporting spatial metadata retrieves too many documents or "hits". There is a need to find a useful structure or pattern in the spatial information metadata for effective web searching. Like other objects, spatial metadata are documents-objects (fuzzy spatial objects) whose state and behaviour are well defined by the information they bear or carry. They have "unique-identifiers" and "state" described by the attributes or core-elements (vague concepts), which can be modelled by fuzzy set.

■ TA12

Westin-Augusta 2, 7th Floor

Cellular Manufacturing

Contributed Session

Chair: Rajan Suri, Professor, University of Wisconsin-Madison, Dept. of IE, 1513 University Avenue,, Madison, WI, 53706, United States, suri@engr.wisc.edu

1 — Robust Design of Dual Resource Constrained Cellular Manufacturing Systems
H. Hakan Balci, Graduate Research Assistant, Auburn University, 207 Dunstan Hall, Auburn, AL, 36849, United States, balcihh@eng.auburn.edu, M.Bulent Durmusoglu, Mustafa Akhun

Cellular manufacturing systems (CMS) had a wide application area, although noise factors like fluctuations in demand and setup times, machine breakdown could easily decrease the performance . In this study, a methodology for the robust design of a dual resource constrained CMS is developed to avoid the noise factors. The methodology is aimed to find the optimum design using response surface technique with a steepest ascent heuristic search procedure.

2 — A Directional Decomposition Heuristic for Machine-Cell Location Problems
Bhaba Sarker, Elton G. Yates Professor, Louisiana State University, Dept. of Industrial Engineering, 3128 CEBA Building, Baton Rouge, LA, 70803-6409, United States, bsarker@lsu.edu, Junfang Yu

A one-dimensional machine-cell location problem that considers jobs with sequenced operations is addressed here. The problem assigns equal number of cells to equal number of equally spaced locations. A directional decomposition heuristic is developed here to minimize the total flows between the cells. The directional decomposition of inter-cell flows and incremental improvement of the computational capability enhance efficiency of the search procedure. Performance measures show good results.

3 — Evaluation of Manufacturing Cell Formation
Thanakorn Kiatbanlue, Associate Professor, King Mongkut's Institute of Technology North Bangkok, 1518 Piboonsongkram Rd., Bangsue, Bangkok, 10800, Thailand, tkl@kmitnb.ac.th

A cell formation problem in a cellular manufacturing system is studied. Four approaches are explored: the rank order clustering, the similarity coefficient, the TSP cell formation, and the closed neighbor algorithm. The simulation results show that the grouping efficiency from the TSP cell formation is 95.48%, which is higher than other methods. But the similarity coefficient algorithm provide a better result in terms of material handling cost, the transportation cost, and the opportunity cost.

4 — A Heuristic Approach for the Machine Loading Problems in Flexible Manufacturing Systems
Jong-Hwan Lee, Graduate Assistant, Research, TEES, 3625 Wellborn Road #1804, Bryan, TX, 77801, United States, jhlee@tamu.edu, Cesar Malave

This paper proposes an approach to the machine loading problem when workload and tool magazine capacity of each machine are restrained. This approach reduces the maximum workload of the machines by partially grouping them and deals with situations where machines require different processing times. The processing time of the operation is different for each machine; these machines can perform different sets of operations if tooled differently.

5 — Analytical Models of Multi-stage Kanban Systems Using New Approximations for Fork/Join Stations
Rajan Suri, Professor, University of Wisconsin-Madison, Dept. of IE, 1513 University Avenue, Madison, WI, 53706, United States, suri@engr.wisc.edu, Ananth Krishnamurthy

We propose a new approach for analyzing queuing models of multi-stage kanban systems. In these networks, often fork/join stations are used to model the synchronization constraint between parts and kanbans. Using new two-moment approximations to characterize the performance of the synchronization station, we develop methods to evaluate network performance.

■ TA13

Westin-Augusta 3, 7th Floor

Product Management and Distribution

Sponsor: Marketing
Sponsored Session

Chair: Douglas Bowman, Associate Professor of Marketing, Emory University, Goizueta Business School, Atlanta, GA, 30322, United States, Doug_Bowman@bus.emory.edu

1 — Crowding the Market Space: Product Line Renewal and Proliferation
Marion Debruyne, Assistant Professor of Marketing, Emory University, Goizueta Business School, Atlanta, GA, 30322, United States, Marion_Debruyne@bus.emory.edu, David Reibstein, Karl Ulrich

Strategic considerations play a central role in product line decisions. Empirical research on the consequences of product line proliferation is sparse. We examine individual-firm positions in the product-market and their impact on product line competition. Specifically, we investigate the effect of product line proliferation on competitor's behavior. We propose and empirically investigate a descriptive model of the determinants and consequences of product line decisions.

2 — Testing the Life-Cycle Theory of Inter-Organizational Relations
Sandy Jap, Associate Professor of Marketing, Emory University, Goizueta Business School, Atlanta, GA, 30322, United States, Sandy_Jap@bus.emory.edu, Erin Anderson

This provides an empirical test of the Dwyer, Schurr & Oh (1987) lifecycle theory of relationships and considers the role of path dependence in achieving overall satisfaction. Using survey data, we find general support for the lifecycle notion and also explore whether relationships that followed the expected lifecycle path outperform relationships that followed aberrant (backward) patterns.

3 — Dual Distribution Channels in Business-to-Business Marketing
Alberto Sa Vinhas, Assistant Professor of Marketing, Emory University, Goizueta Business School, Atlanta, GA, 30322, United States, Alberto_Sa_Vinhas@bus.emory.edu

Manufacturers are increasingly using both vertically integrated and independent channels of distribution to sell the same product/service to the same market. While increasingly common, these channel systems are likely to be conflictual, wasteful, and difficult to manage. To what degree should the manufacturer incur these costs?

4 — Customer Profitability in Industrial Markets
Douglas Bowman, Associate Professor of Marketing, Emory University, Goizueta Business School, Atlanta, GA, 30322, United States, Doug_Bowman@bus.emory.edu, Das Narayandas

A chain-link framework based on the Service-Profit Chain (SPC) is 1) adapted to accommodate important characteristics of industrial markets, and 2) extended to allow for a richer description of the complex linkages between vendor effort and account profitability characteristic of industrial markets. An application is presented.

■ TA14

Westin-Peachtree A, 8th Floor

Intersection of NPD and Supply Chains

Cluster: New Product Development
Invited Session

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

1 — Product Line Design with Component Commonality and Design Investments
Hans Heese, Kenan-Flagger School of Business, University of North Carolina, Chapel Hill, NC, United States, seb@unc.edu, Jayashankar Swaminathan

Component commonality can mitigate the effects of product proliferation on product and supply chain complexity. However, increased component commonality can limit a firm's potential to extract price premiums through product differentiation. In this work, we explore the relationships between optimal commonality, pricing and design investment decisions for a monopolist.

2 — Investment and Information Sharing in Collaborative New Product Development and Introduction
Sreekumar R. Bhaskaran, Doctoral Student, University of Texas at Austin, CBA 4.202, Dept of Management, Austin, TX, 78705, United States, Sreekumar.Bhaskaran-Nair@phd .bus.utexas.edu, Vish Krishnan

We conceptualize and formulate the collaborative product development problem and propose two mechanisms that involve the sharing of development cost and development effort, which we term investment and innovation sharing, respectively. These mechanisms can have varying effects on the investment and profits of firms, which we characterize in this paper.

3 — Technology Introduction and Implications for Adoption
Sanjiv Erat, Georgia Institute of Technology, 755 Ferst Drive, Atlanta, GA, United States, sanjiv.erat@mgt.gatech.edu, Stylianos Kavadias

The article develops a model for a technology supplier who dynamically introduces new technologies (processes or components) to multiple OEMs, that compete on quality in their end-product market. We analyze the resulting game theoretic structure and identify optimal technology pricing policies. In addition, we characterize the resulting market structures.

4 — Collaborative Development of Products and Supply Chains
Nitin Joglekar, Assistant Professor, Boston University, 595 Commonwealth Avenue, Boston, MA, United States, joglekar@bu.edu

Visibility and synchronization are critical governance decisions while managing the collaborative product and supply chain development. Using evidence from the medical devices industry, we model the joint impact of these two decisions on the product development and delivery performance in beginning of life (BOL) and end of life (EOL) situations.

■ TA15

Westin-Peachtree F, 8th Floor

University-Industry Interfaces: How Knowledge Crosses the Moat Surrounding the Ivory Tower

Sponsor: Technology Management
Sponsored Session

Chair: Robert Lowe, Assistant Professor, Carnegie Mellon University, 5000 Forbes Avenue, Pittsburgh, PA, 15213, United States, roblowe@andrew.cmu.edu

1 — Start-ups, Established Firms, and the Commercialization of University Inventions
Robert Lowe, Assistant Professor, Carnegie Mellon University, 5000 Forbes Avenue, Pittsburgh, PA, 15213, United States, roblowe@andrew.cmu.edu, Arvids Ziedonis

We examine the role of the entrepreneurial firm in commercializating university technology. We find that start-ups are neither more nor less "successful" than established firms, but play a distinct role in the commercialization process: intermediate development organizations. We find that commercialized inventions licensed by inventor-founded start-ups are virtually always commercialized only after the start-up has developed the technology and been acquired by an established firm.

2 — Do Strong Property Rights Inspire Academic Entrepreneurship?
Brent Goldfarb, Assistant Professor, University of Maryland, 3314 Van Munching Hall, College Park, MD, 20742, United States, bgoldfarb@rhsmith.umd.edu

We develop a model that describes how strong intellectual property rights encourage inventors to participate in the commercialization of their technologies when they do not have control rights over the intellectual property. This case describes inventions emanating from US universities. We the model using a dataset that follows academic inventors and their relationships with firms. We find that strong IPR's encourage inventor involvement in general, and academic entrepreneurship in particular.

3 — Patterns of Research and Licensing Activity of Science and Engineering Faculty
Jerry Thursby, Professor,Emory University, Atlanta GA, 30322, United States, jthursb@emory.edu, Marie Thursby.

We examine a database of publication, disclosure, and personal profiles of 3,241 faculty from 6 US universities. We examine the evolution of faculty research and licensing behavior over time and the extent to which it is related to characteristics such as age and academic quality of their department. We find that the much-publicized increase in licensing activity appears to be concentrated among a minority of faculty and does not appear to signal a change in the direction of faculty research.

■ TA16

Westin-Peachtree G, 9th Floor

Optimization in Medicine

Sponsor: Health Applications
Sponsored Session

Chair: Andrew Schaefer, Assistant Professor, University of Pittsburgh, 1048 Benedum Hall, Pittsburgh, PA, 15261, United States, schaefer@ie.pitt.edu

1 — A Column Generation Approach for Optimizing Radiation Therapy Treatment Plans
Arvind Kumar, Graduate Student, University of Florida, 303, Weil Hall, P O Box 116595, Gainesville, FL, 32611, United States, arvind22@ufl.edu, Ravindra Ahuja, James Dempsey, H. Edwin Romeijn

Radiation therapy seeks to deliver a prescribed radiation dose to cancerous cells while sparing healthy tissues, giving rise to a very large-scale optimization problem. This talk describes a new formulation which incorporates practical treatment delivery aspects, a column generation approach for solving the problem, and results of the application of this approach to clinical data.

2 — Balancing Patient and Payer Preferences: An Efficient Frontier for Breast Cancer Screening
Julie Ivy, University of Michigan, 701 Tappan Street, Ann Arbor, MI, United States, jsimmons@umich.edu

Using the theory of POMDPs, we develop efficient frontiers for balancing patient and payer preferences for breast cancer screening and treatment. We incorporate uncertainty associated with the partial observability of the disease by the decision maker, and the uncertainty associated with the treatment outcome in determining the effectiveness of screening.

3 — Structured Policies for the Optimal Timing of a Living-Donor Transplant
Oguzhan Alagoz, Graduate Research Assistant, University of Pittsburgh, 1048 Benedum Hall, Pittsburgh, PA, 15261, United States, oga1@pitt.edu, Lisa Maillart, Andrew Schaefer, Mark Roberts

We consider the problem of optimally timing living-donor liver transplantation to maximize patient life expectancy. We formulate an MDP in which the state of the process is described by patient health and liver quality. We derive structural properties of the model, including a set of intuitive, sufficient conditions for the existence of a control-limit optimal policy. We use clinical data in our computational experiments, which show that the optimal policy is typically of control-limit type.

■ TA17

Westin-Peachtree H, 9th Floor

Disease Prediction and Diagnosis I

Cluster: Operations Research for Medical Applications
Invited Session

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

1 — Subset-Conjunctive Rules for Breast Cancer Diagnosis
Ramesh Krishnamurti, Professor, Simon Fraser University, Burnaby, BC, V5A 1S6, Canada, ramesh@cs.sfu.ca, Kamel Jedidi, Rajeev Kohli

A subset-conjunctive model is described to distinguish within a population of patients with and without breast cancer. A deterministic greedy algorithm for the corresponding satisfiability problem is used to identify a Pareto-efficient set of subset-conjunctive rules, similar to existing rules in a clinical setting. and may be used in practice.

2 — Discriminant Analysis of Motility Data from Lung Carcinoma Cells Placed on Purified ECM Proteins
Paul Brooks, Ph.D. Student, Georgia Institute of Technology, Industrial and Systems Engineering, Atlanta, GA, 30332-0205, United States, jpbrooks@isye.gatech.edu, Cheng Zhu, Eva Lee, Adele Wright

Discriminant analysis is concerned with the classification of entities as belonging to one or more groups and/or the determination of the identifying attributes that best characterize the groups. In this talk, we describe the use of a mixed integer programming-based discriminant analysis model (DAMIP) for analyzing lung carcinoma cell motility. The talk will focus on the discriminatory effects of ECM proteins on the motility and morphology of human lung epidermoid carcinoma cells.

3 — Maximum Patterns and Outliers in the Logical Analysis of Data (LAD)
Peter Hammer, RUTCOR-Rutgers University, 640 Bartholomew Road, Piscataway, NJ, 08854, United States, hammer@rutcor.rutgers.edu, Tiberius Bonates, Alex Kogan, Irina Lozina

A "maximum pattern" in LAD is an interval containing no negative observations, and including a maximum number of positive observations. An algorithm identifying maximum patterns is described, and used for defining "outliers". The increase of diagnosis and prognosis accuracy after removing outliers is demonstrated on several biomedical datasets.

■ TA18

Westin-Tower 1201, 12th Floor

Distributed Sensing for Detection, Diagnosis, and Control

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: Yu Ding, Assistant Professor, Texas A&M University, Dept. of Industrial Engineering, 3131 TAMU, College Station, TX, 77843, United States, yuding@iemail.tamu.edu

Co-Chair: Dariusz Ceglarek, Department of Industrial Engineering, University of Wisconsin-Madison, 1513 University Avenue, 266E ME Building, Madison, WI, 53706-1572, United States, darek@engr.wisc.edu

1 — Sensor Placement and Reorientation Strategies for Intrusion Detection in Facilities
Amarnath Banerjee, Assistant Professor, Texas A&M University, Industrial Engineering, College Station, TX, 77843-3131, United States, banerjee@tamu.edu

Facilities can be modeled as a network of nodes and arcs, with suitable sensors populating the network. Timely handling of sensory data is important for intrusion detection. A large-scale memory storage and retrieval neural network is developed for intrusion detection, incorporating fast search, retrieval, forgetting, recall, and partial data analysis.

2 — Sensor-Based Modeling for Process Degradation Monitoring: A Dynamic Systems approach
Satish Bukkapatnam, Assitant Professor, University of Southern California, Epstein Dept. of Industrial Engineering, 3715 McClintock Ave., GER 240, Los Angeles, CA, 90089-0193, United States, satish@usc.edu

We present an approach, rooted in dynamic systems theory, for deriving compact models from the measured signals from a sensory network. The resulting models may either be formal nonlinear stochastic differential/difference equations or multiscale representations. We discuss, using our recent aerospace grinding application, the effectiveness of the approach in capturing complicated bursts and nonstationarities in the measured signals, and the nonlinearities of the underlying process.

3 — Advances on Web-enabled Infotronics-based Prognostics
Jay Lee, Professor, Center for Intelligent Maintenance Systems, Univeristy of Wisconsin-Milwaukee, 3200 N. Cramer St., Milwaukee, WI, 53211, United States, jaylee@uwm.edu

For the past decade, the impact of web-enabled technologies has added "velocity' to the design, manufacturing, and aftermarket service of a product. Today's competition in industry depends not just on lean manufacturing, but also on the ability to provide customers with life-cycle support for sustainable value. To improve customer service responsiveness and aftermarket business efficiency, new service business model for enable products and systems to achieve near-zero downtime has been adopted.

4 — Causality Analysis & Fault Detection in Multistation Manufacturing Process with Distributed Sensing
Kamal Mannar, Project Assistant, Dept of Industrial Engineering, #368, Dept of Industrial Eng., ME building,1513 Univ. Avenue, Madison, WI, 53706, United States, kmannar@wisc.edu, Dariusz Ceglarek, Bassam Abifaraj, Feng Niu, Yu Ding

This paper focuses on diagnosis for multistation manufacturing with distributed sensing. While methods for root cause identification for manufacturing processes with end of line sensing exist, distributed sensing is not a simple extension of it due to noise by operations between the measurement stations making covariance-based analysis difficult. The method illustrated in this paper using an industrial case study, matches the frequency of faults, which are counted by a Poisson counting process.

■ TA19

Westin-Tower 1202, 12th Floor

Joint Session QSR/SCM: Quality and Statistics in Logistics and Supply Chain Management

Sponsors: Quality, Statistics and Reliability; Supply Chain Mgt.
Sponsored Session

Chair: Jye-Chyi Lu, Professor, Georgia Institute of Technology, Groseclose Building, Room 335, 765 Ferst Drive, Atlanta, GA, 30332, United States, JCLU@isye.gatech.edu

1 — Modeling the Trade-off Between Security and the Efficiency of Container Operations at Seaports
Brian Lewis, Graduate Student, Georgia Institute of Technology, Industrial and Systems Engineering, 765 Ferst Dr., Atlanta, GA, 30332-0205, United States, blewis@isye.gatech.edu, Alan Erera, Chelsea C. White, III

The emerging paradigm of transportation and logistics systems emphasizes the integration of security practices into regular operations. We present a series of simple heuristic and optimal analytical models of container security operations at a seaport to quantify the trade-off between security and port efficiency. Comparative results are also discussed.

2 — Dynamic Learning in Supply Chain Management with Repeated Transactions and Service Contributions
Chayakrit Charoensiriwath, Ph.D. Student, Georgia Institute of Technology, The School of Industrial and Systems Eng, Campus Box 0205, Atlanta, GA, 30332-0205, United States, chayakritc@isye.isye.gatech.edu, Jye-Chyi Lu

This research studies a case where there are two manufacturers producing competing products and selling them through a common retailer. The two manufacturers must decide on the wholesale price and the level of service they plan to provide to the consumer. The consumer demand depends on retail price and service level provided by the manufacturer. This research will investigate the strategic learning behaviors of retailers and manufacturers in this channel structure over time.

3 — Quality Management in Supply Chain
Kaijie Zhu, Assistant Professor, Hong Kong University of Science and Technology, Dept of IEEM, Kowloon, HK, Hong Kong, kzhu@ust.hk, Fugee Tsung

This paper provides an analytical model on the quality management of a company's production process within a supply chain. We discuss how the quality management at this company can affect others within the supply chain. Our analysis can quantify the quality management from a supply chain perspective.

■ TA20

Westin-Tower 1203, 12th Floor

Genetic Algorithms and Heuristics in Modeling Applications

Sponsor: Artificial Intelligence
Sponsored Session

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

1 — Optimal Filtering Policy for Corporate E-mail Systems
Wei Yue, University of Texas at Dallas, 2601 N Floyd Road, MS: JO44, Richardson, TX, United States, wei.yue@utdallas.edu

In facing the SPAM problem, firm can filter e-mails at the centralized level or let end users filter unwanted e-mails themselves. Blocking e-mails at a centralized

location creates false-positive costs for the users. Letting end-users filter e-mails create true negative costs . In essence, firm could bundle filtering rules at a centralized gateway or let end users create their own filtering rules. By using Salinger's framework (1995), we seek to find an optimal filtering policy for the firm.

2 — Learning GA Parameters using Hidden Markov Models
Jackie Rees, Assistant Professor of Management, Purdue University, 403 West State Street, West Lafayette, IN, 47907, United States, jrees@mgmt.purdue.edu

Hidden Markov models (HMMs) can be used to characterize real-world processes. Many of these processes can be said to be evolutionary in nature. Using the established Markov model of the exact expected behavior of genetic algorithms (GAs), we apply HMMs to these evolutionary processes, in order to learn the underlying genetic parameters, particularly the crossover and mutation operators. Experimental results are provided to demonstrate the feasibility and accuracy of this approach.

3 — Genetic Algorithms and Risk Management
Dan Conway, Associate Professor of Management, University of Notre Dame, 348 Mendoza College of Business, Notre Dame, IN, 46556, United States, Dan.G.Conway.35@nd.edu

Genetic algorithms have been shown to be competent at adapting to a variety of difficult objective functions. We consider a risk environment, one where the objective function is subject to a variety of perturbations, and examine how a GA might adapt to a riskier environment. We are particularly interested in how a GA might decide to hedge, insure, outsource, exit, or accept risk. Environments with fluid risk management options (such as financial markets) are examined.

■ TA21

Westin-Tower 1204, 12th Floor

Optimization Modeling in Practice I

Sponsor: Computing
Sponsored Session

Chair: Bjarni Kristjansson, President, Maximal Software Inc., 2111 Wilson Boulevard, Suite 700, Arlington, VA, 22201, United States, bjarni@maximalsoftware.com

1 — Recent Work on the AMPL/Solver Interface Library
Robert Fourer, Professor, Northwestern University, Dept of Industrial Eng & Mgmt Sciences, 2145 Sheridan Rd, Evanston, IL, 60208-3119, United States, 4er@iems.northwestern.edu, David M. Gay

AMPL seeks to provide a simple view of solvers that hides their idiosyncrasies. The AMPL/solver interface library facilitates this by providing relevant interface routines and data structures. We review some of these facilities, focusing on recent and forthcoming additions, such as suffix notation for auxiliary information and extensions for dealing with constraint programming. Interfaces to global optimization and constraint programming solvers may require custom "tree walks".

2 — Applications of MPEC Models
Steven Dirkse, GAMS Development Corporation, 1217 Potomac St., NW, Washington, DC, 20007, United States, steve@gams.com

Optimization has long been used to model a variety of applications. More recently, complementarity or equilibrium models have become popular (e.g. where there are many decision makers under no central control). A unifying framework is the mathematical program with equilibrium constraints (MPEC). We look at a number of applications modeled effectively using an MPEC framework (e.g. in network design, engineering, and game theory), demonstrating the MPEC's power, flexibility and ease of use.

3 — Stochastic Programming Models with Decision Dependent Probabilities
David Woodruff, Professor, University of California, Grad. School of Mgt., Davis, CA, United States, dlwoodruff@ucdavis.edu

We review some recent developments in integer stochastic programming with decision dependent random elements. Drawing on specific examples, we explore ways that the Stochastic MPS standard could be extended to facilitate these models.

■ TA22

Westin-Tower 1205, 12th Floor

Behavioral Decision Making I

Sponsor: Decision Analysis
Sponsored Session

Chair: George Wu, Associate Professor, University of Chicago GSB, 1101 E58th St, Chicago, IL, 60637, United States, george.wu@gsb.uchicago.edu

1 — Stochastic Dominance and Cumulative Prospect Theory: Theory and Experiments
Manel Baucells, IESE Business School, Ave. Pearson, 21, Barcelona, 08034, Spain and Canary Islands, MBaucells@iese.edu, Franz Heukamp

We define RW-SD, an extended notion of stochastic dominance that accounts for both the reflection effect (R) and the probability weighting (W). A second definition of stochastic dominance (R*W-SD) for preferences with reverse reflection effect (R*) Markowitz (1952) is presented. Using these definitions, we empirically discriminate between two competing explanations of behavior under risk. Our experiments reject the reverse reflection effect and highlight the relevance of the weighting function.

2 — Testing Prospect Theory through Tradeoff Consistency
George Wu, Associate Professor, University of Chicago GSB, 1101 E58th St, Chicago, IL, 60637, United States, george.wu@gsb.uchicago.edu, Jiao Zhang, Mohammed Abdellaoui

Both old and new prospect theory can be characterized using tradeoff consistency conditions. These conditions require consistency between one set of preferences and another set of preferences. We present a test of prospect theories that exploits the tradeoff consistency conditions for each model.

3 — Diversification Bias and Partition Dependence in Allocation and Choice
Craig Fox, UCLA, Anderson School, 110 Westwood Plaza, Los Angeles, CA, 90095-1481, United States, craig.fox@anderson.ucla.edu

Recent studies suggest that decision makers often follow a "diversification heuristic" in which they allocate choices, investment money, or benefits and burdens evenly over available options, funds, or individuals. I will show that the implications of diversification depend on the way in which decision makers subjectively partition the set of options, investments, or individuals, which is influenced, in turn, by the procedure by which preferences and judgments are elicited.

■ TA23

Westin-Tower 1206, 12th Floor

Analyzing Uncertainties in Risk Assessment

Sponsor: Decision Analysis
Sponsored Session

Chair: Jason Merrick, Assistant Professor, Virginia Commonwealth University, PO Box 843083, Richmond, VA, 23284, United States, jrmerric@vcu.edu

1 — Updating Joint Prior Distributions on Model Inputs and Outputs, with an Application to Simulation
Robert Bordley, General Motors, 585 South Boulevard, Pontiac, MI, 48265-1000, United States, robert.bordley@gm.com, Vicki Bier, Nilay Tanik Argon

Do simulation results provide information about values of simulation inputs as well as outputs? If the analyst had little confidence that the inputs were correct, and the resulting outputs were counterintuitive, she would probably conclude that the inputs were unrealistic. We discuss Bayesian updating of prior distributions for simulation inputs.

2 — Assessing Uncertainty in Simulation Based Maritime Risk Assessment
Jason Merrick, Assistant Professor, Virginia Commonwealth University, PO Box 843083, Richmond, VA, 23284, United States, jrmerric@vcu.edu, Rene van Dorp, Varun Dinesh

Recent work in the assessment of risk in maritime transportation systems has achieved great success using simulation-based probabilistic risk assessment techniques. In this paper, a study of the impact of proposed ferry service expansions in San Francisco Bay is used as a case study to demonstrate the use of Bayesian simulation techniques to propagate uncertainty throughout the analysis.

3 — Uncertainty Analysis in Accident Probabilities Estimated from Expert Judgment
Rene van Dorp, Assistant Professor, George Washington University, 1776 G Street NW, Suite 110, Washington, DC, 20052, United States, dorpjr@seas.gwu.edu, Amita Singh, Jason Merrick

In assessing accident risk in complex, technological systems, data is usually sparse and one may have to resort to expert judgment elicitation to develop frequency data for these low frequency, high consequence events. This paper presents a Bayesian methodology for relative accident probability assessment and its uncertainty utilizing a pairwise comparison elicitation questionnaire. The approach is demonstrated by means of elicited data from the nation's largest passenger ferry system.

■ TA24

Westin-Tower 1207, 12th Floor

Business Continuity and Disaster Recovery

Sponsor: Information Systems
Sponsored Session

Chair: Sabyasachi Mitra, Associate Professor, Georgia Institute of Technology, DuPree College of Management, 755 Ferst Avenue, Atlanta, GA, 30332, United States, saby.mitra@mgt.gatech.edu

1 — Business Continuity Planning for Financial Services
Amitava Dutta, Professor, George Mason University, Fairfax, VA, United States, adutta@gmu.edu, Mahesh Joshi, Linda Parsons

The financial services sector is particularly dependent on information technology, and has also been deemed a component of critical infrastructure for the country. Based on indepth interviews with senior executives in this sector, we outline business continuity concerns faced by this sector and some of the steps being taken to address them.

2 — Toward a Risk Management Model for IS Security
Shamkant Navathe, Professor, Georgia Institute of Technology, College of Computing, Atlanta, GA, 30332, United States, sham@cc.gatech.edu, Fariborz Farahmand

We are currently developing a classification of the security incidents faced by IS managers, identifying the techniques used by security experts and law enforcement agencies in estimating tangible damages, and developing metrics for assessing the intangibles. We synthesize these parameters into a stochastic model. This model can be used by security managers as a decision support tool for assessing risk and choosing the right set of security countermeasures to implement in their organizations.

3 — Investment in Interdependent Security Systems: Private Choice and Public Policy
Thomas Weber, Assistant Professor, Stanford University, Management Science and Engineering, Terman Engineering Center, Stanford, CA, 94305-4026, United States, webert@stanford.edu, Howard Kunreuther

We develop a two-stage model of investments in security systems in the presence of a strategic terrorist, who attempts to place a damage-maximizing harmful device: first, the firms determine their interdependent security investments, then the terrorist selects a target and finds an optimal attack policy. Depending on the firms' information about the terrorist's preferences we examine rent-seeking in equilibrium, security over-/under investment as well as public policy implications.

4 — An Instrument to Measure Business Continuity Practices
Sabyasachi Mitra, Associate Professor, Georgia Institute of Technology, DuPree College of Management, 755 Ferst Avenue, Atlanta, GA, 30332, United States, saby.mitra@mgt.gatech.edu, Tracey King, Naresh Malhotra

Through a review of the academic and practitioner literature,and through several focus groups of IS managers, we have developed a comprehensive framework for evaluating an organization's business continuity practices. The framework and resulting questionnaire can be used as a self-assessment tool by organizations, or as a guideline for developing sound Business Continuity practices. We are currently validating the framework through a data collection effort in the travel and leisure industry.

■ TA25

Westin-Tower 1208, 12th Floor

Issues in Policy Making

Sponsor: Military Applications
Sponsored Session

Chair: Victor Wiley, Major, United States Air Force, AFIT/ENS, 2950 Hobson Way, WPAFB, OH, 45433, United States, victor.wiley@afit.edu

1 — Allocation of Air Resources against an Intelligent Adversary
Andrew P. Armacost, Associate Professor of OR, US Air Force Academy, 2354 Fairchild Dr. Suite 6J100, USAFA, CO, 80840, United States, andy.armacost@usafa.af.mil, Cynthia Barnhart, Stephan Kolitz, Eric Zarybnisky

We consider the problem of allocating scarce airborne resources to activities that conduct pre-strike Intelligence, Surveillance, and Reconnaissance (ISR), take strike actions against targets, and gather battle assessment information. We develop and demonstrate the computational performance of methods combining Partially Observable Markov Decision Processes (POMDPs) and integer programming formulations to find the optimal set of policies given resource constraints.

2 — Interim Static Stability Model (ISSM)
Dean Hartley, Principal, Hartley Consulting, 106 Windsong Ln, Oak Ridge, TN, 37830, United States, dshartley3@comcast.net

The ISSM is an Excel model of the effects that observable factors have on the stability of a country. This is important in assessing the condition of a country involved in a Peace Operation or Complex Humanitarian Emergency. The ISSM is part of the Defense Modeling and Simulation Office (DMSO) Flexible Asymmetric Simulation Technologies (FAST) Toolbox to support Operations Other Than War (OOTW). The Center for Army Analyses (CAA) is deploying the ISSM to Iraq in the Fall of 2003.

3 — The United States Coast Guard: Management and Policies for Homeland Security
Marc Thibault, PhD Candidate, School of Public Policy, George Mason University, 4400 University Drive, MS 2C9, Fairfax, VA, 22315, United States, mthibau1@gmu.edu, Wayne Perry

There has been an extensive amount of research on America's large military establishment. This research, overall, has not included the U.S. Coast Guard (USCG). The USCG is difficult to study and manage because of its complex military and civilian missions. This study will use USCG history, Economics, and Systems Analysis to place the USCG in a policy & managerial context and to identify research issues associated with the USCG's Homeland Security missions.

■ TA26

Westin-Tower 1401, 14th Floor

Data Mining Modeling and Algorithms

Cluster: Data Mining and Knowledge Discovery
Invited Session

Chair: Warren Liao, Professor, Louisiana State University, 3128 CEBA, IMSE Department, Baton Rouge, LA, 70803, United States, ieliao@lsu.edu

1 — Introduction to Support Vector Machines for Data Mining
Mahdi Nasereddin, Assistant Professor pf IST, Penn State University, Tulpohocken RD, P O Box 7009, Reading, PA, 19610, United States, mxn16@psu.edu

Support Vector Machines (SVM) was introduced in 1992 by Boser, Guyon, and Vapnik. Since then, SVM has been successfully used to solve both classification and prediction problems. In this paper, the application of SVM in data mining is introduced.

2 — Genetic Clustering of Time Series
Warren Liao, Professor, Louisiana State University, 3128 CEBA, IMSE Department, Baton Rouge, LA, 70803, United States, ieliao@lsu.edu, Pei-chann Chang

This paper investigates the use of genetic algorithms for clustering time series data. Different designs of genetic algorithms are compared. Several distance measures are also evaluated.

3 — A Rule Induction Approach for Data Mining and Knowledge Discovery
Evangelos Triantaphyllou, Professor, Louisiana State University, 3128 CEBA, IMSE Department, Baton Rouge, LA, 70803, United States, trianta@lsu.edu

Data mining is particularly appealing now that large databases and fast computers become easily available. For many applications it is required that the extracted knowledge to be easily comprehended. Thus, our approach is based on the inference of logical rules. The new approach, called OCAT (for One Clause At a Time), seems to be very versatile. We will discuss some recent results and future research directions. For details please visit: http://www.imse.lsu .edu/vangelis

■ TA27

Westin-Tower 1402, 14th Floor

New Trends in Mixed-Integer Programming

Sponsor: Optimization/Integer Programming
Sponsored Session

Chair: Daniel Bienstock, Professor, Dept. of IEOR, Columbia University, 500 West 120th St., New York, NY, 10027, United States, dano@ieor.columbia.edu

1 — Applying Integer Programming Techniques to Global Optimization Problems
Jeff Linderoth, Lehigh University, Industrial & Systems Enginnering, Bethleham, PA, United States, jtl3@lehigh.edu

Many techniques for solving optimization problems involving nonconvexities rely on a branch-and-bound procedure to find a globally optimal solution. In this talk, we will show how two simple procedures, strong branching and strong preprocessing, borrowed from the field of integer programming can help improve the branch-and-bound procedures in global optimization.

2 — On cutting planes derived from Gomory's Group Polyhedra
Sanjeeb Dash, Research Staff Member, IBM, 1101 Kitchawan Rd/RT 134, Yorktown Heights, NY, 10598, United States, sanjeebd@us.ibm.com, Oktay Gunluk

Gomory (1969) studied certain group relaxations of integer programs, and obtained the Gomory mixed-integer cut as a facet of the group relaxation of a single constraint integer program. We show that an important class of facets of this relaxation is related to cutting planes introduced by Letchford and Lodi (2002) and derive these inequalities from a very simple polyhedral set. We also derive a few facet classes of Gomory's group relaxation of a two-constraint integer program.

3 — Column Basis Reduction and Decomposable Knapsack Problems
Gabor Pataki, Assistant Professor, Dept of Operations Research, University of North Carolina, Smith Building, University of North Carolina, Chapel Hill, NC, 27599, United States, pataki@email.unc.edu, Bala Krishnamoorthy

We generalize and simplify the reformulation technique proposed by Aardal and others, and prove an upper bound on the number of B&B nodes that are necessary to solve the reformulated problem in the case of several classes of hard knapsack problems.

4 — Subset Algebra Lifting for 0-1 Integer Programming
Daniel Bienstock, Professor, Dept. of IEOR, Columbia University, 500 West 120th St., New York, NY, 10027, United States, dano@ieor.columbia.edu, Mark Zuckerberg

The algorithms of Lovasz-Schrijver and Sherali-Adams "lift" a formulation of a 0-1 integer programming problem by appending new variables that represent monomials on the original variables. We present a new approach, which is exponentially stronger to the Lovasz-Schrijver and Sherali-Adams methods, and leads to a polynomial-time epsilon-approximation scheme for the rank-r closure of a set covering problem, for any fixed r > 0.

■ TA28

Westin-Tower 1403, 14th Floor

Global Optimization — Approaches to Military Applications

Sponsor: Optimization/Global Optimization
Sponsored Session

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

1 — An Analytical Method to Derive Survival Probabilities
David E. Jeffcoat, AFRL/MNGN, 101 W Eglin Blvd, Ste 331, Eglin AFB, FL, United States, david.jeffcoat@eglin.af.mil

Determining the probability of survival for combat systems is a significant problem in military ops research. This presentation discusses methods based on reliability and queuing theory to derive survivability probability distributions. Significant time-based analytical results are directly available, with probability distributions that are results, rather than required inputs. Analytical cases are presented with illustrations ranging from a single combat system to hundreds of micro vehicles.

2 — Uncertain Reasoning with Linear Programming
Henry Pfister, AFRL/MNGN, 101 W Eglin Bldv, Ste 331, Eglin AFB, FL, United States, pfister@eglin.af.mil

Reasoning and uncertainty have been studied since invention of probability tree 150 years ago. Method for reasoning with uncertainty developed for logical proposition inferences is presented . Approach has "uncertain", "true" and "false" logic states leading to a model for possibility variables that are solved as a linear program. The 2000-year-old Epiminides paradox is solved. Model flexibility and complex reasoning indicate wide range of applications for decision making and data analysis.

3 — Local Search for the Multidimensional Assignment Problem
Eduardo L. Pasiliao, AFRL/MNGN, 101 W Eglin Blvd, Ste 331, Eglin AFB, FL, 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.

4 — Formulating the Weapon-Target Assignment Problem as a Multidimensional Assignment Problem
Don Grundel, AFRL/MNGN, 101 W Eglin Blvd, Ste 331, Eglin AFB, FL, United States, don.grundel@eglin.af.mil

The target-based Weapon-Target Assignment (WTA) problem is the problem of maximizing the damage to a given set of enemy assets using a given set of weapons. A re-formulation is presented that casts the target-based Weapon-Target Assignment (WTA) problem as a Multidimensional Assignment Problem (MAP). In addition, the formulation is extended to incorporate weapon costs .

■ TA29

Westin-Tower 1404, 14th Floor

Innovations in Financial and Economic Networks

Sponsor: Optimization/Network
Sponsored Session

Chair: Anna Nagurney, John F. Smith Memorial Professor, University of Massachusetts - Amherst, Dept of Finance & Operations Management, Isenberg School of Management, Amherst, MA, 01003, United States, nagurney@gbfin.umass.edu

1 — On Structural Properties of the Market Graph
Vladimir Boginski, University of Florida, Dept of Industrial and Systems Engineer, 303 Weil Hall, Gainesville, FL, 32611, United States, vb@ufl.edu, Sergiy Butenko, Panos Pardalos

We present a new methodology of studying the internal structure of the stock market by representing it as a large network. Our results include the discovery of the power-law distribution in this network, as well as developing a new tool of classifying financial instruments and choosing diversified portfolios.

2 — Applications of Fluid Modelling in Distribution Systems
Soulaymane Kachani, Assistant Professor, Columbia University, Dept. IEOR, New York, NY, United States, sk2267@columbia.edu, Georgia Perakis

In this talk we discuss a fluid model of dynamic pricing and inventory management in a supply chain management under make-to-stock regime. In particular, we consider a distribution system with several wholesalers, intermediate distributors, and retailers. All entities are subsidiaries of the same company producing and selling multiple products. We introduce and analyze a model for joint pricing, production and inventory decisions in a capacitated, multi-product dynamic environment.

3 — A Supply Chain Network Economy: Modeling and Qualitative Analysis
Ding Zhang, SUNY - Oswego, School of Business, Oswego, NY, United States, zhang@oswego.edu, Anna Nagurney, June Dong

This paper presents a general network model of a supply chain economy in the case of multiple products and multiple markets. The model allows for the formulation and analysis of both intra and inter supply chain cooperation and competition. In particular, it predicts the "winning" supply chains in supply chain versus supply chain competition. We also provide qualitative analysis in terms of existence and uniqueness of solution to the model.

4 — Integrated Pension and Corporate Financial Planning: Optimal Contribution Strategies
Koray Simsek, Princeton University, Department of Operations Research, and Financial Engineering, Princeton, NJ, 08544, United States, ksimsek@princeton.edu, John Mulvey

We present a stochastic network model for integrating a defined-benefit pension plan with a company's core financial plan. The shareholder value of the company is maximized over a long horizon. By analyzing liability scenarios for different companies, we show that loss of surplus is preventable. Attention is devoted to optimal contribution policies for under-funded plans. The methodology requires a stochastic scenario generator, a pension/corporate simulator, and a stochastic network optimizer.

5 — International Financial Networks with Intermediation and Electronic Transactions
Jose Cruz, Department of Finance and Operations Management, Isenberg School of Management, University of Massachusetts, Amherst, MA, 01003, United States, jmcc30@yahoo.com, Anna Nagurney

In this paper, we develop a framework for the modeling, analysis, and computation of solutions to international financial networks with electronic transactions. We consider three tiers of decision-makers and model their behavior. We derive the equilibrium conditions, establish the variational inequality formulation, and then obtain qualitative properties of the equilibrium financial flow and price pattern as well as propose an algorithm along with convergence results. Numerical examples are presented.

■ TA30

Westin-Tower 1405, 14th Floor

Complementarity Models and Algorithms in Nonsmooth Mechanics

Sponsor: Optimization/Linear Programming and Complementarity
Sponsored Session

Chair: Mihai Anitescu, Argonne National Laboratory, MCS, Building 221, 9700 South Cass Avenue, Argonne, IL, 60430, United States, anitescu@mcs.anl.gov

1 — Convex Relaxations of Linear Complementarity Subproblems in Nonsmooth Mechanics
Mihai Anitescu, Argonne National Laboratory, MCS, Building 221, 9700 South Cass Avenue, Argonne, IL, 60430, United States, anitescu@mcs.anl.gov

Time-stepping methods that solve linear complementarity subproblems are widely used for nonsmooth mechanics and computer graphics. PATH can successfully solve these subproblems for any simulation parameters but the nonconvexity of the subproblems slows the linear complementarity solver. In this talk we present an algorithm based on a convex relaxation of the subproblems that satisfies many of the constraints of the continuous time problem as the timestep goes to 0.

2 — Differential Variational Inequalities
David Stewart, University of Iowa, McLean Hall, Iowa City, IA, 52246, United States, dstewart@math.uiowa.edu, Jong-Shi Pang

Differential Variational Inequalities are a formalism that encompasses a number of ways of combining inequality constraints with differential equations to describe a range of dynamic systems that include mechanical systems with contact/impact, Nash equilibria of differential games, and electrical circuits with ideal diodes. These systems will be introduced along with their existence theory, and convergence theory for numerical schemes.

3 — Block Pivoting for LCP
Michael Kostreva, Clemson University, Math Dept, Clemson, SC, United States, flstgla@clemson.edu

Block pivoting algorithms have been suggested and justified by Chandrasekaran for the case of Z-matrices. In this talk, it is shown that when a certain form of Mangasarian's equivalent nonlinear equation system for LCP is solved by Newton-Raphson iteration, block pivoting arises. Some justification can be given for certain classes of matrices, and experiments show that the block pivoting works on a larger class than expected.

4 — An Overview of PATH 4.x
Todd Munson, Enrico Fermi Scholar, Argonne National Laboratory, 9700 S. Cass Ave, MCS Division, Argonne, IL, 60439, United States, tmunson@mcs.anl.gov

The PATH algorithm has undergone significant modifications since the original release. Essentially, PATH solves a sequence of linear complementarity problem to calculate directions and uses the Fischer-Burmeister merit function. In this talk, I will provide an overview of the algorithm and the latest enhancements made in version 4.x of the implementation.

■ TA31

Westin-Tower 1406, 14th Floor

Optimization I

Contributed Session

Chair: Romy Shioda, University of Waterloo, Dept. Combinatorics and Optimization, Faculty of Mathematics, Waterloo, Ontario, N2L 3G1, Canada, rshioda@math.uwaterloo.ca

1 — A New Deep Cuts Generation Method for Solving RCP
Khosrow Moshirvaziri, Professor, California State University, 1250 Bellflower Blvd. Long Beach, CA, 90840, United States, moshir@csulb.edu, Mahyar Amouzegar

A major computational barrier in using cutting-plane methods to solve optimization problems is the complexity induced by cuts and increase in problem size. We present a variant of Tuy-type cuts in the context of linear reverse convex program (RCP). This technique generates deeper cuts while preserving dominance and requiring fewer computational steps toward global optima.

2 — Implementation Issues in the KHM Method for Semidefinite Programming
Brian Borchers, New Mexico Tech, Math Department, 801 Leroy Place, Socorro, NM, 87801, United States, borchers@nmt.edu

The HKM method is the most widely implemented method for semidefinite programming. Although many problems can be solved to an accuracy of 8 digits by a straight forward implementation of the method, other problems have been difficult to solve accurately. We review implementation "tricks" that have greatly improved the accuracy of solutions in the most recent version of CSDP, an implementation of the HKM method.

3 — Quadratic Variable Selection Problem
Romy Shioda, University of Waterloo, Dept. Combinatorics and Optimization, Faculty of Mathematics, Waterloo, Ontario, N2L 3G1, Canada, rshioda@math.uwaterloo.ca, Dimitris Bertsimas

We define Quadratic Variable Selection Problems as quadratic optimization problems that limits the total number of variables that can be strictly positive. Such a problem structure is prevalent in fields of statistics (e.g. subset selection in regression) and finance (e.g. optimal portfolio selection). We propose to solve such problems with a combination of implicit branch-and-bound and Lemke's pivoting method, while taking advantage of the special structure of this problem.

4 — Convex Combinatorial Optimization
Uriel G. Rothblum, Industrial Engineering and Management Technion, Haifa 32000, Israel, rothblum@ie.technion.ac.il

A broad class of "convex combinatorial optimization problems" is defined and strongly polynomial algorithm for solving such problems is proposed. The key assumption is the control of the edge-direction of a corresponding polytope.

5 — Implementable Algorithm for Stochastic Optimization Using Sample Average
Johannes Royset, Naval Postgraduate School, Department of Operations Research, Monterey, CA, 93943, United States, joroyset@nps.navy.mil, Elijah Polak

We develop an implementable algorithm for stochastic optimization problems involving probability functions. Problems of this type arise in the design of structural and mechanical systems. The algorithm consists of a nonlinear optimization algorithm applied to sample average approximations and a precision-adjustment rule. We prove that the algorithm converges to a solution with probability one, and illustrate its use by an example from the area of reliability-based structural optimization.

■ TA32

Westin-Tower 1407, 14th Floor

Scheduling II

Contributed Session

Chair: Gang Chen, University of Florida, 324 University Village South, Apt.#5, Gainesville, FL, 32603, United States, cgang@ufl.edu

1 — A Branch-and-Price Approach to the Employee Tour Scheduling Problem
Hua Ni, The George Washington University, 2121 I St. NW, Washington, DC, 20052, United States, nihua@gwu.edu, Hernan Abeledo

We propose a new formulation for the Employee Tour Scheduling Problem and use a branch-and-price algorithm approach. This formulation is explicit in nature, and can be applied to both the continuous and discontinuous cases. We also discuss extensions of different scheduling requirements, including break window, start-time band and interval. Computational results show that our approach is superior, compared with implicit formulations when solving medium to large size scheduling problems.

2 — Robustness Measures for Stochastic Resource Constrained Projects with Stochastic Tasks
Basma Selim, University of Central Florida, 12424 Research Parkway Suite 225, Orlando, FL, 32826, United States, bselim@mail.ucf.edu, Robert Armacost, Julia Pet-Armacost

Performance measures that are typically used in project scheduling focus on the characteristics of the planned schedule, such as schedule duration or cost. When disruptions in project duration or task order occur, new schedule performance measures are needed. This research describes a new set of robustness measures to quantify the impact of changes to the planned initial schedule. The particular "disturbance" considered here is the unexpected occurrence of an unscheduled (stochastic) task.

3 — A Dynamic Program for Minimizing the Expected Number of Tardy Jobs w/ Distinct Exponential Due Dates
Christopher Rump, Assistant Professor, Bowling Green State Univ., Dept. of Applied Stats and OR, Bowling Green, OH, 43403, United States, cmrump@hotmail.com, Jae-Young Choi, Galina Rogova

We examine single-server stochastic scheduling problems with an objective of minimizing the expected number of tardy jobs whose processing times are i.i.d. random variables. Although optimal static-list policies can be found in this case by solving corresponding assignment problems, we propose a dynamic programming approach for the case of distinct exponentially-distributed due dates that is significantly faster. We present computational experience in an application to emergency dispatching.

4 — Using Benders Decomposition to Implicitly Model Personnel Scheduling Problems
Monia Rekik, PhD student, Ecole Polytechnique de Montréal and GERAD, C.P. 6079, succ. Centre-Ville, Montréal, Qc, H3C 3A7, Canada, monia.rekik@polymtl.ca, François Soumis, Jean-François Cordeau

Personnel scheduling problems often incorporate constraints that can be modeled as transportation subproblems. We show that the "forward" and "backward" constraints, introduced by Bechtold and Jacobs (1990), are particular Benders cuts generated from a reformulation of the problem using transportation subproblems. These cuts are sometimes sufficient to ensure feasibility. We apply this result to a real-life shift scheduling problem with multiple breaks and work stretch constraints.

5 — Probabilistic Asymptotic Analysis of Stochastic Online Scheduling Problems
Gang Chen, University of Florida, 324 University Village South, Apt.#5, Gainesville, FL, 32603, United States, cgang@ufl.edu, Zuo-Jun Max Shen

We consider a stochastic online 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 any nondelay algorithm is asymptotically optimal for the stochastic online single machine, flow shop and uniform parallel machine problems under some mild assumptions. Our simulation studies show that two generic nondelay algorithms converge very fast.

■ TA33

Westin-Tower 1408, 14th Floor

Parallel Meta-heuristics for Network Design

Cluster: Parallel Computation
Invited Session

Chair: Teodor Crainic, Professor, U.Q.A.M., Dept. Management et technologie, C.P. 8888, succ. Centre-ville, Montreal, QC, H3C 3P8, Canada, theo@crt.umontreal.ca

1 — A Cooperative Multilevel Tabu Search Algorithm for the Hypergraph
Michel Toulouse, Assistant professor, University of Manitoba, 540 Machray Hall, University of Manitoba, Winnipeg, MB, R3T 2N2, Canada, toulouse@cs.umanitoba.ca, Teodor Crainic, Eric Guillemot

We present a cooperative multilevel algorithm for the hypergraph partitioning problem. The tabu search method is used to guide a Fiduccia Mattheyses like partitioning algorithm at each level of the cooperative procedure. The diversity of search parameters for tabu search is exploited to customize the search strategy for each level of the cooperative algorithm. Memories are also used to supersede cooperation among search processes providing for coordination of the cooperative search.

2 — A Cooperative Multilevel Parallel Tabu Search for Network Design
Teodor Crainic, Professor, U.Q.A.M., Dept. Management et technologie, C.P. 8888, succ. Centre-ville, Montreal, QC, H3C 3P8, Canada, theo@crt.umontreal.ca, Ye Li, Michel Toulouse

We address the fixed cost, capacitated, multicommodity network design problem. Coarsening levels are defined by the number of arcs fixed open. A tabu search explores solutions at each coarsening level. Inter-level information exchanges and the corresponding modifications to the search trajectory and the coarsening arcs makes up the cooperation mechanism. We examine information exchange strategies and the impact of algorithmic design parameters: initial coarsening, frequency of exchanges, etc.

3 — A Scatter Search Heuristic for the Multicommodity Flow Network Design Problem
Michel Gendreau, Centre de recherché sur les transports, Université de Montréal, C.P. 6128, succ. "Centre-ville", Montréal, QC, H3C 3J7, Canada, michelg@crt .umontreal.ca, Teodor Crainic

The Multicommodity Flow Network Design Problem is a highly relevant problem in transportation and telecommunications planning. It is also quite difficult to solve and large instances must be tackled by heuristic approaches. In this talk, we present a new heuristic based on Scatter Search and report computational results on a large set of benchmark problems.

■ TA34

Mart-Room A

Vehicle Routing I

Sponsor: Transportation Science & Logistics
Sponsored Session

Chair: Barrett Thomas, Assistant Professor, University of Iowa, W272 Pappajohn Building, University of Iowa College of Business, Iowa City, IA, 52242-1000, United States, barrett-thomas@uiowa.edu

1 — A Compressed Annealing Approach for the Traveling Salesman
Barrett Thomas, Assistant Professor, University of Iowa, W272 Pappajohn Building, University of Iowa College of Business, Iowa City, IA, 52242-1000, United States, barrett-thomas@uiowa.edu, Jeff Ohlmann

We apply a variant of simulated annealing, compressed annealing, to the traveling salesman with time windows problem. Compressed annealing introduces a dynamic penalty function to simulated annealing. We discuss the algorithm, implementation, results on standard test problems, and suggest general sets of problems to which compressed annealing can be applied.

2 — The A-Priori Dynamic Traveling Salesman Problem with Time Windows
Marius Solomon, Northeastern University, United States, M.SOLOMON@neu.edu, Allan Larsen, Oli Madsen

We propose a real-time solution method that requires the vehicle, when idle,to wait at the current customer location until it can service another customerwithout being early. In addition, we develop enhanced versions that may reposition the vehicle at a location different from that of the current customer based on a-priori information on future requests.

3 — Vehicle Routing Problems with Service Level Choice and Time Dimensions
Gary Chao, Northwestern University, Department of IE/MS, 2145 Sheridan Rd, Evanston, IL, 60208, United States, garychao@iems.nwu.edu, Peter Roy, Karen Smilowitz, Michal Tzur

We study a variation on the vehicle routing problem (VRP) with capacity and time constraints. In this variation the frequency of service is a decision variable, thus adding a time dimension to the problem. An application to interlibrary loan operations is discussed.

■ TA35

Mart-Room B

Operations Management IV

Contributed Session

Chair: Jian Li, Krannert School of Management, Purdue University, 403 W. State Street, West Lafayette IN 47907-2056, United States, li53@mgmt.purdue.edu

1 — Supply Contracts with Endogenous Supply Reliability
Haresh Gurnani, Associate Professor, University of Miami, Dept of Management, 414 Jenkins Building, Coral Gables, FL, 33124, United States, haresh@miami.edu, Mengze Shi

We consider a supply contract where the supplier's delivery reliability depends on the effort level. The model can be formally described in a two-stage setting: In stage one, the buyer makes an order, and in stage two, the supplier invests in reliability-improving efforts. The contract price negotiations can occur in stage one, or stage two, or both. Optimal contract policies are discussed.

2 — Optimizing the Automotive Value Chain
Guntram Noeth, Student, Darmstadt University of Technology, Stauffenbergstrasse 69a, Darmstadt, He, 64283, Germany, guntram_noeth@hotmail.com

Stagnating markets and vehicle prices require the automotive industry to reduce costs while new safety and environmental features increase the value of the car. That requires the automotive industry not only to cut costs in manufacturing, but also to realize cost savings by optimizing the value chain. This talk presents an analytic concept how the value chain can be optimized using operations research modeling and optimization tools. Recommendations for automotive OEMs and suppliers are derived.

3 — Joint Pricing and Inventory Decisions for a Retailer's Product Line
Bacel Maddah, Graduate Student, Virginia Tech, Dept. of Industrial and Systems Engg ., Blacksburg, VA, 24061-0118, United States, bmaddah@vt.edu, Ebru Bish

We study the retailer's problem of jointly determining the inventory level and price of each item in her product line, considering a multinomial logit choice model for demand. We develop an integrated marketing-production model and derive some structural properties of the optimal solution. We then propose a near optimal solution that is easily obtained via a single variable search and provide numerical results to demonstrate its effectiveness.

4 — A Study of Purchasing Contracts with a Probabilistic Demand Date
Jiamin Wang, Assistant Professor, Long Island University - C. W. Post Campus, Department of Management, 720 Northern Blvd., Brookville, NY, 11548, United States, jiamin.wang@liu.edu

In this paper we consider a single-period purchasing contract between a buyer and a supplier. Both the actual demand date and the flow time to complete the contract are uncertain. A game-theoretic model is constructed to optimize the

contractual delivery date and on-time delivery bonus selected by the buyer. The risk-sharing mechanism between the two parties is analyzed.

5 — Sales-Promotion Collaboration or Not: Stationary Analysis on a Two-Stage Supply Chain
Jian Li, Krannert School of Management, Purdue University, 403 W. State Street, West Lafayette, IN, 47907-2056, United States, li53@mgmt.purdue.edu, Leroy B. Schwarz, Jennifer Ryan, Vinayak Deshpande

Promotions are often used by retailers in order to increase sales. However, because of capacity or inventory constraints, the manufacturer may not have enough inventory to support such promotions. In this paper, we employ a two-stage one-retailer, one-manufacturer supply chain to examine the impact of sales-promotion collaboration on supply-chain performance.

■ TA36

Mart-Room C

Capacity Management in Supply Chains

Sponsor: Manufacturing and Service Operations Management
Sponsored Session

Chair: Feryal Erhun, Assistant Professor, Stanford University, Management Science&Engineering, Stanford, CA, 94305, United States, ferhun@stanford.edu

Co-Chair: Ozalp Ozer, Assistant Professor, Stanford University, 314 Terman, Stanford, CA, 94305, United States, ozalp .ozer@stanford.edu

1 — Dynamic Capacity Partitioning during New Product Introduction
Pu Huang, Carnegie Mellon Univ., Pittsburgh, PA, 15217, United States, pu@andrew.cmu.edu, Alan Scheller-Wolf

We embed a Markov process with unknown parameters within a periodic review make-to-stock model to estimate the demand for a new product, while simultaneously partitioning limited capacity between the new product and an extant product line. We provide a procedure that guarantees to find the open-loop optimal solution to the capacity partitioning problem (finding the globally optimal solution is computationally intractable). previously only static approximations and heuristics were available.

2 — Product Differentiation in a Capacitated Environment with Time and Reliability Sensitive Demands
Tamer Boyaci, Professor, Faculty of Management,McGill University, Canada, tamer .boyaci@mcgill.ca, Saibal Ray

We study a single firm selling two substitutable products, one express and another regular, in a time-sensitive market. The products are processed in dedicated facilities and there is an industry norm delivery time. We develop a model that integrates delivery time and reliability decisions with capacity requirements and costs, and investigate the firm's optimal differentiation strategy.

3 — The Role of Flexible Technology in Entry Deterrence
Rodney Parker, Assistant Professor of Operations Management, Yale University, United States, rodney.parker@yale.edu, Roman Kapuscinski

We consider market entry deterrence where the incumbent firm invests in a flexible capacity resource, capable of producing multiple products. The potential entrant decides whether to enter a market. We find the flexible resource is still capable of deterring entry. Moreover, it is possible the incumbent may reduce her capacity investment relative to equivalent dedicated capacity while still achieving entry-deterring monopoly output in the threatened market and monopoly output in the other.

4 — Strategic Commitments for Optimal Capacity Decision under Asymmetric Forecast Information
Ozalp Ozer, Assistant Professor, Stanford University, 314 Terman, Stanford, CA, 94305, United States, ozalp.ozer@stanford.edu, Wei Wei

We study the capacity decision in a two-level supply chain. The supplier is responsible for acquiring the necessary capacity before receiving the order from the manufacturer who possesses private forecast information for its end product. We identify two sources of inefficiency due to a wholesale price contract and propose contracts that achieve credible information sharing and channel coordination. By means of these contracts we also compare signaling game with mechanism design.

■ TA37

Mart-Room D

Heuristic Programming Applications

Contributed Session

Chair: Conrado Borraz Sanchez, Engineer in Systems, Universidad Autonoma de Nuevo Leon, Av. Sierra de Picachos #139, San Nicolas de Los Garza, NL, Mexico, cbs_10_09@hotmail.com

1 — Searching for the Best Genotype(s) to Optimize Breeding Value for Pigs Using Heuristics
Ryan Sherriff, Doctoral Student, Massey University, Statistics and Decision Science, IIST, Massey University, Palmerston North, NZ, 5301, New Zealand, r.l .sherrif@massey.ac.nz, Ramaswami Sridharan, Patrick Morel, Hugh Blair, Graham Wood

Three heuristic procedures, namely, Genetic Algorithm, Tabu Search, and Simulated Annealing were developed to identify the best genotype(s) to optimize the breeding value for pigs. Additive gene action is assumed with a standard growth model for pigs used to simulate the growth of pigs. Computational results, including comparisons of the three heuristics, will be presented.

2 — Optimizing Wood Waste Collection for Energy Generation Using Genetic Algorithms
Claudio Cunha, Professor of Logistics and Transportation, Escola Politécnica - University of Sao Paulo, Departamento de Engenharia de Transporte, Av. Prof. Almeida Prado, Trav.2, n.83, Sao Paulo, SP, 05508-900, Brazil, cbcunha@usp.br, Flavio Galvao

The problem of wood waste collection for energy generation purposes involves selecting the producers and scheduling the vehicles in order to minimize waste supply and transportation costs. The proposed solution decomposes the problem into both IP models and a heuristic based on genetic algorithms (GA). The GA aims to select the best days to visit each producer to minimize the fleet size. The model was applied to a real problem involving energy generation for a sugar refinery plant in Brazil.

3 — Building A Scenario Tree To Reduce Bias
Anukal Chiralaksanakul, Vanderbilt University, 2118 Erin Lane, Nashville, TN, 37221, United States, anukal@mail.utexas.edu, David Morton

We discuss in the context of stochastic lot sizing a method to allocate sample size for building a tree in order to reduce bias associated with an estimator of the optimal objective function value.

4 — A Piece-by-Piece LP Based Heuristic for a Multi-Level Lotsizing Problem in High Volume Factories
Xinhui Zhang, Assistant Professor, Depart of Biomedical, Industrial and Human Factors Engineering, Wright State University, Dayton, OH, 45440, United States, xinhui.zhang@wright.edu, Jonathan F. Bard

We investigate a piece-by-piece LP-based heuristic to solve a multi-level lotsizing problem in high volume factories. The heuristic uses the LP solution as a target and attempts to find an integer solution that is as close to it as possible. The procedure consists of solving the LP relaxation and two integer programs and is similar to a "piece-by-piece decomposition" in nonlinear programming. The heuristic is able to yield good solutions an order of magnitude faster than branch and bound.

5 — A Local Search Heuristic for Pipeline Network Optimization
Conrado Borraz Sanchez, Engineer in Systems, Universidad Autonoma de Nuevo Leon, Av . Sierra de Picachos #139, San Nicolas de Los Garza, NL, Mexico, cbs_10_09@hotmail .com, Roger Rios

In this talk we address the problem of minimizing the total fuel consumption over a natural gas pipeline network. We attempt to exploit the special structure of this nonconvex nonlinear problem to derive a discrete neighborhood and develop a local search heuristic. We present preliminar computational experience over a wide database instance set with different network topologies, which show the effectiviness of the proposed procedure.

■ TA38

Mart-Room E

Stochasticity and Vehicle Routing in Traffic Networks

Sponsor: Transportation Science & Logistics
Sponsored Session

Chair: Elise Miller-Hooks, The Pennsylvania State University, Department of Civil and Environmental En, United States, edm3@psu.edu

1 — Optimal Vehicle Routing with Real-Time Traffic Information
Seongmoon Kim, Assistant Professor, Industrial & Systems Engineering, Florida International University (FIU), 10555 W. Flagler Street, (EC 3100), Miami, FL, 33174, United States, Seongmoon.Kim@FIU.EDU, Chelsea C. White, III, Mark Lewis

This paper examines the value of real-time traffic information to optimal vehicle routing in a non-stationary stochastic network. We present a systematic approach to aid in the implementation of transportation systems integrated with real time information technology. We develop decision-making procedures for determining the optimal driver attendance time, optimal departure times, and optimal routing policies under stochastically changing traffic flows based on a Markov decision process formulation. With a numerical study carried out on an urban road network in Southeast Michigan, we demonstrate significant advantages when using

this information in terms of total costs savings and vehicle usage reduction while satisfying or improving service levels for just-in-time delivery.

2 — Shortest Path Problems with Time Constraints in Stochastic Time-Varying Networks
Deepak Kumar, University of Texas, Dept. of Civil Eng, Austin, TX, 78712, United States, dkumar1@uiuc.edu, S Travis Waller

We discuss several new variations of stochastic shortest path problems where some specified constraint must be met on the travel time of the path. We use a modified label correcting approach to find a shortest path with least possible cost, subject to the constraint that the expected travel time is at most some specified constant. The travel times are considered to be stochastic and/or time-varying while the costs may take on simple static values or stochastic and/or time-varying values. The correctness of the proposed algorithm will be proved and results from the model will be presented in addition to discussing some of the instances where this problem has practical significance.

3 — Adaptive Hyperpaths in Multicriteria Stochastic, Time-Varying Networks
Sathaporn Opasanon, University of Maryland, Department of Civil and Environmental Engineering, 1173 Glenn Martin Hall, College Park, MD, 20742, United States, sxo151@psu.edu, Elise Miller-Hooks

We develop an efficient algorithm to determine a set of adaptive Pareto-optimal hyperpaths that seek to minimize the expected value of a number of criteria in stochastic, time-varying multicriteria networks. Such adaptive strategies allow the traveler to adaptively choose the next move from each intermediate location en route to a chosen destination in accordance with his/her changing preference for optimizing with respect to a particular criterion.

4 — Robust Optimization with Traffic Assignment under Demand Uncertainty
Satish V S K Ukkusuri, University of Texas, Dept. of Civil Eng., Austin, TX, 78712, United States, ukkusuri@uiuc.edu, S Travis Waller, V M Tom

This research deals with finding the impact of demand uncertainty of O-D trip pairs on traffic network performance. This work represents a solution methodology that follows from previous work on demand uncertainty in static traffic assignment. Specifically, the second order moments will be explicitly considered in addition to the expected value of system costs for network design decisions via a genetic algorithm approach. Some initial solutions will be presented and the importance of considering the volatility in the model will be demonstrated to achieve robust solutions for network improvements using traffic assignment models.

■ TA39

Mart-Room F

Supply Chain Management II

Contributed Session

Chair: Renee Butler, Georgia Institute of Technology, 812 N. Elizabeth Pl, Atlanta, GA, 30318, United States, rbutler@isye.gatech.edu

1 — Solving a Probabilistic Inventory Model in Supply Chain by Simulated Annealing
Masoud Rabbani, Professor, Tehran University, Faculty of Eng. University of Tehran, Tehran, Te, Iran, fzfn@parsonline.net, Fariborz Forutan

A simulated annealing algorithm was developed to solve a probabilistic inventory model in supply chain. Since, the inventory models in supply chain are so complicated that cannot be solved exactly, we used this metaheuristic method. After writing its program, the parameters of algorithm were set so that the results gave the best local optimum.

2 — Supply Chain Management with Service Contributions
Chayakrit Charoensiriwath, Georgia Institute of Technology, 324868 GA Tech Station, Atlanta, GA, 30332, United States, chayakritc@isye.gatech.edu, Jye-Chyi Lu

3 — Robust Optimization Model for Production and Distribution Capacity Development
Renee Butler, Georgia Institute of Technology, 812 N. Elizabeth Pl, Atlanta, GA, 30318, United States, rbutler@isye.gatech.edu, Jane Ammons, Joel Sokol

This paper develops a scenario-based robust optimization model for making production and distribution capacity development decisions through time in the face of future uncertainty. A case study based on a Fortune 200 company's introduction of a spinoff product line illustrates the effectiveness of the approach.

4 — Life Cycle Pricing in a Remanufacturing Environment
Umut Aytekin, Northwestern Univeristy, IEMS Department, Evanston, IL, 60208, United States, umut@northwestern.edu, Canan Savaskan

We investigate the pricing strategy of a monopolist in a dynamic setting, which jointly optimizes the revenues from new product sales and the cost savings from remanufacturing. This paper develops an accurate model of the new product demand dynamics and the supply dynamics of used products. We address how would the price of the new product be set at each time point in a remanufacturing environment and compare the price pattern to a purely manufacturing environment .

5 — Value of Information in A Multi-client Production-Inventory System
Boray Huang, Northwestern University, 2145 Sheridan Road, IEMS, Tech C124, Evanston, IL, 60202, United States, b-huang@northwestern.edu, Seyed Iravani

We consider a capacitated supply chain with one manufacturer and two retailers. The manufacturer's optimal production policies are studied under three information sharing scenarios: Full, None, and Selective. We show the structures and properties of the optimal policies. An extensive numerical study is also performed to investigate the effects of system factors and the insights on the parameters that affect the partner selection for information sharing.

■ TA40

Mart-Room G

Topics in Supply Chain Management

Cluster: Supply Chain Management
Invited Session

Chair: Costis Maglaras, Columbia University, 409 Uris Hall, 3022 Broadway, NY, NY, 10027, United States, c.maglaras@columbia.edu

Co-Chair: Assaf Zeevi, Columbia University, NY, 10027, United States, assaf@gsb.columbia.edu

1 — Dynamic Leadtime Management in Supply Chains
Alp Muharremoglu, United States, alp2101@columbia.edu, John Tsitsiklis

A common way to hedge against fluctuations in demand in supply chains is to change leadtimes dynamically. Having multiple suppliers, transportation modes or routing options are examples of flexible leadtimes. We study a serial system with leadtime flexibility. Under a certain supermodularity assumption on the costs, we show that optimal policies can be characterized as extended echelon base stock policies, which is a natural generalization of the well known echelon base stock policies.

2 — Competition in Service Industries
Gad Allon, Graduate School of Business, Columbia University, Uris Hall, New York, NY, United States, ga2003@columbia.edu, Awi Federgruen

We develop models for a service industry, in which an arbitrary number of differentiated service providers compete for customers, by selecting service fees and processing capacities so as to meet pre-announced service standards (e.g. expected waiting times). The demand rate faced by each of the competing service providers may, in general, depend on all of the prevailing prices and service standards.

3 — An Inventory Model with Markov-Modulated Demands and Long Lead Times
Martin Reiman, Bell Labs, Lucent Technologies, Room 2C-315, 600 Mountain Ave., Murray Hill, NJ, 07974, United States, marty@research.bell-labs.com, Alan Weiss

We consider a periodic review inventory model with Markov modulated demand and fixed positive lead time (L). We examine the asymptotic behavior of the optimal base stock levels as L becomes large. When the transition probabilities out of each state of the modulating Markov chain scale as 1/L the safety stock will be O(L) and may be negative.

4 — An Agency Model in a Periodic-Review Inventory System
Jun-Yeon Lee, Krannert School of Management, Purdue University, West Lafayette, IN, 47907, United States, lee6@mgmt.purdue.edu, Leroy B. Schwarz

We consider a single-item, T-period, stochastic inventory-replenishment system from an agency perspective. Specifically, a risk-neutral principal delegates the operation of the system to an agent with an exponential utility function. A replenishment order is delivered immediately or one period later, depending probabilistically on the unobservable effort expended by the agent. The principal's objective is to design a contract that minimizes her expected total cost, which includes an end-of-horizon payment to the agent that depends on the realized leadtimes. We show that there exists an optimal payment scheme whose form is the sum of the single-period optimal payment schemes. Then, under a unimodality assumption, we characterize the optimal effort strategy and inventory policy to be induced. We find that a modified base-stock policy is optimal and that, unlike in the traditional multi-period newsvendor model, given the same initial inventory the optimal order-up-to levels may not be monotonic as the end of the horizon approaches. Several insights are provided based on a computational study.

■ TA41

Mart-Room H

Incentives, Competition and Cooperation in Supply Chains

Cluster: Supply Chain Management
Invited Session

Chair: Daniel Granot, Professor, University of British Columbia, Faculty of commerce, Vancouver, BC, V6T 1Z2, Canada, daniel.granot@commerce.ubc.ca

1 — Supply Chains with Newsvendors under Competition
Xuan Zhao, University of British Columbia, Operations and Logistics Division, Sauder School of Business, Vancouver BC V6T 1Z2, Canada, xuan.zhao@sauder.ubc.ca, Derek Atkins

We investigate a two-echelon supply chain system with a common supplier selling to newsvendors engaging in price and inventory competition. Each newsvendor's total stochastic demand depends on his retail price and inventory level, and those of the competitors. We analyze the equilibrium behaviors, the effect of competition, and coordination contracts.

2 — On Postponement in the Newsvendor Model with Price-Dependent Demand
Shuya Yin, University of British Columbia, Vancouver, BC, V6T 1Z2, Canada, shuya .yin@commerce.ubc.ca, Daniel Granot

We investigate the effect of postponement in a price-dependent newsvendor model. Postponement allows the parties to commit to the contract parameters (e.g., wholesale price, retail price, buyback rate and order quantity) sequentially and alternately, and we study the effect of different postponement strategies on channel efficiency and the profits of the channel members .

3 — Price-Setting Retailers Facing Stochastic Demand: Effects of Clearance Pricing and Inventory Sharing
Greys Sosic, Marshall School of Business, University of Southern California, Los Angeles, CA, United States, sosic@marshall.usc.edu

We analyze how the possibility of selling residual inventory at a clearance price influences stocking and pricing decisions for a retailer facing a stochastic price-sensitive demand, how it affects his decision to participate in inventory-sharing agreements with other retailers, and what are the impacts of using different rules for allocation of the profit resulting from inventory sharing.

4 — Lead Time Reduction in a Decentralized Supply Chain with Two Supply Sources
Harish Krishnan, University of British Columbia, Faculty of Commerce and Business Admin, Vancouver, BC, Canada, harish.krishnan@commerce.ubc.ca, Roman Kapuscinski, David Butz

We study the impact of lead time reduction (LTR) on individual payoffs in a decentralized channel, where the manufacturer sells to a retailer who also stocks a competing (generic) product. Results show that LTR may be detrimental to the manufacturer and may induce the retailer to stock more of the generic product. Desirable supply chain innovations may not be adopted because benefits are appropriated by other firms in the channel. Contractual methods to mitigate this problem are discussed.

■ TA42

Mart-Room I

Dynamic Pricing and Revenue Management

Sponsor: Revenue Management & Dynamic Pricing
Sponsored Session

Chair: Rene Caldentey, Assistant Professor, New York University, Stern School of Business, 44 W Fourth St. Room 8-77, New York, NY, 10012, United States, rcaldent@stern.nyu.edu

Co-Chair: Mark Ferguson, Assistant Professor, DuPree College of Management, Georgia Institute of Technology, 755 Ferst Drive, Atlanta, GA, 30332, United States, Mark.Ferguson@mgt.gatech.edu

1 — Dynamic Pricing Policies under Competition
Rene Caldentey, Assistant Professor, New York University, Stern School of Business, 44 W Fourth St. Room 8-77, New York, NY, 10012, United States, rcaldent@stern.nyu .edu

We investigate optimal dynamic pricing strategies for two firms that compete selling substitute products to the same population of buyers during a fixed time horizon. Initial inventory levels for each firm are private information, however each firm is able to monitoring the price process of its competitor. Demand is modeled as an exogenous price sensitive stochastic process and no inventory replenishment is allowed during the selling season.

2 — Price and Quantity Decisions Considering Quality and Inter-Company Competition
Mark Ferguson, Assistant Professor, DuPree College of Management, Georgia Institute of Technology, 755 Ferst Drive, Atlanta, GA, 30332, United States, Mark .Ferguson@mgt.gatech.edu

Firms often make production or purchasing decisions without knowledge of the exact market size of their product. Given a perishable product whose quality level decreases over time, how does a firm make pricing and inventory decisions for its unsold inventory. We characterize these decisions and find conditions under which the firm is better off scrapping either all or part of its leftover inventory in order to avoid competition with any new product obtained in the future periods.

3 — A Dynamic Negotiation Framework for Manufacturing Contracts
Jeremie Gallien, MIT Sloan School of Management, Cambridge, MA, United States, jgallien@MIT.EDU, Yann Le Tallec, Tor Schoenmeyr

Seeking to establish quantitative guidelines for negotiating manufacturing contracts along the dimensions of price, quantity and lead-time, we investigate the dynamic admission control of jobs with hard deadlines into a single machine queue with preemptive scheduling. We derive admission control policies using various DP approximation techniques, compare them against the myopic and optimal anticipative policies, and discuss their potential implementation into a decision support system.

4 — Applications of Robust Optimization in Supply Chains and Revenue Management
Aurelie Thiele, MIT, 77 Mass Ave Rm 35-205, Cambridge, MA, 02139, United States, aurelie@mit.edu, Dimitris Bertsimas

We propose a robust optimization methodology as a tractable alternative to stochastic programming in supply chains and revenue management in presence of uncertainty. This approach does not suffer from the curse of dimensionality, builds upon a related deterministic framework that leads to theoretical insights into the optimal robust policy and gives encouraging numerical results.

■ TA43

Mart-Room J

Auction Models and Bidding Strategies

Cluster: Auctions
Invited Session

Chair: Roy Kwon, University of Toronto, Mechanical and Industrial Engineering, 5 King's College Road, Toronto, On, M5S 3G8, Canada, rkwon@mie.utoronto.ca

1 — Bidding Strategy for Combinatorial Auctions
Na An, Georgia Tech ISYE, 325433 Georgia Tech Station, Atlanta, GA, 30332, United States, engp8759@isye.gatech.edu, Pinar Keskinocak, Wedad Elmaghraby

Combinatorial auctions are auctions where bidders can name their prices on combinations of items. The use of combinatorial auctions in industrial settings is increasing. However, there is very little research on the bidding strategies of bidders. Our research focuses on how to efficiently represent bidder's priority by strategically generating bundles and how to wisely bid in the combinatorial auction.

2 — Comparison of Procurement Auctions
Woonghee Tim Huh, Assistant Professor, Columbia University, IEOR Department, S.W. Mudd Building, New York, NY, 10027-6699, United States, huh@orie.cornell.edu, Micheal Freimer, Robin Roundy, Amar Sapra

We consider a market with one agent having large capacity and other agents having small capacities. We study 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.

3 — Combinatorial Auction Mechanisms for Telecommunications Network Design
Roy Kwon, University of Toronto, Mechanical and Industrial Engineering, 5 King's College Road, Toronto, On, M5S 3G8, Canada, rkwon@mie.utoronto.ca, Anand Anandalingam

We present a multi-round combinatorial auction mechanism for call admission and routing in advance reservation telecommunications networks. A bid will consist of a set of links. Bidders optimize to find utility maximizing paths that meet connection and quality of service constraints. The auctioneer maximizes revenue based on bids received. Computational results will be presented.

■ TA44

Mart-Room K

Modeling Uncertainty in Air Traffic Management Session

Sponsor: Aviation Applications
Sponsored Session

Chair: Joyce Yen, University of Washington, Box 352650, Seattle, WA, United States, joyceyen@u.washington.edu

1 — Using Selective Delays to Increase Fleet Performance
David Benson, NetJets, Inc., United States, dbenson@netjets.com

We alter the fractional airline scheduling problem to include the ability to purchase a delay in a requested flight. We are able to show that the savings of the selective delays, in decreased empty miles and subcontracted flights, overcome seemingly prohibitive penalties for moving the departure time of a flight.

2 — The Single Airport Ground Holding Problem: Insights and Risk Analysis
Kevin Taaffe, University of Florida, 303 Weil Hall, Gainesville, FL, 32611, United States, taaffe@ufl.edu

Many researchers have presented efficient methods for solving variants of the Single Airport Ground Holding Problem. We provide a foundation for this research by presenting the underlying motivation for using stochastic programming as opposed to using a deterministic approach. We also introduce risk aversion objectives that allow a decision maker more flexibility in proposing a ground holding plan, while attempting to minimize the extent to which extremely poor outcomes exist.

3 — A Stochastic Programming Approach to the Schedule Recovery Problem under Weather Uncertainty
Berkin Toktas, University of Washington, Industrial Engineering Box 352650, Seattle, WA, 98195, United States, berkin@u.washington.edu, Joyce Yen, Zelda B. Zabinsky, Matthew E. Berge, Craig A. Hopperstad

In this study, we focus on the schedule recovery problem under stochastic weather conditions. We propose alternative stochastic programming formulations to model this problem, and present techniques to solve the resulting models. We discuss issues related to the complexity of the proposed techniques, and give results on a set of test problems.

4 — Model for Adaptive Rescheduling of Flights in Emergencies
Jerzy A. Filar, Foundation Chair of Mathematics and Statistics, School of Mathematics, University of South Australia, Mawson Lakes, SA 5095, Australia, Jerzy .Filar@unisa.edu.au, Prabhu Manyem, Kevin White, David Panton

We devise an ATM methodology to optimize response to perturbations in flight schedules caused by sudden capacity drops at Sydney airport. An adaptive optimization model was developed to reduce the airport capacity levels, thereby reducing the need to place incoming planes in holding patterns and therefore decreasing noise and fuel wastage.

■ TA45

Mart-Room L

Models for Decision Support

Contributed Session

Chair: Nagi Gebraeel, Ph.D. Candidate, Purdue University, 227 Arnold Drive, Apt. 14, West Lafayette, IN, 47906, United States, gebraeel@ecn.purdue.edu

1 — Decision Support System Model for IT Security Management in Enterprises
Mohammed Hamdi, PhD student at School of Telecommunications, University of Carthage, National Digital Certification Agency, 3 bis Rue d'Angleterre, Tunis, 1000, Tunisia, mmh@certificatin.tn, Noureddine Boudriga, Wafa Jridi, Salah Benabdallah

The objective of this paper is to present a decision support system model based on cognitive maps to help security decision makers to detect hostile activities in the enterprise information and communications resources. The model will adapt the cognitive maps (CM) techniques to perform a qualitative approach to the quantitative security risk management. We begin by defining the basic causal operators of our model that determine how an action (attack or countermeasure) influences the system and assign a value to this influenced relationship. The defined operators are divided into categories depending on the way they change the state of the system (positive or negative effect) and the entities that they put in relationship. In addition, the same quantitative inference-based parameters can be used to estimate the impact of a malicious action against the enterprise's system. Another advantage of the model is that it can be easily integrated within the global decisional framework of the enterprise since the security decisions can be immediately translated to the management environment. To ensure an optimal decision, we investigate several multi-objective optimization techniques (mainly evolutionary algorithms). We define an optimization model where each individual (set of decisions) can be represented by the use of the aforementioned quantitative cognitive maps. Finally a decision support system will be developed to link between the system representation and the optimization model.

2 — Intelligent Decision Support Systems for Integration of e-Manufacturing and e-Business
Sk Ali, Teaching Assistant, University of Wisconsin-Milwaukee, Industrial and Manufacturing Engineering, 3200 N. Cramer St., Milwaulee, WI, 53211, United States, ahad@uwm.edu, Jay Lee, Hamid Seifoddini

Companies are moving towards an increasingly global market economy and increase in customer expectations which has put industry under pressure to become more agile under highly dynamic market and supply conditions. The research provides the genetic algorithm based agent system for dynamic optimal scheduling of a manufacturing system. It also proposes a novel environment for coordination/integration methodology for synchronization of e-Manufacturing and e-Business for decision support systems.

3 — User Acceptance of Multi-Criteria Decision Analysis: The Impact of Preference Elicitation Techniques
John Aloysius, Associate Professor, University of Arkansas, WCOB 204, Fayetteville, AR, United States, aloysius@comp.uark.edu, Ross Taylor, Fred Davis, Darryl Wilson, Jeff Kottemann

MCDA uses many techniques to measure attribute evaluations and weights. The normative validity of these techniques has been studied, but their effects on user acceptance of MCDA is overlooked. Two commonly used elicitation techniques are absolute measurements and pairwise comparisons. We find that users regard tools that employ pairwise comparisons as less accurate, more effortful, higher in decisional conflict, and overall less desirable to use than absolute measurement.

4 — A Generalized GDSS Based on the Mathematical Solution to the Voter Paradox
Nagib Callaos, Retired Professor, International Institute of Informatica and Systemics, 14269 Lord Barclay Dr, Orlando, FL, 32837, United States, ncallaos@callaos.com, William Lesso, Belkis Sanchez

The purpose of this paper is to describe a conceptual design and a basic architecture of a Generalized Group Decision Support System (GDSS), based on the Mathematical Solution of the Voter Paradox, and aimed to sustain processes of Group Problem Solving. The Generalized GDSS described here has been applied to several specific cases as, for example, Strategic Planning, Reengineering, Management Control, Participatory Management, Participatory Democracy, etc.

5 — Prediction of Residual Life Distributions for Maintenance and Replacement Management
Nagi Gebraeel, Ph.D. Candidate, Purdue University, 227 Arnold Drive, Apt. 14, West Lafayette, IN, 47906, United States, gebraeel@ecn.purdue.edu, Mark Lawley

This research develops and compares two approaches that model a database of degradation signals in order to predict remaining life distributions of partially degraded components. These distributions are then used to develop optimal replacement strategies. A Neural Network model with Fuzzy Clustered degradation information is used to predict component failure times. Secondly, a Random Coefficients model with jointly distributed parameters is used to compute remaining life distributions.

■ TA46

Mart-Room M

E-Business I

Contributed Session

Chair: Gewei Ye, Assistant Professor, Towson University, 100 Hillman Ct., Alpharetta, GA, 30022, United States, gye1@ohio.edu

1 — Topic Driven Information Retrieval for Organizational Data using Web Scraping
Uday Shankar Nadupalli, Student, Louisiana State University, 3128 CEBA, Baton Rouge, LA, 70803, United States, n_udayshankar@yahoo.com, Gerald Knapp

The explosive growth of the Web motivated the development of tools for locating specific information on the Web. Web Scrapers are hypertext resource discovery models that seek out pages relevant to a pre-defined set of topics. The design of an effective scraping strategy to traverse the links, according to their importance was a challenge. A pattern matching classifier evaluates the relevance of the web page and Data extraction from semi structured web pages is done using efficient parsing.

2 — Identifying Factors of Marketing Relationship in B2C e-Business
Edward Chen, Associate Professor, U. of Massachusetts Lowell, Management Department, One University Avenue, Lowell, MA, 01854, United States, Edward_chen@uml.edu

With the widespread of e-business, marketing managers have focused on the strategies to last relationship between the enterprise and its online consumers.

This empirical study surveyed more than 350 online shoppers. The results found that both trust and commitment are two major factors to keep customer relationship.

3 — E-Finance: The Create-Collect-Manage-Protect (CCMP) Model
Gewei Ye, Assistant Professor, Towson University, 100 Hillman Ct., Alpharetta, GA, 30022, United States, gye1@ohio.edu, Garland Keesling

The capital infrastructure of e-Commerce, termed e-Finance, is extended with a conceptual model . E-Finance deals with construction and destruction treatment of Internet financial data. Four sub-fields (1)Internet business models to create wealth;(2)Internet monetary transactions to collect and use wealth;(3)Financial database management system to manage wealth; and (4)Financial Internet security system to protect wealth. The CCMP model integrates financial management and e-Commerce.

■ TA47

Atlanta G, 7th Floor

Software Demonstration

Cluster: Software Demonstrations
Invited Session

1 — GoldSim Technology Group - Probabilistic Dynamic Simulation Using GoldSim
Rick Kossik, GoldSim Technology Group, 18300 NE Union Hill Rd. Ste. 200, Redmond, WA, 98052, United States, rkossik@goldsim.com

GoldSim is a Windows-based probabilistic, dynamic simulation tool designed for building hierarchical models of complex systems to support strategic planning and risk management in business, engineering and science. The software can simultaneously address both continuous and discrete dynamics, and propagates uncertainty using Monte Carlo simulation. The probabilistic simulation philosophy on which the software is based will be discussed. Attendees will learn how GoldSim is different from other approaches (e.g., discrete event simulation, system dynamics, spreadsheets), and the kinds of problems to which the software can be applied. The key features and capabilities of the software will be demonstrated.

2 — Decisioneering, Inc. - Spreadsheet Simulation and Modeling Using Crystal Ball Professional
Lawrence Goldman, Decisioneering, Inc., 1515 Arapahoe St. #1311, Denver, CO, 80202, United States, lgoldman@crystalball.com

How will you teach risk analysis to your students? Crystal Ball, one of the most recognized simulation software tools, enhances Excel with the ability to easily perform Monte Carlo analysis, optimization, and time-series forecasting. This presentation will use practical examples to show how Crystal Ball can help quantify and reduce operational and financial risks

Tuesday 10:00pm - 11:30pm

■ TB01

Westin-Intl. A, 6th Floor

Applied Queueing

Contributed Session

Chair: Ho Woo Lee, Professor, Dept. of Systems Management Engineering, Sung Kyun Kwan University, Su Won, 440-746, Korea Repof, hwlee@yurim.skku.ac.kr

1 — Markov Processes with Linear Rates on a Semi-Infinite Strip
David Schweitzer, Lehigh University, Industrial and Systems Eng., 200 West Packer Ave, Bethlehem, PA, 18015, United States, desc@lehigh.edu, Ivo Adan, Jacques Resing

Generalizing $M^X/E2/s$, $M^X/M/s$ with server breakdowns, and a multi-server queue with locking, we determine the equilibrium probabilities for a general class of Markov processes on a semi-infinite strip. We express them as a finite sum, and give numerically attractive methods for determining the complex roots of the necessary equations.

2 — Optimal Admission Control for a Single Server Loss Queue
Kyle Lin, Assistant Professor, Virginia Tech, Grado Dept of Industrial and Systems Eng, 250 Durham Hall, Blacksburg, VA, 24061, United States, kylin@vt.edu, Sheldon Ross

Consider a single server loss queue where a gatekeeper exercises admission control without knowing the busy-idle status of the server. There is a cost if the gatekeeper blocks a customer, and a larger cost if an admitted customer finds the server busy. The gatekeeper's goal is to minimize the total expected discounted cost on an infinite time horizon. We derive the optimal policy for exponential service distribution, and discuss its structural properties in general.

3 — Analysis of MAP/G/1 Queue Under D-policy
Ho Woo Lee, Professor, Dept. of Systems Management Engineering, Sung Kyun Kwan University, Su Won, 440-746, Korea Repof, hwlee@yurim.skku.ac.kr, Sang Hoon Cheon, Kyung Suk Song

We present the queue length and waiting time analyses of the MAP/G/1/FCFS queue under D-policy. The server becomes idle as soon as the system becomes empty. Then, it is reactivated only when the cumulative workload exceeds D. Firstly, we derive the vector GFs of queue lengths. Secondly, we derive the LST of the waiting time distribution. Finally, the M/G/1/D-policy queue will be investigated as a special case and existing results will be confirmed.

■ TB02

Westin-Intl. B, 6th Floor

Financial Engineering

Contributed Session

Chair: Muffasir Badshah, Graduate Student, Drexel University, Korman Center, 3141 Chestnut St, Philadelphia, PA, 19104, United States, mhb25@drexel.edu

1 — Asset Allocation with Bayes-Stein Estimators
Robert Groat, CPO, netDecide Corp, 7600A Leesburg Pike, West Building, Suite 100, Falls Church, VA, 22043, United States, robert.groat@netDecide.com, Chang Li, Yuan Wang, Grep Chen

The portfolio performance will be significantly improved if you properly use the statistical adjustment. We present a simple empirical Bayes-Stein estimator in the MVO application. It has a good performance with portfolio selection.

2 — Variance Estimators for an Inter-Market Equity Trading Model
David Goldsman, Professor, Georgia Institute of Technology, School of Industrial and Systems Eng., Atlanta, GA, 30332, United States, sman@isye.gatech.edu, Sungjoo Lee

We develop an equity-trading model that uses a variety of estimators for the variance parameter of a stationary stochastic process, e.g., estimators arising from such methods as batch means, overlapping batch means, and standardized series.

3 — Multi-period Stochastic Optimization Models for Dynamic Asset Allocation
Norio Hibiki, Associate Professor, Keio University, 3-14-1 Hiyoshi, Kohoku-ku, Yokohama, 223-8522, Japan, hibiki@ae.keio.ac.jp

The path of uncertainties is typically revealed as a scenario tree in the multi-period stochastic programming (MSP) model. An alternative stochastic programming model using simulated paths is proposed by Hibiki, which is called the hybrid model. We compare the hybrid model with scenario tree model by using some numerical examples. The results show that the efficient frontier of the hybrid model is better than that of the scenario tree model evaluated using the same simlated paths.

4 — Bayesian Learning Real Options
Luke Miller, PhD Candidate, Auburn University, 628 Samford Ave, Auburn, AL, 36830, United States, millelt@eng.auburn.edu, Chan Park

This research develops a Bayesian Learning Real Option (BLRO) by merging the Bayesian decision-making process with the real options framework. Utilizing the lognormal conjugate relationship, real option values are discussed from an underlying asset and volatility perspective with bounds identified for posterior and preposterior option values.

5 — Short-Term Equity Dynamics and Endogenous Market Fluctuations
Muffasir Badshah, Graduate Student, Drexel University, Korman Center, 3141 Chestnut St, Philadelphia, PA, 19104, United States, mhb25@drexel.edu, Theodore Theodosopoulos

We present a model that investigates the spontaneous emergence of randomness in equity market microstructure. The phase space analysis of our model imposes limits to the contemporaneous determination of volume and price momentum, which serve as canonical conjugate variables. We formulate a control problem for maximizing price regularity and stability while minimizing entanglement with the market, representing the NYSE specialists' affirmative obligation to maintain "fair and orderly markets".

■ TB04

Westin-Intl. D, 6th Floor

Supply Chain Optimization for the Retail Industry

Cluster: Practice Track
Invited Session

Chair: Dawn Rose, Department of Mathematics, Emmanuel College, Boston, MA, United States, rosed@emmanuel.edu

1 — Building Adaptive Supply Chains in Retail
Noha Tohamy, Forrester Research, Boston, MA, United States, NTohamy@forrester.com

With increased focus on flexibility as well as efficiency, retailers are striving to build adaptive supply networks. These are networks of supply chain partners that use technology to sense, interpret, and act on changes in their environment in a coordinated fashion. This talk will describe how retailers are investing in technologies, implementing new processes and aligning people to build and manage such networks.

2 — Best Practices in Using Optimization Techniques to Manage Retail Supply Chains
Dawn Rose, Department of Mathematics, Emmanuel College, Boston, MA, United States, rosed@emmanuel.edu

Retailers are under increasing pressure imposed by bargain-savvy customers and competition. They respond by cutting prices, increasing promotions, and expanding their product assortment. If not done carefully, these moves can harm profits and increase operational costs. This talk will focus on various intervention points throughout the retail supply chain where opportunities exist for optimization models.

■ TB05

Westin-Intl. E, 6th Floor

Scheduling and Stability of Stochastic Networks

Sponsor: Applied Probability
Sponsored Session

Chair: John Hasenbein, Assistant Professor, University of Texas at Austin, Dept. of Mechanical Engineering, 1 University Station, C2200, Austin, TX, 78712, United States, jhas@mail.utexas.edu

1 — Instability in Stochastic and Fluid Queueing Networks
David Gamarnik, Research Staff Member, IBM, PO Box 218, T.J.Watson Research Center, Yorktown Heights, NY, 10598, United States, daveg@us.ibm.com, John Hasenbein

Fluid models is one of the most effective tools for the stability analysis of stochastic queueing networks. It is known that weak stability of a fluid model implies rate stability of the underlying stochastic network. However, only partial converse results are established. We show that, for two-station networks, if the fluid model is not weakly stable under all work conserving policies, then the underlying queueing network is not rate stable under all work conserving policies.

2 — Dynamic Resource Allocation in Stochastic Processing Networks
Jim Dai, Professor, Georgia Institute of Technology, School of Industrial and Systems, Engineering, Atlanta, GA, 30332, United States, dai@isye.gatech.edu, Wuqin Lin

Complex systems like semiconductor wafer fabs, networks of data switches, and large scale call centers all demand efficient resource allocation. In this talk, we will present a family of dynamic, operational policies, called maximum pressure policies, that can achieve maximum throughput predicted by linear programs for a wide class of stochastic processing networks.

3 — Scheduling Distributed Servers with Partial Service Time Information
Douglas Down, McMaster University, Department of Computing and Software, Hamilton, ON, Canada, downd@mcmaster.ca, Rong Wu

We study a system which consists of a dispatcher and several identical servers. There are two types of tasks, where the first type has processing times known upon arrival, while the second has processing times that are known only upon the completion of processing. We suggest a combined dispatch and service policy and evaluate its performance in the face of high task size variability. Finally, we discuss implementation issues for the proposed policy.

4 — Scheduling the Cambridge Ring
John Hasenbein, Assistant Professor, University of Texas at Austin, Dept. of Mechanical Engineering, 1 University Station, C2200, Austin, TX, 78712, United States, jhas@mail.utexas.edu, Daniel Bauer

Motivated by a model of 300mm wafer fab material handling systems, we investigate a queueing model called the Generalized Cambridge Ring. This model is a generalization of a model considered, by Dantzer and Dumas (2002) and other researchers. We discuss several issues that arise when scheduling these systems and provide insights on effective scheduling policies.

■ TB06

Westin-Intl. F, 6th Floor

Protein Structure and Alignment

Cluster: OR in Biology
Invited Session

Chair: Joel Sokol, Georgia Institute of Technology, School of ISyE, Atlanta, GA, 30332-0205, United States, jsokol@isye.gatech.edu

1 — Depth and Designability in Protein Folding
Hyun-suk Yoon, Georgia Institute of Technology, United States, hsyoon@isye.gatech.edu

One of current issues in protein folding is to find highly designable structures since it is very hard to find a ground state conformation directly from a given sequence of amino acids. We use heuristic search techniques to show the relationship between the depth of local minima and the designability. If high designability has low depth, we may reach a highly designable structure.

2 — Secondary Structure Heuristics for the Contact Map Overlap Model
Rebeca Sandino, Georgia Institute of Technology, School of ISyE, Georgia Institute of Technology, Atlanta, GA, 30332-0205, United States, rmsandino@hotmail.com, Joel Sokol

When solving the contact overlap model of protein structure alignment, maximum clique branch-and-bound methods often require stronger initial lower bounds than generic methods find quickly. We develop a maximum weighted clique heuristic based on protein's secondary structure (e.g. alpha helices or beta sheets) and report computational results.

3 — Optimal Protein Structure Alignment Using Maximum Cliques
Dawn Strickland, Winthrop University, 156 Bancroft, Rock Hill, SC, 29733, United States, stricklandd@winthrop.edu, Earl Barnes, Joel Sokol

The contact map overlap model of protein structure alignment can be cast as a maximum clique problem on an appropriately defined graph. We exploit properties of these protein-based maximum clique problems to develop some specialized preprocessing techniques, and use these in concert with generic branch-and-bound methods to solve contact overlap instances to optimality .

■ TB07

Westin-Intl. G, 6th Floor

Environment/Natural Resources

Contributed Session

Chair: Erin Baker, Asst. Professor, University of Massachusetts, Amherst, 120 Elab, Mechanical & Industrial Engineering Dpt, Amherst, MA, 01002, United States, edbaker@ecs.umass.edu

1 — An Integer Programming Production Scheduling Model for an Underground Mine
Alexandra Newman, Assistant Professor, Colorado School of Mines, Division of Economics and Business, Golden, CO, 80401, United States, newman@mines.edu, Mark Kuchta

Motivated by an underground mining operation in Kiruna, Sweden, we formulate a multi-period mixed integer program to schedule iron ore production. To expedite solution time, we develop a heuristic based on using information gained from solving a smaller, aggregated model. We present a worst case performance bound and numerical results.

2 — Modeling Improvements to Evaluate the Reliability of Restructured Electric Power Systems
Frank Felder, Assistant Professor, Manhattan College, Manhattan College Parkway, New York, NY, 10471, United States, fafelder@erols.com

A reliability model of a restructured bulk power system is presented that accounts for transmission constraints, investment incentives, and random outages of system components. Probabilistic risk analysis is combined with Monte Carlo simulations to analyze a competitive market. Independent failures of components, common cause failures, and changes in availabilities are modeled. Results are reported for loss of load, energy prices, and investment decisions. Policy implications are discussed.

3 — R&D as Greenhouse Insurance
Erin Baker, Asst. Professor, University of Massachusetts, Amherst, 120 Elab, Mechanical & Industrial Engineering Dpt, Amherst, MA, 01002, United States, edbaker@ecs.umass.edu, Leon Clarke, John Weyant

Can R&D be considered a hedge against climate uncertainty? The primary result of the paper is to show that whether optimal R&D increases or decreases with increasing uncertainty about damages from climate change depends crucially on

how R&D is modeled. Our approach is to add a decision to invest in R&D to a stochastic version of the well-known DICE model. We compare three common assumptions for R&D, and show that only one of them can be considered a hedge against uncertainty.

4 — Abatement and Output under Auctions for Emissions Permits
Ravi Subramanian, PhD Candidate, Michigan Business School, D2259 Davidson Hall, 701 Tappan St., Ann Arbor, MI, 48109, United States, rsubramz@bus.umich.edu, Sudheer Gupta, Brian Talbot

The EPA has been conducting auctions for emissions permits, and many other countries have chosen auctioning as a means of allocating permits in their emissions trading programs. There is, however, a need to delineate the effects associated with permit auctioning and firms' abatement and output decisions. We analytically describe these effects, modeling the auction for emissions permits as a "share" auction, and assuming that firms are constrained by emissions stipulations.

■ TB08

Westin-Intl. H, 6th Floor

Batching Methods for Simulation Output Analysis

Sponsor: Simulation
Sponsored Session

Chair: Nilay Tanik Argon, Assistant Professor, University of Wisconsin-Madison, Department of Industrial Engineering, 1513 University Avenue, Madison, WI, 53706, United States, nilay@engr.wisc.edu

1 — Dynamic Batch Means in Simulation Output Analysis
Bruce Schmeiser, Purdue University, School of Industrial Engineering, West Lafayette, IN, 47907-2023, United States, bruce@purdue.edu, Yingchieh Yeh

Batching simulation output observations and using the resulting batch means is a classic approach for estimating the standard error of the sample mean. Minimizing the mean squared error of the estimator of the variance of the sample mean is one way to define an optimal batch size, which depends upon the output-process autocorrelations, the type of batch-means estimator, and the simulation run length. In this context, we develop dynamic methods for estimating standard error.

2 — Effects of Different Batching Sequence on Ranking & Selection Procedures for Steady State Simulation
Seong hee Kim, Assistant Professor, Georgia Institute of Technology, United States, skim@isye.gatech.edu, David Goldsman, Barry Nelson

Recently, Kim and Nelson developed new indifference-zone ranking and selection procedures specifically designed for steady-state simulations (KN+ without variance updates and KN++ with variance updates). Both procedures assume unknown asymptotic variance constants. We study the effect of using variance estimators that are asymptotically chi-squared distributed in KN+, and variance estimators that are strongly consistent in KN++. We also evaluated different batching sequences for KN++.

3 — Flexible Batching Methods for Stationary Output Data
Andrew Seila, Professor, University of Georgia, Terry College of Business, 303 Brooks Hall, Athens, GA, 30602-6273, United States, andy@ms.terry.uga.edu, Christos Alexopoulos, David Goldsman

The batch means method has proven to be a robust and reliable method to estimate the mean of a stationary output process. However, one problem with the method is that it relies on equal batch sizes for every batch. We present a flexible batching approach to estimating the mean and discuss how it can simplify the implementation of batch means, especially when multiple means are being estimated using the same output process.

■ TB09

Westin-Vinings 1, 6th Floor

Active Learning in Education

Contributed Session

Chair: Jim Lowe, Associate Professor of OR/Mgt, US Air Force Academy, 2354 Fairchild Dr, Suite 6H242, USAir Force Academy, CO, 80840, United States, Jim.Lowe@usafa.af.mil

1 — Integrating Lean Thinking in Introductory Operations Management through a Discovery Approach
Sharon Johnson, Associate Professor, Worceter Polytechnic Institute, Department of Management, Worcester, MA, 01609, United States, sharon@wpi.edu, Boris Ramos, Saumitra Mishra, Amy Zeng, Arthur Gerstenfeld

Lean thinking has transformed process design in organizations, but is an add-on topic in many courses. In this paper, we describe an introductory operations course where traditional topics were linked through the lean concepts of value, flow, demand pull, and perfection. To support student learning, we also developed a set of laboratory exercises based on a physical simulation of clock assembly called TimeWise. We report on student impact and experiences after offering the course twice.

2 — An Active Learning Model for the Construction of a Relative Self-Contained Network of Meaning
José Bermeo, Doctoral Student, Universidad de los Andes, Cra. 1 Este N∫ 18-A -70, Bogotá, DC, Colombia, j-bermeo@uniandes.edu.co, Roberto Zarama, Jairo Villamil

This model enables the construction of a relative self-contained network of meanings. It is based on three characteristics: equipment, purposes, and identity. The model is inspired in Stafford Beer's invention of Team Syntegrity. The paper describes the manner in which the icosahedron is used for learning in engineering courses.

3 — Achievement Motivation and Computational Estimation Skills Of College Business Students
Darrell Parker, Professor, Georgia Southern University, P.O. Box 8151, Statesboro, GA, 30460, United States, parkerd@gasou.edu, William Jones, Martha Spears

Does achievement motivation influence computational estimation skills? First, achievement behaviors are measured. These measures include locus of control, work ethic, mastery, and competitiveness. A direct measure of estimation skill is then performed for each student. The research analyzes the link between these behavioral characteristics and estimation skill among college students.

4 — Working with the X,Z Production Laboratory
Cesar Jaramillo, Teacher, UTP, Ap.aereo 629, Pereira, Colombia, cejana@utp.edu.co

In this paper I will show the methodology and conclusions of two additions to the game THE PRODUCT X, PRODUCT Y, PRODUCTION LABORATORY, by Robert J. Schlesinger. I begin showing the performance of the factory using a generic container, when the factory needed 27 sc/u. During the second run, I used special containers for every order size, and the factory only needed 15 sc/u. Finally I will present the development of our research with this laboratory.

5 — Community Involvment at the Undergraduate OR level
Jim Lowe, Associate Professor of OR/Mgt, US Air Force Academy, 2354 Fairchild Dr, Suite 6H242, USAir Force Academy, CO, 80840, United States, Jim.Lowe@usafa.af.mil, Andrew P. Armacost

The USAF Academy offers a bachelor's degree in OR. Faculty within four departments administer the degree. A capstone course highlights the program. OR420 evolved from a case study-driven course into an application-based seminar. Students consult for a variety of community clients. The course is an outstanding educational capstone and a valuable service to our military and civilian communities. We discuss outcomes, the level of undergraduate OR consulting, and interesting illustrations.

■ TB10

Westin-Vinings 2, 6th Floor

Optimization in Financial Services I

Sponsor: Financial Services
Sponsored Session

Chair: Edward Lau, Bank One Card Services, 3 Christina Center, Wilmington, DE, 19801, United States, ed_lau@bankone.com

1 — Optimal Check-Cashing Fee Policy for a Credit Union Branch Network
Bruce Moore, Credit Union of Texas, Dallas, TX, United States, bmoore@cuoftexas.org

Bank and Credit Union branches generally experience dramatic fluctuations in transaction volume during the course of a week. To increase overall capacity and revenue, a time-based check cashing fee structure is proposed as a means to shift demand from Friday afternoon (a capacity constrained time period) to mid-week when branches typically have significant excess capacity. A mixed integer program optimization model is presented for determining an appropriate fee structure.

2 — Optimization Will be Important in Preparing for Check-21
Joseph Walter,Senior Vice President, Bank of America, NC1-022-16-01, 201 North Tryon Street, Charlotte NC 28255, United States, Joseph.Walter@bankofamerica.com

Check-21 or the Check Truncation Act, having passed both houses of congress and currently being finalized in committee, will allow financial service companies to exchange images and data rather than paper deposits in 12 to 18 months from the time it is signed into law. This game changing legislation requires financial service companies to rethink the deposit-processing environment. This will be an expository talk on the legislation and its implications.

3 — IT and Cost and Profit Efficiencies in Banking and Insurance Companies - A Global Comparison

Hong-Jen Lin, Assistant Professor, Nyack College, 1 South Boulevard, Nyack, NY, 10960, United States, apborodin@yahoo.com, Winston T. Lin

Information technology (IT) has reshaped the landscape of international financial markets and institutions. This research compares the efficiency and IT of financial institutions across developed, newly developing, and less developing countries. The generalized stochastic frontier approach is employed to measure the influence from IT. We draw several concrete implications from our findings for bankers, insurance managers, vendors of IT, and policy makers.

4 — CANARY - A Model for Credit Card Acquisitions

Edward Lau, Bank One Card Services, 3 Christina Center, Wilmington, DE, 19801, United States, ed_lau@bankone.com, Brian Murphy, Shane Pederson, Margaret Trench, Audrey Lyke, Suresh Nair

Customer acquisitions in the credit card business is very competitive and challenging. Competitive offers abound and response rates are usually very low. Using past contact history we develop a stochastic dynamic programming model to determine when a particular type of product or pricing should no longer be sent to a prospect so as to improve acquisition efficiency and maximize long term profits. In results to date, live testing of our model has delivered good results.

■ TB11

Westin-Augusta 1, 7th Floor

Tutorial: Including the Human Dimension in Operations Management Models - Theory and Practice: On the Interface between Operations and Human Resources Management

Cluster: Tutorials
Invited Session

Wallace Hopp, Professor, Northwestern University, Dept. of Industrial Engineering, Evanston, IL, United States, hopp@northwestern.edu

This session will discuss past research and research needs in how to connect OR models better with human responses to different work settings. First a senior manager will provide an industry perspective on the role of modeling human behavior on operations management practice. Then two papers will be discussed. Audience discussion of potential research topics will be encouraged throughout the tutorial.

1 — Industry Perspective: Human Resource Issues in Improving Workforce Flexibility

William Jordan, General Motors R&D, Mail Code 480-106-EX1, 30500 Mound Rd, Warren, MI, 48090, United States, william.c.jordan@gm.com

In improving workforce flexibility there are significant human relations issues related to training and learning, worker motivation, and worker autonomy and control. Practices that might lead to the greatest flexibility are sometimes not practical from an HR viewpoint. This talk will discuss strategies for improving flexibility that are also practical or perhaps even beneficial from an HR viewpoint.

2 — A Framework for Agile Workforce Evaluation

Mark Van Oyen, Loyola University Chicago, 25 E. Pearson Street, Chicago, IL, United States, mvanoye@luc.edu, Wallace Hopp

This talk outlines frameworks for assessing and classifying manufacturing and service operations in with regard to their use of cross-trained (flexible) workers. The talk will present (1) a "strategic assessment framework" that structures the key mechanisms supporting organizational strategy, and (2) a "tactical framework" that guides the implementation of an architecture and worker coordination policy.

3 — On the Interface between Operations and Human Resources Management

John Boudreau, Professor, Cornell University, 388 Ives Hall, United States, jwb6@cornell.edu, Wallace Hopp, John McClain, Joseph Thomas

Operations management (OM) and human resources management (HRM) have historically been separate fields of research and practice. In this talk, we will probe the interface between operations and human resources by examining how human considerations affect classical OM results and how operational considerations affect classical HRM results. We then propose a unifying framework for identifying new research opportunities at the intersection of the two fields.

■ TB12

Westin-Augusta 2, 7th Floor

Strategic Planning

Contributed Session

Chair: Jong Wook Jeong, Ph.D Candidate, Seoul National University Techno-Econmics and Policy Program, San 56-1, Shillim-dong Kwanak-gu, Seoul, kr, 151744, South Korea, braveguy@hitel.net

1 — The Location Choices of the US Semiconductor Industry: Application of the Mixed Logit Models

Heli Kilpala, Ph.D., Oulu University, Faculty of Economics and Industrial, Engineering, PO BOX 4600, Oulu, FI, 90014, Finland, heli.kilpala@oulu.fi, Paul Box

The Mixed Logit models are the newest development in the random utility theory that constitute of models exploring individual choice behavior. This study applies these models a study of location of the US semiconductor industry. The results suggest that proximity to international cargo airports, proximity to technical universities, taxes, land costs, and quality of life are some of the preferred criteria considered by the US semiconductor companies.

2 — Application of Campaign + Level Modeling using DMOES for Coast Guard force planning

Patrick Ryan, MicroSystems Integration, Inc., 181 S. Broad St., Suite 103, Pawcatuck, CT, 06379, United States, patr@msi-ct.com, Michael Migdail-Smith, James Passarelli

The Deepwater Maritime Operational Effectiveness Simulation (DMOES) model was developed to support assessment of large scale, integrated "systems of systems" for Coast Guard maritime, multi-mission and military operations. Air, surface, C4ISR and logistics components tied together with CONOPS and CONLOG to execute Coast Guard missions in response to multiple, concurrent threats and demands. The model has been extended and applied to Coast Guard force planning efforts.

3 — Executive Compensation: Are we Asking the Right Questions

Gunter P. Sharp, Dr., Georgia Institute of Technology, School of ISyE, Atlanta, GA, 30332, United States, gsharp@isye.gatech.edu, Judith T. Guzzetta

Most research studies on executive compensation pose the question as: is the pay package statistically explained by the firm's performance? We believe the correct form of the question is: is the firm's performance statistically explained by the pay package. An in-depth study examines this issue, along with longitudinal and industry-specific analyses. Bonuses and stock options are reflected in the pay packages, resulting in a more realistic appraisal of compensation.

4 — Optimal Timing Analysis and Valuation of a IT Start-up

Jong Wook Jeong, Seoul National University, Sillim 9 Dong Kwanak-Gu, Seoul, South Korea, mirue@snu.ac.kr, Jeong Dong Lee

The research is the empirical study on the valuation and optimal investment timing analysis of a IT startup using real option. We analyze future investment plan and then, we should apply the compound option pricing model in order to consider the value interaction between real options. Thus, we use European and American compound option frameworks for valuation and simulate it several times with changing the exercise time to obtain the optimal investment timing for commercialization and switching.

■ TB13

Westin-Augusta 3, 7th Floor

Electronic Marketing Issues

Sponsor: Marketing Science
Sponsored Session

Chair: Naveen Donthu, Georgia State University, Marketing Department, Atlanta, GA, 30303, United States, ndonthu@gsu.edu

1 — Productivity of Internet Shops

Naveen Donthu, Georgia State University, Marketing Department, Atlanta, GA, 30303, United States, ndonthu@gsu.edu, Paul Alpar

Productivity of Internet Shops is computed and benchmarked using Data Envelopment Analysis

2 — Consumer Research in Virtual Communities: Sampling Issues and Methods

Constance Porter, Doctoral Candidate, Georgia State University, Marketing Department, MSC 4A1370, 33 Gilmer Street SE Unit 4, Atlanta, GA, 30303-3084, United States, mktcepx@langate.gsu.edu

Researching consumer behavior in virtual communities presents new methodological challenges. How should a researcher select an appropriate sample, given that virtual communities vary on a variety of key attributes? How can researchers deal with issues of avoiding self-selection bias, achieving response variation and randomly sampling from potentially thousands of respondents?

This presentation will address these critical issues and provide implications for data collection methods.

3 — Electronic Marketing in Business-to-Business Relationships
Talai Osmonbekov, Assistant Professor, University of Southern Mississippi, USM Box 5091, Hattiesburg, MS, United States, mkttdox@langate.gsu.edu

The paper examines electronic marketing in the business to business setting. It explores the performance consequences of the various functionalities of the manufacturers' websites as they are used by the resellers of their products. An empirical study of several hundred reseller firms reveals interesting patterns of usage. Implications for researchers and practitioners are discussed.

4 — Bidding Frenzy: Intensity of Competitive Interaction Among Bidders and Product Valuation in Auctions
Peter T. L. Popkowski Leszczyc, Director CampusAuctionMarket.com and Associate Professor of Marketing, University of Alberta, 4-20 F School of Business, Edmonton, AB, T6G 2R6, Canada, ppopkows@ualberta.ca, Gerald Haubl

This paper examines the effects of competitive interaction among consumers on their product valuations in open ascending-bid (English) auctions. As a result of the interactive nature of such auctions, bidders may experience bidding frenzy, a mental state characterized by a high level of arousal or excitement, a sense of competition, and a strong desire to win. We hypothesize that higher levels of bidding frenzy will cause consumers to value an auctioned product more highly. The results of five laboratory experiments, focusing on dynamic interaction among bidders and the intensity of competition in an auction, provide strong support for this prediction.

■ TB14

Westin-Peachtree A, 8th Floor

Cooperation and Coordination in NPD

Cluster: New Product Development
Invited Session

Chair: Thomas Roemer, Assistant Professor, MIT, 50 Memorial Drive, Cambridge, MA, United States, troemer@mit.edu

1 — Collaborative Prototyping and the Pricing of Customized Products
Christian Terwiesch, Wharton School of Business, 1319 Steinber-Dietrich Hall, Philadelphia, PA, United States, terwiesch@wharton.upenn.edu, Christoph Loch

A major challenge in the creation of custom-designed products lies in the elicitation of customer needs. This process, to which we refer as collaborative prototyping, allows both parties to anticipate the outcome of the design process. We show that, depending on the design problem and the market characteristics, the customizing producer should offer prototypes with a profit, at cost, or even for free.

2 — Work Groups, Structural Diversity, and Knowledge Sharing in a Global Organization
Jonathan Cummings, MIT, 50 Memorial Drive, Cambridge, MA, United States, cummings@mit.edu

Building on social network theory, this paper argues that variation in features of group structure, termed structural diversity, can increase the value of external knowledge sharing. Using corporate database records, group member surveys, and senior executive's ratings of performance, a field study of 182 work groups in a global organization reveals that external knowledge sharing is more strongly associated with performance when groups have greater structural diversity.

3 — The Role of Knowledge Redundancy in Collaborative Product Development
Kingshuk Sinha, United States, ksinha@csom.umn.edu, Debasish Mallick, Changyue Luo

Despite the growing consensus on the importance of inter-firm collaboration in product development, over 75% of the firms are not satisfied with their CPD performance. We will present results of a multiple-case study, where we investigate how knowledge redundancy, a firm's internal capability of understanding and collaborating with its partners, impacts CPD performance

4 — Contracting, Architectural Knowledge and Warranty Costs: Evidence from the Automotive Industry
Sharon Novak, Kellogg School of Management, United States, s-novak@kellogg.nwu.edu, Sridhar Tayur

There has been a rise in the automotive industry of "full service" supplier contracts where suppliers adopt contractual responsibility for development of complete subsystems, such as the seat. This research demonstrates that the common practice of including buyer-specified components, or "direct parts," in such contracts can have unintended negative consequences for supplier effort incentives. This paper provides the first theoretical model and empirical test of the relationship.

■ TB15

Westin-Peachtree F, 8th Floor

Innovations: Market Entry and Diffusion

Sponsor: Technology Management
Sponsored Session

Chair: Christian Schade, Professor Dr., Humboldt University, Berlin, Spandauer Str. 1, Berlin, D, 10178, Germany, schade@wiwi.hu-berlin.de

1 — Using Spatial Statistics for the Analysis of New-Product Adoption over Time
Christian Schade, Professor Dr., Humboldt University, Berlin, Spandauer Str. 1, Berlin, D, 10178, Germany, schade@wiwi.hu-berlin.de, Yasemin Boztug

The paper concerns itself with a new way to analyze the new-product adoption over time: spatial statistics. The major advantage of this approach is that observations may be treated as spatially dependent, i. e. a low-distance adoption is more likely to impact on an individual's adoption decision than a large-distance adoption. Implications of this new kind of analysis and requirements for further research are discussed.

2 — Dependence and Switching Behavior in Technology Procurement
Ralf Linke, Research Associate, Humboldt University, Berlin, Alexanderplatz. 6, Berlin, D, 10178, Germany, linke@wiwi.hu-berlin.de

A firm may face barriers to adopt to a new technology. In case of a specific technology the firm will be locked in due to a transaction and production costs advantage with the current technology which cannot be transferred to the innovation. A strong body of empirical evidence suggests that perceived system dependence may also influence switching behavior. Implications for the innovator are discussed.

3 — Analyzing E-Learning Adoption via Recursive Partitioning
Philipp Koellinger, Research Associate, DIW Berlin, Koenigin-Luise-Strafle 5, Berlin, D, 14195, Germany, pkoellinger@diw.de, Christian Schade

The paper analyzes factors that influence the adoption of e-learning and gives an example of how to forecast technology adoption based on a post-hoc predictive segmentation using a classification and regression tree (CART). We find strong evidence for the existence of technological interdependencies and organizational learning effects. Furthermore, we find different paths to e-learning adoption. The results of the analysis suggest a growing "digital divide" among firms.

■ TB16

Westin-Peachtree G, 9th Floor

Modelling Applications III

Sponsor: Health Applications
Sponsored Session

Chair: Amy Wilson, University of Minnesota, Health Services Research and Policy, 420 Delaware St. SE, MMC 729, Minneapolis, MN, 55455, United States, arwilson@umn.edu

1 — Adjusting Radiotherapy Plans
Allen Holder, Trinity University, 715 Stadium Drive, San Antonio, TX, 78212, United States, aholder@trinity.edu

A new model was recently used to design external beam radiotherapy treatments for cancerous tumors. This model produces favorable plans that are not implementable because of time constraints. We discuss how to use image compression techniques to prune treatment plans so that they are clinically viable.

2 — Optimization Techniques and Nonlinear Dynamics for Seizure Prediction
Wanpracha Chaovalitwongse, University of Florida, Department of Industrial and Systems Engineering, 303 Weil Hall, Gainesville, FL, 32611, United States, arty@ufl .edu, Panos Pardalos

There is growing evidence that temporal lobe seizures are preceded by spatio-temporal patterns, characterized by gradual changes in dynamics in electroencephalogram (EEG) time series acquired from patients with epilepsy. In this research, we employ the theory of nonlinear dynamics and optimization techniques to study the spatio-temporal patterns in EEG time series. The results of this study suggest that it is possible to predict epileptic seizures by identifying brain electrode sites that exhibit spatio-temporal patterns preceding seizures. Such electrode sites have to show the dynamical convergence in the measure of chaos and can be selected by optimization techniques.

3 — Integrated Screening Decisions: Cost-Effective Management of Health Maintenance
Julie Ivy, University of Michigan, 701 Tappan Street, Ann Arbor, MI, United States, jsimmons@umich.edu

We present an efficient frontier for integrating patient and payer preferences in breast cancer screening decisions utilizing POMDPs. We consider the impact of patient risk factors (e.g., race and family history) on these decisions. In addition, we investigate the influence of these risk factors on patient preferences and the resulting screening efficient frontier.

4 — Screening for Depression in Primary Care: A Markov Model
Amy Wilson, University of Minnesota, Health Services Research and Policy, 420 Delaware St. SE, MMC 729, Minneapolis, MN, 55455, United States, arwilson@umn.edu, Donna McAlpine

We develop a Markov model of depression in a general primary care population and use it to explore questions about what screening interval produces the most cost effective screening strategy. The model states characterize severity of depression and history of depression.

■ TB17

Westin-Peachtree H, 9th Floor

Disease Prediction and Diagnosis II

Cluster: Operations Research for Medical Applications
Invited Session

Chair: Eva Lee, Assistant Professor, Georgia Institute of Technology, School of Industrial and, Systems Engineering, Atlanta, GA, 30332-0205, United States, eva.lee@isye.gatech.edu

1 — Multi-Quadratic Integer Programming and Chaos Theory for Seizure Prediction
Panos Pardalos, Professor, University of Florida, Dept. of Industrial Engineering, 303 Weil Hall, PO Box 116595, Gainesville, FL, 32611, United States, pardalos@ufl .edu, Wanpracha Chaovalitwongse

We present a new methodology of studying the spatio-temporal patterns in EEG time series by employing chaos theory and optimization techniques, specifically multi-quadratic integer programming. The application of this methodology is to select brain electrode sites that exhibit the dynamical convergence in the measure of chaos, which can be identified by optimization techniques, for the prediction of epileptic seizures.

2 — Pattern Space Representation of Biomedical Data and Applications
Peter Hammer, RUTCOR-Rutgers University, 640 Bartholomew Road, Piscataway, NJ, 08854, United States, hammer@rutcor.rutgers.edu, Sorin Alexe, Gabriela Alexe

The "Logical Analysis of Data" transforms numerical datasets to binary ones, indicating the coverage of the observations by each pattern contained in a model. The use of this "pattern space" representation for classification, attribute analysis, class discovery, decision support system design, etc., will be illustrated on real-life medical datasets.

3 — Pattern Recognition and Discriminant Analysis in Genomic Analysis of Human Cancer
Eva Lee, Assistant Professor, Georgia Institute of Technology, School of Industrial and, Systems Engineering, Atlanta, GA, 30332-0205, United States, eva.lee@isye .gatech.edu

A pattern recognition / discriminant analysis approach is described for genomic classification in human cancer. A pattern recongition heuristic first identifies short hidden patterns in DNA sequences, and the identified patterns are subsequently used as attributes for an MIP-based discriminant analysis model. The model maximizes the total number of correct classifications while constraining the percentage of misclassifications. The model also allows a reserved judgement region.

■ TB18

Westin-Tower 1201, 12th Floor

Panel: Distributed Sensing for Quality and Productivity Improvement

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: Yu Ding, Assistant Professor, Texas A&M University, Dept. of Industrial Engineering, 3131 TAMU, College Station, TX, 77843, United States, yuding@iemail.tamu.edu

1 — Panel: Distributed Sensing for Quality and Productivity Improvement.
Panelists:Yu Ding, E.A. Elsayed, Soundar Kumara, Jye-Chyi Lu, Feng Niu, Jianjun (Jan) Shi

System-wide deployment of sensing devices, known as distributed sensing, has resulted in a data-rich manufacturing environment that holds the potential for an information-driven setting. This panel will gather research leaders to discuss the state-of-the-art practice, research opportunities, and future directions related to distributed sensing for quality and productivity improvement.

■ TB19

Westin-Tower 1202, 12th Floor

Six Sigma and Quality Improvement

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: Qianmei Feng, University of Washington, Industrial Engineering, Box 352650, Seattle, WA, 98195, United States, fengqm@u.washington.edu

1 — Modeling the Bottom Line of Quality Methods and Six Sigma
James Brady, Engineering Manager, LaBarge Inc., 1505 Maiden Ln., Joplin, MO, 64802, United States, james.brady@labarge.com

We review methods that have proposed to model data about the profitability of six sigma related projects. Then, we propose approaches with clear advantages in this context. We illustrate the proposed methods using actual data and discuss the implications for a midwest manufacturer.

2 — Capability Indices Dedicated to the Two Quality Characteristics Case
Philippe Castagliola, Tenure Assistant Professor, Ecole des Mines de Nantes, 4 rue Alfred Kastler BP 20722, Nantes, 44307, France, philippe.castagliola@emn.fr, Victor Garcia-Castellanos

We propose a new method in order to compute the process capability indices for two quality characteristics. The new indices are based on the nonconforming proportion of products and a method based on the Green's formula is developped for computing it. An illustrative example is given and a comparison is done between our method and some others proposed previously.

3 — Quality in North Dakota: Opportunities and Challenges
Canan Bilen, Assistant Professor, North Dakota State University, Industrial and Manufacturing Eng, Fargo, ND, 58105, United States, canan.bilen.green@ndsu.nodak .edu, Ritesh Saluja

The transition to industry-based economy motivates the assessment of quality methods in North Dakota (ND). This paper discusses the challenges of establishing quality and reliability systems in mid-to-small size electronics manufacturing companies and the importance of developing reliability models that can be effectively implemented in such environments. We propose a model for reliability implementation framework to assist the ND electronics industry, with the goal of improved competitiveness.

4 — Some Optimization and Modelling Strategies for DFSS
Qianmei Feng, University of Washington, Industrial Engineering, Box 352650, Seattle, WA, 98195, United States, fengqm@u.washington.edu, Kailash Kapur

A typical process for quality improvement has six steps: Define, Measure, Analyze, Improve, Control and Technology Transfer. (D)MAIC(T) is well known and highly utilized process for DESIGN FOR SIX SIGMA. There are many optimization problems in this design and improvement process. In order to minimize the total cost to the system, this paper develops optimization models for the analysis and improvement phases of this process.

■ TB20

Westin-Tower 1203, 12th Floor

Machine Learning in Optimization

Sponsor: Artificial Intelligence
Sponsored Session

Chair: Anurag Agarwal, Assistant Professor, University of Florida, Dept of Decision and Information Science, PO Box 117169, Gainesville, FL, 32611, United States, aagarwal@ufl.edu

1 — Augmented Neural Networks for the Open Shop Scheduling Problem
Selcuk Colak, Ph.D. Student, University of Florida, Dept. of DIS, PO Box 117169, Gainesville, FL, 32611, United States, scolak@ufl.edu, Anurag Agarwal

We show the results on several large benchmark problems on Open Shop Scheduling, solved using Augmented Neural Networks approach. We find many optimum or near optimum solutions in few iterations. We also show results on several large problems of sizes up to 100 by 100.

2 — Artificial Intelligence in Manufacturing Process
Dragan M. Eric, CAD/CAM Engineer, SLOBODA, Ratka Mitrovic b.b., 32000 CACAK, 32000, Yugoslavia, ericmdragan@yahoo.com

Paper shows some possibilities of applications artificial intelligence in manufacturing process for metalworking with Electrical Discharge machining technology. For this project we have used shell-software with object-oriented hierarchy. Knowledge representation yes in form rules and frames. In this programming objects communicate with each other throughout messages and methods . As strategies for inference processwe have used forward and backward chaining.

3 — Augmented Neural Networks for the Bin Packing Problem
Nihat Kasap, Ph.D. Student, University of Florida, DIS department, PO Box 117169, Gainesville, FL, 32611, United States, nkasap@ufl.edu

We develop an Augmented Neural Network (AugNN) approach for solving the Bin Packing Problem. This approach allows one to combine heuristic approaches with learning. We propose some reinforcement based learning strategies that find very good solutions quickly. We test the AugNN framework on over 700 benchmark problems and show the results.

4 — Augmented Neural Networks for the Job Shop Scheduling Problem
Enes Eryarsoy, Ph.D. Student, University of Florida, Dept. of DIS, PO Box 117169, Gainesville, FL, 32611, United States, eryarsoy@ufl.edu, Anurag Agarwal

We attempt to apply the Augmented Neural Networks (AugNN) approach to the Job Shop Scheduling Problem. We test this approach on a number of problems from the literature and discuss the results. Various AugNN learning strategies are discussed.

■ TB21

Westin-Tower 1204, 12th Floor

Optimization Modeling in Practice II

Sponsor: Computing
Sponsored Session

Chair: Bjarni Kristjansson, President, Maximal Software Inc., 2111 Wilson Boulevard, Suite 700, Arlington, VA, 22201, United States, bjarni@maximalsoftware.com

1 — MIP Modeling
Robin Lougee-Heimer, IBM Research, 1101 Kitchawan Road, Yorktown Heights, NY, 10598, United States, robinlh@us.ibm.com

It is well-known in the integer programming community that how one formulates a mixed integer program (mip) can be the difference between acceptable and lousy run times. In this talk, geared to the practitioner, we survey the commonly held "good practices" of mip modeling.

2 — Logistics Planning and Optimization for a Canadian Beverage Manufacturer
Mehmet Atilla Begen, University of British Columbia, Sauder School of Business, 2053 Main Mall, Vancouver, BC, Canada, mabegen@coe.ubc.ca, Ernest Wu, Martin Puterman

This talk describes the development of a large-scale optimization tool designed to enhance the performance of manufacturing, inventory and distribution system for the company. The tool enables planners to determine the optimal quantities to manufacture and store at each facility for its complete range of products. It furthermore enables managers to investigate impacts of their decisions. The model supports the production teams for operational planning and management for tactical planning.

3 — Implementing Supply-Chain Optimisation Models in an Algebraic Modelling Language
Sandip Pindoria, Maximal Software, Inc., 97 Oxford Road, Middlesex, Uxbridge,, United Kingdom, sandip@maximalsoftware.co.uk

Supply-Chain Management solutions are increasingly utilising optimisation models to provide better decision-making information. We will discuss how supply-chain optimization models can be implemented in an algebraic modelling language, such as MPL, leading to reduced development times. We will demonstrate a standalone supply-chain application written in Visual Basic that incorporates an optimisation model.

■ TB22

Westin-Tower 1205, 12th Floor

Behavioral Decision Making II

Sponsor: Decision Analysis
Sponsored Session

Chair: Jack Soll, Associate Professor of Decision Sciences, INSEAD, Bd de Constance, Fontainebleau, France, jack .SOLL@insead.edu

1 — The Role of Cognitive Biases and Group Dynamics in Catastrophic Risk Management
Ayse Onculer, INSEAD, France, ayse.onculer@insead.edu

Risk and time preferences, affective responses, interactions with other individuals all have a strong impact on catastrophic risk management. This study analyzes individuals' responses to catastrophic risk by using the results of a large-scale survey on earthquake risk in Turkey. Based on this analysis, we identify the factors influencing willingness-to-pay measures for risk mitigation and insurance.

2 — Pessimism and Context Dependence in Decision under Risk
Philippe Delquié, INSEAD, France, philippe.delquie@insead.edu

We propose a model of decision under risk in which a pessimistic individual will subjectively transform a lottery by shifting probability from higher over to lower payoffs. The lottery is valued as the EV of the transformed distribution. Our model differs from Rank-Dependent Utility. It can explain choices that are consistent with Expected Utility within a given choice set, but inconsistent with EU across choice sets, thereby offering a novel perspective on context dependence of preferences.

3 — Creating Best Portfolios of Projects with Decision Conferencing: The Allergan Experience
Larry Phillips, Visiting Professor of Decision Science, London School of Economics, Department of Operational Research, Houghton Street, London, WC2A 2AE, United Kingdom, larry_phillips@msn.com, Bob Kitchen

We apply multi-criteria modelling within a decision conferencing process to a common problem facing all organisations in every sector: prioritising investments on projects under limited budgets. The result is a portfolio that gives on average 30% more benefit than the optimisation of individual projects. We illustrate the process with Allergan.

4 — Subjective Impressions of Objective Distributions
Jack Soll, Associate Professor of Decision Sciences, INSEAD, Bd de Constance, Fontainebleau, France, jack.SOLL@insead.edu, Joshua Klayman

Judges assessed x% intervals for objective distributions (weights, heights). We compare assessed to true fractiles, and find large differences in calibration across elicitation methods. We also show that good calibration on the response scale (i.e., unbiased fractile estimates) can lead to poor calibration in probabilities (i.e., x% intervals include less than x% of the data), and vice versa. Simultaneous perfect calibration on both scales appears possible only in a noise-free environment.

■ TB23

Westin-Tower 1206, 12th Floor

Auctions and Bargaining

Sponsor: Decision Analysis
Sponsored Session

Chair: Matthias Hild, Assistant Professor, Darden Business School, PO Box 6550, Charlottesville, VA, 22906, United States, matthias@hild.org

1 — Auctioning the Airwaves
Simon Wilkie, Chief Economist, FCC, California Institute of Technology, HSS 228-77, Pasadena, CA, 91125, United States, wilkie@hss.caltech.edu

2 — Behavioral Game Theory
Colin Camerer, Axline Prof. of Business Economics, Caltech, Div HSS 228-77, Pasadena, CA, 91125, United States, camerer@hss.caltech.edu

An emerging branch of game theory, called behavioral game theory, seeks to model how constraints on iterated reasoning, emotions, and learning can be used to improve the accuracy of predictions about how actual people play games. This talk describes some central experimental results and the theories which have resulted from them.

3 — Bargaining and the Predictive Value of Social Utility
Gary Bolton, Professor of Business Economics, Smeal College of Business, Penn State University, University Park, PA, 16802, United States, geb3@psu.edu, Arnaud De Bruyn

We fit a social utility bargaining model to data from a simple ultimatum game, and use it to predict players' behaviors to five sequential bargaining games. We compare out-of-sample predictions to observations reported by 6 different research groups (a total of 19 different experimental conditions). We find that the model provides reasonably accurate predictions of actual bargaining behavior in across all these settings.

■ TB24

Westin-Tower 1207, 12th Floor

Supporting Knowledge Intensive Processes

Sponsor: Information Systems
Sponsored Session

Chair: Balasubramaniam Ramesh, Georgia State University, Dept. of Computer Information Systems, 35 Broad Street, Atlanta, GA, 30303, United States, bramesh@gsu.edu

1 — Understanding Contingency Factors in Software Process Tailoring

Peng Xu, Georgia State University, 35 Broad St, Atlanta, GA, United States, pxu@cis .gsu.edu

Software Processes need to be tailored to suite each project's context. Based on a grounded theory analysis of data from semi-structured interviews of IT professionals, we have developed a model to understand the factors that need to be considered in process tailoring and how these factors affect tailoring decisions.

2 — Supporting Software Configuration Management with Traceability

Kannan Mohan, Zicklin School of Business, One, Bernard Baruch Way, New York, NY, 10010, United States, kmohan@cis.gsu.edu

The importance of Software Configuration Management (SCM) has been emphasized by its role in moving to higher levels of process maturity. Even with state of the art tools, SCM still faces numerous challenges. One of the common challenges faced in SCM is managing the process between multiple versions of product assets. We propose the use of a traceability system to augment SCM in managing the process through which the product assets are modified.

3 — Show Me the Data: A Simulation of Agile Software Development Approach

Lan Cao, Georgia State University, Department of CIS, Robinson School of Business, Atlanta, GA, 30302, United States, lcao@cis.gsu.edu

Agile methodologies have gained a lot of attention recently. However, systematic evaluation of their applicability across different software development settings have not been reported. In this research we use a system dynamics model to simulate agile software development process to investigate their impacts on cost, quality, schedule and project management decisions.

■ TB25

Westin-Tower 1208, 12th Floor

Military Applications I

Contributed Session

Chair: John Willis, TRADOC Analysis Center - Monterey, 4 Shubrick Road, Monterey, CA, 93940, United States, john .willis@trac.nps.navy.mil

1 — Prediction of KC135 Tanker Availability for the U.S. Air Force

Elvira Loredo, Rand, 1700 Main Street, PO Box 2138, Santa Monica, CA, 90407, United States, loredo@rand.org, Aparna Huzurbazar, Raymond Pyles

The KC135 tanker aircraft is used to carry out midair refueling. The average age of this fleet is approximately 42 years, leading to increased maintenance. Programmed Depot Maintenance (PDM) plays an important role in assuring the safety and availability of these aircraft. Our study focuses on predicting tanker availability based on uncertainty due to the effects of aging within the PDM process. Methods draw on traditional queuing models as well as newer statistical flowgraph models.

2 — Classifying Threat Ground Force Weapon Systems

John Harris, CPT, Department of Systems Engineering, Mahan Hall, United States Military Academy, West Point, NY, 10996, United States, john.harris@usma.edu, Don Brown

The ability of an analyst to accurately classify a threat force weapon system is a difficult task. In many cases, data are missing, incomplete, intermittent, or deceptive. Contained in the radio transmissions are data fields from which inference to the type of equipment, and the type of unit of the weapon system can be made. This research develops a methodology and algorithm based on the theory of intelligent systems to automate the process of accurately classifying threat force weapon systems.

3 — Using Campaign Simulations to Models The True Cost of Aging Aircraft

Frye David, Systems Engineer, Lockheed Martin Aeronautics, 86 S Cobb Drive, Dept 1AD2 MZ 0674, Marietta, GA, 30063-0674, United States, david.c.frye@lmco.com

Economics and politics require the military to employ aircraft well beyond their designed service life. It is no small task to assess the economic costs and benefits of maintaining aging aircraft and improving their performance. It is an even bigger challenge to calculate the cost of aging aircraft with respect to the warfighters' performance. We describe a methodology for gauging the impact of aging aircraft on combat outcomes and present results from selected studies using this methodology.

4 — Fabric Handle as a Critical Aspect of Comfort

Fatma Selcen Kilinc, Graduate Research Assistant, Auburn University, Textile Engineering Department, 115 Textile Building, Auburn, AL, 36849, United States, kilinfs@eng.auburn.edu, Mounir Hassan, Yehia El Mogahzy

Human comfort has been one of the major concerns particularly under severe environmental/physical conditions for military applications.The underlying concept of the approach presented in this paper is a comfort model that was developed to express comfort using a single index.Obviously,this is a major undertake considering the complex nature of the comfort phenomenon and the nonlinear interaction of several factors influencing comfort.Our focus here will be on the handle aspect of comfort.

5 — Research Plan Development for Modeling and Simulation of Military Operations in Urban Terrain

John Willis, TRADOC Analysis Center - Monterey, 4 Shubrick Road, Monterey, CA, 93940, United States, john.willis@trac.nps.navy.mil, Thomas Cioppa, Lloyd Brown, Niki Goerger

US Army transformation continues to rely heavily upon the use of modeling and simulation for analysis including assessment of our ability to fight in urban environments. The Military Operations in Urban Terrain Focus Area Collaborative Team (MOUT FACT) directs urban operations modeling efforts ensuring that new simulations credibly depict MOUT. This paper details the methodology and results of the MOUT FACT to develop the urban M&S research plan including details of current MOUT M&S projects.

■ TB26

Westin-Tower 1401, 14th Floor

Data Mining Applications in Business and Management

Cluster: Data Mining and Knowledge Discovery
Invited Session

Chair: Alan Porter, Director, Search Technology, Inc., Research and Development, 4960 Peachtree Industrial Blvd, Suite 230, norcross, GA, 30071-1580, United States, aporter@isye.gatech.edu

1 — QTIP: Quick Technology Intelligence Products

Alan Porter, director, Search Technology, Inc., Research and Development, 4960 Peachtree Industrial Blvd, Suite 230, norcross, GA, 30071-1580, United States, aporter@isye.gatech.edu, Merrill Brenner

Search Technology and Air Products are collaborating to develop user (researcher, analyst) tools to exploit search results in R&D abstract databases (e.g., EI Compendex or Science Citation Index, MicroPatents or Derwent World Patent Index). QTIP aims toward rapid, easy, and cheap ways to mine these structured text resources. Scripted templates answer particular technology management questions. For instance, one output addresses "Who are leaders in Technology T?"

2 — Distributed Knowledge System for School System Management

Vittal Prabhu, Associate Professor, Penn State University, 310 Leonhard Building, University Park, PA, 16802, United States, prabhu@engr.psu.edu, Meg Small, Vamsi Salaka

In this paper we present applications of data mining for improving our understanding of demographics of students within a school district and across school districts. The objective is to provide relevant actionable information about student-level risk and protective factors (e.g, social and emotional adjustment), school-level risk and protective factors (e.g., school environment), and best practices (e.g., social services) to school personnel so they can manage limited resources optimally.

3 — Sample Temporal Percentile Plots

James J. Cochran, Assistant Professor, Louisiana Tech University, Department of Economics & Finance, P.O. Box 10318, Ruston, LA, 71272, United States, JCochran@cab .latech.edu

We present a graphical method for using sample data to distinguish temporal shifts in a probability distribution. Examples from Major League Baseball covering the entire twentieth century are used to demonstrate the usefulness of this type of display, and sample displays will be compared to comparable population displays.

■ TB27

Westin-Tower 1402, 14th Floor

Column Generation in Integer Programming

Sponsor: Optimization/Integer Programming
Sponsored Session

Chair: Wilbert Wilhelm, Barnes Professor, Texas A&M University, Department of Industrial Engineering, TAMUS 3131, College Station, TX, 77843-3131, United States, wilhelm@tamu.edu

1 — Generalized Column Generation and Cutting Planes FOR 0-1 Integer Programming
Osman Oguz, Professor, Bilkent University, Department of Industrial Engineering, 06800 Ankara, Ankara, Turkey, ooguz@bilkent.edu.tr

Generalized column generation is a new approach for solving linear programs with bounded variables. We adapt this approach to solve 0-1 integer programming problems using cutting plane techniques. Specifically, the problem of generating a column to restore primal feasibility with the dual simplex method after the addition of the cut is addressed. It is shown that a column that preserves dual feasibility may be obtained by a simple procedure. Some experimental results will also be provided.

2 — Branch and Price: Application to Coloring and Clustering
Anuj Mehrotra, Chairman and Associate Professor, University of Miami, Department of Management Science, 412 KE Building, Miami, FL, 33124-8237, United States, anuj@miami.edu, Michael Trick

We discuss models and branch-and-price based methods for solving graph coloring and clustering problems. Several applications and computational results are presented.

3 — A Branch-and-Price Approach for the Maximum Weight Independent Set Problem
Deepak Warrier, Texas A&M University, Department of Industrial Engineering, TAMUS 3131, College Station, TX, 77843-3131, United States, Jeffrey Warren, Wilbert Wilhelm, Illya Hicks

We describe a branch-and-price approach to the maximum weight independent set problem and present computational results using two vertex-set partitioning schemes.

■ TB28

Westin-Tower 1403, 14th Floor

Global Optimization — Algorithms and Applications

Sponsor: Optimization/Global Optimization
Sponsored Session

Chair: János D. Pintér

President, PCS Inc. & Adjunct Prof., PCS Inc. / Dalhousie U., 129 Glenforest Drive, Halifax, NS, B3M 1J2, Canada, jdpinter@hfx.eastlink.ca

1 — Packing Non-Uniform Size Circles by Global Optimization
János D. Pintér, President, PCS Inc. & Adjunct Prof., PCS Inc. / Dalhousie U., 129 Glenforest Drive, Halifax, NS, B3M 1J2, Canada, jdpinter@hfx.eastlink.ca, Frank J. Kampas

Arrangements of identical size circles in a minimal embedding square or circle are well-known mathematical challenges with important applications. We introduce the more general case of non-uniform size circle packing, and solve illustrative numerical examples using (our) global optimization software.

2 — On the Global Optimization of Sums of Linear Fractional Functions over a Convex Set
Harold P. Benson, University of Florida, United States, harold.benson@cba.ufl.edu

We show that by using suitable transformations, a number of potential and known methods become available for globally solving optimizations of sums of linear fractional functions over convex sets. These methods are often more accessible and use more standard tools than the customized algorithms proposed for these problems to date. They include, for example, parametric convex programming and concave minimization methods.

3 — Empirical Comparison of Solution Procedures for the Block Layout Design Problem with Unequal Areas
Ignacio Castillo, Assistant Professor, University of Alberta School of Business, 3-30G Business Building, Edmonton, AB, T6G2R6, Canada, ignacio.castillo@ualberta.ca, Stefan Emet, Tapio Westerlund, Joakin Westerlund

We will introduce MINLP models for the block layout design problem with unequal areas and compare the performance of various methods in finding globally optimal solutions.

■ TB29

Westin-Tower 1404, 14th Floor

Networks & Graphs I

Contributed Session

Chair: Earl Barnes, Professor, Georgia Institute of Technology, School of ISyE, Atlanta, GA, United States, ebarnes@isye.gatech.edu

1 — A New Routing & Scheduling Problem in Transportation Networks
Jan van Vuuren, Associate Professor, University of Stellenbosch, Dept of Applied Mathematics, Private Bag X1, Matieland, WC, 7602, South Africa, vuuren@sun.ac.za, George Groves, Jeanne le Roux

We present a graph theoretic heuristic to determine an efficient circular traversal of a weighted graph that requires a subset of its edges to be traversed, each a specified (potentially different) number of times. Consecutive time instances at which the same edge has to be traversed should additionally be spaced through a scheduling time window as evenly as possible. We apply the heuristic to randomly generated graphs and interpret these test results .

2 — Optimal Paths in Networks with Negative Arc Attributes and Fractional Cost Functions
H.M. Soroush, Associate Professor, Kuwait University, Dept. of Stat. & Opns. Res., PO Box 5969, Safat, KU, 13060, Kuwait, hsoroush@kuc01.kuniv.edu.kw

We study the problem of finding an optimal path in a network whose arc attributes are not necessarily non-negative and the cost function for path evaluation is fractional. An optimal path algorithm is developed based on some path domination structures. Computational results will be also presented.

3 — A Least-Squares Network Flow Algorithm
Balaji Gopalakrishnan, Postdoctoral Fellow, University of Minnesota, Institute for Mathematics & Its Applications, 400 Lind Hall, 207 Church St. S.E, Minneapolis, MN, 55455, United States, balaji@ima.umn.edu, Ellis Johnson, Earl Barnes, Joel Sokol

Network flow problems exhibit many special least-squares properties. We show how these properties can be used in a primal-dual setting for solving minimum cost network flow problems quickly. Computational results show the least-squares network flow algorithm to perform nearly twice as fast as the network simplex algorithm for solving a wide range of minimum cost flow problems and as much as ten times faster on some of the more degenerate problems.

4 — An Upper Bound for the Largest Clique in a Graph
Earl Barnes, Professor, Georgia Institute of Technology, School of ISyE, Atlanta, GA, United States, ebarnes@isye.gatech.edu, Joel Sokol, Katharina Baamann

We describe a linear programming model whose solution gives an upper bound for the largest clique in a graph. The bound is sharper than the one given by the usual LP relaxation of the integer programming formulation of the maximum clique problem, and the new LP is simpler. For a graph with n nodes, m edges, maximum degree of D, and no claw of size k, the LP model has n+m variables and order nD constraints.

■ TB30

Westin-Tower 1405, 14th Floor

Duality and Complexity in Conic Optimization

Sponsor: Optimization/Linear Programming and Complementarity
Sponsored Session

Chair: Gabor Pataki, Assistant Professor, Dept of Operations Research, University of North Carolina, Smith Building, University of North Carolina, Chapel Hill, NC, 27599, United States, pataki@email.unc.edu

1 — Bad Semidefinite Systems: They Look all the Same
Gabor Pataki, Assistant Professor, Dept of Operations Research, University of North Carolina, Smith Building, University of North Carolina, Chapel Hill, NC, 27599, United States, pataki@email.unc.edu

We give a surprisingly simple, “excluded minor” type characterization of all semidefnite systems that have a badly behaved dual for some objective function. An analogous result is proven for second order conic systems. These results are based on a new result on the closedness of the linear image of a closed convex cone.

2 — Hyperbolic Polynomials and the Lax conjecture
Motakuri Ramana, Crew Scheduling Optimization, United Airlines Inc., Elk Grove Village, IL, 60005, United States, ram_motakuri@yahoo.com, Adrian Lewis, Pablo Parrilo

Hyperbolic multivariate polynomials are defined by the property that the roots of every univariate restriction of the polynomial through some fixed point are real, and have recently been shown to be useful in convex optimization. We display the validity of a conjecture by Lax, which stated that every hyperbolic polynomials in three variables is the determinant of a linear combination of three symmetric matrices, using a recent result of Helton and Vinnikov.

3 — On the S-Procedure
Tamas Terlaky, Professor, Canada Research Chair, McMaster University, Computing and Software, 1280 Main Street West, Hamilton, ON, L8S 4K1, Canada, terlaky@mcmaster.ca, Imre Pólik

The S-Procedure is a powerful tool that is frequently used in engineering applications, especially in signal processing and control. In this paper we explore the relations between the S-Procedure and various classic results of nonlinear optimization, such as the Convex Farkas Lemma and other theorems of alternatives under generalized convexity assumptions.

■ TB31

Westin-Tower 1406, 14th Floor

Optimization II

Contributed Session

Chair: Ross Link, President, Marketing Analytics, Inc., 500 Davis Street, Suite 1010, Evanston, IL, 60201, United States, RossLink@MarketingAnalytics.com

1 — Minimax under Nonlinear Integral Transportation Constraints
Vladimir Tsurkov, Prof., Computing Center of RAS, 40 Vavilov str, Moscow, 119991, Russian Federation, tsurkov@ccas.ru, Anatoly Mironov

Closed transportation minimax problem is generalized to a functional case. In classical transportation models the cost functions are defined on a set of nonnegative matrices having sums of elements in rows or columns equal to given values. Here, in contrast, the matrices are replaced by nonnegative functions of two variables. Their integrals with respect to either variable are equal to values of the given functions of one variable. The algorithm to solve this problem is constructed.

2 — Marketing Mix Optimization for Retailers Using Nonlinear Bayesian Response Models
Ross Link, President, Marketing Analytics, Inc., 500 Davis Street, Suite 1010, Evanston, IL, 60201, United States, RossLink@MarketingAnalytics.com, Alvin Lim

We discuss a production, large-scale nonlinear optimization which derives profit-maximizing advertising and pricing plans for retailers with billion-dollar marketing budgets. The underlying statistical model uses empirical Bayesian techniques to derive reliable estimates of price and advertising sales response. Nonlinearities are incorporated using "reach curves", the foundation of modern media optimization. We cover technical issues, implementation considerations, and future directions.

3 — Backpacking Optimization for Reducing the Soldier's Energy Expenditure During Load Carriage
Steven Yuhaski, Operation Research Analyst, Natick Soldier Center, Supporting Sci. & Tech. Directorate, 1 Kansas Street, Natick, MA, 01760, United States, steve .yuhaski@natick.army.mil, Louis Piscitelle

This paper presents the formulation of user-friendly software that will enable the user to determine the effects of backpack load configurations on the inertial properties of the soldier-backpack system. Optimal configurations are determined efficiently, using genetic programming concepts. A novel and important aspect of the heuristic is that it produces configurations under the condition that there can be no extra space and zero tolerance between all contiguous surfaces.

4 — A Parallel Computing System for Multi-Stage Stochastic Programs
Lihua Yu, Research Assistant, University of Arizona, Systems&Industrial Engineering Dept., Tucson, AZ, 85721, United States, lihua@email.arizona.edu, Suvrajeet Sen

We design a column generation based parallel computing system for multi-stage stochastic programming problems. The system allows certain enhancements like dropping columns, warm starts etc. Computational results based on a large-scale realistic instance whose deterministic equivalent LP has over one million constraints shows that system can solve large-scale SP problems.

5 — Order and Bound: A New Enumeration Method to Solve 0-1 Integer Programs Competing with B&B
Gabriella Muratore, Maat, Via M.Polo 1, Ficarazzi PA, Italy, gabriellamuratore@yahoo.com

In this talk we will present a new enumeration method, Order and Bound, of candidate solutions to general 0-1 integer programs. This method is competing with the general branch and bound method in that one doesn't need to solve iteratively LP relaxations but only needs to check, at each step, for feasibility. If good bounds to the problem are known this algorithm has a worst case performance strictly better than O(2n mn), which is, up to date, the better worst-case result known.

■ TB32

Westin-Tower 1407, 14th Floor

Machine Scheduling

Contributed Session

Chair: Sang-Oh Shim, Ph.D. Student, Korea Advanced Institute of Science and Technology (KAIST), Dept. of Industrial Engineering, KAIST, Guseong-dong, Yuseong-gu, Daejeon NA 305-701, Korea Repof, mizar@kaist.ac.kr

1 — Procedures for the Single Machine Group Scheduling Problem to Minimize Total Tardiness
Jeffrey Schaller, Professor of Operations Management, Eastern Connecticut State University, Department of Business Administration, 83 Windham Street, Willimantic, CT, 06226, United States, schallerj@easternct.edu

This paper propose optimal and heuristic procedures for the problem. The problem is considered with and without the group technology assumption. The procedures are tested on various classes of problems. The results show that if the group technology assumption is relaxed by processing a group of jobs in multiple batches then total tardiness is reduced.

2 — Parallel Machine Rescheduling with Machine Disruptions
Oguzhan Alagoz, Graduate Research Assistant, University of Pittsburgh, 1048 Benedum Hall, Pittsburgh, PA, 15261, United States, oga1@pitt.edu, Meral Azizoglu

In this study we address a rescheduling problem on identical parallel machines. We consider total flow time as an efficiency measure and the number of jobs processed on different machines in the initial and new schedules as a stability measure. We show that all efficient schedules with respect to efficiency and stability measures can be generated in polynomial time.

3 — Scheduling Flow Shops with Parallel Machines by Progressively Improving Bottleneck Stages
Shardul Phadnis, Supervisor, Lean Promotion Office, Russell William Limited, 1710 Midway Rd, Odenton, MD, 21061, United States, phadnis.1@osu.edu, Jerald Brevick

This paper presents a 2-stage heuristic procedure to solve parallel machine flow shop scheduling problem with deterministic job arrival times to minimize makespan. The procedure works by decomposing the problem into a number of subproblems. Each subproblem is solved to schedule one job at all the stages in the flow shop by identifying the bottleneck stage. This procedure is repeated until all jobs are scheduled. The initial schedule thus formed is refined in the second stage of the heuristic.

4 — Scheduling Unrelated Parallel Machines to Minimize Total Tardiness
Sang-Oh Shim, Ph.D. Student, Korea Advanced Institute of Science and Technology (KAIST), Dept. of Industrial Engineering, KAIST, Guseong-dong, Yuseong-gu, Daejeon, NA, 305-701, Korea Repof, mizar@kaist.ac.kr, Yeong-Dae Kim, Byung-Jun Joo

In this research, we consider the problem of scheduling n independent jobs on m unrelated parallel machine. If processing times of a job on each machine are arbitrary, the machines are called unrelated. Each job has different processing times on different machines and a due date. We assume that the machines are continuously available, no preemption or job splitting are allowed. Heuristic algorithms are devised to minimize total tardiness of jobs and computational experiments are performed.

■ TB33

Westin-Tower 1408, 14th Floor

Data Envelopment Analysis II

Contributed Session

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

1 — Measuring Performance for Third-Party Companies in Taichung Harbor District, Taiwan
Chiun-Ming Liu, Professor, Feng Chia University, Department of Industrial Engineering, P.O. Box 25-097, Taichung, TC, 407, Taiwan, cmliu@fcu.edu.tw, Sen-Hsiun Ho

Issues of performance evaluation for third-party companies in Taichung Harbor district (THD), Taiwan, are addressed. DEA is utilized to evaluate the performance for 22 third-party companies . Management data are collected. DEA models are used for analyzing these data. The information obtained include potential improvement, peer contribution, input-output contributions, and total potential improvement. The results suggest that there exists a great potential of improvement for many companies.

2 — Technical Efficiency of the Brazilian Municipalities: Correcting Non-Parametric Frontiers for Outlier
Maria C. Sampaio de Sousa, Full Professor, University of Brasilia, Economics Department, Campus Darcy Ribeiro S/N, Brasìlia, DF, 70000-900, Brazil, mcss@unb.br, Borko Stosic

We estimate DEA efficiencies for 4796 Brazilian communes, by combining Bootstrap and Jacknife techniques to eliminate the effect of outliers and errors. Jacknife technique was used to extract leverages of all DMUs.This information, together with Bootstrap techniques and distribution functions were used to identify high leverage cities. Scale economies and excess spending due to royalty receipts explain why efficiency scores increases with the size of the municipality.

3 — An Integrated Decision Model of Supply Chain Management
Byunghak Leem, Professor, Pusan University of Foreign Studies, 55-1 Uam-Dong, Nam-Gu, Busan, Korea, Busan, Kr, South Korea, bhleem@pufs.ac.kr, K.J. Rogers

This paper proposes a methodology of configuring multi-echelon logistics networks using AHP and DEA. The methodology will consist of three phases. AHP phase is to quantify and analyze the current logistics network using subjective information in an uncertain environment. DEA phase selects the logistics partners with the best-of-breed competencies. Transshipment phase configures a feasible logistics network integrating the partners chosen in phase two.

4 — The Impact of Manufacturing Practices on Manufacturing Plant Performance
Indranil Bardhan, Assistant Professor, The University of Texas at Dallas, School of Management, 2601 North Floyd Road, Richardson, TX, 75083, United States, bardhan@utdallas.edu, Hsihui Chang, Rajiv Banker

We study the impact of manufacturing practices and plant-level information systems on plant performance. Data Envelopment Analysis (DEA) is used in the first stage to evaluate relative plant performance based on plant output measures. In the second stage, a regression model is developed to identify the impact of manufacturing practices and other plant characteristics on plant effectiveness as measured by the DEA model.

5 — Multi-Factor Performance Measure Model Applied to Portuguese Industrial Sector
Amìlcar Serrao, Associate Professor, Evora University, Largo dos Colegiais, Evora, AL, 7000, Portugal, amilcar-serrao@clix.pt

This research works develops an approach to study the overall performance through the DEA methodology that permits to reconcile eight single financial measures via a two-stage transformation process for 500 Portuguese companies. Model results show that the revenue-top-ranked companies do not necessarily have top-ranked performance in terms of profitability and marketability. The congestion study shows that a reduction in the current levels of employees, assets and equity.

■ TB34

Mart-Room A

Vehicle Routing II

Sponsor: Transportation Science & Logistics
Sponsored Session

Chair: Ann Campbell, Assistant Professor, University of Iowa, Department of Management Sciences, Iowa City, IA, 52245, United States, ann-campbell@uiowa.edu

1 — The Selective Vehicle Routing Problem with Time-Dependent Rewards: A Service Application
Elise Miller-Hooks, The Pennsylvania State University, Department of Civil and Environmental En, United States, edm3@psu.edu, Hao Tang

We address the Selective Vehicle Routing Problem with Time-Dependent rewards. In the SVRPTD, the amount of reward received by visiting a customer depends on the time that the visit takes place. The objective of the SVRPTD is to maximize the total time-dependent reward collected by scheduled vehicle tours that satisfy a tour duration limitation. We propose a tabu search heuristic to solve this problem and illustrate the solution approach on a large-scale real-world service application.

2 — Pickup and Delivery Problems in Drayage Operations
Karen Smilowitz, Assistant Professor, Northwestern University, 2145 Sheridan Road, Room M233, Evanston, IL, 60202, United States, ksmilowitz@northwestern.edu, Peter Roy

We explore vehicle routing and scheduling in drayage operations, in which containers are moved between intermodal yards and customers. We present the formulation and solution methodologies which are applied to Chicago.

3 — Incentives for Consumer Direct Delivery
Ann Campbell, Assistant Professor, University of Iowa, Department of Management Sciences, Iowa City, IA, 52245, United States, ann-campbell@uiowa.edu, Martin Savelsbergh

We will discuss the use of incentives to reduce delivery costs for goods ordered online and delivered to the home. We will examine different types of incentives and assumptions about consumer behavior and address how they impact solution methodology and computational results.

4 — Determining the Benefit of Fleet Sharing Across Various Boundaries
Maciek Nowak, Georgia Tech, Department of Industrial and Systems Eng, United States, mnowak@isye.isye.gatech.edu, Chelsea C. White, III

A major indicator of truck fleet inefficiency is the common occurrence of excess capacity. A solution to this is to combine separate fleets traveling similar routes with partial loads. We use the pickup and delivery problem to determine the benefit of breaking down barriers, stimulating communication and fleet sharing.

■ TB35

Mart-Room B

Operations Management V

Contributed Session

Chair: Joong Son, Assistant Professor, University of California, Riverside, 900 University Ave, AGSM, Riverside, CA, 92521, United States, joong.son@ucr.edu

1 — A Generalized Delivery-Time Guarantee Model
Timothy Urban, Professor, The University of Tulsa, Operations Management, 600 South College Avenue, Tulsa, OK, 74012, United States, timothy-urban@utulsa.edu

Many firms utilize a uniform delivery-time performance guarantee to attract customers, and incur a cost for late deliveries. We generalize existing delivery-time guarantee models by considering features such as incorporating a quadratic loss function to reflect the quality loss, a Gamma delivery-time distribution, among others.

2 — Joint Price and Due Date Quotation - Centralized and Competitive Cases
Ling Wang, University of Michigan, D2259, Business School, Ann Arbor, MI, 48109-1234, United States, lingw@umich.edu, Roman Kapuscinski

We study a continuous-time finite-horizon model, where a firm jointly quotes price and lead-time. In centralized case, under fairly weak conditions on the acceptance probability function, we describe the structure of optimal quotation policy, which results quoting the earliest available due date. The price is shown to be uniquely determined. We also derive the properties of the quotation equilibrium for duopoly competition.

3 — Optimal Design of Delayed Product Differentiation Networks
Erik Lystad, PhD Student, Georgia Tech, 755 Ferst Drive, Atlanta, GA, 30332, United States, erik.lystad@mgt.gatech.edu

The analysis of delayed differentiation of multiple product lines in existing literature typically assumes that installations along the supply chain may be treated independently from one another, resulting in single stage inventory policies. We remove this decoupling assumption and consider the optimal design of production chains.

4 — Inventory Models in an E-Retailing Setting: A Two-Stage Serial System with Space Constraints
Ping Xu, PhD Candidate, MIT, 77 Massachusetts Ave. E40-139, Cambridge, MA, 02139, United States, pingx@mit.edu, Stephen Graves, Russell Allgor

A retailer splits a warehouse into two regions for picking orders and holding reserve stock. Such warehouse is a multi-item two-stage, serial system. We investigate a stochastic problem that minimizes the long-run average cost under space constraints. We generate an approximate formulation, solution procedure for a periodic-review, nested ordering policy. The extension accounts for shipping delays and advanced order information. We report on tests with data from a major global e-retailer.

5 — Demand Commitment and Price Discount in a Decentralized Supply Chain
Joong Son, Assistant Professor, University of California, Riverside, 900 University Ave, AGSM, Riverside, CA, 92521, United States, joong.son@ucr.edu

This paper analyzes future demand commitment and price discount as incentive compatible mechanisms in a decentralized supply chain with a single wholesaler and multiple retailers. In particular, we focus on how retailers can be compensated for committing to future demand under run-out situations at the upper echelon. We investigate and present the effectiveness of our coordination scheme and identify settings under which our policy is beneficial for each stakeholder.

■ TB36

Mart-Room C

MSOM Fellow Award

Sponsor: Manufacturing and Service Operations Management
Sponsored Session

Chair: Ananth Iyer, Professor, Purdue University, Krannert School of Management, 1310 Krannert Building, West Lafayette, IN, 47907, United States, aiyer@mgmt.purdue.edu

1 — Operations Management and Homeland Security
Lawrence M. Wein, Paul E. Holden Professor of Management Science, Stanford University, Graduate School of Business, 518 Memorial Way, Stanford, CA, 94305, United States, lwein@stanford.edu

Many homeland security problems possess important operations management aspects, but also include other issues, such as epidemiology, atmospheric transport, dose-response relationships, disease progression, radiation emissions and detection, and biometrics. We survey four problems: emergency response to smallpox and anthrax attacks, and border security for nuclear weapons and terrorists.

■ TB37

Mart-Room D

Heuristic Search Methods

Contributed Session

Chair: Vincent Li, Visiting Assistant Professor, Ithaca College, School of Business, 326 Smiddy Hall, Ithaca, NY, 14850, United States, vli@ithaca.edu

1 — A Systems Approach to Evaluating the Financial Condition of Public Airports
Salwa Ammar, Professor, Le Moyne College, 1419 Salt Springs Road, Syracuse, NY, 13214, United States, ammar@lemoyne.edu, Ronald Wright

Evaluating the credit worthiness of public organizations is an ideal application of fuzzy rule-based systems (FRBS). Subscribers expect ratings to be consistent and to be monitored and updated as financial conditions change. An automated expert system would guarantee consistency and at the same time allow for relatively easy ongoing monitoring. This paper describes a successful effort to develop a FRBS to evaluate the credit worthiness of US public airports.

2 — Evaluating the Performance of Several Search Methods Applied to a Probabilistic Location Model
Cem Saydam, Professor, UNC Charlotte, Bus. Info. Sys & Ops. Mgt, 9201 Univ City Blvd, Charlotte, NC, 28223, United States, saydam@email.uncc.edu, Hari K. Rajagopalan, F. Elizabeth Vergara, Jing Xiao

The main objective of this study is to develop and benchmark the performance of four heuristic search methods (hill-climbing, tabu search, simulated annealing and evolutionary algorithm) applied to the maximum expected coverage location problem developed by Daskin. The secondary objective is to assess the quality and the realism of the solutions generated by the heuristics and the optimal solutions to MEXCLP with a comprehensive simulation model.

3 — A New Method for Arrangement Layout Problems, Including Group Nesting and Tree Representation
Chanchai Jirakanjana, Nippon Institute of Technology,Hoshino Laboratory Department of Systems Engineering, 4-1 gakuendai miyashiromachi, Saitama, 00, Japan, s2024014@stu.nit.ac.jp, Pranchalee Rattanasakornchai, Tsutomu Shohdohji, Hoshino Yasushi

The method using genetic algorithms (GAs) to fine the optimal or near-optimal solution for the problem that determines arrangement layout of a given number of patterns on a sheet to make the minimizing required length of the sheet. The arrangement layout consists of two parts, group nesting and tree representation. The both of parts are arranged by each pattern without overhanging and overlapping. In this paper we discussed the group nesting mainly to solve the arrangement layout problems.

4 — DAKOTA: Design Analysis Kit for Optimization and Terascale Applications
Laura Swiler, Sandia National Laboratories, P.O. Box 5800, MS 1176, Albuquerque, NM, 87185-1176, United States, lpswile@sandia.gov

The DAKOTA (Design Analysis Kit for Optimization and Terascale Applications) toolkit provides a flexible interface between the user's analysis codes and iterative analysis methods. DAKOTA contains algorithms for optimization (gradient and nongradient-based methods); uncertainty quantification; parameter estimation with nonlinear least squares methods; and sensitivity analysis with design of experiments and parameter study capabilities. This talk will present an overview of DAKOTA.

5 — Solving Multidimensional Knapsack Problems with GUBs by Perturbation Guided Strategic Oscillations
Vincent Li, Visisting Assistant Professor, Ithaca College, School of Business, 326 Smiddy Hall, Ithaca, NY, 14850, United States, vli@ithaca.edu, Guy Curry

We use a critical-event tabu search approach to solve the multidimensional knapsack problem with GUB constraints. Upon crossing the feasibility boundary, the heuristic looks for trial solutions in the neighborhood of critical solutions (solutions obtained immediately before/after crossing the boundary). A perturbation guided strategic oscillation is used to accomplish the goal of intensifying the search.

■ TB38

Mart-Room E

Region-Wide and Intermodal DTA Applications

Sponsor: Transportation Science & Logistics
Sponsored Session

Chair: Athanasios K. Ziliaskopoulos, Northwestern University, Evanston, IL, 60208, United States, a-z@northwestern.edu

1 — INDY: New Analytical Multiclass Dynamic Traffic Assignment Model
Michiel C.J. Bliemer, Delft University of Technology, Faculty of Civil Engineering and Geoscie, P.O. Box 5048, 2600 GA Delft, The Netherlands, m.bliemer@ct.tudelft.nl, Kerry M. Malone, Christian Ménard

INDY is a true multi-class DTA model based on an route-based analytical description of the traffic simulation. In contrast to other analytical approaches, INDY is capable of solving for a dynamic user-equilibrium on large-scale networks using a standard PC as shown in a case-study for The Netherlands.

2 — Simplicial Decomposition Algorithm for Solving the Intermodal Dynamic Traffic Assignment Problem
Elaine Chang, Northwestern University, Department of Civil Engineering, Evanston, IL, United States, ejchang@northwestern.edu, Athanasios K. Ziliaskopoulos

The combined mode split and traffic assignment problem is formulated as an intermodal dynamic traffic assignment model. The model presented is a variational inequality (VI) that aims to find the equilibrium number of travelers on each origin-destination-departure time path. The only constraint is one that ensures that path demands sum to total demands for each OD-departure time. Since this convex hull feasible space, a simplicial decomposition approach is proposed to find the solution that minimizes the gap function of the VI. The traffic propagation be captured by a simulation model. The algorithm iterates between traffic simulation, calculation of an extreme point path assignment based on the simulation travel times, and combination of the new extreme point with the previous solution. Computational test results are presented and implementation issues are discussed.

3 — Evaluation of Transit Signal Priority Using a Regional Assignment-Simulation Model
Athanasios K. Ziliaskopoulos, Northwestern University, Evanston, IL, 60208, United States, a-z@northwestern.edu, Elaine Chang

A large-scale cell-transmission-based simulation-assignment approach has been used to evaluate the regional impacts of transit signal priority (TSP) in the Chicago region. TSP is typically modeled on a corridor-by-corridor basis using microscopic models; however this approach fails to capture driver route-choice behavior that result as signal advantages shift. The cell-transmission-based mesoscopic model is more computationally efficient than microscopic models, and thus allows for simulation of large and detailed regional networks in order to capture origin-destination route choice behavior, while still capturing realistic traffic propagation and interaction of cars with bus operations. The data used to model the Chicago region will be briefly described along with the difficulties encountered and assumptions made. The experiments will be described, with computational results and key findings regarding the regional impacts.

4 — A Structural State Space Model for Real-Time Origin-Destination Demand Estimation and Prediction
Xuesong Zhou, University of Maryland, 1188 Glenn L. Martin Hall, Maryland Transportation Initiative, College Park, MD, 20742, United States, xszhou@wam.umd .edu, Hani Mahmassani, Xiao Qin

A structural state space model is presented to estimate and predict traffic OD demand in real-time. The model incorporates historical demand information and time-varying structural variations into a general Kalman filtering framework. The model is applied and tested using data for the Irvine network.

■ TB39

Mart-Room F

Supply Chain Management III

Contributed Session

Chair: Hamid Pourmohammadi, PhD Candidate, University of Southern California, 3715 Mc Clintock Avenue, GER 240, Los Angeles, CA, 90089, United States, pourmoha@usc.edu

1 — EDI Usage and Its Performance Implications in the Supply Chain
Craig Hill, Georgia State University, P.O. Box 4014, Atlanta, GA, 30302, United States, chill4@gsu.edu, Peter Zhang

Information technology is the backbone of supply chain management. This study empirically examines the relationship between a company's EDI usage and its implications on supply chain performance. Survey data is used to build empirical models to study this relationship. We identify the most critical factors for the successful management of supply chain. Results will have implications on how to effectively use EDI for supply chain management.

2 — Electronic Replenishment in a Two-Stage Make-to-Order Supply Chain
Powell Robinson, Associate Professor, Texas A&M University, INFO Dept. Mays Business School, College Station, TX, United States, probinson@cgsb.tamu.edu, Funda Sahin, Li-Lian Gao

We examine electronic replenishment systems in an MTO supply chain. Utilizing rolling schedule procedures that link manufacturer, shipper and vendor processes, we study manual, semi-automated, and fully automated e-procurement strategy in decentralized, centralized and VMI systems. The average cost reduction, moving from a traditional manual-based system to a fully automated system, is 19.6, 12.5 and 7.2% respectively for decentralized, centralized and VMI structures.

3 — Reverse Logistics Network Design: The Introduction of Uncertainty
Kris Lieckens, Research Assistant, University of Antwerp, Prinsstraat 13, Antwerp, An, 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-single level network with the technique of differential evolution.

4 — Shipper Valuation of Interstate Natural Gas Pipeline Point-to-Point Transportation Contracts
Nicola Secomandi, Carnegie Mellon University, GSIA, Pittsburgh, PA, 15213, United States, ns7@andrew.cmu.edu

The talk investigates how shippers should value simplified interstate natural gas pipeline point-to-point transportation contracts. Its economic and managerial insights should be of interest to commercial managers of natural gas production, merchant, local distribution, and interstate pipeline companies, and to federal regulators.

5 — Regional Industrial Waste Materials and By-Products Exchange Network Optimization
Hamid Pourmohammadi, PhD Candidate, University of Southern California, 3715 Mc Clintock Avenue, GER 240, Los Angeles, CA, 90089, United States, pourmoha@usc.edu, Maged Dessouky, Mansour Rahimi

In this study, wastes/byproduct flows in a material exchange network are modeled. The objective is to minimize environmental and operational costs of exchanging waste/byproduct materials in a B2B network. The network contains firms, collection centers, value added process (VAP)centers, disposal centers, and virgin material market. The model determines the number and location of the facilities (collection/VAP centers) and the flow of material. A case study is conducted to validate the model.

■ TB40

Mart-Room G

Topics in Supply Chain, Complementarities and Technology Choice

Cluster: Supply Chain Management
Invited Session

Chair: Pranab Majumder, Duke University, Fuqua School of Business, Durham, NC, 27708, United States, majumder@duke .edu

1 — Inventory Policies for Multi-product Systems with Different Life Cycles
Hyun-soo Ahn, Assistant Professor, University of California, 4185 Etcheverry Hall, Berkeley, CA, 94720, United States, ahn@ieor.berkeley.edu, Katia Frank, Rachel Zhang

We consider a periodic review inventory system where multiple parts with differet life times are required to produce the end item. While the life time of Part 1 is long and assumed infinite, Part 2 is perishable and only lasts for one period. For the case with the fixed ordering cost for Part 1 and backorder, we characterize the structure of the optimal policy. We demonstrate the value of a joint inventory policy in a numerical study.

2 — Impact of Supply Chain Structure on Transmission of Demand Variability into Price Variability
Amar Sapra, School of Operations Research and Industrial Engineering, Cornell University, Ithaca, NY, 14853, United States, sapra@orie.cornell.edu, Peter Jackson

We consider a linear-quadratic cost model to analyze a continuous time capacity market for a single homogeneous commodity. We obtain closed form expressions for the equilibrium capacity, production and price trajectories and analyze the impact of the supply chain cost parameters on the variance of the equilibrium market price.

3 — The Role of Technology Cloning and Licensing when there are Network Externalities
Xiaohui Xu, University of Texas at Austin, 1 University Station B6300, Austin, TX, 78712, United States, Xiaohui.Xu@phd.mccombs.utexas.edu, Stephen M. Gilbert

We study the consequences to a technological innovator from licensing its product. We show that licensing can dominate direct distribution when there are complementary products that create indirect network benefits. We contrast our results with existing results for direct network benefits and assess alternative approaches that a technological innovator can take to licensing its technology.

4 — Asset-Specific Supply Tree Competition and Leadership
Pranab Majumder, Duke University, Fuqua School of Business, Durham, NC, 27708, United States, majumder@duke.edu, Ashok Srinivasan

We consider asset-specific supply chains which are prevalant in many industries, notably the Japanese keiretsu, with price dependent deterministic demand. We study the effect of contract leadership and coordination. We demonstrate the importance of the leader position in the chain- this determines the extent of demand marginalization and cost curve marginalization. We consider Cournot competition between competing supply chains and show the effect of changes in leadership and cost efficiency.

■ TB41

Mart-Room H

New Dimensionality Reduction Approach Applied to Computer Scheduling

Cluster: Supply Chain Management
Invited Session

Chair: Alan Scheller-Wolf, Associate Professor, Carnegie Mellon University, GSIA, Pittsburgh, PA, 15213, United States, awolf@andrew.cmu.edu

1 — Cycle Stealing and the Dimensionality Reduction Technique
Mor Harchol-Balter, Assistant Professor, Carnegie Mellon University, Computer Science Department, 5000 Forbes Hall, Pittsburgh, PA, 15213, United States, harchol@cs.cmu.edu, Alan Scheller-Wolf, Takayuki Osogami

We introduce a new technique that we refer to as dimensionality reduction. This technique reduces certain 2-dimensionally-infinite Markov chains to 1-dimensionally-infinite chains, thereby making the chain computationally tractable via Matrix-analytic methods. Our technique utilizes busy period modeling. We apply this technique to a range of open problems in computer scheduling, starting with the problem of cycle stealing (where one machine can steal the idle cycles of another).

2 — Performance Analysis of Benefits of Cycle Stealing
Takayuki Osogami, Ph.D. student, Carnegie Mellon University, Computer Science Department, 5000 Forbes Ave., Pittsburgh, PA, 15213, United States, osogami@cs.cmu .edu, Alan Scheller-Wolf, Mor Harchol-Balter

We analyze the cycle stealing problem, whereby a beneficiary processor can steal the idle cycles of a donor processor. We assume generally-distributed service requirements, and switching costs. We allow for threshold constraints, whereby the donor processor only initiates helping if the donor is idle and the beneficiary queue exceeds a certain threshold. We analyze mean response times and stability conditions. Results illuminate interesting principles the design of cycle stealing policies.

3 — Analysis of Task Assignment
Alan Scheller-Wolf, Associate Professor, Carnegie Mellon University, GSIA, Pittsburgh, PA, 15213, United States, awolf@andrew.cmu.edu, Mor Harchol-Balter, Takayuki Osogami, Mark Squillante, Cuihong Li

We analyze task assignment in a non-preemptible distributed server system, where short and long jobs are separated, but short jobs may be run in the long job partition if it is idle. We analyze central queue and immediate dispatch models. Results show that cycle stealing can reduce mean response time for short jobs by orders of magnitude, while long jobs are only slightly penalized. Furthermore using a central queue yields significant performance improvement over immediate dispatch.

4 — Priority Scheduling in Multiserver System
Adam Wierman, PhD Student, Department of Computer Science, Carnegie Mellon University, 5000 Forbes Ave, Pittsburgh, PA, 15213, United States, acw@cs.cmu.edu, Alan Scheller-Wolf, Takayuki Osogami, Mor Harchol-Balter

We apply dimensionality reduction to analyze a preemptive priority M/G/k queue with an arbitrary number of priority classes. We compare with results from a single server preemptive priority queue.

■ TB42

Mart-Room I

Pricing Schemes under Advertising, Correlation, Competiton, and Service Level

Sponsor: Revenue Management & Dynamic Pricing
Sponsored Session

Chair: Juan Carlos Ferrer, Assistant Professor, P. Universidad Católica de Chile, Casilla 306 Correo 22 Santiago, Santiago, RM, 6904411, Chile, jferrer@sloan.mit.edu

1 — Dynamic Pricing Policies in the Retail Industry
Juan Carlos Ferrer, Assistant Professor, P. Universidad Católica de Chile, Casilla 306 Correo 22 Santiago, Santiago, RM, 6904411, Chile, jferrer@sloan.mit.edu, Rene Caldentey

This work is part of an ongoing research project being performed with the leading department store in Chile. We present our main findings in terms of (i) identification of best practices in this industry, (ii) development of demand curves for different families of products, and (iii) optimization of pricing policies. This research considers many aspects such as correlation among items' demand, dynamic seasonalities, and competition.

2 — Intrafirm Coordination of Pricing
Woonghee Tim Huh, Assistant Professor, Columbia University, IEOR Department, S.W. Mudd Building, New York, NY, 10027-6699, United States, huh@orie.cornell.edu, Robin Roundy, Jon A. Higbie

An Internet service provider generates revenue from both advertising and subscription services. A stovepipe approach of setting prices by the advertising manager and the subscription manager often leads to suboptimal optimal prices. We present a mechanism which coordinates the incentives of managers to obtain the enterprise-wide optimal pricing scheme.

3 — Managing Customer Relationships Through Price and Service Quality
Ariel Schilkrut, Chile, Ariel.Schilkrut@sloan.mit.edu, Gabriel Bitran, Paulo Oliveira

We examine ways in which a service provider's pricing and service level policies affect the size of its customer base and profitability. The system is modeled as a queueing network based on a model of customer behavior. The analysis reveals counterintuitive results of the effect of prices and service level on the size of the customer base and the system's profits. We also develop optimality conditions through which managers can assess the adequacy of their pricing and service level policies.

4 — Capacitated Inventory Management in the Presence of a Spot Market
Victor Araman, NYU, Stern School of Business, 44 W. 4th street KMC 8-74, New York, NY, 10012, United States, varaman@stern.nyu.edu, Ozalp Ozer

Consider a capacitated supplier that is involved in a long-term contract with a buyer. The supplier also has the option to sell at the spot market. The sales price for the long-term contract is predefined whereas the spot market price is the result of a clearance mechanism with random outcomes. We consider a finite horizon multi-period problem with finite total capacity, and study the supplier's capacity allocation and inventory management problem.

■ TB43

Mart-Room J

Algorithmic Aspects of Game Theory

Cluster: Auctions
Invited Session

Chair: Lisa Fleischer, GSIA, Carnegie Mellon University / IBM Watson Research, Pittsburgh, PA, 15213, United States, lkf@andrew.cmu.edu

1 — Market Equilibria: New Algorithms and Models
Vijay Vazirani, Professor, Georgia Tech, 801 Atlantic Av, Atlanta, GA, 30332, United States, vazirani@cc.gatech.edu

We will provide a glimpse of the ideas involved in the new polynomial time algorithms developed for computing market equilibira, as well as new equilibira models (developed from algorithmic considerations), and results derived for these models.

2 — Approximating General Market Equilibrium Problem
Kamal Jain, Microsoft Research, One Microsoft Way, Redmond, WA, 98007, United States, kjain@cc.gatech.edu, Mohammad Mahdian, Amin Saberi

The classical Market Equilibrium theorem by Arrow and Debreu says that there exist market clearing prices in a market with fixed supplies of divisible goods and concave utilities. The existing proof of the theorem is non-constructive in the sense that it does not lead to any efficient algorithm to find such prices. Using the algorithm of Devanur et. al. as a subroutine we develop an algorithm to find an approximate equilbirium as defined by Deng et. al. with factor arbitrary close to 1.

3 — Primal-Dual Algorithms, Strategy Proof Mechanisms and Cost Sharing
Martin Pal, Cornell University, 4106 Upson Hall, Ithaca, NY, 14853, United States, mpal@cs.cornell.edu, Eva Tardos

We develop a general method for turning a primal-dual algorithm into a group strategyproof cost-sharing mechanism. We use our method to design approximately budget balanced cost sharing mechanisms for two NP-complete problems: metric facility location, and single source rent-or-buy network design. Both mechanisms are competitive, group strategyproof and recover a constant fraction of the cost.

■ TB44

Mart-Room K

Operations Research at Delta Air Lines I

Sponsor: Aviation Applications
Sponsored Session

Chair: Milind Sohoni, Sr. OR Specialist, Delta Technology Inc., Research, Modeling and Design, Department 709, 1001 International Blvd., A3 Bldg., 9th Floor, United States, Milind.Sohoni@delta.com

1 — Modeling Price Elasticity
Kiran Ravulapati, Delta Technology, 1001 International Blvd, Dept 709, Atlanta, GA, 30354, United States, kirankumar.ravulapati@delta.com, Katia Frank, Wassim Chaar

We study the relation between price and demand in an airline setting. Airline demand is unique because of the revenue management controls used for customer segmentation. This makes the estimation of true demand at different prices very difficult. We present a model that estimates the demand under certain conditions and assumptions by eliminating revenue management effects from the data. The resulting demand curve is then used to obtain price elasticity for airline products at different fares.

2 — O&D Passenger Demand Forecasting
John Blankenbaker, Delta Technology, Dept 709, 1001 International Blvd, Atlanta, GA, 30354, United States, john.blankenbaker@delta.com, Wassim Chaar

In this talk, we describe a top-down method for inferring OD passenger demand forecasts from readily available flight segment passenger demand forecasts. The novelty of the proposed approach is its ability to blend historical product usage, leg level forecasts, and future flight schedules to estimate future OD level demands. Furthermore, the method provides a natural OD control mechanism that is lacking from many other OD revenue management systems.

3 — SimDelta: A Simulation Model to Analyze Airline Operations
Milind Sohoni, Delta Technology Inc., Dept 709, 1001 International Blvd, Atlanta, GA, 30354, United States, mgsohoni@yahoo.com, Raman Thirumalai, Katia Frank, Kristi Martin, Christos Makrigeorgis, John Blankenbaker, Wassim Chaar, Glenn Bailey

Airline operations are subject to many uncertainties and anecdotal evidence suggests that most airlines never experience a day without disruptions. Disruptions vary in size and effect, resulting in anything from minor delays to major cancellations. For large airlines, such as Delta, the gap between planned costs and actual operating costs can be several millions of dollars. We present a large scale simulation model, that models significant sources of disruptions, to study Delta's operations.

4 — Research, Modeling and Design Support for Delta Air Lines
Glenn Bailey, Delta Technology Inc., Dept 709, 1001 International Blvd., Atlanta, GA, 30354, United States, glenn.bailey@delta.com

This talk gives an overview of the operations research, business process modeling, and human factors support Delta Technology provides to Delta Air Lines. Specific topics include our organizational structure; engagement model with

information technology; integration of operations research with process re-engineering and human factors competencies; and, comments on the direction of decision support requirements in the airline industry.

■ TB45

Mart-Room L

Decision Support Systems

Contributed Session

Chair: Sari Stenfors

Researcher, Helsinki School of Economics, P.O.Box 1210, Helsinki, FI, 00101, Finland, sari .stenfors@hkkk.fi

1 — A Highly Efficient Heuristic for Finding Good Dispatching Schedules from Warehouses to Stores
Pedro Gazmuri, Professor, Pontificia Universidad Católica de Chile, V Mackenna 4860, Santiago, Chile, pgazmuri@ing.puc.cl, José Zapata, Yadran Eterovic

A very efficient heuristic 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.Application of our procedure to a big company in Chile has generated a 18% reduction in workforce costs.

2 — Introduction to International Journal of Information Technology & Decision Making
Jing He, Research Associate, Institute of Systems Science, Academy of Mathematics and Systems Science, Beijing, No, 100080, China, hejing@mail.amss.ac.cn

International Journal of Information Technology and Decision Making (IJITDM) provides a global forum for exchanging research findings and case studies which bridge the latest information technology and various decision-making techniques. It promotes how information technology improves decision techniques as well as how the development of decision-making tools affects the information technology era. The journal is peer-reviewed and publishes papers in information technology related topics.

3 — Production Policies for Multi-Product Systems with Deteriorating Process Condition and Random Yield
Thomas Sloan, Assistant Professor, University of Miami, Dept. of Management 414 JB, School of Bus. Admin., Coral Gables, FL, 33124, United States, tsloan@miami.edu

We study a single-stage system with deteriorating equipment and state-dependent yield. The yield of a product decreases as the process condition deteriorates, but each product has a different yield/state relationship. A reward is earned for a finished unit, and a maintenance cost is incurred to return the process to its initial state. Structural properties of the problem indicate that the optimal policy depends on the product rewards, production times, and machine state transition probabilities.

4 — Decision Support for Strategic Decisions in Organizations
Sari Stenfors, Researcher, Helsinki School of Economics, P.O.Box 1210, Helsinki, FI, 00101, Finland, sari.stenfors@hkkk.fi, Leena Tanner, Ilkka Haapalinna

We have studied the use of strategic decision support methods in 500 largest companies in Finland. We will present the array of methods that are currently used to aid strategic decisions. Furthermore, based on our research, we will discuss the perceived suitability of the methods and give suggestions for further development of the methods. See http://hkkk .fi/methods/dssd/

■ TB46

Mart-Room M

e-Business Applications

Sponsor: E-Business

Sponsored Session

Chair: Arvind Rangaswamy, Jonas H. Anchel Professor of Marketing, Penn State University, 707D, BAB, University Park, PA, 16801, United States, arvindr@psu.edu

1 — An Available-To-Promise Model for Periodical Order Promising of a Non-perishable Product
Chien-Yu Chen, Assistant Professor, George Mason University, Fairfax, VA, 22030, United States, cchen8@gmu.edu, Michael Ball, Zhenying Zhao

We develop a stochastic available-to-promise (ATP) model, based on a dynamic resource allocation policy, to maximize expected total profit in a periodical/batched order promising process. Four competing demand classes, with known demand distributions, are considered to mimic co-existing more profitable and less profitable customer orders at both current and future demand stages for a non-perishable product. The dynamic resource allocation policy maintains a resource reservation level at the end of current demand stage to protect more profitable future customer orders in order to improve overall profitability over both demand stages. We conduct a series of simulation experiments to demonstrate a real-world application with a key part shortage situation and provide insightful managerial implications based on the simulation results.

2 — e-Business Model using Web Services
Youxu (Tammy) Tjader, PhD student, University of Pittsburgh, Room 343 Mervis Hall, Pittsburgh, PA, 15260, United States, yotst1@katz.pitt.edu

This paper summarizes the research effort devoted in developing an e-Biz model that can be adopted by new startup companies. The model is formulated to suit the emerging Web services based business environment. A hypothetical business scenario is used in constructing the model. The key issue addressed by this research is the integration of optimized supply chain (value chain) in the e-Marketplace.

3 — Mass Customization versus Mass Production: Variety and Price Competition
Aydin Alptekinoglu, Ph.D. Candidate, Anderson Graduate School of Management, UCLA, 110 Westwood Plaza, B501, Los Angeles, CA, 90095, United States, aalpteki@anderson .ucla.edu, Charles J. 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). In the tradition of Hotelling (1929), 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 will decrease variety upon entry by MC.

4 — Designing Optimal Sequence of Questions for Online Recommendation Systems
John Liechty, Assistant Professor, Penn State University, The Smeal College of Business, BAB 1, University Park, PA, 16802, United States, John Liechty, Arnaud De Bruyn, Arvind Rangaswamy

We design and develop a new Bayesian Recommender System that develops real-time optimal sequence of questions to ask customers in helping them find their most preferred products. The conjoint analysis based elicitation procedure minimizes expected prediction error for the options most preferred by customers. We conduct several empirical tests with the new method and show that it rapidly reduces prediction errors around the most preferred options. We compare its performance to several competing procedures such as adaptive conjoint analysis.

■ TB47

Atlanta G, 7th Floor

Software Demonstration

Cluster: Software Demonstrations

Invited Session

1 — Aptech Systems, Inc. - Gauss Mathematical and Statistical System
Ron Schoenberg, Aptech Systems, Inc., 23804 SE Kent-Kangley Rd., Maple Valley, WA, 98038, United States, rons@aptech.com

GAUSS is a full-featured matrix programming language designed to provide rapid development of numerical analysis projects from the very simple in an interactive mode to the most complex and large scale using its thread-safe Engine. It is a 4th generation language optimized to eliminate the tradeoffs such languages have with respect to speed of execution. The GAUSS Engine provides a highly efficient means of delivering high-end analytics to any desktop. With GAUSS, research expertise is optimized through a highly efficient mathematical language combined with fast execution. With the Engine companies can combine the development efforts of both their research departments and IT departments in the deployment of high-end analytical solutions throughout the enterprise. The GAUSS Run-Time Engine (GRTE) allows unlimited royalty-free distribution of applications using the GAUSS Engine.

2 — Expert Choice, Inc. - Strategic Portfolio Alignment
James Devlin, Expert Choice Inc., 1501 Lee Highway Ste. 302, Arlington, VA, 22209, United States, jdevlin@expertchoice.com

During the demonstration we will provide a brief background on Expert Choice. This will be followed by demonstrations of several different Expert Choice models, to include portfolio management and vendor selection applications.

Tuesday 1:30pm - 3:00pm

■ TC01

Westin-Intl. A, 6th Floor

Applied Probability

Contributed Session

Chair: Sandeep Juneja, Academic Member, School of Technology and Computer Science, Tata Institute of Fundamental Research, Homi Bhabha Road, Colaba, Mumbai, MH, 400005, India, juneja@tifr.res.in

1 — Stability of Data Networks Under An Optimization-Based Bandwidth Allocation
Hengqing Ye, Assistant professor, National Univ of Singapore, Dept of Decision Sci,, BIZ, NUS, Singapore, SG, 117592, Singapore, bizyehq@nus.edu.sg

It is known that a data network may not be stable at the connection level under some unfair bandwidth allocations, even under the normal offered load condition. In this paper, we show that, under the normal load condition, a data network is stable when the bandwidth of the network is allocated so as to maximize a class of general utility functions. This result may shed light on the stability issue of the Internet since its bandwidth sharing can be modelled as a special type of above utility.

2 — Funding a Warranty Reserve After Each Sale and Fiscal Period
Peter Buczkowski, Doctoral Student, Department of Operations Research, UNC - Chapel Hill, CB#3180, Chapel Hill, NC, 27599, United States, buczkows@email.unc.edu, Vidyadhar Kulkarni

We consider the problem of funding a warranty reserve. We model a manufacturer who contributes to the reserve after each sale, and also can change it at prespecified times. The reserve earns interest at rate alpha. We allow for a general stochastic sales process and random repair costs . The problem is to determine the initial level of the reserve and the amount to be put in after each sale, so as to ensure that the reserve covers all the warranty liabilities with a prespecified probability.

3 — Outsourcing and Price-QoS Equilibrium for E-commerce and Internet
Parijat Dube, IBM Watson Research Center, P. O. Box 218, Yorktown Heights, NY, 10598, United States, pdube@us.ibm.com, Laura Wynter, Zhen Liu, Cathy Xia

Provisioning of on-demand outsourcing capability to e-commerce firms is a preoccupation of many companies in the IT business and a concern of many e-commerce firms. In this work, we present a framework to model the choice of outsourcing, situating it in the context of market equilibrium for e-commerce and the internet sectors. Our framework allows for general distributions on usage levels, price-QoS tradeoffs, and price and cost structures.

4 — Optimizing QoS for Composite Web Services Modelled as PERT Networks
Sandeep Juneja, Academic Member, School of Technology and Computer Science, Tata Institute of Fundamental Research, Homi Bhabha Road, Colaba, Mumbai, MH, 400005, India, juneja@tifr.res.in, Perwez Shahabuddin

Consider a composite web service provider with a fixed budget whose objective is to allocate resources to select vendors and levels of service to minimize the probability of large overall delay in completion of specified tasks in a specified order. This problem is modelled as a resource allocation problem for a stochastic PERT network. An asymptotically optimal solution is analytically determined. We also develop stochastic optimization and importance sampling techniques for this.

5 — Speeding up Exact DP for Series Line Optimization
Michael Veatch, Professor, Gordon College, Department of Mathematics and Computer S, Wenham, MA, 01984, United States, veatch@gordon.edu, W. Owen Webb

Value iteration is made more efficient on specific networks by characterizing the transient and "insensitive" states. Transient states are identified iteratively with the search for a policy. Insensitive states with small probability or cost of a suboptimal decision are truncated or aggregated. A five-machine line with machine failures is solved.

■ TC02

Westin-Intl. B, 6th Floor

Financial Risk and Uncertainty

Contributed Session

Chair: Qi Li, Student, Stanford University, 65 Escondido Village, Apt D, Stanford, CA, 94305, United States, liq@stanford.edu

1 — Value-at-Risk Estimation for Multi-period Mean Square Optimal Hedging with Jumps
Yuji Yamada, University of Tsukuba, 3-29-1 Otsuka, Bunkyo-ku, Tokyo, TK, 112-0012, Japan, yuji@gssm.otsuka.tsukuba.ac.jp, James Primbs

In this work, we present a Value-at-Risk (VaR) estimation technique for mean square optimal hedges with jumps in the underlying asset model. We first formulate the problem on a multinomial lattice, where the underlying process is approximated by matching (higher order) moments. After applying mean square optimal hedging, the hedging error distribution is computed to estimate its VaR. Finally, this methodology is applied to a numerical example.

2 — Dynamic Financial Planning: Certainty Equivalents, Stochastic Constraints and Conjugate Duality
Thomas Jefferson, Visiting Professor, University of Florida, 210 Wedgewood Cir S., Ormond Beach, FL, 32176, United States, trjefferson@hotmail.com, Carlton Scott

This paper studies portfolios under risk and stochastic constraints. Certainty equivalents combine risk aversion and exponential utility to form the objective. Budget and stochastic constraints on account balance are used to ensure positive net worth over time. These portfolio models are analyzed by functional conjugate duality for general distributions and by conjugate duality for the normal distribution.

3 — Case Studies in Shape and Trajectory Optimization: Catenary Problem
Igor Griva, Princeton University, United States, igriva@Princeton.EDU, Robert Vanderbei

We present a case study in modern large-scale constrained optimization to illustrate how recent advances in algorithms and modeling languages have made it easy to solve difficult problems using optimization software. We consider the shape of a hanging chain, which, in equilibrium, minimizes the potential energy of the chain. We emphasize the importance of the modeling aspect, present several models of the problem and demonstrate differences in iteration numbers and solution time.

4 — Stochastic Dominance Pricing in Incomplete Markets
Daniel Osborn, Stanford University, PO Box 18857, Stanford, CA, 94309, United States, dosborn@stanford.edu

We generalize the monotone concave(convex) stochastic orders and describe them in terms of normed vector spaces. Application of these orders to asset pricing in incomplete markets includes no-arbitrage and integer-ordered stochastic dominance pricing as special cases. This method allows us to substantially reduce the range of reasonable prices for an unpriced asset by relating it to a class of risk free assets and the market.

5 — Asset Pricing under Market Segmentation
Qi Li, Student, Stanford University, 65 Escondido Village, Apt D, Stanford, CA, 94305, United States, liq@stanford.edu, James Primbs

One cannot apply asset pricing theories, such as CAPM, APT, and the fundamental theorem of asset pricing directly to a segmented market. This paper examines a general form of market segmentation by means of ownership restrictions. We propose an algorithm to decompose priced states according to their investor bases. The analog stochastic discount factor, beta, and factor formulas are given. We derive explicit pricing formulas using a CARA utility function.

■ TC03

Westin-Intl. C, 6th Floor

Anniversary of the Birth of Philip M. Morse

Cluster: 100th Anniversary of the Birth of Philip M. Morse
Invited Session

Chair: Saul I. Gass, Professor Emeritus, Robert H. Smith School of Business, 4544 Van Munching Hall, University of Maryland, College Park, MD, 20742, United States, sgass@rhsmith.umd.edu

1 — Philip M. Morse and the Beginnings
John D. C. Little, Professor, MIT, 77 Massachusetts Ave., Cambridge, MA, 01773, United States, jlittle@mit.edu

Morse was the many-sided founder of operations research in the United States. Following his pioneering wartime effort, he vigorously promoted the nonmilitary development of the field. A glimpse into his activities and accomplishments helps explain the vitality and high intellectual standards of the field.

2 — Inventing a Science: Philip Morse and the Establishment of Operations Research
William Thomas, Department of the History of Science, Harvard University, Cambridge, MA, 02163, United States, thomas@fas.harvard.edu

During World War II OR was broadly defined by the application of a scientific analysis to military operational data and the implementation of improvements via the military hierarchy. Afterwards Philip Morse struggled to maintain the broader culture of the wartime activity while expanding the field as a defined science through ORSA and the new graduate curriculum at MIT.

3 — Looking for Hemibels
Robert M. Oliver, Professor Emeritus, University of California, Berkeley, 260 Southampton Avenue, Berkeley, CA, 94707, United States, oliver@ieor.berkeley.edu

Models based on ruthless stripping of details, Hemibel thinking, continued search for relevant measures of effectiveness, action based predictors and calibration through observation — some enduring contributions of a researcher, scientist and founder.

■ TC04

Westin-Intl. D, 6th Floor

Optimization in Transportation and Warehousing

Cluster: Practice Track
Invited Session

Chair: Dan Ockerman, Manhattan Associates, Atlanta, GA, United States, DOckerman@manh.com

1 — An Optimization Based Approach to Large Scale Transportation Consolidation
Francisco Jauffred, Manhattan Associates, Boston, MA, United States, FJauffred@manh .com

Transportation costs represent a large portion of supply chain expenditures. We developed a model which simultaneously decides which carriers to use and through which consolidation-centers to route orders - and which can produce near optimal solutions for networks with as many as 1000 facilities in a few hours.

2 — Concurrent Optimization of Transportation and Warehouse Operations
Udai Tennati, Manhattan Associates, Atlanta, GA, United States, UTennati@manh.com, Dan Ockerman

We developed a joint optimization method linking two components of the supply chain: transportation and warehouse operations. For the time constrained loading of categorized inventory onto multi-stop multi-class trucks we developed a solution which minimizes labor-handling costs in the warehouse using a series of network flow models.

■ TC05

Westin-Intl. E, 6th Floor

Stochastic Decision Models & Applications

Sponsor: Applied Probability
Sponsored Session

Chair: Emmanuel Fernandez, Electrical & Comp. Eng. & Comp. Sci. Dept., 837 Rhodes Hall, University of Cincinnati, Cincinnati, OH, 45221-0030, United States, emmanuel@ECECS.UC.EDU

1 — Shelf-Space Allocation for a Single Retailer and Multiple Suppliers
Bogdan Bichescu, PhD Student, Dept. of Quantitative Analysis and Operations Management, College of Business Administration, University of Cincinnati, Cincinnati, OH, United States, bichesbc@email.uc.edu, Emmanuel Fernandez, Michael Fry

Shelf space allocation is a crucial decision for a retailer's profitability. We analyze the case of one retailer and multiple suppliers in both a centralized and a decentralized supply chain, under stochastic demand, and propose a space allocation model within the theoretical framework of inventory-control.

2 — Machine Maintenance with Workload Considerations
David L. Kaufman, Industrial & Operations Eng. Dept., University of Michigan, 1205 Beal Avenue, Ann Arbor, MI, 48109-2117, United States, davidlk@engin.umich.edu, Mark Lewis

Consider a queueing system where the server deteriorates over time. Deterioration causes the service rate to decrease. Repairs restore the server, but are not instantaneous. We discuss the stability region and show the existence of a (not necessarily monotone) switching curve that describes an optimal policy.

3 — Cooperative Control for Multiple Autonomous UAV's Searching for Targets
Matthew Flint, ECECS Dept., University of Cincinnati, Cincinnati, OH, 45221-0030, United States, flintmd@email.uc.edu, Emmanuel Fernandez, Marios Polycarpou

We formulate the problem of generating near-optimal trajectories to follow in order for several UAV's to cooperatively search for targets in a given area for which some a priori data about target distribution is available. An algorithm that utilizes a model of the cooperation is developed, and a dynamic programming implementation is presented as a solution to this problem.

4 — Optimal Joint Production and Maintenance Control Policies
Xiaodong Yao, Institute for Systems Research, A.V. Williams Building, University of Maryland, College Park, MD, 20742, United States, xdyao@isr.umd.edu, Xiaolan Xie, Michael Fu, Steven Marcus, Emmanuel Fernandez

We consider optimal joint production and (preventive) maintenance control policies for unreliable production systems. A joint policy will decide for a machine when to do PM, and if not to do PM, how much the machine should produce. Two types of failures, i.e., time-dependent and operation-dependent failures, are modeled. The problems are formulated as Markov decision processes. Some structural properties of optimal joint PM and production control policies will be derived.

■ TC06

Westin-Intl. F, 6th Floor

Joint Session OR in Bio/Computing: Computational Biology II

Clusters: OR in Biology, Computing
Invited Session

Chair: Allen Holder, Trinity University, 715 Stadium Drive, San Antonio, TX, 78212, United States, aholder@trinity .edu

Co-Chair: Harvey Greenberg, Mathematics Department, University of Colorado at Denver, Denver, CO, United States, Harvey .Greenberg@cudenver.edu

1 — Clustering Gene Expression Data Using Independent Component Analysis
Stephen Billups, Associate Professor, University of Colorado at Denver, Department of Mathematics, Campus Box 170, P.O. Box 173364, Denver, CO, 80217-3364, United States, Stephen.Billups@cudenver.edu, Lawrence Hunter

A method is presented for clustering gene expression data using independent component analysis. Data are grouped into clusters which are modeled as linear mixtures of statistically independent "hidden" sources. The method is promising for analyzing gene expression data since differences in expression levels may be due to several independent mechanisms. To achieve computational tractability, a variational Bayesian method is applied to approximate the density functions of the model parameters.

2 — Haplotype Inferencing and Minimum Diversity Graphs
Courtney Davis, Trinity University, 715 Stadium Drive, San Antonio, TX, 78212, United States, cdavis4@trinity.edu

This talk introduces diversity graphs as a useful construct for characterizing and bounding the minimum haplotypic diversity required in a ancestral population to achieve the genotypic diversity present in a population of genetically-related descendants.

3 — Algorithmic Issues with Generation of Parametric PET Images
Rosemary Renaut, Department of Mathematics and Statistics 87-1804, Arizona State University, Tempe, AZ, 85287 -180, United States, renaut@asu.edu, Hongbin Guo, Cristina Negoita

We discuss generation of parametric images from time series positron emission tomography images. Tracer flurodioxyglucose(FDG) is used for imaging metabolic process in the brain. Dynamics are described by a very simple compartmental model. Estimation of rate constants is a nontrivial inverse problem, because of limited information of input and noise contamination of output. For estimation we use novel preclustering, nonlinear constrained minimization, and anisotropic diffusion filtering.

■ TC07

Westin-Intl. G, 6th Floor

Environment/Natural Resources

Contributed Session

Chair: Robert Eynon, U.S. Department of Energy, 1000 Independence Ave SW, Washington, DC, United States, reynon@eia.doe.gov

1 — Groundwater Management under Random Contaminant Sources
Patrick Wang, Professor, University of Alabama, Dept of Mathematics, Tuscaloosa, AL, 35487, United States, pwang@ua.edu, Chunmiao Zheng

In this talk, we first characterize the random sources in groundwater transport. We then present a stochastic optimal control model that minimizes the total operation cost over a finite time horizon subject to maintaining the contaminant concentration at desired level. Approaches of finding the optimal solution will be discussed and some numerical results will be given.

2 — Trade, Technology, and Environmental Damage in U.S. Agriculture
Shunsuke Managi, Dr., South Carolina State University, P.O. Box 8040 SCSU, Orangeburg, SC, 29118, United States, smanagi@scsu.edu, David Karemera

Trade liberalization has the potential to contribute to overall improvements in environmental performance, while countries might lose a comparative advantage in trade because of stringent environmental regulations. We derive a theoretical framework to address this simultaneous issue. The results suggest that freer agricultural trade is bad for the environment.

3 — Function Approximation Optimization for Costly Nonlinear Models with Environmental Examples
Christine Shoemaker, Ripley Professor, Cornell University, 210 Hollister Hall, Ithaca, NY, 14853, United States, cas12@cornell.edu, Pradeep Mugunthan, Rommel Regis

The new algorithm for finding global optima is used with "costly" functions, i.e. those that require large CPU time for each function evaluation.. It is applied to test functions and to optimal calibration of a nonlinear transport model of enhanced bioremediation of chlorinated ethenes, where each function evaluation requires hours of CPU to solve a system of stiff partial differential equations. The new method outperforms other methods considered.

4 — Representing Standard Market Design in the National Energy Modeling System
Robert Eynon, U.S. Department of Energy, 1000 Independence Ave SW, Washington, DC, United States, reynon@eia.doe.gov

The proposed rulemaking by the Federal Energy Regulatory Commission concerning transmission access and pricing requires revisions to NEMS. This includes structural as well as data revisions. This paper will discuss data requirements and modeling enhancements needed to incorporate SMD.

■ TC08

Westin-Intl. H, 6th Floor

Simulation I

Contributed Session

Chair: Tony Wu, Princeton University, Dept of Operations Research, and Financial Engineering, Princeton, NJ, 08544, United States, twu@princeton.edu

1 — The Optimizing Simulator: An Illustration for the Military Airlift Problem
Tony Wu, Princeton University, Dept of Operations Research, and Financial Engineering, Princeton, NJ, 08544, United States, twu@princeton.edu, Warren Powell

We introduce the concept of an optimizing simulator in the context of the military airlift problem. We explicitly model four classes of information, creating a spectrum of simulation architectures with increasing levels of information. We show that as the information increases, the performance improves. The fourth information class allows an expert to guide the behavior of the simulation through low dimensional patterns. Computational results are presented.

2 — Reporting Significant Digits of Point Estimators for Random Experiments
Wheyming Song, Professor, Dep. of IEEM, Tsing Hua University, Kunag Fu Road, Hsinchu, Taiwan, wheyming@ie.nthu.edu.tw, Bruce Schmeiser

We are interested in simple useful methods of reporting significant digits of point estimators. Based on three criteria - loss of statistical information, number of characters required, and likelihood of user misinterpretation, we advocate our procedure for use when reporting many point estiamtros in tabular form. The procedure discards meaningless digits of the point estiamtors, and all but the leftmost non-zero digits of the standard error

3 — A Weighted Stochastic Mesh Method for Pricing High-Dimension American Options
Xiaoping Xiong, University of Maryland, College Park, 11212 Evans Trail, Apt 203, Beltsville, MD, 20705, United States, xxiong@rhsmith.umd.edu, Michael Fu

American-style options are challenging to price, especially for high-dimensional underlying securities. For options where there are a finite number of exercise dates, we present a weighted stochastic mesh method that only requires some easy-to-verify assumptions and a method to simulate the behavior of underlying securities. The estimators converge to the true values as the computational effort increases.

■ TC09

Westin-Vinings 1, 6th Floor

INFORMS High School OR: How to Teach HS Math Teachers

Sponsor: INFORMS Teachers Program: How to Teach the Teachers
Sponsored Session

Chair: Kenneth Chelst, Wayne State University, Detroit, MI, United States, chelst@mie.eng.wayne.edu

1 — INFORMS Teachers Program: How to Teach the Teachers
Kenneth Chelst, Wayne State University, Detroit, MI, United States, chelst@mie.eng .wayne.edu

As an operations researcher, you can make a major improvement in your community's math education by making a very small investment of your time. You can train dozens of local math teachers, who in turn will give hundreds, if not thousands, of high school students an appreciation of OR and real-life applications of mathematics. This session hosted by the INFORMS Public Awareness Committee (PAC) provides you with everything you need to "Teach the Teachers" at a local or state math teacher conference near your home. Members of the PAC team that developed the INFORMS materials at http://www.hsor.org will demonstrate how to conduct these workshops at the comprehensive briefing. As a session participant, you will receive the program materials, videos, software packages (with instructions), and Teacher Instructional Modules you need to deliver a program at a state, county, or school district conference

■ TC10

Westin-Vinings 2, 6th Floor

Optimization in Financial Services II

Sponsor: Financial Services
Sponsored Session

Chair: Suresh Nair, Professor and Ackerman Scholar, Department of Operations and Information Management, School of Business, Unit 1041, University of Connecticut, Storrs, CT, 06269, United States, suresh .nair@uconn.edu

1 — Optimal Retail-Deposit Sweeps and the Implications of Changes in Regulations
Richard Anderson, Vice President, Federal Reserve Bank of St. Louis, Research Division, 411 Locust Street, St. Louis, MO, 63102, United States, Richard.G .Anderson@stls.frb.org, Suresh Nair

We model the profit function for a bank that operates a retail sweep program and uses a minimum-maximum threshold approach. We determine optimal levels for these thresholds that would reduce reserves and satisfy Regulation D of the Federal Reserve. We also evaluate the effect that changes in regulations may have on retail bank sweep behavior, reserve balances with the Fed, and consequently its effect on the Fed's leverage in transmitting its monetary policy to the markets through retail banks.

2 — Managing Liquidity Risk at Merrill Lynch Bank
Russ Labe, Director, Merrill Lynch, Plainsboro, NJ, United States, RLabe@NA2.US.ML .com, Manos Hatzakis

Merrill Lynch has over $60 billion in money market deposits at its bank. A key concern of the bank is managing the liquidity risk or term structure of these deposits. We conducted a series of studies to evaluate client behavior during periods of stress in the equity markets, interest rates, and the economy. We developed a constrained regression model to help set daily interest rates on the deposits, and models to estimate future balances based on historical relationships.

3 — Optimal Management of Sweeps to Reduce Sterile Bank Reserves
Suresh Nair, Professor and Ackerman Scholar, Department of Operations and Information Management, School of Business, Unit 1041, University of Connecticut, Storrs, CT, 06269, United States, suresh.nair@uconn.edu

The Federal Reserve requires holding a 10% minimum reserve of banks' transaction account deposits. To lower these non-income producing reserves, banks sweep balances from transaction accounts to money market accounts. Federal Reserve's Regulation D limits such transfers to at most six per month. We develop a stochastic dynamic programming model for sweeps.

■ TC11

Westin-Augusta 1, 7th Floor

Tutorial: Technology of the Future of Health Care

Cluster: Tutorials
Invited Session

1 — Technology of the Future of Health Care
Myron Hatcher, Professor and Chair, Information Systems and Decision Sciences, Craig School of Business, California State University, Fresno, CA, 93740, United States, myronh@csufresno.edu

Technology advances have changed the face of health care. This paradigm shift blurred the boundaries between public health, acute care, and prevention. Technology's role in the diagnosis, treatment assignment, follow up and prevention will be reviewed and future impact projected. The shift in our expectation for each aspect of health care is the crucial requirement for success.

■ TC12

Westin-Augusta 2, 7th Floor

Business Process Reengineering

Contributed Session

Chair: Daniel Berg, Institute Professor, Rensselaer Polytechnic Institute/Decision Sciences and Engineering Systems, 5015 C.I.I., Troy, NY, 12180, United States, bergd@rpi.edu

1 — Workflow Management Using Modular Supervisory Control
Pranav Deshpande, University of South Florida, ENC 2400,, 4202, East Fowler Avenue, Tampa, Fl, 33620, United States, pranav@eng.usf.edu, Ali Yalcin, Atul Khemuka

In this work, the Supervisory Control theory proposed by Ramadge and Wonham is applied to workflow management systems. Tasks and the dependencies between the tasks of a workflow are represented by Finite Automata models. The resultant supervisory controller restricts the behavior of the system according to governing business policies.

2 — Modeling and Analysis of Workflows Using Finite Automata Theory
Atul Khemuka, University Of South Florida,, ENC 2400,, 4202, E.Fowler Avenue, Tampa, FL, 33620, United States, khemuka@eng.usf.edu, Ali Yalcin, Pranav Deshpande

Workflows represent a given process that is made up of well-defined collection of tasks. These tasks are executed based on some business rules or dependencies. In our work we present a technique based on finite automata, to provide a formal framework for modeling and analysis of workflows.

3 — Effectiveness of Internet-Based Streaming Media Training for Credit Unions
John W. Stamey, Jr, Instructor, Department of Computer Science, Coastal Carolina University, Conway, SC, 29582, United States, jwstamey@coastal.edu, Dan Santangelo

Training of credit union employees contributes to the quality service experienced by their members. A survey of credit unions in Summer 2003 established two results. First, a cost model for credit union training based on the size of the organization was established. Second, it was determined that training delivered by Internet-based streaming media had a definite cost advantage over live training, while providing equal or better delivery of information when compared to a live trainer.

4 — Exploratory Research On Streamlining Opportunities For Construction Permitting In Disaster Recovery
Daniel Berg, Institute Professor, Rensselaer Polytechnic Institute/Decision Sciences and Engineering Systems, 5015 C.I.I., Troy, NY, 12180, United States, bergd@rpi.edu, Norman G. Einspruch

An exploratory research program was undertaken under NSF sponsorship to identify opportunities to streamline the construction permitting and code enforcement processes. Data gathering was primarily conducted through structured interviews. Several conclusions were drawn concerning the potential for the institutionalization of Information Technology. It was found that established permitting processes did not take into account the need for legitimate waivers and shortcuts.

5 — Using The Value Chain To Facilitate Goal Orientation
Arzu Akcal, Quality Systems, Arcelik A.S., Head Office, Tuzla, Istanbul, 34950, Turkey, arzu.akcal@arcelik.com, Catherine Hajnal

Being efficient and effective are worthy goals for any organization. The challenge however is that being efficient may not be effective. This is the example of putting resources into a set of activities that do not bring value to the firm's customers. We posit that using a value-based approach to defining process goals can enhance a firm's ability to focus on efficiency while ensuring effectiveness in terms of bringing value to customers.

■ TC13

Westin-Augusta 3, 7th Floor

Marketing

Contributed Session

Chair: Thomas R. Sexton, Director, Harriman School/Stony Brook University, 306 Harriman Hall, Stony Brook, NY, 11794-3775, United States, Tsexton@notes.cc.sunysb.edu

1 — Market Power and Buyer Collusion in Posted-price Markets
Amy Kallianpur, University of Notre Dame, Department of Marketing, Mendoza College of Business, Notre Dame, IN, 46556, United States, amy.kallianpur.wp99@wharton .upenn.edu

We design posted-offer markets where sellers have market power and buyers are provided with opportunities to form buying consortia. In this setting, we assess how the basic performance properties of markets change in terms of parameters such as prices, profits, surpluses and efficiencies.

2 — Research on the Convergence of the New Generation Mobile Terminal using Conjoint Analysis
Daeyoung Koh, Seoul national university, 56-1, Shinlim 9 dong (san), Kwanak-gu, 38-415, Seoul National University, Seoul, 151-742, Korea Repof, koh123@snu.ac.kr, Jeong Dong Lee, Yoenbae Kim

Convergence of the new generation mobile terminals would be the key information for the success of the mobile industry. In this paper, we investigate the issue employing the conjoint analysis framework. Empirical estimation is performed with the rank-ordered logit based on the survey conducted in Seoul, Korea. Trade-offs between key attributes and willingness-to-pay information are presented, and implication for future evolution of mobile terminals is summarized.

3 — Optimal Sales Strategy for Durable Goods with Impatient Customers
Kunpeng Li, University of Illinois at Urbana Champaign, 350 wohlers hall,, 1206 S. sixth street, Champaign, IL, 61820, United States, kli@students.uiuc.edu, Dilip Chhajed

Product obsolescence gives the seller the opportunity to segment the market according to customer's impatience level and therefore apply different sales strategies. We use the self-selection analysis to explore how product obsolescence speed, customer valuation change and impatience level will influence the seller's profit and his optimal sales strategies.

4 — Optimal Pricing for a Multi-Generation Service
Richard Curry, London Business School, Regent's Park, London, NW1 4SA, United Kingdom, rcurry@london.edu

This paper develops a family of optimal pricing models for a multi-generation service. The one-period model indicates that the price for the second generation is higher than the expected monopoly price. The two-period extension produces an optimal price for the first-period that is lower than the one-period price. A continuous time extension generates a pricing policy that aggressively prices the first generation and adopts a "U" shaped policy for the second, with both below the optimal price.

5 — Modeling New Products: Customer Satisfaction, Word of Mouth and Market Shares
Thomas R. Sexton, Director, Harriman School/Stony Brook University, 306 Harriman Hall, Stony Brook, NY, 11794-3775, United States, Tsexton@notes.cc.sunysb.edu, Sanal Mazvancheryl

This paper presents a multi-equation multi-period difference equation model that describes the effects of marketing activities, customer satisfaction and word of mouth, both positive and negative, on the sales and market shares of a frequently purchased new product or service through the stages of its life cycle following its introduction. In addition, our paper also derives a closed form solution for the number of customers as well as market shares in steady state.

■ TC14

Westin-Peachtree A, 8th Floor

Management of Uncertainty in NPD

Cluster: New Product Development

Invited Session

Chair: Stylianos Kavadias, Georgia Institute of Technology, 755 Ferst Drive, Atlanta, GA, United States, stylianos .kavadias@mgt.gatech.edu

1 — Dynamic Management of NPD Portfolios
Pirooz Vakili, Boston University, Manufacturing Eng. Department, Boston, MA, United States, vakili@bu.edu, Leonardo Santiago

A model of an NPD portfolio with a multi-dimensional state space and several funding/resource allocation levels for each project is considered. The issues of project selection, incremental resource allocation, and risk management in an integrated setting will be discussed. Results related to the optimal management of the portfolio will be presented

2 — The Effect of Improving Data Quality upon Managing Product Development
Nitin Joglekar, Assistant Professor, Boston University, 595 Commonwealth Avenue, Boston, MA, United States, joglekar@bu.edu, Edward Anderson

We develop a control theoretic model to capture management decisions within distributed product development projects and allow for corruption in the progress status data either by mis-estimation or information systems errors. Our analysis yields a framework that illustrates the balance between data quality improvement costs/delays and ongoing product development costs.

3 — Managing Dynamically Project Portfolios
Stylianos Kavadias, Georgia Institute of Technology, 755 Ferst Drive, Atlanta, GA, United States, stylianos.kavadias@mgt.gatech.edu, Christoph Loch

We analyze how portfolio decisions and resource allocation are optimally done over time, when new product ideas get generated dynamically, and resources may or may not be available. We derive dynamic policies and discuss the implications.

4 — Efficiently Identifying Synergies in Project Portfolios
Jeffrey Keisler, Assistant Professor, University of Massachusetts Boston, M/5-230, 100 Morrissey Boulevard, Boston, MA, 02125, United States, Jeff.Keisler@umb.edu

Early stage R&D portfolios contain numerous assets low-EV assets whose effects, applications, interactions, and markets are unknown. Complete detailed decision analysis has prohibitive costs. Instead, several frugal analytic strategies are compared using simulated portfolios, e.g ., combining detailed local evaluations of individual project characteristics with a coarse representation of the entire portfolio.

5 — Product Portfolio and Resource Management in Delay Sensitive Markets
Ram Akella, Professor & Director Information Systems and Technology Management, Baskin School of Engineering 131, University of California, Silicon Valley Center/Santa Cruz, Santa Cruz, CA, 95064, United States, akella@acsu.buffalo.edu, Kristin Fridgeirsdottir

We construct optimal product portfolio and resource management models for a profit-maximizing facility that develops products where the profit generated by each product family decreases with increasing delay. The objective function has a particular non-concave structure that implies in our far-processing settings it is optimal to focus on one product family, while diversification results when there are priorities among the products. Next we simultaneously determine the optimal portfolio and the optimal resource levels.

■ TC15

Westin-Peachtree F, 8th Floor

Practical and Theoretical Insights on New Venture Formation

Sponsor: Technology Management
Sponsored Session

Chair: Maria Minniti, Associate Professor of Economics, Babson College, Forest Street, Babson Park, MA, 02457, United States, minniti@babson.edu

1 — Quantitative Process Model for a Technology Transfer Firm
Michael Dowell, 5iTech LLC, 1768 E. 25th Street, Cleveland, OH, 44114, United States, mbdowell@5itech.com, L.A. Polott

Flow diagrams for a firm that validates foreign technologies are presented. Technology is channeled to (a) industrial partners supporting its flow, (b) license to third parties, or (c) formation of U.S. firms, or is discarded. Issues such as outcome mix and funds flow can thus be modeled in a familiar and quantitative way.

2 — In Search of a Useful Theory of Entrepreneurship: Knightian Uncertainty and New Firm Formation
Atul Nerkar, Columbia University, 721 Uris Hall, 3022 Broadway, New York, NY, 10027, United States, aan19@columbia.edu

This paper explores explanations for the emergence of entrepreneurial firms based on a "knightian" notion of uncertainty. Such firms emerge at the nexus of environment, existing firms, individuals and opportunities. Based on this nexus, theoretical propositions that predict the likelihood of emergence of new firms are developed.

3 — Different Ways to Model Preferences: An Application to Entrepreneurship Experiments
Andreas Schroeder, research associate, Humboldt University, Berlin, Spandauerstr. 1, Berlin, D, 10178, Germany, aschroed@wiwi.hu-berlin.de, Christian Schade

Experimental research in entrepreneurship often requires a formal benchmark actual behavior may be compared with. A formal benchmark model requires integrating a preference calculus into an optimization approach that is consistent with rationality and at the same time simple enough to keep the model tractable. These requirements are met with mean-variance preferences under certain conditions. These conditions are analyzed via a check of consistency with the expected utility world.

4 — An Optimal Stopping Model for the Exploration and Exploitation of a New Venture Opportunity
Moren Levesque, Case Western Reserve University, 10900 Euclid Avenue, Cleveland, OH, 44106, United States, mxl101@cwru.edu

The decision of when to change focus from exploring the viability of a business opportunity to exploiting it impacts a new venture's profitability and survival. We propose the notion of an uncertainty threshold as the basis for a number of decision rules for deciding when to shift focus from exploration to exploitation.

■ TC16

Westin-Peachtree G, 9th Floor

Health Applications I

Contributed Session

Chair: Martha Centeno, Associate Professor, Florida International University, 10555 W. Flagler St, Miami, Fl, 33174, United States, centeno@fiu.edu

1 — A Queueing Network Model with Blocking: Analysis of Congested Patients Flows in Mental Health System
Naoru Koizumi, Post doctoral researcher, University of Pennsylvania, Department of Systems Engineering, 200 South 33rd Street, Philadelphia, PA, 19104, United States, koizumi@seas.upenn.edu, Eri Kuno

Congestion at various psychiatric facilities has been observed in the US since the downsizing of state mental hospitals started in 1992. There have been many occasions such that patients are spending extra days at unnecessarily high structured settings, because the beds that patients are referred to are full. The study applied an open queuing network model with blocking to analyze the congestion at various types of interrelated psychiatric facilities based on the experience of Philadelphia.

2 — Internal Investments and Competitive Bidding in a Health Care Setting
Ying Li, The University of Michigan Business School, 701 Tappan, Ann Arbor, MI, 48109, United States, yingl@bus.umich.edu, Sudheer Gupta, William Lovejoy

Hospitals make internal investments in their operations, which change their cost structure and hence their behavior when negotiating with HMO's. This paper looks at the revenue consequences of internal investments in a health care setting where two hospitals vie for the business of a monopoly HMO through competitive bidding.

3 — Modifying Input Parameters in Goal Driven Simulation (GDS) of ER systems
Martha Centeno, Associate Professor, Florida International University, 10555 W. Flagler St, Miami, Fl, 33174, United States, centeno@fiu.edu, Tuba Sevimoglu

GDS seeks to meet a user's predefined. The challenge has been what parameters to change and by how much to steer the results towards the goal. Although simulation models generate information for several measures of performance, GDS research has focused on only one measure of performance. We present a study of the response surface of ER systems which led to the definition of decision rules to automatically change input parameters and steer the model towards the user's goals.

4 — Breast Cancer Screening: Trade-offs in Planning and Service Provision
Evrim Gunes, INSEAD, Bvd de Constance, Fontainebleau, 77, France, evrim-didem .gunes@insead.edu, Stephen Chick

This work combines and extends previous work on breast cancer screening models by explicitly incorporating health care states, program outreach, and the screening volume-quality relationship in a service model context to examine the effect of public health policy and service capacity decisions on public health outcomes. Simulation experiments analyze the effectiveness of investing on several levers in different health care system contexts.

5 — Treatment Outcomes Predictor for Complementary and Alternative Medicine
Nina Meledandri, Physician, NCNM, Pettygrove, portland, OR, 97213, United States, jfr1@speakeasy.net, Micaela Carew, Janice Forrester

The Treatment Outcomes Predictor for Complementary and Alternative Medicine(TOPCAT)model is an analytical tool that will help determine if a patient is a likely candidate for effective alternative care or if western medical intervention is required. The TOPCAT model uses multi-criteria decision making techniques combined with logit regression.

■ TC17

Westin-Peachtree H, 9th Floor

Industry Applications

Contributed Session

Chair: Menkes van den Briel, Ph.D. Student, Arizona State University, 1207 East 8th Street, Tempe, AZ, 85281, United States, menkes@asu.edu

1 — Mathematical Programming Model for Electric Power Capacity Expansion
Takayuki Shiina, Central Research Institute of Electric Power Industry, 2-11-1 Iwado kita, Komae, Tokyo, To, 201-8511, Japan, shiina@criepi.denken.or.jp

This paper is concerned with power system expansion planning under uncertainty. In our approach, integer programming and stochastic programming provide a basic framework. We develop a multistage mathematical programming model in which some of the variables are restricted to integer values. The electric power capacity expansion problem is reformulated as a problem with first stage integer variables and continuous second stage variables. We propose an algorithm to solve the problem.

2 — Aluminum Casting Scheduling
Ekrem Duman, Wichita State University, Department of Industrial and Manufacturing Engineering, 1845 Fairmount, Wichita, KS, 67260-0035, United States, eduman@dogus.edu.tr, Mehmet Bayram Yildirim

The casting scheduling in an aluminum manufacturing facility is considered where the major concern is the existence of sequence dependent setup times. A three phase solution approach is proposed: First, the orders are assigned to casting lines while considering some production constraints. The sequencing of these orders is modeled and solved as a TSP. Finally, the resulting schedule is improved by exchanging orders between the lines.

3 — Optimal Drug Development Portfolio Selection for Biotech Company.
Vladimir Shnaydman, Biogen, 14 Cambridge Center, Cambridge, MA, 02142, United States, vladimir_shnaydman@biogen.com

Project portfolio selection is a part of portfolio management process. It is defined as periodic activity involved in selecting projects that meet an organization's objectives and business rules without exceeding available resources. Projects in the portfolio should be aligned with business goals and strategy, balance overall risks and rewards, and select optimum portfolio to maximize its value. Mixed integer programming model for drug development portfolio was developed and validated.

4 — Efficient Airplane Boarding Srategies
Menkes van den Briel, Ph.D. Student, Arizona State University, 1207 East 8th Street, Tempe, AZ, 85281, United States, menkes@asu.edu, Rene Villalobos, Gary Hogg

We present efficient airplane boarding strategies when boarding airplanes in different groups. A reduction in passenger boarding time can result in significant benefits for the airline industry; airlines can improve their turnaround time and increase airplane utilization. We provide a mathematical programming model and a simulation model for the airplane boarding problem suggesting that structured group boarding can result in boarding time reductions.

5 — Understanding and Predicting Vehicle Resale Values
Dan Zetu, Power Information Network, LLC, 5435 Corporate Dr., Suite 300, Troy, MI, 48098, United States, dan.zetu@jdpa.com, Jie Cheng, Sarah Zaka

An analytical approach, using structural equations, to improve the accuracy of vehicle resale value prediction as well as interpretability of causal relationships regarding the future resale value has been developed. The model examines a set of resale value drivers, reflecting product decisions, brand perception, product lifecycle and marketing decisions.

■ TC18

Westin-Tower 1201, 12th Floor

Technometrics Invited Paper Session

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: Bill Notz, Ohio State University, Dept. of Statistics, 1958 Neil Avenue, Columbus, OH, 43210-1247, United States, win@stat.ohio-state.edu

1 — Design of EWMA Control Charts for Autocorrelated Processes with Model Uncertainty
Daniel Apley, Assistant Professor, Texas A&M University, Dept. of Industrial Engineering, College Station, TX, 77843-3131, United States, apley@tamu.edu

Residual-based control charts for SPC of autocorrelated processes are based on an estimated time series model, and model estimation errors often cause the actual in-control ARL to differ substantially from the desired value. We develop a method for designing residual-based EWMA charts under consideration of the uncertainty in the estimated model parameters. The resulting EWMA control limits are widened by an amount that depends on a number of factors, including the level of model uncertainty.

2 — Adaptive Forecast-Based Monitoring for Dynamic Systems
Harriet Nembhard, University of Wisconsin-Madison, 1513 University Ave, Madison, WI, 53562, United States, hbnem@engr.wisc.edu

This talk presents an adaptive forecast-based monitoring approach that performs well on dynamic systems. We examine two competing procedures - the adaptive time-series model and the adaptive EWMA. We use a plastic extrusion process with first-order dynamics to illustrate the application of these two procedures. The performance of the two procedures is also evaluated via simulation.

3 — Diagnosability Study of Multistage Manufacturing Processes Based on Linear Mixed-Effects Models
Yu Ding, Assistant Professor, Texas A&M University, Dept. of Industrial Engineering, 3131 TAMU, College Station, TX, 77843, United States, yuding@iemail.tamu.edu, Shiyu Zhou, Yong Chen, Jianjun (Jan) Shi

We discuss the diagnosability of the process faults in a multistage manufacturing process using a linear mixed-effect model. The concept of a minimal diagnosable class is proposed to expose the "aliasing" structure among process faults in a partially diagnosable system. The algorithms and procedures necessary to obtain the minimal diagnosable class and to evaluate the system-level diagnosability are presented and illustrated using a panel assembly process and an engine-head machining process.

■ TC19

Westin-Tower 1202, 12th Floor

Statistics in Logistics and Supply Chain Management

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: Jye-Chyi Lu, Professor, Georgia Institute of Technology, Groseclose Building, Room 335, 765 Ferst Drive, Atlanta, GA, 30332, United States, JCLU@isye.gatech.edu

1 — Supply-Chain Contract Decisions Involving Logistics Uncertainties
Hyoungtae Kim, Ph.D Candidate, Georgia Institute of Technology, 2500 Shallowford Rd 4314, Atlanta, GA, 30345, United States, htkim@isye.gatech.edu, Jye-Chyi Lu

Our research outlines the process of deciding the contracts of price, quantity and logistics-service level among three supply chain partners under the uncertainty in the number of products successfully reached the warehouse or the retailer. Probability models based on a series of convolution of mixture distributions characterize the service quality in regular and contingent situations (e .g., 911, West Coast's labor dispute, severe weather).

2 — Approximation-Based Logistics Network Design Considering Security
Sashidhar Dandamudi, Ph.D. Student, Georgia Institute of Technology, The School of Industrial and Systems Eng, Campus Box 0205, Atlanta, GA, 30332-0205, United States, sashi@isye.gatech.edu, Jye-Chyi Lu

We present continuum approximation based models to analyze realistic logistics systems under increased security considerations under which they have to operate. We show how these models provide the designer critical insights leading to robust design and control policies.

3 — Quality Investment and Collaboration in a Supply Chain
Anson Kwok, Hong Kong University of Science and Technology, Hong Kong, kwoktl@ust .hk, Kaijie Zhu, Fugee Tsung

In this study, we have considered the role of quality management within a supply chain. Through a series of analyses, we have examined how the quality of the buyer and supplier are affected by different circumstances. Most importantly, we have justified how both buyer and supplier can benefit from proper quality investment and possible collaboration. This result can help to quantify the advantage of current practices of investing in supplier quality improvement.

■ TC20

Westin-Tower 1203, 12th Floor

Agent-Based Modeling Applications

Sponsor: Artificial Intelligence
Sponsored Session

Chair: Charles Macal, Director, Center for Complex Adaptive Systems, Argonne National Laboratory, 9700 S. Cass Ave, Decision & Information Sciences Division, Argonne, IL, 60439, United States, macal@anl.gov

1 — Information Sharing in Supply Networks
Yifeng Zhang, Information & Decision Sciences, College of Business Administration, University of Illinois at Chicago, 601 S. Morgan Street (MC 291), Chicago, IL, 60607, United States, yzhang14@uic.edu, Sidh Bhattacharyya

Most studies on supply chains employ linear or divergent structures. With technology advancements and the emergence of B2B exchanges, supply chains are evolving into supply networks. This study investigates information sharing in supply networks using agent-based models. Relationship of various factors, including lead-time and capacity, on information sharing are also examined.

2 — Modeling Supply Chains as Networks of Social Agents
Charles Macal, Director, Center for Complex Adaptive Systems, Argonne National Laboratory, 9700 S. Cass Ave, Decision & Information Sciences Division, Argonne, IL, 60439, United States, macal@anl.gov, Michael North

Supply chains are systems that touch all aspects of production, distribution, and retailing of goods and services, linking suppliers to manufacturers, to distributors, to wholesalers, to retailers, and finally to consumers. Supply chains can be thought of as collections of autonomous, interacting decision-making units (agents), such as organizations, business units, and individual decision makers. When supply chain agents have access to only locally available information (for example, their own inventory and outstanding orders) and information visibility is minimal, supply chains may operate far from a cost-minimizing state. Attempts to control system behavior by agents who use only locally optimizing decision rules may be highly ineffective. The current computational study provides a method for quantifying the value of information from the agent perspective and from the systemic perspective. The simulation is used to study the effects of alternative agent decision rules and business processes on the supply chain, investigate the effects of agent behavior on supply chain dynamics, and measure the robustness of system performance.

3 — Agent-Based Modeling of Terrorist Social Networks
Michael North, Deputy Director, DIS-CCASS, Argonne National Laboratory, 9700 S. Cass Ave., Argonne, IL, 60439, United States, north@anl.gov, Charles Macal

Terrorism is a complex phenomenon. Typically, little is known about terrorist groups until they strike. This naturally leads to the question can the structure of terrorist groups be inferred from very small amounts of data? Furthermore, can the collection of intelligence data be steered to minimize dependencies on chance encounters? A carefully considered agent-based model of terrorist group may provide solid answers. The NetBreaker conceptual prototype is just such a model. NetBreaker is based on the fact that terrorist groups are first and foremost social networks. These social networks include the terrorists themselves along with uninvolved bystanders, and counter forces. Each of these groups is represented as a set of individual agents with rules or behavioral repertoires. The agent rules include things like movement, an ability to gather resources, and personal traits such as group membership. Given these rules, terrorist networks form according to rules that can be computationally modeled. NetBreaker uses agent-based social modeling to find all feasible terrorist networks bounded by (1) known rules of social network formation, (2) a given list of participants, along with possible unknown players, and (3) existing evidence documenting interactions between the participants, along with possible unobserved, but hypothesized, interactions. The result is a "space" of all feasible terrorist networks that contains the actual network being investigated. This space can be used to create actionable questions that reduce the possibilities for the actual network.

4 — CASCADE-CD: A Complex Adaptive Systems View of the South American Cocaine Trade
John Christiansen, Advanced Simulation Technology Center, Argonne National Laboratory, Decision & Information Sciences Division, Bldg. 900, Argonne, IL, 60439, United States, jhc.anl.gov

CASCADE-CD is a new agent-based complex adaptive system (CAS) simulation software framework developed at Argonne National Laboratory. The problem domain addressed by the framework is the South American cocaine trade, and the ongoing multinational efforts to disrupt it. CASCADE-CD development was sponsored by the J-8 Directorate of the Joint Chiefs of Staff (JCS/J-8). Its principal intended role is to aid drug interdiction analysts in deriving and justifying force structure and operational planning recommendations for combating the cocaine trade. Another major role for the CASCADE-CD effort has been as a proof-of-principle test for the use of CAS techniques in other highly complex multidisciplinary Defense applications. CASCADE-CD is an object-based software system constructed using Argonne's proven DIAS and GeoViewer object-based frameworks. CASCADE-CD simulations concurrently address such diverse dynamic processes as socioeconomics, diplomacy, psychology, sensor and platform performance, and environmental effects. Adaptive software agents are used to represent the relevant organizations and their components, ranging in scale from theater-wide interdiction coordinator organizations down to individual smuggler and interdictor vehicle crews. The cocaine trade is modeled as an ecology of diverse enterprises, each with its own set of goals, capabilities, resources, and perceptions. Proactively adaptive behaviors of both interdictor and drug trafficker agents are modeled in CASCADE-CD with the aid of genetic algorithms that continuously evolve better operational plans and tactics in response to their agents' perceptions of the shifting situation. CASCADE-CD was delivered to the Joint Staff in 2002. The success of CASCADE-CD has led JCS/J-8 to sponsor a follow-on project for Argonne, to construct a complex adaptive system simulation system to help design the U.S. military of the future, by providing support for analysis of Joint Operational Concepts and Architectures, including Precision Engagement and Dominant Maneuver.

■ TC21

Westin-Tower 1204, 12th Floor

Optimization Modeling in Practice III

Sponsor: Computing
Sponsored Session

Chair: Bjarni Kristjansson, President, Maximal Software Inc., 2111 Wilson Boulevard, Suite 700, Arlington, VA, 22201, United States, bjarni@maximalsoftware.com

1 — Using Modeling and Optimization to Achieve Better Supply Chain Planning
Gene Ramsay, Profit Point, Inc., Atlanta, United States, gene@profitpt.com

This talk will look at solving supply chain network design problems, both from a business perspective (e.g. how do we go from the available accounting data to the required cost coefficients?) and an optimization perspective (how do we ensure that we get efficient product solutions?)

2 — A Graphical Modeling Language for Stochastic Optimization
Leonardo B. Lopes, Northwestern University, Evanston, IL, 60208-3119, United States, leo@iems.nwu.edu, Robert Fourer

We describe a graphical modeling language, based on the Unified Modeling Language standard, that we have created to support the analysis, elicitation, and communication of stochastic optimization models. The language covers both the dynamic and the algebraic aspects of the models, supports an object-oriented approach to the modeling process, and is specifically designed to encourage better communication between analysts and decision-makers.

3 — Developing Optimization Algorithms using Mosel
Alkis Vazacopoulos, Dash Optimization, 560 Sylvan Avenue, Englewood Cliffs, NJ, 07632, United States, av@dashoptimization.com

We will demonstrate Mosel examples showing how optimization algorithms can be implemented using a combination of the Mosel language and the Mosel callable libraries. The first example implements a branch and cut method, in which the cuts are generated in a callback function defined in the Mosel language, with reference to the algebraic objects defined in the model. The second example implements a column generation algorithm to solve an optimization problem.

■ TC22

Westin-Tower 1205, 12th Floor

Operations Management VI

Contributed Session

Chair: Adrian Choo, Assistant Professor, Rensselaer Polytechnic Institute, 110 8th Street, Pittsburgh Building, Troy, NY, 12065, United States, chooa@rpi.edu

1 — Marketing and Collection Strategies for Remanufacturable Products under Competition
Seviye Yoruk, Graduate Assistant, University of Florida, 303 Weil Hall, PO Box 116595, Gainesville, FL, 32611, United States, yoruks@notes.cba.ufl.edu, Elif Akcali

Companies adopt different collection and marketing strategies for their remanufacturable products. In this paper, using a two-period model, we study the strategic implications of collection and marketing policies in remanufacturing and highlight their impact on system profits. Our objective is to provide a better understanding of the marketing and collection strategies that should be adopted for remanufacturable products in monopolistic and competitive environments.

2 — Knowledge Creation using a Structured Improvement Approach
Adrian Choo, Assistant Professor, Rensselaer Polytechnic Institute, 110 8th Street, Pittsburgh Building, Troy, NY, 12065, United States, chooa@rpi.edu

A Structured Improvement Approach is a formal methodology institutionalized in an organization for problem-solving activities. This research studies Six Sigma as an example of such an approach. First, we develop two contrasting perspectives of knowledge creation—each relies on a different assumption—and next, we propose and investigate an integrated framework. Results support two knowledge sources that are distinct from each other.

3 — Alternative Approaches to Cellular Manufacturing Systems Design
Rohit Bhatnagar, Associate Professor, Nanyang Technological University/Singapore MIT Alliance, Nanyang Avenue, Singapore-MIT Alliance, 4 Engg. Drive 3, Singapore, Si, 639798, Singapore, arbhatnagar@ntu.edu.sg, Venkatramanaiah Saddikutti

In this research we have compared two alternative approaches for design of cellular manufacturing systems encompassing cell formation and allocation of parts and operators to these cells. Using a variety of machine similarity coefficients (part and operator based) we tested 44 existing problem sets from literature. Our

results indicate that the proposed concurrent approach is superior, outperforming the traditional sequential approach in 66% cases.

4 — Joint Replenishment with Minimum Order Quanitities
Rommert Dekker, Prof, Erasmus University Rotterdam, Burg Oudlaan 50, Rotterdam, ZH, 3062PA, Netherlands, rdekker@few.eur.nl, Eric Porrasmusalem

In the traditional Joint Replenishment Problem in inventory control, the replenishment cost consists of two parts: a common set-up and an item specific part. In this paper we consider a real case where the item specific set-up costs were replaced by minimum order quantities. We present new algorithms to determine the optimal cyclic policy for two cases, viz. with and without compensation for empty replenishments. The cases appear to be quite different.

5 — Robust Demand Estimation in Supply Chains
Avi Giloni, Assistant Professor, Sy Syms School of Business, Yeshiva University, 500 West 185th Street, BH-428, New York, NY 10033, United States, agiloni@ymail.yu.edu, Bhaskar Sengupta, Jeffrey S. Simonoff

Consider a supply chain where the retailer serves an AR(1) demand. The retailer places orders with a manufacturer using a periodic review order-up-to policy, but the retailer might choose not to share information about the actual realizations of demand with the manufacturer. It has been previously shown that the parameters of the demand process are directly related to those of the order process, and therefore, it is possible to estimate the parameters of the demand process from historical order data. Autoregressive least squares methods could be used for this task, but since they are sensitive to unusual values, one aberrant value of demand can deleteriously affect the estimated coefficients for the demand process. We provide an easily implementable but effective robust estimation scheme that allows the manufacturer to immediately highlight an unusual order from the retailer, and would result in forecasts that "settle down" much more quickly than would ones based on least squares.

■ TC23

Westin-Tower 1206, 12th Floor

Joint Session DA/MAS: Military Decision Analysis

Sponsors: Decision Analysis, Military Applications
Sponsored Session

Chair: Gregory Parnell, Professor of Systems Engineering, US Military Academy, Department of Systems Engineering, West Point, NY, 10996, United States, gregory.parnell@usma.edu

1 — Program Objectives Memorandum (POM): Alternative Decision Analytic Approaches
Terry Bresnick, President, Innovative Decisions Inc., 3011 Weber Place, Oakton, VA, 22124, United States, bresnick@ix.netcom.com

While virtually all agencies in DoD & Intelligence Community (IC)must prioritize programs, there is little consistency in approach. We review 3 DA implementations: (1)USMC POM, (single benefit, balance beam approach to produce an order-of-buy);(2)an IC agency IPOM (MAU framework of problems and information needs);(3)DoD and IC application (incremental B/C analysis,Pareto-optimal frontier). We discuss advantages/disadvantages & social aspects of implementing into organizational cultures.

2 — Modeling Homeland Security: A Capabilities Based Approach
Kristopher Pruitt, Operations Research Analyst, Air Force Logistics Management Agency, Logistics Analysis Division, 501 Ward Street, Maxwell AFB — Gunter Annex, AL, 36114-3236, United States, kristopher.pruitt@maxwell.af.mil, Dick Deckro, Stephen Chambal

This study develops a first cut decision analysis methodology for identifying and structuring key homeland security objectives and facilitates the measurement of the United States' capability to execute these objectives. Three hierarchies are developed that capture the impact on security, resources, and civil liberties

3 — The Hybrid Value-Utility Model
William Klimack, Director, ORCEN, USMA, Department of Systems Engineering, United States Military Academy, West Point, NY, 10996, United States, William.Klimack@usma .edu

One interpretation of utility theory is that value functions are appropriate under certainty and utility functions are appropriate under uncertainty or risk. The latter measures strength of preference and risk attitudes of the decision maker. Access to decision makers may be limited. By eliciting a value model from subject matter experts, a hybrid value-utility may be developed model that sufficiently approximates the true utility model and requires greatly reduced decision maker contact.

4 — The Value of Intelligence
Gregory Parnell, Professor of Systems Engineering, US Military Academy, Department of Systems Engineering, West Point, NY, 10996, United States, gregory.parnell@usma .edu, Dick Deckro

The events of September 11, 2001 highlighted the value of intelligence to our national leadership, the intelligence community, defense planners, and the American public. Quantifying the value of intelligence is one of the unsolved problems of intelligence analysis. This paper examines decision analysis approaches to the value of intelligence information.

■ TC24

Westin-Tower 1207, 12th Floor

Information Integrity: An Emerging Field

Sponsor: Information Systems
Sponsored Session

Chair: Elie Geisler, Professor, Illinois Institute of Technology, 565 W. Adams Street, Stuart Graduate School of Business, Chicago, IL, 60661, United States, geisler@stuart.iit.edu

1 — The Information Integrity Imperative
Madhavan Nayar, Company Leader, Unitech Systems Inc., Naperville, IL, United States, mnayar@informationintegrity.org

This paper examines the emerging field of information integrity (I*I). It reviews the economic and social impacts of lack of integrity, and the growing peril that such errors pose to companies, the economy,and society. The paper also advances the case for a new field of inquiry in information integrity.

2 — A Business Process Perspective of Trust
Paul Prabhaker, Associate Professor, Stuart Graduate School of Business, Illinois Institute of Technology, 565 W. Adams Street, Chicago, IL, 60661, United States, prabhaker@stuart.iit.edu

This paper examines the role that trust plays in the integrity of information. Trust is a crucial component of social and business relationships and commercial activities. This paper attempts to establish a relationship between trust and information integrity, which is the dependability of information. The paper shows that information integrity can be successfully used as a builsing block of trust in the information driven economy.

3 — Metrics of Information Integrity
Elie Geisler, Professor, Illinois Institute of Technology, 565 W. Adams Street, Stuart Graduate School of Business, Chicago, IL, 60661, United States, geisler@stuart.iit.edu, Salimol Thomas, Paul Prabhaker

How can we measure the effects of integrity or lack of it on business processes? This paper suggests a model of a stage perspective in which the integrity of information is measured as the information is absorbed and used by organizational members and by organizational functions. The paper offers a toolkit of relevant metrics to assess the impacts of the lack of integrity in information. Issues in the construction of indexes of information integrity are also discussed.

4 — Information Integrity and the Case of the SARS Epidemic
Darcy Lewis, Stuart Graduate School of Business, Illinois Institute of Technology, Chicago, IL, United States, darcy@stuart.iit.edu, Elie Geisler

This paper describes the impacts of the SARS (Severe Accute Respiratory Syndrom) epidemic on the city of Toronto, Canada. The case unfolds as a case of information integrity in which information from the People's Republic of China was received by the World Health Organization (WHO) which then issued travel advisory to Toronto. The paper provides an illustration of the crucial role of information integrity.

■ TC25

Westin-Tower 1208, 12th Floor

Military Applications II

Contributed Session

Chair: Eva Regnier, Assistant Professor, Naval Postgraduate School, Defense Resources Management Institute, 1522 Cunningham Road, Monterey, CA, 93943-5201, United States, eregnier@nps.navy.mil

1 — Superlative TINs are Superfluous for Line of Sight
Robert G. Chamberlain, Principal, Jet Propulsion Laboratory, 4800 Oak Grove Dr T1089B, Pasadena, CA, 91109-8099, United States, rgc@jpl.nasa.gov, Eric A. Tailor, Joseph E. Gonzalez, Gary M. Gutt

This paper describes both a new process for constructing "superlative" TINs and a new quadtree approach to line-of-sight assessment and data compression that uses SRTM data directly and efficiently — thereby making superlative TINs superfluous!

2 — Optimal Estimation of Theater Ballistic Missile Parameters
Jay-wan Kim, Graduate student, Clemson University, Department of Industrial Engineering, Clemson, SC, 29634, United States, kjaywan@clemson.edu, Sangmun Shin, Madhumohan S. Govindaluri

Theater ballistic missile (TBM) detection by two-dimensional radar, is creates relatively ineffective as compared to three-dimensional radar. However some measurement outputs can be very important to the initial stage of the navy theater missile defense. The main purpose of this research is the optimization of TBM

parameter estimation using two-dimensional radar measurement outputs and the Kalman filter technique. The formulation for the estimation of TBM parameters are presented.

3 — Statistical Methods for Learning Curves and Cost Analysis
Matthew Goldberg, Research Team Leader, CNA Corporation, 4825 Mark Center Drive, Alexandria, VA, 22311-1850, United States, goldberg.matt@verizon.net, Anduin Touw

Explores statistical methods used in calibrating the two most important models in military and industrial cost analysis: the learning curve and the cost-estimating relationship. The former pertains to the marginal cost of successive units in a production sequence. The latter compares several production sequences, to explain cost differences in term of differences in system characteristics. Goldberg and Touw's monograph was recently published in the INFORMS Topics in Operations Research series.

4 — Uncertainty Resolution in Hurricane Forecasting
Eva Regnier, Assistant Professor, Naval Postgraduate School, Defense Resources Management Institute, 1522 Cunningham Road, Monterey, CA, 93943-5201, United States, eregnier@nps.navy.mil

Storm evacuation decisions are usually framed as Go-No Go, based on storm track and instantaneous probability-of-strike forecasts. The value of waiting for more information is neglected. Meteorologists qualitatively assess the information they anticipate before the next forecast, which could be used to reduce unnecessary evacuations. We develop an empirical typhoon model, an uncertainty resolution measure, and an optimal evacuation policy as a function of cost:loss ratio for the North Pacific.

■ TC26

Westin-Tower 1401, 14th Floor

Modeling and Applications in Data Mining

Cluster: Data Mining and Knowledge Discovery
Invited Session

Chair: Seoung Bum Kim, Georgia Institute of Technology, 417 Groseclose Building, Atlanta, GA, United States, sbkim@isye.gatech.edu

1 — A Frontier-Based Tree Pruning Algorithm and Automatic Identification of Inadmissibility
Shuchun Wang, Student, Georgia Tech, 324719 Gatech Station, Atlanta, GA, 30332, United States, swang1@isye.gatech.edu, Xiaoming Huo, Kwok Tsui, Seoung Bum Kim

A frontier-based tree pruning algorithm is proposed, which is computationally comparable with existing algorithms and provides a full spectrum of information: given the penalty parameter, it provides the best tree; given a tree size, it provides the range of the penalty parameter, within which the tree pruning procedure will render a tree of given size; it tells inadmissible tree sizes. Simulations illustrate the usefulness of this method, and reveal that most tree sizes are inadmissible.

2 — Network Intrusion Detection with Data Mining
Yongro Park, Atlanta, GA, 30318, United States, yongpark@isye.gatech.edu

Intrusion Detection System(IDS) attempts to detect an intruder breaking into your information system or a legitimate user misusing system resources. And Data Mining is finding a valuable knowledge from enormous data. In this study, we summarize the data mining approaches to build an IDS and investigate the chance of applying statistical data mining techniques to build an efficient IDS.

3 — A Study of Cross-Validation in Tree-Based Classification
Seoung Bum Kim, Georgia Institute of Technology, 417 Groseclose Building, Atlanta, GA, United States, sbkim@isye.gatech.edu, Kwok-Leung Tsui, Xiaoming Huo

The most widely used method for evaluating a model is cross-validation (C.V.). In this paper, we propose new criteria to evaluate the performance of using C.V. in a tree-based model. We define an oracle classifier which works statistically optimal and a tree-based cross-validatory classifier generated from a tree-based model. We present the classification performance of using C.V. by showing the statistical relationship with an an oracle classifier.

■ TC27

Westin-Tower 1402, 14th Floor

Solving Hard Integer Programs

Sponsor: Optimization/Integer Programming
Sponsored Session

Chair: Eva Lee, Assistant Professor, Georgia Institute of Technology, School of Industrial and, Systems Engineering, Atlanta, GA, 30332-0205, United States, eva.lee@isye.gatech.edu

1 — Mixed Integer Programming with Variable Upper Bounds
Diego Klabjan, Assistant Professor, University of Illinois at Urbana-Champaign, 1206 West Green Street, Urbana, IL, United States, klabjan@uiuc.edu, Sergei Chebalov

A single mixed integer programming constraint with variable upper bounds often occurs in many applications. We present a study of the underlying polyhedron. We obtain valid inequalities and we strengthen them by lifting. Several properties of the lifting function are given.

2 — Implementing Gomory's Cutting Plane Algorithm in Exact Arithmetic
Kris Farwell, Rensselaer (RPI), Math Sciences, Troy, NY, 12180, United States, farwek@rpi.edu, John Mitchell

Gomory's cutting plane algorithm solves integer programming problems by adding constraints constructed from rows of the simplex tableau. When the algorithm is implemented in floating point arithmetic, numerical inaccuracies in the tableau may lead to the addition of invalid constraints. We show that this difficulty can be avoided by implementing the algorithm in exact arithmetic, at some computational cost. We also consider combining floating point and exact arithmetic implementations.

3 — Generating Cutting Planes Using Master Cyclic Group Polyehdra
Lisa Evans Miller, Assistant Professor, University of Minnesota, Department of Mechanical Engineering, 111 Church St. SE, Minneapolis, MN, 55455-0111, United States, lmiller@me.umn.edu, Ellis Johnson

We will review the master cyclic group polyhedron, and discuss how its facets can be used to generate cutting planes for general integer programming problems. Some practical implementation issues will be discussed, and computational results will be given.

4 — On Solving Random Multiple Knapsack Problems
Kevin Hooker, Kansas State University, 237 Durland Hall, Manhattan, 66506, United States, kjh9898@ksu.edu, Todd Easton

A method to solve random multiple knapsack problems (maximize c^t x subject to Ax<=b, x in {0,1}) is presented. These small problems (less than 500 variables and 30 constraints) have proven particularly intractible. A problem partitioning algorithm is presented that solves some previously unsolved instances from J.E. Beasley's OR Library website. The effectiveness of cutting planes is also explored. The partitioning method is extended to produce both quality bounds and quality solutions.

■ TC28

Westin-Tower 1403, 14th Floor

Global Optimization — Generalized Convexity

Sponsor: Optimization/Global Optimization
Sponsored Session

Chair: Siegfried Schaible, Professor, University of California, Riverside, Anderson Graduate School of Management, Riverside, CA, 92521, United States, siegfried.schaible@ucr.edu

1 — A Recent Survey in Symmetric Duality for Nonlinear Fractional Programming
Do Sang Kim, Dr., Pukyong National University, Department of Applied Mathematics, Pusan 608-737, Korea Repof, dskim@pknu.ac.kr

We review recent developments in symmetric duality for nonlinear fractional programming. We consider single-objective and multi-objective nonlinear fractional programs. In addition we focus on single-objective and multi-objective variational problems as the dynamic case and present new results.

2 — Convex Extensions and Convexification of Nonlinear Functions
Mohit Tawarmalani, Professor, Purdue University, Krannert Graduate School of Management, 403 W. State Street, W. Lafayette, IN, 47907, United States, mtawarma@mgmt.purdue.edu

We use the theory of convex extensions to construct convex envelopes of many nonlinear functions. In particular, we construct novel relaxation schemes for fractional terms and for polynomial terms over a general hypercube and compare them with the relaxations currently used in the literature.

3 — Optimality and Duality for Invex Nonsmooth Multiobjective Programming Problems
Siegfried Schaible, Professor, University of California, Riverside, Anderson Graduate School of Management, Riverside, CA, 92521, United States, siegfried .schaible@ucr.edu, Do Sang Kim

We consider nonsmooth multiobjective programming problems with inequality and equality constraints involving locally Lipschitz functions. We present various optimality theorems under (generalized) invexity and certain regularity conditions. Then we introduce Wolfe type and Mond-Weir type dual problems and establish duality relations under (generalized) invexity and some regularity conditions.

4 — Multiobjective Fractional Programming with a Modified Objective Function
Do Sang Kim, Dr., Pukyong National University, Department of Applied Mathematics, Pusan 608-737, Korea Repof, dskim@pknu.ac.kr, Heung Sik Jeung

We consider multiobjective fractional programming problems with generalized invexity. An equivalent multiobjective programming problem is formulated by using a modification of the objective function due to Antczak. We give relations between the (weakly) Pareto-optimal solutions for our equivalent problems and present modified vector saddle point theorems.

■ TC29

Westin-Tower 1404, 14th Floor

Networks & Graphs II

Contributed Session

Chair: Phongchai Jittamai, Texas A&M University, Department of Industrial Engineering, College Station, TX, 77843-3131, United States, phongchai@tamu.edu

1 — Heuristic Methods for Delay Constrained Least Cost Routing Problem Using k-Shortest-Path Algorithms
Zhanfeng Jia, PhD Candidate, University of California, Berkeley, 307 Cory Hall, Berkeley, CA, 94720, United States, jia@eecs.berkeley.edu, Pravin Varaiya

The Delay Constrained Least Cost problem is motivated by QoS routing problem, while it has various applications on decision-making problems. Many algorithms have been proposed towards the DCLC problem, which is NP-complete, in a practically efficient way. None of them achieves the optimum. This paper presents two new methods based on k-Shortest-Path algorithms. These heuristic methods are both polynomial. Numerical experiments show their unique feature: they almost always find the optimal paths.

2 — Multicommodity Oil Pipeline Problem with Delivery Time Windows
Phongchai Jittamai, Texas A&M University, Department of Industrial Engineering, College Station, TX, 77843-3131, United States, phongchai@tamu.edu, Alberto Garcia-Diaz

We consider the sequencing of multiple oil products to be sent along a pipeline, assuming a single supply source and various delivery points. Products travel in the form of batches and delivery time window are imposed. Our objective is to find a feasible product sequence that minimizes the total time deviation from the delivery time windows. The problem is formulated and modeled as a multicommodity network with time constraints. We propose a modified DP approach to solve the problem.

3 — A Tabu Search Algorithm for the Steiner Tree Problem
Girish Kulkarni, NC State University, Operations Research Program, 207 Daniels, NC State University, Raleigh, NC, 27695, United States, gkulkar@unity.ncsu.edu, Yahya Fathi

The Steiner Tree problem in graphs is an NP-hard problem having applications in many areas including telecommunication, distribution and transportation systems. We propose a Tabu search algorithm for this problem using a neighborhood structure that is based on the concept of key-paths. We discuss the advantages of using this neighborhood structure, and through a computational experiment demonstrate the effectiveness of the resulting Tabu search algorithm.

■ TC30

Westin-Tower 1405, 14th Floor

Nonlinear Programming

Contributed Session

Chair: Vinayak Shanbhag, Dept of Mgmt. Science and Engg, Stanford University, Stanford, CA, 94305, United States, udaybag@stanford.edu

1 — Factoring as Nonlinear Optimization
Laleh Behjat, Assistant Professor, Univesity of Calgary, ECE Department, 2500 University Dr. NW, Calgary, AB, T2N 1N4, Canada, laleh@enel.ucalgary.ca, Gabriel Schulhof, Vassil Dimitrov, Konrad Walus

In this paper, a new method to factorize large integers is considered. The problem is formulated as a nonlinear optimization problem. The new technique solves the problem by finding a good local minimum instead of searching for a global solution. It requires fairly small computational resources and It can be combined with other optimization methods without any additional efforts. Our results show that the new technique works very well and offers a promising alternative to the existing methods.

2 — Recent Advances on Natural Gas Pipeline Optimization
Roger Rios, Assistant Professor, Universidad Autonoma de Nuevo Leon, Systems Engineering Program, AP 111-F, Cd. Universitaria, San Nicolas, NL, 66450, Mexico, roger@yalma.fime.uanl.mx

First, the problem of minimizing fuel consumption in natural gas pipeline networks is presented. After describing its modeling assumptions and mathematical framework, a description of the main theoretical properties and a classification of network topologies is made. Finally, the most relevant work on models and algorithms, including current and most promising research trends, is highlighted.

3 — A Geometric Programming Approach for Bivariate Cubic L1 Splines
Yong Wang, Ph. D candidate, North Carolina State University, Department of Industrial Engineering,, NCSU, Campus Box 7906, Raleigh, NC, 27695-7906, United States, ywang16@eos.ncsu.edu, John Lavery, Shu-Cherng Fang

Bivariate cubic L1 splines provide C1-smooth, shape-preserving interpolation of arbitrary data. The minimization principle for bivariate cubic L1 splines results in a nondifferentiable convex optimization problem. This problem is reformulated as a generalized geometric programming problem. A geometric dual with a linear objective function and convex cubic constraints is derived. A linear system for dual to primal conversion is established. The results of computational experiments are presented.

4 — A Decomposition-Based Path-Following Method for Two-Stage Stochastic Semidefinite Programs
M. Gokhan Ozevin, Northwestern University, IE/MS Department, Tech C217, 2145 Sheridan Road, Evanston, IL, 60208, United States, ozevin@northwestern.edu, Sanjay Mehrotra

In this talk we present a Benders decomposition-based linearly convergent primal path-following algorithm to solve two-stage stochastic (dual) semidefinite programs with recourse. We prove polynomial iteration complexity bounds for the short- and long-step versions of the algorithm showing that the recourse function is a self-concordant barrier on the first-stage solutions.

5 — A Local Relaxation Approach Toward the Siting and Sizing of Electrical Substations
Vinayak Shanbhag, Dept of Mgmt. Science and Engg, Stanford University, Stanford, CA, 94305, United States, udaybag@stanford.edu, Walter Murray

The Substation Siting Optimization problem can be formulated as a nonlinear integer programming problem. A new methodology has been developed to solve large problems of this variety. The approach is based on the solution of a sequence of quadratic programs(QP). The solution of each QP provides a starting point for the next iteration. Compuational results are provided for large problems with various load distributions. Bounds for the solution are also provided.

■ TC31

Westin-Tower 1406, 14th Floor

Optimization III

Contributed Session

Chair: Larry Deschaine, Engineering Physicist, SAIC/Chalmers, Suite 200, 360 Bay Street, Augusta, GA, 30901, United States, Larry.M.Deschaine@saic.com

1 — Parallel Optimization of Computationally Expensive Functions Using Radial Basis Functions
Rommel Regis, Ph.D. candidate, Cornell University, 296 Rhodes Hall, Ithaca, NY, 14853, United States, rregis@orie.cornell.edu, Christine Shoemaker

We develop parallel algorithms for the optimization of computationally expensive functions with box constraints when derivatives are unavailable. These algorithms iteratively utilize radial basis function models to identify a diverse set of promising points for simultaneous evaluation in parallel. We apply these algorithms on a variety of test functions and on a groundwater bioremediation problem.

2 — A Comparsion of the Outer Approximation Method and LGO on Optimal Groundwater Quality Management
Larry Deschaine, Engineering Physicist, SAIC/Chalmers, Suite 200, 360 Bay Street, Augusta, GA, 30901, United States, Larry.M.Deschaine@saic.com

This work compares the effectiveness of the LGO method with the Outer Approximation method on optimizing the challenge of managing groundwater quality impacts. Various methods have been proposed to optimize the response action to this billion dollar global problem. These algorithms have been successful, albeit very computation intensive or labor intensive, but with savings up to $100M. LGO is tested for robustness, efficiency and effectiveness of implementation.

3 — Maximizing Correlation in the Presence of Missing Data
Xinfang Wang, University of Cincinnati, Department of QA/OM, College of Business, 501 Lindner Hall, PO Box 210130, Cincinnati, OH, United States, wangfx@email.uc.edu

We study the use of constraint programming for a combinatorial optimization problem encountered in evironmental monitoring. The problem is to maximize the dot product of two vectors by finding the locations to insert zeros into the shorter of the two vectors so as to maximize their dot product.

4 — A New Linear 0-1 Formulation for Maximum Independent Set Problem
Roger L. Zhan, PhD Student, University of Florida, Dept. of Industrial and Systems Eng, 303 Weil Hall, PO Box 116595, Gainesville, FL, 32611, United States, zhan@ufl .edu, Panos Pardalos, Wanpracha Chaovalitwongse, Oleg Prokopyev

We consider a novel formulation for the maximum independent set problem based on a quadratic 0-1 approach. Preliminary computational results using the DIMACS test problem are reported.

■ TC32

Westin-Tower 1407, 14th Floor

Scheduling III

Contributed Session

Chair: Douglas McWilliams, Doctoral Candidate, North Carolina A&T State University, Department of Industrial Engineering, 419 East Market Street, Greensboro, NC, 27411, United States, dm003160@ncat.edu

1 — Group Scheduling Problems in Hardware Manufacturing
Rasaratnam Logendran, Associate Professor, Oregon State University, Dept. of Industrial and Mfgr. Engr., 118 Covell Hall, Corvallis, OR, 97331-2407, United States, logendrr@engr.orst.edu, Nasser Salmasi

We present a mathematical programming model for the multi-machine sequence-dependent group scheduling problem in hardware manufacturing. An example problem is used to demonstrate the model and the solution technique.

2 — The Job Shop Total Inventory Minimization Problem
Yunpeng Pan, Reseach Associate, Univ. of Wisconsin-Madison, 1513 University Ave., IE Dept., Madison, WI, 53706, United States, pany@cae.wisc.edu, Leyuan Shi

We introduce a new model that optimizes a job shop schedule with respect to a performance measure called the total inventory. This work was motivated by our joint project with John Deere Horicon Works (located in Horicon, Wisconsin) to help one of their suppliers, R&B Grinding to revamp its scheduling function. Solution methods are proposed. The effectiveness of the proposed algorithms is demonstrated through extensive computational experiments.

3 — Minimizing Total Tardiness of Orders with Reentrant Lots in a Hybrid Flowshop
Seong-Woo Choi, Ph.D. Student, Korea Advanced Institute of Science and Technology (KAIST), Dept. of Industrial Engineering, KAIST, Guseong-dong, Yuseong-gu, Daejeon, NA, 305-701, Korea Repof, capman@kaist.ac.kr, Yeong-Dae Kim, Geun-Cheol Lee

This study focuses on a scheduling problem in a hybrid flowshop, in which there are serial stages, each with identical parallel machines. Each order is composed of multiple lots with the same due date and each lot is processed on any one of parallel machines at each stage. In addition, there are reentrant flows in that some products have to visit the stages twice. Some heuristic algorithms are devised to minimize total tardiness of orders and computational experiments are performed.

4 — A Simulation Optimization Approach to Minimize Completion Time in a Parcel Consolidation Terminal
Douglas McWilliams, Doctoral Candidate, North Carolina A&T State University, Department of Industrial Engineering, 419 East Market Street, Greensboro, NC, 27411, United States, dm003160@ncat.edu, Paul Stanfield

The presented research describes and demonstrates a simulation optimization approach to the hub scheduling problem. The hub scheduling problem is a classic problem associated with organizations operating in the small package delivery industry. It consists of the scheduling of a set of inbound trailers to unload docks. Given that each inbound trailer contains a set of heterogeneous parcels, the objective is to minimize the completion time of the transfer operation.

■ TC33

Westin-Tower 1408, 14th Floor

Data Envelopment Analysis I

Contributed Session

Chair: Mark Fabish,CEO, StrategyMap, 401 N Wabash, Suite 536, Chicago IL 60611, United States, markf@strategymap.com

1 — Fair Selection Scheme from Various Criteria by Centext-Dependent DEA
Koichiro Hirokawa, Osaka Univeristy, Dept. Information Physics and Sciences, Ishii Lab., Suita, 5650871, Japan, hirokawa@ist.osaka-u.ac.jp, Hiroshi Morita

It is important to do a fair selection under multiple evaluation criteria. DEA is effectively applied to the evaluation by multiple criteria, however, it has no viewpoint of fairness. We consider the fair selection scheme by using context-dependent DEA based on the stratification of DMUs.

2 — Development of DEA Program for Huge Size Problem
Takashi Namatame, Lecturer, Senshu University, 2-1-1, Higashimita, Tama-ku, Kawasaki, Kanagawa, Ka, 214-8580, Japan, takashi@isc.senshu-u.ac.jp, Miho Ikai, Nobuhiro Henmi, Keiichiro Nakagawa, Takahito Tanabe

DEA is formulated as a linear programming problem through a fractional programming problem, so it can be solved straightforwardly. However, DEA needs to solve for each DMU. Hence, if the number of DMU becomes large, then it is difficult to solve completely. In this study, we introduce our DEA program for huge size probem by devising algorithm.

3 — A New Model for Finding the Most Favorable Constituency in Data Envelopment Analysis
Jorge Santos, Universidade de Evora, R. Elina Guimaraes 7-4-A, Lisboa, P, 1750-095, Portugal, jmas@uevora.pt

DEA is a mathematical programming technique presented in 1978 by Charnes, Cooper and Rhodes, focused mainly on the efficiency assessment of not-for-profit organizations. When constructing a DEA model, a major decision is the choice of inputs and outputs for the study. The CCR DEA model is not suited for studies with constituencies with dissonant judgments about the desirability of the attributes. This is overcome by the work of Bougnol and Dula. A faster new formulation is presented.

4 — Project Selection: Some Side-Constrained Data Envelopment Analysis Approach
Fuh-Hwa Liu, Professor, National Chiao Tung University, Department of Industrial Engineering, Hsin Chu, TW, 300, Taiwan, fliu@cc.nctu.edu.tw, Hao-Hsuan Peng

This paper proposes a methodology for evaluating and selecting, from a larger set of projects, a subset of projects to be undertaken. Each project is expected to make use of input resources under a number of headings to produce outputs under a number of headings. It is desired to establish a subset of projects be justified as making use the best of available resources and producing the best of outputs with the given lower bound possesses the best performance among all projects in the subset.

5 — StrategyMap Tools Allow Measurement and Management of the Previously Immeasurable
Mark Fabish, CEO, StrategyMap, 401 N. Wabash, Suite 536, Chicago, IL, 60611, United States, markf@strategymap.com

StrategyMap online tools provide direct financial benefits by enabling the effective management of previously intangible or “hard to measure” company functions, often related to the effectiveness of people. Key areas such as customer service, communication, effect of incentives, and team effectiveness can be measured and monitored, with effects on the related corporate strategic goals being visible and measurable. Hidden root causes of problems are uncovered, corrected, and savings documented.

■ TC34

Mart-Room A

Hazardous Materials Transportation

Sponsor: Transportation Science & Logistics
Sponsored Session

Chair: Vedat Verter, McGill University, 1001 Sherbrooke St. W., Montreal, PQ, H3A 1G5, Canada, vedat.verter@mcgill .ca

1 — Logistics Planning under Uncertainty for Disposition of Radioactive Wastes
Mark Turnquist, Professor, Cornell University, United States, mat14@cornell.edu, Bryan Wood, Linda Nozick, George List

This analysis focuses on equipment acquisition and fleet sizing issues related to transportation of hazardous wastes from remediation sites to disposal sites. Planning for this transportation must be done with recognition of important uncertainties. To address this problem, we have created a stochastic optimization model for the equipment investment decisions .

2 — Cyberinfrastructure Development: Implications for Hazmat Transportation Incidents and Related Emerg
Ted Glickman, Professor, George Washington University, United States, glickman@gwu .edu

The cyberinfrastructure is being heralded as the critical foundation of a new age in technological research and development, pushed by progress in information and communication systems and pulled by the increasing complexity and scale of societal applications. The implications for hazardous materials transportation safety and related research are examined.

3 — Sparse Network Design for Hazmat Transport
Erhan Erkut, Professor, University of Alberta, 3-40G Business Building, Edmonton, AB, Canada, erhan.erkut@ualberta.ca, Osman Alp

We consider the problem of finding a spanning-tree that results in minimum total risk for hazmat shipments, where risk for an origin-destination pair is defined as a function of the number of shipments, link accident probabilities, and population exposure. The resulting problem is difficult since link attributes depend on topology.

4 — A Risk Assessment Framework for Rail Transport of Dangerous Goods
Vedat Verter, McGill University, 1001 Sherbrooke St. W., Montreal, PQ, H3A 1G5, Canada, vedat.verter@mcgill.ca, Manish Verma

We incorporate differentiating features of trains in the assessment of hazmat transport risk. A novel railcar referencing and risk approximation approach is devised and implemented to a real life problem in Montreal, Canada. The method is robust with regards to the position of hazardous cargo in the train.

■ TC35

Mart-Room B

Inventory Management I

Contributed Session

Chair: Ralph Badinelli, Professor, Virginia Tech, Dept. of Business Information Technology, Virginia Tech, Blacksburg, VA, 24061, United States, ralphb@vt.edu

1 — Component Reallocation Policy for ATS Systems
Loo Hay Lee, Assistant Professor, National University of Singapore, 10 Kent Ridge, Singapore, Si, 119260, Singapore, iseleelh@nus.edu.sg, Ek Peng Chew, Yew Loon Lau

A component reallocation policy which is based on the minimization of the expected total inventory cost is proposed for an assembled to stock (ATS) system. Based on this policy, the optimal component order-up-to levels are found by using the Infinitesimal Perturbation Analysis (IPA) approach. The computation results show that the proposed policy consistently outperforms the policy that does not allow the reallocation of common components under a wide range of parameter settings.

2 — Integrated Production and Allocation Policies with Time and Quantity Dependent Waiting Costs
Wooseung Jang, Assistant Professor, University of Missouri - Columbia, E3437 Engineering Building East, Columbia, MO, 65211, United States, jangw@missouri.edu, Cerry Klein

We consider an integrated production and inventory allocation model in a two-echelon supply chain system. The higher echelon is a manufacturer, and the lower echelon consists of multiple distributors who might face stochastic or deterministic demands from multiple retailers. Our analytical model provides optimal decision policies minimizing total production and customer waiting costs from the view of a manufacturer when there are time and quantity dependent customer waiting costs.

3 — Capacitated Production Control with Virtual Lateral Transshipments
Jian Yang, Assistant Professor, New Jersey Institute of Technology, Dept. of IME, New Jersey Inst. of Tech., Newark, NJ, 07102, United States, yang@adm.njit.edu

We study the optimal control of a firm with two capacitated manufacturing plants situated in two distinct geographical regions. Demands from each region are mostly satisfied by the local plant. However, if necessary, some of the newly arrived demands can be designated without regret to be served by the other more remote plant. We derive structural results for the optimal control policies of the problem.

4 — Evaluating Echelon (R,nT) Policy in Two-Stage Serial Inventory System with Stochastic Demand
Keli Feng, PhD student, University of Cincinnati, 2920 Scioto street, #1005, Cincinnati, OH, 45219, United States, fengk@email.uc.edu, Uday Rao

We study a fixed interval, order-up-to (R,nT) policy in a two-stage serial inventory system with setup costs and stochastic demand. We use simulation-based optimization to estimate optimal parameter values and long-run average cost. Computational results are presented. We see that the periodic review (R,nT) policy is only slightly more expensive than the continuous review (r,nQ) policy, particularly when the demand rate and setup cost at the upstream stage are relatively large.

5 — Policies for Risk, Revenue and Logistics Management with Forward Contracts
Ralph Badinelli, Professor, Virginia Tech, Dept. of Business Information Technology, Virginia Tech, Blacksburg, VA, 24061, United States, ralphb@vt.edu

This paper joins inventory-control with revenue and risk management by optimizing a sales policy and stock allocation to different market segments. Measures for financial risk and stockout risk are included in the optimization. The market segments are differentiated by the unit selling price, the unit stockout penalty, demand volatility, price volatility and contract terms. The sales policy and the inventory policy together constitute a combined revenue-, risk- and logistics-management plan.

■ TC36

Mart-Room C

Topics in Inventory Control and Supply Chain Management

Sponsor: Manufacturing and Service Operations Management
Sponsored Session

Chair: Srinagesh Gavirneni, Assistant Professor, Indiana University, Bloomington, IN, 47405, United States, sgavirne@indiana.edu

1 — Algorithms and Results for Dual Sales Channel Inventory Systems
Steve Mahar, Indiana University, Kelley School of Business, Operations & Decision Technolgies Dept, Bloomington, IN, 47405, United States, smahar@indiana.edu, Kurt Bretthauer, M Venkataramanan

This research considers optimal inventory allocation policies for companies satisfying both in-store and on-line demand. Specifically, we derive the optimal placement of e-fulfillment w .r.t. holding and backorder costs. These results are then incorporated in a branch-and-bound algorithm to determine which locations should handle e-sales such that system-wide holding, backorder, transportation, and setup costs are minimized.

2 — Inventory Planning and Control in Remanufacturing
Kevin Gaudette, Doctoral Student, Indiana University, Business 670, 1309 East Tenth Street, Bloomington, IN, 47405-1701, United States, kgaudett@indiana.edu, Vincent Mabert

In a remanufacturing environment, the availability and condition of cores is uncertain. This poses a unique problem for inventory planners, since the yields of usable parts (and therefore the requirements for new parts) are unknown. A stochastic model is proposed to simultaneously solve the core ordering, core disassembly, and new part ordering problems with the objective of minimizing total cost.

3 — Multi-phase Planning of Purchases of Bundled Products/Services
Anthony Ross, Assoc. Prof., Michigan State Univ, Eli Broad Graduate School of Management, Dept. of Mktg. & Supply Chain Mgt., East Lansing, MI, 48820, United States, rossant@msu.edu, M Venkataramanan, Kathy Ernstberger

The purchase of various products and services in the right quantities using bundles is the focus of this paper. Lowering sourcing costs, reducing inventories, and maintaining quality and reliability are the key issues addressed. This paper describes and models the strategic purchase of bundled products and services over multiple time periods.

4 — Improving Supply Chain Performance by Inducing Information Flow
Wanshan Zhu, Graduate Student, University of Michigan, 1205 Beal Avenue, Ann Arbor, MI, 48109, United States, zhuws@umich.edu, Roman Kapuscinski, Srinagesh Gavirneni

A case of one supplier and one retailer with outsourcing option is considered. To improve the efficiency of decentralized supply chain, we propose a strategy that the supplier operates under a m-period cycle with predetermined orders in last m-1 periods. This strategy generates information flows with benefits that outweigh the increased costs. By comparing the centralized and decentralized solution, we analyze the major factors that cause inefficiency in decentralized setting.

■ TC37

Mart-Room D

Integer Programming and Combinatorics

Contributed Session

Chair: William Christian, James Madison University, College of Business-MSC 0202, Harrisonburg, VA, 22807, United States, christwa@jmu.edu

1 — Solving a Multi-objective Set Covering Problem in a Fuzzy Environment
Chin-I Chiang, Assistant Professor, Hsuan Chuang University, No. 48, Hsuan Chuang Rd., Hsinchu, Taiwan, cichiang@hcu.edu.tw, Yi-Hsin Liu, Ming-Jiu Hwang

This work defines the set covering problem under a fuzzy environment. We apply the fuzzy set theory and integer program to develop an efficient algorithm which optimizes the membership grade of the strength of the cover.

2 — The Unconstrained Quadratic Binary Programming Approach to Combinatorical Optimization
Gary Kochenberger, Professor, University of Colorado, 4505 So. Yosemite St #145, Denver, CO, 80237, United States, gary.kochenberger@cudenver.edu, Fred Glover, Bahram Alidaee, Cesar Rego

In recent years the Unconstrained Quadratic Binary Program has emerged as a general modeling and solution framework with surprising versatility and computational promise. In this talk we review these developments and provide computational experience with a variety of important problems.

3 — Bicriteria Network Flow Problems: A Computational Study
José Figueira, DIMACS Center - Rutgers University, 96, Frelinghuysen Road, Piscataway, NJ, 08854-8018, United States, figueira@dimacs.rutgers.edu, Rui Monteiro

This paper is devoted to computational results for a set of bi-criteria network flow instances. It presents a study on the number of supported and unsupported non-dominated solutions in both spaces, decision and criteria spaces. The paper presents also several issues on the implementation of the method by Figueira (2002). It is based on a parametric technique to find supported solutions and in a branch-and-bound procedure for unsupported non-dominated solutions .

4 — Pivot and Shift — A Mixed Integer Programming Heuristic
Chris Wallace, Carnegie Mellon, 5000 Forbes Ave. - Mathematical Sciences, Pittsburgh, pa, United States, cwallace@andrew.cmu.edu, Egon Balas

Through joint work with C. H. Martin and S. Schmieta, the Pivot and Complement heuristic is extended to general mixed integer programming. It is a rounding procedure that starts from the LP optimum, performs several types of nonstandard pivots and value shifts of the integer variables, until it finds a "good" integer solution. Computational experience on a variety of publicly available benchmark problems will be presented.

5 — JPAD: A Java-based Program for Analyzing and Drawing Graphs and Their Branch Decompositions
William Christian, James Madison University, College of Business-MSC 0202, Harrisonburg, VA, 22807, United States, christwa@jmu.edu

We present a package we call JPAD. In addition to being useful for viewing simple graphs, JPAD is unique in its ability to display branch decompositions and graphs and to demonstrate the relationships between the two. The primary features and an overview of how to extend them are presented. Of particular interest is that traditional and branch decomposition based algorithms can be incorporated into the program using some provided wrapper classes.

■ TC38

Mart-Room E

Transportation Applications of Queueing Theory

Sponsor: Transportation Science & Logistics
Sponsored Session

Chair: Tom van Woensel, Eindhoven University of Technology, Den Dolech 2, Eindhoven, NL, 5600 MB, The Netherlands, t.v.woense@tm.tue.nl

1 — State Dependent Queueing Models for Uninterrupted Traffic Flows
Bart Wuyts, Belgium, bart.wuyts@ua.ac.be, Nico Vandaele

The purpose of this paper consists in developing new state dependent functions for queueing models for uninterrupted traffic flows: instead of using a fixed service rate, the service rate is a function of the traffic flow. The most accurate models will be used in a traffic application.

2 — Vehicle Routing Problems with Time Windows and Stochastic Travel Times
Laoucine Kerbache, HEC Paris, Paris, France, kerbache@hec.fr, Tom Van Woensel

Despite numerous publications dealing with efficient scheduling methods for vehicle routing with time windows, very few addressed the inherent stochastic nature of this problem. The approach developed introduces mainly the traffic congestion component in the VRPTW models. Standard datasets are used for illustration of the unfeasibility of the current solutions.

3 — Multi-objective Evacuation Routing in Transportation Networks
Alexander Stepanov, United States, astepano@ecs.umass.edu, Jim MacGregor Smith

In this paper, the design and analysis of evacuation routing in transportation networks is examined. State dependent queueing network models measure the congestion phenomenon and k-shortest path routing algorithms optimally route the vehicles within a multi-objective framework. Extensive experimental results are included.

■ TC39

Mart-Room F

Supply Chain Sourcing and Pricing

Contributed Session

Chair: Amy Zeng, Associate Professor, Worcester Polytechnic Institute, Department of Management, 100 Institute Road, Worcester, MA, 01609, United States, azeng@wpi.edu

1 — Managing a Product Line: a Supply Chain Focus
Lifang Wu, University of Iowa, 230 Hawkeye Ct., Iowa City, IA, 52246, United States, lifang-wu@uiowa.edu, Renatto De Matta

High product variety is often desirable to consumers. However, excessive product variety buildup could create a host of managerial and operational problems that leads to poor performance for firms. We study the product line design and pricing problem in a centralized supply chain. We also investigate the design and marketing coordination issues in determining the optimal product variety in a decentralized supply chain.

2 — Pricing and Replenishment Coordination through Vertically Restrictive Pricing Policy
Yong Liu, University of Cincinnati, College of Business, Cincinnati, OH, 45221, United States, liyo@email.uc.edu, Michael Fry, Amit Raturi

We examine the behavior of a manufacturer and a retailer in a decentralized supply chain faced with price dependent demand. We prove the existence of optimal pricing and replenishment policies. We compare the performance of decentralized supply chains operating under price-only and vertically restrictive pricing policies.

3 — Speed vs. Reliability Tradeoffs in Supplier Selection
Jianli Hu, Ph.D. Candidate, Washington State University, Dept. of Management & Decision Sciences, PO BOX 644736, Pullman, WA, 99164-4736, United States, hu@mail .wsu.edu, Charles Munson

In this study, we explore the tradeoffs among reliability, speed, and price when selecting suppliers. We examine the dynamics of a supply chain that has the option of using either one supplier or multiple suppliers from a variety of suppliers categorized by their lead time and reliability characteristics. Our study identifies the conditions under which each type of supplier dominates, and explores the circumstances where a tailored sourcing strategy should be used.

4 — Designing Supply Contracts with Information Asymmetry in Supplier- and Buyer-Driven Channels
Xingchu Liu, Texas A&M University, Industrial Engineering Department, College Station, TX, 77843-3131, United States, liuxch@neo.tamu.edu, Sila Cetinkaya

This paper concentrates on two important issues in supply contract design: impact of power structure and value of information. More specifically, we consider a buyer-driven channel where the pricing scheme involves a multiplier and a slotting fee. We derive the buyer's optimal contracts where the buyer has either full or incomplete information about the supplier's cost structure. We also provide a comparative analysis of buyer- and supplier-driven channels on the impact of the power structure.

5 — Single or Multiple Sourcing in the Presence of Risk and Uncertainty
Amy Zeng, Associate Professor, Worcester Polytechnic Institute, Department of Management, 100 Institute Road, Worcester, MA, 01609, United States, azeng@wpi.edu

This paper studies the optimal size of supply base in the presence of risk and uncertainty. We rely on a decision-tree approach to formulate the expected total cost function, and then obtain the optimal solution of the number of the suppliers under various situations. Numerical results along with managerial implications will be also discussed.

■ TC40

Mart-Room G

Contracts, Informal Agreements and Relationships in Supply Chain Management

Cluster: Supply Chain Management
Invited Session

Chair: Erica Plambeck, Assistant Professor of Operations, Information and Technology, Stanford Graduate School of Business, 518 Memorial Way, Stanford, CA, 94305-5015, United States, plambeck_erica@gsb.stanford.edu

1 — Supply Auctions and Relation Based Vertical Contracts
Tunay Tunca, Assistant Professor of Operations, Information and Technology, Graduate School of Business, Stanford Univeristy, Stanford, CA, United States, tunca_tunay@gsb.stanford.edu, Stefanos Zenios

We examine the interaction between vertical relational contracting and a (second price) auction-based procurement exchange in a two-layer supply chain with multiple suppliers and buyers. We find the conditions under which relational contracting and the exchange would coexist and examine the equilibrium characteristics. By comparing to the multi-party equilibrium with no exchange, we also derive the welfare implications.

2 — Complementarity Among Vertical Integration Decisions:Evidence from Automobile Product Development
Sharon Novak, Assistant Professor, Kellogg School of Management, 2001 Sheridan Road, Evanston, Il, 60208, United States, s-novak@nwu.edu, Scott Stern

This paper examines interdependence among vertical integration decisions in the automobile industry. This paper offers evidence for complementarity by developing and implementing an instrumental variables estimator that distinguishes contracting complementarity from firm-level fixed effects in governance choice. The results suggest that assuming away complementarities in contracting may be problematic in contexts where coordination activities are both important and difficult to monitor.

3 — The Effect of Repeated Interaction on Capacity Investment and Contracting
Erica Plambeck, Assistant Professor of Operations, Information and Technology, Stanford Graduate School of Business, 518 Memorial Way, Stanford, CA, 94305-5015, United States, plambeck_erica@gsb.stanford.edu, Terry Taylor

The supplier of an innovative product must invest in capacity before the buyer can write a contract. When the price is negotiated, his capacity cost will be sunk (irrelevant). Anticipating hold-up, the supplier buys little capacity. However, with repeated innovation and capacity investment, the buyer promises to purchase at a price that reflects the cost of capacity and the supplier buys more capacity. The value of future cooperation induces the buyer to pay the supplier as promised.

■ TC41

Mart-Room H

Retail Operations Management

Cluster: Supply Chain Management
Invited Session

Chair: Naren Agrawal, Santa Clara University, OMIS Department, Santa Clara, CA, 95053, United States, nagrawal@scu .edu

Co-Chair: Stephen Smith, Professor, Santa Clara University, OMIS Department, Santa Clara, CA, 95053, United States, ssmith@scu.edu

1 — Hedging Inventory Risk Through Market Instruments
Vishal Gaur, Stern School of Business, NYU, Rm 8-72, 44 West 4th St., New York, NY, 10012, United States, vgaur@stern.nyu.edu, Sridhar Seshadri

We address the problem of hedging inventory risk for a short lifecycle or seasonal product when its demand is correlated with the price of a financial asset. The price information of the asset is used to determine the optimal inventory level, as well as the minimum variance hedge. We also show that a risk-averse decision maker prefers to hedge the inventory risk, and orders more inventory upon hedging. We demonstrate our methodology using data from a retailing firm.

2 — Demand Estimation and Assortment Optimization under Substitution: Methodology and Application
Gurhan Kok, Duke University, Fuqua School of Business, United States, gurhan .kok@duke.edu, Marshall Fisher

We study the joint assortment selection and inventory planning problem under consumer driven substitution. We introduce a relatively simple model of demand substitution and present a novel methodology for demand estimation. We describe an iterative heuristic that basically solves a series of nonlinear separable knapsack problems and assess its performance. We establish new structural properties that relate which products are included in the assortment as well as their inventory levels to demand rates and other characteristics of the products. We also describe the application of our methodology at a large grocery chain.

3 — Optimal Pre-Pack Design in Retail Supply Chains
Naren Agrawal, Santa Clara University, OMIS Department, Santa Clara, CA, 95053, United States, nagrawal@scu.edu, Stephen Smith

Retailers frequently bundle multiple units of inventory together into "prepacks," which may contain several units of one SKU or an assortment of different SKUs. The goal of prepack design is to optimize the tradeoff between the reduced handling costs associated with using prepacks versus the increased holding costs that can result from receiving replenishment shipments that contain units in excess of the inventory requirements. In this talk, we will present our analysis of this problem.

■ TC42

Mart-Room I

Consumer Behavior Effects in Revenue Management

Sponsor: Revenue Management & Dynamic Pricing
Sponsored Session

Chair: Garrett van Ryzin, Columbia University, 412 Uris Hall, New York, NY, United States, gjv1@columbia.edu

1 — Adaptive Sales Mechanisms
Jeremie Gallien, MIT Sloan School of Management, Cambridge, MA, United States, jgallien@MIT.EDU

Most Pricing and Auction Theory models assume the structure and parameters of demand to be known, which is only valid in mature markets with enough historical sales data available. In contrast, I present dynamic market mechanisms relying on statistical Bayesian inference to jointly perform trading and demand estimation, and discuss the impact of buyers' behavior on their expected outcome.

2 — Optimal Bayesian Quantity Control when Some Customers will Accept a Substitute
Li Chen, Ph.D. Candidate, Stanford University, Stanford University, Stanford, CA, 94305-4026, United States, skychen@stanford.edu, Erica Plambeck

Customers' willingness to pay the full fare, to substitute the next flight, or to wait for a product that is out-of-stock can be modelled as independent Bernoulli trials. The manager must control the quantity (booking limit) for N periods while estimating the substitution probability. We show that, to maximize discounted expected profit, the manager should initially reduce the quantity to learn about the substitution probability, and thus improve his quantity control in future periods.

3 — Optimal Design of Markdown Pricing Mechanisms under Incomplete Information
Pinar Keskinocak, Georgia Institute of Technology, School of Industrial and Systems Eng., Atlanta, GA, 30332, United States, pinar@isye.gatech.edu, Altan Gulcu, Wedad Elmaghraby

We consider markdown mechanims under incomplete information where the seller faces potential buyers who are "strategic". Each buyer demands multiple units of the homogeneous product and the valuations and/or demands of the buyers are not common knowledge. We explore the buyers' purchasing behavior and the optimal design of markdown mechanisms.

4 — Simulation-Based Optimization of Virtual Nesting Controls Under Consumer Choice
Garrett van Ryzin, Columbia University, 412 Uris Hall, New York, NY, United States, gjv1@columbia.edu, Gustavo Vulcano

We extend previous work on simulation-based method for optimizing virtual nesting controls to the case where consumers choose among products, flights and/or routes. Since the method is simulation-based, it is possible to model quite complicated consumer behavior. We discuss the algorithm and provide computational examples.

■ TC43

Mart-Room J

Models and Methods for Combinatorial Auctions

Cluster: Auctions
Invited Session

Chair: Roy Kwon, University of Toronto, Mechanical and Industrial Engineering, 5 King's College Road, Toronto, On, M5S 3G8, Canada, rkwon@mie.utoronto.ca

1 — Decomposition Approaches and Iterative Combinatorial Auctions
Jawad Abrache, University of Montreal-CRT, Montreal, Canada, jawad@crt.umontreal.ca, Teodor Crainic, Michel Gendreau

Iterative auctions are motivated by the fact that the market maker often lacks complete and truthful information about the bidders private valuations of the resources on sale. In this presentation, we consider a general production/consumption economy of interdependent goods, for which we investigate iterative auction mechanisms based on mathematical programming decomposition methods. We focus specifically on two well-known approaches: the Lagrangian relaxation, and Dantzig-Wolfe column-generation.

2 — Computing the Winning Bid in a Combinatorial Auction with Quantity Discounts
Dmitry Krass, Professor, University of Toronto, 105 St. George St., Toronto, ON, M5S 3E6, Canada, krass@rotman.utoronto.ca, Rongbing Huang

We consider an auction where N players bid on M jobs. In addition to specifying the price for each job, each player specifies the quantity discount to be applied to the total amount awarded to this player; the size of the discount depends on the total amount of the award. Determining the winning bids leads to a non-linear

integer program. We develop several methods for dealing with this problem and discuss applications to on-line auctions in the transportation industry.

3 — Combinatorial Auctions using Matrix Bids
Robert Day, University of Maryland, College Park, MD, 20742, United States, rwday@math.umd.edu, S. Raghavan

Combinatorial Auctions inherently experience a problem of exponential bid data for complete preference expression. We introduce "matrix bidding" as a compact method for preference representation, demonstrate the types of bidders modeled exactly by this representation, and explore IP techniques for the solution of the associated winner determination problem.

4 — A Multi-Round Combinatorial Auction Mechanism for Transportation Bidding
Roy Kwon, Chi-Guhn Lee, University of Toronto, 5 King's College Road, Toronto, ON, M5S3G8, Canada, chi@mie.utoronto.ca, Zhong Ma

We consider a multi-round combinatorial auction for transportation procurement. Bidders (carriers) employ vehicle routing models to identify lanes. This allows carriers to find a set of lanes based on the actual routes that a fleet of trucks will follow in order to minimize repositioning costs. The use of approximate-dual information from the auctioneer (shipper) winner determination at each round is used as "prices" for lanes in bidder optimizations.

■ TC44

Mart-Room K

Operations Research at Delta Air Lines II

Sponsor: Aviation Applications
Sponsored Session

Chair: Irina Ioachim, Delta Technology, Dept. 709, 1001 International Blvd., Atlanta, GA, 30354, United States, irina.ioachim@delta.com

1 — A Robust Optimization Approach for Aircraft Schedule Dependability: Simulation, Evaluation and Re-flow
Qing Zhao, Delta Technology, 1001 International Blvd., Atlanta, GA, 30354-1801, United States, qing.zhao@delta.com, Irina Ioachim, Hilda H. Valero, Guangzhen Xing

In this talk we will present a robust optimization approach to build a dependable aircraft schedule. In the approach, we use a simulation process to identify problem flight legs which cause flight delays and cancellations. We then describe a two-step method to improve the dependability of an aircraft schedule by localizing and minimizing the damaging effect of those problem flight legs.

2 — 50-Minute Turn Simulation for Song
Wendy Lockhart, Delta Technology, 1001 International Blvd, Atlanta, GA, 30354-1801, United States, wendy.m.lockhart@delta.com, Irina Ioachim

The time an aircraft spends on the ground between flights (i.e. an "aircraft turn") is time during which the operating airline is not generating revenue. In preparation for the launch of Song (Delta's low cost subsidiary), we developed a simulation model in Arena with the intent to reduce the turn time and, thus, increase aircraft utilization.

3 — A Preferential Bidding System for Song
Armand Zakarian, Delta Technology, 1001 International Blvd, Atlanta, GA, 30354-1801, United States, armand.zakarian@delta.com, Aravind Muralidharan, Irina Ioachim

A preferential bidding system constructs monthly schedules for crew members according to their individual preferences and subject to a set of legality constraints. We describe how we implemented preferential bidding at Song to balance maximizing crew bid satisfaction with the operational constraints of the airline.

4 — A Multi-Criteria Optimization Approach for Building Robust Aircraft Rotations
Hilda H. Valero, Delta Technology, 1001 International Blvd, Atlanta, GA, 30354-1801, United States, hilda.valero@delta.com, Irina Ioachim, Guangzhen Xing, Ananth Madabushi, Qing Zhao

Building a robust aircraft rotation is a challenging task due to its nature of multi-criteria objectives and a very complex combination of soft and hard constraints. In this talk we will present an approach which combines the use of daily, weekly and fully-dated models with global and heuristic optimization techniques.

■ TC45

Mart-Room L

Multicriteria Decision Making I

Contributed Session

Chair: Darby Grande, University of Michigan, 1205 Beal Avenue, Ann Arbor, MI, 48109, United States, dgrande@umich .edu

1 — Efficient Frontier Sensitivity and the Case for Multiple Objectives in Portfolio Optimization
Yue Qi, Ph.D. candidate, the University of Georgia, Department of Banking and Finance,, Brooks Hall, the University of Georgia, Athens, GA, 30602, United States, yorkche@terry.uga.edu], Ralph Steuer

We study Markowitz portfolio theory and ensuing assumptions. After examining the sensitivity of the efficient (nondominated) frontier to concerns such as number of securities, a multiple criteria formulation is proposed. With the nondominated frontier becoming a nondominated surface, the paper considers that what is the "modern portfolio theory" might best be interpreted as a projection onto two-space of the real multiple criteria portfolio selection problem from higher dimensional space.

2 — Comprehensive Representation of the Solution Set in Multi-Criteria Programming
Margaret Wiecek, Clemson University, Department of Mathematical Sciences, Clemson, SC, United States, wmalgor@clemson.edu

A methodology to obtain a representation of a solution set of multi-criteria programs is presented. The methodology consists of a relevant optimality concept, an approach to approximate the resulting solution set in which the approximation error is objectively measured by the approximation itself, and tools that guarantee an expected quality of approximation. The concepts and results are demonstrated on examples in engineering design and related to the context of radiation therapy planning.

3 — Binary Relations in Multiple Criteria Choice: Some Applications
Marina Polyashuk, Assistant Professor, Northeastern Illinois University, Department of Mathematics, 5500 N. St. Louis Ave., Chicago, IL, 60625, United States, m-polyashuk@neiu.edu

This presentation will focus on examples of decision-making situations when several, rather than one, "best" alternatives have to be chosen, with further determination left to a decision maker. Binary preference relations with multiple criteria will be applied as an appropriate choice model.

4 — Multi-objective Modeling for Determining Location of Undesirable Facilities
Jasenka Rakas, Researcher, University of California at Berkeley, NEXTOR, Institute for Transp. Studies, 107D McLaughlin Hall, Berkeley, CA, 94720, United States, jrakas@ce.berkeley.edu, Dusan Teodorovic

This research is concerned with the optimization of the number and location of undesirable facilities. A multi-objective modeling is used and the methodology is improved by introducing a compensatory Multiple Attribute Decision Making Technique as a part of the prescreening process used to reduce the number of landfill candidate sites. A new method is also proposed to address uncertainty associated with this class of location problems. The methodology is tested using the real-world data.

5 — Multiobjective Analysis of a Vehicle Replacement Problem
Darby Grande, University of Michigan, 1205 Beal Avenue, Ann Arbor, MI, 48109, United States, dgrande@umich.edu, James Bean

We discuss construction of a decision support system for policies affecting passenger vehicle purchase and retirement. We use multiobjective evolutionary algorithms to find Pareto optimal solutions to a single vehicle replacement problem considering environmental and economic objectives. We aggregate these solutions to approximate decision impacts on household and national levels.

■ TC46

Mart-Room M

e-Business Applications

Sponsor: E-Business
Sponsored Session

Chair: Manfred Krafft, Director of Institute of Marketing, University of Muenster, Am Stadtgraben 13-15, Muenster, 48143, Germany, mkrafft@uni-muenster.de

1 — Viral Recruiting: Model and Applications
Arvind Rangaswamy, Jonas H. Anchel Professor of Marketing, Penn State University, 707D, BAB, University Park, PA, 16801, United States, arvindr@psu.edu, Arnaud De Bruyn

We exploit Internet technologies and the social network of connections among people in targeted segments to implement a concept we call "viral recruiting." We start by contacting an initial (small) pool of potential job applicants through email, and ask them either to apply for the job, or use our online "spread the word" tool to forward information about the job opportunity to people in their network who might find the job attractive. People along the chain of links that lead to a successful hire are rewarded suitably. In several field tests we assess the efficacy and efficiency of this approach to recruiting.

2 — Explaining and Forecasting Customer Migration in the Internet Using Hazard Regression
Manfred Krafft, Director of Institute of Marketing, University of Muenster, Am Stadtgraben 13-15, Muenster, 48143, Germany, mkrafft@uni-muenster.de, Edith Rüger

Although the reduction of customer churn plays an important role within the context of customer relationship management only a few empirical studies have been published in which models are implemented for explaining and predicting the defection of customer relationships. In this paper, customer migration is explained and predicted by semi-parametric and parametric hazard models, which are calibrated based on usage data from 40,000 users of an US-American web browser. Key explanatory variables influencing migration are the frequency of log-ins into the web browser, the used Internet access, and the number of topics users are interested in. Several parametric hazard models are applied to predict the likelihood of customer migration. The results are then compared to actual usage behavior observed within and beyond the study period. It turns out that models with log-logistically distributed hazard rates yield the most reliable forecasts.

3 — Technical Efficiency Analysis of Electronic Procurement Systems: A Two-Stage Empirical Investigation
Florian Haas, Dipl. Wirtsch.-Ing., University of Muenster, Institute for Entrepreneurship, Leonardo-Campus 18, Muenster, D-48149, Germany, haas@ug .uni-muenster.de, Thomas Ehrmann

There are few systematic studies regarding the success factors associated with electronic procurement systems. We investigate the efficiency of e-procurement systems, and in particular, desktop purchasing, using a two-stage nonparametric frontier Data Envelopment Analysis (DEA). We collected detailed data from 60 major German companies already running electronic procurement systems, including the costs of implementation and operation, the number of order items placed with the system and process runtimes. We will report the results of our analyses using the DEA measure of operational efficiency as the dependent variable in a Tobit regression model.

■ TC47

Atlanta G, 7th Floor

Software Demonstration

Cluster: Software Demonstrations
Invited Session

1 — SAS Institute, Inc. - Marketing Decision-Making with SAS Marketing Optimization
Manoj Chari, SAS Institute, Inc., SAS Campus Dr., Cary, NC, 27513, United States, Manoj.Chari@sas.com

SAS Marketing Optimization assists marketing organizations in planning large, complex, multi-product, multi-channel campaigns. A scalable method determines the optimal assignments of offers to individual customers, producing the best results and meeting all relevant requirements. A graphical user interface places these capabilities squarely within the grasp of the marketing campaign decision-maker.

2 — StrategyMap.com, Inc. - StrategyMap Tools Allow Measurement and Management of the Previously Immeasurable
Mark Fabish, StrategyMap, Inc., 401 N. Wabash Ste. 536, Chicago, IL, 60611, United States, mark@strategymap.com

StrategyMap can help you discover and achieve bottom line improvements in less than 90 days. Key areas such as customer service, sales activity management, communication, effect of incentives and team effectiveness can be measured, monitored and managed more effectively. Hidden root causes of problems are uncovered and corrected, and savings are documented.

Tuesday 4:30pm - 6:00pm

■ TD01

Westin-Intl. A, 6th Floor

Stochastic Networks I

Contributed Session

Chair: Scott Provan, Professor, OR, Univ of North Carolina, CB#3180 UNC, Chapel Hill, NC, 27599, United States, Scott_Provan@unc.edu

1 — Solving the K Dynamic Stochastic Shortest Paths Problem in Acyclic Networks with Random Arc Lengths
Haiqing Song, PhD Candidate, Industrial Engineering and Engineering Management, Hong Kong Univ. of Sci. & Tech., Clear Water Bay, Kowloon, HK, Hong Kong, seating@ust.hk, Raymond Cheung

In this paper, we develop a polynomial-time algorithm to calculate the expected lengths of the K dynamic stochastic shortest paths in acyclic networks where arc lengths are independent, finite, discrete random variables. Then we leverage this algorithm to solve a class of dynamic constrained shortest path problems. Numerical experiments are conducted to evaluate the efficiency of the algorithm and the sensitivity of the choice of K in the proposed constrained shortest path problems.

2 — Network Optimization with Stochastic Demand
Dohyun Pak, University of Michigan, 1205 Beal Avenue, Ann Arbor, MI, 48109, United States, pakd@umich.edu, Jussi Keppo

We optimize network flow by minimizing fictitious point-to-point costs and by using constant routing probabilities. The uncertainties in network are driven by stochastic point-to-point demands. We use the basket option pricing model to represent the point-to-point cost for the overflow on each link and describe the insight of the solution.

3 — Optimization Methods for the Inference of Queueing Network Arising from IT Systems
Zhen Liu, Research Staff Member, IBM Watson Research Center, P.O. Box 218, Yorktown Heights, NY, 10598, United States, zhenl@us.ibm.com, Petar Momcilovic, Cathy Xia, Li Zhang

One of the biggest challenges in modeling complex IT systems using queueing network models consists in the calibration of queueing network parameters such as the service requirements of various classes of customers at each station. We present an optimization framework for the inference of these parameters based on end-to-end response time measurements. Different formulations and corresponding optimization techniques are proposed to address open and closed queueing networks.

4 — Finding Maximum-Capacity Paths with Recourse
Scott Provan, Professor, OR, Univ of North Carolina, CB#3180 UNC, Chapel Hill, NC, 27599, United States, Scott_Provan@unc.edu, Rob Pratt

We study the problem of finding a maximum expected-capacity path through a stochastic network where link capacities are known only when the tail node is reached. If capacities reset randomly after each step, there is a compactly-described strategy for determining the optimal choice of arcs in the path. We give a Dijkstra-like method for finding this strategy, based on applying a primal-dual technique to the appropriate LP. All known no-reset versions of this problem are shown to be NP-hard.

■ TD02

Westin-Intl. B, 6th Floor

Economics I

Contributed Session

Chair: Maria Rosaria Alfano, University of Salerno, Via Ponte Don Melillo,1, FISCIANO, SA, 84084, Italy, mralfano@unisa .it

1 — Quality-Based Competition, Profitability and Variable Costs
Chester Chambers, Asst. Prof., Southern Methodist University, Cox School of Business, PO Box 750333, Dallas, TX, 75275, United States, cchamber@mail.cox.smu .edu, John Semple

We consider the impact of variable production costs on competitive behavior in a duopoly where manufacturers compete on quality and price in a two-stage game. We make no a-priori assumptions regarding the nature of these costs, or whether or not the market is covered. We find that slight differences in the curvature of the variable cost function produces dramatically different equilibrium outcomes, regarding the degree of differentiation, which competitor is more profitable, market coverage.

2 — Evaluation of Chinese Sustainable Development
Ming Lei, Professor, Guanghua School of Management,Peking University, Guanghua School of Management,Peking Uni, Beijing, BB, 100871, China, leiming@gsm.pku.edu.cn

In this paper,analysis of Chinese sustainable development evaluation and policy choice be made based on the integrated accounting of environment & economy. Whole paper includes three parts. 1)framework of integratedn accounts system of environmentat-economy of China and green input-output accounting be designed.2)Integrated accounting of China 1992 & 1995,estimate of Chinese green GDP and green charges be given.3)policy sugessions for China sustainable development be put forward.

3 — Demographic Structure and Stock Prices
A. M. M. Jamal, Professor, Southeastern Louisiana University, 1104 Rue Cannes, Hammond, LA, 70403, United States, ajamal@selu.edu, Shakil Quayes

This paper investigates the relationship between the demographic structure and the price of financial assets, incorporating both demand and supply factors. The results show that the proportion of the population in the prime earning age has a direct influence on stock prices. This suggests that the stock market may be negatively impacted by the projected decline in the prime earning part of the population.

4 — Does a Luxury Model Lose Luster when the Blue-Jeans Version Arrives?
William Tunnercliffe, MRC Consultants, 1102-J University Village, East Lansing, MI, 48823, United States, tunnercliffe@yahoo.com

Automobile manufacturers sometimes introduce a virtually identical clone of a luxury model at a substantially lower price. For instance, Honda introduced the 2003 Pilot which is a lower-priced version of Honda's luxury SUV, the Acura MDX. In this paper, we model whether a luxury brand loses luster when the blue-jeans version arrives.

5 — Tax Policy in a Global Framework: An Empirical Analysis on Inward FDI
Maria Rosaria Alfano, University of Salerno, Via Ponte Don Melillo,1, FISCIANO, SA, 84084, Italy, mralfano@unisa.it

Paper purpose is to detect how fiscal policy could influence FDI inflows in EEU countries. Therefore, it analyses the empirical evidence for the following hypotheses: (a) fiscal policy, level of openness index will lead to relocation of FDI to EEU countries; (b) Inflows of FDI will influence economic growth; testing the model through panel estimations within a simultaneous equation framework using a non linear regression analysis. Then we will test the same model using a Neural Networks—GMDH.

■ TD03

Westin-Intl. C, 6th Floor

Queueing Applications: Approximation and Optimization

Cluster: Practice Track
Invited Session

Chair: Cathy Xia, Research Staff Memeber, IBM T. J. Watson Research Center, P. O. Box 704, Yorktown Heights, NY, 10598, United States, cathyx@us.ibm.com

Co-Chair: Yingdong Lu, Research Staff Member, IBM Watson Research Center, Yorktown Heights, NY, 10598, United States, yingdong@us.ibm.com

1 — Diffusion Approximations for Queueing Systems with Hard Deadlines
Jim Dai, Professor, Georgia Institute of Technology, School of Industrial and Systems, Engineering, Atlanta, GA, 30332, United States, dai@isye.gatech.edu, Wuqin Lin, Zhen Liu, Cathy Xia

We consider queueing systems with jobs having hard deadlines. A job will be lost if not served by its deadline. We prove that the virtual waiting time process can be approximated by a Reflected Brownian Motion when the traffic intensity is close to 1 and the relative deadline is large. We give approximations for the steady state distribution of the virtual waiting time, the idle probability, and the loss probability, and show the accuracy of these approximations via numerical examples.

2 — Optimal Probalistic Routing for Queues with Markov Modulated Arrivals
Xin Guo, Assistant Professor, ORIE Department, Cornell University, Ithaca, NY, United States, xinguo@orie.cornell.edu, Yingdong Lu, Mark Squillante

We study the problem of routing a single stream of jobs to a parallel queueing systems. The performance measures are approximated by a Markov modulated Diffusion process with assumption of Markov modulated arrivals. Key quantities are derived through integral equation techniques. Various risk factors are also considered.

3 — A Queueing Network Approach for Application Server Configuration
Cathy Xia, Research Staff Memeber, IBM T. J. Watson Research Center, P. O. Box 704, Yorktown Heights, NY, 10598, United States, cathyx@us.ibm.com, Li Zhang, Zhen Liu, Bowei Xi

Web server systems are complicated. It is a tough problem to set the environment variables, such as the number of threads and cache sizes, etc. The objective is to search for the best parameter setting so as to maximize the system performance. We propose a nested closed queueing network approach and use approximation schemes to obtain the system throughput and user response times. Optimization methods are then used to obtain the best configuration.

4 — Developing Efficient Simulation Methodology for Approximating and Optimizing Performance Measures of Complex Queueing Networks
George Michailidis, Professor, The University of Michigan, Department of Statistics, Ann Arbor, MI, 48109, United States, gmichail@umich.edu

Simulation can provide insight to the behavior of a complex queueing systems. However, simulations of large systems are expensive both in terms of CPU time and use of available resources (e.g. processors). In this study, we present a methodological framework for designing efficient simulations for complex networks that approximate well the underlying response surface of interest (e.g. delays, backlogs) and can locate the optimal configuration of the system under study, while minimizing the required number of simulation runs. The proposed approach works in sequential fashion and combines decision trees with ideas from the field of experimental design.

■ TD04

Westin-Intl. D, 6th Floor

Best Practices in Transportation

Cluster: Practice Track
Invited Session

Chair: Ram Pandit, Georgia Pacific, Atlanta, GA, 30303, United States, RPandit@GAPAC.com

1 — Solving Transportation Related Problems with Operations Research
Pete Cheney, Yellow Transportation, Overland Park, KS, United States, Pete .Cheney@yellowcorp.com

Operations Research provides important tools to minimize costs in the competitive less-than-truckload transportation business. We will provide an overview of the use of OR tools for network design and linehaul planning at Yellow Transportation. Recent development of a scheduling tool for movements within a region will be discussed.

2 — Operations Research at Southwest Airlines
Ed Fox, Southwest Airlines Co., P.O. Box 36611, HDQ 4SY, 2702 Love Field Dr., Dallas, TX, 75235, United States, ed.fox@wnco.com

At Southwest Airlines, we strive to "do more with less" and "move with speed". The recently-formed OR Team embraces and supports these goals. This presentation discusses our Team and the problems we face as we establish ourselves and drive value into the business.

3 — Order and Load Right-Sizing in a Vendor-Managed-Inventory (VMI) Environment
David Rutan, Sr. Manager, Supply Chain Systems, Georgia-Pacific Corporation, 133 Peachtree Street, Atlanta, GA, 30303, United States, DGRutan@gapac.com, Ram Pandit

We consider the problem of determining replenishment quantities to VMI customers. The order sizes for the replenishment quantities are "optimized" to achieve "perfect" truckloads, while maintaining inventory and delivery restrictions. We present one such case with detailed operational considerations, information technology systems involved, overall solution and the results achieved.

■ TD05

Westin-Intl. E, 6th Floor

Stochastic Inventory Models

Sponsor: Applied Probability
Sponsored Session

Chair: Xiuli Chao, Professor, NC State University, Dept of Industrial Engineering, NC State University, Raleigh, NC, 27695, United States, xchao@unity.ncsu.edu

1 — Inventory Policies for Partially Observable Inventory Levels
Suresh Sethi, Professor, School of Management, Univ of Texas at Dallas, SOM, JO 4.7,, 2601 N. Floyd Rd, Richardson, TX, 75080, United States, sethi@utdallas.edu, Metin Cakanyildirim

In some inventory control contexts, such as VMI, inventory with spoilage or theft, inventory levels may not always be observable to decision makers. We study an inventory model where orders are made with partial information when the inventory level is positive (nonpositive). We establish that order sizes are nonincreasing in time elapsed since the last full observation, and provide lower bounds for order sizes.

2 — Pricing and Inventory Control in a Periodic-Review System: Optimality and Optimization of (s, S, P)
Youyi Feng, Associate Professor, Chinese University of HK, HK, Hong Kong, yyfeng@se .cuhk.edu.hk, Frank Chen

We consider the joint pricing and inventory control problem in a periodic-review setting. The demand in a period depends on both the selling price and randomness. Besides the holding and backlogging costs, stock replenishment incurs a variable-plus-fixed ordering cost. At the beginning of each period, a joint decision on stock replenishment and pricing has to be made. We find an optimal pricing and stock replenishment policy so as to maximize the long-run average profit.

3 — Inventory Competition in Make-to-Stock Systems
Saif Benjaafar, Professor and Director, University of Minnesota, Center for Supply Chain Research, Minneapolis, MN, 55455, United States, saif@ie.umn.edu, Ehsan Elahi, Karen Donohue

We present models for competition among multiple suppliers for market share from a single manufacturer. The suppliers produce to stock a homogenous product and are allocated market share by the manufacturer based on the quality of service they commit to provide. We prove the existence of a Nash equilibrium for a general class of market allocation schemes and derive several structural results.

4 — Optimality of Four-Threshold Policies in Inventory Systems with Customer Returns and Borrowing/Storage
Eugene Feinberg, Professor, SUNY Stony Brook, Stony Brook, NY, 11794, United States, eugene.feinberg@sunysb.edu, Mark Lewis

We consider an extension of the basic inventory control and cash management models so as to capture the availability of one-period storage and borrowing. We obtain four thresholds optimal policy as opposed to the two threshold result that is seen in the cash management literature. Moreover, the options to store or borrow are only used a secondary options, so that the thresholds are ordered in a nice way.

■ TD06

Westin-Intl. F, 6th Floor

Biological Applications of OR

Cluster: OR in Biology
Invited Session

Chair: Steven Shechter, University of Pittsburgh, 1048 Benedum Hall, Pittsburgh, PA, 15261, United States, sms13@pitt .edu

1 — Optimization in Protein Design under Resources Constraints
Yuval Nov, Stanford University, GSB, Stanford University, Stanford, CA, 94305, United States, yuvaln@stanford.edu, Lawrence M. Wein

We present a new stochastic spatial model for protein fitness landscape, and estimate its parameters from industrial data. We formulate, analyze, and solve various optimization problems in protein design: how to find the best variant of a protein under resources constraints.

2 — Different Approaches to Modeling the Progression of End-Stage Liver Disease
Oguzhan Alagoz, Graduate Research Assistant, University of Pittsburgh, 1048 Benedum Hall, Pittsburgh, PA, 15261, United States, oga1@pitt.edu, Cindy Bryce, Andrew Schaefer, Joyce Chang, Derek Angus, Mark Roberts

We present several approaches for modeling the changes in the clinical characteristics of an end-stage liver disease patient, such as bilirubin, creatinine, prothrombin time and albumin, which have been shown to predict pre-transplant survival and post-transplant life expectancy. Simulated results after 6 months showed changes in these variables similar to those of to the original data and the acute deterioration in clinical status occurred with equal frequency to the actual population.

3 — Dynamical Details in the Formation of Animal Dominance Hierarchies
Craig Tovey, Professor, ISYE/ Georgia Institute of Technology, School of ISyE, Georgia Tech, Atlanta, Ga, 30345, United States, ctovey@isye.gatech.edu, Ivan Chase

We collect and visually represent data from animal dominance hierarchy formation at a more detailed level than is customary. OR techniques help demonstrate the inadequacy of present-day models to explain hierarchy formation, in light of this detailed dynamical information. We briefly discuss what a more adequate model might be.

4 — Two's Company, Three's a Crowd
Craig Tovey, Professor, ISYE/ Georgia Institute of Technology, School of ISyE, Georgia Tech, Atlanta, Ga, 30345, United States, ctovey@isye.gatech.edu, Ivan Chase

We explore a broad system analysis issue in a specific context. In several experiments we find significant differences in basic dominance behaviors of isolated pairs versus pairs within small groups. Hence, interactions between pairs don't suffice as the sole unit of analysis through which dominance hierarchies are to be understood.

■ TD07

Westin-Intl. G, 6th Floor

Resource Planning

Contributed Session

Chair: Kelli Robinson, University of Oklahoma, 1121 Brandywine Ln, #5, Norman, OK, 7307, United States, krobinson@ou .edu

1 — A Tactical Planning Model for Liner Shipping Company
Xinxin Liu, Research student, National University of Singapore, #10-02 Waldorf Mansion, 235 Balestier Rd, Singapore, -, 329699, Singapore, fbap1306@nus.edu.sg, Xueming Yuan, Hengqing Ye

A mathematical model is developed to assist liner shipping companies' tactical planning procedure which covers two main issues: the containers' flow management problem and the ship deployment problem. It is suggested that the two problems should be solved concurrently at the tactical planning level rather than sequentially. It is also discussed that empty containers' flow should be managed jointly with the loaded containers' flow so as to provide an accurate instruction for ship deployment.

2 — A Simulation Study on the Selectivity of Order Acceptance Procedures in Batch Process Industries
V. Cristina Ivanescu, Technische Universiteit Eindhoven, Den Dolech 2, Postbus 513, Eindhoven, Eh, 5600 MB, Netherlands, c.v.ivanescu@tm.tue.nl, Jan C. Fransoo, J. Will M. Bertrand

Order acceptance decisions in make-to-order industries should be made such that a specified delivery reliability is achieved, while maximizing resource utilization.Selecting orders with specific characteristics to maximize resource utilization changes the mix of orders such that the expected delivery reliability is not longer.We investigate the selectivity of two acceptance policies in batch process industries.We show that selectivity is a relevant issue with high impact on delivery performance.

3 — Two-Level Disassembly Scheduling: An Exact Algorithm
Hwa Joong KIM, Ph.D. Student, Institute of Production and Robotics (STI-IPR-LICP), Swiss Federal Institute of Technology, Lausanne, VD, Switzerland, hwa-joong .kim@epfl.ch, Dong Ho Lee, Paul Xirouchakis

We consider the problem of determining the disassembly schedule of used or end-of-life products while satisfying the demand of their parts/components over a given planning horizon. The case of a single product type with a two-level structure is considered for the objective of minimizing the sum of setup and inventory holding costs. The problem is formulated as a dynamic program. Properties for optimal solutions are derived and an exact algorithm in polynomial time is suggested.

4 — Impact of Price Postponement on Capacity and Flexibility Investment Decisions
Ana Muriel, Assistant Professor, University of Massachusetts, Dept. of Mechanical and Industrial Engg., 160 Governor's Drive, Amherst, MA, 01003, United States, muriel@ecs.umass.edu, Stephan Biller, Yongmei Zhang

We study the effect of the price decision delay on the optimal investments on dedicated and flexible capacity. Computational experiments show that considering price postponement at the planning stage leads to a large reduction in capacity investments, especially in the more expensive flexible capacity, and a significant increase in profits. This effect is stronger as demand correlation grows and demand elasticity decreases.

5 — Effect of Granularity of Planning on Estimates of Resource Availability
Kelli Robinson, University of Oklahoma, 1121 Brandywine Ln, #5, Norman, OK, 7307, United States, krobinson@ou.edu, Scott Moses

Planning tasks requires determining when resources will be available. This presentation presents results of studies that explore the nature of the tradeoff between precision of planning, computational cost of planning, and accuracy of plans. The study is motivated by an application to real-time order promising.

■ TD08

Westin-Intl. H, 6th Floor

Large-Scale Simulation

Contributed Session

Chair: Christopher Poile, University of Waterloo, Management Sciences Dept. CPH, 200 University Ave. West, Waterloo, ON, N2L 3G1, Canada, cpoile@uwaterloo.ca

1 — A Simulation Model of a Sow Farm to Support Decision-Making Tasks

LluisMiquel Pla, Dr, University of Lleida, Jaume II 73, Lleida, L, 25001, Spain and Canary Islands, lmpla@matematica.udl.es, Jesus Pomar

Many times, optimisation is performed implicitly via simulation. Dynamic programming is widely used in farm management. Deterministic models are preferred in order to avoid difficulties that stochastic models can show. We propose a simulation model combining the advantages of deterministic and stochastic models. The former, to get insight into the problem to be analysed and the latter to get an overview of the variability affecting outputs. A sow herd model is presented developed in ExtendTM.

2 — Simulating Social Network Interactions in New Product Introductions

Christopher Poile, University of Waterloo, Management Sciences Dept. CPH, 200 University Ave. West, Waterloo, ON, N2L 3G1, Canada, cpoile@uwaterloo.ca, Natasha Derbentseva, Bing Ran, Frank Safayeni, P. Robert Duimering

We present a novel method of gathering organizational behaviour data and simulating their effects on the NPI process. Helpful and non-helpful inter-personal behaviours are mapped onto time savings and delays, which gives managers a graphical macro level view of their organization's social network and its impact on project performance. Examples of data and a preliminary simulation program will be demonstrated from a 2 year empirical study of a large Canadian telecom company.

3 — Simulation Models for Port Operations

Loo Hay Lee, Assistant Professor, National University of Singapore, 10 Kent Ridge, Singapore, Si, 119260, Singapore, iseleelh@nus.edu.sg, Kok Choon Tan, Ek Peng Chew

With increasing competition between port operators, it is important for a port operator to look into ways to improve its current operations, especially when heavy investment in new equipment and new technologies has been committed. Since port operations are complex, it is usually not easy and often impossible to come out with analytical models which can address the various operations planning and operational control problems . Simulation is usually the most realistic, if not the only, tool to use. In this presentation, several container port simulation models will be highlighted to show the applicability of simulation models to address the real port operation problems.

■ TD09

Westin-Vinings 1, 6th Floor

Educational Issues I

Contributed Session

Chair: Sambhavi Lakshminarayanan, Asst. Prof., Medgar Evers College CUNY, Dept of Business Administartion, 1650 Bedford Ave, Brooklyn, NY, United States, sLakshminarayanan@mec.cuny.edu

1 — Pitfalls in Predicting Student Retention in the Post 9/11 Environment

Andrew Braunstein, Hagan Sch. of Bus. - Iona College, 715 North Avenue, New Rochelle, NY, 10801, USA, abraunstein@iona.edu, Donn Pescatrice, Mary Lesser

Logistic regression analysis is often used to measure the impact of various demographic, academic, and financial factors on student retention. This presentation illustrates that it may be difficult to disentangle the impact of some of these variables from post 9/11 influences on student behavior.

2 — Student Factors Associated with the Student Evaluation of Teaching at Universities

Choonho Ryu, Professor, Hong-ik University, 72-1 Sangsoo-dong Mapo-gu, Seoul, 121-791, Korea Repof, ryuch@wow.hongik.ac.kr, Joungho Lee

This is to find student factors associated with the student evaluation of teaching at universities. Using the surveyed questionnaires in the internet evaluation of teaching, this study analyzes (1) the influences of student's grade, attendance, effort, and demographic characteristics on student satisfaction and (2) the relationship between student's grade and participation in the evaluation process.

3 — The Engineering Capstone Conference Experience at West Point

Sue Petroff, Cadet, USMA, PO Box 2934, West Point, NY, 10997, United States, Susan-Petroff@usma.edu, Troy Vaughn, James Corrigan

Each year, the United States Military Academy hosts an annual Engineering Capstone Conference. This presentation explores the structure and merits of this event, advocating it as an effective vehicle for integrating diverse engineering communities. We show how capstone venues prepare military leaders for technical work while cultivating relationships between civilian and military researchers. Past formats, topics, schedules, and issues are discussed .

4 — The Returns to Information Technologies in Education

Luisa Esteban, University of Zaragoza, FAC H.CC.SS. Teruel, Teruel, Spain and Canary Islands, luisaes@unizar.es, Ana Gargallo Castel, Mercedes Marzo Navarro, Amador Marin

This paper presents an experience undertaken with higher education students that consists in utilizing a Web Course Tool to serve as an aid in their study. We estimate the returns to this tool, measured according to the evolution of the students' results. This values are compared with students' results who have used traditional teaching methods. The statistical treatment of the data suggests the existence of significantly differences between students IT-users and no IT-users.

5 — A Management Model for Diversity Programs in Schools

Sambhavi Lakshminarayanan, Asst. Prof., Medgar Evers College CUNY, Dept of Business Administartion, 1650 Bedford Ave, Brooklyn, NY, United States, sLakshminarayanan@mec.cuny.edu

Diversity is an increasingly important issue in schools. One reason is the growing diversity of the population itself. Another is the recognition in the last few years of gender issues in the classrooms and growing interest and demand for dealing with it in the school environment.

■ TD10

Westin-Vinings 2, 6th Floor

Heuristics and AI in Financial Services

Sponsor: Financial Services

Sponsored Session

Chair: Kumar Mehta, Asst Professor, University of Connecticut, Storrs, CT, 06269, United States, kumar.mehta@uconn .edu

1 — Monte Carlo Simulation: Application to Pricing of Asian Options

Georgios Dalakouras, University of Michigan, Applied & Interdisc Math, 525 East University Ave, Ann Arbor, MI, 48109, United States, gbdalako@umich.edu

Pricing of Asian (Average) Options is one of the most challenging computational problems in finance. Asians give the ability to hedge volatile commodities and provide insurance against price manipulations. A new approach is used and a new diffusion process is studied whose terminal distribution gives the price. Monte Carlo simulation and modifications of it can be used effectively and have very attractive features. We compute the option price to illustrate the effectiveness of the new approach.

2 — Using Artificial Neural Networks to Develop an Investment Strategy in Taiwanese Stock Markets

Kuang-Hsun Shih, Assistant Professor, Chinese Culture University, 55, Hwa-Kang Road, Yang-Ming-Shan, Taipei, TW, 111, Taiwan, shihsteve@giga.net.tw, Wen-Chyuan Chiang

This study uses an artificial neural network prediction system to develop an investment strategy in Taiwanese stock markets. This system accepts trading information from major Taiwanese and U.S. indices as an input vector. The prediction system will be discussed in details.

3 — Evolutionary Mining of Trading Rules: Improving Performance Desirables through Evaluation Criterion

Kumar Mehta, Asst Professor, University of Connecticut, Storrs, CT, 06269, United States, kumar.mehta@uconn.edu, Sidh Bhattacharyya

This research presents GA-based mining of financial time series for discovery of trading rules, with a focus on role of evaluation criteria in terms of the correctness and strength of bias they introduce in the search process. Using S&P500 data, 6 criteria are proposed and evaluated in terms of performance and consistency. Leveraging GA's ability to discover multiple optima in a complicated landscape, the potential for further improvement by integrating the discovered rules is also examined.

■ TD11

Westin-Augusta 1, 7th Floor

Tutorial: Optimization for Intensity Modulation Radiation Therapy Treatment Planning

Cluster: Tutorials
Invited Session

1 — Optimization for Intensity Modulation Radiation Therapy (IMRT) Treatment Planning
H. Edwin Romeijn, Associate Professor, University of Florida, Dept. of Industrial and Systems Eng., 303 Weil Hall, P O Box 116595, Gainesville, FL, 32611, United States, romeijn@ise.ufl.edu, Ravindra Ahuja, James Dempsey, Arvind Kumar, Jonathan Li

The goal of IMRT is to cure or control cancer by delivering a prescribed radiation dose to targets while sparing healthy tissues. We discuss the role of optimization in designing high-quality treatment plans by studying the core so-called fluence map optimization problem, as well as the problems of beam angle optimization and leaf sequencing. We review various methodologies, discuss the power of LP-based approaches, and demonstrate their performance using our in-house treatment planning system.

■ TD12

Westin-Augusta 2, 7th Floor

Traffic

Contributed Session

Chair: Chandra Bhat, Associate Professor, The University of Texas at Austin, Dept of Civil Engineering, 1 University Station, C1761, Austin, TX, 78712, United States, bhat@mail.utexas.edu

1 — Factors Affecting the Variability of Traffic Flow Measures across Freeway Lanes
Angshuman Guin, Ph.D. Candidate, Georgia Tech, 331670 Georgia Tech Stn., Atlanta, Ga, 30332, United States, gte006k@prism.gatech.edu

Traffic flow measures like speed or volume usually vary over different lanes of a freeway. This study attempts to quantify the variations and relate them to geometric features of the roadway. Data for 1 month over a 12 mile segment of SR-400 near Atlanta, Georgia, is used for the study. The results are expected to be useful for calibration of freeway traffic flow models and their applications.

2 — Travel Time Estimation Using a Plug Flow Model
Emily Parkany, Assistant Professor, Villanova University, Civil and Environmental Engineering, 800 Lancaster Ave, Villanova, PA, 19085, United States, emily .parkany@villanova.edu, Kenneth Muske

We apply a chemical engineering plug flow model to real spatial and point traffic data acquired from a five mile stretch of arterial. The spatial data provides post-trip travel times. Current time estimates are obtained using point sensor data updates analogous to valve sensor inputs used in plug flow models.

3 — CEMDAP: A Comprehensive Econometric Micro-simulator of Daily Activity-Travel Patterns
Chandra Bhat, Associate Professor, The University of Texas at Austin, Dept of Civil Engineering, 1 University Station, C1761, Austin, TX, 78712, United States, bhat@mail.utexas.edu, Jessica Guo, Siva Srinivasan, Aruna Sivakumar

The growing demand for better understanding of travel behavior responses to transportation control measures has led to the need for new modeling tools using the activity-based approach. CEMDAP (Comprehensive Econometric Micro-simulator of Daily Activity-Travel Patterns) represents one of the first software development efforts to meet such need and is currently applied to a region in Texas. In this presentation we describe and demonstrate the system and also discuss the application results.

■ TD13

Westin-Augusta 3, 7th Floor

Marketing and Consumer Behavior

Contributed Session

Chair: Takuya Satomura, Associate Professor, Osaka University, Osaka University Econ, 1-7 Machikaneyama, Toyonaka,Osaka, Os, Japan, satomura@econ.osaka-u.ac.jp

1 — Instant CRM - A Simple Method for Instantly Analyzing Customers' Buying Habits
Hiroko Sukeda, Researcher, Central Research Laboratory, Hitachi Ltd., 1-280 Higashi-Koigakubo, Kokubunji-shi, Tokyo, 185-8601, Japan, hiroko@crl.hitachi.co.jp, Kazuhiro Oozeki, Chiaki Matsumoto, Masahiro Kaminaga

We developed a simple method for instantly analyzing a customer's buying habits. This method only requires a very small amount of data and can be implemented in devices with limited hardware performance such as smart cards or mobile phones. Using this method, real-time in-store analysis for identifying loyal customers is possible at low cost without communicating with a server. It improves the quality of face-to-face service at the shop and builds better relationships with customers.

2 — Understanding the Customer Base of Retailers: Relationship Between Store Loyalty and Customer Value
Emine Batislam, Assistant Professor, Sabanci University, Orhanli-Tuzla, Istanbul, TR, 81474, Turkey, batislam@sabanciuniv.edu, Yucel Saygin, Meltem Denizel

Loyalty is considered essential for the profitability of service operations. In this study, we measure the degree of store loyalty of individual customers for a retailer and form clusters based on differences in shopping patterns and customer characteristics. We then model the impact of store loyalty behaviors on customer value and utilize the model to predict the potential customer value and store switching posibility of customers.

3 — A Two-Step Process for Sales Forecasting in Retail Merchandising
Mahesh Kumar, MIT, 305 Memorial Drive, #404 C, Cambridge, MA, 02139, United States, maheshk@mit.edu, Jim Orlin, Nitin Patel

We propose a new two-step process for sales forecasting in retail merchandising. The first step estimates the seasonality coefficients using time series analysis. The second step estimates other sales parameters (price elasticity and product life cycle, for example) using linear regression. In both steps, we use clustering to pool data from similar merchandise, which improves the estimates of the seasonality coefficients and sales parameters. We show effectiveness of this technique empirically.

4 — Marketing in a More Modern Way in Developing Countries
Ngefac Foji, Student, Tafe and Sons Enterprise, Prestige Pharmacy, Buea Road, Kumba, 269, Cameroon

Marketing is defined by Frank Jeflins as a management science that seeks to identify, anticipate and satisfying consumers needs and want in a profitable manner. Information technology should be applied and the use of computer to facilitate marketing activities in the developing world.

5 — A Model to Analyze the Spatial Distribution of Customer Purchase Behavior
Takuya Satomura, Associate Professor, Osaka University, Osaka University Econ, 1-7 Machikaneyama, Toyonaka,Osaka, Os, Japan, satomura@econ.osaka-u.ac.jp

We developed a model which analyzes the spatial distribution of customer purchase behavior in a retail store. Total Amount of money he paid to a store during a period is expressed by his demographical variables and area constants using linear regression model. The problem in using a conventional approach based on linear regression model inference is that it does not take account of any spatial pattern in area constants, so we applied a Bayesian method to estimate the parameters of the model.

■ TD14

Westin-Peachtree A, 8th Floor

Product Development and Time-To-Market

Cluster: New Product Development
Invited Session

Chair: Janice Carrillo, Assistant Professor, Univeristy of Florida, 358 Stuzin Hall, Gainesville, FL, United States, janice.carrillo@cba.ufl.edu

1 — The Crucial Linkage Between Time-to-Market and Production Ramp-Up
Janice Carrillo, Assistant Professor, Univeristy of Florida, 358 Stuzin Hall, Gainesville, FL, United States, janice.carrillo@cba.ufl.edu, Richard Franza

We present a model which offers guidance regarding several key new-product development (NPD) decisions. An appropriate investment strategy in both design and production capabilities is determined to speed new products to market. The model develops the optimal time-to-market and ramp-up-time necessary to meet peak demand for the new product.

2 — New Product Strategy and Industry Clockspeed
Gilvan Souza, Assistant Professor, University of Maryland, Smith School of Business, College Park, MD, 20742, United States, gsouza@rhsmith.umd.edu, Barry Bayus, Harvey Wagner

We study the role of external industry factors (i.e., clockspeed), internal firm factors (i.e., product development, production, and inventory costs), and competitive factors in determining a firm's optimal new product introduction timing and product quality decisions. We explicitly model market demand uncertainty, and competition via an infinite-horizon Markov decision process. We find that more frequent new product introductions are optimal under faster clockspeed conditions.

3 — The Interaction of Quality, Warranty, and Price
Dilip Chhajed, University of Illinois at Urbana-Champaign, 350 Wohlers Hall, 1206 S . Sixth Street, Champaign, IL, 61820, United States, chhajed@uiuc.edu, Kunpeng Li, Suman Mallik

Warranty is important in the relationship amongst products, manufactures, and customers. Purchase decisions are often based on warranty when the true quality is unknown. Using a stylized model we seek answers to questions such as: Should a company with higher quality offer longer warranty? How a firm's prior reputation and price affect these decisions?

4 — Coordinated Product and Process Development for Multiple Product Generations
Leslie Morgan, University of Utah, 1645 E Campus Center Drive, Salt Lake City, UT, United States, mgtlm@business.utah.edu, Janice Carrillo, Ruskin Morgan, William Moore

We develop an analytical model of coordinated product and process development when there are multiple generations of a product. Critical strategic decisions include not only the quality and timing of successive product generations, but also the synchronized introduction of new production technology

■ TD15

Westin-Peachtree F, 8th Floor

Knowledge, Technology and Organization in New Product Development

Sponsor: Technology Management
Sponsored Session

Chair: Diane Bailey, Assistant Professor, Stanford University, Terman 428, MS&E Dept., Stanford, CA, 94305-4026, United States, debailey@leland.stanford.edu

1 — Organizing New Product Development Projects in Strategic Alliances
Donald Gerwin, Carleton University, Business School, Ottawa, ON, K1S 5B6, Canada, dgerwin@ccs.carleton.ca, Stephen Ferris

We use research on strategic alliances and on new product development (NPD) to study how alliances organize NPD projects. We identify at least four viable project organization options . Under varying conditions, we compare the costs and benefits of the options with respect to the underlying transaction costs, potential for learning, and contribution to developing a social relations network. We then determine the points at which costs and benefits indicate a switch from one option to another.

2 — Accelerating New Product Development with Peer-to-Peer Technologies: Some Unanticipated Consequences
Julie Rennecker, Asst. Professor, Weatherhead School of Management, Case Western Reserve University, 10900 Euclid Avenue, PBL 522, Cleveland, OH, 44106, United States, jar27@weatherhead.cwru.edu

This paper contrasts claims used to sell a peer-to-peer systems integration tool with observations of automotive NPD engineers' pre-implementation collaborative practices, illustrating the technical and organizational risks of substituting technology for "inefficient" person-mediated processes without compensating for their secondary benefits. The paper furthers our understanding of the contextualization of information as a foundation for designing and implementing NPD tools.

3 — Overcoming Barriers to Knowledge Sharing: At the Frontier of Operations Strategy
Enno Siemsen, Kenan Flagler Business School, University of North Carolina at Chapel Hill, McColl Building, CB 3490, Chapel Hill, NC, 27599, United States, Enno_Siemsen@kenan-flagler.unc.edu, Aleda Roth, Sridhar Balasubramanian

Creating knowledge is a fundamental process to generate competitive advantage. Employees are major contributors to the generation of knowledge. Besides being an asset for the company, this knowledge is also an asset for each individual employee. Employees gain value with expertise. However, employees do not always share what they know with fellow employees. We present a conceptual framework that addresses this phenomenon, and we develop scales for an empirical test of this framework.

4 — Research Issues for Reducing NPD Risk through Knowledge Management
Lynne Cooper, Jet Propulsion Laboratory, 4800 Oak Grove Drive, MS 303-310, Pasadena, CA, 91109, United States, lynne.p.cooper@jpl.nasa.gov

Knowledge management systems (KMS) offer significant potential benefits for reducing risk in new product development (NPD). The promises of improved access to relevant knowledge and increased effectiveness for managing project team information, however, have not been fully realized. Instead, systems claiming these benefits may actually introduce new risks. This work suggests a research agenda for balancing risks and benefits in the use of knowledge-based tools.

■ TD16

Westin-Peachtree G, 9th Floor

Health Applications II

Contributed Session

Chair: Patrick Ryan, Sr. Applications Systems Analyst, University of Arizona Arthritis Center, 1501 N Campbell Ave PO Box 245093, Tucson, AZ, 85724, United States, pbr@email.arizona.edu

1 — Evaluating Work Obstacles for Intensive Care Nurses
Ayse Gurses, PhD candidate, Industrial Engineering and Center for Quality and Productivity Improvement, University of Wisconsin-Madison, 2121 University Avenue, Apt#16, Madison, WI, 53726, United States, apgurses@wisc.edu, Pascale Carayon

Work Obstacles are factors in a work environment that inhibit people from optimally performing their jobs. In our research, we evaluated work obstacles faced by intensive care nurses that may hinder their capacity to provide safe, high-quality patient care. We conducted interviews with 15 nurses of a medical/surgical intensive care unit. A content analysis of the interview data is then performed and questionnaire to systematically evaluate work obstacles is developed

2 — Appointment Scheduling and Patient Flow in a Clinical Practice
Linda LaGanga, University of Colorado-Boulder, UCB 419, Boulder, CO, United States, laganga@colorado.edu, Stephen Lawrence

We analyze appointment scheduling and daily patient flow through an outpatient mental health clinic. Using empirical data, we seek the optimal time interval between scheduled psychiatric appointments to maximize patient throughput and clinic productivity while minimizing patient wait-times. Simulation experiments demonstrate the effectiveness of our methods compared to various other heuristics reported in the practitioner literature.

3 — Scheduling Outpatients in a Hospital Diagnostic Testing Center
Marie Matta, PhD candidate, Duke University, The Fuqua School of Business, Durham, NC, 27708-0120, United States, mem11@duke.edu, Salah E. Elmaghraby

The multiprocessor open shop (MPOS) scheduling problem is NP-complete. A special case of a MPOS—a proportionate one—is examined as it relates to the machine environment of outpatient testing facilities in a hospital. A three-phase algorithm is developed that determines stage capacity, selects jobs from a wait list, and schedules jobs according to the criterion of minimizing makespan. A genetic algorithm is developed to schedule jobs for the proportionate MPOS. Computational results are discussed.

4 — Development of an Information System to Support Clinical Practice and Outcomes Research
Patrick Ryan, Sr. Applications Systems Analyst, University of Arizona Arthritis Center, 1501 N Campbell Ave PO Box 245093, Tucson, AZ, 85724, United States, pbr@email.arizona.edu, David Yocum, Wm. Lesley Castro

The Outcomes Research Management Information System (ORMIS) was developed to improve data management and analysis within the Arizona Arthritis Center. A touchscreen-enabled GUI allows patients to enter information directly into the system. ORMIS provides real-time data reporting to support clinical care while also facilitating desired analyses for projects' primary objectives. More significantly, ORMIS enables data mining across all project data to identify new and emerging research needs.

■ TD17

Westin-Peachtree H, 9th Floor

Business Applications

Contributed Session

Chair: Larry LeBlanc, Professor, Vanderbilt University, Owen Graduate School of Management, 401 21st Avenue South, Nashville, TN, 37203, USA, larry.leblanc@owen.vanderbilt.edu

1 — Applicative Issues in Evaluation of Promotional Campaign Effects in Cross Sectional Data
Shkelqim Cela, Senior Statistician, InterContinental Hotels Group Inc., Three Ravinia Drive, Suite 100, Atlanta, GA, 30041, United States, jimmy .cela@ichotelsgroup.com, Zubin Dowlaty

Propensity score methods, applied in data with self-selection, are in practice non-parametric. Parametric estimation, suggested as regression solely on propensity scores, is not applied. We simulate many treatment assignment scenarios to show that this regression is not sufficient to mitigate bias. We consider propensity scores as omitted variable, add it to the model as a generated regressor to induce conditional independence in explanatories. This substantially alleviates estimation bias.

2 — Knowledge Empowers; Information Enriches
Ekhator Christian Osaze, Business Development Consultant, Zedek Resources Information Center Entre, P.O.Box 8982, Benin City, EDO State, Benin City, 234, Nigeria, icentres@yahoo.com

Information has nutritional value in business growth. It is an ingredient much needed for business to actually live, breath and experience posterity. The life of every business cells and nerves depends on relevant, accurate, timely, and evident-based business information, just as bio-organic cells depends on oxygen to live.

3 — Towards Zero Abandonments in Call Center Performance
Moshe Rosenwein, Medco Health Solutions, 100 Parsons Pond Road, Franklin Lakes, NJ, United States, moshe_rosenwein@medcohealth.com

In customer service call centers, queueing delays increase a customer's likelihood to abandon the queue. We provide a mathematical framework to evaluate the cost of abandonments. It may financially justify an investment in additional agents, empirically demonstrating that improved customer service can enhance a firm's profitability.

4 — Nu-kote International's Global Procurement
Larry LeBlanc, Professor, Vanderbilt University, Owen Graduate School of Management, 401 21st Avenue South, Nashville, TN, 37203, USA, larry.leblanc@owen.vanderbilt .edu, Michael Galbreth, James Hill, Gregory Greenwell

Nu-kote manufactures cartridges for printers, copiers and fax machines. Most cartridges are re-manufactured from empty cartridges obtained from businesses, individual consumers, and independent brokers. Cartridges are re-manufactured in Nu-kote facilities in the U.S. and China . We describe a linear programming model for minimal-cost procurement, re-manufacture, and distribution of cartridges over a multi-period time horizon.

■ TD18

Westin-Tower 1201, 12th Floor

Integration Models in Quality Engineering

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: Harriet Nembhard, University of Wisconsin-Madison, 1513 University Ave, Madison, WI, 53562, United States, hbnem@engr.wisc.edu

1 — Strategic Maintenance Decisions Using Statistical Quality Control and Optimization
Julie Ivy, University of Michigan, 701 Tappan Street, Ann Arbor, MI, United States, jsimmons@umich.edu, Harriet Nembhard

We present a methodology for monitoring and maintenance decision making for deteriorating systems under conditions of uncertainty. The methodology integrates statistical quality control (SQC) and partially observable Markov decision processes (POMDPs) through simulation in order to develop realistic maintenance policies for real-world environments. Specifically, we use advanced SQC techniques to sample and represent real-world systems. These techniques are used to define the observation distributions and structure for a POMDP. We propose a general simulation methodology for integrating SQC and POMDPs in order to develop and evaluate optimal maintenance policies as a function of process characteristics, system operating and maintenance costs.

2 — A Framework for Integrating Experimental Design and Statistical Control for Quality Improvement
Harriet Nembhard, University of Wisconsin-Madison, 1513 University Ave, Madison, WI, 53562, United States, hbnem@engr.wisc.edu

As a result of a successful case study we advance a methodology for combining design of experiments (DOE) and cumulative score (Cuscore) charts to control and monitor an industrial process subject to a feedback control scheme. We use DOE to determine the critical variable and use it as a compensating factor in a feedback controller. We derive the proper Cuscore statistic that will identify spike signals in a dynamic system that is subject to feedback control.

3 — Decision Support Tool for Preventive Maintenance Scheduling in Production Line
Max Yang, University of Michigan, 1210 H H Dow, Ann Arbor, MI, United States, maxyang@umich.edu, Jun Ni, Julie Ivy

Based on the predicted performance of individual machines, the decision support tool calculates the profit over a short-term horizon considering the interaction between production and maintenance. Schedule candidates are then optimized through Genetic Algorithm for a near-optimal decision. Simulation results from demonstrate improved performance in comparison to traditional maintenance strategies.

4 — Simulating System Behavior Under An Opportunistic Maintenance Policy
Lisa Maillart, Case Western Reserve University, 321 Peter B. Lewis Building, 10900 Euclid Avenue, Cleveland, OH, 44106, United States, Lisa.Maillart@weatherhead.cwru .edu, C. Richard Cassady

We study an opportunistic age-replacement policy for a two-component series system. A discrete-event simulation model is developed to (1) estimate the system availability function and (2) determine simple-form, cost-optimal opportunistic policies.

■ TD19

Westin-Tower 1202, 12th Floor

Reliability Research III

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@rci.rutgers.edu

1 — Exploiting Tabu Search Memory in System-Redundancy Allocation Problem
Sadan Kulturel-Konak, Assistant Professor, Penn State Berks-Lehigh Valley College, Tulpehocken Road P.O. Box 7009, Reading, PA, 19610, United States, sadan@psu.edu, David Coit, Bryan A. Norman, Alice E. Smith

We consider a constrained version of system redundancy allocation problem where the objective is to minimize system cost given overall restrictions on maximum system weight and minimum system reliability. This version of RAP carries more practical meaning since it is often used in actual engineering design problems; however, finding feasible solutions is difficult. The Tabu Search methods using adaptive penalty approach and another penalty approach from literature are compared on a test problem.

2 — Bounds on the Multistate Two Terminal Reliability
Jose Ramirez-Marquez, Rutgers University, Department of Industrial & Systems Engin, 96 Frelinghuysen Rd., Piscataway, NJ, 08854, United States, pollazo@eden.rutgers .edu, David Coit

The two-terminal reliability 2TR problem has been formulated assuming system links have a range of degraded states. Methodologies for computing multistate 2TR (M2TR) rely on obtaining minimal path/cut vectors and then computing M2TR implementing the inclusion/exclusion formula. The problem with these approaches is that even for medium sized networks computing the M2TR through inclusion/exclusion becomes problematic. Three 2TR-bounding methodologies are extended to the multistate case.

3 — Exploring the Effects of Cannibalization on Fleet Performance
Edward A. Pohl, Ph.D., Lt Col, USAF, Associate Professor, Department of Systems Engineering, United States Military Academy, West Point, NY, 10999, United States, fe6428@exmail.usma.army.mil, Stephen Orman, C. Richard Cassady

Cannibalization is the act of replacing a failed component with a functioning component from another system that is non-operational for some other reason. Cannibalization is utilized to account for shortages in the supply system and a desire to quickly return a failed system to its operational state. Cannibalization increases the maintenance burden in the field because cannibalization actions take at least twice as much time to complete when compared with a normal remove and replace action for the same component. Although cannibalization is a common practice in many industries and m military organizations, the overall effects on fleet performance are unclear. In this presentation we describe the development of a multi-echelon, closed-network, discrete event simulation model that can be used to study the impact of cannibalization and sparing policies on fleet performance.

4 — Performance Evaluation of Generalized Neural Network for All-Terminal Network Reliability Estimation
Berna Dengiz, Professor, Gazi University, Industrial Eng. Dept., Celal Bayar Bulvari, Maltepe, Ankara, 06, 06570, Turkey, dengiz@eng.auburn.edu, Fulya Altiparmak, Alice E. Smith

The calculation of all-terminal network reliability is NP-hard. In this study, an artificial neural network (ANN) is used to estimate all-terminal network reliability for networks between 10 and 20 nodes. This approach is unique in that it can accommodate networks of different number of nodes with a single ANN estimator.

■ TD20

Westin-Tower 1203, 12th Floor

Agent-Based Modeling Tools

Sponsor: Artificial Intelligence
Sponsored Session

Chair: Michael North, Deputy Director, DIS-CCASS, Argonne National Laboratory, 9700 S. Cass Ave., Argonne, IL, 60439, United States, north@anl.gov

1 — A Survey of Agent-based Modeling Tools
Michael North, Deputy Director, DIS-CCASS, Argonne National Laboratory, 9700 S. Cass Ave., Argonne, IL, 60439, United States, north@anl.gov

A wide variety of agent-based modeling and simulation (ABMS) tools are available. These tools include Ascape, DIAS, Repast, StarLogo, Swarm, and many proprietary systems. The range of available ABMS tools will be surveyed and the advantages and disadvantages of each of the major choices will be discussed.

2 — Agent-Based Modeling with Swarm
Glen Ropella, Swarm Development Group, 1325 4th Avenue, Suite 1820, Seattle, WA, 98101, United States, gepr@swarm.org

Swarm is a free, open-source software package for multi-agent simulation of complex systems that is useful for researchers in a variety of disciplines. Swarm is maintained by the Swarm Development Group (SDG). The SGD is a not-for-profit organization dedicated to advancing the state-of-the-art in multi-agent based simulation through the continued advancement of the Swarm and support of the Swarm user community. The structure, features, and capabilities of Swarm will be discussed.

3 — Using Repast for Agent-Based Modeling
Nick Collier, University of Chicago, 1155 East 60th Street, Room 049, Chicago, IL, 60637, United States, nick.collier@verizon.net, Michael North, Thomas Howe

The University of Chicago's Social Science Research Computing's RePast is a software framework for creating agent based simulations using the Java language. It provides a library of classes for creating, running, displaying and collecting data from an agent based simulation. In addition, RePast can take snapshots of running simulations, and create quicktime movies of simulations. RePast borrows much from the Swarm simulation toolkit and can properly be termed "Swarm-like."

4 — The Dynamic Information Architecture System
Kathy Lee Simunich, Argonne National Laboratory, Decision & Information Sciences Division, Argonne, IL 60439, United States, simunich@dis.anl.gov, John Christiansen

A major challenge in modeling and simulation is the need to account for the complex, dynamic, and multi-scale nature of "real-world" systems for the purpose of experimentation, problem solving and decision support. Over the past 7 years, Argonne has developed the Dynamic Information Architecture System (DIAS), an object-oriented framework with capabilities for attacking complex modeling and simulation problems.

■ TD21

Westin-Tower 1204, 12th Floor

Optimization Modeling in Practice IV

Sponsor: Computing
Sponsored Session

Chair: Bjarni Kristjansson, President, Maximal Software Inc., 2111 Wilson Boulevard, Suite 700, Arlington, VA, 22201, United States, bjarni@maximalsoftware.com

1 — Some Keys to Success for Optimization Modeling
Richard E. Rosenthal, Professor, Naval Postgraduate School, Monterey, CA, 93943, United States, rosenthal@nps.navy.mil

Practical optimization applications continue to be bigger, more complex, closer to real-time, less dependent on OR gurus, and more depended upon by organizations of all kinds. We have many great researchers and commercial implementers to thank for the remarkable advances in computers and solvers that make this possible, but there is another big part of the story, which is sometimes overlooked: good modeling practice. This talk will recommend some keys to successful optimization modeling.

2 — Using OPL to Solve Optimization Problems in Semiconductor Manufacturing
Jim Wuerfel, Optimization Program Coordinator, Intel Corporation, 5000 W. Chandler Blvd., CH3-113, Chandler, AZ, 85225, United States, james.r.wuerfel@intel.com

We discuss application areas and case studies in current LP and MIP optimization uses at Intel. Our group, Operations Decision Support Technology, has been using OPL for four years. We will also highlight some lessons learned and "tips 'n tricks" using OPL.

3 — Using MPL and OptiMax 2000 to Create Embedded Optimization Applications
Bjarni Kristjansson, President, Maximal Software Inc., 2111 Wilson Boulevard, Suite 700, Arlington, VA, 22201, United States, bjarni@maximalsoftware.com

MPL is a modeling system that allows the model developer to efficiently formulate complicated optimization models. We will demonstrate advanced indexing and data modeling techniques that are used to provide the speed and scalability required to solve large-scale models with millions of variables and constraints. We will also demonstrate how the OptiMax 2000 Component Library can be used to embed MPL models in customized end-user applications to solve real-world optimization problems.

■ TD22

Westin-Tower 1205, 12th Floor

Software Agents for Automated Decisionmaking

Sponsor: Decision Analysis
Sponsored Session

Chair: Piotr Gmytrasiewicz, CS Department, University of Illinois, Chicago, IL, 60607, United States, piotr@cs.uic.edu

1 — Decision Support Systems vs. Autonomous Agents
Piotr Gmytrasiewicz, CS Department, University of Illinois, Chicago, IL, 60607, United States, piotr@cs.uic.edu

This talk will address focus on differences, and similarites, between decision support systems, used in numerous areas of managment and autonomous agents. While the role of decision support systems traditionally has been to provide a specific service to aid a human decision-maker, the role envisioned for agents is, largely, to replace the human altogether. As such, agents have limited applicability, but offer a promising technology in areas which decision-making can be automated.

2 — Coordination and Control of Collaborative Agents Using Decentralized POMDPs
Daniel Bernstein, Computer Science, University of Massachusetts, Amherst, MA, United States, bern@cs.umass.edu

The Markov decision process (MDP) has emerged as a central model for problems of sequential decision making under uncertainty. The more general POMDP allows modeling of situations in which an agent must base its decisions on partial information. Even more general is the DEC-POMDP, which models decision making by a team of distributed agents. I explain why the decentralized problem is harder to solve, give a complexity-theoretic analysis, and survey recent work on approximation algorithms.

3 — Arming Influence Diagrams with Electronic Agents.
Jeffrey Keisler, Assistant Professor, University of Massachusetts Boston, M/5-230, 100 Morrissey Boulevard, Boston, MA, 02125, United States, Jeff.Keisler@umb.edu

How could nodes in influence diagrams command electronic agents? At the time of modeling, the result of an agent's action(s) is treated as a stochastic event(s). At the time of evaluation, agents perform tasks defined by the model and by the state of nature. Structuring the links presents challenges in programming and assessment. Agents can interact with cyberspace operating in ways analogous to probes, sensors, monitors, beacons, etc. Some decision classes seem well-suited to this application.

4 — Bidding Agents with Hard Valuation Problems
Kate Larson, Computer Science, Carnegie Mellon University, Pittsburgh, PA, United States, klarson@cs.cmu.edu, Tuomas Sandholm

We investigate deliberation and bidding strategies of agents who are limited in their deliberation capabilities by either deadlines or cost and who are participating in auctions. The agents do not a priori know their valuations for the items auctioned. Instead they devote computational resources to compute their valuations. We present a normative model of bounded rationality where deliberation actions of agents are incorporated into strategies and analyze resulting equilibria.

■ TD23

Westin-Tower 1206, 12th Floor

Linear Programming I

Contributed Session

Chair: Miguel Argaez, Assistant Professor, University of Texas at El Paso, 500 W. University Ave., El Paso, TX, 79968-0514, United States, mar@math.utep.edu

1 — Application of Network Models and Linear Programming to Locate a Facility
Maurice Levy, Universidad Anahuac, Av. Lomas Anáhuac s/n, Lomas Anáhuac, Huixquilucan, Edo. Mex., Mx, 52780, Mexico, mlevy@anahuac.mx

To offer a better service and have a competitive advantage, a company that sells purified water containers uses small vans instead of large trucks. The cost of this system is higher but it ensures easy circulation in Mexico City's heavy traffic. To reduce the costs, the company decided to open a warehouse from which it will deliver the water to clients far off from the plant. The problem to locate the warehouse was solved first using network models and then linear programming.

2 — Uniform Boundedness of a Preconditioned Normal Matrix Used in Interior Point Methods
Jerome O'Neal, student, Georgia Institute of Technology, School of Industrial and Systems Engr, Atlanta, GA, 30332, United States, joneal@isye.gatech.edu, Renato Monteiro, Takashi Tsuchiya

Solving systems of linear equations with "normal" matrices of the form AD^2A^t is a key step in computing search directions for interior-point algorithms. In this talk, we show that a well-known preconditioner for such systems produces scaled matrices with uniformly bounded condition numbers as D varies over the set of all positive diagonal matrices. We also show a stronger result for the case when A is the node-arc incidence matrix of a connected digraph with one of its rows deleted.

3 — A Primal-Dual Quasicentral Path-Following for Linear Programming
Miguel Argaez, Assistant Professor, University of Texas at El Paso, 500 W. University Ave., El Paso, TX, 79968-0514, United States, mar@math.utep.edu

We present a primal-dual path-following interior-point algorithm for linear program using the quasicentral path as a central region. This notion excludes the dual condition from the central path. The algorithm finds a solution using only the primal variable x and its complementarity variable z. The algorithm uses just one numerical factorization, AA^t, and matrix-vector multiplications in all the iterative process. We present some numerical results of large scale problems.

4 — An LP Based Distribution Network Planning Tool for a Large Pulp and Paper Manufacturer
Mariel Lavieri, Graduate Student, University of British Columbia, 2053 Main Mall, Vancouver, BC, V6TZ2, Canada, mlavieri@coe.ubc.ca, Martin Puterman, Shuya Yin

This talk describes the development, testing and implementation of a large-scale PC based optimization tool that was designed to improve the distribution system of a North American pulp and paper company. The tool determines the amount of product to send on each route and transportation mode in order to minimize total distribution costs. Its simplicity to use and expand, make it ideal for scenario and "What-If" analyses.

■ TD24

Westin-Tower 1207, 12th Floor

Information Systems

Contributed Session

Chair: Kevin Desouza, PhD Student, Department of Information & Decision Sciences, University of Illinois at Chicago, 601 South Morgan Street M/C 294, 2401 University Hall, Chicago IL 60607, United States, kdesou1@uic.edu

1 — Information Systems Outsourcing: Values, Governance Structures, and Outcomes
Shaila Miranda, Associate Professor, University of Oklahoma, Division of MIS, College of Business, Norman, OK, 73072, United States, shailamiranda@ou.edu, Yong-Mi Kim

As the focus of IS outsourcing broadens from cost to knowledge elicitation and knowledge creation, it is imperative that we understand how outsourcing relationships based on different values need to be governed. This paper examines the relationship between outsourcing objectives, initial governance via the contract, and emergent governance via social capital. Data from a survey of 139 managers of city governments will be used to test the proposed model .

2 — Analysis of Collaboration Intelligence using Shared Process Model
Namkyu Park, Purdue University, GRIS, School of Industrial Engineering, 315 N.Grant Street, W.Lafayette, IN, 47907-2023, United States, namkyup@purdue.edu, Shimon Nof

The conventional strategy for IT has been focused on improving intra-organization process and data flow. However, focuses in collaboration approach are being shifted into inter-organization and process flow. As a new approach of collaboration, shared process using workflow control is developed. We formulated/analyzed computational intelligence of this system. We also compared a standard model of shared process to a Hub and Spoke model in every way of their performance characteristics.

3 — On the Development and Quantification of Privacy-Enhancing Data Mining Methods
Jingquan Li, Dr., University of Illinois at Urbana-Champaign, 350 Wholer's Hall, 1206 South Sixth Street, Champaign, IL, 61820, United States, jli4@students.uiuc .edu, Michael Shaw

The challenge of privacy-enhancing data mining is on protecting the privacy but at the same time preparing relevant data for effective mining. We develop privacy sensitive data preprocessing techniques, including data filter, partitioning and randomization methods. We propose privacy and information loss metrics to quantifying the methods. We give an example of classification from modified data to evaluate the methods.

4 — Dynamics of Knowledge Asset Consumption: Re-Use, Re-Design or Re-Discovery
Kevin Desouza, PhD Student, Department of Information & Decision Sciences, University of Illinois at Chicago, 601 South Morgan Street M/C 294, 2401 University Hall, Chicago, IL, 60607, United States, kdesou1@uic.edu, Yukika Awazu

A specific question of interest, yet to be answered in the knowledge management literature, is what factors lead to re-use of knowledge assets found within the firm? In this paper, we propose a model to explicit knowledge consumption. We draw existing literature to portray factors that govern when knowledge assets will be re-used, re-designed, or re-discovered.

■ TD25

Westin-Tower 1208, 12th Floor

Military Applications III

Contributed Session

Chair: Mark Youngren, Principal Operations Research Analyst, MITRE, 7515 Colshire Drive, MS N250, McLean, VA, 22124, United States, youngren@mitre.org

1 — Finding Interkilling Time Probability Distribution in Stochastic Combats
Yoon Gee Hong, Professor, Hansung University, 389, 2-Ga, Samsun-dong, Sungbuk-gu, Seoul, 136-792, Korea Repof, yhong@hansung.ac.kr

A technique of finding both probability density and distribution function for interkilling times is considered and demonstrated. An important result is that any arbitrary interfiring random variables fit to this study. The numerical inversion of a particular transformation makes these possible and the results appear to be excellent. In case of ammunition supply is limited, an alternative way of getting the pdf or cdf of time to the killing is investigated.

2 — Aggregate Models of Association and Fusion with Varying Degrees of Classification
Mark Youngren, Principal Operations Research Analyst, MITRE, 7515 Colshire Drive, MS N250, McLean, VA, 22124, United States, youngren@mitre.org

Ongoing research into how sensor reports with varying levels of classification and misidentification can be fused, and how fusion supports an end-to-end model of ISR planning, collection, processing, and exploitation that drive C2 decisions will be shown. Current fusion generally works at the track level, which is not suitable for aggregated models and ignores important information such as unit composition, multiple signatures, and varying classifications. These issues will be discussed. 1. Military Applications, 2. Simulation, 3. Applied Probability.

3 — Information Fusion in Battlefield Networks
Steve Henderson, Captain, United States Military Academy, Department of Systems Engineering, West Point, NY, 10996, United States, steven.henderson@us.army.mil, Pat Driscoll

The U.S. Army is engaged in a dramatic metamorphosis that necessitates revised information fusion techniques. The presented work proposes a meta-model that can define models for conducting information fusion. This meta-model provides the abstractions for structuring low-level battlefield information into a meaningful representation of an enemy's true state. The work introduces implementations of the meta-model, and details an experiment that analyzes how the implementations predict behavior.

4 — Optimal Manpower Planning Model in a Hierarchical System
Somchai Noypitak, The George Washington University, 1776 G Street Room 162, Washington, DC, 20052, United States, noypitak@gwu.edu, Richard M. Soland

We develop and exercise a manpower planning model for a hierarchically structured organization, the Royal Thai Navy, by expressing algebraically the relationships between its recruited age distributions, attrition, recruitment, promotion and retirement. A multiple objective model for manpower planning is developed and tested to identify bottlenecks in the manpower planning operations and improve the preparation of future manpower budgets.

■ TD26

Westin-Tower 1401, 14th Floor

Data Mining I

Contributed Session

Chair: Xue Bai, PhD student, Carnegie Mellon Univeristy, the Heinz School, Pittsburgh, PA, 15213, United States, xbai@andrew.cmu.edu

1 — Acceptance Scoring for Financial Products Using Internet Application Forms
Lyn Thomas, Professor, University of Southampton, School of Management, University of Southampton, Southampton, Ha, SO17 1 BJ, United Kingdom, l.thomas@soton.ac.uk, Gimun Jung

Using the internet for delivery of financial products means the exact details of the product do not need to be defined until more information on the applicant is known. This seminar discusses three different approaches to building probability of acceptance functions over the different combinations of features available in a financial product.- logistic regression, linear programming, accelerated life modelling. The methods are applied to data from a student bank account.

2 — Support Vector Classifications by Using Total Margin Algorithms
Yeboon Yun, Assistant Professor, Kagawa University, 2217-20 Hayashi-cho, Takamatsu, Ka, 761-0309, Japan, yun@eng.kagawa-u.ac.jp, Min Yoon, Takeshi Asada, Hirotaka Nakayama

Support Vector Machines (SVMs) are popular in the machine learning theory. In pattern classification with two-class sets, main idea of SVMs is to find a linear classifier by maximizing the margin, which is the minimal distance between each data point and classifier, on the feature space. Based on the margin, this paper defines Åetotal marginÅf and suggests new algorithms using the total margin. Finally, the paper compares several support vector algorithms through numerical examples.

3 — New Model and Solution Methodology for Clustering Data Mining
Haibo Wang, University of Mississippi, P.O.Box 1588, University, MS, 38677, United States, hwang1@olemiss.edu, Bahram Alidaee, Gary Kochenberger

Clustering in data mining is intended to divide objects into groups so that objects within groups have a high degree of similarity. In the absence of capacities, many such clustering problems can be modeled as clique partitioning problems (CPP). The associated CPP model is solved by first re-casting it into the form of an unconstrained quadratic binary program (UQP) which is then solved by a tabu search heuristic. Preliminary computational experience will be presented.

4 — Learning Bayesian Network Classifier Using Tabu Search Algorithms
Xue Bai, PhD student, Carnegie Mellon Univeristy, The Heinz School, Pittsburgh, PA, 15213, United States, xbai@andrew.cmu.edu, Rema Padman

This research proposes and evaluates a two-stage algorithm of learning Bayesian network classifier for prediction by using Tabu Search strategies. Independence test is used in the first stage to select the Markov blanket nodes for the prediction node; Tabu search combined with a prequential criterion is used in the second stage to learn the structure of the Markov blanket. We apply the algorithm to healthcare data and compare it with the existing machine learning methods and measurements.

■ TD27

Westin-Tower 1402, 14th Floor

Large-Scale Parallel Integer Programming Algorithms for Real-World Applications

Cluster: Parallel Computation
Invited Session

Chair: Eva Lee, Assistant Professor, Georgia Institute of Technology, School of Industrial and, Systems Engineering, Atlanta, GA, 30332-0205, United States, eva.lee@isye.gatech.edu

1 — A Parallel IP/CP Approach to Solving the Traveling Tournament Problem
Kelly Easton, Kansas State University, 1762 King's Rd, Manhattan, KS, 66503, United States, keaston0@yahoo.com, George Nemhauser, Michael Trick

The Traveling Tournament Problem (TTP) represents the fundamental issues involved in creating a schedule for sports leagues where the amount of team travel is an issue. The solution methodology presented here is a parallel branch-and-price algorithm that uses integer programming to solve the master problem and constraint programming to solve the pricing problem .

2 — Integer Programming for Efficient Parallel Processing of Imagery Data
William Donaldson, Applied Mathematician, Donaldson Consulting, 2699 Aikin Circle N ., Lewis Center, OH, 43035, United States, wwd@cs.wisc.edu, Robert R. Meyer

A "good" partition of the original image is necessary when processing in parallel. Two metrics for measuring the quality of a partition are: amount of interprocessor communication and amount of memory each processor is required to use. Our algorithm produces good solutions as measured by either metric.

3 — Freight Routing in Less-than-Truckload Networks
Devang Dave, Georgia Institute of Technology, 332173 Georgia Tech Station, Atlanta, GA, 30332, United States, devang@isye.gatech.edu, Eva Lee, John J. Bartholdi, III

LTL carriers focus on hub-and-spoke based network models. We develop MIP model to capture all shipments routes - an accurate but intractable model. A network decomposition scheme is designed to facilitate the solution process. Solving all the MIPs associated with the sub-networks (55 terminals 2 hubs) sequentially took over 2 days. To reduce wall-clock time we extended the work in a parallel distributed environment. Issues related to parallelization and computational results will be discussed.

■ TD28

Westin-Tower 1403, 14th Floor

Global Optimization — Stochastic Agorithms

Sponsor: Optimization/Global Optimization
Sponsored Session

Chair: Zelda B. Zabinsky, Professor, Industrial Engineering, University of Washington, Seattle, WA, 98195, United States, zelda@u.washington.edu

1 — Development of Stopping Criterion for Stochastic Global Optimization
Charoenchai Khompatraporn, Ph.D. Student, University of Washington, Industrial Engineering Program, Box 352650, Seattle, WA, 98195, United States, ckhom@u .washington.edu, Zelda B. Zabinsky

A strategy that integrates a tradeoff between the algorithmic computational effort with the probability of obtaining the global optimum is developed. The strategy identifies the best number of restarts of a sequential random search to minimize computation while ensuring a statistical confidence on the optimum.

2 — Annealing Adaptive Search: Theoretical and Computational Studies
Yanfang Shen, University of Washington, Industrial Engineering, Seattle, WA, 98195, United States, shyf@u.washington.edu, Zelda B. Zabinsky

An ideal simulated annealing algorithm, annealing adaptive search (AAS), is introduced. Its efficiency to solve a general global optimization problem over a finite or a bounded continuous domain is analyzed. An algorithm based on AAS using a theoretically motivated cooling schedule is developed and computational results are presented.

3 — A Fictitious Play Approach to Large-Scale Optimization
Marina Epelman, Professor, University of Michigan, Industrial and Operations Engineering, 1205 Beal Avenue, Ann Arbor, MI, 48109, United States, mepelman@umich .edu, Theodore Lambert, Robert Smith

In this talk we examine how the game-theoretic paradigm of fictitious play can be used as an optimization heuristic for large-scale problems. We present a sampling-based approximate version of a traditional fictitious play algorithm and its theoretical convergence properties. We also discuss the distinguishing characteristics of certain large-scale optimization problems that make them well-suited for application of the resulting heuristic, illustrating with several computational examples.

■ TD29

Westin-Tower 1404, 14th Floor

Column Generation Approaches to Large-Scale Optimization Problems

Sponsor: Optimization/NonLinear Programming
Sponsored Session

Chair: E. Alper Yildirim, Department of Applied Mathematics and, State University of New York, Stony Brook, NY, 11794-3600, United States, yildirim@ams.sunysb.edu

1 — Analytic Center Cutting Surfaces Methods
Jean-Louis Goffin, Faculty of Management, McGill University, 1001 Sherbrooke Street West, Montreal, Quebec, H3A 1G5, Canada, jean-louis.goffin@.mcgill.ca, Mohammad Oskoorouchi

Convex feasibility problem in general is a problem of finding a point in a convex set, that we assume described by a separation oracle given by by second-order cone inequalities. We propose an analytic center cutting surface method to solve this problem. We discuss primal and dual settings simultaneously. Two complexity results are reported; the complexity of restoration procedure and complexity of the overall algorithm. We prove that an approximate analytic center is updated after adding a second-order cone cut (SOCC) in one Newton step, and that the ACCPM with SOCC is a fully polynomial approximation scheme.

2 — Computation of Minimum Volume Covering Ellipsoids
Peng Sun, Assistant Professor of Decision Sciences, Fuqua School of Business, Duke University, Durham, NC, 27708, United States, psun@duke.edu, Robert Freund

We present a practical algorithm for computing the minimum volume n-dimensional ellipsoid that must contain m given points $a_1,...,a_m in R^h$. This convex constrained problem arises in a variety of applied computational settings, particularly in data mining and robust statistics. Its structure makes it particularly amenable to solution by interior-point methods, and it has been the subject of much theo-

retical complexity analysis. Here we focus on computation. We present a combined interior-point and active-set method for solving this problem. Our computational results demonstrate that our method solves very large problem instances (m=3D30,000 and n=3D30) to a high degree of accuracy in under 30 seconds on a personal computer.

3 — Minimum Enclosing Balls ad Ellipsoids for Large Data Sets
E. Alper Yildirim, Department of Applied Mathematics and, State University of New York, 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 (1+epsilon)-approximation to the optimal solution, our algorithm requires the generation of at most O(1/epsilon) columns for the MEB problem and at most O(d log(d) + d/epsilon) columns for the MVEE problem in d dimensions. Extensive experimental results indicate the efficiency of our algorithm in practice on large data sets.

■ TD30

Westin-Tower 1405, 14th Floor

NLP-Interior Point Methods

Contributed Session

Chair: Jaime, Jr. Hernandez, Graduate Student, University of Texas at El Paso, Bell Hall Rm. 215, El Paso, TX, 79968, United States, jaimeh@utep.edu

1 — Analytic Center Cutting Plane Method in Conic Programming
Vasile Basescu, Rensselaer (RPI), Math Sciences, Troy, NY, 12180, United States, basesv@rpi.edu

We analyze the problem of finding a point strictly interior to a bounded, fully-dimensional set from a finite dimensional Hilbert space. We try to generalize the results obtained for the LP, SDP and SOCP cases. The cuts added by our algorithm are central and linear. We will find an upper bound for the number of Newton steps required to compute an approximate analytic center. Also, we will provide an upper bound for the total number of cuts added to solve the problem.

2 — Convergence of Infeasible-Interior-Point Methods for Self-Scaled Conic Programming
Bharath Kumar Rangarajan, Student, Cornell University, 278, Rhodes Hall,, Cornell University, Ithaca, NY, 14853, United States, bharath@cs.cornell.edu, Michael Todd

We present results on global and polynomial-time convergence of infeasible-interior-point methods for self-scaled conic programming, which includes linear and semidefinite programming. First, we establish global convergence for an algorithm using a wide neighborhood. Next, we prove polynomial complexity for the algorithm with a slightly narrower neighborhood. Both neighborhoods are related to the "infinity" neighborhood for LP and much larger than the 2-norm neighborhood.

3 — An Inexact Newton Trust Region Interior-Point Algorithm for Nonlinear Programming Problems
Jaime, Jr. Hernandez, Graduate Student, University of Texas at El Paso, Bell Hall Rm. 215, El Paso, TX, 79968, United States, jaimeh@utep.edu, Miguel Argaez, Leticia Velazquez

We present an algorithm for solving large scale nonlinear programming problems. We use interior-point methodology, a trust region globalization strategy, and the conjugate gradient method with Steihaug's ending conditions. Some preliminary numerical results are presented.

■ TD31

Westin-Tower 1406, 14th Floor

Optimization IV

Contributed Session

Chair: Dukwon Kim, Assistant Professor, University of Tennessee, Industrial Engineering, 410 East Stadium Hall, Knoxville, TN, 37996, United States, dkim@utk.edu

1 — An Inexact Newton Interior-Point Algorithm for Nonnegative Constrained Minimization
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, Roberto Saenz

We present a trust region inexact Newton interior-point algorithm for solving nonnegative constrained minimization problems. We use a new central region, proximity measure, and a new merit function to make progress towards the central region. We propose to solve the linear system using conjugate gradient method with a termination test proposed by Steihaug. Some preliminary numerical results on large scale problems are reported.

2 — The Goal Multiobjective in the Sugarcane Production Planning Problem
Edmundo Vergara, Dr. en Ciencias Matemáticas, Universidad Nacional de Trujillo, Urb . Albrecht J-402, Trujillo, Tr, 00001, Peru, edmundovergara@yahoo.es, Helenice de Oliveira, Márcia Sartori

This work proposes a mathematical model to aid variety selection and planting quantity of sugarcane in order to reduce crop residues, maximize energy generated by this residue, and satisfy all the supply of the mill. We propose Linear Programming with two conflict objectives and we solve using fuzzy technique. Both objectives one to transform to fuzzy goals then we solve using a method of Fuzzy Linear Programming.

3 — A Post-optimality Analysis Algorithm for Multi-objective Optimization
Vandana Venkat, Graduate Student, University of Illinois, 140 MEB, 1206 W. Green Street,, MC 244, Urbana, IL, 61801, United States, vvenkat@uiuc.edu, Sheldon H. Jacobson, James A. Stori

This paper introduces and analyzes the Greedy Reduction (GR) algorithm for obtaining subsets of Pareto optima from large Pareto sets in multi-objective optimization. The algorithm's implementation is based on a set-reduction and element-elimination strategy. The algorithm is proven to be optimal and executes in linear time in the worst case.

4 — A Visual Implementation of Dynamic Slope Scaling Procedure for Fixed Charge Network Flow Problems
Dukwon Kim, Assistant Professor, University of Tennessee, Industrial Engineering, 410 East Stadium Hall, Knoxville, TN, 37996, United States, dkim@utk.edu

In this talk, we present a visual implementation of the dynamic slope scaling procedure (DSSP) for fixed charge network flow problem. The DSSP is a recent algorithm for solving NP-hard combinatorial network problems by dynamically transforming a discontinuous fixed charged network problem into linear programming problems. The computational performance is promising and some computational results are discussed.

■ TD32

Westin-Tower 1407, 14th Floor

Scheduling IV

Contributed Session

Chair: Patricia Randall, Industrial Engineering Dept. Clemson University, 110 Freeman Hall, Clemson, SC, 29634, United States, pcavedo@clemson.edu

1 — A Branch-and-Cut Procedure for the Multi-mode Resource Constrained Project Scheduling Problem
Guidong Zhu, The University of Texas at Austin, Department of MSIS, CBA 5.202, Austin, TX, 78712, United States, Guidong.Zhu@phd.bus.utexas.edu, Jonathan F. Bard, Gang Yu

An exact branch-and-cut algorithm is presented for MRCPSP based on the integer linear programming formulation. Various techniques are used to reduce the number of variables and to generate cuts that tighten the LP relaxation. The solution process is accelerated by an adaptive branching scheme with a bound tightening scheme. A high level neighborhood search strategy known as local branching is included to find good feasible solutions early. Numerical results are reported for benchmark problems.

2 — Some Approximate Algorithms for Single Machine Weighted Tardiness Problem
Jozef Grabowski, Professor, Wroclaw University of Technology, Institute of Engineering Cybernetics,, ul. Janiszewskiego 11/17, Wroclaw, 50-372, Poland, grabow@ict.pwr.wroc.pl, Jaroslaw Pempera

This paper deal with the single machine total weighted tardiness problem. The problem belongs to the class NP-hard problems, what justifies searching for effective heuristics. This paper presents a collection of heuristics based on the interchange approaches as the tabu search, simulated annealing, and so-called basic and composed descending search. These heuristics are compared on a large set of test problems with the number of jobs ranging between 20 and 100.

3 — Random Keys Genetic Algorithms Applied to Dynamic Multiobjective Scheduling Problem
Uday Haral, Student, Clemson University, 807, College Avenune, Apt.#18, Clemson, SC, 29631, United States, uharal@clemson.edu, William Ferrell, Mary Beth Kurz

This research is focused on adapting the random keys genetic algorithms (RKGA) approach to solve multiobjective production scheduling problem. This study is an experimental investigation to generate the efficient frontier for such a problem using RKGA. This problem includes traditional objectives like total flowtime and non-traditional objectives like Maximum earliness and the impact of different combinations of these two different objectives on the efficient frontier is also determined.

4 — Batch Scheduling on Unrelated Die Stamping Machines with Sequence-Dependent Setups
Patricia Randall, Industrial Engineering Dept. Clemson University, 110 Freeman Hall, Clemson, SC, 29634, United States, pcavedo@clemson.edu, Mary Beth Kurz

In a die stamping environment, a job consists of multiple copies of the same part that can be divided into batches and scheduled accordingly on several different die stamping presses. Each press is purchased separately and has unique processing times and characteristics, resulting in unrelated machines. A mixed-integer programming model is given that seeks to minimize total weighted tardiness under different due dates. Motivation for modeling decisions are given as well.

■ TD33

Westin-Tower 1408, 14th Floor

Sequencing and Scheduling II

Contributed Session

Chair: Bhaba Sarker, Elton G. Yates Professor, Louisiana State University, Dept. of Industrial Engineering, 3128 CEBA Building, Baton Rouge, LA, 70803-6409, United States, bsarker@lsu.edu

1 — Integer Programming Approach to Production Scheduling for Make-to-Order Assembly
Tadeusz Sawik, Professor, AGH - University of Science & Technology, Dept. of Management, al. Mickiewicza 30, Krakow, PL, 30-059, Poland, ghsawik@cyf-kr.edu.pl

A few IP models are proposed for production scheduling in make-to-order hybrid flowshop environment with various due-date related criteria. Scheduling of divisible vs. indivisible orders are considered. For the proposed IP formulation new cutting constraints are identified. Numerical examples modeled after real-world make-to-order assembly system are provided.

2 — Production Sequencing Methods
Syed Shahabuddin, Professor, Central Michigan University, Smith 203 C, Mt Pleasant, MI, 48858, United States, shaha1s@cmich.edu

There are many sequence methods available. The simplist is the priority rules, i.e. FCFS, SPT, EDD, LPT. However, each of these has its unique uses. My paper will compare the uses of each method and compare the performace with respect to performance.

3 — Selecting Material Control Strategies for Complex Manufacturing Systems: Insights from Simulation
Rahul Shinde, Research Assistant, Center for Quick Response Manufacturing, University of Wisconsin Madison, 1513 University Avenue #267, Madison, WI, 53705, United States, rshinde@cae.wisc.edu, Rajan Suri

Our preliminary research shows that different material control strategies (MCS) such as MRP, Kanban, CONWIP and POLCA are each best suited to different manufacturing environments. However, the existing literature does not provide insights about selecting MCS for a given manufacturing environment. Our research attempts to provide a framework for selecting MCS based on system characteristics, for example, number of parts, complexity of routings, and location of bottlenecks.

4 — Modeling Routing Flexibility using State Space Representation
Denis Borenstein, Associate Professor, Federal University of Rio Grande do Sul, Av. Washingtion Luis 855, Porto Alegre, RS, 90010-460, Brazil, denisb@ea.ufrgs.br, Leonardo Rohde

This paper describes a state space representation for routing flexibility in manufacturing. Routing flexibility is represented using five different levels, using state transition graph and disjunctive normal form representations. Each representation is able to represent routing flexibility at different levels of detail. The versatility of the representation enables it to be easily linked with other analysis tools to support FMS design, operation, and control.

5 — Optimal Batch Quantity Models for Products with Rework and Scrap
Bhaba Sarker, Elton G. Yates Professor, Louisiana State University, Dept. of Industrial Engineering, 3128 CEBA Building, Baton Rouge, LA, 70803-6409, United States, bsarker@lsu.edu, Pablo Biswas

A process is considered where rework is done after N cycles of normal production. Three types of scrap production and detection methods are considered. Based on these procedures, a cost function for a single-stage imperfect manufacturing system is developed to find the optimum policy for economic inventory storage and manufacturing batch operation. Some numerical examples are provided to validate the model and a sensitivity analysis is carried out to study the general behavior of the models.

■ TD34

Mart-Room A

Routing and Scheduling of Cargo Ships

Sponsor: Transportation Science & Logistics
Sponsored Session

Chair: Alan Erera, Assistant Professor, Georgia Institute of Technology, Industrial and Systems Engineering, 765 Ferst Dr., Atlanta, GA, 30332-0205, United States, alerera@isye.gatech.edu

1 — A Ship Scheduling Problem with Flexibility in Cargo Size
Marielle Christiansen, Professor, Norwegian University of Science and Technology, Section of Managerial Economics and OR, Norwegian University of Science and Tech, Trondheim, N-7491, Norway, Marielle.Christiansen@iot.ntnu.no

We present a real short-term ship scheduling problem. It involves the design of a set of maximum profit schedules for a fleet of ships lifting contracted and optional bulk cargoes from loading ports to corresponding ports of discharge within given time windows. Each cargo consists of a quantity given in an interval range, and the variable load quantity will be determined simultaneously with the generation of schedules. Further, we present the solution approach and give computational results.

2 — Ship Routing and Scheduling for Multi-Commodity Liquid Bulk with Inventory-Constrained Time Windows
Seung-June Hwang, Graduate Student, Georgia Institute of Technology, School of Industrial and Systems Eng, 765 Ferst Drive, Atlanta, GA, 30332-0205, United States, sejhwang@isye.isye.gatech.edu, Shabbir Ahmed, Faiz Al-Khayyal

We formulate a mixed integer LP for the problem of finding a minimum cost routing schedule for a heterogeneous ship fleet engaged in pickup and delivery of liquid bulk cargoes. The solution determines the amount of each product to carry, on which ship, subject to the conditions that all ports must have sufficient products to meet demand and the stock levels of the products cannot exceed the inventory capacity of every harbor. Computational strategies for solving the model will be discussed.

3 — Routing and Scheduling of a Fleet of Multi-parcel Chemical Tankers
I A Karimi, National University of Singapore, 10 Kent Ridge Crescent, Singapore, Singapore, cheiak@nus.edu.sg, Audun S Jetlund

Efficient routing and scheduling of multi-parcel chemical tankers to reduce logistics expenditure is important for both chemical and shipping industry. We present a novel MIP formulation and a heuristic algorithm for the maximum-profit scheduling of a fleet of multi-parcel tankers engaged in shipping bulk liquid chemicals. We illustrate their performance on an industrial case study involving 10 tankers, 36 ports and 79 cargos.

4 — Inventory-Routing Problems in Sea Freight
Chung-Piaw Teo, National University of Singapore, Singapore, Singapore, bizteocp@nus.edu.sg, Mabel Chou, Miao Song

A fleet of ships are responsible for the transportation of a given commodity between a supply port and the demand ports. Their routes should be selected so that both the transportation cost and the inventory cost should be minimized. We consider two routing strategies often used in the shipping industry- the multiple ports of call and the hub-and spoke system. We compare the performance of the two systems using sample ports in the asia pacific region.

■ TD35

Mart-Room B

Inventory Management II

Contributed Session

Chair: Vernon Hsu, Associate Professor, School of Management, George Mason University, Fairfax, VA, 22030, United States, vhsu@gmu.edu

1 — Inventory Control in a Semi-Markov Modulated Demand Environment
Jie Cao, Graduate Student, University of Florida, Dept. of Industrial and Systems Eng, 303 Weil, P.O. Box 116595, Gainesville, FL, 32611-6595, United States, jiecao@ufl.edu, H. Edwin Romeijn

We consider stochastic continuous-time inventory control for a single item. The demand process is governed by a semi-Markov chain. The state of this chain identifies the rate of a Poisson process for the demands. We show that a myopic policy is optimal if inventory holding and penalty costs are linear, and products can be purchased or returned at a single price. We also derive conditions on the semi-Markov chain under which the return option will never be used.

2 — Demand Variability under Batch Ordering
Xiaoming Li, Visiting Assistant Professor, Tennessee State University, 330 10th Ave. North, Nashville, TN, 37203, United States, xli1@tnstate.edu

The main objective of this study is to identify how demand information in supply chains is transformed under the batch ordering. Using probability models, this study first shows how customer demand is transformed to the facility's orders. Then it examines how this transformed demand information affects the supplier's replenishment behavior. Our results show that the batch ordering distorts demand information and, in turn, downgrade upstream suppliers performance.

3 — Capacitated Inventory Systems with Dual Supply Modes
Senthil Veeraraghavan, Carnegie Mellon University, #27 GSIA CMU, Pittsburgh, PA, 15213, United States, senthilv@cmu.edu, Alan Scheller-Wolf

We examine a capacitated backordered periodic-review single stage inventory system where replenishment occurs either by a regular channel or a premium channel with smaller lead-time. We introduce and evaluate the class of dual-index policies, showing how to efficiently find optimal parameters when either one or both channels have a finite capacity. We then compare costs when different modes are capacitated, highlighting how capacity limits affect performance .

4 — Improved Base-Stock Policies Under Order Crossover
James Bradley, Assistant Professor, Cornell Univeristy, 321 Sage Hall, Johnson Graduate School of Mgmt, Ithaca, NY, 14853-6201, United States, jrb28@cornell.edu, Lawrence Robinson

Inventory levels must be set using inventory shortfall rather than lead-time demand when order crossover is possible. A Normal approximation of the shortfall distribution, such as is used with lead-time demand, has heretofore been difficult because it depends on the variance of the number of orders outstanding, the computation of which is cumbersome and requires substantial information. This paper makes the Normal shortfall approximation tractable by computing bounds on this variance.

5 — Approximation and Bounds for an Economic Lot Size Problem with Economies of Scale Costs
Vernon Hsu, Associate Professor, School of Management, George Mason University, Fairfax, VA, 22030, United States, vhsu@gmu.edu

The costs in many business situations exhibit economies of scale in which the average unit cost decreases as the volume increases. In this study, we develop efficient procedures with guaranteed worst case bounds to solve an economic lot size problem with economies of scale production, inventory and backlogging costs.

■ TD36

Mart-Room C

Healthcare Operations

Sponsor: Manufacturing and Service Operations Management
Sponsored Session

Chair: Edieal Pinker, University of Rochester, Simon School of Business, Rochester, NY, United States, PINKER@simon .rochester.edu

1 — Organizational Learning from Operational Failures
Anita Tucker, Harvard Business School, Morgan T80, Boston, MA, 02163, United States, atucker@hbs.edu

I examine two approaches for removing underlying causes of operational failures. Individual-based problem solving emphasizes maximizing individual employees' motivation to resolve failures whereas system-based problem solving emphasizes designing processes to support coordinated, team-based efforts. Survey data from 55 nursing units found that units with higher levels of system-based problem solving had higher job satisfaction.

2 — Predicting Waiting Times at LAC Emergency Room
Sriram Dasu, University of Southern California, Marshall School of Business, IOM, Los Angeles, CA, 90089, United States, Dasu@marshall.usc.edu

In this work we develop models for predicting waiting times for patients at the Los Angeles county emergency center. There are multiple classes of patients. On occasion the waiting times can be as long as 15 hours. Our goal here is to develop a system for predicting waiting times.

3 — Rolling-Horizon Planning for Medical Appointments
Vera Tilson, PhD Candidate, Weatherhead School of Management, CWRU, 10900 Euclid Avenue, Cleveland, OH, United States, vxt15@weatherhead.cwru.edu, Lisa M. Maillart

We consider the problem of how to schedule advance-appointments in a medical office. We assume that: (1) daily demand for appointments is uncertain; (2) the longer the time till appointment the more likely the patient is to be a "no-show"; (3)the overtime capacity of the office is constrained. We model this decision making process as a profit-maximizing stochastic dynamic program and discuss numerical and structural results.

4 — Economies of Scale in Primary Care Physician Offices?
Edieal Pinker, University of Rochester, Simon School of Business, Rochester, NY, United States, PINKER@simon.rochester.edu

We present preliminary results of an emprical study of primary care physician offices. In this study we try to identify the organizational and process variables that influence the profitability of a physician practice.

■ TD37

Mart-Room D

Dynamic Programming/Control

Contributed Session

Chair: Dr. Nasreddine Saadouli, Assistant Professor, American University in Dubai, PO Box 28282, Dubai, DB, United Arab Emirates, nsaadouli@aud.edu

1 — An Alternative Dynamic Approach for Scheduling a Preventive Maintenance
Seong Jong Joo, UPS Foundation Postdoctoral Fellow, University of Louisville, CBPA Room #188, Louisville, KY, 40292, United States, sludoc95@hotmail.com, Hokey Min

A preventive maintenance is repetitive over the lifetime of a system and should be performed within a certain interval that is not allowed to extend. Dynamic programming (DP) for scheduling the preventive maintenance is initially solved with linear programming. However, the approach requires extensive knowledge and experience about DP for each time and is not appropriate for practitioners without expertise. We suggest an alternative approach that is easy to solve by practitioners.

2 — Statistical Techniques for Estimating High Dimensional Value Functions in Dynamic Programming
Warren Powell, Professor, Princeton University, Dept of Opns Res and Financial Eng'g, Princeton, NJ, 08540, United States, powell@princeton.edu, Abraham George

We address the problem of statistically estimating the value of an asset with complex attributes that arise in stochastic asset allocation problems. We use Monte Carlo methods to estimate the values of individual assets, and then improve the statistical reliability by taking a weighted average at different levels of aggregation. Optimal weights, which capture the correlations between estimates, are compared with simpler formulas.

3 — SGDDP: Stochastic Generalized Dual Dynamic Programming Theory
Jesus Velasquez Bermudez, Director CITAD, Universidad de La Sabana, Campus Puente El Común-Chìa, Bogotá, DC, Colombia, jvelasquez@decisionware-ltd.com

The work presents theoretical considerations about the solution of stochastic dynamic optimization problems integrating the Benders Theory with the Dynamic Programming approach and with the concepts of Control Theory. The so called Generalized Dual Dynamic Programming Theory (GDDP), developed by Velasquez, can be considered as an extension of two previous approaches known as Dual Dynamic Programming (DDP): The first is the work developed by Pereira and Pinto [2] [3] [4] which was revised by Velásquez, Restrepo and Campo. The second is the work developed by Read and others. Additionally, it can be considered as a specialization of the called Nested Benders Decomposition techniques (Ruszczynski and Birge).

4 — Multistage Stochastic Model for a Multipurpose Water Reservoir with Target-Priority Operation
Dr. Nasreddine Saadouli, Assistant Professor, American University in Dubai, PO Box 28282, Dubai, DB, United Arab Emirates, nsaadouli@aud.edu, Chanaka Edirisinghe

In this paper, we consider the same problem presented in Edirisinghe et al.(2000). However, we develop a multistage stochastic programming recourse model that recognizes a release policy that is adapted to the uncertainty in the problem for shorter time periods. It is solved using stochastic dynamic programming (SDP) ideas but with customized algorithms that exploit the problem structure for a more efficient solution. A detailed analysis of the results and a simulation analysis are presented.

■ TD38

Mart-Room E

Military Logistics

Sponsor: Transportation Science & Logistics
Sponsored Session

Chair: Mahyar Amouzegar, Professor and OR Specialist, RAND Corporation, 1700 Main Street PO Box 2138, Santa Monica, CA, 90407, United States, mahyar@rand.org

1 — A Math Programming Model for the Reconstitution of US Air Force War Reserve Materiel
Ronald McGarvey, Associate Operations Researcher, RAND, 201 N Craig St, Pittsburgh, PA, 15213, United States, ronm@rand.org, Ed Chan, Mahyar Amouzegar, Bob Tripp

This paper examines alternative postures for the US Air Force global network of Forward Supply Locations for War Reserve Materiel. A math programming model is developed that selects the minimum cost FSLs from a candidate list and allocates WRM to these FSLs, subject to a scenario-specific set of time-restricted demand constraints. A series of computational tests is performed on potential conflict scenarios to identify sets of robust FSLs and to evaluate alternative reconstitution schemes.

2 — Utilizing Patterns in US Military Interventions to Improve Logistics Decision Making
John Bell, Assistant Professor, Air Force Institute of Technology, AFIT/ENS, Wright-Patterson AFB, OH, 45433, United States, John.Bell@afit.edu

Variables such as oil, religion and democracy appear to contribute to the US decision to intervene in a conflict between states. This research proposes a list of variables that might impact intervention decisions and puts forth a neural network approach for analyzing the underlying relationships present in existing conflict data. Preliminary results indicate that a reasonably small number of variables can be used to predict US conflict intervention.

3 — Vendor Selection and Order Quantity Allocation in Volume Discount Environments
Eddine Dahel, Associate Professor of Operations Management, Monterey Institute of International Studies, 460 Pierce Street, Monterey, C, 93940, United States, edahel@miis.edu

This article presents a multiobjective mixed integer programming approach to simultaneously determine the number of vendors and the order quantities to allocate to these vendors in a multiple-product, multiple-supplier competitive sourcing environment. The selection process is driven by the price, delivery, and product quality objectives of the buyer and subject to the capacity constraints of the vendors.

■ TD39

Mart-Room F

Supply Chain Management I

Contributed Session

Chair: Thomas Willemain, Vice President, Smart Software, Inc., 4 Hill Road, Belmont, MA, 02478-4349, United States, willet@rpi.edu

1 — A Heuristic Approach for the Inventory Routing Problem with Backorders
Tamer Abdelmaguid, Ph.D. Candidate, University of Southern California, Department of Industrial and Systems Eng, 3715 McClintock Ave. GER 204, Los Angeles, CA, 90089, United States, abdelmag@usc.edu, Maged Dessouky, Fernando Ordonez

We study the inventory routing problem with backorders. We consider the case in which demand at each customer is relatively small compared to the vehicle capacity and customers are closely located so that a consolidated shipping strategy is appropriate. We present a lower bound generation technique based on Benders' decomposition and propose a heuristic approach to solve the problem.

2 — A Constraint-Based Method for Inventory-Service Optimization in a Push/Pull Manufacturing Process
Heng Cao, Staff Software Engineer, IBM Research, 1101 Kitchawan Road, Rte. 134/PO Box 218, Yorktown Heights, NY, 10598, United States, hengcao@us.ibm.com, Feng Cheng, Stephen Smith

We describe a constraint based method for inventory optimization in a Push/Pull manufacturing process. Capacity constraints as well as the service requirement are considered. The necessary conditions for the optimal production plan are established first, which serve as the starting point of our algorithm. Then heuristic is applied to solve the capacity constraint violations. The optimality can be proved through showing the heuristic satisfying the Bellman equation in a Markov Decision Process.

3 — A Pruning Rule for the Hormozi-Khumawala (HK) Multi-period Facility Location Algorithm
Jaydeep Balakrishnan, Associate Professor, University of Calgary, Haskayne School of Business, Operations Management Area, Calgary, AB, T2N 1N4, Canada, balakris@ucalgary.ca

This rule can be used to reduce the number of candidate single period location configurations to be examined in the H-K algorithm. An important feature of theproposed rule is that very little additional computation is required in order to apply it. The rule is illustrated using one of the examples in the previously published paper. Finally an experiment is also conducted to examine the effectiveness of the proposed rule under different conditions.

4 — An Approximation Procedure for a Non-Linear Mixed Integer DC Location Problem
Balram Avittathur, Assistant Professor, IIM Calcutta, 427 E Magnolia Avenue, Apt # 33, Auburn, AL, 36830, United States, balram_a@hotmail.com, Janat Shah, Omprakash Gupta

A DC location problem is formulated for differential sales tax structure. It is a Non-Linear Mixed Integer Problem (NLMIP) owing to the safety stock inventory cost in the objective function. Owing to complexity of solving the NLMIP, an MIP approximation of the NLMIP is proposed. By simulating different parameter values, the exact and approximate formulations are compared. The difference between the optimal solutions of the NLMIP and its approximation were found to be in the zero to 0.36% range.

5 — A New Technology for Forecasting Intermittent Demand for Service Parts
Thomas Willemain, Vice President, Smart Software, Inc., 4 Hill Road, Belmont, MA, 02478-4349, United States, willet@rpi.edu, Charles Smart

Intermittent or slow-moving demand is a multi-billion dollar challenge for service parts inventory planners. Setting accurate stocking levels can save millions of dollars while simultaneously improving customer service. We define intermittent demand, compare traditional methods to forecast it and set stocking levels, explain a new patented methodology based on the bootstrap, and present case studies about how companies using the methodology improved forecast accuracy and inventory planning.

■ TD40

Mart-Room G

Pricing and Procurement Strategies

Cluster: Supply Chain Management
Invited Session

Chair: David Simchi-Levi, Professor, MIT, 77 Massachusetts Ave, Bldg 1-171, Cambridge, MA, United States, dslevi@mit.edu

Co-Chair: Julie Swann,Assistant Professor, Georgia Institute of Technology, School of Industrial and Sys Engineering, 765 Ferst Drive, NW, Atlanta, GA, 30332, United States, julie.swann@isye.gatech.edu

1 — Multi-Period Models with Capacities in Competitive Supply Chain
Georgia Perakis, Sloan Career Development Associate Professor, Sloan School MIT, 50 Memorial Drive, Sloan School, E53-359, Cambridge, MA, 02139, United States, georgiap@mit.edu, Marina Zaretsky

This talk considers a competitive, multi-period supply chain setting with several competing suppliers and a single retailer. Our model allows inventories and capacity expansions at an additional cost. We characterize equilibrium policies and consider coordination mechanisms.

2 — A Framework for Evaluating Capacity Flexibility & Postponement Strategies in Retailing
Naren Agrawal, Santa Clara University, OMIS Department, Santa Clara, CA, 95053, United States, nagrawal@scu.edu

While the idea of postponement has been discussed and implemented by a number of companies in the high-technology industry, it is relatively new to the apparel retailing industry. In this presentation, we will discuss a methodology that was developed to quantify the potential value of implementing postponement in conjunction with a contract for flexible production capacity between an apparel retailer and its vendor. Key managerial insights are also summarized.

3 — Stochastic Cash Balance Problem with Fixed Cost
Xin Chen, MIT, 77 Mass Ave, Bldg E40-149, Cambridge, MA, 02139, United States, xchen@mit.edu, David Simchi-Levi

The stochastic cash balance problem is a periodic review inventory problem face by a firm in which the customer demands may be positive or negative. In particular, the firm may decide to replenish the inventory or return excess stock. We show how the concept symmetric K-convexity introduced by Chen and Simchi-Levi for the joint inventory and pricing problem can be used to provide a characterization of the stochastic cash balance problem.

4 — Optimizing Planned Order Lead Times under Lead-Time Sensitive Demand
Bibo Yang, University of Florida, 303 Weil Hall PO Box 116595, Gainesville, FL, 32611, United States, yangbibo@ufl.edu
Joseph Geunes

Planned order lead times impact a supplier's forecast accuracy and inventory-related cost. Suppliers may extract cost benefits from longer lead times, which permit increased reaction time. A supplier's expected demand, however, often decreases as a function of planned order lead time. We consider the tradeoff between revenues and costs in determining optimal planned order lead times for a supplier facing its own procurement lead time and lead-time sensitive demand.

■ TD41

Mart-Room H

Supply Chain Management V

Contributed Session

Chair: Mehmet Barut, Assistant Professor, Wichita State University, 1845 Fairmount Box 77, Wichita, KS, 67260-0077, United States, Mehmet.Barut@wichita.edu

1 — Integrated Supply Chain Strategic Optimization using MIP and ABC
Javier Holguin de la Cruz, PhD Candidate, New Mexico State University, P.O. Box 4147, Las Cruces, NM, 88003, United States, javholgu@nmsu.edu

We are developing a single-period multi-echelon deterministic MIP optimization model applied to a international automotive production-distribution logistics network, including suppliers, manufacturers, distribution centers (inbound/outbound), and customers. The model utilizes estimated activity-based costing (ABC) data from a traditional managerial accounting system. Main processes are characterized with the potential to provide feedback to an activity-based management (ABM) function.

2 — Synchronization of Procurement Production-Delivery Policy In a Single Warehouse and Multiple Plants
Taebok Kim, graduate student, Pohang University of Sciecence and Technology, San 31, Hyoja-dong, Nam-gu, Pohang, Kyungbuk, 790-784, South Korea, tbkim@postech.ac .kr, Yushin Hong

The synchronized procurement-production-delivery activity is one of important factors to get competitive collaboration benefits between the manufacturer and the retailer(s). Each plant makes products and transfers them to a single central warehouse by the constant production and transfer rate. Retailer requests equal-size delivery quantity from a warehouse. We propose solution procedure to find optimal producton-delivery policy to allocate batch production quantity to multiple plants.

3 — Supply Network Strategy: A Framework and Tool
Choy Leong Yee, Researcher, Cambridge University, Institute for Manufacturing, Mill lane, Cambridge, CB, CB2 1RX, United Kingdom, cly25@cam.ac.uk, Kim Hua Tan

Managing a supply network is of great importance to both manufacturers and distributors. So far, little is available to guide managers in monitoring the network performance. This paper proposes a framework and tool to address this gap. The tool enables managers to visualise the performance of a supply network in such a way that it is easy to understand and communicate, that unlock the creativity of participants. A case study is used to illustrate the application of the tool.

4 — Measuring Supply Chain Connectedness: A Communication Structure Approach
Mehmet Barut, Assistant Professor, Wichita State University, 1845 Fairmount Box 77, Wichita, KS, 67260-0077, United States, Mehmet.Barut@wichita.edu, Ahmet Ozkul

Achieving high global supply chain performance requires full commitment of information sharing. The literature lacks the attention on how differently information can be shared and measured. Considering each supply chain relationship as a separate network, a methodology is presented for a focal company to measure the degree of its connectedness with the others. Measurements developed can be useful in establishing and coordinating healthy communication lines or in reducing the Bullwhip effect.

■ TD42

Mart-Room I

Revenue Management I

Contributed Session

Chair: Opher Baron, MIT, 30 Wadsworth St. E53-356, Cambridge, MA, 02142, United States, opher.baron@sloan.mit .edu

1 — Application of Seat Inventory Control to Intercity Passenger Rail
Shintaro Terabe, Kochi Univ. of Tech., Dept. of Infra. Sys. Eng., Tosayamada, Kochi, 7828502, Japan, terabe.shintaro@kochi-tech.ac.jp, Saratchai ONGPRASERT, Masahiko MIZUGUCHI

We intend to apply revenue management to inter-city railway transportation so as to investigate the optimal allocation of seats for each passenger who has different origin and destination pairs. Passenger demand is derived from conjoint analysis which modelled passenger's preference on different fare class. Results show that all indices such as load factor, number of rejected call for reservation, and revenue for operating company are improved than that without control .

2 — Network Control through Resource Pricing
Bobby Ninan, Graduate Student, North Carolina State University, 308 Daniels, 111 Lampe Drive, Raleigh, NC, 27695, United States, bmninan@ncsu.edu, Mihail Devetsikiotis

We model the network - user interaction as a pricing mediated Stackelberg game. The network sets the market price for bandwidth which the users employ to allocate the resources through a noncooperative game. The distributed version of the user game is then analyzed for a finite buffer scenario. We show the conditions under which the network-user game would be the dual of one another and propose an algorithm for achieving system optimality.

3 — Characterizing the Output Process of Token Bucket Admission Controls
Opher Baron, MIT, 30 Wadsworth St. E53-356, Cambridge, MA, 02142, United States, opher.baron@sloan.mit.edu, Gabriel Bitran

The characterization of the output streams from token bucket and token bucket with rate control admission-controls is required for their implementation as pricing schemes. This is identical to the steps of one-or two-sided regulated random walks, which also characterize the steady state behavior of inventory level under loss-sales or backlog models. Combining results from sequential analysis and Brownian motion provides approximations for the probabilistic characterization of these streams.

4 — Competitive Dynamic Pricing Model with Multiplicative Demand
Soheil Sibdari, Student, Virginia Tech, 223 Durham, Blacksburg, VA, 24060, United States, ssibdari@vt.edu, Kyle Lin

We develop a competitive dynamic pricing model where two sellers sell their perishable products over a finite time horizon. We use the multinomial logit model to describe the consumer choice behavior. We show the existence of a Nash equilibrium and apply it to a numerical example.

■ TD43

Mart-Room J

Auctions I

Contributed Session

Chair: Kendra Taylor, Georgia Institute of Technology, 765 Ferst Drive, Atlanta, GA, United States, ktaylor@isye .gatech.edu

1 — An Algorithm for Divisible Object Auctions
Natalia Santamaria Tobar, Research Assistant, Universidad de los Andes, Industrial Engineering, CGSR, Bogota, DC, A.A. 4976, Colombia, n-santam@uniandes.edu.co, Fernando Beltran, Andres Medaglia

We introduce an algorithm that finds the optimal assignment in a divisible object auction. The algorithm uses the decomposition principle and a column generation technique that allows an efficient implementation in large-scale environments. We simulate different payment rules using data from the Colombian Treasury bonds' auctions (i.e., large amount of debt). These experiments allow us to analyze the behavior of the auctions and also provide grounds for comparing their efficiencies.

2 — Modeling Bidder Strategies in Sequential Business-to-Business Auctions
Kendra Taylor, Georgia Institute of Technology, 765 Ferst Drive, Atlanta, GA, United States, ktaylor@isye.gatech.edu, Wedad Elmaghraby, Paul Griffin, Joel Sokol

Electronic auctions allow for economic discovery in business-to-business (B2B) transactions. Motivated by the pulp and paper industry, we aid procurement management in economic decisions while exploring the less-studied area of auction theory where individual buyers and suppliers initiate auctions sequentially and receive financial and informational benefits.

3 — Stochastic Modeling of Business-to-Consumer Online Auctions
Fredrik Odegaard, PhD student, Sauder School of Business, University of British Columbia, 2053 Main Mall, PhD lounge, Vancouver, BC, V6E2E5, Canada, odegaard@sauder.ubc.ca, Martin Puterman

In this paper we set out to model buyers' behavior in B2C online auctions. More specifically we are focusing on companies selling commodities using a fixed time auction format, eg eBay store. The objective of the paper is to develop a model that 1) incorporates that buyers' valuation may dynamically change with the progression of the auction, 2) accounts for that interested buyers do not have to bid through out the auction in order to indicate their willingness to pay the current going price.

■ TD44

Mart-Room K

Joint Session AAS/TSLS: Crew Management

Sponsors: Aviation Applications, Trans. Science & Logistics
Sponsored Session

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

1 — Integrated Crew Recovery
Goran Stojkovic, Optimization Team Leader, SBS International, 444 Park Avenue South, New York, NY, 10016, United States, gstojkovic@sbsint.com

Integration of different subsystems of an airline is possible on multiple levels: data, decision support, planning, operations. We present a global overview of sequential and parallel integrations focusing on Crew Recovery as a part of Integrated Airline Operation Center. Crew recovery, a most difficult part of an airline recovery system, requires a scalable approach to solve different levels of irregularity in an acceptable period of time. Some models with preliminary results will be presented.

2 — Solving Integrated Aircraft Routing and Crew Scheduling Problem by Benders Decomposition
Huei Chuen Huang, Associate Professor, National University of Singapore, 1 Engineering Drive 2, Singapore, SG, 117576, Singapore, isehhc@nus.edu.sg, Rongheng Li, Zhe Liang

This paper uses the Benders decomposition to solve the integrated aircraft routing and crew scheduling problem. Reversing the conventional approach, we consider the crew scheduling as the Benders master problem while the aircraft maintenance routing as the sub-problem. Ways to generate feasibility cuts and a framework for the implementation are proposed. The approach is substantiated with extensive computer runs.

3 — Solving Crew Augmented Pairing Problems using Column Generation
Curt Hjorring, Carmen Systems, Odinsgatan 9, Gothenburg, SE, 411 03, Sweden, curt .hjorring@carmensystems.com

Crew augmentation is a variant of the pairing problem in which the number of crew operating each flight is a decision variable. Depending on union and safety rules, the rest times between flights can sometimes be reduced by adding extra crew. Even though there are additional costs associated with the extra crew, it may still be advantageous to operate with additional crew, due to the efficiency improvement from the reduced rest times. Models are compared on real world problems.

■ TD45

Mart-Room L

Multicriteria Decision Making II

Contributed Session

Chair: Funda Samanlioglu, Clemson University, Department of Industrial Engineering, Clemson, SC, United States, fsamanl@clemson.edu

1 — A Biobjective Method for Sample Allocation in Stratified Sampling
Emilio Carrizosa, Universidad De Sevilla, Matematicas. Reina Mercedes S/N, Sevilla, 41012, Spain and Canary Islands, ecarrizosa@us.es, Dolores Romero-Morales

The two main and contradicting criteria guiding sampling design are accuracy of estimators and sampling costs. In stratified random sampling, the sample size must be allocated to strata in order to optimize both objectives. In this talk we address, following a biobjective methodology, this allocation problem.

2 — Multicriteria Decision Support for Customer-Concurrent Robust Design
Madhumohan S Govindaluri, Graduate student, Clemson University, Department of Industrial Engineering, 203, Freeman Hall, Fernow cafe street, Clemson, SC, 29634, United States, mgovind@clemson.edu, Sangmun Shin, Jay-wan Kim

Robust design is a popular methodology for quality improvement. Most robust design models consider a single quality characteristic, although customers often judge a product based on more than one quality characteristic. This research investigates robust design model for multiple characteristics in a multicriteria decision-making framework. The proposed model enables integration of customer preferences into the robust design model that are often ignored in existing robust design models.

3 — Examining Heterogeneity in Group Judgments with Stochastic Multi-Criteria Decision-Making Methods
Eugene Hahn, Salisbury University, 1101 Camden Ave, Salisbury, MD, 21801, United States, edhahn@salisbury.edu

Stochastic multi-criteria decision-making methods offer some advantages over their classical deterministic counterparts. Chief among these is the ability to test inferential hypotheses regarding the alternatives under consideration. This allows a decision maker to understand whether he or she can be 95% confident that one alternative is judged to better than another in the presence of errors in judgments. However, this type of inferential test is not the only one which can be developed. It is also possible to empirically test whether members of a group of decision makers exhibit heterogeneity in judgments with regard to a particular decision task. A Bayesian approach is adopted. The implications of the method for group decision making are discussed.

4 — Random Keys Genetic Algorithm for a Symmetric Multi-Objective Traveling Salesman Problem
Funda Samanlioglu, Clemson University, Department of Industrial Engineering, Clemson, SC, United States, fsamanl@CLEMSON.EDU, Sarat Tangudu, Mary Beth Kurz, William G. Ferrell, Jr.

In this paper we solve a specific multiple objective traveling salesman problem taken from the literature using a weighted Tchebycheff program and the random keys genetic algorithm. We investigate the use of inversion as a genetic operator. Local search is included to capitalize upon the good solutions to this problem found by the random keys genetic algorithm. Computational results are discussed.

4 — Preference-Nondominated Solutions in Combinatorial Multi-Citeria Problems
Murat Koksalan, Professor, Middle East Technical University, Industrial Engineering, Ankara, 06531, Turkey, koksalan@ie.metu.edu.tr, Selcen Pamuk Phelps

We propose an evolutionary metaheuristic for approximating the preference nondominated solutions of a decision maker in multiobjective combinatorial problems under partial preference information. We present simulation results on the Multiobjective Knapsack Problem and the Multiobjective Spanning Tree Problem.

■ TD46

Mart-Room M

E-Commerce

Contributed Session

Chair: Cuihong Li

PhD Student, GSIA, Carnegie Mellon University, 5000 Forbes Ave, Pittsburgh, PA, 15213, United States, cuihong@andrew.cmu.edu

1 — A Framework for the Identification of Electronic Commerce Design Elements that Enable Trust
Todd Stephens, Doctoral Candidate, Nova Southeastern University, 8450 Hwy 54, Sharpsburg, GA, 30277, United States, rstephen@nova.edu

Trust plays an important role in any customer relationship or transaction. This is especially true in the world of commerce. Buyers and sellers must make the conscious decision whether or not to trust the other party. With the emerging use of the Internet as a business medium of exchange, trust maintains an important role in electronic commerce. This research reviews the impact of visual design elements on the emotion of trust within an online environment.

2 — Impact of Inter-Organizational Systems on Organizational Scope
Ramesh Sankaranarayanan, Doctoral Candidate, NYU Stern School of Business, 44 W.4th Street, KMEC 8-181, New York, NY, 10012, United States, rsankara@stern.nyu.edu, Arun Sundararajan

We model a multi-tier industry structure with downstream finished-goods manufacturers, specialized parts suppliers and upstream commodity-parts vendors. Our research suggests that the costs of searching for commodity parts, which decrease due to improved inter-organizational systems (e.g. B2B electronic markets), affect downstream manufacturers' make-versus-buy decision of specialized parts, and therefore influence organizational scope.

3 — Implementation of Business Service Interface
Sunghwan Choi, Researcher, Electronics Telecommunications Research Institute, 161 Gajeong-dong Yuseong-gu, Daejeon, cn, 305-350, South Korea, conch@etri.re.kr

Business partners collaborate by linking their business model and executing business processes. The ebXML Business Process Specification Schema (BPSS) models describe business processes that enable business partners to collaborate in interoperable manner. In this paper, we devise a method of implementing business service interface in order to automate execution of business processes described in BPSS.

4 — Software Trials and Consumer Switching
Michael Pangburn, Assistant Professor of Decision Sciences, University of Oregon, 314 Gilbert Hall, Eugene, OR, 97403, United States, mikepangburn@gmx.net, Euthemia Stavrulaki

Substitutable software products (e.g., standard and professional packages) from a single firm compete for consumers' purchases. Firms sometimes make trial versions of software available on the internet. Given uncertainty, a customer may install the standard software version and then decide to purchase a more expensive full-featured version (or vice versa). We investigate the profit impact of software trials and customer uncertainty, to better understand how firms can manage product variety.

5 — Design of a GroupBuyAuction E-Marketplace
Cuihong Li, PhD Student, GSIA, Carnegie Mellon University, 5000 Forbes Ave, Pittsburgh, PA, 15213, United States, cuihong@andrew.cmu.edu, Shuchi Chawla, Junichi Yamamoto, Uday Rajan, Katia Sycara

Group-buy-auctions improve the efficiency of a group-buying market by differentiating buyers with the valuations and having them pay differently for the items purchased with group-buying. The desired properties of a group-buy-auction mechanism include efficiency, fairness and computational feasibility. We propose coalition formation algorithms and cost sharing rules for group-buy-auction markets with different preference structures.

■ TD47

Atlanta G, 7th Floor

Software Demonstration

Cluster: Software Demonstrations
Invited Session

1 — Lumina Decision Systems, Inc. - Analytica: Beyond the Spreadsheet
Robert D. Brown, III, Decision Strategies, Inc., 6635 Hampton Creek Drive, Cumming, GA, 30041, United States, rbrown@decisionstrategies.com

Analytica offers intuitive user-interface metaphors better suited to effective business modeling than the standard spreadsheet grid. These metaphors include influence diagrams to visualize model structure, intelligent arrays for multidimensional data, and probabilistic views for uncertainty and risk. According to PC Week: "Everything that is wrong with the common PC spreadsheet is fixed in Analytica."

Wednesday 8:00am - 9:30am

■ WA01

Westin-Intl. A, 6th Floor

Stochastic Networks II

Contributed Session

Chair: Aniket Gune, Research Assistant, University of Michigan, 1205 Beal Avenue, Ann Arbor, MI, 48109, United States, aniket@umich.edu

1 — Approximations for the Variability Parameter of the Departure Process from a Fork/Join Station
Ananth Krishnamurthy, Assistant Professor, Rensselaer Polytechnic Institute, 5225 CII, Dept. of DSES, 110 8th Street, Troy, NY, 12180, United States, krisha@rpi.edu, Rajan Suri

Fork/join stations model synchronization constraints in queuing models of manufacturing and computer systems. We analyze the departure process from a fork/join station and derive two-moment approximations for the variability parameter of the departure process. Using these approximations parametric decomposition methods can be applied to analyze queuing networks with fork/join stations.

2 — Approximation of Time-Dependent Expected Queues for Non-Markovian Queueing Networks
Germán Riaño Mendoza, Universidad de los Andes, Cra 1 E # 18A70, Bogota, DC, Colombia, griano@uniandes.edu.co, Steven Hackman, Richard Serfozo

We present a numerical method to evaluate time-dependent expected queue lenghs for non-Markovian queueing networks. The method uses phase type distributions and is based on a novel time-dependent Little Law for non-stationary processes. Numerical experiments are presented.

3 — Response Times and Queues in Fork-Join Network
Sung-Seok Ko, Georgia Tech, School of Industrial and Systems Eng., Georgia Tech, Atlanta, GA, 30332, United States, sungseok@isye.gatech.edu, Richard Serfozo

We study a fork-join processing network in which each arriving job splits into m tasks, which are simultaneously assigned to m nodes. When all of its tasks are finished, the job is completed and exits the system. The main concern are the network's response time and the quantity of jobs in the network, when the network is in equilibrium. We derive formulas that accurately approximate the distributions of these random variables.

4 — Call Routing with Continuous Uncertainties and Jump Diffusions
Aniket Gune, Research Assistant, University of Michigan, 1205 Beal Avenue, Ann Arbor, MI, 48109, United States, aniket@umich.edu, Xu Meng, Jussi Keppo

This paper considers call routing in a telecommunications network. The network demands are assumed to be driven by Brownian motions with jump diffusion processes. Call routing takes place either directly or alternatively via an intermediate node. The expected routing processes and blocking probabilities are solved in terms of trivariate normal distributions. We consider effects of demand uncertainty levels and their correlations on call routing and illustrate our model with a numerical example.

■ WA02

Westin-Intl. B, 6th Floor

Economics II

Contributed Session

Chair: Ram Bala, UCLA, 110 Westwood Plaza, Suite B5.12, Los Angeles, CA, 90095, United States, ram .bala@anderson.ucla.edu

1 — Efficiency Scores as By-Products of Linear Programming System Identification
Marvin Troutt, Professor, Kent State University, 1587 Morris Road, Kent, Oh, 44240, United States, mtroutt@kent.edu

Given a data set of input vectors, x, and output vectors, y, for each of several units under comparison, consider finding a constraint matrix, A, and an objective coefficient vector, c, which best fits this data in the following way. We require y to be the decision or output vector and x to be the resources vector. Then we want the minimum value of the ratio of cy to cy* over the units to be as large as possible. I call these ratios decisional or performance efficiencies. The proposed method finds c, A and an efficiency score for each unit by combining decisional efficiency and maximum likelihood.

2 — Knowledge Sharing in Organizations: Role of Incentives and Information Systems
Zuopeng Zhang, Penn State University, 324 Beam Building, University Park, PA, 16802, United States, zoz102@psu.edu, Shankar Sundaresan

Information technology enables and improves ease of learning and sharing of knowledge for which people are the central element. We capture the characteristics of both information system and incentive schemes in a modeling framework and explore how the investment of information technology complements the incentive structure in facilitating knowledge sharing and learning. This paper provides guidelines for matching investments in information technology with appropriate incentive systems.

3 — Usage-Based Pricing of Software Services with Heterogeneity in Consumer Valuation
Ram Bala, UCLA, 110 Westwood Plaza, Suite B5.12, Los Angeles, CA, 90095, United States, ram.bala@anderson.ucla.edu, Scott Carr

We compare usage-based pricing and flat-fee pricing of software services when consumers vary not only in their usage level but also in the value they derive with use. We look at different monopolistic and competitive situations and characterize the equilibria based on the transaction costs incurred by the service provider and the level of product differentiation. Based on this analysis, we provide some insights on industry and market structures that might emerge in such settings.

4 — Getting out of the Abyss: An Analysis into Post War Economic Recoveries in the US
Waithaka Iraki, Doctoral Student, Jackson State University, P.O.Box 190734, 1400JR Lynch St, Jackson, MS, 39217, United States, xniraki@yahoo.com, Mohammad Bsat

Stimulating an economy out of a recession and ensuring economic growth have been the role of fiscal and monetary policies since Keynes great insights in 1930s. This paper focuses on how these policies have pulled the US economy out of the abyss to recovery in post World War II period.

■ WA05

Westin-Intl. E, 6th Floor

Stochastic Models in Systems Prognosis

Sponsor: Applied Probability
Sponsored Session

Chair: Tim Matis, New Mexico State University, P.O. Box 30001, MSC 4230, Las Cruces, NM, 88003, United States, tmatis@nmsu.edu

Co-Chair: Jeff Kharoufeh, Air Force Institute of Technology, AFIT/ENS, 2950 Hobson Way, Wright Patterson AFB, OH, 45433, United States, Jeffrey.Kharoufeh@afit.edu

1 — Prognostics and Health Management (PHM)
Laura Swiler, Sandia National Laboratories, P.O. Box 5800, MS 1176, Albuquerque, NM, 87185-1176, United States, lpswile@sandia.gov

This talk will present an overview of the current state of Prognostics and Health Management. Prognostics, loosely defined as the capability to predict Remaining Useful Life (RUL) of critical components, is very important to military systems as a way to better manage support costs in an "autonomic logistics" framework.

This talk will present the steps necessary to perform PHM. Various PHM technologies and implementation issues will be discussed.

2 — A Bayesian Inventory Model Using Condition Monitoring
Rong Li, School of Industrial Engineering, Purdue University, 133-8 Nimitz Dr., West Lafayette, IN, 47906, United States, li25@purdue.edu

We study a Bayesian inventory model for service parts that are subject to deterioration. Information regarding part deterioration can be captured through condition monitoring. Optimal inventory policies are determined for parts that are ordered periodically according to endogenous demand (i.e., demand driven by life distributions and part deterioration).

3 — Markov Reward Models for Lifetime Estimation in Prognostics
Steven Cox, Air Force Institute of Technology, AFIT/ENS, Bldg 640, 2950 Hobson Way, Wright Patterson AFB, OH, 45433, United States, Steven.Cox@afit.edu, Jeff Kharoufeh

The essential aim of prognostic procedures is to estimate the remaining life of deteriorating components for the purpose of making sound maintenance decisions. In this talk, we discuss stochastic models for estimating remaining lifetime probabilities using degradation-based data. Numerical results demonstrate the efficacy of our procedure.

■ WA06

Westin-Intl. F, 6th Floor

Biotechnology/Bioinformatics

Contributed Session

Chair: Somnath Datta, University of Georgia, Department of Statistics, ATHENS, GA, 30043, United States, datta@stat .uga.edu

1 — A Topology-Based Characterization of Protein Structure
Bala Krishnamoorthy, Graduate Student, University of North Carolina, CB#3180 UNC, Chapel Hill, NC, 27599, United States, kbala@email.unc.edu, Scott Provan

We characterize protein structure using a subcomplex of the Delaunay tessellation known as the alpha complex. This allows us to identify tubular neighborhoods of the backbone chain of the protein that are adjacent at given distances. Betti numbers (ranks of homology groups) are used to identify structural characteristics of these neighborhoods, and tie secondary and tertiary structure of the protein to the behavior of the neighborhood betti numbers as a function of neighborhood distance.

2 — A Simulation Study on Transcellular and Transcapillary Fluid Shifts Induced by Hemodialysis
Amin Hadadzadeh, Iran University of Science & Technology, Management & Planning Organization, Department of Bio-Medical Engineering(Me, Management & Planning Organiza, Iran, hadadzadeh@hotmail.com

In this study, we developed a computer model to analyze body fluids volume variations, especially plasma volume changes. Also, serum sodium concentration and Blood Urea Nitrogen (BUN) changes were simulated using a combined model for transcapillary and transcellular fluid shift. Model predictions were found to be in good agreement with values which had been measured by Kimura et al[12,13]. Urea and sodium transfer across the dialyzer membrane and transcellular fluid shifts which occurs in response to the sodium and the other electrolytes transfer, were modeled. Tanscapillary fluid and proteins exchange occurs too, which influences hydrostatic and oncotic pressures in interstitial and capillary space due to ultrafiltration (UFR). With regard to that any of transcapillary and transcellular models itself cannot discuss fluids and electrolytes behavior in body, introducing lymphatic system, interstitial and capillary protein content as nonlinear behavior and transcellular electrolytes exchange, we simulated a new model . Using this model, it is possible to predict serum sodium concentration, blood osmolality, Blood Urea Nitrogen (BUN) after dialysis and plasma volume during dialysis in order to better hemodialysis therapy. Also, it is possible using model optimization and feedback blood volume controlling and monitoring systems to avoid hypotension. Using rational dialysate concentration with respect to serum sodium concentration changes can be used to reduce disequilibrium syndrome.

3 — A Study of Multicasting using Ants Algorithm
Sunggeun Lee, Phd Student, Kyung Hee Univ, Computer Engineering Dept, Seo Chun Ree, Yong-In, Gyung Gi Do, 449-701, South Korea, sglee00@daum.net, Chigun Han

In this paper, we design ants algorithms for muticasting problems. The multicasting problem is to find a minimum muticast tree that satisfies given constraints in network. We consider hop limit and node degree constraints for multicasting problems. Computational experiments using several strategies of ants algortihms are presented.

4 — Improving the Sensitivity of Detecting Differentially Expressed Genes
Somnath Datta, University of Georgia, Department of Statistics, ATHENS, GA, 30043, United States, datta@stat.uga.edu, Glen Satten, Susmita Datta

In this talk, we consider an ANOVA formulation of the gene expression levels corresponding to multiple tissue types. We provide resampling-based step-down adjustments to correct the observed levels of significance for the individual ANOVA t-tests coupled with a novel empirical Bayes adjustment. Using simulated data, we show that the empirical Bayes adjustment improved the sensitivity of differentially expressed genes up to 16%. We illustrate our approach using a colon cancer dataset.

■ WA07

Westin-Intl. G, 6th Floor

Resource Allocation

Contributed Session

Chair: Zhiling Guo, University of Texas at Austin, Dept. of Mgmt Sci & Info Sys., 1 University Station B6500, Austin, TX, 78712, United States, zhiling@mail.utexas.edu

1 — Revenue Sharing Contracts and Marketing Resource Allocation
Prashant Yadav, University of Alabama, Info. Systems, Management Sc. & Stats, Tuscaloosa, AL, United States, pyadav@cba.ua.edu

Under a co-promotion agreement two or more pharmaceutical firms collaborate to market a new drug and share revenue in an agreed proportion.Given each partner's product portfolio and resource limitations,fixed proportion revenue sharing may lead to sub-optimal allocation of promotion resources to the new drug. Proportional revenue sharing however is difficult to implement as resources committed by each partner cannot be perfectly verified.We study this problem through a stylized model.

2 — Resource Allocation for Software Development Projects
Luis D. Otero, USF, 4202 E. Fowler Ave., Tampa, FL, United States, ldotero@eng.usf .edu, Grisselle Centeno

The completion of reliable software products within the expected time frame are still a major problem for companies dedicated to the development of software applications. As the field continues to grow, the software industry continues to struggle with delivering reliable software on time. We study some of the factors affecting the overall schedule of software products. The objective is to develop a systematic approach to assign tasks to resources that reduce production time a meet deadlines.

3 — Resource Allocation between the Research and Development Phases of Product Development
Souvik Banerjee, Northwestern University, IE/MS Department, Tech C210, 2145 Sheridan Road, Evanston, IL, 60201, United States, s-banerjee@northwestern.edu, Wallace Hopp

We model the problem of allocating resources between research and development phases of product development using a continuous time stochastic control diffusion/jump process. The optimal solution suggests allocation flexibility is more important than budget flexibility. It also indicates that common industry strategies may be less efficient than other practical heuristics .

4 — A Distributed Resource Allocation Mechanism for Grid Computing
Zhiling Guo, University of Texas at Austin, Dept. of Mgmt Sci & Info Sys., 1 University Station B6500, Austin, TX, 78712, United States, zhiling@mail.utexas.edu, Gary Koehler, Andrew Whinston

We propose a continuous, asynchronous, bundle auction market model to support real time distributed resource allocation in grid computing. Within certain time periods, our market-based algorithm either asymptotically converges to the market equilibrium or provides an approximation via its decentralized iterative and competitive bidding process. The mechanism is designed to deal with the distributed communication and coordination issues in a dynamic and heterogenous environment.

■ WA08

Westin-Intl. H, 6th Floor

Simulation II

Contributed Session

Chair: Nagesh Murthy, Assistant Professor of Operations Management, University of Oregon, Lundquist College of Business, Decision Sciences Department, Eugene, OR, 97403, United States, nmurthy@lcbmail .uoregon.edu

1 — A Longitudinal Study of Recreational Boat Traffic
Edward Baker, Professor, University of Miami, Dept of Mgt Science, School of Business, Coral Gables, FL, 33124, United States, ebaker@miami.edu

This paper updates the boat traffic simulation model that was developed in 1997 for Naples Bay, Florida. In the years between 1997 and 2002, several marinas and boat storage facilities on the bay have been newly constructed or remodeled. Data collected in October of 2002 provided an opportunity to validate the model. The results of the model are shown to match well both the total and the hourly boat traffic flows observed on the bay.

2 — Avalanches of Team Member Substitutions from Complex Systems Analysis
Daniel Lacks, Professor, Case Western Reserve University, Dept. of Chemical Engineering, Cleveland, OH, United States, daniel.lacks@cwru.edu

Simulations based on the NK model are used to address changes in team membership. For teams in which team members do not interact, team member substitutions occur individually. However, for teams in which team members do interact, team member substitutions occur as avalanches that follow an exponential size distribution. These avalanches of team member substitutions are largest for teams with intermediate complexity — teams in which each member interacts with about 1/3 of the team.

3 — Call Center Staffing with Simulation and Cutting Plane Methods
Julius Atlason, University of Michigan, 1205 Beal Ave, Ann Arbor, MI, 48109-2117, United States, jatlason@umich.edu, Marina Epelman, Shane G. Henderson

The dynamics of call centers, and service systems in general, are often so complicated that analytical methods for computing various performance measures fail. This of course makes any kind of optimization, such as determining the lowest cost staffing schedule that satisfies minimum service level requirements, inherently difficult. We present an iterative subgradient-based cutting plane algorithm that uses simulation to evaluate the objective function and/or constraints.

4 — The Impact of Simulation-Based Training on Call Center Agent Performance: An Empirical Study
Nagesh Murthy, Assistant Professor of Operations Management, University of Oregon, Lundquist College of Business, Decision Sciences Department, Eugene, OR, 97403, United States, nmurthy@lcbmail.uoregon.edu, Leslie Harris, Goutam Challagalla

This study evaluates the effectiveness of simulation-based training as a behavior modeling technique relative to role-playing in a real-world call center environment. We use a state of the art simulation tool to evaluate the effectiveness of simulation-based training by involving call centers at two Fortune 100 firms.

■ WA09

Westin-Vinings 1, 6th Floor

Educational Issues II

Contributed Session

Chair: Carl Briggs, Indiana University, Kelley School of Business, 1309 East 10th Street, Bloomington, IN, 47405, United States, briggsc@indiana.edu

1 — A Decision Model for Course Bundling for Incoming Business Students
Roger Grinde, Associate Professor of Management Science, University of New Hampshire, Whittemore Sch. of Business & Economics, 15 College Road/McConnell Hall, Durham, NH, 03824, United States, roger.grinde@unh.edu, Cari Moorhead

Incoming business majors take several required courses their first semester. Orientations are in early June for the incoming class, comprising approximately 400 majors and 60 non-majors. Course bundles are created to avoid capacity/time conflicts for the later orientation sessions. This has been a time-consuming manual process. A decision model has been created to improve the bundle-creation process. This session provides mathematical foundations, initial implementation, and findings.

2 — E-Learning An Approach To Self-Directed Education: A Case Study Of Curtin Sarawak Campus First Year
Alex Ng, Curtin University of Technology, CDT 250, 98009, Miri, Sarawak, Miri, SA, 98009, Malaysia, alex.ng@curtin.edu.my

This paper is a case study of first year engineering (Chemical, Civil, Mechanical) students in the unit Engineering Dynamics. It will explore the use of e-learning in web-based tutorial (WBT). Students' surveys were conducted, gathered, and compared with both the University of western Australia (UWA), National University of Singapore (NUS) and Curtin University of Technology, Sarawak Campus.

3 — Improving an Introductory OR/MS Course in South Africa
Neil Manson, Lecturer, Monash South Africa, School of Information Technology, Private Bag X60, Roodepoort, GP, 2162, South Africa, neil.manson@infotech.monash .edu

Monash University offers an introductory OR/MS course on 3 of its 8 campuses. The students on the South Africa campus performed very poorly in 2002. The objectives, content, teaching strategies and assessment are described. The results obtained by the SA students are analysed and compared to those of students on other campuses. Student feedback is also discussed and compared to the other campuses. Possible modifications to the course are suggested that will hopefully improve student performance.

4 — Using Bloom's Taxonomy to Increase Student Achievement of Course Learning Objectives
Mary Beth Kurz, Clemson University, Department of Industrial Engineering, 108 Freeman Hall, Clemson University, Clemson, SC, 29634, United States, mkurz@CLEMSON .EDU, Michael Leonard, D. L. Kimbler, Anand K. Gramopadhye, Sarat Tangudu, J. Mullenix, S. Regunath, R. Jacob

Faculty at Clemson University have developed a curricular renewal process for a scalable, deployable IE B.S. degree. Validation of parts of the process began with the Summer 2003 offering of an introductory course in IT. Course learning objectives were written, explicitly including the nature of the desired outcome in terms of Bloom's taxonomy. We report on initial results, focusing on student self assessment and instructor assessment of student achievement of the course learning objectives.

5 — Predicting Performance in Conceptual and Analytical Operations Management Problem Solving
Carl Briggs, Indiana University, Kelley School of Business, 1309 East 10th Street, Bloomington, IN, 47405, United States, briggsc@indiana.edu, Rex Cutshall, Kenneth Schultz

This paper details findings from a pilot study examining the relationship between cognitive style and performance in conceptual and analytical operations management problem solving for a cohort of undergraduate business school students enrolled at a large Midwestern university. Issues in measuring cognitive style as well as problem solving performance are discussed. Findings are discussed with particular attention to designing more effective operations management pedagogical strategies.

■ WA10

Westin-Vinings 2, 6th Floor

Sports/Games and Entertainment

Contributed Session

Chair: Henry Amato, Professor of Supply Chain Management, University of Nevada Reno, 9th and Virginia St, Mail Stop 028, Reno, NV, 89557, United States, hna@unr.edu

1 — Owner's Guide: A Predictor of Wins for Sports Franchises
William Brooks, United States Military Academy, PO Box 458, West Point, NY, 10997, United States, x45543@usma.edu, Stephen Sapol, Patrick Lanier

Our presented work introduces a model that sports franchises could use to forecast their final season standings and determine playoff potential. This model is based on linear relationship principles, and we demonstrate how team owners and general managers could use it to increase their franchise's success during a given season. Our discussion includes experiment design and an analysis of our simulation results.

2 — Parlay versus Multiple Single Bets: Expected Returns Against the Spread
Henry Amato, Professor of Supply Chain Management, University of Nevada Reno, 9th and Virginia St, Mail Stop 028, Reno, NV, 89557, United States, hna@unr.edu, Sheri Faircloth

This paper considers the rationality of betting parlays, which have been referred to as the "sucker's bet" and is limited to football wagering. In general, it is determinde that a bettor who can at pick with at least a break-even probability on each of several games has a higher expected return on investment by placing parlay wagers than multiple single game wagers.

■ WA11

Westin-Augusta 1, 7th Floor

Tutorial: Nonlinear Optimization in Modeling Environments

Cluster: Tutorials
Invited Session

1 — Nonlinear Optimization in Modeling Environments
János D. Pintér, President, PCS Inc. & Adjunct Prof., PCS Inc. / Dalhousie U., 129 Glenforest Drive, Halifax, NS, B3M 1J2, Canada, jdpinter@hfx.eastlink.ca

We discuss the use of nonlinear (global and convex) optimization software across several development platforms (currently: C, Fortran, Excel, GAMS, and Mathematica). The presentation is mainly based on our algorithm and software development work, including 'live' model and solution examples, as well as a review of some interesting challenges and advanced applications.

■ WA12

Westin-Augusta 2, 7th Floor

Inventory Management V

Contributed Session

Chair: Qiaohai (Joice) Hu, Dept. of Operations, Weatherhead School of Management, Case Western Reserve University, 10900 Euclid Avenue, Cleveland, OH, 44106, United States, qxh3@cwru.edu

1 — Backorder Cost/Fill Rate Duality: Discrete Demand
Jiang Zhang, PhD Candidate, Dept of Operations, Weatherhead School, Case Western Reserve University, 10900 Euclid Ave., Cleveland, OH, 44106-7235, United States, Jiang.Zhang@cwru.edu, Matthew J. Sobel

We specify a weakly monotone mapping between the sets of optimal policies in two dynamic newsvendor models with discrete demand distributions: (a) backorder costs, and (b) fill rate constraints. Therefore, analyzing a backorder cost model is an easy way to analyze a model with a fill rate constraint.

2 — Generalized (s, S) Policies in Production Scheduling: Lost Sales Case
Yanyi Xu, Ph.D Student, Purdue University, Krannert School of Management, 403 W .State St, West Lafayette, IN, 47907, United States, xu21@mgmt.purdue.edu, Maqbool Dada

In this paper, we consider a production scheduling problem with H periods (planning horizon) where demand in each period is stochastic, for which, the environment can be described as follows: 1) Demand is stochastic and stationary but independent between periods. 2)The demand distribution in each period is known. 3) Unsatisfied demand is lost.

3 — Sample Path Derivatives for (s, S, p) Inventory System
Huiju Zhang, PhD Student, University of Maryland, College Park, 1308 Van Munching Hall, University of Maryland, College Park, MD, 20742, United States, joyzhang@wam .umd.edu, Michael Fu

We consider the (s, S, p) inventory system with the objective of minimizing the average loss per period for a single product, periodic review model.We develop sample path derivatives of performance measures with respect to the parameters being optimized via infinitesimal perturbation analysis (IPA)and smoothed perturbation analysis (SPA).

4 — Base-stock Control of General Assembly Systems with Supply and Demand Uncertainty
Jun Zhang, Tulane University, 7 McAlister Dr, New Orelans, LA, 70118, United States, jzhang4@tulane.edu

We consider a general assembly system facing demand and supply uncertainty. We demonstrate how a multi-echelon assembly system with common components may be converted into an equivalent two-echelon assembly system. For two-echelon assembly systems, we propose a system decomposition approach which uses internal service levels to determine near-optimal base-stock levels for each component and empirically test the performance of our decomposition approach.

5 — Impact of Capital Structure on Inventories
Qiaohai (Joice) Hu, Dept. of Operations, Weatherhead School of Management, Case Western Reserve University, 10900 Euclid Avenue, Cleveland, OH, 44106, United States, qxh3@cwru.edu, Matthew J. Sobel

Production decisions of many firms are constrained by cash availability which, in turn, is affected by the firm's balance between debt and equity financing. In a stochastic demand model, we analyze the dependence of optimal policies on capital structure and show that a higher debt/equity ratio implies lower inventories.

■ WA13

Westin-Augusta 3, 7th Floor

Risk Management

Contributed Session

Chair: Andrew Carver, Stanford University, 729 Escondido Rd. #104, Stanford, CA, 94305, United States, acarver@stanford.edu

1 — Quasi-Monte Carlo Simulation Estimator of Portfolio Value-at-Risk
Xing Jin, Assistant Professor, National University of Singapore, 113 Clementi Rd, BLK D, #06-03, Singapore, 129793, Singapore, matjx@nus.edu.sg, Allen Zhang

Quasi-Monte Carlo sequences provide considerable improvement in convergence rate over standard Monte Carlo simulation for pricing a financial derivative that has reasonably regular payoff. For Value-at-Risk estimation problem, the distribution function of loss process is the expectation of an indicator function. In other words, the integrand is discontinuous, and thus the improvement of quasi-Monte Carlo is diminished. The purpose of the present paper is to translate the expectation estimation of an indicator function into that of a smooth function by using conditional distribution function, and thus, the faster convergence rate of quasi-Monte Carlo method is restored for Value-at-Risk simulation. Numerical experiments illustrate the potential of those methods for variance reduction.

2 — Application of Semidefinite Programming to Asian Options
Georgios Dalakouras, University of Michigan, Applied & Interdisc Math, 525 East University Ave, Ann Arbor, MI, 48109, United States, gbdalako@umich.edu

Pricing of Average (Asian) Options is one of the most challenging computational problems in Wall Street. Asians give the ability to hedge volatile commodities (oil/energy) and provide insurance against price manipulations. A new approach using the moments of a diffusion process is utilized and the problem is cast as a semidefinte programming problem for efficient solution . Computational results are presented.

3 — The Debt and Equity Finacing Decision for Individuals
Andrew Carver, Stanford University, 729 Escondido Rd. #104, Stanford, CA, 94305, United States, acarver@stanford.edu

To finance education, a borrower may desire an equity style contract, which specifies a percentage of income payment rather than a fixed loan payment. This research explores the market and policy implications when both percentage of income loans (equity) and standard fixed payment loans (debt) are available. A model of debtor-creditor interaction is used to explore the characteristics of optimal loan contracts. Some related government policy issues are addressed.

4 — Applications of Two-Stage Conic Quadratic Programming to Finance
Sanjay Mehrotra, Professor, Northwestern University, IE/MS Department, Tech C140, 2145 Sheridan Road, Evanston, IL, 60208, United States, mehrotra@iems.nwu.edu, M. Gokhan Ozevin

During the last decade the scope of classical optimization was enlarged by introduction of conic quadratic and semidefinite programming. In this talk we consider the Markowitz's mean-variance, mean-downside risk portfolio selection and portfolio compression/index tracking problems in a two-period setting. We show that these problems can be cast as two-stage stochastic conic quadratic programs with recourse. We also briefly discuss efficient solution methodologies for these models.

5 — Optimal Derivative Investment Under Random Jumps
Seo Yeon Lee, Ph.D. Candidate, University of Chicago, Graduate School of Business, 1101 East 58th Street, Chicago, IL, 60637, United States, seo.lee@gsb.uchicago.edu

Given the existence of event-related jumps, I provide the optimal portfolio allocation under the market incompleteness. I find that under random jumps arrival, risk tolerent investors make more loss than highly risk averse investors from derivative invesments. Moreover, it shows that investing on negative jumps gives higher return and a separate investment on positive and negative jumps gives less loss. Finally, the frequency of jumps is a strong determinant of the portfolio improvement.

■ WA14

Westin-Peachtree A, 8th Floor

Information Systems and Risk Management of Technology in New Product Development

Cluster: New Product Development

Invited Session

Chair: Ram Akella, Professor & Director Information Systems and Technology Management, Baskin School of Engineering 131, University of California, Silicon Valley Center/Santa Cruz, Santa Cruz, CA, 95064, United States, akella@acsu.buffalo.edu

1 — Models for Efficient Triggered Learning in NPD
John Voit, Delphi Corporation, United States, john.r.voit@delphi.com, Ram Akella, Rajiv Kishore, R. Ramesh

We develop queuing models to provide managerial insights on the conditions under which knowledge management systems are competitive. These cost-benefit models enable us to understand the value of allocating resources between staff and line capacities to efficiently incorporate learning into New Product Development. We also discuss the related ontology development that increases the learning process efficiency in an automotive setting.

2 — Value of Management Flexibility in R&D Projects Revisited
Leonardo Santiago, Boston University, Manufacturing Eng. Department, Boston, MA, United States, leonardo@bu.edu, Pirooz Vakili

We analyze the impact of increased uncertainty/variability on the value of R& D projects and flexibility in managing them. We show that for development or market requirement uncertainty, general statements about the impact of increased uncertainty can not be made. However, when market payoff variability increases, the project value generally increases but there is a significant difference between improvement and abandonment options.

3 — Applying Decision Production Systems to Improve Environmentaly Responsible Product Development
Jeffrey Herrmann, Associate Professor, University of Maryland, Department of Mechanical Engineering, College Park, MD, 20742, United States, jwh2@umd.edu, Peter A. Sandborn, Linda C. Schmidt

The decision production systems methodology models the decision-making and information flow in a product development organization, analyzes the model, and identifies feasible improvements to the new product development process. This novel methodology has been applied to improve decision-making related to environmental impacts at a printed circuit board manufacturer.

■ WA15

Westin-Peachtree F, 8th Floor

Telecommunications III

Contributed Session

Chair: Hyun-Jung Lee, Seoul National University, Sillim 9 Dong, Kwanak-Gu, Seoul, South Korea, hjlee938@snu.ac .kr

1 — Work Forecasting and Resource Planning for the Field Workforce of British Telecommunications plc
Christos Voudouris, R&D Manager, British Telecommunications plc, Orion Building, mlb1/pp12, Adastral Park, Ipswich, Su, IP5 3RE, United Kingdom, chris.voudouris@bt .com, Gilbert Owusu, Raphael Dorne, Cedric Ladde, Botond Virginas

This paper describes an integrated system called ARMS developed for British Telecommunications plc to automate the planning and deployment of the company's field engineer workforce. ARMS integrates forecasting with resource planning and scheduling providing an end-to-end resource management solution for the organisation. OR/AI techniques used in the system include ARIMA models for forecasting, Constraint Satisfaction for problem modelling and also Heuristic Search for problem solving.

2 — Performance Analysis of a Finite-Buffer Discrete-Time Queue with Bulk-Serivce and Multiple Vacations
Seok-Hee Lee, Professor, Pusan National University, School of Mechanical Engineering, Pusan 609-735, Korea Repof, sehlee@pnu.edu, Seok Ho Chang

This paper considers a finite-buffer discrete-time queue with bulk service, Bernoulli arrival process and multiple vacations that has wide applications in modern digital telecommunication systems. The main purpose of this paper is to present a performance analysis of this system. Various useful performance measures of interest are suggested such as the moments of the number of packets in the queue the mean delay in the queue of a packet and the loss probability with computational experiences.

3 — Performance Analysis of Discrete-Time BMAP/G/1 Queue with Multiple Vacations and Exhaustive Services
Seok Ho Chang, Ph.D., Laboratory for Manufacturing and Productivity, Massachusetts Institute of Technology, 77 Massachusetts Avene, Cambridge, MA, 02139-4307, United States, soccer9@mit.edu

The main purpose of this paper is to present a performance analysis of discrete-time BMAP/G/1 queue with multiple vacations and exhaustive services. We present the vector generating functions (GFs) of the queue lengths of this system, and show that they are decomposed into two GFs, one of which is the vector GF of the queue length of the standard discrete-time BMAP/G/1 queue without vacations, and the other is a matrix GF for the number of customers that arrive during an elapsed vacation time.

4 — Design and Valuation of the Policy Options in the Spectrum Management for Wireless LAN Services
Hyun-Jung Lee, Seoul National University, Sillim 9 Dong, Kwanak-Gu, Seoul, South Korea, hjlee938@snu.ac.kr, Jong Wook Jeong, Min-Jung Kim, Jeong Dong Lee

We evaluate the spectrum policy regarding wireless LAN services and design an optimal policy scheme for maximizing national economic benefits from wireless LAN services using real options model (ROM). ROM has been little applied to make optimal decision-making strategies for public sectors compared with private sectors. Several kinds of policy options are analyzed and evaluated through a Monte Carlo simulation under the feasible scenarios made by the experts in government and industry.

■ WA16

Westin-Peachtree G, 9th Floor

Health Applications III

Contributed Session

Chair: Jennifer Kreke, University of Pittsburgh, 1048 Benedum Hall, Pittsburgh, PA, 15261, United States, jekreke@msn.com

1 — Simulating the Allocation of Livers for Transplantation
David Thompson, Altarum Institute, P.O. Box 134001, Ann Arbor, MI, 48113, United States, david.thompson@altarum.org, Larry Waisanen, Robert Wolfe, Robert Merion, Keith McCullough, Ann Rodgers

Simulation-based analysis can inform the process of setting cadaveric organ allocation policies by predicting likely effects of alternative policies on a variety of measures. The Scientific Registry of Transplant Recipients is developing a family of simulations for use by the transplant community in evaluating potential policy changes for allocating donated livers, hearts, lungs, kidneys, and pancreata. This paper describes the Liver Simulated Allocation Model (LSAM).

2 — Simulating Activities at an Intensive Care Unit in a Large Teaching Hospital
Janet Williams, Lecturer, Cardiff University, Mathematics Institute, Senghennydd Road, Cardiff, CF24 4YH, United Kingdom, WilliamsJE@cardiff.ac.uk, Jeff Griffiths, Naomi Price-Lloyd

A simulation model is proposed to investigate the adequacy of the current Intensive Care facilities at a large Teaching Hospital. This model is validated against data collected at the hospital; it is then used to explore a range of further scenarios, including changes in arrival profiles, better utilization of available resources, alterations in admission and/or discharge rules etc.

3 — Redesigning the Medication Ordering, Dispensing and Administration Process in an Acute Care Hospital
Carolyn Busby, PhD Student, University of Toronto, 5 King's College Road, Toronto, ON, M5S3G8, Canada, busby@mie.utoronto.ca, Michael Carter

Simulation models built to quantify the advantages of an electronic medication ordering, dispensing and administration process compared with the current manual process at an acute care academic health sciences centre are presented. A model was constructed for both the current manual system and the proposed electronic system. The results show that there is a potential to significantly reduce the overall turnaround time therefore improving the percentage of patients receiving medication on time.

4 — Simulating Patient-Specific Response to HIV Therapy
Steven Shechter, University of Pittsburgh, 1048 Benedum Hall, Pittsburgh, PA, 15261, United States, sms13@pitt.edu, Scott Braithwaite, Mark Roberts, Andrew Schaefer

We describe a discrete-event simulation model of HIV progression for patients undergoing Highly Active Anti-Retroviral Therapy (HAART). We discuss factors such as mutation rates and patient compliance that hasten drug resistance and necessitate a change in therapy. We will discuss validation results and future enhancements to the model.

5 — Simulating the Clinical Course of Severe Community-acquired Pneumonia and Sepsis
Jennifer Kreke, University of Pittsburgh, 1048 Benedum Hall, Pittsburgh, PA, 15261, United States, jekreke@msn.com, Mark Roberts, Andrew Schaefer, Derek C. Angus

We present a biologically based simulation model of pneumonia-induced sepsis, a leading cause of death in the U.S. We focus on modeling challenges in developing the patient generation and disease progression components of the simulation. We propose future expansions to the model such as incorporating diagnostic and therapeutic decisions. This work is supported by NIGMS R01 GM61992.

■ WA17

Westin-Peachtree H, 9th Floor

New Product Development I

Contributed Session

Chair: B. Joon Park, Assistant Professor, Singapore Management University, 469 Bukit Timah Road, Singapore, NR, Singapore, jpark@smu.edu.sg

1 — Integrating Distributed Organizational Knowledge in New Product Introduction Projects
P. Robert Duimering, Assistant Professor, Dept. of Management Sciences, University of Waterloo, Waterloo, ON, N2L3G1, Canada, rduimering@uwaterloo.ca, Christopher Poile, Natasha Derbentseva, Bing Ran

We present findings from an interview study of project managers involved in new product introduction (NPI) in a large telecom firm. NPI project management involved complex social interactions associated with the integration of knowledge, distributed across a network of specialized "subject matter experts" in a functional organization structure. Results highlight difficulties of communication, planning, requirements specification, and the systematic use of "padding" to buffer uncertainty.

2 — Optimal Sales Contracting for Remanufacturers
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 C. Petruzzi

We develop an analytical model discussing the sales contract and product design decisions of a remanufacturer. After characterizing the optimal actions, we analyze the problem further by investigating the effects of exogeneous variables on both the remanufacturer and its customers .

3 — Green Product Development in Competitive Environments: Price Competition and Quality Choice
Chialin Chen, Assistant Professor, Queen's School of Business, Queen's University, Kingston, ON, K7L 3N6, Canada, cchen@business.queensu.ca, Kilsun Kim

This paper analyzes the pricing and design decisions of environmentally friendly products in competitive environments. We derive the optimal price and quality levels of green products and analyze price leadership for both static- and extensive-form games. Contrary to the popular view that monopoly is a friend to the environment, our analysis shows that competition can benefit the environment by pricing out products with low environmental quality or inducing firms to make better quality choices.

4 — Product Platform Development for Manufacturing Flexibility
B. Joon Park, Assistant Professor, Singapore Management University, 469 Bukit Timah Road, Singapore, NR, Singapore, jpark@smu.edu.sg, Soumen Ghosh, Nagesh Murthy

In recent years, the world's automakers have heavily invested in manufacturing flexibility as a solution to the "nagging" sense of market uncertainty. Further, automakers have utilized product platforms to enable manufacturing flexibility by integrating flexible architectures into flexible manufacturing systems. In this paper, we have investigated how product platform development could be integrated with firm's manufacturing flexibility strategies.

■ WA18

Westin-Tower 1201, 12th Floor

Simulation, Numerical, and Markov Chain Techniques for QSR

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: William Griffith, Associate Professor, University of Kentucky, 841 Patterson Office Tower, Lexington, KY, 40506-0027, United States, griffith@ms.uky.edu

1 — Using Monte Carlo Simulation to Improve Productivity
Jussi Kyllonen, Production Manager, Sulzer Process Pumps (US), Inc., P.O. Box 2069, Easley, SC, 29641, United States, jussi.kyllonen@sulzer.com

This paper presents an application of Monte Carlo simulation to optimizing production capacity levels for the anticipated demand characteristics in the built-to-order discrete manufacturing environment. In this system, maximum focus is given in mass-customizing the product to the customer needs. This concept enables the company to enhance customer satisfaction. For the optimal financial outcome for the producer, the demand characteristics need to be taken into consideration in process design.

2 — Model Sensitivity Analysis of EWMA Control Charts for Autocorrelated Data
Hyun Cheol Lee, Texas A&M University, Dept. of Industrial Engineering, College Station, TX, 77843-3131, United States, Daniel Apley

ARMA parameter modeling errors cause serious adverse effects on the performance of control charts for autocorrelated data. We derive analytical results for the sensitivity (with respect to modeling errors) of residual-based EWMA charts, as well as EWMA charts on the original autocorrelated data, and compare the robustness of the two approaches.

3 — Numerical Methods for Minimizing the Minimax Error in Digital Metrology
Abhijit Gosavi, Assitant Professor, State University of New York, Buffalo, 342 Bell Hall, Box 602050,, Buffalo, NY, 14620, United States, agosavi@buffalo.edu

The minimax error is perhaps the most important criterion in form-error measurement. Its importance has increased dramatically with the advent of nano-manufacturing. An exact mathematical formulation and numerical methods of form-error minimization for minimax error will be presented. Case examples will be drawn from the domains of straightness, flatness, and circularity.

4 — Start-up Demonstration Tests: Markov Chain Techniques and Questions of Inference
William Griffith, Associate Professor, University of Kentucky, 841 Patterson Office Tower, Lexington, KY, 40506-0027, United States, griffith@ms.uky.edu, Michelle Smith

Start-up demonstration tests using various criteria for acceptance/rejection are studied. These criteria involve consecutive and/or total numbers of successes and failures or clusters within a certain number of trials. Multistate versions where multiple levels of success or failure are distinguished are also treated. Markov chain techniques are used for the probabilistic analysis. Issues of finding a good test,estimation, and comparing tests are described.

■ WA19

Westin-Tower 1202, 12th Floor

Static, Dynamic and Sequential Robust Design

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: Terrence Murphy, Ph.D Candidate, Georgia Institute of Technology, 657 Stratford Green Way, Avondale Estates, GA, 30002, United States, tmurphy@isye.gatech.edu

1 — Principal Components of Loss-Scaled Responses
Terrence Murphy, Ph.D Candidate, Georgia Institute of Technology, 657 Stratford Green Way, Avondale Estates, GA, 30002, United States, tmurphy@isye.gatech.edu, Kwok-Leung Tsui

Principal components (PCs) which integrate the loss constant matrix are used to approximate the trace-covariance and off-target vector product terms of the multivariate quadratic loss (Tsui 99) of a multi-response data set. PCs derived from both covariance and correlation matrices are examined. The proposed technique is used in a multiple response product design.

2 — Generalized Linear Models (GLMs) for Analyzing Dynamic Robust Design Experiments
Suk Joo Bae, Phd Student, Georgia Institute of Technology, 328237, gatech station, atlanta, 30332, United States, sjbae@isye.gatech.edu, Kwok-Leung Tsui

The authors use GLM to enhance the response function model (RFM) of Tsui 2000. The proposed GLM-RM approach identifies hidden noise variables to further reduce process variance. Loss model (LM) and RFM approaches are prone to spurious effects for process variance. Simulation shows GLM-RM providing more reliable results by modeling the residuals from the fitted response model. Two practical examples are analyzed with response model, LM, RFM and GLM-RM approaches to demonstrate.

3 — Sequential Exploratory Experimental Design
Yao Lin, Georgia Institute of Technology, 492A Calhoun Street, Atlanta, GA, 30318, United States, gt5226d@prism.gatech.edu, Janet Allen, Farrokh Mistree

To facilitate sequential computer experimental design, the authors developed an information-theoretic method which identifies new data points through entropy optimization based on information from previous metamodels and metamodel validations. Metamodel validation, and selection & usage of additional validation points are incorporated in this method.

■ WA20

Westin-Tower 1203, 12th Floor

Artificial Intelligence

Contributed Session

Chair: Eldad Haber, Emory University, 400 Dowman Drive, Dept of Math/CS, Atlanta, GA, 30322, United States, haber@mathcs.emory.edu

1 — An Intelligent Approach for Financial Crises Warning: Case-Based Reasoning Method
Ying Wei, the Chinese University of Hong Kong, Dept. of SEEM, Hong Kong, HK, China, ywei@se.cuhk.edu.hk

This paper presents case-based reasoning method for financial crises warning. Unlike traditional rule-based reasoning approach, CBR is a methodology providing adaptive solutions by systematic comparison between current situation and the similar cases stored in the case library. Three critical techniques are studied: financial case representation, case retrieval and case learning. At last implementation of the Case-based Financial Crises Warning Prototype System is also described in brief.

2 — Software Development Effort Estimation using GMDH-type Neural Networks
Omar El-gayar, Assistant Professor, Dakota State University, 810 Washinton Ave, madison, SD, United States, elgayaro@pluto.dsu.edu, Kalyan Boinapalli

Estimating development effort of a software project in the early stages has bountiful benefits .This paper presents software development effort estimation using group method of data handling (GMDH) type Neural Networks. The paper also presents the advantages of GMDH over traditional software development effort estimation methods. A comparison between the COCOMO models and GMDH-type model is also outlined.

3 — The Structure and Progress of Knowledge: A Reconciliation of Contending Theories
Elie Geisler, Professor, Illinois Institute of Technology, 565 W. Adams Street, Stuart Graduate School of Business, Chicago, IL, 60661, United States, geisler@stuart.iit.edu

This paper describes a model of the structure and progress of human knowledge. The model is non-evolutionary and cumulative. It reconciles opposing theories such as Popper, Campbell, and Lakatos. A graphic description is provided of the sedimentary growth of knowledge in a network format. Some applications to databases and organizational information systems are also presented.

4 — Learning Regularization Functionals - A Supervised Training Approach
Eldad Haber, Emory University, 400 Dowman Drive, Dept of Math/CS, Atlanta, GA, 30322, United States, haber@mathcs.emory.edu, Luis Tenorio

We consider the solution of inverse problems by using Tikhonov regularization. However, it is not clear what type of regularization should be used for a given problem as different regularizations yield different solutions. Here we use supervised learning techniques to determine a regularization functional given a training set of feasible solutions. Our approach leads to a constraint optimization problem that we solve using inexact SQP methods. We illustrate the methodology with two examples.

■ WA21

Westin-Tower 1204, 12th Floor

Modeling Systems & Languages I

Contributed Session

Chair: Kipp Martin, Professor, University of Chicago, Graduate School of Business, 1101 East 58 Street, Chicago, IL, 60637, United States, kipp.martin@gsb.uchicago.edu

1 — Recent Work on the AMPL/Solver Interface Library
David Gay, AMPL Optimization LLC, 35 Livingston Avenue, New Providence, NJ, 07974, United States, dmg@acm.org, Robert Fourer

AMPL seeks to provide a simple view of solvers that hides their idiosyncrasies. The AMPL/solver interface library facilitates this by providing relevant interface routines and data structures. We review some of these facilities, focusing on recent and forthcoming additions, such as suffix notation for auxiliary information and extensions for dealing with constraint programming. Interfaces to global optimization and constraint programming solvers may require custom "tree walks".

2 — Visual Modeling Language for Probabilistic Business Problems
Lev Virine, Schlumberger Ltd., 600, 322-11 Ave S.W., Calgary, AB, T2ROC5, Canada, lvirine@calgary.geoquest.slb.com, Lisa Rapley

Comprehensive visual modeling language defines the probabilistic business model by the sequential generation of the diagrams. The language includes Modeling diagrams, sensitivity analysis tools, influence diagrams, Monte Carlo diagrams, probabilistic Gantt charts, Risk charts, and other tools. It can be applied to simplify the process of creating the model and simplify the interpretation of the results of the analysis. The language is implemented in risk analysis application Decision Tool Kit.

3 — Distributed System Management Architecture Considering High Availability
Chang-Won Ahn, Senior Researcher, ETRI, 161 Gajeong-dong Yuseong-gu, Daejeon, 305-350, South Korea, ahn@etri.re.kr

Recently the growth rate of network bandwidth is very higher than that of computing power. Industry has begun to use many entry-level servers to satisfy the customer's needs for high quality service. To deliver the high performance service to the customer, it is better way to deploy the server to the customer as close as possible. Besides, to provide seamless service with low-cost entry-level server, it is a cost-effective way to adopt cluster architecture with HA.

4 — Extending Three Dimensions of Requirement Engineering
Tuure Tuunanen, Assistant Professor, Helsinki School of Economics, P.O.Box 1210, Helsinki, FIN-00101, Finland, tuure.tuunanen@hkkk.fi, Matti Rossi

Today most information systems are procured as either shrink wrapped software, or as parameterized products. This is contra dictionary with the view of requirements engineering (RE) techniques, which make strict assumptions about the availability of end-users. The study seeks to find the gaps in RE and argue that the risk should be considered. We suggest that a solution can be found from marketing. We propose to augment the model with a risk dimension to make it feasible with current needs.

5 — A Modeling System for Mixed Integer Linear Programming Using XML Technologies
Kipp Martin, Professor, University of Chicago, Graduate School of Business, 1101 East 58 Street, Chicago, IL, 60637, United States, kipp.martin@gsb.uchicago.edu

We show that XSLT and XPath can be used in lieu of a traditional algebraic modeling language for generating instances of linear programs. Our approach is to take raw data files in XML format and transform them using XPath and XSLT into a single XML file that represents the instance of a linear program. We show that the existing W3C standards for XPath 1.0 and XSLT 1 .0 contain the necessary functionality for defining sets and indices, and operating on them by looping and summing.

■ WA22

Westin-Tower 1205, 12th Floor

Decision Analysis I

Contributed Session

Chair: Elizabeth Schott, MAJ, Department of Mathematical Sciences, United States Military Academy, West Point, NY, 10996, United States, elizabeth.schott@usma.edu

1 — Selecting a Portfolio of Interdependent R&D Projects to Achieve Technology Goals
Kevin Gormley, Simulation & Modeling Engineer, The MITRE Corporation, 7515 Colshire Drive, McLean, VA, 22102, United States, kgormley@mitre.org, William Scherer

Many organizations desire to select the best portfolio of R&D projects to achieve future technology goals. Interactions among projects and uncertainties in each project's time, cost and probability of success add complexity to the decision. A method using sequential, stochastic decision theory is examined to determine whether each project should be funded as soon as technically possible or should be delayed. A case study of Unmanned Aerial Vehicle (UAV) development will be presented.

2 — Project Valuation in Mixed Asset Portfolio Selection
Janne Gustafsson, Helsinki University of Technology, Otakaari 1M, Helsinki, FI, 02015, Finland, jgustafsson@london.edu, Bert De Reyck, Zeger Degraeve

We develop a project valuation procedure in a setting where an investor can invest in a portfolio of projects and securities. The procedure requires the solution of a portfolio selection problem with and without the project being valued. We develop a general deviation-based mean-risk model, which allows us to solve these problems for many mean-risk investors, and use this model to examine the pricing behavior of mean-variance and mean-absolute deviation investors through numerical experiments.

3 — A Combantant Commander COA Evaluation Tool
Dave Taylor, Consultant, Toffler Associates, 302 Harbor's Point, 40 Beach Street, Manchester, MA, 01944, United States, dtaylor@toffler.com, Robert Molepske

Joint doctrine publications reflect the fundamental principles, objectives, and constraints that are important to the combatant commander in this value model. Three dominant, top-level functions, with subordinate objectives were developed into a Logical Decisions for Windows model. The distinguishing features are its application to a user base as a "template" for decision making, and its ability to contrast a wide range of disparate alternatives (e.g., kinetic, non-kinetic and IO options).

4 — Nash Equilibrium in Data Envelopment Analysis
Wu Dash, PhD, University of Science and Technology of China, School of Business, Hefei, 230026, China, dash@ustc.edu, Liang Liang

The max-min DEA model is proposed by maximizing the efficiency of the minimal efficiency Units. The idea combines self-rated and other-rated schema. Thus, two problems that are weak discriminating power and unrealistic weight distribution occurred in classical DEA are solved. It is proved that Nash equilibrium(NE) can be led to by using the model.The NE-DEA methods may be suitable for evaluation of efficiency in for-profit organizations. A new method to estimate frontier is also presented.

5 — Estimating the Number of Finite Partitions in an Infinite Population
Elizabeth Schott, MAJ, Department of Mathematical Sciences, United States Military Academy, West Point, NY, 10996, United States, elizabeth.schott@usma.edu, Joe Myers

In reliability tests, failures are noted until you stop seeing new failures-you "find" them all . What is your best guess for number of failure types? This question is generalized and studied using infinite populations with finite partitions. We investigate algorithms using MLEs based on current samples to find the most likely number of partitions. These algorithms apply to any question about how a population is divided-from detecting missile failures to searching for gene defects.

■ WA23

Westin-Tower 1206, 12th Floor

Linear Programming II

Contributed Session

Chair: Hans Halim, Case Western Reserve University, 10900 Euclid Ave, Peter B. Lewis 320, Cleveland, OH, 44106, United States, hhh2@cwru.edu

1 — Accelerating the von Neumann Algorithm for Linear Programming
Joao Goncalves, Lehigh University, 200 West Packer Avenue, Bethlehem, PA, 18015-1582, United States, jog7@lehigh.edu, Robert Storer, Jacek Gondzio

We study the performance of the von Neumann algorithm on the Netlib test problems. We introduce some accelerating strategies and show the improvements they provide. We show that these algorithms have a very slow convergence but might still be useful when used in conjunction with other methods.

2 — The Cosine Simplex
Federico Trigos, IE PhD Program Chairman, ITESM Toluca Campus, Eduardo Monroy Cardenas 2000, San Antonio Buenavista, Toluca, Me, 50110, Mexico, ftrigos@itesm.mx, Jenny Diaz, Glicina Merino, Juan Frausto

A new starting point for Simplex Method will be presented, which uses all the information from the LP problem. Modified iteration of the Simplex Method will be shown producing a high performance algorithm. Great savings in the number of iterations versus commercial implementations will also be presented based on the Netlib set of problems.

3 — Coordinate Transformations for Bounded Linear Programs Based on a Geometric Explanation of Phase 1
Hans Halim, Case Western Reserve University, 10900 Euclid Ave, Peter B. Lewis 320, Cleveland, OH, 44106, United States, hhh2@cwru.edu, Daniel Solow, Chanin Srisuwannapa

An open question pertaining to the simplex algorithm is where phase 1 terminates. In this work, computer simulations support the conjecture that phase 1 terminates at a feasible point that is geometrically close to the starting point. This observation is exploited to develop a coordinate transformation for bounded linear programs that typically results in phase 1 ending at a feasible solution that is geometrically close to the optimal solution, thus requiring fewer pivots in phase 2.

■ WA25

Westin-Tower 1208, 12th Floor

Project Management

Contributed Session

Chair: Weiyu Tsai, Assistant Professor, University of Utah, David Eccles School of Business, 1645 East Campus Center Drive (107 KDGB), Salt Lake City, UT, 84112, United States, wytsai@u.washington.edu

1 — Payment Scheduling to Maximize Project Net Present Value: The Owner's Perspective
Joseph Szmerekovsky, Assistant Professor of Management, North Dakota State University, PO Box 5137, Fargo, ND, 58105, United States, Joseph.Szmerekovsky@ndsu .nodak.edu

The problem of a project owner in choosing a payment schedule is considered. The project owner would like to select a payment schedule which maximizes the net present value of the project. However, contractors tend to schedule activities for completion to maximize their own net present value, not that of the project owner. Hence, models are considered in which the owner selects an optimal payment schedule given that the contractor behaves in his own best interest .

2 — Activity Perturbations in PERT Networks
Anand Paul, University of Florida, Warrington College of Business, Stuzin 351, Gainesville, Fl, 32611, United States, paulaa@ufl.edu

We review research on the impact of changes in the statistics of activity duration on the statistics of project duration in general, and mean project duration in particular. We present some new results and outline opportunities for further research.

3 — Project Planning Under the Threat of a Disruptive Event
Gary Mitchell, Student, University of Washington, Department of Management Science, Seattle, WA, 98195-3200, United States, gfmitch2@u.washington.edu, Ted Klastorin, Prabhu Aggarwal

We consider a project planning problem when there exists the threat of a disruptive event occurring during the project. Given information about the likelihood of such an event, how should a project manager react? We analyze a number of cases (e.g., no due date, random duration) and indicate significant managerial implications.

4 — Mathematical Models for Studying How to Divide a Team
Will Millhiser, Case Western Reserve University, 2293 Bellfield Ave #2, Cleveland Heights, OH, 44106, United States, wxm29@cwru.edu, Daniel Solow

When a firm chooses to divide a department, it must decide how to reassign employees. Based on Kauffman's NK model, several mathematically-based assignment policies are studied to investigate how this process should take place. Computer simulations show that the best policy depends on firm characteristics such as the amount of worker interaction, leader skill, and the performance of the original team. Managerial insights from these simulations will be analyzed and interpreted.

5 — Applying a New Slack Measure to Resource Constrained Scheduling Problems
Weiyu Tsai, Assistant Professor, University of Utah, David Eccles School of Business, 1645 East Campus Center Drive (107 KDGB), Salt Lake City, UT, 84112, United States, wytsai@u.washington.edu

When solving resource-constrained project scheduling problems, numerous researchers have shown that it is fruitful to use slacks/floats to prioritize tasks in heuristic and optimization algorithms alike. In this paper, we propose a new slack measure that is composed of path-dependent and path-independent slacks. Using this metric to prioritize tasks, we develop an efficient heuristic for project scheduling problems. A numerical example illustrates this new metric and associated heuristic.

■ WA26

Westin-Tower 1401, 14th Floor

Data Mining II

Contributed Session

Chair: John Kros, Assistant Professor of Decision Sciences, East Carolina University, 3206B Bate, College of Business, East Carolina University, Greenville, NC, 27858, United States, krosj@mail.ecu.edu

1 — Scheduling Using Data Mining
Sigurdur Olafsson, Assistant Professor, Iowa State University, 2019 Black Engineering, Ames, IA, 50011, United States, olafsson@iastate.edu

Production scheduling is often done in an ad-hoc manner, relying on the implicit knowledge and experience of the scheduler. Such knowledge is often difficult to capture in an explicit model, making it difficult to either automate or improve the scheduling. In this talk, we describe how to use data mining to discover previously unknown patterns in historic production data, use the data mining models to schedule new jobs, and to use patterns discovered to improve on current scheduling practices.

2 — Data Mining on Credit Cardholder Behavior by Using Fuzzy Linear Programming
Yong Shi, Professor, University of Nebraska-Omaha, 60th and Dodge Street, Omaha, NE, 68118, United States, yshi@unomaha.edu, Jing He, Xiantao Liu

Behavior analysis of credit cardholders is one of the main research topics in credit card portfolio management. This paper proposes a heuristic classification method by using the fuzzy linear programming (FLP) to discover the bankruptcy patterns of credit cardholders. In the paper, a real-life credit database from a major US bank is used for empirical study which is compared with the results of known multiple linear programming approaches.

3 — Classification: A Biobjective Approach
Belen Martin-Barragan, Universidad de Sevilla, Matematicas. Reina Mercedes S/N, Sevilla, 41012, Spain and Canary Islands, belmart@us.es, Emilio Carrizosa, Dolores Romero-Morales

In this talk we present a model for nonparametric statistical classification in which two (contradicting) criteria are considered: maximization of the generalization and minimization of the cost.

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

This research tests the impact of imprecise data on the Neural Network Transfer Function type in KDD. Most commercial KDD software packages that utilize Neural Networks employ the s-Sigmoid Transfer Function. The s-Sigmoid Transfer Function is investigated and compared in this work. Specific imputation methods (case deletion, mean substitution, hot deck, cold deck, etc.) for dealing with imprecise data are compared using a Neural Network employing the s-Sigmoid Transfer Function.

■ WA27

Westin-Tower 1402, 14th Floor

Integer Programming/Combinatorics

Contributed Session

Chair: Balaji Gopalakrishnan, Postdoctoral Fellow, Institute for Mathematics & Its Applications, 400 Lind Hall, 207 Church St . S.E, Minneapolis, MN, 55455, United States, balaji@ima.umn.edu

1 — Parallel Replacement under Deterioration
Jinlong Ban, Lehigh University, Industrial and Systems Engineering, H.S.Mohler Lab, #476, 200 W. Packer Ave, Bethlehem, PA, 18015, United States, jib5@lehigh.edu, Joseph Hartman

In this paper, we investigate the parallel replacement problem with heterogeneous assets. We show its complexity is NP-complete, and solve this problem with different methods: branch-and-cut algorithm and lagrangian decomposition algorithm. We compare these two methods and provide computational results.

2 — Staff Scheduling: The Wedelin/Carmen Algorithm and Elastic Constraint Branching
Andrew Mason, University of Auckland, School of Engineering, Private Bag 92019, Auckland, NZ, New Zealand, a.mason@auckland.ac.nz

The Wedelin algorithm is a Lagrangian heuristic used by Carmen Systems to solve large crew pairing problems. We extend this approach by developing an implementation for personnel scheduling (also termed staff rostering) that exploits the special structure of this problem. We introduce elastic constraint branching & show that it improves the performance of our new approach while making it more column generation friendly. Our approach can outperform the commercial solver Cplex on hard instances.

3 — A Polynomial Algorithm for Recognizing Perfect Graphs
Xinming Liu, Carnegie Mellon University, 5000 Forbes Ave, Pittsburgh, PA, 15213, United States, xinming@cmu.edu, Kristina Vuskovic, Gerard Cornuejols

We present a polynomial algorithm for recognizing perfect graphs. The algorithm uses a decomposition theorem of Conforti, Cornuejols and Vuskovic. Another polynomial algorithm for recognizing perfect graphs, which does not use decomposition, was obtained simultaneously by Chudnovsky and Seymour. Both algorithms need a first phase developed jointly by Chudnovsky, Cornuejols, Liu, Seymour and Vuskovic.

4 — Production Planning and Scheduling for Process Industries: A Cutting Plane Approach
Francesco Gaglioppa, Graduate Assistant, University of Minnesota, 111 Church Street SE, Mechanical Engineering Bldg., Minnesota, MN, 55455, United States, fgagliop@me.umn.edu, Saif Benjaafar, Lisa Evans Miller

We consider the problem of determining production quantities and production timing in a batch process where each task may require one or more inputs and may produce one or more outputs. Final products are the results of a sequence of such tasks. We formulate the problem as a mixed integer linear program. We identify several valid cuts which we show can significantly reduce solution time.

5 — Minsum Vertex Cover Problem for Trees
Balaji Gopalakrishnan, Postdoctoral Fellow, Institute for Mathematics & Its Applications, 400 Lind Hall, 207 Church St. S.E, Minneapolis, MN, 55455, United States, balaji@ima.umn.edu, Gianpaolo Oriolo

The Minsum vertex cover (MSVC) problem is a linear arrangement of the vertices of a graph that minimizes the average cover time of the edges. Linear arrangement problems on graphs often come up as heuristics for speeding up matrix computation. Recently, it was shown [Feige, Lovasz, Tetali] to be NP-hard to approximate within some constant C > 1. The problem remains open for trees. We present a polynomial time algorithm for the MSVC problem for a special class of trees.

■ WA28

Westin-Tower 1403, 14th Floor

Integer Programming II

Contributed Session

Chair: Luis Zuluaga, Carnegie Mellon University, 269 Spring Run Road, Crescent, PA, United States, lzuluaga@andrew .cmu.edu

1 — Modified Lenstra's Algorithm for Mixed Integer Optimization
Zhifeng Li, Northwestern University, IE/MS Department, Evanston, IL, United States, z-li1@northwestern.edu, Sanjay Mehrotra

We will report our progress on developing methodology on redesigning lenstra's mixed integer linear programming algorithm for implemenation in large sparse problems. We will show how the problem of finding a branching hyperplane in the branch-and-bound tree can be formulated in the original space. Depending on the progress, we will present results on some difficult test problems to demonstrate the value of this approach.

2 — Strategic Budgeting for Initial Response Costs Incurred in Wild-Land Fire Management — an IP Modeling Approach
Gyana R. Parija, On Demand Innovation Services (ODIS), Optimization and Analytics Research/Math, IBM Thomas J. Watson Research Center, United States, parija@us.ibm .com, Brian Booher, Dan Keller

We will present an IP model for optimizing the initial attack (IA) organization needed to maximize the effectiveness of various fire containment activities that can be sustained by the optimal IA organization. An initial attack organization could consist of a set of hand crews, engines, dozers, helicopters, and the like. The optimization model attempts to find the "best" IA organization (a collection of resources) available within the allowable annual cost allocations to respond to a set of representative fire ignitions that could occur within a planning year. We will also discuss some of our computational experiences of running the IP model on a few prototype data sets.

3 — Lift-and-Project for 0-1 Programming via Algebraic Geometry
Luis Zuluaga, Carnegie Mellon University, 269 Spring Run Road, Crescent, PA, United States, lzuluaga@andrew.cmu.edu, Juan Vera, Javier Pena

Algebraic tools have been applied to develop solution schemes for a large class of optimization problems. A central idea in these constructions is to express a polynomial that is positive on a given domain in terms of high degree polynomials. This resembles the "lifting" phase in lift-and-project procedures. For special domains, we propose an enhancement to these schemes via a construction that is reminiscent of the "projecting" phase in lift-and-project procedures.

4 — The Unit Commitment Problem - An Integer Programming Approach
Deepak Rajan, University of California, Berkeley, 4135 Etcheverry Hall, Berkeley, CA, United States, deepak@ieor.berkeley.edu, Jon Lee, Samer Takriti

In the unit commitment problem, if a generator is started up, then it must remain on for a certain number of time periods (and similarly when shut down). We present computational results that analyze the trade-offs in the different approaches to handling these up/down constraints in a branch-and-cut framework.

5 — Optimal Region Design for the National Organ Allocation System
Nan Kong, University of Pittsburgh, 1048 Benedum Hall, Pittsburgh, PA, 15261, United States, nak11@pitt.edu, Brady Hunsaker, Mark Roberts, Andrew Schaefer

Currently organs are allocated at a local, regional, and national level, in that order, depending on patient-organ matches. The number of donations is insufficient for the number of patients who need them, which requires that we allocate organs more efficiently. In this talk, we redesign the regions such that total number of intra-regional liver transplants is maximized. We consider the issue of fairness. We discuss the possibility of applying some advanced computational optimization techniques.

■ WA30

Westin-Tower 1405, 14th Floor

Facilities Planning & Design III

Contributed Session

Chair: Siddharth Chandramouli, PhD candidate, University of Michigan, IOE Department, 1205 Beal Avenue, Ann Arbor, MI, 48109, United States, siddhart@umich.edu

1 — Cluster Analysis and Third World Countries
G S Kumar, Management Consultant, 4105 Marable Lane, Johnson City, TN, 37601, United States, gskumar@earthlink.net

Is cluster analysis in cellular manufacturing history? We will attempt to show that it isn't. We feel it has vast potential as a first cut in plant layout in third world countries.

2 — John Wayne Airport Security
Daniel Weiss, Cadet, United States Military Academy, PO Box 3789, West Point, NY, 10997, United States, x46988@usma.edu, Jason Miller

Under the Aviation and Transportation Security Act, 100% of passenger baggage must be screened for explosives, weapons, and other harmful materials at all federally regulated airports. The presented work examines this requirement in detail and proposes a specific design solution for John Wayne Airport, Orange County, California.

3 — Throughput Analysis of Loop-Based AGV Systems with Vehicle Blocking
Siddharth Chandramouli, PhD candidate, University of Michigan, IOE Department, 1205 Beal Avenue, Ann Arbor, MI, 48109, United States, siddhart@umich.edu, Yavuz Bozer

Loop-based AGV systems — also known as "Shuttle Transfer Vehicles" (STVs) — offer simplicity and flexibility in supporting a wide range of job routings that may change over time. Assuming FEFS dispatching, we present analytical and simulation models to study vehicle blocking and its impact on system throughput capacity.

■ WA31

Westin-Tower 1406, 14th Floor

Facilities Planning & Design II

Contributed Session

Chair: Necati Aras, Assistant Prof., Bogazici University, Bebek, Istanbul, TR, Turkey, arasn@boun.edu.tr

1 — Planar Maximal Covering Location Problems with Different Block Norms
Hassan Younies, Graduate Student, McMaster University, School of Business, 1280 Main Street West, Hamilton, ON, L8S 4M4, Canada, youniehz@mcmaster.ca, George Wesolowsky

Given n demand pointsin R2 with equal weights, we discuss the planar maximal coverage problem for facilities with different norms. We present a technique to transform and solve this problem as an unconstrained binary quadratic problem (UQP).

2 — Solving The Uncapacitated Multi-facility Weber Problem by Vector Quantization
Necati Aras, Assistant Prof., Bogazici University, Bebek, Istanbul, TR, Turkey, arasn@boun.edu.tr, I. Kuban Altinel, Kerem Ozkisacik

We consider the vector quantization method to solve the uncapacitated version of the multi-facility Weber problem formulated using any distance metric. This problem is concerned with locating m facilities in the Euclidean plane to satisfy the demand of n customers with the minimum possible transportation cost. Experimental results on benchmark problems indicate that this method is comparable to other neural network based heuristics both in terms of solution quality and computational time.

3 — Integration of Flow-Based Department Formation into Facility Layout Design
Junjae Chae, Dept. of Industrial Engineering, Texas A&M University, 340D Zachry Engineering Center, College Station, TX, 77843-3131, United States, jchae@tamu.edu, Brett A. Peters

Facility layout design generally solves complex relationships in a sequential manner. In this research, we integrate flow-based department formation and layout into a comprehensive mathematical model intended to determine assignment of manufacturing components to departments, number and dimension of departments, and location of departments within the floor space. Complicating department area constraints are linearized to allow solution with general purpose optimization software.

■ WA32

Westin-Tower 1407, 14th Floor

Production Planning

Contributed Session

Chair: I.A. Karimi, National University of Singapore, 10 Kent Ridge Crescent, Singapore, cheiak@nus.edu.sg

1 — A Production Planning Model for Assemble-to-Order Products
Ke Fu, Student, Department of IEEM, Hong Kong U of Sci & Tech, Clear Water Bay, Kowloon, Hong Kong, HK, Hong Kong, kefu@ust.hk, Chung-Yee Lee, Vernon Hsu

We consider a contract assembly manufacturer who produces one product with multiple components during a finite horizon. The demand is uncertain at the moment and will become less uncertain as time goes on. The products will be delivered to the customers at the end of the horizon. Our objective is to determine the optimal stocking quantity of the components.

2 — Scheduling and Ordering Production Policies in a Limited Capacity Manufacturing
Soundouss Bouhia, PhD candidate, Harvard University, 29 oxford St, Pierce 411, Cambridge, MA, 02138, United States, sbouhia@deas.harvard.edu, Frederick H. Abernathy

This paper formulates production policies to maximize the performance of an apparel manufacturing system that replenishes items characterized by a flat average demand. The simulation-based model compares a number of production strategies and chooses an ordering and scheduling policy that increases the overall performance of the supply chain. The optimal strategy is selected to maximize the supplier's profit while maintaining a high order fill rate and minimizing the risk of carrying inventory.

3 — Dynamic Assignment of Cross-trained Workers in a Production Line
Janice Winch, Associate Professor, Pace University, Lubin School of Business, One Pace Plaza, New York, NY, 10038, United States, jwinch@pace.edu

We consider a production line where cross-trained workers can be reallocated among the stations as needed. Modeling this as a tandem queueing system, we study the optimal dynamic allocation policy which maximizes the throughput of the system. The results for small systems are obtained analytically and larger systems are analyzed using simulation.

4 — Using Visualization in Production Scheduling in the Apparel Industry
Melissa Bowers, Associate Professor, University of Tennessee, 607 Stokely Management Center, Knoxville, TN, 37996, United States, mrbowers@utk.edu, Anurag Agarwal

A leading apparel manufacuturer found themselves with insufficient capacity to meet demand in one of their most profitable divisions. Visualization was employed as an analysis tool to document the production process and was key to understanding that the perceived shortage of capacity was due in large part to inefficiencies in scheduling. Visualization then facilitated a production scheduling heuristic adopted at the facility which led to a significant improvement in throughput.

5 — Integrating Refinery Supply Chain Operations from Tanker Arrivals to Crude Oil Processing
I A Karimi, National University of Singapore, 10 Kent Ridge Crescent, Singapore, Singapore, cheiak@nus.edu.sg, R Srinivasan, P C Prakash Reddy

Petroleum refining is an extremely competitive business. We present a novel mixed-integer linear programming approximation to and an iterative algorithm for this nonlinear problem of responding to tanker arrivals and selecting crude mixes in a refinery, which can improve refinery supply chain operations through intelligent use of less expensive crude stocks, capture of quality barrels, reduction of yield and quality giveaways, reduced demurrage costs, etc.

■ WA33

Westin-Tower 1408, 14th Floor

Scheduling V

Contributed Session

Chair: Saif Benjaafar, Professor and Director, University of Minnesota, Center for Supply Chain Research, Minneapolis, MN, 55455, United States, saif@ie.umn.edu

1 — Constraint Programming Applications in a Class of Production Scheduling Problems
Omer Benli, Associate Professor, California State University, Long Beach, Department of Information Systems, 1250 Bellflower Boulevard, Long Beach, CA, 90840-8506, United States, obenli@csulb.edu

It is possible to formulate a class of production scheduling problems as periodic review models with variable period lengths. Mixed integer formulation of such problems, in addition to requiring a number of assumptions, results in very large-scale problems. This study compares and contrasts the use of "conditional constraint" of constraint programming with traditional mathematical programming approach.

2 — Heuristic to Improve Computation Time of A Single Machine Distributed Scheduling Problem
Sun Woo Kim, Graduate Assistant, Texas A&M University, Dept. of Industrial Eng., College Station, TX, United States, sun-woo-kim@neo.tamu.edu, Jorge Leon

We consider a single machine scheduling problem where the decision authorities and information are distributed in multiple sub-production systems. The problem is formulated by integer programming and thus the computation time significantly increases as the number of jobs increases. We propose a heuristic which improves the computation time. The experimental results will be presented and discussed.

3 — Challenges in Scheduling of Fractional Owership Aircraft
Wei Yang, Visiting Faculty, Case Western Reserve Univ., Weatherhead School of Management, Cleveland, OH, United States, wxy11@cwru.edu, Itir Karaesman, Sridhar Tayur, Pinar Keskinocak

In the fractional ownership aircraft business, both the demand and the supply change dynamically over time. We develop a real time minimum impact optimizer that can accommodate changes in the demand and/or supply conditions to produce a near-optimal while managerially acceptable solution. We further analyze the scheduling problem and show when and how optional demand (such as charter requests) can be incorporated.

4 — Scheduling a Production-Distribution System with Due Dates
Guruprasad Pundoor, PhD student, University of Maryland, R.H.Smith School of Business, College Park, MD, 20742, United States, Zhi-Long Chen

We consider a make-to-order production-distribution system with one supplier and one or more customers. A set of orders from the customers need to be processed by the supplier and delivered to the customers once completed. The objective is to optimize the tradeoff between maximum delivery lateness and the total distribution cost. We analyze the solvability of various cases of the problem, propose a heuristic, and study the value of production-distribution integration.

5 — Sequencing with Limited Flexibility
Saif Benjaafar, Professor and Director, University of Minnesota, Center for Supply Chain Research, Minneapolis, MN, 55455, United States, saif@ie.umn.edu, Maher Lahmar

We consider the problem of resequencing a set of prearranged jobs when there is limited resequencing flexibility and sequence dependent changeover costs. Resequencing flexibility is limited by how far forward or backward a job can shift in the sequence relative to its original position. We show how the problem can be modeled as constrained TSP and solved using dynamic programming in time polynomial in the number of jobs. We discuss various applications.

■ WA34

Mart-Room A

Design and Operational Issues in Maritime Container Terminals

Sponsor: Transportation Science & Logistics
Sponsored Session

Chair: Ardavan Asef-Vaziri, Assistant Professor, Department of Systems and Operations Management, California State, United States, aasef@uh.edu

1 — Automated Cross-Docking Container Terminal
J.M.A. Tanchoco, Professor, School of Industrial Engineering, Purdue University, West Lafayette, IN, 47907, United States, tanchoco@purdue.edu, Mohammad J. Alkhedher

We present the results of studies on the use automated guided vehicles (AGVs) and deep-lane flow racks for an automated cross-docking maritime container terminal. A number of facility design issues were addressed.

2 — A Heuristic Algorithm for Container Loading Problem
Ali Haghani, University of Maryland, Department of Civil Engineering, College Park, MD, 20742, United States, haghani@eng.umd.edu, Evangelos Kaisar

This paper presents a model system that can realistically optimize the procedure of loading containers on containerships. The mathematical model presented addresses the complexity by considering many factors, such as longitudinal moment, trim, and metacentric height (GM). This mixed integer-programming model is based on minimizing the extra container handling cost. A heuristic algorithm for solving the problem is presented as well as some implementation results .

3 — Modeling and Simulation for Enabling Container Terminal Re-Engineering
Agostino Bruzzone, Professor, University of Genoa, via Opera Pia 15, Genoa, GE, 16145, Italy, agostino@itim.unige.it, Roberto Revetria

Container Terminals represent a elaborate system in Ports; however in this sector significant improvements can be achieved by introducing automation and IT (Information Technology) management systems. Modeling & Simulation (M&S) represent an effective approach for re-engineering of container terminals. We proposes a set of successfully M&S applications to Container Terminal devoted to face different aspects such as design, Dock management, and Parking Policy Definition etc. We provide a general overview about critical issues and effective potentials in this application field.

4 — A Combined Container Handling System in Maritime Terminals
Ardavan Asef-Vaziri, Assistant Professor, Department of Systems and Operations Management, California State, United States, aasef@uh.edu, Maria Cadavid, Ed Dougherty

We introduce a new concept of high density storage and retrieval system in maritime terminals. While the staking system is similar to the conventional container blocks, the vertical and horizontal movements are combined. Instead of gantry cranes and hustlers, both vertical and horizontal movements are accomplished using an overhead grid system of rails and container carrying shuttles. A 3D simulation and animation model is developed to evaluate throughput and space utilization of alternative designs.

■ WA35

Mart-Room B

Inventory Management III

Contributed Session

Chair: Brian Rieksts, Graduate Student, Penn State, 310 Leonhard Building, University Park, PA, 16802, United States, bqr2@psu.edu

1 — The Use of Imperfect Advance Demand Information When Two Demand Classes Exist
Tarkan Tan, Eindhoven University of Technology, Department of Technology Management, Pav. F07, Eindhoven, The Netherlands, t.tan@tm.tue.nl, Refik Gullu, Nesim Erkip

In this talk, we consider an inventory problem with two demand classes having different priorities. We develop a model that incorporates imperfect Advance Demand Information (ADI) with the ordering decision and rationing available inventory. In a two-period setting, we propose a solution methodology based on Monte Carlo simulation. We conduct empirical tests under normally distributed demand case to measure the impact of system parameters on the expected value of ADI.

2 — The Impact of Delayed Demand Information on Inventory Performance
Xiaolong Zhang, Assistant Professor, Fairleigh Dickinson University, Department of ISDS, 285 Madison Avenue, Madison, NJ, 07940, United States, zhang@fdu.edu

This paper examines the impact of delayed demand information on the inventory performance of a single-stage replenishment system. We quantify the delay effect with an additive measure and a multiplicative measure—both are functions of the demand autocorrelation and delivery leadtime. The findings suggest that a delay in demand information can increase the inventory cost significantly when the demand is positively autocorrelated. Longer leadtime exacerbates this negative delay effect on cost.

3 — Using Customer Wait Time to Improve a Supply Chain
Carol Fan, Mathematician, RAND Corporation, 1700 Main Street, Santa Monica, CA, 90407, United States, fan@rand.org, Candice Riley, Kenneth Girardini, Robert Agnew, Sungho Lee, Elvira Loredo

The Navy's submarine force typically undergoes short, periodic maintenance refits. To ensure a high performing fleet, RAND was asked to track the performance of the Boat Refit Supply Chain. Using Customer Wait Time (CWT) metrics by source of supply and by linking CWT to maintenance processes, we were able to pinpoint two ways to improve CWT: 1) increase local issues through establishment of new inventory levels, and 2) reduce dependence on local purchases with long associated CWT.

4 — Food Logistics in Cruise Liner Operations
Murat Erkoc, U of Miami, IE Dept, Coral Gables, FL, 33124, United States, merkoc@miami.edu, Eleftherios Iakovou, Andre Spaulding

In order to receive better prices, most cruise liners contract the purchases of food that will be consumed by the guests during their stay in advance when the final number of bookings is not realized yet. Based on the finalized bookings, the cruise liner may need to make additional purchases paying higher spot market prices. We investigate multi stage optimal policies for inventory management of food items in cruise liners under such settings where daily consumption rates are stochastic.

5 — Effective Inventory Policies with Quantity Discounts for Serial Supply Chains
Brian Rieksts, Graduate Student, Penn State, 310 Leonhard Building, University Park, PA, 16802, United States, bqr2@psu.edu, José Ventura, Yale Herer

This paper derives worst-case performance bounds of power-of-two policies for a series inventory system with an incremental quantity discount in the first stage. An extension is also provided for a system with price dependent holding costs.

■ WA36

Mart-Room C

Managing Supply Chains with Multiple Products

Sponsor: Manufacturing and Service Operations Management
Sponsored Session

Chair: Pinar Keskinocak, Georgia Institute of Technology, School of Industrial and Systems Eng., Atlanta, GA, 30332, United States, pinar@isye.gatech.edu

Co-Chair: Aliza Heching, IBM TJ Watson Research Lab, 1101 Kitchawan Rd / Rt 134, PO Box 218, Yorktown Heights, NY, 10598, United States, ahechi@us.ibm.com

1 — Optimal Production Across Markets with Stochastic Exchange Rates
John Birge, Northwestern University, Industrial Engineering & Management Scie, Evanston, IL, United States, jrbirge@northwestern.edu, Umut Aytekin

We consider a multinational manufacturing meeting demand in different markets with production in each market. We consider a stochastic exchange rate and a continuous-time framework for production decisions. 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 — Competition, Cooperation and Information Sharing in a Two-Echelon Assembly System
Fuqiang Zhang, PhD candidate, University of Pennsylvania, 3730 Walnut St. Suite 500, Philadelphia, PA, 19104-6340, United States, fuqiang@wharton.upenn.edu, Gerard Cachon

This paper studies a two-echelon assembly system and explores several important issues in managing decentralized supply chains. We show that the Nash equilibrium of the competitive assembly system exists but is never system optimal. We also investigate the role of horizontal information sharing between the suppliers. Finally a demand-independent coordination contract is proposed to coordinate the assembly system.

3 — Optimal Pricing and Inventory Management of Substitutable Products
Lap Mui Ann Chan, Assistant Professor, University of Toronto, School of Management, 105 St. George Street, Toronto, ON, M5S 3E6, Canada, achan@rotman.utoronto.ca, Mustafa Karakul

We consider the introduction of a new product, which can also be used as a substitute to a well-established existing product. It is assumed that the price and demand of the existing product are known. Our objective is to maximize the profit while making optimal combined pricing and ordering decisions for these two products.

4 — Supply Chain Interactions between a Durable Goods Manufacturer and Complementary Firms
Sreekumar R. Bhaskaran, Doctoral Student, University of Texas at Austin, CBA 4.202, Dept of Management, Austin, TX, 78705, United States, Sreekumar.Bhaskaran-Nair@phd .bus.utexas.edu, Stephen M. Gilbert

We examine the effect that a complementary product has on a durable goods manufacturer's distribution strategy to lease or sell its product. We show that when the production of complementary products is controlled by a separate firm(s), the durable goods manufacturer's preference for leasing diminishes. In fact, even if the complementarity is relatively weak, some amount of selling is always optimal.

■ WA37

Mart-Room D

Optimization Modeling and Techniques

Contributed Session

Chair: Alex Meeraus, GAMS Development Corporation, 1217 Potomac Street, NW, Washington, DC, 20007, United States, ameeraus@gams.com

1 — A Variation of the Primal-Dual Method for Approximation Algorithms
Vardges Melkonian, Ohio University, 550 Morton Hall, Athens, OH, 45701, United States, vardges@math.ohiou.edu

We present a new method of designing primal-dual approximation algorithms for combinatorial optimization problems. The idea of the new method is to keep the current solution in the interior of the dual feasible region. Our computational results compare the performance of the new method with the traditional primal-dual for certain classes of problems, particularly for the set cover problem.

2 — The TOMLAB Optimization Environment for Large-Scale Optimization in MATLAB
Marcus M. Edvall, Business Manager, Tomlab Optimization Inc., 455 Union St. #13, Arcata, CA, 95521-7107, United States, medvall@tomlab.biz, Kenneth Holmström

TOMLAB, http://tomlab.biz, has seen a tremendous growth during the last years. Most state-of-the-art optimization software has been hooked up, e.g. KNITRO, SNOPT and CONOPT for large-scale nonlinear programming, and CPLEX and Xpress-MP for large-scale mixed-integer programming. The unified input-output format makes comparison easy. Tomlab now makes MATLAB a tool for large-scale optimization. The talk will discuss design, user examples, experience, solver comparisons and results.

3 — On the Construction of a Family of Stochastic Programming Test Probelms
Cristina Cacho, GE Capital GCF, Av. Prolongacion Reforma 490, Mexico, DF, 01217, Mexico, ccacho@yahoo.com, Andrew Felt, K. A. Ariyawansa

Ariyawansa and Felt have recently created a test problem collection for testing stochastic programming software. We describe the construction of a new family of stochastic programming test problems based on a tactical manpower planning model that would be added to the collection in the near future.

4 — 0-1 Inequalities For MIP from Short Start BB Runs
Kurt Spielberg, Dr., 100 N 22 street, unit 134, Philadelphia, PA, 19103, United States, kurtspie@yahoo.com

For difficult (0-1) MIP problems we construct short starts at a good known solution. Via brief BB runs we then can find (0-1) inequalities which tighten the search, e.g. by introducing double contraction characteristics. The approach appears promising but will require substantial testing of its final effectiveness in finding better solutions.

5 — Rapid Implementation of Branch-and-Cut with Heuristics using GAMS
Alex Meeraus, GAMS Development, 1217 Potomac Street, NW, Washington, DC, 20007, United States, alex@gams.com, Michael R. Bussieck, Hua Ni, Hernan Abeledo

We report on a novel architecture for implementing solver-independent cut generators and primal heuristics within the GAMS framework, requiring no additional programming skills and solver-specific knowledge. This new facility utilizes the GAMS Data Exchange (GDX) and currently can be used with commercial solvers like CPLEX, XPRESS and SBB. The benefits of this approach will be illustrated with examples from the recent literature.

■ WA38

Mart-Room E

Transportation II

Contributed Session

Chair: Jennifer Farver, Doctoral Candidate, Massachusetts Institute of Technology, 410 Memorial Dr., #242, Cambridge, MA, 02139, United States, jennyfar@mit.edu

1 — Transportation Demand Using Structural Equations
Julian Benjamin, Professor, North Carolina A&T State University, Department of Economics, Greensboro, NC, 27408, United States, benjamin@ncat.edu

Forecasting travel demand has traditionally been a two-stage process. However, structural equation methods have been used to analyze demand when there is feedback. The structural equation models however cannot be used to forecast. Simulated forecasts based on the relationships in the structural equation model are developed and evaluated.

2 — Estimation of Economic Impact of V.M.S. Route Guidance using Microsimulation
Bekir Bartin, Graduate Assistant, Rutgers University, Civil & Environmental Engg Dept, 623 Bowser Rd, Piscataway, NJ, 08854, United States, bbartin@rci.rutgers.edu, Kaan Ozbay

This paper evaluates the effectiveness of traveler information via Variable Message Signs in a highly congested highway network in South Jersey. The study network is modeled and calibrated using PARAMICS simulation software. The simulation routine is modified to model a realistic VMS routing algorithm and route choice behavior. The effectiveness of several VMS locations is evaluated based on Full Marginal Cost reductions obtained for trips along the main route between SJ and Philadelphia CBD.

3 — Solving the Single-Track Train Scheduling Problem with Enhanced Branch-and-Bound Methods
Ming Zhong, University of Maryland, R H Smith School of Business, 3300 Van Munching Hall, University of Maryland, College Park, MD, 20742, United States, mzhong@rhsmith.umd.edu, Xuesong Zhou

Based on a branch-and-bound framework, an efficient schedule generation scheme with enhanced lower bounds and dominance rules is developed to find optimal solutions for the train scheduling problem in a single-track line and further provide benchmarks for evaluating several heuristic algorithms. Implementation issues and computational results are discussed.

4 — Moving Slot Model on Automated Highway System
Chi-Nan Chin, University of Southern California, 1226 Armacost Ave. Apt. 2, Los Angeles, CA, 90025, United States, chinanch@usc.edu

The Moving Slot Model is designed on an Automated Highway System to achieve better utilization of space in rush hours. Slot Assignment Rules are developed to reduce the support of infrastructure. A simplified one-lane AHS will be presented to illustrated and compare performances.

5 — Vehicle-Centric Hybrid Route Guidance
Jennifer Farver, Doctoral Candidate, Massachusetts Institute of Technology, 410 Memorial Dr., #242, Cambridge, MA, 02139, United States, jennyfar@mit.edu, Ismail Chabini

We present an algorithm for hybrid route guidance in which a decentralized logic that operates at the vehicle level is employed to improved upon routes generated by a centralized, predictive layer. The algorithm has been implemented and tested on a sample network in which both guided and unguided drivers are modeled. Results are given which show that the algorithm is successful at responding to low levels of network stochasticity, as well as to congestion caused by incidents.

■ WA39

Mart-Room F

Supply Chain Management IV

Contributed Session

Chair: Sirong Luo, Ph.D Candidate, School of Management, The University of Texas At Dallas, 2601 North Floyd Road, Richardson, TX, 75083-0688, United States, sxl01200@utdallas.edu

1 — Supply Chain Design under Product Substitutability
Chongqi Wu, University of Illinois at Urbana-Champaign, 339 Wohlers Hall, 1206 S. Sixth Street, Champaign, IL, 61820, United States, cwu5@uiuc.edu, Suman Mallik

Manufacturers often compete on substitutable products, rather than on identical products. Using stylized models, we study the supply chain contracting problems between manufacturers and retailers under product substitutability. We compare and contrast different decentralized supply chain structures and benchmark our results against centralized systems.

2 — Evaluate Postponement Strategies to Accommodate Mass Customization
Che-Ping Su, Ph. D. Student, Georgia Tech, DuPree College of Management, Georgia Institute of Technology, Atlanta, GA, 30332-0520, United States, gte063k@prism .gatech.edu, Yih-Long Chang, Mark Ferguson

Postponement is the center feature of Mass customization. We evaluate two types of Postponement strategies and discuss the effect of product proliferation on them. In addition, we derive conditions under which one is preferred than the other.

3 — Optimal Promotion-Production Decision and Demand Process Switching Two States
Hisashi Kurata, Ph.D. student, Univ. of Wisconsin-Milwaukee, P.O. Box 742, School of Business, Milwaukee, WI, 53201, United States, hkurata@uwm.edu, John J. Liu

This study analyzes marketing-manufacturing coordination under switching demand of a retailer-manufacturer supply chain. First, we model the demand process under promotions as time series imposed with Markov switching. Second, we study how a retailer reasonably makes its promotion decision by considering promotion effect on demand and on the manufacturer's production as response to promotion. We obtain an analytical solution and then examine the behavior of the solution via numerical simulation.

4 — Fit Between Plant Flexibility and Supplier Flexibility Enhances Profits in US Manufacturers Abroad
Paul Swamidass, Professor and Associate Director (TWCTM), Auburn University, Thomas Walter Center for Technology Mana, Tiger Drive, Room 104, Auburn University, AL, 36849-5358, United States, swamidp@eng.auburn.edu, Balram Avittathur

In a study of supply chains of 26 US plants located in India, we found that the variables "plant flexibility" and "supplier flexibility" mutually interact to give interesting results. The results are: 1) flexible plants using flexible suppliers show increased profits; and 2) inflexible plants using flexible suppliers show declining profits. Conclusions include, for sake of profitability, flexible plants should seek flexible suppliers, but inflexible plants should seek less flexible suppliers.

5 — Lead Time Options in Supply Chain
Sirong Luo, Ph.D Candidate, School of Management, The University of Texas At Dallas, 2601 North Floyd Road, Richardson, TX, 75083-0688, United States, sxl01200@utdallas.edu, Metin Cakanyildirim

We study lead time options in a manufacturer and a retailer supply chain where the retailer uses the (R,Q) inventory policy and has an opportunity to expedite or postpone the delivery of the order. We establish the optimal lead time policy. We discuss that R is much more sensitive to lead time than Q and focus on finding optimal R. We also discuss the application of lead time options. Finally, we numerically illustrate the benefit of options in improving supply chain performance.

■ WA40

Mart-Room G

Supply Chain Dynamics

Contributed Session

Chair: Debra Elkins, General Motors R&D Center, 30500 Mound Road, Mailcode 480-106-359, Warren, MI, 48090, United States, debra.elkins@gm.com

1 — Supply Chain Dynamics, Analysing Structural Causes of Bullwhip Effect
Felipe Villegas-Moran, Doctoral Programme Member, Manchester Business School, Greygrath Hall, 1 Lower Park Road, Manchester, GM, M14 5RS, United Kingdom, fvillegas@man.mbs.ac.uk

The Bullwhip effect (BW) is used to describe the signal distortion produced along the supply chain of the original demand signal from the market. Our research focuses on the "structural causes" of the BW defined by decision makers along the supply chain. We present three real models of supply chain dynamics of multinational companies in the consumer goods industry. Using systems dynamics, we analyse opportunity areas for their managers.

2 — Models for Robust and Reliable Supply Chains
Diego Klabjan, Assistant Professor, University of Illinois at Urbana-Champaign, 1206 West Green Street, Urbana, IL, United States, klabjan@uiuc.edu, Deborah Thurston, Markus Bundschuh

We present formulations for strategic design of robust and reliable supply chains with long term and options contracting. Reliable chains are less likely to be disrupted, whereas robust chains perform well in a case of a disrupted supply channel. We consider an integrated inbound supply chain of a manufacturer and we embed aspects of reliability and robustness into the traditional supply chain model.

3 — Supply Chain Stability
Robert Burgess, Georgia Institute of Technology, 755 Ferst Drive, Atlanta, GA, 30332, United States, robert.burgess@mgt.gatech.edu, Craig Hill

There is a set of competencies that make Contract Manufacturers (CM) successful in the supply chain. As the CM produces a better supply chain, the downside risk to the CM increases. This research provides a theoretical framework of the effects of this risk on the stability of the supply chain.

4 — ERP for Small Business: Is it Feasible?
Mohammed Arif, Assistant Professor, Carthage College, 2001 Alford Park Drive, Kenosha, WI, 53140, United States, marif@carthage.edu

Enterprise Resource Planning (ERP) systems have been used by organizations either to reduce the cost or to add value to the operations. ERP vendors have started offering a new range of products for the small business environment following their success in larger corporations. This presentation highlights some of the characteristics of ERP, which make it difficult for the small business environment to implement.

5 — Supply Chain Risk and Vulnerability Analysis: Practice and Promise
Debra Elkins, General Motors R&D Center, 30500 Mound Road, Mailcode 480-106-359, Warren, MI, 48090, United States, debra.elkins@gm.com, Datta Kulkarni, Jeffrey Tew

Supply chain risks can significantly disrupt normal business operations. We discuss an industry portfolio of risks, and highlight the subset of risks that industry "worries" about on a regular basis. To quantify business interruption risk financially, we suggest a general modeling framework that connects probabilistic risk information to business operations and supply chain models. Finally, we comment on the industry need for proactive and reactive supply chain risk analysis.

■ WA41

Mart-Room H

Information Issues in Supply Chain Management

Contributed Session

Chair: Dmitriy Shaltayev, University of Alabama, Box 870226, 300 Alston Hall, Tuscaloosa, AL, United States, dshaltay@cba.ua.edu

1 — Network Flow Problems with Step Cost Functions
Rui Yang, Ph. D student, University of Florida, Department of Industrial and Systems Eng, 303 Weil Hall, P.O. Box 116595, Gainesville, FL, 32611, United States, maggiey@ufl.edu, Panos Pardalos

Thought network Flow problems are widely studied, network flow problems with general nonlinear cost functions receive little attention. We present equivalent linear 0-1 formulation for network flow problems with step-cost objective functions. Preliminary computational results on randomly generated test beds are presented.

2 — Analyzing Interorganizational Information Sharing Strategies in B2B E-Commerce Supply Chains, Hamid Mohtadi, Robert Kauffman

We extend existing theory for information sharing in e-commerce-based procurement. We analyze a sequential form game-theoretical model of buyer-supplier profits with uncertainties about final consumer demand, and different operational cost regimes for information sharing and withholding strategies. The contribution is that the information strategies of a buyer in a supply chain include the possibility of withholding information upstream from its supplier due to possible supplier opportunism.

3 — Opportunism in Information Sharing in A Supply Chain
Tomoaki Shimada, PhD Candidate, INSEAD, Boulevard de Constance, Fontainebleau, 77305, France, tomoaki.shimada@insead.edu

Almost all the studies on information sharing in a supply chain assume that information is always shared truthfully in their analytical models. However, is this widely accepted assumption reasonable? We provide a theoretical model of truthful information sharing. We study what factors are related to the buyer's intentional overstatement of her demand forecasts from the three perspectives. Furthermore, we examine the factors that cause the supplier to doubt the buyer's demand forecasts.

4 — Value of Information in a Two-Echelon Supply Chain with Limited Capacity
Refik Gullu, Associate Professor, Middle East Technical University, IE Department, Ankara, 06531, Turkey, gullu@ie.metu.edu.tr, Nesim Erkip, Ismail Bakal

In supply chain models it is usually assumed that full information is available for all the parties involved. In real situations there are cases where chain members are independent agents and possess different levels of information. In this study we analyze a supply chain of a supplier and retailers where the capacity of the supplier is limited. Embedding the information asymmetry on the capacity of the supplier in the model, we analyze the response by the retailers using game theoretic tools.

5 — The Role of Information in a Serial Supply Chain with Markov Modulated Demand
Dmitriy Shaltayev, University of Alabama, Box 870226, 300 Alston Hall, Tuscaloosa, AL, United States, dshaltay@cba.ua.edu, Charles Sox

This research explores the role of information in a two-echelon serial supply chain. Customer demand at the retailer is modeled as a Markov modulated process, while the demand experienced by the supplier arises from the retailer's orders. Thus, the supplier's demand can be modeled as a Markov modulated process, as well. We examine the effect of various assumptions made about the information communicated from the retailer to the supplier.

■ WA42

Mart-Room I

Revenue Management II

Contributed Session

Chair: Jamison Day, PhD Student, Indiana University, 401 E Allen St, Bloomington, IN, 47401, United States, jday@indiana.edu

1 — Pricing and Production Game under Revenue Sharing and Information Update
Metin Cakanyildirim, School of Management, The University of Texas At Dallas, 2601 North Floyd Road, Richardson, TX, 75083-0688, United States, metin@utdallas.edu, Sirong Luo

We study the pricing and production game in a vendor managed inventory system where the supplier determines the quantity and the retailer determines the price. We discuss the existence and uniqueness of Nash Equilibrium in one period game and the Myopic Nash Equilibrium in finitely repeated games. We also investigate the positive effect of revenue sharing and information update on the performance of supply chain.

2 — Yield Management for IT Provisioning
Laura Wynter, IBM Watson Research Center, P.O. Box 218, Yorktown Heights, NY, 10598, United States, lwynter@us.ibm.com, Parijat Dube, Zhen Liu

We propose a model to handle resource-driven pricing for IT services, such as those in On Demand computing centers. The model takes into account particularities of the IT infrastructure as well as the behavior of users, through distributions on the relevant quantities. We illustrate the workings of such a model on a number of instances .

3 — Product Bundling and Pricing for Rational Customer Segments
Jamison Day, PhD Student, Indiana University, 401 E Allen St, Bloomington, IN, 47401, United States, jday@indiana.edu, Wayne Winston

We explore the effects of pricing non-substitute products and groups of products. Each "rational" customer obtains non-increasing value from each product of the same type purchased. Segments are grouped through cluster analysis, and a linear, aggregate utility function is generated. For each segment, we solve a non-linear utility surplus maximization to determine optimal purchasing behavior. We employ a genetic algorithm to evolve a high-performance pricing and bundling strategy.

4 — The Impact of Customer Strategic Behavior on Airline Booking Limits
Sang Won Kim, The University of Western Ontario, 1151 Richmond Street North, Department of Management Science, London, Ontario, N6A 3K7, Canada, swkim@ivey.uwo .ca, John G. Wilson

Consumers are being increasingly aware of strategies used by airlines to set prices. We investigate how an airline should adapt its strategy for setting booking limits if customers behave strategically and sometimes postpone purchasing in the hope that a cheaper ticket will become available.

5 — Capacity Setting and Pricing for Multi-generation Technology Products
Shankar Sundaresan, Penn State University, 509Q BAB, University Park, PA, 16802, United States, shankar-s@psu.edu, Michael Pangburn

A high-tech firm periodically releases new product generations to heterogeneous consumers. Given costly and constrained capacity, the product sales rate is limited, thus inducing declining prices over time. We analyze the optimal capacity acquisition strategy, its allocation across old and new product generations, and the resulting intertemporal price trajectories.

■ WA43

Mart-Room J

Auctions II

Contributed Session

1 — An Allocation Heuristic for Winner Determination in Combinatorial Auctions
Viswanath Gnanasekaran Uma, Graduate Student, Louisiana State University, 600 East Roosevelt Street, Apt 382, Baton Rouge, LA, 70802, United States, vumagn1@lsu.edu, Gerald Knapp

Combinatorial auction mechanisms allow shippers to auction lane (distinct delivery routes) bundles to carriers taking advantage of substitutable and complementary lanes. The winner determination problem to find the optimal allocation that minimizes the shippers' costs is NP-hard. This paper presents an extension to the Local Ratio Technique which yields a heuristic solution to the winner determination problem to find a better quality allocation.

2 — Optimal Erosion Rate Policy - Procurement Mechanism in Multiple Periods
Se-Kyoung Oh, Ph.D student, Georgia Institute of Technology, 765 Ferst Drive, Atlanta, GA, 30332, United States, tweetiee@isye.gatech.edu, Wedad Elmaghraby, Shabbir Ahmed

When the buyer repeats to precure some product, incumbent supplier may decrease his cost over time. It may be advantageous for the buyer to keep the supplier, in the hopes of reducing her procurement costs. However, this will only occur if the supplier is forced to pass along a portion of his cost savings to the buyer. We explore procurement mechanism, "Erosion Rate Policy", where the buyer can use to help capture some of the cost savings.

3 — The Combinatorial Bid Generation Problem for Transportation Service Provision
Mu Xia, University of Illinois at Urbana-Champaign, Dept. of Business Administration, 350 WH, 1206 S 6th St, Champaign, IL, 61820, United States, mxia@ux1.cso.uiuc.edu, Xiubin Wang

We study the bidders' bid generation problem (BGP) in a combinatorial auction, specifically faced by transportation services providers. We clarify the optimality criterion from the bidder's perspective, under which we show the difference between the optimal combinatorial bid and the optimal routing and scheduling. We compare two heuristics in bid generation: optimal routing and scheduling and a simple nearest insertion method. Our simulation result shows the solutions are comparable in quality.

■ WA44

Mart-Room K

Joint Session AAS/TSLS: Air Cargo Planning

Sponsors: Aviation Applications, Trans, Science & Logistics
Sponsored Session

Chair: Andrew P. Armacost, Associate Professor of OR, US Air Force Academy, 2354 Fairchild Dr. Suite 6J100, USAFA, CO, 80840, United States, andy.armacost@usafa.af.mil

1 — Gate Assignment Problem at Airport Terminals
Ek Peng Chew, Associate Professor, National University of Singapore, 1 Engineering Drive 2, Singapore, SG, 117576, Singapore, isecep@nus.edu.sg, Huei Chuen Huang, Fei Gao

We look at a gate assignment problem that allocates gates to aircraft arrivals and departures at airport terminals. Mixed integer programs and heuristics are proposed to solve the problem within reasonable amount of time for large scale problems. The proposed models are further tested using an actual daily flight schedule and a number of randomly generated data.

2 — Integrated Fleet Assignment with Cargo Routing
Alexander D. Morton, National University of Singapore, 10 Kent Ridge Crescent, Singapore, SG, Singapore, isemad@nus.edu.sg, Ek Peng Chew, Huei Chuen Huang, Dong Li

In modeling airline "fleet assignment", it is difficult to capture network effects: assigning a particular aircraft type to a particular flight has implications for the traffic on all flights which might connect with that flight. In this paper, we propose a Benders' decomposition-based framework for modeling the cargo flow within the fleet assignment model, and report some preliminary computational results.

3 — A Manpower Problem at Air Cargo Terminals
Ivy Mok, National University of Singapore, 10 Kent Ridge Crescent, Singapore, SG, 119260, Singapore, isemoki@nus.edu.sg, Ek Peng Chew, Huei Chuen Huang, Rongheng Li

This paper examines the manpower allocation problem in an international air cargo terminal. A master roster shift schedule is first constructed which follows the union rules and matches the expected daily workload as closely as possible. The workload assignment is then solved daily when the work demand information is known.

4 — Aircraft and Cargo Routing and Scheduling for the US Air Force
Andrew P. Armacost, Associate Professor of OR, US Air Force Academy, 2354 Fairchild Dr. Suite 6J100, USAFA, CO, 80840, United States, andy.armacost@usafa.af.mil, Stephan Kolitz, Christopher Nielsen, Cynthia Barnhart

The US Air Force's Air Mobility Command is responsible for designing a large-scale air mobility network — called the channel route network — that is used to transport personnel and cargo throughout the world. To overcome the obstacles of using conventional network design formulations, we apply a reformulation method known as the "composite variable" approach. The reformulation is computationally superior to the conventional approaches, allowing excellent integer solutions to be found quickly.

■ WA45

Mart-Room L

Logistics I

Contributed Session

Chair: John Walker, Assistant Professor, Brock University, Faculty of Business, 500 Glenridge Avenue, St. Catharines On L2S 3A1, Canada, jowalker@taro.bus.brocku.ca

1 — Customer Attitudes to Retail Returns Policies
Ronald Tibben-Lembke, Associate Professor, Supply Chain Management, University of Nevada, MGRS / 028, Reno, NV, 89557, United States, rtl@unr.edu, Dale Rogers

For North American retailers, one of the largest sources of product in the reverse logistics pipeline is customer returns. Retailers have taken various measures to reduce the flow of returns: tighter returns policies, shorter time windows, restocking fees, etc. We present the results of two different focus-group studies, taken three years apart, totaling 29 focus groups . We concentrate on consumers' reactions to return policies, and how these reactions have changed over time.

2 — Issues in Minimax Hub Allocation
Li Zhang, student, University of Iowa, Department of Management Science, Iowa City, IA, United States, lizhang@softhome.net, Tim Lowe, Ann Campbell

We will present some results from our study of minimax hub allocation problems. The objective of these problems is to assign customers to hubs while minimizing the maximum travel time between any two locations. These issues are clearly important whenever a company wants to make time guarantees on service. We will present complexity results and algorithms for variations of the problem with different assumptions about the underlying network.

3 — Cross-facility Management of Production and Transportation Planning
Sandra Duni Eksioglu, Assistant Professor of Management, University of Evansville, 1600 Lincoln Ave., School of Business Administration, Evansville, IN, 47722, United States, se44@evansville.edu, H. Edwin Romeijn, Panos Pardalos

This paper studies an integrated production and transportation planning problem in supply chains. In particular we analyze the cross-facility production and transportation planning problem faced by companies that own a number of facilities, each capable of producing the final products. We propose a number of heuristic approaches to solve this problem. We evaluate the performance of the heuristics on a set of randomly generated problems.

4 — A Logistics Problem Integrating Transportation and Inventory with Algorithm
Mingzhou Jin, Mississippi State University, P.O. Box 9542, Mississippi State, MS, 39762, United States, mjin@ie.msstate.edu

A mixed integer model is presented to minimize total transportation cost, like stop cost, distance cost, and fixed cost for a vehicle. Early ordering is considered to increase loading factor under just-in-time situation. A three stage algorithm for rolling horizon is developed to solve the model with real world size.

5 — Statistical Properties of the lk,p,theta Norm's Parameters
John Walker, Assistant Professor, Brock University, Faculty of Business, 500 Glenridge Avenue, St. Catharines, On, L2S 3A1, Canada, jowalker@taro.bus.brocku.ca, Robert Love

The lk,p,theta norm can be used for estimating distances between points in the Cartesian plane. The parameters, k, p, and theta, have been determined for different geographic regions using three different goodness-of-fit criteria in previous work. However, the robustness of the parameters has not been examined. We use the bootstrap technique to examine the distributions of the aforementioned parameters using distance data from a number of geographic regions.

■ WA46

Mart-Room M

E-Commerce

Contributed Session

Chair: Udo Averweg, Durban Institute of Technology, P O Box 50612, Musgrave Road, Durban, 4062, South Africa, averwegu@durban.gov.za

1 — The Role of Online Intermediaries in Information Orchestration: Evidence from Auto-Retailing
Siva Viswanathan, Univ. of Maryland, Robert H. Smith School of Business, 4313, Van Munching Hall, College Park, MD, United States, sviswana@rhsmith.umd.edu, Jason Kuruzovich, Sanjay Gosain, Scott Weitzman

A new breed of online intermediaries has sought to capitalize on traditional-channel inefficiencies. Using an extensive data set based on surveys of 26000 consumers and 1000 dealers we study the impact of online buying services on demand-generation and fulfillment activities in auto-retailing. Our study provides rich insights into the pivotal role of these intermediaries as information orchestrators responding to differentiated consumer needs, and as value-reconfiguring channel partners.

2 — Implementing ERP Software in a South African Municipality: The Post-Implementation Stage
Udo Averweg, Durban Institute of Technology, P O Box 50612, Musgrave Road, Durban, 4062, South Africa, averwegu@durban.gov.za, Don Petkov, Henri Moolman

Many organisations have initiated ERP projects using various software packages. A post-implementation review is an important stage of the ERP life cycle. During 1997 the eThekwini Municipality in South Africa embarked on an ERP project to replace its inhouse non integrated financial systems with JDEdwards ERP software. In July 1999 the implementation successfully went live with 1,150 named users. A post-implementation review was conducted and reported. Future ERP research agenda is suggested.

3 — An Objective Approach to Validating Integrated Metrics of E-commerce Quality
Xin Ding, University of Utah, 1645 E Campus Center Drive, Salt Lake City, UT, 84112, United States, pmgtxd@business.utah.edu

Metrics for the quality of e-commerce are essential in predicting user satisfaction and perceived value, which in turn determine the loyalty and usage of e-commerce.Through a conceptual framework developed on the basis of the quality-value-satisfaction chain, this study applies data mining to test the validity of the metrics for the quality of e-commerce by analyzing the usage of websites.

Wednesday 10:00am - 11:30am

■ WB01

Westin-Intl. A, 6th Floor

Stochastic Networks III

Contributed Session

Chair: Sai Rajesh Mahabhashyam, Student, The Pennsylvania State university, 310 Leonhard building, University Park, PA, 16802, United States, sym110@psu.edu

1 — Regularly Varying Asymptotic Analysis for a Fluid Queue Driven by an M/G/1 Queue
Weixin Shang, HKUST, Department of IEEM, HKUST, Clear Water Bay, Kowloon, HK, Hong Kong, shangwx@ust.hk, Quan-lin Li, Liming Liu

An infinite-buffer fluid queue driven by an M/G/1 queue is discussed. The Laplace transform of the stationary probability distribution of the buffer content is expressed through the minimal positive solution of a crucial equation. Furthermore, the stationary probability distribution of the buffer content is shown to be regularly varying with index -a+1 if the service time is regularly varying with index -a<-1. Meanwhile, the first [a]-1 moments of the stationary buffer content are given.

2 — On Systems with Impatient Multiclass Customers: A Queueing Perspective
Parijat Dube, IBM Watson Research Center, P. O. Box 218, Yorktown Heights, NY, 10598, United States, parijat_fr@yahoo.com

The customers decide to submit their jobs to the system or not depending on the value of the disutility function (a function of customer's waiting time and the price paid) associated with the customer class. We obtain a characterization of the waiting time distribution for such a system. Our formulation and analytic results provide "engineering" guidelines for designing improved policies for admission control, capacity planning and pricing in presence of multiclass customers.

3 — Outsourcing Warranty Repairs: Dynamic Routing
Michelle Opp, University of North Carolina, Dept. of Operations Research, Chapel Hill, NC, 27599, United States, opp@email.unc.edu, Vidyadhar Kulkarni, Kevin Glazebrook, Jayashankar Swaminathan

We consider the problem of outsourcing warranty repair services for a finite population of items to several repair vendors using dynamic routing at the times of failure. We develop nearly-optimal routing policies using both a policy-improvement approach and a restless bandit approach, and we compare these policies to the optimal static allocation model.

4 — Discrete-Time Two-Phase Service Geo/G/1 Queue with Setup Time
Tae-Sung Kim, Professor, Department of Management Information System, Chungbuk National University, 48 Gaeshin-dong Heungduk-gu,, Cheongju, CB, 361-763, South Korea, kimts@cbnu.ac.kr, Seok Ho Chang

In this paper, we consider discrete-time two-phase service Geo/G/1 queue with setup time that has a wide range of applications in computer, manufacturing systems and other related systems. We present the system size probability generating function (PGF) at an arbitrary slot boundary of this system, and show that they are decomposed into two PGFs, one of which is the system size PGF of standard discrete-time Geo/G/1 queue without vacations.

5 — Modeling a Web Server Channel Using Multi-Class Queues
Sai Rajesh Mahabhashyam, Student, The Pennsylvania State university, 310 Leonhard building, University Park, PA, 16802, United States, sym110@psu.edu, Natarajan Gautam

We consider a web server where arriving requests belong to two classes: real-time traffic (bandwidth-sensitive) and data traffic (delay requirement). All the channel bandwidth not used by real-time traffic is allocated to data traffic. We model this as a stochastic process and present matrix geometric method and queueing-based approximation as no closed-form expression exists for the performance measures. We use the performance models in optimal design, admission control and load-balancing.

■ WB02

Westin-Intl. B, 6th Floor

Finance and Economics

Contributed Session

Chair: Ben Marcus, Student, Ivey School of Business, University of Western Ontario, London, ON, N6A3K7, Canada, bmarcus@ivey.uwo.ca

1 — A Global Suitability Analysis for Investors and Employees
Mabel Chou, National University of Singapore, 1 Business Link, BIZ 1, #04-08, Singapore, Singapore, bizchoum@nus.edu.sg

The opening of economies to free trade has caused investors, employers and employees in the economy today to seek investments, set up or expand business, recruit personnel, and obtain employment from sources that are not limited to their own countries of origin. It is thus of significant interest to study how different nations fare relative to each other. We use Data Envelopment Analysis to evaluate nations from the perspective of investors, recruiters, and job-seekers.

2 — A Sample-Path Approach to Optimal Transaction Implementation
Paul Krokhmal, Visiting Assistant Professor, University of Florida, 1350 N Poquito Rd, Shalimar, FL, 32579, United States, krokhmal@ufl.edu, Stanislav Uryasev

We consider the problem of optimal position liquidation that maximizes expected cash flow from the transaction under temporary or permanent market impact. A stochastic programming formulation utilizing a collection of sample paths as a scenario set, is used to derive trading strategies that differentiate decisions with respect to observed realizations of market conditions. The approach admits incorporation of different types of constraints in the trading strategy.

3 — Monte Carlo Simulation for Valuing Executive Stock Options
Ben Marcus, Student, Ivey School of Business, University of Western Ontario, London, ON, N6A3K7, Canada, bmarcus@ivey.uwo.ca, Chris Anderson

We consider the joint decision of debt and warrant issue levels in the context of tax incentives and corporate default. While each type of issue provides a certain potential tax shield for a company, the resulting effects on the default rate are opposing. A Monte Carlo simulation is used to explore these effects for a firm issuing incentive based managerial options.

■ WB05

Westin-Intl. E, 6th Floor

Stochastic Models in Finance

Sponsor: Applied Probability
Sponsored Session

Chair: Ulrich Rieder, Universitat Ulm, Abteilung Mathematik VII, Universitat Ulm, D-89069 Ulm, Germany, rieder@mathematik.uni-ulm.de

1 — Portfolio Optimization with Transaction Costs and Delays
Tim Maull, Graduate Student, University of Michigan, 1205 Beal Avenue, Ann Arbor, MI, 48109-2117, United States, timmaull@umich.edu, Jussi Keppo

We consider the portfolio optimization of a risk-adverse agent facing transaction costs and delays when changing his portfolio. We compare the trading frequency under different parameter values and match it to trading volume data.

2 — Optimal Bank Capital in a Fast Mean-Reverting Stochastic Volatility Environment
Leonard Kofman, Graduate Student, University of Michigan, Department of Industrial and Operations, 1205 Beal Avenue, Ann Arbor, MI, United States, lkofman@umich.edu, Jussi Keppo

We study optimal bank capital holding under different market frictions. We show that a fast-mean reverting stochastic volatility model is reasonable for bank returns and then analyze the optimal times for dividends and recapitalizations.

3 — A Multiple Periods Disclosure Game
Zhaolin Li, The Pennsylvania State University, Pennsylvania State University, Dept. of, Smeal College of Business and Admin., University Park, PA, 16802, United States, zxl110@psu.edu, Paul Fischer

We model a sender's disclosures about an evolving state variable up to a critical event date. We demonstrate that the creditability of the sender's disclosure erodes as the event date approaches, and analyze how the cost of deception and the presence of other information sources affect the speed of the erosion in creditability.

4 — Portfolio Optimization with Differential Information
Ulrich Rieder, Universitat Ulm, Abteilung Mathematik VII, Universität Ulm, D-89069 Ulm, Germany, rieder@mathematik.uni-ulm.de

We consider simple models of financial markets with regular traders and insiders possessing some extra information hidden in a random variable from the beginning of the trading interval. Both investors are interested in maximizing the expected utility from terminal wealth. The optimal values and strategies of the regular trader and of the insider are compared for various models of inside information.

■ WB12

Westin-Augusta 2, 7th Floor

Inventory Management VI

Contributed Session

Chair: Barry Pasternack, Chair, Dept. of Information Systems & Decision Sciences, Room LH 540, CSU Fullerton, Fullerton, CA, 92834, United States, bpasternack@fullerton.edu

1 — On the Optimal Retailer's Ordering Policies in the EOQ Model under Trade Credit Financing
Jinn-Tsair Teng, Professor, William Paterson University of New Jersey, 1600 Valley Road, Wayne, NJ, 07470, United States, tengj@wpunj.edu

In this note, I amend Huang's economic order quantity model by considering the following two important facts: (1) the retailer's selling price per unit is necessarily higher than its unit cost, and (2) the interest rate charged by a supplier or a bank is not necessary higher than the retailer's investment return rate. I then propose an appropriate EOQ model, and provide an easy-to-use closed-form solution to the problem. In addition, I also establish two theoretical results.

2 — Optimal Inventory Policies for College Textbooks
Barry Pasternack, Chair, Dept. of Information Systems & Decision Sciences, Room LH 540, CSU Fullerton, Fullerton, CA, 92834, United States, bpasternack@fullerton.edu

Textbook publishers frequently sell books overseas for less than the amount charged domestically. This disparity could give rise to a gray market for such

books. This paper uses a single period inventory model approach to determine the optimal ordering quantities when a bookstore can order both texts sold by publishers as well by gray market vendors. We also look at the effect used text sales could have on the optimal inventory policy and discuss the implications for channel coordination.

3 — Optimal Inventory Policies for a Make-to-Order System with Demand Prioritization
Ting Shen, Stanford University, Management Sci. & Eng. Dept., Stanford, CA, 94305, United States, tingshen@stanford.edu, Edison Tse

We model a Make-to-Order firm that keeps inventory of a generic product and customizes it into different end products after observing demand with the objective of maximizing profit. A demand prioritization rule is derived to allocate the stock. We show that a base stock policy is optimal for the generic product and derive the form of the policy. Numerical examples show the optimal quantity is insensitive to demand variance and the form of demand distribution.

■ WB14

Westin-Peachtree A, 8th Floor

New Product Development III

Contributed Session

Chair: Xiaowei Xu, Graduate Student, Northwestern University, Tech C210, 2145 Sheridan Road, Evanston, IL, 60201, United States, xuxiaowe@northwestern.edu

1 — Pilot Projects and Codifiability: Is More Knowledge Better?
Moti Levi, Smeal College of Business Administration, Pennsylvania State University, 509 BAB, University Park, PA, 16802, United States, mlevi@psu.edu, Thomas Noe

Pilot projects and prototyping are used when transaction knowledge is uncodifiable. We examine such a scenario and find how buyers and supplier interact in this context. Surprisingly, bargaining issues may result in buyers masking knowledge from the developer. We examine a single and multiple pilot projects.

2 — A Joint Marketing/Operations Model of Differentiated Product Decisions
Xiaowei Xu, Graduate Student, Northwestern University, Tech C210, 2145 Sheridan Road, Evanston, IL, 60201, United States, xuxiaowe@northwestern.edu, Wallace Hopp

This paper addresses the problem of how much product variety to offer, along with how to price the product variants. We represent consumer preferences with the logit model and market segments with a Bayesian model. We use an interval analysis based algorithm to find optimal solutions. Extensive comparative statics results are proved for the single and multiple market segment cases. These illustrate that reducing operations costs usually, but not always, increase the optimal level of variety.

■ WB15

Westin-Peachtree F, 8th Floor

Management of Technology

Contributed Session

Chair: Don Petkov, Associate Professor, Eastern Connecticut State University, 83 Windham Street, Willimantic, CT, 06226, United States, petkovD@easternct.edu

1 — An Optimal Incentive Mechanism Design between Public Research Institute and Researcher in Technology
Tae-Kyu Ryu, Ph. candidate, Techno-Economics and Policy Program, College of Engineering, Seoul National University, Seoul, 151-742, South Korea, tkryoo30@snu.ac.kr, Yoon-joon Lee, Jeong Dong Lee, Jong-Bok Park

This study develops the optimal incentive contract between public research institute and researcher for extracting the researcher's effort level in technology transfer. The model is a two-period game model with moral hazard. The first period is for technology development and the second is for technology transfer. this study may give the insights of optimal incentive contract which can enhance the technology transfer.

2 — The Effect of Learning on Performance in Sequential-market Firms: The Hard Disk Drive Industry
Charlotte R. Ren, Doctoral Student, The Anderson School at UCLA, 11140 Rose Ave.,, Apt. 207, Los Angeles, CA, 90034, United States, rren@anderson.ucla.edu

This paper examines the effect of learning on performance at dual levels of analysis in the hard disk drive industry and finds that (1) learning from own experience improves both market-level technological performance and firm-level financial performance. (2) Learning from previous-generation markets impairs market-level technological performance but contributes to firm-level performance, suggesting the existence of intergenerational spillovers in other dimensions rather than technology.

3 — Information Technology, Complementarities and Performance
Ana Gargallo Castel, University of Zaragoza, FAC. EE.EE. C/Dr. Cerrada 2, Zaragoza, Spain and Canary Islands, gargallo@unizar.es, Carmen Galve Gorriz

The aim of this paper is to investigate the productivity impact of information technology in the Spanish industry. Using detailed firm-level data and the complementarity approach, we explore the hypothesis that the combination of IT and complementary skilled workers constitute an important determinant organizational performance. The results suggest that the complementarity approach offers valuable insights to understand the complex relationship between IT and organisational performance.

4 — The Impact of Web-Based Technologies on EIS in South Africa: Some Exploratory Findings
Don Petkov, Associate Professor, Eastern Connecticut State University, 83 Windham Street, Willimantic, CT, 06226, United States, petkovD@easternct.edu, Udo Averweg, Geoff Erwin, Henri Moolman

Web-based technologies are causing a revisit to existing IT implementation models, including those for EIS. These technologies include: Intranet, Internet, Extranet, B2B, B2C, WAP and other mobile technologies. The authors conducted a survey of organisations in KwaZulu/Natal, an important region in South Africa, which successfully implemented EIS. The authors report that the current impact of Web-based technologies on EIS implementations in organisations in KwaZulu/Natal is relatively small.

■ WB16

Westin-Peachtree G, 9th Floor

Service Industry II

Contributed Session

Chair: Laura McLay, University of Illinois at Urbana-Champaign, 1206 W. Green St., mc 244, Urbana, IL, 61874, United States, lalbert@uiuc.edu

1 — Strategic R&D Investments with Continuous Costs and Multiple Technologies
Tao Yao, Stanford University, Management Science and Engineering, Terman Engineering Center Rm# 494, Stanford, CA, 94305, United States, taoyao@stanford.edu, John Weyant

We consider multiple technology investment problem with competition and continuous costs in R&D under a winner-take-all situation. The model accounts technical uncertainty about R&D and market uncertainty about benefit. Simultaneous equilibrium and leader-follower equilibrium may occur. New technology may be disruptive or sustaining to old technology. Keywords: Real Options, R&D, Pre-emption, Game Theory, Strategic timing, disruptive technology .

2 — Join or Balk: Equilibrium Analysis of Queuing Systems under Delay Information
Pengfei Guo, Duke University, P.O.Box 368,Fuqua School of Business, Durham, NC, 27708, United States, pg18@duke.edu, Paul Zipkin

Informing customer delay information is quite common in practice as a way to enhance service quality. To analyze the effects of delay information on queuing systems, we carry out the equilibrium analysis of the queuing system in which customer are informed different types of delay information: no information, half information (the queue length) and full information (the exact waiting time). Three equilibrium models are established and numerical comparison is given.

3 — Field Service Dispatching with Multiple Customers Classes and Time Windows
Qunhong Tang, Lehigh University, 200 west packer ave., Bethlehem, PA, 18015, United States, qht2@lehigh.edu, George R. Wilson, Eugene Perevalov

Dispatching policy has an important impact on field service performance. We address a real time field service application with multiple customer classes and time windows. Each class of customers has a different service contract. A general framework for system design is presented and several dynamic dispatching policies are proposed. The service performance is evaluated based on the percentage of customers satisfied within time windows(PSTW).

4 — Design for Serviceability
Vrinda Rajiv, Computer Scientist, GE Global Research, K1 — 5C3, 1 Research Circle, Niskayuna, NY, 12309, United States, rajiv@research.ge.com, Mark Osborn

The diagnosis of any complex equipment often depends on the expertise of the service engineer, resulting in repeated site visits before a repair is effected. The "Design for Serviceability" process provides a validated fault detection & isolation capability assessment prior to product release. It also generates a diagnostic model for deployment on the product or at a remote service center. These are achieved using the information provided in an extended FMEA during the design of the equipment.

5 — Modeling and Analyzing Checked Baggage Screening Systems
Laura McLay, University of Illinois at Urbana-Champaign, 1206 W. Green St., mc 244, Urbana, IL, 61874, United States, lalbert@uiuc.edu, Sheldon Jacobson, John Kobza

Aviation security baggage screening procedures require all checked baggage to be screened by an explosive detection system (EDS) or alternative method. However, not all airports have a sufficient number of EDSs to screen all baggage. This research considers partial baggage screening models and measures their effectiveness with three performance measures.

■ WB17

Westin-Peachtree H, 9th Floor

New Product Development II

Contributed Session

Chair: Wenge Zhu, Student, University of Texas at Austin, 1630 W 6th St Apt E, Austin, TX, 78703, United States, zwenge@mail.utexas.edu

1 — The Use of Multicriterial Optimization Analysis and Sensitivity
Carol Ventresca, President, SynGenics Corporation, 5190 Olentangy River Road, Delaware, OH, 43015, United States, Carol@SynGenics.com, George Richards, Ph.D., Marvin Gridley, Gregory Addington, Ph.D.

Multicriterial desirability optimization analysis was used for airframe structural design. Authors investigated multidimensional solution spaces near each candidate design point to assess robustness. Sensitivity analysis permitted selection and optimization of a robust design . Understanding the sensitivity of a design's customer value to multiple competing criteria enabled project leadership to invest resources wisely and to develop the inlet to meet goals for affordability and customer value.

2 — Modeling NPD Teams: A General Systems Theory Approach
Ralitza PatrashkovaVozdolska, University of Massachusetts Amherst, Isenberg School of Management, Amherst, MA, 01003, United States, rpatrachkova@som.umass.edu, Sara McComb

NPD teams are complex dynamic systems. Thus, in our work, we suggest using General Systems Theory (GST) to create dynamic models of team behavior. To demonstrate the applicability of GST, we develop a model of team communication. Also, we compare GST team models with I-P-O team models and review how a GST model is analyzed. We conclude by discussing how this approach enriches the existing research on NPD teams and expands our understanding of why seemingly similar teams produce varying results.

3 — Software Upgrading and Renting Strategy
Wenge Zhu, Student, University of Texas at Austin, 1630 W 6th St Apt E, Austin, TX, 78703, United States, zwenge@mail.utexas.edu, Vish Krishnan

We study product-upgrading policy for monopolist in packaged software industry, when there is no second-hand market. The monopolist firm tries to maximize its profit by determine optimal product upgrading policy, which includes the quality improvement over versions, frequency of new version launch, and the optimal upgrade price. We also study what can the firm benefit from renting its software rather than selling them.

■ WB18

Westin-Tower 1201, 12th Floor

Quality Control/Reliability

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: Paul Kvam, Associate Professor, Georgia Institute of Technology, 417 Groseclose Building, Industrial and Systems Engineering, Atlanta, ga, 30332, United States, pkvam@isye.gatech.edu

1 — Is There Truth in Averages That Seem Reliable or Must You Go Beyond the Seems
Elliot Levy, Economist, Federal Gov't.-US Dept. of Commerce, 11011 Saffold Way, Reston, VA, 20190, United States, Elliot_Levy@ita.doc.gov

When using export data by US metropolitan data of export establishment size categories (small, medium, large), two methods were applied in computing medians:(1) from the original number per size grouping and(2) percent per grouping. At the inception, their findings showed the medians were similar, but further probing displayed that they were not sufficiently invariant. Thus, midpoints were taken to have a single estimate per size group by state composition of their SMSAs. Also, general size of national proportion were substituted into a binomial probability distribution, confirming the percent of small firms, which is the largest percentage in exporter establishment size.

2 — Regression by Least Absolute Value Method with L1-constraint on Parameters
Young-Hyun Ko, POSTECH, Hyoja NamGu San 31, Pohang, KB, South Korea, notime@postech .ac.kr, Chi-Hyuck Jun

We propose a new method for estimation linear models. We use L1-loss function as in least absolute value method. This guarantees more robust estimation of coefficients when the distribution of the errors has very heavy tails. Also, we use the L1-constraint on parameters as in Lasso. Because of the nature of this constraint, it tends to produce some coefficients that are exactly 0 and hence gives interpretable models like subset selection.

3 — A Comparison of Variable Selection Methods Using Simulation
Il-Gyo Chong, POSTECH, Hyoja Namgu san 31, Pohang, kb, South Korea, chig@postech.ac .kr, Chi-Hyuck Jun

Variable selection refers to the problem of selecting predictors most predictive for a given outcome. We compares the performance of different selection methods using stepwise regression and VIP scores based on MLR, RR, PCR, PLS, and LRR through simulation. To do this, we choose several true regression models and generate two types of datasets. Some new findings are reported as simulation results.

4 — An Implicit Enumeration Algorithm for Model Selection in Linear Multiple Regression
Xinli Bao, The University of Tennessee, Knoxville, 1611 Laurel Ave. Apt 918, Knoxville, TN, 37916, United States, xbao@utk.edu, Vuttichai Chatpattananan, Kenneth Gilbert, Minhui Liu

This paper gives an exact algorithm for identifying the subset of variables that minimize Akaike's Information Criterion (AIC) in linear multiple regression. The model uses implicit enumeration to identify the optimal subset of variables while looking at only a small portion of all possible subsets. We give methods for computing upper and lower bounds which are used to eliminate branches in the enumeration tree that do not contain the optimal solution.

5 — The Analysis of Change-Point Characterizing Incomplete Burn-in in a Manufacturing Process
Paul Kvam, associate professor, Georgia Institute of Technology, 417 Groseclose Building, Industrial and Systems Engineering, atlanta, ga, 30332, United States, pkvam@isye.gatech.edu, Suk Joo Bae

The degradation path of brightness of a light display characterizes incomplete burn-in in the manufacturing process. We introduce a linear model with a change-point to model the nonmonotonic degradation path. We provide an inference procedure for the parameters of a change-point model and introduce methods for estimating the lifetime distribution derived from change-point model. This article show that lifetime can be substantially extended by extrapolating an inherent degradation path.

■ WB19

Westin-Tower 1202, 12th Floor

Recent Advances in Industrial Statistics

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: F. Fred Choobineh, Professor, Univ. of Nebraska-Lincoln, Department of Industrial Engr., 175 Nebraska Hall, lincoln, NE, 68588-0518, United States, fchoobineh@unl.edu

1 — Empirical Bayes Forecasting Methods for Jobs' Flow-Times
F. Fred Choobineh, Professor, Univ. of Nebraska-Lincoln, Department of Industrial Engr., 175 Nebraska Hall, lincoln, NE, 68588-0518, United States, fchoobineh@unl .edu, Mansour Abdoli

We consider empirical Bayes methods for forecasting multi-class job flow-times in a resource-sharing environment. We assume flow-time in each class follows an exponential distribution with its parameter following a gamma distribution. A large simulation experiment is conducted to assess and compare the performance of the forecasting methods. Simulation results show that non-parametric empirical Bayes methods are more efficient and robust relative to parametric empirical Bayes.

2 — Minimum Prediction Error Estimation and A Bayesian Model Diagnostic
Gavin Richards, Graduate Research Associate, Ohio State University, 1971 Neil Avenue, Columbus, OH, 43210, United States, richards.177@osu.edu, Mikhail Bernshteyn, Theodore T. Allen

We propose a Bayesian estimate of expected prediction errors to provide the first summary of fit model quality that includes bias and addresses the entire region of interest. This leads to a new estimation approach. We illustrate advantages compared with adjusted R-squared and Cp using data sets from the literature.

3 — A Comparison of Bayesian Clustering with Other Data Clustering Techniques
Rong Pan, Assistant Professor, University of Texas at El Paso, Department of Mechanical and Industrial, El Paso, TX, 79968, United States, rpan@utep.edu

Most cluster analysis algorithms are empirical procedures based on similarity or dissimilarity measures. Statistical model-based clustering methods have not been thoroughly compared with other clustering techniques before. This talk presents a study of the comparison of Bayesian clustering technique with three others — k-means, Ward's, and average linkage methods. Simulated and real life multivariate data sets are used to compare the various clustering methods. SAS and AutoClass are used to perform the cluster analysis and results are validated using MANOVA (Multivariate Analysis of Variance) tests.

4 — Multivariate Liquid Association with Application to Drug Optimization
Abhyuday Mandal, Industrial and System Engineering, Georgia Institute of Technology, 765 Ferst Drive, Atlanta, GA, 30332-0205, United States, mandala@umich.edu, Kerby Shedden

The "liquid association" (LA) method developed by Li can be used to screen a large set of predictor variables so as to identify a pair of variables X and Z where the direction of the regression relationship of Y on X is maximally dependent on Z. We extend the LA method that allows X and Z to be uncorrelated linear combinations of the predictor variables rather than coordinate projections. This is related to, but distinct from, the dimension reduction method of principal Hessian directions.

5 — Optimal Linear Filters for Control Charting
Chang-Ho Chin, Texas A&M University, Dept. of Industrial Engineering, College Station, TX, 77843-3131, United States, Daniel Apley

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.

■ WB21

Westin-Tower 1204, 12th Floor

Modeling Systems & Languages II

Contributed Session

Chair: Britton Landry, Department of Systems Engineering, US Military Academy, West Point, NY, 10996, United States, Britton.Landry@usma.edu

1 — Target Path Modeling and Forecasting by Time Series Methodology
Jiali Liu, Senior Engineer, Tsinghua Univeristy, 3-302,#2Lou,#1 Yuan,HuiXinNanLi,Chaoyang, Beijing, BJ, 100029, China, liujiachen@yahoo.com

Network object adaptive control system is applied in precision target tracking. One of the key points in precision target tracking is to forecast target path at each time step.This paper introduces how to set up the model of the target path and do forecasting by the time series analysis. Autoregressive moving average model is applied in the analysis. Numberical example is provided.

2 — Distributing Interactive Constructive/Virtual Simulations For Military Operations Analysis
Britton Landry, Department of Systems Engineering, US Military Academy, West Point, NY, 10996, United States, Britton.Landry@usma.edu, Daniel Delargy, George Feagins, Jerry Mitchell

Modeling and simulation is increasingly used to decrease system development time and costs. This work illustrates our methodology for analysis using integrated virtual and constructive simulations in a common but geographically distributed synthetic environment. Research includes surveying existing simulations, designing a framework, and testing through a distributed exercise.

■ WB22

Westin-Tower 1205, 12th Floor

Decision Analysis II

Contributed Session

Chair: Kathleen Whitcomb, Associate Professor, University of S. Carolina, Moore School of Business, Columbia, SC, 29208, United States, whitcomb@moore.sc.edu

1 — Optimal Dynamic Effort and Risk Decisions for a Risk-Averse Agent
Ayse Kocabiyikoglu, INSEAD, Decision Sciences Department, Fontainebleau, CE, 77305, France, ayse.kocabiyikoglu@insead.edu, Ioana Popescu

We investigate the dynamic problem of an agent deciding on the amount of effort and the level of risk to adopt over time, with the objective of maximizing the utility of terminal payoff. We model the problem as a dynamic program and answer comparative static questions about the influence of time and past performance on the agent's decisions. We provide conditions that guarantee the optimality of monotone policies, and discuss their implications in the context of sales force compensation.

2 — Abandonment Options in Duopolistic Markets
Makoto Goto, Waseda University, 3-4-1, Okubo, Shinjuku, Tokyo, 169-8555, Japan, mako.50@ruri.waseda.jp, Tomoaki Tabata, Takashi Namatame

In recent years, Japanese firms need to decide to abandon from the market in the business recession. Decision of abandonment is choosing larger one of project value or abandonment level . If the project value and abandonment level are random, then the problem cannot be analyzed by deterministic method. One can analyze the problem by using Real Options approach. For duopolistic markets, Game Theory is efficient to consider the influence of competitive firm.

3 — Value of Information in Decision Making under Uncertainty
Niyazi Onur Bakir, Graduate Assistant Lecturer, Texas A&M University, 2002 Longmire Ct., #10C, College Station, TX, 77840, United States, nob3152@unix.tamu.edu

We examine the effects of information on risky decision problems. We use a variant of the Hausdorff metric on sigma-algebras to evaluate information bundles. We illustrate these concepts in lotteries and insurance risk problems.

4 — Applications of Quasi-Bayesian Analysis
Kathleen Whitcomb, Associate Professor, University of S. Carolina, Moore School of Business, Columbia, SC, 29208, United States, whitcomb@moore.sc.edu

We demonstrate quasi-Bayesian methods for cases where expert opinion can not adequately be modeled by a precise prior. An imprecise prior is used to model beliefs of multiple experts with disparate views. Uncertainty is propagated using the linear programming formulation of the generalized Bayes rule (GBR). Results of a quasi-Bayesian analysis for ecological impact assessment and for evaluating medical trials are presented

■ WB32

Westin-Tower 1407, 14th Floor

Sequencing and Scheduling I

Contributed Session

Chair: Susan Slotnick, Assistant Professor, Cleveland State University, OMS Dept., BU 539, 2121 Euclid Avenue, Cleveland, OH, 44115, United States, s.slotnick@csuohio.edu

1 — Order Splitting with Multiple Capacitated Suppliers
Xiangtong Qi, Assistant professor, Hong Kong University of Science and Technology, Department of IEEM, Clear Water Bay, HK, Hong Kong, ieemqi@ust.hk

In manufacturing systems, multiple sourcing is beneficial and necessary. The benefit may be to reduce supplying uncertainty. The necessity is due to the fact that a supplier may have a limited capacity. Suppose a manufacturer has a large order and wants to subcontract it to multiple suppliers, each of which has different capacity and cost. The problem is to decide how to split the order to tho small suppliers. We model the problem as a knapsack-like problem, analyze it under various scenarios.

2 — Distributed Scheduling of Multiclass Manufacturing Systems
Germán Riaño Mendoza, Assistant Professor, Universidad de los Andes, Cra 1 E # 18A70, Bogota, Colombia, griano@uniandes.edu.co, Rodrigo Alberto Cáliz Ospino, Gonzalo Mejia

In this paper the "Guided-Batch-Join-The-Shortest-Queue"(GBJSQ) routing policy is proposed. The GBJSQ policy described bellow assigns process batches of predetermined size depending on the family products to a machine into a workstation with multiple nonidentical machines, based on the solution of the continous-flow relaxation model of every workstation and the "Join the Shortest Queue" (JSQ) routing policy.

3 — A Hybrid MILP/CP Framework for the Planning and Scheduling of Batch Chemical Plants
Christos Maravelias, Graduate Student, Carnegie Mellon University, 5000 Forbes Ave, Doherty Hall, Pittsburgh, PA, 15213, United States, ctm@andrew.cmu.edu, Ignacio Grossmann

We propose a hybrid algorithm to overcome computational difficulties with standalone MILP and CP models for complex scheduling problems involving vari-

ous plant configurations and objective functions. A MIP model is used for the planning decisions (type/number of batches, assignment of units to batches) and a CP subproblem is used to derive a feasible schedule. Integer cuts are added for non-optimal or infeasible schedules. Computational imrovements of order of magnitude are achieved.

4 — Queuing Model and Linking Equations for a Series of Automated Workstations
David Kim, Associate Professor, Oregon State University, 121 Covell Hall, Corvallis, OR, 97331, United States, david.kim@orst.edu, Raghavendran Nagarajan

We develop equations to estimate the average number in system for an "automated" server with deterministic processing times, and random failure and repairs, which receives it's input from a similar type of server. Equations are also developed for the output process from such a server so that a series of such automated servers may be analyzed. Comparisons with G/G/1 models and simulation are presented.

5 — Job Selection with Weighted Tardiness
Susan Slotnick, Assistant Professor, Cleveland State University, OMS Dept., BU 539, 2121 Euclid Avenue, Cleveland, OH, 44115, United States, s.slotnick@csuohio.edu, Thomas Morton

We investigate the problem of choosing which jobs to process, given a set of available jobs with assigned processing times, due-dates, penalty weights and revenue. Our objective is to maximize profit, which consists of per-job revenues minus weighted tardiness.

■ WB34

Mart-Room A

Transportation I

Contributed Session

Chair: Byung-In Kim, Assistant Professor, University of Memphis, Industrial and Systems Engineering, Memphis, TN, 38152, United States, kimb4@alum.rpi.edu

1 — Modeling the Total Benefits for Electronic Toll Collection
Grisselle Centeno, Assistant Professor, University of South Florida, 4202 E. Fowler Ave., Tampa, Fl, 33620, United States, gcenteno@eng.usf.edu, Rajesh Chaudhary

One of the problems in the deployment of ITS application is the insufficient data availability for decision making regarding the success of the technology. On this research, we develop an algorithm that models the total benefits for ETC and serves as a decision making tool for the toll facility providers. We consider parameters such as time delay, gasoline consumption, air pollution and evaluate the effects on these parameters due to the number of the ETC lanes over the manual lanes.

2 — Multi-Period Optimization Of Pavement Management Systems
Jaewook Yoo, Graduate Student, Texas A & M University, Department of Industrial Engineering, College Station, TX, 77843-3131, United States, jyoo@tamu.edu, Alberto Garcia-Diaz

An optimization methodology is developed for determining the most cost-effective maintenance and rehabilitation (M&R) activities for each pavement section in a highway pavement network, along an extended planning period. A multi-dimensional 0-1 knapsack problem with alternative selection and precedence-feasibility constraints is formulated to maximize the total benefits associated with the selected M&R activities. The solution approach is a hybrid Dynamic Programming/Branch-and-Bound procedure.

3 — ALADIN: Algorithm of Addition and Insertion to Solve the Vehicle Route Problem with Time Windows
Eduardo Guillen Solorzano, Associate Professor, University of La Coruna, Mendizabal, s/n, Department of Management Science, Ferrol, Co, 15403, Spain and Canary Islands, edugs@udc.es, Alejandro Garcia del Valle, Javier Faulin

ALADIN is a new construction algorithm to solve the Vehicle Routing Problem with Time Windows (VRPTW). It is based on the previous algorithms of Solomon (1987) though it involves new construction techniques such as the double node insertion, ellipsoidal insertion area restrictions, as well as new route assignment procedures. The mathematical model is presented, and applied to the benchmark problems R and RC from the literature.

4 — Maximum Reward Algorithm for Cooperative Path Planning Problem
Andrei Vakhutinsky, Sr. Research Analyst, Alphatech, Inc., 6 New England Executive Park, Burlington, MA, 01803, United States, andrewv@alphatech.com

We develop an algorithm for real-time vehicle routing to perform certain tasks. Each task may require multiple actions by vehicles of different types with specified precedence and time constraints. In addition, there is certain risk to loose a vehicle associated with traveling between the tasks. The objectives are to maximize the total expected value of the performed tasks and minimize the time en route. We present results of our computational experiments in open and close loop settings.

5 — Clustering Based Insertion Algorithm for Vehicle Routing Problem
Byung-In Kim, Assistant Professor, University of Memphis, Industrial and Systems Engineering, Memphis, TN, 38152, United States, kimb4@alum.rpi.edu, Seongbae Kim

We address the visual attractiveness of a solution of vehicle routing problem since it is an important criterion of the solution in many practical applications. The cluster first, route second approach is followed. Stops are clustered based on their locations with an estimated number of vehicles. Each cluster is solved by an extended insertion algorithm. Then, the visual attractiveness of the solution would be improved further by moving stops among clusters.

■ WB35

Mart-Room B

Inventory Management IV

Contributed Session

Chair: Yao Zhao, Assistant Professor, Rutgers University, Dept of Management Science and Info. Sys, 180 University Ave, Newark, NJ, 07102, United States, yaozhao@andromeda.rutgers.edu

1 — Effects of Substituting Perishable Products
Borga Deniz, Carnegie Mellon University, GSIA, Pittsburgh, PA, 15213, United States, bdeniz@andrew.cmu.edu, Alan Scheller-Wolf, Itir Karaesmen

We study a retailer selling a perishable product with a lifetime of two periods, who uses a base stock policy for total inventory in system. There are separate,possibly correlated, demand streams for different aged items. We compare three substitution policies over an infinite horizon: a. 2-way; b. 1-way (new to old); c. No substitution. We find that freshness, or average remaining life, of inventory is higher under substitution and 2-way substitution provides lower cost.

2 — First Expire First Out Inventory System
Viput Ongsakul, Assistant Professor, National Institute of Development Administration, School of Business, Serithai Road, Bangkapi, Bangkok, BK, 10240, Thailand, vongsakul@nida.nida.ac.th

We investigate the First Expired First Out rule used in managing perishable items in a supply chain system. We found that this rule performs well when we have limited information regarding drawing pattern, truck scheduling, customer shelf life requirement and so on. In contrast, we can show that our heuristic algorithm performs better, if we have some of those information in advance.

3 — Determination of Semiconductor Chip Reel Numbers and Sizes
K. Jo Min, Iowa State University, IMSE 2019 Black, Ames IA, United States, jomin@iastate.edu, Sasi Malladi

In semiconductor chip assembly industries, numerous reels of various kinds are utilized for Printed Circuit Board (PCB) manufacturing. In this paper, we show how the reel numbers and sizes can be determined in the context of inventory control under specific reel allocation policies across assembly lines. Managerial insights will be provided via numerical examples.

4 — Evaluation of Continuous Time Base-Stock Policies in Large-Scale Assemble-to-Order Systems
Yao Zhao, Assistant Professor, Rutgers University, Dept of Management Science and Info. Sys, 180 University Ave, Newark, NJ, 07102, United States, yaozhao@andromeda .rutgers.edu

We propose a new modeling approach to evaluate the continuous-time base-stock policies in multi-product and multi-component Assemble-to-Order (ATO) systems. The replenishment lead-times are stochastic, sequential and exogenously determined. We characterize the delivery lead-time distribution for single-product systems, the correlation of delays among components for the multi-product systems, and propose two numerical methods which are scalable to evaluate large-sized ATO systems.

■ WB36

Mart-Room C

Supply Chain Management VII

Contributed Session

Chair: Arif Rana, Associate Professor, Lahore University of Management Sciences, DHA,, Lahore Cantt., Pu, 54792, Pakistan, arif@lums.edu.pk

1 — Channel Coordination in a Three-level Supply Chain
Ajay Mishra, Assistant Professor, SUNY-Binghamton, School of Management, Binghamton, NY, 13902, United States, amishra@binghamton.edu

We study channel coordination in a manufacturer-distributor-retailer supply chain using a Stackelberg framework and look at decentralized and centralized decision-making. Price-sensitive consumer demand and EOQ assumptions characterize the model. We extend the previous studies that have produced valuable insights on two-level supply chains. We study quantity discounts, franchise fees, volume discounts, and revenue sharing as control mechanisms .

2 — Coordination of a Supply Chain with Risk-Averse Agents
Xianghua Gan, PhD student, University of Texas at Dallas, School of Management, JO47, 2601 N. Floyd, Richardson, TX, 75080, United States, ganxh@utdallas.edu, Suresh Sethi, Houmin Yan

We propose a definition of supply chain coordination, which generalizes the standard definition in the risk-neutral case. We show that coordinating a supply chain consisting of risk-averse agents is to find a contract that results in a Pareto-optimal solution. Then we find coordinating contracts for the supply chain consisting of one supplier and one retailer in four special cases. Our results provide the optimal inventory decision of the channel and the rule of allocating the channel profit.

3 — The Optimality of Hedging Point Policies for Stochastic Two-Product Flexible Manufacturing Systems
Shaoxiang Chen, Associate Professor, Nanyang Technological University, S3-B2A-30, Nanyang Business School, Singapore, S, 639798, Singapore, aschen@ntu.edu.sg

We study the stochastic two-item flexible manufacturing systems. Based on a notion called u-difference monotone introduced, we prove that the hedging point policy is optimal to the systems in general for both finite and infinite horizon cases. This result is (demand) distribution free and does not require strict convexity or even differentiability of the one-period expected cost function. A general characterization of the hedging point policy together with monotone switching curves is provided.

4 — Economics of Outsourcing in Industrial Clusters: Casestudy of the Gujrat Fan Industry
Arif Rana, Associate Professor, Lahore University of Management Sciences, DHA,, Lahore Cantt., Pu, 54792, Pakistan, arif@lums.edu.pk, Jawaid Abdul Ghani

Factors influencing outsourcing decisions are reviewed in the context of industrial clusters, characterized by high levels of specialization, low transaction costs, knowledge diffusion, and intense rivalry. A case-study from the Gujrat Fan cluster is presented. It is found that given the extremely low cost of conducting transactions and the presence of highly specialized and efficient firms, the decision regarding core activities to be retained in-house is key to survival in clusters.

■ WB37

Mart-Room D

Supply Chain Management IX

Contributed Session

Chair: Joern Meissner, Columbia Business School, 2840 Broadway #284, New York, NY, 10025, United States, joe@meiss .com

1 — System Dynamic Model to Study the Impact of CPFR on a Supply Chain Performance
Amarpreet Kohli, University of Louisville, 784 Raymond Kent Cy., # 2, Louisville, KY, 40217, United States, askohl01@gwise.louisville.edu

Companies have realized that although their focus on consumer satisfaction has been important to achieve in-house innovation, their competitiveness and profitability have not been considerably improved. CPFR provides a stage where partners of the supply chain can work jointly to create more pragmatic and comprehensive forecasts that can be used to streamline their internal and cross-functional operations.The research will help to explain the role of CPFR in enhancing supply chaIn performance.

2 — Structural Network of Supply Chain Competition
Deming Zhou, Ph.D condidate, Anderson School, UCLA, 110 Westwood Plaza, Suite B513, Los Angeles, ca, 90095, United States, deming.zhou@anderson.ucla.edu, Uday Karmarkar

By focusing on large scale decentralized supply chain framework, this paper examines the impact of structural factors (i.e., number of entrants and fixed/variable costs) to the market price and production quantities in both B2B and B2C interactions. We treat the competition of a supply chain as a two stage game: entry and post-entry stage; and exlpore the structure along two directions: heterogeneous entrants for a serial supply chain, and homogenous entrants for a general network.

3 — Effects of Random Yield in Supply Chain
Yuanjie He, Ph.D Candidate, Case Western Reserve University, Dept. of Operations, 10900 Euclid Avenue, Cleveland, OH, 44106, United States, yxh35@cwru.edu, Matthew Sobel, Yunzeng Wang

Randomness in the quantity yielded by production should affect the decisions of supply chain parties. We study several supply chain models with different risk sharing contracts to understand the influence of random yield on supply chains and the advantages or the disadvantages of using different contracts.

4 — Coordinated Inventory and Transportation Decisions in a Two-Stage Supply Chain
Ismail Capar, Mississippi State University, Department of Industrial Engineering, Starkville, MS, 39762, United States, ic21@msstate.edu, Burak Eksioglu

A two stage supply chain with multiple retailers and two distribution centers (DCs) is analyzed . The retailers face Poisson demand and Dcs are also responsible to transport goods. To analyze the impact of VMI on inventory, purchasing, and transportation costs, three scenarios are considered (1) each member use (Q,r) policy; (2) the DCs control the inventories at the retailers (VMI); (3) the retailers impose maximum and minimum invetory levels and the DCs control the inventories at the retailers.

5 — Progressive Interval Heuristics for Multi-Item Capacitated Lot-Sizing Problems
Joern Meissner, Columbia Business School, 2840 Broadway #284, New York, NY, 10025, United States, joe@meiss.com, Awi Federgruen, Michal Tzur

We present a new class of heuristics for multi-item capacitated lot-sizing problems. These can be implemented to be asymptotically optimal as well as of low polynomial complexity, or to come within any desired relative gap with respect to the optimum. We report on an extensive numerical study exhibiting their practical effectiveness.

■ WB38

Mart-Room E

Transportation III

Contributed Session

Chair: Alan Rao, Senior Operations Research Analyst, Volpe National Transportation Systems Center, 55 Broadway, Kendall Sqaure, Cambridge, MA, 02142, United States, rao@volpe.dot.gov

1 — Optimal Bus Transit Route Network Design Problem: Algorithms, Implementations and Numerical Results
Wei Fan, University of Texas, Dept. of Civil Eng., ECJ 6.9, C1761, Austin, TX, 78712, United States, weifan@mail.utexas.edu, Randy Machemehl

A multi-objective nonlinear mixed integer model is formulated for the bus transit route network design problem. Five algorithms, including the genetic algorithm, local search, simulated annealing, random search and exhaustive search methods are examined as solution methods for finding an optimum transit route set. A small example network is successfully tested as a pilot study for the BTRNDP both with fixed and variable demand. Numerical results and related characteristics are presented.

2 — Continuous Network Design Problem via Bilevel Programming and its Implementations
Suh-Wen Chiou, Assistant Professor, National Dong Hwa University, Information Management Department, 1, Sec. 2, Da Hsueh Rd.,, Shou-Feng,, Hualien, 97401, Taiwan, chiou@mail.ndhu.edu.tw

An equilibrium network design problem is to determine the set of link capacity expansions and the corresponding equilibrium flows. A bilevel programming technique can be used to formulate this problem. In this paper, the descent approach to solving the bilevel program is used and new algorithms are proposed. Obtained numerical results show that the proposed algorithms are robust and computationally efficient in comparison with other alternatives.

3 — A 'Tabu Search' Meta-Heuristic for 'Capacitated VRP' with Simultanous Pick-Up and Deliveries
Arif Vural, Research Assistant, Mississippi State University, Dept. of Industrial Eng. McCain Building, Room 390 F, Starkville, MS, 39762, United States, avolkan@su .sabanciuniv.edu, Burak Eksioglu

In this study, we focus on a decision model for a real world problem. The problem reveals itself as simultaneous distribution of commodities and recollection of empty packages the same size as the initial state with a single depot and a fleet of uniform vehicles with limited capacities. Resembling instances are named in the literature as "CVRPSPD". To solve the arousing NP-hard problem we use "Tabu Search" based approach. Reduced number of parameters, and a good solution performance are sought.

4 — Optimal Cluster Repair Sequence
Fahad Alrakabi, Ph.D., USC, 333 San Marcos st., Apt. # X, San Gabriel, CA, 91776, United States, alrakabi@usc.edu, Jim Moore

After a major earthquake bridges and other network links will most likely have to be grouped into clusters in order to define a repair sequence. This will result in a finite number of clusters. We are concerned with the method of sequence repair of these clusters, given that resources may not be available to repair all

clusters simultaneously. Our goal is to determine the sequence in which the clusters should be repaired. The optimal repair sequence minimizes total network delay.

5 — Base Case Risk Assessment in US Railroad Systems
Alan Rao, Senior Operations Research Analyst, Volpe National Transportation Systems Center, 55 Broadway, Kendall Sqaure, Cambridge, MA, 02142, United States, rao@volpe .dot.gov, Frank Roskind

Since Mid-90's, FRA/Volpe Center has been developing Probabilistic Risk Assessment models for US railroad systems. Base Case Risk Assessment/RISK2 is the latest example supporting RSAC's NPRM of 49-CFR-236-H. Built from a GIS, RISK2 applies both linear and non-linear methods to analyze failure rates and accident consequences in different railroad territories. This performance-based model studies the per-train-mile risk for future railroad development projects.

■ WB39

Mart-Room F

Supply Chain Contracts

Contributed Session

Chair: Hakan Tarakci, Graduate Assistant, Purdue University, Krannert Graduate School of Management, 403 W. State Street, West Lafayette, IN, 47907, United States, tarakci@mgmt.purdue.edu

1 — Supply Chain Coordination Contracts and their Impact on Collaborative Forecasting Effort
Prashant Yadav, University of Alabama, Info Systems, Stats & Management Sc., Tuscaloosa, AL, 35487, United States, pyadav@proctr.cba.ua.edu, Chuck Schmidt

In the distribution of seasonal products, returns policies and buy-back contracts offered by the manufacturer have gained wide acceptance.We study how the incentives to participate in collaborative forecasting get affected by the nature of the buy-back contract offered. We show that buy-back contracts designed without considering the impact on collaborative forecasting do not coordinate the supply chain.Contracts that can coordinate the supply chain in this new setting are discussed.

2 — Supply Contracts in Drop-shipping Operation with Asymmetric Demand
Suresh Sethi, Professor, School of Management, Univ of Texas at Dallas, SOM, JO 4.7,, 2601 N. Floyd Rd, Richardson, TX, 75080, United States, sethi@utdallas.edu, Xianghua Gan, Jing Zhou

We study a drop-shipping supply chain in which the retailer receives customer orders and the supplier fills them. We propose a commitment-penalty contract that coordinates the chain for the full information case. We focus on the contracting issue under asymmetric demand information. We show that the supplier can infer the retailer's demand information by the retailer's response to a menu of commitment-penalty contracts. Finally, we find the solution that maximizes the supplier's expected profit.

3 — Incentive Maintenance Contracts For Optimizing Channel Profit
Hakan Tarakci, Graduate Assistant, Purdue University, Krannert Graduate School of Management, 403 W. State Street, West Lafayette, IN, 47907, United States, tarakci@mgmt.purdue.edu, Kwei Tang

We discuss channel coordination issues in maintenance outsourcing contracts. Consider a service chain, consisting of a manufacturer and an external maintenance contractor. The manufacturer pays the contractor a fixed amount for performing preventive maintenance and corrective maintenance. We propose three coordination methods for inducing the contractor to select the maintenance policy that optimizes the profit of the service chain.

4 — Removing the Shop Floor White Board
John Hosford, Chief Process Improvement Officer, Advanced Manufacturing Supply Chains Solutions INC (AMSCSINC), 770 Bentgrass Ct, Dacula, Ga, 30019, United States, hosford5@bellsouth.net

Most planning systems use static data and are unable to accurately model shop floor operations. The purpose of this paper is to discuss the methodology we used to remove the shop floor white board by constructing a real time integrated system consisting of; Enterprise Resource Planning (ERP), Advanced Planning and Scheduling (APS) and Manufacturing Execution System (MES) components, tied together by a message bus architecture.

■ WB40

Mart-Room G

Strategic Supply Chain Management

Contributed Session

Chair: Tan Miller, Director, Pfizer, 201 Tabor Road, Morris Plains, NJ, 07950, United States, tan.miller@pfizer .com

1 — Emerging Supply Chain Management Research Issues in the Automotive Industry
Prakash Singh, Queensland University of Technology, GPO Box 2434, Brisbane, QL, 4113, Australia, p2.singh@qut.edu.au

Many players in automotive industry are focusing on their supply chains for competitive advantage. This paper reports on an Australian study that examined issues related to the supply chains of the automotive industry. Data from interviews with personnel from various industry players enabled the articulation of ten key issues. These showed that the relationships between the parties are "complex", and there are many weaknesses. This paper articulates these and presents research questions.

2 — Strategic Directions for Improving Supply Chain Performance
Germaine Saad, Professor of Management, School of Business Administration, Widener University, One University Place, Chester, Pa, 19013, United States, Germaine.H.Saad@widener.edu, Samia Siha

This paper addresses main challenges faced in managing supply chains in general and those in highly dynamic decision environments in particular. These include: complexity of inter-firm and intra-firm interfaces, uncertainty, behavioral, and, informational challenges. A dual dimensional approach (DDA) is proposed to help overcome these challenges. This includes both reactive and proactive strategies and systems.

3 — Strategic Supply Chain Planning: A Framework to Support Make/Buy Decisions.
Luis Vasconcellos, Consultant, Volkswagen do Brasil, Via Anchieta km 23,5, Al. Casa Branca 1204 ap 14, Sao Paulo, SP, 05621-000, Brasil, lhrv@gvmail.br

In an competitive environment, while strategic chains appear to flourish, the perspective of competition among isolated companies seems increasingly distant. This scenario favors approaches that rely on strategically planned supply chains, that is, a structured means of making decisions regarding composition, or even a simple adjustment to a strategic chain to make it more efficient and competitive.

4 — Cooperation Model for the Management of an International Supply Chain in Phase of Growth
Matthieu Lauras, Ph D. Student, Ecole des Mines d'Albi-Carmaux, Centre Génie Industriel, Campus Jarlard, route de teillet, ALBI, 81, 81000, France, lauras@enstimac.fr, Jacques Lamothe, Hervé Pingaud

Companies seek to anticipate the impacts of their growth on the organization modes within their Supply Chain. They wish to have tools enabling them to better understand how the industrial agreements should progress. We propose a two step approach that defines typologies of actors and of cooperation states: Interviews on a pharmaceutical and cosmetic industry and Data Analysis allowing to extract the representative variables. From these typologies, we propose strategic performance indicators.

5 — Global Supply Chain Profit Maximization Model
Tan Miller, Director, Pfizer, 201 Tabor Road, Morris Plains, NJ, 07950, United States, tan.miller@pfizer.com, Vijay Gupta, Renatto De Matta, Emmanuel Peters

Developing integrated manufacturing and distribution plans for a global supply chain represents a formidable undertaking. Developing plans to maximize profits on a global basis presents a far greater challenge. In this paper we formulate, solve and discuss a model that addresses global profit maximization.

■ WB41

Mart-Room H

Supply Chain Management VI

Contributed Session

Chair: Fouad El Ouardighi, Associate Professor, ESSEC Business School, BP 105, Cergy Pontoise, FR, 95021, France, elouardighi@essec.fr

1 — Managing and Evaluating Suppliers in a Supply Chain
Gal Raz, Australian Graduate School of Management, room 205, UNSW,, Sydney, NS, 2026, Australia, galraz@agsm.edu.au

This paper studies the evaluation and management of suppliers in a supply chain based on their risk and partnership potential. Using an example of a leading edge biotechnology company, we examine the process of evaluating the upstream suppliers and suggest the different types of contract schemes for the different kinds of suppliers.

2 — Exploring SCM Past Limitations and Possible Future Concepts
Fei Qi, Graduate Student, University of Nebraska, Lincoln, APT1, 870N 25st, Lincoln, NE, 68503, United States, qifeimail@yahoo.com

Abstract: The Internet has brought a revolution opportunity to supply chain management (SCM). This paper provides a historic summarization of traditional SCM limitations: tradeoff between information reach, richness, and system adoption as a foundation to understand the impact of the Internet on SCM. From this, a concept of "flexible integration" is suggested focusing on high integration but easy changing of business partnerships.

3 — Inventory Flexibility through Adjustment Contracts
Rong Li, School of Industrial Engineering, Purdue University, 133-8 Nimitz Dr., West Lafayette, IN, 47906, United States, li25@purdue.edu, Jennifer Ryan

We study a multi-period inventory problem for a buyer who has a portifolio of supply contracts: (1) wholesale price contract and (2) adjustment contract. (2) offers more flexibility by allowing the buyer to adjust upwards/downwards his inventory levels more frequently than (1). We characterize the optimal inventory control policy.

4 — Chain-to-Chain Competition under Demand Uncertainty
Owen Q. Wu, Sauder School of Business, University of British Columbia, 2053 Main Mall, Vancouver, BC, V6T1Z2, Canada, owen.wu@sauder.ubc.ca, Hong Chen

The type of industry we analyze is comprised of multiple manufacturers, each selling differentiated products through multiple exclusive retailers. The retailers are faced with fixed market prices but uncertain demands. Industries falling in this category include telecom industry, fast food chains, gasoline, etc. We link the analytical marketing literature on channel structures to the supply chain literature on coordination under demand uncertainty, and examine the impact of demand uncertainty.

5 — A Differential Game Model of Supply-Chain Management
Fouad El Ouardighi, Associate professor, ESSEC Business School, BP 105, Cergy Pontoise, FR, 95021, France, elouardighi@essec.fr

In this paper, we formulate a differential game model of supply-chain mananagement characterized by a strong operations/marketing interface. The model involves a manufacturer and a retailer interacting dynamically within a vertical channel. Qualitative solutions for the noncooperative case as well as for the cooperative case are provided.

■ WB42

Mart-Room I

Revenue Management III

Contributed Session

Chair: Francois Bouffard, McGill University, 3480 University St. Rm. 633, Montreal, QC, H3A 2A7, Canada, francois.bouffard@mail.mcgill.ca

1 — Airline Revenue Management With Shifting Capacity
Kevin Pak, PhD Student, Erasmus University Rotterdam, Burg. Oudlaan 50, Room H16-22, Rotterdam, ZH, 3000DR, Netherlands, kpak@few.eur.nl

Arlines often use business class capacity to allocate economy class passengers by "moving the curtain" or upgrading a passenger. In this paper however, we consider the use of convertible seats. A row of these seats can be converted from business to economy class and vice versa. This way the airline is better suited to adjust the capacity configuration of the plane to the demand pattern at hand. We incorporate the shifting capacity opportunity into a dynamic, network-based booking control policy.

2 — Integrated Pricing Management
Rahul Bhaskar, California State University, 800 North College Boulevard, Fullerton, CA, 92831, United States, rbhaskar@fullerton.edu

Pricing is a crucial management responsibility that has important strategic and operational consequences. Among the most important parts of the marketing mix, pricing is the only variable that has immediate financial impacts. In this presentation, we underscore the importance of treating pricing as an ongoing process which when supported by information technology can result in a valuable strategic benefits.

3 — Equitable Rules under Generalized Uplifts in Electricity Markets
Francois Bouffard, McGill University, 3480 University St. Rm. 633, Montreal, QC, H3A 2A7, Canada, francois.bouffard@mail.mcgill.ca, Francisco D. Galiana

The notion of generalized uplifts has been proposed as a systematic mechanism to impose a market equilibrium in those cases where one does not exist. Generalized uplifts reward and/or threaten competing generators so that they alter their profit maximizing self-scheduling behaviour until equilibrium is achieved. In this paper, we show that the rules underlying the computation of these uplifts must be chosen carefully in order to avoid any potential inequities among the market players.

■ WB44

Mart-Room K

Aviation

Contributed Session

Chair: Avijit Mukherjee, Ph.D. Candidate, U.C. Berkeley, 107E McLaughlin Hall, Berkeley, CA, 94720, United States, avijit@ce.berkeley.edu

1 — Modeling of Network Competition in Air Transport Market
Mikio Takebayashi, associate professor, Kobe University, 1-1 Rokkodai, Nada, Kobe, hy, 657-8501, Japan, takebaya@kobe-u.ac.jp

The goal of the present paper is to express the structure of contemporary air transport market by concerning the Low Cost (LC) carriers' behavior. I deal with the tree level optimization problem. The first level is of the HS carrier's profit maximization. The second level is of the LC carrier's share maximization. The third level is of the air passengers's route choice. Next, I show that the three level optimization problem can be handled as the bi-level programming, i.e. MPEC problem.

2 — Scatter-Search and Bionomic Algorithms for the Aircraft Landing Problem
Hélène Pinol, PhD student, Imperial College London, The Business School, South Kensington campus, London, En, SW7 2AZ, United Kingdom, h.pinol@imperial.ac.uk, John Beasley

The aircraft landing problem (ALP) is a decision problem involving computing a sequence of aircraft, assigning them to a runway and scheduling their landing times. The ALP is formulated as a mixed-integer zero-one program and solved using two heuristic techniques: scatter-search and the bionomic algorithm, genetic approaches that have not been applied to the ALP before. Computational results are presented for publicly available test problems involving up to 500 aircraft and 5 runways.

3 — Dynamic Stochastic Ground Holding Problem for a Single Airport
Avijit Mukherjee, Ph.D. Candidate, U.C. Berkeley, 107E McLaughlin Hall, Berkeley, CA, 94720, United States, avijit@ce.berkeley.edu, Mark Hansen

We present a stochastic integer programming model with recourse to assign ground delay to flights, by using updated information on evolving arrival capacity conditions at an airport. A finite set of scenarios, each associated with certain probability of occurrence, of time varying capacity of the airport is considered. At every decision stage, ground delays assigned to various aircraft are revised, depending on which set of scenarios is realized at that time.

■ WB45

Mart-Room L

Logistics II

Contributed Session

Chair: Guvenc Sahin, PhD Student, University of Florida, Ind. and Sys. Eng. Dep., Gainesville, FL, 32611, United States, guvencs@ufl.edu

1 — Solving Two Location Models by using Scatter Search
Joaquin Pacheco, Associate Professor, University of Burgos, Plaza Infanta Elena s/n, BURGOS, BU, 09001, Spain and Canary Islands, jpacheco@ubu.es, Jesus Alegre, Silvia Casado

We propose a Scatter Search algorithm for two location problems: the p-Center and the "critical-time". Our algorithm incorporates Local Search, GRASP, and Path Relinking. Quality solutions with few facilities are obtained. The algorithm proposed gave better results than recently methods. We applied it to the health resources location in Spain

2 — A Review of Hierarchical Facility Location Models
Guvenc Sahin, PhD Student, University of Florida, Ind. and Sys. Eng. Dep., Gainesville, FL, 32611, United States, guvencs@ufl.edu, Haldun Sural

A comprehensive treatment of hierarchical location problems has not been provided since the mid 80s. We classify the models according to the features of systems studied, which are based on flow type, flow pattern, service availability at each level of the hierarchy, and spatial configuration of services in addition to the optimization criterion. We investigate the motivations of each study and the solution methods presented, and consolidate the main results on hierarchical location problems.

3 — Security Profiling of Airline Passengers: How Effective Would It Be?
Susan Martonosi, Graduate Student, MIT, MIT, E40-131, Cambridge, MA, 02142, United States, sem18@mit.edu, Arnold Barnett

Some critics of Computer-Assisted Passenger Pre-Screening Systems (CAPPS), used to determine which airline passengers receive extra scrutiny, say that such

systems are "Carnival Booths", easily defeated by terrorists. Others, however, believe that such systems are the "right answer" to security. We develop a mathematical model to investigate the assumptions made and conclusions drawn by both parties.

4— Modelling LPG Distribution in Indian Context
Narasimahan Ravichandran, Professor, Indian Institute of Management, Vastrapur, Ahmedabad, 380015, India, nravi@iimahd.ernet,in

This paper presents astochastic inventory model to optimize the total cost of managing LPG distriburtion in the Indian context. The system as of now is managed with redundant stock at every consumer location to ensure one hundred percent service level. We propose an alternate model which would minimize the float in the system and ensure reliable service levels. The model is scalable. Some implementation issues are also discussed.

■ WB46

Mart-Room M

E-Business II

Contributed Session

Chair: Kemal Altinkemer, Associate Professor, Purdue University, Krannert GSM, W. Lafayette, IN, 47907, United States, kemal@mgmt.purdue.edu

1 — Diffusion of Electronic Procurement Technologies
Paul Brown, Georgia State University, 35 Broad St, Atlanta, Ga, United States, brownpries@aol.com

The procurement function is becoming an increasingly strategic importance to organizations, however, inefficiencies abound. A promising solution for these inefficiencies has been the creation of electronic procurement technologies. The new technologies promise to provide increased savings and productivity for organizations. Using innovation theory and trust literature, we create a model to examine the factors that facilitate the diffusion of electronic procurement technologies.

2 — A Strategic Analysis of Online Expert Advice
Zafer Ozdemir, PhD student, Purdue University, Krannert GSM, W. Lafayette, IN, 47907, United States, ozdemir@mgmt.purdue.edu, Kemal Altinkemer

This paper studies how the Internet impacts the market for expert services. Specifically, we analyze the conditions under which local experts with a physical presence adopt online consultations and when an online expert can profitably enter local experts' markets. We find that the online expert can enter the high-end local market only if his quality is higher than those of local experts. Such a condition is not necessary for the low-end local market.

3 — An Economic Analysis of Online Channel Adoption in Higher Education Sector
Kemal Altinkemer, Associate Professor, Purdue University, Krannert GSM, W. Lafayette, IN, 47907, United States, kemal@mgmt.purdue.edu, Zafer Ozdemir

Many universities offer distance education, however adoption rates vary depending on institutional type. We study a reputation model where a monopolist university considers whether to offer an online degree. While institutional size and public support do matter, we also find that institutions with high-quality education are more likely to adopt the online channel. The results suggest that reputation plays a significant role in a university's online channel adoption decision.

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Shen, Jerry SB30
Shenoy, Prakash MB23
Shen, Ting WB12
Shen, Yanfang TD28
Shen, Zuo-Jun Max SA34 SB 31 SC31 MD43 TA32
Sherali, Hanif SA27 SC44
Sherman, David MD16
Sherriff, Ryan TA37
Shetty, Vijay SB10
She, Yuehua MB10
Shi, Bin MD20
Shi, Dailun SA36 SC03
Shi, Jianjun (Jan) SA19 SB19 SC19 MC18 TB18 TC18
Shi, Leyuan SB32 SC36 MC27 TC32
Shi, Mengze TA35
Shields, Rob MC42
Shier, Douglas R. SA27
Shih, Kuang-Hsun TD10
Shih, Maverick MC06
Shiina, Takayuki TC17
Shimada, Tomoaki WA41
Shim, Sang-Oh MC32 TB32
Shimshak, Daniel MD16
Shim, Won P. SB10
Shinde, Rahul TD33
Shin, Sangmun MD20 TC25 TD45
Shioda, Romy TA31
Shive, Sophie SC02
Shi, Yong MD11 WA26
Shmoys, David MA32
Shnaydman, Vladimir TC17
Shneorson, Shiri SA24
Shoemaker, Christine SC20 SD20 TC07 TC31
Shohdohji, Tsutomu TB37
Shortle, John MB05
Shou, Biying MA12
Shreve, Steven SA05
Shu, Lianjie MD18
Shulman, Herbert B. MC04
Shultes, Bruce SD08
Shumsky, Robert MA12
Shyllon, E. A. TA11
Sibdari, Soheil TD42
Siemsen, Enno SA35
Siemsen, Enno TD15
Sier, David SB16
Siha, Samia MC20 WB40
Sikder, Arun K. SD19
Silverman, Brian SC15
Sim, Thaddeus SD37
Simao, Hugo MC34
Simchi-Levi, David SA34 SA43 SD36 SD40 MA42 MB34 MC41 MD41 TD40
Simıes, Lucia Novaes MD17
Simon, Burt MD08
Simpson, Timothy W. SC09
Sims, Katharine SC12
Simsek, Koray TA29
Simunich, Kathy Lee TD20
Singhal, Vinod MB36
Singh, Amita TA23
Singh, Prakash WB40
Singh, Praneet SD41
Singireddy, Abhilash MD06
Sinha, Amitabh MD29
Sinha, Kingshuk MC14 TB14
Sircar, Ronnie MA02 MC02
Sivakumar, Aruna TD12
Skaf, Mazen MA23
Sloan, Thomas TB45
Slotnick, Susan WB32
Small, Meg TB26
Smart, Charles TD39
Smilowitz, Karen MD34 TA34 TB34
Smirnov, Yuri MC42
Smith, Alice E. SB20 MD01 TD19
Smith, Barry MC44
Smith, Cole SB01 MB30 MD46
Smith, Donald R MC04
Smith, James E. MB23
Smith, Michael MD24
Smith, Michelle WA18
Smith, Neale MC39
Smith, Robert TD28
Smith, Stephen TD39
Smith, Stephen TC41
Snyder, Lawrence V. MC40
Sobek II, Durward MA14
Sobel, Matthew J. WA12
Sobel, Matthew WB37
Sofer, Ariela MB17
Sohoni, Milind MD03
Sohoni, Milind TB44
Sokol, Joel SC08 MC34 MC45 TA39 TB06 TB29 TC29 TD43
Soland, Richard M. TD25
Soll, Jack TB22
Solomon, Marius TA34
Solow, Daniel WA23
Solow, Daniel WA25
Sommersguter, Margit MB16
Sommer, Svenja MB14
Song, Haiqing TD01
Song, Jeannette MA36
Song, Jin-Hwa SC34
Song, Jiongjiong MC42
Song, Kyung Suk TB01
Song, Liying SB34 MA34
Song, Miao TD34
Song, Wheyming TC08
Son, Joong TB35
Sood, Anshul SB42
Sorensen, Stephen SA17
Soriano, Patrick SC01
So, Rick MB37
Soroush, H.M. TB29
Sosa, Manuel MD14
Sosic, Greys SC37 TA41
Soumis, François TA32
Sounderpandian, Jayavel MA22
Souza, Gilvan SA35 SC40 TD14
Sox, Charles MA37 WA41
Spaulding, Andre WA35
Spears, Martha TB09
Spelsberg-Korspeter, Gottfried MD33
Spielberg, Kurt WA37
Spinler, Stefan SD15
Spitulnik, Charles A. SC39 SD39
Spoerl, David MA30
Squier, Laura SB26
Squillante, Mark TB41 TD03
Squire, Michelle MC32
Sridharan, Ramaswami TA37
Sridhar, V. SB24
Srinivasan, Ashok TB40
Srinivasan, R WA32
Srinivasan, Siva TD12
Sriskandarajah, Chelliah SA32 SC32 MC01
Srisuwannapa, Chanin WA23
Staats, Raymond SC44
Stacey, Craig MD13
Stamey, Jr, John W. TC12
Stanfield, Paul TC32
Stanley, K. J. SA45 SB03
Stanojevic, Daliborka MB01
Staum, Jeremy SA02
Stavrulaki, Euthemia TD46
Steckley, Samuel G. MB08
Steedman, Mark MA06
Stein, Cliff MA32 MA32
Steinemann, Patrick SC15
Stenfors, Sari TB45
Stepan, Adolf MB16
Stepanov, Alexander TC38
Stephens, Todd TD46
Sterman, John MB35 SB43
Stern, Scott TC40
Steuer, Ralph TC45
Stevens, Scott TA10
Stewart, David TA30
Stewart, William SD07

Stidham, Jr., Shaler MC05
Stier Moses, Nicolás MC29
Stock, Adrian SD47
Stojkovic, Goran TD44
Stokes, Brian SA23
Stolyar, Alexander MA05
Stonebraker, Jeffrey MB22 SD23
Storer, Robert WA23
Stori, James A. TD31
Stosic, Borko TB33
Stouffer, Virginia MA44
Stratman, Jeff MB36
Stremersch, Stefan SB13
Strickland, Dawn TB06
Strotmann, Christian SC32
Stuart, Julie Ann SB35 SD35 MA35
Subramanian, Ravi TB07
Su, Che-Ping WA39
Sudit, Moises SB10
Suiter, Ron MA44
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Sullivan, Michael SC02
Summers, Gary SA33
Sun, Aichong SA38
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Sun, Daewon SD24
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Sundaresan, Shankar WA02 WA42
Sun, Jiong MA24
Sun, Peng TD29
Sural, Haldun WB45
Suresh, Nallan MD24
Suri, Rajan TA12 TD33 WA01
Suri, Subhash MC42
Su, Xuanming SC17
Swafford, Patty SA13
Swamidass, Paul WA39
Swaminathan, Jayashankar SA35 SC40 SD41 MC04 TA05 TA14 WB01
Swaminathan, Rajesh SC45
Swann, Julie SB42 SC17 SC40 SD36 MD41
Swiler, Laura TB37 WA05
Swindle, Glen MB07
Syam, Siddhartha SD16
Sycara, Katia TD46
Szechtman, Roberto MA08
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Taaffe, Kevin SB36 SC41 TA44
Tabata, Tomoaki WB22
Tailor, Eric A. TC25
Takebayashi, Mikio WB44
Talbot, Brian TB07
Talreja, Dheeraj SB10
Tamir, Arie SC31
Tanabe, Takahito TC33
Tanchoco, J.M.A. WA34
Tang, Christopher MD17
Tang, Hao TB34
Tang, Kwei WB39
Tang, L C MA19
Tang, Qian SC24
Tang, Qunhong WB16
Tangudu, Sarat TD45 WA09
Tan, Kim Hua TD41
Tan, Kok Choon TD08
Tanner, Leena TB45
Tan, Tarkan WA35
Tan, Yong SA21
Tao, Guoyu SA17
Tarakci, Hakan WB39
Tarantino, William SD22
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Tardos, Eva TB43
Tavana, Hossein MD38 SD44
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Teng, Jinn-Tsair WB12
Tennati, Udai TC04
Tenorio, Luis WA20
Teo, Chung-Piaw MB29 TA02 TD34
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Terabe, Shintaro TD42
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Terwiesch, Christian SA14 SC35 SD14 TB14
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Tezcan, Tolga SB45
Theodosopoulos, Theodore TB02
Thibault, Marc TA25
Thiele, Aurelie TA42
Thierry, Ricardo SD03
Thirumalai, Raman TB44
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Thomas, Helen SA21
Thomas, Joseph TB11
Thomas, Lyn TD26
Thomas, Marlin SA20
Thomas, Salimol TC24
Thomas, William TC03
Thom, Belinda MC06
Thomke, Stefan SD14
Thompson, David WA16
Thompson, Matt MC07 MD03
Thomson, Mary SC06
Thoney, Kristin SC22
Thornton, Paul SC22
Thursby, Jerry TA15
Thursby, Marie TA15
Thurston, Deborah WA40
Tibben-Lembke, Ronald WA45
Tilson, Vera TD36
Tjader, Youxu (Tammy) TB46
Todd, Michael TD30
Tohamy, Noha TB04
Tokol, Gamze SD03
Toktas, Berkin MA30 TA44
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Tombak, Mihkel MC14
Tomlin, Brian MC40
Tompaidis, Stathis TA07
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Topaloglu, Huseyin SB30 MC30
Totten, John MB13
Toulouse, Michel TA33
Touw, Anduin TC25
Tovey, Craig MB21 MD06 TD06
Toyasaki, Fuminori MA35
Trainor, LTC Timothy SB22 SC22
Trani, Antonio MA44 SC44
Trekoff, Carol MC21
Trench, Margaret TB10
Triantaphyllou, Evangelos TA26
Trick, Michael SC21 TB27 TD27
Trietsch, Dan MD35
Trigos, Federico WA23
Tripp, Bob TD38
Troutt, Marvin WA02
Truchet, Charlotte MB06
Tsai, Julia MD26 SC20
Tsai, Roger SC03
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Tschantz, Steven SA42
Tse, Edison WB35
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Tsetlin, Ilia SD43
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Tuncalp, Deniz SA10
Tunca, Tunay TC40
Tuncel, Levent MC03
Tunnercliffe, William TD02
Turnquist, Mark TC34
Tu, Rungting MC17
Tuunanen, Tuure WA21
Tyagi, Rajesh MB04
Tzur, Michal TA34 WB37

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Ukkusuri, Satish V.S.K. MB38 MD38 TA38
Ulrich, Karl SA14 SB14 SC14 SD14 TA13
Umweni, Felix E. SB10
Un, Annique SB15
Ungar, Lyle MA24
Uppal, Raman SD02
Urban, Timothy MD32 TB35
Ure, Renee MB03
Uryasev, Stanislav MB02 MD02 MD02 SB31 WB02
Usowicz, Thad SC10
Utkin, Oleg B. SC33

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Valente, Patrick SB21
Valenzuela, Jorge TA07
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Van Dyke, Carl MA39
Van Hentenryck, Pascal MB46
van Houtum, Geert-Jan MA37
Van Hove, John MC01
van Ittersum, Koert SA13
Van Mieghem, Jan SD36 MB40
van Nunen, Jo SD35
Van Nyen, Pieter MC35
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Van Oyen, Mark SC12 MB12 TB11
Van Roy, Benjamin SD05
van Ryzin, Garrett SB42 TC42
Van Trijp, Hans C.M. SA13
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Vandenbussche, Dieter MB27
Vanderbei, Robert SA28 MB28 TC02
VanderMeer, Debra SA21
Vane, Russell SD25
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Vardar, Cem SC45 MB45
Vargas, S. Claudina MA33
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Vasigh, Bijan MC33
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Vazacopoulos, Alkis TC21
Vazirani, Vijay TB43
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Veloso, Francisco SC15
Vengazhiyil, Roshan MB19
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Venkat, Vandana TD31
Ventosa, Mariano SB07
Ventresca, Carol WB17
Ventura, José MD31 WA35
Vera, Juan WA28
Vergamini, Didier MD21

Vergara, Edmundo TD31
Vergara, F. Elizabeth TB37
Verma, Manish TC34
Verter, Vedat SA31 TC34
Vidakovic, Brani MD20
Villalobos, Rene SC09 MC12 TC17
Villamil, Jairo TB09
Villegas-Moran, Felipe WA40
Vining, G. Geoffrey MB18
Virginas, Botond WA15
Virine, Lev WA21
Viswalingam, Vinod SD37
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Viswanathan, Vish SD23
Viswanath, Kannan SD34
Vogel, W. Bruce SD16
Vohra, Rakesh V. SB43
Voit, John WA14
Volk, Anja MB06
Volodin, Andrei V. SC33
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Vossen, Thomas MD44
Voudouris, Christos WA15
Vulcano, Gustavo SB42 TC42
Vural, Arif WB38
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Wagner, Janet MD10
Waisanen, Larry WA16
Waissi, Gary TA10
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Wallace, Chris TC37
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Waller, S Travis MB38 MD38 TA38
Walls, Michael MC23
Walter, Joseph TB10
Waltz, Richard SA28
Walus, Konrad TC30
Wang, Haibo TD26
Wang, Hui SA05
Wang, Jiamin TA35
Wang, Kaibo MD18
Wang, Ling TB35
Wang, Ni MB19
Wang, Patrick TA01 TC07
Wang, Qiong SD36
Wang, Qiong SB29
Wang, Sheng-Pen SC06
Wang, Shuchun TC26
Wang, Siqun MC32
Wang, Tuo SB35
Wang, Xia SA33
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Wang, Xiubin MA34 WA43
Wang, Yong TC30
Wang, Yuan TB02
Wang, Yunzeng WB37
Wang, Zhouyan MC43
Wan, Hong MA20
Wansink, Brian SA13
Wan, Steve MA07
Wan, Yen-Tai SD45
Ward, Amy SD05 MA05 MB40
Ward, Timothy MC16
Ware, Keith A. MD04
Warren, Jeffrey TB27
Warrier, Deepak TB27
Warsing, Donald MC36 MD40
Washington, Michael SA17 MA17
Wasil, Edward SD21 MB01
Webb, Michael SA22
Webb, W. Owen TC01
Weber, Thomas TA24
Wei, Donna SB35
Wein, Lawrence M. SC17 MA17 TB36 TD06
Wein, Lawrence SB34
Weintraub, Andres SD04 MC31
Weir, Jeffery MC25
Weiss, Alan TA40
Weiss, Daniel WA30
Weitzman, Scott WA46
Wei, Wei SD40 TA36
Wei, Ying WA20
Welch, Ronald SB22
Wen, Aihong SC20
Wen, Ue-Pyng MD27
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Whitaker, Roger M. SA01
Whitaker, Roger MD01
Whitcomb, Kathleen WB22
White, III, Chelsea C. SB34 TA19 TA38 TB34
White, Kevin TA44
Whitten, Daniel MD25
Whitten, Nathan MD25
Wiecek, Margaret TC45
Wierman, Adam TB41
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Wiley, Mark MC47
Wilhelm, Wilbert MA40 TB27
Wilkie, Simon TB23
Wilkins, Alex SB34
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Willemain, Thomas TD39
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Williams, Janet TA01 WA16
Williams, Michael SC22
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Wilson, Alysia M. MD04
Wilson, Amy TB16
Wilson, Darryl TA45
Wilson, George R. WB16
Wilson, John G. WA42
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Wilson, Thomas MB43
Winch, Janice WA32
Wingrove, Earl MA44
Winston, Wayne WA42
Wolf, Eric TA08
Wolfe, Robert WA16
Wolter, Claudio SC15
Wolyniec, Krzysztof MB07
Womer, N. Keith MA33
Wong, Cathy SC16
Wong, Jonathan SC03
Wong, Nancy SA13
Wongweragiat, Sudaratana SD35
Won, You-Dong MB20
Wood, Bradford MB17
Wood, Bryan TC34
Wood, Graham TA37
Wood, Kevin SA25 MA30
Woodruff, David TA21
Wood, Sam SC47
Wright, Adele TA17
Wright, P. Daniel SD16 MA16
Wright, Ronald TB37
Wu, Chongqi WA39
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Wu, Ernest TB21
Wu, George TA22
Wu, Jeff SA18 SC26 MB18 MD19
Wu, Joe SC17 MA17
Wu, Lifang TC39
Wu, Owen Q. WB41
Wu, Rong TB05
Wu, Shinyi SD24
Wu, Teresa MA33
Wu, Tony TC08
Wuerfel, Jim MD21 TD21
Wuyts, Bart TC38
Wu, Zhengping MA40
Wynter, Laura TC01 WA42
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Xia, Mu WA43
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Xia, Yu MD40
Xia, Yusen MD40
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Xia, Zhendong MB07
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Xie, Xiaolan TC05
Xie, Ying SD13
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Xue, Mei MC17
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Xu, Kai MA19
Xu, Peng TB24
Xu, Ping TB35
Xu, Susan SB36 MC36
Xu, Xiaodong SB30
Xu, Xiaohui TB40
Xu, Xiaowei WB14
Xu, Yan SC21 MB21
Xu, Yanyi WA12
Xu, Yi SC35
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Yadav, Prashant WB39
Yalabik, Baris WA17
Yalcin, Ali TC12
Yamada, Yuji MC02 TD40
Yamamoto, Junichi TD46
Yan, Bo TA06
Yang, Bibo MC32 TD40
Yang, Byounghak MD31
Yang, Feng MA20
Yang, Jian TC35
Yang, Jie SA15
Yang, Max TD18
Yang, Rui WA41
Yang, Saini SD21
Yang, Wei WA33
Yang, Xudong SD08
Yang, Zehua SC20 MD26
Yan, Houmin SD40 WB36
Yano, Candace SB41
Yao, Jian (Jay) SA07
Yao, Tao WB16
Yao, Xiaodong SA45 TC05
Yasushi, Hoshino TB37
Yazid, Erika MA39
Yee, Choy Leong TD41
Ye, Gewei TA46
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Yeh, Yingchieh TB08
Yen, Joyce MA30 TA44
Yeung, Shu-Ngai SA05
Ye, Yinyu SD46
Yildirim, E. Alper TD29
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Yoo, Jaewook WB34
Yoon, Hyun-suk TB06
Yoon, Min TD26
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Yoshizaki, Hugo MC45
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Younies, Hassan WA31
Yuan, Xueming TD07
Yu, Bin SC02
Yue, Wei TA20
Yu, Gang MD40 MD41 TD32
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Yuhaski, Steven TB31
Yu, Junfang TA12
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Yu, Liming SA15
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Zabinsky, Zelda B. SA06 SB06 MA30 TA44 TD28
Zakarian, Armand TC44
Zakaria, Oliviana SC45 MB32
Zaka, Sarah TC17
Zambelli, Giacomo MD29
Zantek, Paul MD18
Zapata, José TB45
Zappe, Christopher J. MA09

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Zarama, Roberto SA10 TB09
Zaretsky, Marina TD40
Zaric, Gregory MD16
Zarybnisky, Eric TA25
Zeevi, Assaf SA37 SC05 SD05
Zemel, Eitan SA40
Zeng, Amy TB09 TC39
Zenios, Stefanos SC17 TC40
Zenzen, Fran MD19
Zetu, Dan TC17
Zhang, Allen WA13
Zhang, Bo SB29
Zhang, Dan SD42
Zhang, Ding TA29
Zhang, Fuqiang MD36 WA36
Zhang, H. Michael MC38
Zhang, Hanqin SD40
Zhang, Huiju WA12
Zhang, Jiang WA12
Zhang, Jiao TA22
Zhang, Jie MB10
Zhang, Jun WA12
Zhang, Li TD01 TD03
Zhang, Li WA45
Zhang, Pengcheng SD34
Zhang, Peter TB39
Zhang, Rachel SC36 MD43 TB40
Zhang, Xiaolong WA35
Zhang, Xinhui TA37
Zhang, Xueyi (Stuart) MC36
Zhang, Xueyi MD40
Zhang, Yifeng TC20
Zhang, Yin SC28
Zhang, Yongmei TD07
Zhang, Zhanmin SB38
Zhang, Zuopeng WA02
Zhan, Roger L. TC31
Zhao, Hui SC35
Zhao, Qing TC44
Zhao, Wenbiao SA20
Zhao, Xuan TA41
Zhao, Yao SA34 MB34 WB35
Zhao, Yonggan SD02
Zhao, Zhenying SB36 SC40
TB46
Zheng, Chunmiao TC07
Zheng, Kai SA16
Zheng, Ning MD19
Zheng, Xiaona MA22
Zhong, Ming WA38
Zhong, Weiping MB20
Zhou, Deming WB37
Zhou, Fangjun SB17
Zhou, Jing WB39
Zhou, Li MC35
Zhou, Shiyu SA19 SC19 MC18 TC18
Zhou, Xian SA32
Zhou, Xuesong TB38 WA38
Zhou, Xun Yu SB02
Zhou, Yong-pin MC40
Zhou, Zhihong SC19
Zhuang, Jifang SC07
Zhu, Cheng TA17
Zhu, Guidong TD32
Zhu, Kaijie TA19 TC19
Zhu, Wanshan TC36
Zhu, Wei MC07
Zhu, Wenge WB17
Zhu, Xiaoyan MA40
Ziedonis, Arvids TA15
Ziemba, William SD02
Ziliaskopoulos, Athanasios K. MB38 MD34 TB38
Zimm, Alan SB10
Zingeser, James SD03
Zipkin, Paul MB40
Zipkin, Paul WB16
Ziya, Serhan MC05
Zlobin, Natalya SC17
Zoltners, Andy SD13
Zou, Yan MB35
Zrazhevsky, Grigory MD02
Zuckerberg, Mark TA27
Zuidwijk, Rob SD35
Zuluaga, Luis WA28

Sunday 8:00am - 9:30am

SA01 Wireless Networks and Connectivity
SA02 Derivative Pricing Methods
SA03 Tutorial: A Time-Based Approach to Modeling Inventory Problems
SA04 Panel: Having a Career in OR Practice
SA05 Asymptotics and Control of Stochastic Networks
SA06 Panel: The Industry Job Search
SA07 Stochastic Energy Market Models
SA08 spORts: OR in Sports
SA09 Incorporating Communication in Engineering Undergraduate Education
SA10 Organizational Theory I
SA11 Tutorial: An Introduction to Call Center Modeling
SA12 Tutorial: Workforce Agility in Production and Service Operations Systems
SA13 Measure Development and Usage: Substantiative and Methodological Issues
SA14 Pedagogy: NPD in Business School Settings
SA15 Innovation/Entrepreneurship
SA16 Supply Chain Management - Applications in Health Care
SA17 Operation Research and Management Science in Public Health: Part I
SA18 Recent Developments in Robust Parameter Design
SA19 Integration of Multiscale Wavelet Analysis and SPC for Process Monitoring, Diagnosis, and Control (I)
SA20 Reliability Research I
SA21 Optimization Problems in IT Operations
SA22 Real Time Analysis Support to the Warfighter
SA23 Portfolio Decision Analysis
SA24 Information, Technology and Market Structure
SA25 Tutorial on Supply Chain Vulnerability
SA26 A Tutorial Data Mining Applications and Forecasting
SA27 Integer Programming: Algorithms and Theory
SA28 Interior-Point Methods for Nonlinear Programming
SA29 Network Design
SA30 Non-Convex Sochastic Programming
SA31 Location Analysis
SA32 New Scheduling Models
SA33 Data Envelopment Analysis I
SA34 Supply Chain Design Issues
SA35 Closed-Loop Supply Chain Strategy
SA36 Supply Chain Disruption: Risk Management
SA37 Pricing and Design of Differentiated Services
SA38 Public Transportation Applications of OR
SA39 Demand Forecasting for Railroad Systems
SA40 Supply Chain Management
SA41 Supply Chain Demand Management
SA42 Multi-diciplinary Approaches to Revenue Management
SA43 Hybrid Bidding Mechanisms
SA44 Joint Session AAS/TSLS: Robust Airline Scheduling & Recovery I
SA45 SRC/IMST Factory Operations Research Center
SA46 Security and Utility of Confidential Data 1

Sunday 10:00am - 11:30am

SB01 Optimization Models in Telecommunications
SB02 Financial Modeling and Real Options
SB03 Applications of OR to Semiconductor Manufacturing
SB04 Panel: Building an OR Tools Business
SB05 Queueing Systems with Time Varying Parameters
SB06 Panel: The Academic Job Search
SB07 Modeling Competition in Electricity Markets
SB08 Sports Scheduling - Going the Distance
SB09 Undergraduate Capstone OR Projects
SB10 Organizational Theory II
SB12 Workforce Flexibility
SB13 Word of Mouth: Theory and Practice
SB14 Panel: NPD Emerging Research Themes
SB15 Interactions: Technological and Organizational Change
SB16 Modelling Applications I
SB17 Operation Research and Management Science in Public Health: Part II
SB18 Quality, Statistics & Reliability Section Best Student Paper Competition
SB19 Integration of Multiscale Wavelet Analysis and SPCfor Process Monitoring, Diagnosis, and Control (II)
SB20 Reliability Research II
SB21 Optimization Services on the Internet
SB22 USMA ORCEN I
SB23 Utility, Probability, and U-Values
SB24 Perspectives in IS Outsourcing Research
SB25 Ballistic Missile Defense and Weapons of Mass Destruction
SB26 Leading Software in Data Mining and Knowledge Discovery
SB27 Advances in Commercial IP Solvers
SB28 Large-Scale Nonlinear Programming
SB29 Economics and Network Design
SB30 Multistage Stochastic Programming and Pricing Problems
SB31 Network Location
SB32 Scheduling Supply Chains
SB33 Data Envelopment Analysis II
SB34 Supply Chain Security
SB35 Marketing, Remarketing and Product Return Issues Regarding Remanufactured Products
SB36 Order Promising and Fulfillment
SB37 Multi-Echelon Inventory Models
SB38 Transportation Infrastructure Management
SB39 Freight Rail Applications
SB40 Collaborative Supply Chains
SB41 Models for Coordinating Pricing and Production-Inventory Decisions
SB42 Pricing and Revenue Management
SB43 Supply Chains and Marketplaces
SB44 Joint Session AAS/TSLS: Robust Airline Scheduling & Recovery II
SB45 Dynamic Control in Semiconductor Wafer Fabs
SB46 Security and Utility of Confidential Data 2
SB47 Software Demonstration

Sunday 1:30pm - 3:00pm

SC01 Network Design
SC02 Financial Engineering
SC03 Demand Forecasting and Risk Management
SC04 Panel: The OR Consulting Business
SC05 Planning and Optimization in Call Centers
SC06 Forecasting
SC07 Energy Market Equilibria
SC08 Lies, Damn Lies, and OBP + SLG: OR Models for Baseball Strategy
SC09 Active Learning Design and Introductory Courses
SC10 Technology Acceptance
SC11 Tutorial: Hybrid Approaches to Model-Free Reinforcement Learning Controllers
SC12 Flexible Servers and Control of Queues I
SC13 Pharmaceutical Marketing I
SC14 Managing New Product Variety
SC15 Technology & Strategy: Managing the Firm Knowledge Base
SC16 Modelling Applications II
SC17 Operations Research in Health Care
SC18 Recent Advances in Reliability and Quality
SC19 Statistical Diagnosis and Modeling
SC20 Joint Session QSR/Computing: Statistical Methods for Stochastic Dynamic Programming
SC21 Open-Source Interfaces for Optimization
SC22 USMA ORCEN II
SC23 Perspectives on Decision Analysis
SC24 Economics of Information Systems
SC25 New Challanges for OR from the New Warfare and Transformation-I
SC26 Clustering and Categorization Applications
SC27 Nicholson Student Paper Prize Competition, I
SC28 Cutting Plane Approaches to Cone Programming Problems
SC29 Network Optimization: Models and Methods
SC30 Cooperative and Noncooperative Markov Decision Processes
SC31 Location Modeling
SC32 Scheduling with Logistics Issues
SC33 Data Envelopment Analysis III
SC34 Real Time Fleet Management
SC35 Gaming with Inventory/Product Flexibility
SC36 Models for Joint Financial and Operational Decisions
SC37 Gaming the Supply Chain
SC38 Urban Transportation Planning Models I: Networks and Activity Systems
SC39 The Use of OR Techniques in Rail Policy Development
SC40 Leadtime and Customer Service Strategies to Improve the Supply Chain
SC41 Integrated Production and Demand Planning
SC42 Frontiers of Revenue Management
SC43 Auction Theory and Experiments
SC44 Air Traffic Management: Models and Algorithms
SC45 Scheduling Semiconductor Wafer Fabs
SC46 Security and Utility of Confidential Data 3
SC47 Software Demonstration

Sunday 4:30pm - 6:00pm

SD01 Provisioning for Guaranteed QoS Multimedia Delivery
SD02 Capital Growth Theory and Practice
SD03 OR Research and Applications
SD04 Towards a Theory of the Practice of OR/MS
SD05 Numerical Methods for Performance Analysis and Control of Brownian Queueing Models
SD06 Tutorial: Ethical Issues in Operations Research
SD07 Market Design I
SD08 Joint Session SIM/QSR: Rare Event Simulation and Finance
SD09 Active Learning and Globalization in Engineering Education
SD10 Expert Choice (AHP) Applications
SD11 Tutorial: Fuzzy Probabilities/Sets in OR/MS
SD12 Sizing the Agile Workforce
SD13 Pharmaceutical Marketing II
SD14 Market and Performance Considerations in NPD
SD15 Technology and Strategy II
SD16 Identifying, Modeling, and Allocating Healthcare Resources
SD17 Planning and Preparing for a Catastrophic Infectious Event
SD18 Highlights of NSF-Sponsored Research in QSR
SD19 Statistical Applications of Time-Frequency Analysis using Wavelets
SD20 Joint Sesson QSR/Computing: Computational Statistical Methods for Optimization
SD21 New Perspectives on Routing and Scheduling
SD22 US Army Units and Installations
SD23 Decision Analysis Society Practice Award Competition
SD24 Versioning Digital Information Products
SD25 New Challenges for OR from the New Warfare and Transformation-II
SD26 Process Data Mining
SD27 Nicholson Student Paper Prize Competition, II
SD28 Robust Optimization
SD29 Telecommunications Network Design
SD30 Methodology for Stochastic Optimization
SD31 P-median and Related Models: New Directions
SD32 Panel: Publishing Research on Scheduling
SD33 Data Envelopment Analysis IV
SD34 Transportation Network Vulnerability
SD35 Reverse Production Systems Design and Analysis
SD36 Flexibility and Pricing Issues in Operations Management
SD37 Queueing Applications in Operations Management
SD38 Urban Transportation Planning Models II: Network Applications
SD39 The Use of OR Techniques in Rail Policy Development (Continued)
SD40 New Directions in Inventory Management
SD41 Emerging Topics in Supply Chain Analysis
SD42 Modeling and Methodology
SD43 Optimal Auctions and Mechanism Design
SD44 Joint Session AAS/TSLS: Revenue Issues for Airlines
SD45 Design of Automated Material Handling Systems in the Semiconductor Factory of the Future
SD46 Convexity Analysis and Convexification in Nonlinear Programming
SD47 Software Demonstration

Monday 8:00am - 9:30am

MA01 Management Issues in Telecommunications
MA02 Risk Management and Option Pricing
MA03 INFORMS Publications
MA04 Industry and Academic Collaboration
MA05 Diffusion Models of Stochastic Networks
MA06 Mathematical Models for Musical Design I
MA07 Market Design II
MA08 Joint Session SIM/QSR: Rare Event Simulation Techniques
MA09 INFORMS 2003 Annual Case Competition - Presentations of Finalists 1&2
MA10 Public Programs
MA11 Tutorial: Looking for a Job? Sounds Like an OR Problem – The Workshop
MA12 Worker Cross-training in Production and Service Systems
MA13 Direct Marketing
MA14 Coordinating NPD and Technology Supply Chains
MA15 Managing the R&D Process
MA16 Scheduling and Logistics in Health Care
MA17 Methods for Designing Vaccination Strategies
MA18 Recent Advances in Statistical Process Control (I)
MA19 Recent Advances in Multi-Response Systems
MA20 Joint Session QSR/Simulation: Statistical Methods for Simulation Experiments
MA21 Capital Budgeting and Planning: Applications and Technology
MA22 Advances in Decision Analysis
MA23 Advanced Applications in Decision Analysis
MA24 Auctions and the Supply Chain
MA25 Alternative Modeling Approaches
MA26 Data Mining Applications in Telecommunications
MA27 Advances in Mixed-Integer Programming
MA28 Nonlinear Programming: Theory and Applications
MA29 Very Large Scale Neighborhood Search
MA30 Stochastic Network Optimization
MA31 SOLA Dissertation Competition
MA32 Effective Scheduling Algorithms
MA33 DEA Supply Chain Applications
MA34 Freight Transportation
MA35 Recycling Network Models
MA36 Managing Distribution Systems
MA37 Service Parts Management
MA38 Urban Transportation Planning Models III: Intermodal and Transit Applications
MA39 Railroad Blocking and Scheduling Approaches
MA40 Topics in Supply Chain Management
MA41 Simulation and Control of Supply Chains via PDE-Models
MA42 Applications of Dynamic Pricing in Telecom, Retail, Commodity Markets and Supply Chain Networks
MA43 Online Auction Strategies
MA44 The FAA Strategy Simulator, Part 1
MA45 Economic Analysis of Semiconductor Manufacturing
MA46 Optimization Software - The State of the Art
MA47 Software Demonstration

Monday 10:00am - 11:30am

MB01 Tree Network Design
MB02 Computational Problems in Financial Engineering
MB03 Outsourced Supply Chains
MB04 Daniel H. Wagner Prize Competition
MB05 Numerical Problems in Queueing Theory
MB06 Mathematical Methods for Musical Design II
MB07 Energy Trading and Risk Management
MB08 Advances in Simulation Methodology
MB09 INFORMS 2003 Annual Case Competition — Presentations of Finalists 3&4
MB10 Advances on Metaheuristics for Combinatorial Optimization
MB11 Tutorial: Developing Spreadsheet-Based Decision Support Systems
MB12 Flexible Servers and Control of Queues II
MB13 Spatial Marketing
MB14 Complexity and Ambiguity in Project Management
MB15 Technology Management Section Dissertation Award
MB16 Applications in Health Care II
MB17 OR Methods for Therapeutic Treatment for Cancer
MB18 Panel: Design of Experiments in Engineering Practice and Engineering Curriculum
MB19 Industrial Statistics in Design and Manufacturing
MB20 Statistical Quality Control
MB21 Open-Source Linear and Mixed-Integer Programming Tools
MB22 Panel: What Makes for a Successful Decision Analysis?
MB23 Decision Analysis Arcade
MB24 Measurement of Digital Supply Chain Collaboration & Its Impacts
MB25 Information and Architecture
MB26 Modeling and Data Mining in Bioinformatics
MB27 Recent Advances in Integer Programming I
MB28 Applications of Nonlinear Optimization
MB29 Network Routing 1
MB30 Computational Approaches for Stochastic Integer Programming
MB31 Equity in Facility Location
MB32 The Theory and Practice of Rescheduling
MB33 Panel: Teaching Data Envelopment Analysis
MB34 Collaborative Logistics
MB35 Operations Management I
MB36 Measuring the Value of Supply Chain Management
MB37 Organizational Structures in Operations Management
MB38 Algorithmic Issues in Dynamic Traffic Assignment
MB39 RASIG Student Paper Contest
MB40 Strategic Capacity Management
MB41 Warehousing & Order Fulfillment
MB42 Pricing and Revenue Management in Practice
MB43 Large-Scale Combinatorial Auction Design
MB44 The FAA Strategy Simulator, Part 2
MB45 Seminconductor Industry
MB46 ICS Prize Tutorial
MB47 Software Demonstration

Monday 1:30pm - 3:00pm

MC01 Telecommunications I
MC02 Modeling of Price Dynamics and Hedging
MC03 New Primal-Dual Methods for Linear and Convex Optimization
MC04 Daniel H. Wagner Prize Competition
MC05 Pricing in Networks and Service Systems
MC06 Interactive Music Systems
MC07 Scheduling in Electricity Markets
MC08 Panel: Operational Modeling and Simulation of Semiconductor Manufacturing: A Panel Discussion
MC09 INFORMS Case and Teaching Materials: Dialog with Authors and Teachers
MC10 Exploring Ways to use Spreadsheets
MC11 Tutorial: Developing Web-Enabled Decision Support Systems
MC12 Dynamics and Performance of Bucket Brigade Production Lines
MC13 Marketing Models and Industry Practice
MC14 Joint Session NLP/TM: Panel: The Interface Between the Management of Technology and New Product Development
MC15 Management of Technology
MC16 Modeling and Analysis to Support Optimization of the Military Health System
MC17 Service Industry I
MC18 Panel: New Developments in Statistical Process Monitoring and Diagnosis for Multistage Manufacturing Processes
MC19 Engineering Design Optimization
MC20 Quality Issues
MC21 All Things Scheduled I
MC22 Redstone Practice
MC23 Managing Petroleum Resources with DA and Real Options
MC24 Information Security Applications
MC25 Decision Analysis in the Military
MC26 Emerging Research Problems in Data Mining
MC27 Solving Difficult Combinatorial Optimization Problems
MC28 Global Optimization - Graphs and Networks
MC29 Network Routing 2
MC30 Stochastic Integer Programming
MC31 Public Sector Location Models
MC32 Scheduling I
MC33 Data Envelopment Analysis V
MC34 Operations Research Applications in Trucking
MC35 Operations Management II
MC36 Production Systems with Stochastic Demand
MC37 JFIG Paper Competition II
MC38 Traffic Flow Theory and Modeling
MC39 Applying Supply-Chain in Developing Countries
MC40 Supply Chain Disruption: Network Management
MC41 Capacity and Pricing in Supply Chains
MC42 Combinatorial Auctions
MC43 Supply Chain Management VIII
MC44 Optimization in Airline Industry I
MC45 Logistics Applications
MC46 Global Optimization Software in GAMS: Performance and Applications
MC47 Software Demonstration

Monday 4:30pm - 6:00pm

MD01 Telecommunications II
MD02 Quantitative Methods in Finance Applications
MD03 2003 Dantzig Dissertation Award Finalists
MD05 Queueing Models: Asymptotics and Approximations
MD06 Biological Heuristics
MD07 Retail Electric Power Risk
MD08 Adaptive Simulation
MD09 Cases in OR/MS Education
MD10 Spreadsheet Research
MD11 Tutorial: Credit Card Business Intelligence by using Linear Programming-based Data Mining Techniques
MD12 Workforce Decision Making
MD13 Marketing Productivity and Marketing Return-on-Investment
MD14 Empirical Perspective on NPD and Technology Management
MD15 Technology Management Section Distinguished Speaker
MD16 Efficiency and Effectiveness in Healthcare
MD17 Industry Applications
MD18 Recent Advances in Statistical Process Control II
MD19 Recent Advances in Design of Experiments
MD20 Statistical Quality Control
MD21 All Things Scheduled 2
MD22 Analysis Support to the Warfighting Commander
MD23 Decision Analysis Society Awards
MD24 E-Business
MD25 OR at USMA
MD26 Data Mining Applications and Implementations
MD27 Integer Programming I
MD28 Global Optimization — Scientific and Engineering Applications
MD29 Combinatorial Graph Algorithms
MD30 Developments in Interior-Point Methods
MD31 Facilities Planning & Design I
MD32 Scheduling Applications
MD33 Recent Advances in Integer Programming II
MD34 Intermodal Container Management
MD35 Operations Management III
MD36 Economics of Supply Chain Management
MD37 JFIG Paper Competition I
MD38 Modeling Issues in Dynamic Traffic Assignment
MD39 Modeling and Deploying Strategic Organizational Forms
MD40 Inventory Management and Supply Chain Coordination
MD41 Pricing and Procurement Strategies II
MD42 New Applications of Pricing Optimization
MD43 Design of Auction Mechanisms
MD44 Optimization in Airline Industry II
MD45 Logistics Planning
MD46 Applied Research and Problem Solving: Practice and Theory
MD47 Software Demonstration

Tuesday 8:00am - 9:30am

TA01 Stochastic Processes
TA02 Probabilistic Methods in Finance and Insurance
TA04 Daniel H. Wagner Prize Competition Awards
TA05 Pricing in Queueing and Service Systems
TA06 Joint Session OR in Biology/Computing: Computational Biology I
TA07 Pricing in Electricity Markets
TA08 Military Simulation Applications
TA09 Education Applications
TA10 Panel: On-Line Delivery of Management Science and Statistics
TA11 Tutorial: A Structure of Spatial Information Metadata for Web Searching: Fuzzy Set Theoretic Approach
TA12 Cellular Manufacturing
TA13 Product Management and Distribution
TA14 Intersection of NPD and Supply Chains
TA15 University-Industry Interfaces: How Knowledge Crosses the Moat Surrounding the Ivory Tower
TA16 Optimization in Medicine
TA17 Disease Prediction and Diagnosis I
TA18 Distributed Sensing for Detection, Diagnosis, and Control
TA19 Joint Session QSR/SCM: Quality and Statistics in Logistics and Supply Chain Management
TA20 Genetic Algorithms and Heuristics in Modeling Applications
TA21 Optimization Modeling in Practice I
TA22 Behavioral Decision Making I
TA23 Analyzing Uncertainties in Risk Assessment
TA24 Business Continuity and Disaster Recovery
TA25 Issues in Policy Making
TA26 Data Mining Modeling and Algorithms
TA27 New Trends in Mixed-Integer Programming
TA28 Global Optimization - Approaches to Military Applications
TA29 Innovations in Financial and Economic Networks
TA30 Complementarity Models and Algorithms in Nonsmooth Mechanics
TA31 Optimization I
TA32 Scheduling II
TA33 Parallel Meta-heuristics for Network Design
TA34 Vehicle Routing I
TA35 Operations Management IV
TA36 Capacity Management in Supply Chains
TA37 Heuristic Programming Applications
TA38 Stochasticity and Vehicle Routing in Traffic Networks
TA39 Supply Chain Management II
TA40 Topics in Supply Chain Management
TA41 Incentives, Competition and Cooperation in Supply Chains
TA42 Dynamic Pricing and Revenue Management
TA43 Auction Models and Bidding Strategies
TA44 Modeling Uncertainty in Air Traffic Management Session
TA45 Models for Decision Support
TA46 E-Business I
TA47 Software Demonstration

Tuesday 10:00am - 11:30am

TB01 Applied Queueing
TB02 Financial Engineering
TB04 Supply Chain Optimization for the Retail Industry
TB05 Scheduling and Stability of Stochastic Networks
TB06 Protein Structure and Alignment
TB07 Environment/Natural Resources
TB08 Batching Methods for Simulation Output Analysis
TB09 Active Learning in Education
TB10 Optimization in Financial Services I
TB11 Tutorial: Including the Human Dimension in Operations Management Models- Theory and Practice: On the Interface between Operations and Human Resources Management
TB12 Strategic Planning
TB13 Electronic Marketing Issues
TB14 Cooperation and Coordination in NPD
TB15 Innovations: Market Entry and Diffusion
TB16 Modelling Applications III
TB17 Disease Prediction and Diagnosis II
TB18 Panel: Distributed Sensing for Quality and Productivity Improvement
TB19 Six Sigma and Quality Improvement
TB20 Machine Learning in Optimization
TB21 Optimization Modeling in Practice II
TB22 Behavioral Decision Making II
TB23 Auctions and Bargaining
TB24 Supporting Knowledge Intensive Processes
TB25 Military Applications I
TB26 Data Mining Applications in Business and Management
TB27 Column Generation in Integer Programming
TB28 Global Optimization - Algorithms and Applications
TB29 Networks & Graphs I
TB30 Duality and Complexity in Conic Optimization
TB31 Optimization II
TB32 Machine Scheduling
TB33 Data Envelopment Analysis II
TB34 Vehicle Routing II
TB35 Operations Management V
TB36 MSOM Fellow Award
TB37 Heuristic Search Methods
TB38 Region-Wide and Intermodal DTA Applications
TB39 Supply Chain Management III
TB40 Topics in Supply Chain, Complementarities and Technology Choice
TB41 New Dimensionality Reduction Approach Applied to Computer Scheduling
TB42 Pricing Schemes under Advertising, Correlation, Competiton, and Service Level
TB43 Algorithmic Aspects of Game Theory
TB44 Operations Research at Delta Air Lines I
TB45 Decision Support Systems
TB46 e-Business Applications
TB47 Software Demonstration

Tuesday 1:30pm - 3:00pm

TC01 Applied Probability
TC02 Financial Risk and Uncertainty
TC03 Anniversary of the Birth of Philip M. Morse
TC04 Optimization in Transportation and Warehousing
TC05 Stochastic Decision Models & Applications
TC06 Joint Session OR in Bio/Computing: Computational Biology II
TC07 Environment/Natural Resources
TC08 Simulation I
TC09 INFORMS High School OR: How to Teach HS Math Teachers
TC10 Optimization in Financial Services II
TC11 Tutorial: Technology of the Future of Health Care
TC12 Business Process Reengineering
TC13 Marketing
TC14 Management of Uncertainty in NPD
TC15 Practical and Theoretical Insights on New Venture Formation
TC16 Health Applications I
TC17 Industry Applications
TC18 Technometrics Invited Paper Session
TC19 Statistics in Logistics and Supply Chain Management
TC20 Agent-Based Modeling Applications
TC21 Optimization Modeling in Practice III
TC22 Operations Management VI
TC23 Joint Session DA/MAS: Military Decision Analysis
TC24 Information Integrity: An Emerging Field
TC25 Military Applications II
TC26 Modeling and Applications in Data Mining
TC27 Solving Hard Integer Programs
TC28 Global Optimization - Generalized Convexity
TC29 Networks & Graphs II
TC30 Nonlinear Programming
TC31 Optimization III
TC32 Scheduling III
TC33 Data Envelopment Analysis I
TC34 Hazardous Materials Transportation
TC35 Inventory Management I
TC36 Topics in Inventory Control and Supply Chain Management
TC37 Integer Programming and Combinatorics
TC38 Transportation Applications of Queueing Theory
TC39 Supply Chain Sourcing and Pricing
TC40 Contracts, Informal Agreements and Relationships in Supply Chain Management
TC41 Retail Operations Management
TC42 Consumer Behavior Effects in Revenue Management
TC43 Models and Methods for Combinatorial Auctions
TC44 Operations Research at Delta Air Lines II
TC45 Multicriteria Decision Making I
TC46 e-Business Applications
TC47 Software Demonstration

Tuesday 3:30pm - 6:00pm

TD01 Stochastic Networks I
TD02 Economics I
TD03 Queueing Applications: Approximation and Optimization
TD04 Best Practices in Transportation
TD05 Stochastic Inventory Models
TD06 Biological Applications of OR
TD07 Resource Planning
TD08 Large-Scale Simulation
TD09 Educational Issues I
TD10 Heuristics and AI in Financial Services
TD11 Tutorial: Optimization for Intensity Modulation Radiation Therapy Treatment Planning
TD12 Traffic
TD13 Marketing and Consumer Behavior
TD14 Product Development and Time-To-Market
TD15 Knowledge, Technology and Organization in New Product Development
TD16 Health Applications II
TD17 Business Applications
TD18 Integration Models in Quality Engineering
TD19 Reliability Research III
TD20 Agent-Based Modeling Tools
TD21 Optimization Modeling in Practice IV
TD22 Software Agents for Automated Decision Making
TD23 Linear Programming I
TD24 Information Systems
TD25 Military Applications III
TD26 Data Mining I
TD27 Large-Scale Parallel Integer Programming Algorithms for Real-World Applications
TD28 Global Optimization - Stochastic Agorithms
TD29 Column Generation Approaches to Large-Scale Optimization Problems
TD30 NLP-Interior Point Methods
TD31 Optimization IV
TD32 Scheduling IV
TD33 Sequencing and Scheduling II
TD34 Routing and Scheduling of Cargo Ships
TD35 Inventory Management II
TD36 Healthcare Operations
TD37 Dynamic Programming/Control
TD38 Military Logistics
TD39 Supply Chain Management I
TD40 Pricing and Procurement Strategies
TD41 Supply Chain Management V
TD42 Revenue Management I
TD43 Auctions I
TD44 Joint Session AAS/TSLS: Crew Management
TD45 Multicriteria Decision Making II
TD46 E-Commerce
TD47 Software Demonstration

Wednesday 8:00am - 9:30am

WA01 Stochastic Networks II
WA02 Economics II
WA05 Stochastic Models in Systems Prognosis
WA06 Biotechnology/Bioinformatics
WA07 Resource Allocation
WA08 Simulation II
WA09 Educational Issues II
WA10 Sports/Games and Entertainment
WA11 Tutorial: Nonlinear Optimization in Modeling Environments
WA12 Inventory Management V
WA13 Risk Management
WA14 Information Systems and Risk Management of Technology in New Product Development
WA15 Telecommunications III
WA16 Health Applications III
WA17 New Product Development I
WA18 Simulation, Numerical, and Markov Chain Techniques for QSR
WA19 Static, Dynamic and Sequential Robust Design
WA20 Artificial Intelligence
WA21 Modeling Systems & Languages I
WA22 Decision Analysis I
WA23 Linear Programming II
WA25 Project Management
WA26 Data Mining II
WA27 Integer Programming/Combinatorics
WA28 Integer Programming II
WA30 Facilities Planning & Design III
WA31 Facilities Planning & Design II
WA32 Production Planning
WA33 Scheduling V
WA34 Design and Operational Issues in Maritime Container Terminals
WA35 Inventory Management III
WA36 Managing Supply Chains with Multiple Products
WA37 Optimization Modeling and Techniques
WA38 Transportation II
WA39 Supply Chain Management IV
WA40 Supply Chain Dynamics
WA41 Information Issues in Supply Chain Management
WA42 Revenue Management II
WA44 Joint Session AAS/TSLS: Air Cargo Planning
WA45 Logistics I
WA46 E-Commerce

Wednesday 10:00am - 11:30am

WB01 Stochastic Networks III
WB02 Finance and Economics
WB05 Stochastic Models in Finance
WB12 Inventory Management VI
WB14 New Product Development III
WB15 Management of Technology
WB16 Service Industry II
WB17 New Product Development II
WB18 Quality Control/Reliability
WB19 Recent Advances in Industrial Statistics
WB21 Modeling Systems & Languages II
WB22 Decision Analysis II
WB32 Sequencing and Scheduling I
WB34 Transportation I
WB35 Inventory Management IV
WB36 Supply Chain Management VII
WB37 Supply Chain Management IX
WB38 Transportation III
WB39 Supply Chain Contracts
WB40 Strategic Supply Chain Management
WB41 Supply Chain Management VI
WB42 Revenue Management III
WB44 Aviation
WB45 Logistics II
WB46 E-Business II

Sunday, October 19, 2003

SA

NEW PRESENTATIONS

■ SA33.3

3 — Commercial Performance in the Motion Pictures Industries using Data Envelopment Analysis
Moez Hababou, Shorebank Advisory Services, mhababou@sasbk.com

Although the cinema industry is unique in many respects due to its production and marketing structure, it remains guided by the same processes as any industry, namely that several resources are assembled to produce a marketable service: a movie. These resources can take the form of production, marketing, and distribution inputs. In this paper, we propose the use of the Data Envelopment Analysis methodology to measure the relative performance of released motion pictures. By analyzing movies produced between 1998 and 2002, each of whose production cost is at least $20 millions, we investigate those factors that are key to the commercial success of a movie.

■ SA36.4

4 — Single vs. Multiple Supplier Sourcing Strategies Under Supply Chain Uncertainty
Gerard J. Burke, University of Florida, Department of Decision and Information Sciences, Warrington College of Business, 358 Stuzin Hall, Gainesville, FL 32611-7169, United States, burkegj@ufl.edu, Janice Carrillo, Asoo J. Vakharia

Successful supply chain management necessitates an effective sourcing strategy to combat uncertainties in both supply and demand. In particular, supply disruption results in excessive downtime of production resources, upstream and downstream supply chain repercussions, and eventually a loss in the market value of the firm. Component sourcing decisions are analyzed incorporating the following factors: uncertain market demand, supplier costs, capacities, reliabilities and firm specific inventory costs. Using our analysis, we characterize optimal conditions under which a firm should choose either a specialized (i.e., single supplier) or a generalized (i.e., multiple suppliers) sourcing strategy to hedge against both supply and demand uncertainties.

CANCELLATIONS

■ SA33.3

Data Envelopment Analysis and Relative Variety Analysis: Formal Relationships and Joint Performance Tests, Fred Phillips

■ SA36.4

Incorporating Options Market Data into Planning and Investment Models, Alan King

■ SA39.2

Adaptive, Hierarchical Forecasting for Short-Term, Tactical Forecasting, Warren Powell

REVISIONS

■ SA27.1

New Title:

A Level-1 RLT Bound for the Quadratic 3-Dimensional Assignment Problem Based on a New Lower Bound for the 3-Dimensional Assignment Problem, Peter Hahn

■ SA33

New Chair:

Data Envelopment Analysis I, Moez Hababou, mhababou@sasbk.com

■ SA42.4

New Title and Abstract:

4 — Newsboy Problem of a Monopolist with Two Customer Categories, Mustafa Karakul

The newsboy problem searches for the optimal replenishment quantity of a perishable product to satisfy the single period stochastic demand when overage and underage costs are linear. An interesting extension of this basic model in literature is when selling price can also be controlled. In this paper, we consider a more general newsboy with pricing model in which there are limits on the selling price and another category of customers. We generate optimal ordering and pricing policies for this model under fairly general assumption of the demand distribution, and show that the order quantity and selling price are higher in the presence of this category of customers.

PRESENTATIONS MOVED

SA11 Presentation Moved to SB11:

An Introduction to Call Center Modeling, Ger Koole

SB

NEW PRESENTATIONS

■ SB15.3

3 — Absorptive Capacity Revisited: Organizational Integration and Firm's Innovative Capabilities
Marco Tortoriello, Carnegie Mellon University, Graduate School of Industrial Administration, 5000 Forbes Ave, Pittsburgh, PA, 15213, United States, marcot@andrew.cmu.edu

While research on knowledge management has significantly contributed to the debate about why organizations should invest in R&D, the organizational processes leading from R&D to the development of commercial innovations have received comparatively less attention. In this paper I will discuss the role of social networks and their relevance in the knowledge integration process.

CANCELLATIONS

■ SB15.3

Unintended Consequences of Product Innovation: Organizational Change, Annique Un

■ SB24.1

The Value of IT Outsourcing Arrangements: An Event Study Approach, Vijay Gurbaxani

■ SB44.3

Robust Airline Scheduling: Minimizing Passenger Delay, Sepehr Sarmadi

PRESENTATIONS MOVED

■ SB11

Presentation Moved from SA11:

An Introduction to Call Center Modeling, Ger Koole

SC

NEW PRESENTATIONS

■ SC03.4

4 — Optimal Pricing and Replenishment in an Inventory System
Hong Chen, Cheung Kong Graduate School of Business, Beijing, China, hchen@ckgsb.com, Owen Q. Wu, David D. Yao

We study an inventory system that supplies price-sensitive demand, focusing on the optimal pricing and inventory replenishment decisions, under both discounted and long-run average objectives. Analytical solutions to these decisions are provided. In addition, we bring out the interplay between the two decisions, and the way they react to demand uncertainty.

■ SC06.4

4 — Automobile Warranty Data: Issues in Failure Rate Estimation and Forecasting
Bharatendra Rai, Reliability Engineer-Purchased Powertrain, Ford Motor Company, Rotunda Court 2, 15021 Commerce Drive South, Dearborn, MI 48120, United States, brai3@ford.com, Nanua Singh

Annual warranty costs for North American automobile companies run into billion of dollars. Warranty cost reduction programs thus receive high priority. They mainly depend on warranty data to extract failure trends and patterns to help achieve their objectives. By capturing actual usage profiles and environmental exposures, warranty datasets conceal valuable information that can help to improve reliability/robustness of vehicle and thus reduce warranty costs. It also helps to take service related actions that help in reducing warranty costs. However, automobile warranty datasets are often noisy and need addressing of specific issues viz., truncation, censoring, and bias for proper modeling and analysis to unearth hidden failure trends and patterns. We highlight these issues and provide latest trends in this area.

CANCELLATIONS

■ SC42.4

Optimal Release and Distribution Policies in the Motion Picture Industry, Moez Hababou

REVISIONS

■ SC21.1

New Lead Author:

Stochastic Modeling Interface for COIN, Leonardo B. Lopes, Northwestern University, Evanston, IL, 60208-3119, United States, leo@iems.nwu.edu

IMPORTANT NOTE

■ SC39 & ■ SD39

Note: This session is a contiguous session that lasts three hours followed by RASIG Business Meeting.

SD

NEW PRESENTATIONS

■ SD44.3

3 — MultiFlight AU Analyzer
Judy Pastor, Continental Airlines, 1600 Smith Street, MailCode HQSRT, Houston, TX, 77002, United States, jpasto@coair.com

Most no show forecasting (and the subsequent authorization level setting) is done on a flight-by-flight basis. This myopic approach ignores the effectof oversales and the resultant rollover of passengers from previous flights. The burden is on the Revenue Management analyst to take this effect into account outside the modeling system. This tool is a first step in the examination of AU decisions on the entire market via simulation.

CANCELLATIONS

■ SD28.3

Robust Statistics and Robust Optimization, Garud Iyengar

■ SD44.3

Agent Simulations and Partical Swarm Intelligence for Development of Profitable Airline Schedule, Roger Parker

Monday, October 20, 2003

MA

NEW PRESENTATIONS

■ MA13.4

4 — New Insights in List Selection for Direct Marketing
Chaim Ehrman, cehrman@wpo.it.luc.edu

Many direct marketers select systematic samples from different lists to measure estimated response rates. The “best” list has the highest response rate. The problem is that we use point estimates without any confidence intervals around the estimates. Furthermore, the decision maker does not have a mechanism to incorporate his own feelings as to which list has the greatest promise. Bayesian Analysis is used to show how to remedy these problems.

CANCELLATIONS

■ MA19.1

A Goal Attainment Approach to Multiresponse Systems Optimization, Kai Xu

■ MA24.4

Information Revelation and Preference Elicitation in B2B Multi-Attribute Auctions, Joni Jones

■ MA34.1

Improving Port Operations Using Double Cycling, Anne Goodchild

MB

NEW PRESENTATIONS

■ MB03

Supply Chain Management in an e-Business Environment

Chair: Markus Ettl, IBM T. J., Watson Research Center, Yorktown Heights, NY 10598, United States, msettl@us.ibm.com

Co-Chair: Grace Lin, Associate Partner, IBM Global Services; Member, IBM Academy of Technology; VP Pratice, INFORMS, United States, gracelin@us.ibm.com

■ MB03.1

1 — Inventory Optimization in Manufacturing of Products with Steady Demands: A Case Study
Tim Brown, IBM, tmbrown@us.ibm.com, Kaan Katircioglu

We will present a case study based on a project that is being conducted by IBM Business Consulting Services and IBM Research for a major manufacturer of brass and plastic pipes and flow control units. We will describe theenvironment of the manufacturer, and explain our proposed approach of managing the inventory. We will also mention sources of other potential improvements and conclude with lessons learned.

■ MB03.2

2 — An On-Demand Management System for Outsourced Supply Chains
Markus Ettl, IBM T. J., Watson Research Center, Yorktown Heights, NY 10598, United States, msettl@us.ibm.com

Outsourcing of commodity products shifts responsibility for supply chain planning and execution to outsourced suppliers. We describe an on-demand management system that combines light integration, sense and respond, and supply chain analytics to optimize supply chain processes in a shared utility outsourcing environment.

■ MB03.3

3 — Web-enabled Integrated Aftermarket Services, Alberto Castanopardo, Business Consulting Services, IBM, acastano@us.ibm.com,
Arundhati Bhowmick, Li Chen, Jun-jang Jeng, Hui Lei, Eric Lin, Grace Lin

Pressed by ever decreasing margins, Original EquipmentManufactures (OEM) are taking a fresh look at their aftermarket service as a source of revenue and an opportunity to improve customer satisfaction and loyalty. This presentation illustrates how information technology can be applied to enable and improve Service-Lifecycle-Management processes.

CANCELLATIONS

■ MB03

Outsourced Supply Chains, Sue Rothberg

■ MB05.1

Numerical Inversion of Generating Functions - A Computational Experience, Mohan Chaudhry

■ MB22

Analysis Support to the Warfighting Commander, David LaRivee

MC

CANCELLATIONS

■ MC25.1

Decision Aids and Decision Support - MORS Workshop, Patrick McKenna

■ MC35.2

The Impact of Returns on the Stochastic Performance of Supply Chains, Li Zhou

REVISIONS

■ MC47.2

New Email Address:
Johannes Bisschop, jan.bisschop@paragon.nl

■ MC46.1

Addition of Co-Authors:
OQNLP/GAMS: A Multi-start Approach to Global Optimization, Zsolt Ugray, Business Information Systems Department, Utah State University, 3515 Old Main Hill, Logan UT 84322, zsolt.ugray@usu.edu, John Plummer, MSIS Department, McCombs School of Business, University of Texas, Austin, TX, 78731, jcplummer@austin.rr.com

MD

NEW PRESENTATIONS

■ MD22

User's Introduction to COIN-OR's OSI and CLP Open-Source

Chair: Robin Lougee-Heimer, IBM Research, 1101 Kitchawan Road, Yorktown Heights, NY 10598, United States, robinlh@us.ibm.com

■ MD22 .1

1 — "Software Tutorial : A Gentle Introduction to COIN-OR's Open Solver Interface (OSI), Part 1"
Brady Hunsaker, Assistant Professor, University of Pittsburgh, School of Engineering, 1036 Benedum Hall, Pittsburgh, PA 15261, United States, hunsaker@engr.pitt.edu, John Forrest, Robin Lougee-Heimer, Ted Ralphs, Matthew Saltzman

The Open Solver Interface (OSI) is a standard interface to a variety of commercial and free LP solvers. The free open-source OSI library of C++ classes lets users change underlying LP solvers easily.

■ MD22 .2

2 — "Software Tutorial : A Gentle Introduction to COIN-OR's Open Solver Interface (OSI), Part 2"
Brady Hunsaker, Assistant Professor, University of Pittsburgh, School of Engineering, 1036 Benedum Hall, Pittsburgh, PA 15261, United States, hunsaker@engr.pitt.edu, John Forrest, Robin Lougee-Heimer, Ted Ralphs, Matthew Saltzman

At the end of the 2-part introduction, attendees will have seen an overview of the OSI functionality, where the OSI code lives on the COIN-OR website, how to compile the code, how the OSI files are organized, how the class libraries are structured, and reviewed major components of the library.

■ MD22 .3

3 — "Software Tutorial: A Simple Use of the COIN LP Solver for the Unitiated"
John Forrest, IBM, T. J. Watson Research Center, Yorktown Heights, NY 10598, United States, jjforre@us.ibm.com, Robin Lougee-Heimer, Brady Hunsaker, Ted Ralphs, Matthew Saltzman

The COIN LP Solver is an free, open-source, linear program solver written by John Forrest. In this talk, we walk through two introductory examples written in C++ and answer your questions. The source code to the COIN LP Solver and the examples are available at www.coin-or.org.

CANCELLATIONS

■ MD22

Analysis Support to the Warfighting Commander, David LaRivee

■ MD45.2

An AI Planning Approach to the Vehicle Routing Problem with Stochastic Demands, Karolina Glowacka

■ MD45.3

Model and Algorithm for Multi-Period Sea Cargo Mix Problem, Chengxuan Cao

REVISIONS

■ MD21.2

New Title and Abstract:

2 — Using Constraint Programming Approaches on an Advertising Scheduling Problem, Derek Bennett

This talk presents an advertising scheduling problem and discusses the use of Constraint Programming to model and solve such a problem. The problem is to assign a set of commercials to time slots so that they are as evenly spaced as possible.

■ MD41.1

New Lead Author: Strategic Interactions Between Channel Structure and Demand Enhancing Services, Stephan M. Gilbert

Tuesday, October 21, 2003

TA

NEW PRESENTATIONS

■ TA01.3

3 — Integrating Application Based Modules into the Undergraduate Stochastic Processes Curriculum
Tim Matis, New Mexico State University, P.O. Box 30001, MSC 4230, Las Cruces, NM 88003, United States, tmatis@nmsu.edu, Linda Ann Riley

This presentation highlights an innovative plan to address learning challenges frequently encountered by undergraduate students in an introductory stochastic processes course. The curriculum of a traditional course may be enhanced through the integration of modules that describe "real-world" applications of this material. Each module consists of a self contained DVD that is collaboratively produced with an industrial partner.

■ TA01.4

4 — The Pricing of a Callable Call under Non Constant Interest Rates
Luis Hernandez, Georgia Institute of Technology, 147 Skiles Bldg, 686 Cherry St., Atlanta, GA, 30332-0160, United States, newton@math.gatech.edu

In this talk we show some preliminary results regarding the pricing of a callable call under non constant interest rates. Interest rates are assumed to follow an extended Vasicek model and callibrated to market data.

■ TA35.2

2 — Optimal Pricing and Service Level in a Competitive Environment
Hong Yin, University of Texas at Dallas, 2601 North Floyd Road, Richardson, TX, 75080, United States, windyyin@utdallas.edu, Qi Feng, Shun-chen Niu

We study a service system with a dispatcher who allocates the incoming customers to competitive servers. A sequential game model is established, an incentive compatible dispatching policy is proposed, the equilibrium is characterized, and profit allocation is discussed. Our results show that customers have last-move advantage in the sequential game, and the dispatcher gets the largest proportion of total profit when the industry is very profitable.

CANCELLATIONS

■ TA20.1

Optimal Filtering Policy for Corporate E-mail Systems, Wei Yue

■ TA32.3

A Dynamic Program for Minimizing the Expected Number of Tardy Jobs w/ Distinct Exponential Due Dates, Christopher Rump

■ TA32.4

Using Benders Decomposition to Implicitly Model Personnel Scheduling Problems, Monia Rekik

■ TA35.2

Optimizing the Automotive Value Chain, Guntram Noeth

■ TA37.5

A Local Search Heuristic for Pipeline Network Optimization, Conrado Borraz Sanchez

TB

NEW PRESENTATIONS

■ TB03

Technology Management

Chair: Dundar F. Kocaoglu, Portland State University, Engineering and Technology Management Department, Portland, OR 97201, kocaoglu@etm.pdx.edu

■ TB03.1

1 — An Analytical Approach to Building a Technology Development Envelope (TDE) for Technology Roadmapping for Emerging Technologies
Nathasit Gerdsri, Ph.D. Candidate, ETM / Portland State University, 1900 SW Fourth Ave., Suite LL-50-02, Portland, OR 97201, United States, nathasitg@etm.pdx.edu, Dundar F. Kocaoglu

This paper presents a approach to help technology managers to identify, evaluate and select emerging technologies in which to invest in order to achieve technological competitiveness. The combination of Delphi method and hierarchical decision is used in building a technology development envelope (TDE) — a curve representing a series of technologies with maximum impact on company's competitiveness over time. TDE can be used as a strategic input into the company's technology roadmapping process.

■ TB03.2

2 — Liebig's Law of the Minimum: The Internal Engine of the Learning Curve
Charles M. Weber, Portland State University, Engineering and Technology Management Department, Portland, OR, 97201, United States, charles.weber@etm.pdx.edu

An empirically grounded model of the lifecycle of a high technology manufacturing venture demonstrates that most learning in an organization occurs by paying attention to the weakest mechanism within that organization until that mechanism is no longer the weakest one, and shifting attention to the mechanism that replaces it as the weakest one. The model explains why learning is both punctuated (Weber, INFORMS, 2002) and leveraged.

■ TB03.3

3 — Education and Research Characteristics of Engineering and Technology
Dundar F. Kocaoglu, Portland State University, Engineering and Technology Management Department, Portland, OR, 97201, United States, kocaoglu@etm.pdx.edu, Ivan Patricio Hernandez, Halime Inceler Sarihan, Iwan Sudrajat

This paper reports the initial findings of a worldwide study on educational and research components of the Engineering and Technology Management (ETM) discipline. Approximately 3,500 individuals were contacted in more than 1,200 academic institutions in this year-long study. A total of 270 institutions granting degrees in ETM were identified. Detailed responses were received and analyzed about their education and research activities.

■ TB07.4

4 — Backup Coverage Models for Species Preservation
Scott Malcolm, University of Delaware, 210 Townsend Hall, 530 S. College Ave., Newark, DE, 19717, malcolm@udel.edu, Charles ReVelle

The Location Set Covering Problem has been used to model the selection of the minimum number of parcels required to guarantee that every species is included in at least one parcel. Application of this model typically results in solutions that cover abundant species multiple times but rare species only once. In this paper, zero-one programming models are developed that reflect different coverage requirements for rare and abundant species.

■ TB32.3

3 — A Simulation Study of Machine Assignment Stability in Parallel Machine Scheduling
James Curry, Texas A&M University, 601 S. Mesa Hills Dr. #1424, TX 79912, United States, jamescc@tamu.edu, Brett A. Peters

This research examines using machine reassignment costs and constraints that limit the number of machine reassignments to control nervousness in the parallel machine scheduling problems with a stepwise increasing tardiness cost objective. Simulation experiments indicate that nervousness can be controlled at a low cost. Significant gains in stability can be achieved by just selecting the alternative optimal solution with the fewest machine reassignments.

■ TB45.3

3 — Fashion Season Calendars and Supply Lead Times
Manas Fuloria, SupplyChainge Inc., 9270 SW Maplewood Dr., T-210, Tigard, OR 97223, United States, manas@supplychainge.com, Subhash Wadhwa

Apparel products are usually merchandised in seasons, often with a common design theme running through each season. In recent years, seasons have become shorter as companies attempt to offer fresher products to consumers. Using a simulation model, the authors caution this policy may become counter-productive in uncertain demand environments with finite re-supply times.

CANCELLATIONS

■ TB02.1

Asset Allocation with Bayes-Stein Estimators, Robert Groat

■ TB29.2

Optimal Paths in Networks with Negative Arc Attributes and Fractional Cost Functions, H.M. Soroush

■ TB32.3

Scheduling Flow Shops with Parallel Machines by Progressively Improving Bottleneck Stages, Shardul Phadnis

■ TB45.1

A Highly Efficient Heuristic for Finding Good Dispatching Schedules from Warehouses to Stores, Pedro Gazmuri

REVISIONS

■ TB32

New Chair:

Machine Scheduling, James Curry, Texas A&M University, jamescc@tamu.edu

TC

NEW PRESENTATIONS

■ TC08.3

3 — Pre-Board Screening Analysis for An Airport
Liping Liang, University of British Columbia, Centre for Operations Excellence, Sauder School of Business, 2053 Main Mall, Vancouver, Bc V6T 1Z2, Canada, lliang@coe.ubc.ca, Derek Atkins, Mehmet Atilla Begen, Bailey Kluczny

A North American airport sought a methodology to determine the staffing levels required for passenger pre-board screening to satisfy a target service level. The objective of this study is to obtain a thorough understanding of the pre-board screening operation and provide recommendations to improve the efficiency and effectiveness of this system. A simulation model has been developed to determine optimal staffing levels, to identify bottlenecks and to uncover other potential system improvements.

■ TC31.4

4 — Derivative Free Algorithms for Optimization of Functions with Noise
Vijay Bharadwaj, Ph.D. Candidate, Georgia Institute of Technology, 765 Ferst Drive, Atlanta, GA, United States, vijay@isye.gatech.edu, Anton Kleywegt

We consider optimization problems with inexact and expensive objective function evaluations and no gradient evaluations. We present a framework for the convergence analysis of algorithms for such problems and show that modifications of many nonlinear programming algorithms with exact function evaluations fit in this framework. We also present computational results for such an algorithm.

■ TC40.3

3 — Breach Remedy and Renegotiation of Supply Contracts
Erica Plambeck, Assistant Professor of Operations, Information and Technology, Stanford Graduate School of Business, 518 Memorial Way, Stanford, CA, 94305-5015, United States, plambeck_erica@gsb.stanford.edu, Terry Taylor

A manufacturer writes supply contracts with N buyers. Then the buyers invest in product development and marketing, and the manufacturer builds capacity. Then demand is realized, and the firms renegotiate the supply contracts to achieve an efficient allocation of capacity among the buyers. The court remedy for breach of contract affects how the firms share the gain from renegotiation, and hence how the firms make investments ex ante. We discuss the implications for design of optimal contracts.

CANCELLATIONS

■ TC01.1

Stability of Data Networks Under An Optimization-Based Bandwidth Allocation, Hengping Ye

■ TC30.2

Recent Advances on Natural Gas Pipeline Optimization, Roger Rios

REVISIONS

■ TC11

Addition of Co-Author:

Technology of the Future of Health Care, Irene Heetebry, RN, M.S.N., Nurse Practitioner in Adult Medicine at Kaiser Permanente, Fresno, CA, 93720

■ TC32.4

Revisions made to Affiliation and Lead Author:
Sequencing with Limited Flexibility, Maher Lahmar, Department of Industrial Engineering, University of Houston, Houston, TX, 77058, United States, mlahmar@uh.edu, Saif Benjaafar

■ TC40.3

New Lead Author:
The Effect of Repeated Interaction on Capacity Investment and Contracting, Terry Taylor

PRESENTATIONS MOVED

■ TC32.4

Presentation Moved from WA33.5:

5 — Sequencing with Limited Flexibility
Maher Lahmar, Department of Industrial Engineering, University of Houston, Houston, TX, 77058, United States, mlahmar@uh.edu, Saif Benjaafar

We consider the problem of resequencing a set of prearranged jobs when there is limited resequencing flexibility and sequence dependent changeover costs. Resequencing flexibility is limited by how far forward or backward a job can shift in the sequence relative to its original position. We show how the problem can be modeled as constrained TSP and solved using dynamic programming in time polynomial in the number of jobs. We discuss various applications.

TD

NEW PRESENTATIONS

■ TD17.4

4 — Finding the Best Probability Model for Flatness Data
Abdelaziz Berrado, Ph.D. Candidate, Arizona State University, Industrial Engineering Dept., Arizona State University, PO Box 875906, Tempe, AZ, 85281-5906, United States, berrado@asu.edu, Esma S. Gel, Norma Hubele

Flatness measurements are based on the geometric dimensioning and tolerancing standard. Statistically, flatness measurements are sample range values of residuals of part surface regression models. Twenty-four industrial data sets demonstrate that the range distribution can be approximated by the normal distribution, thus affording many process assessment tools.

■ TD24.4

4 — Computational Analysis of End User Satisfaction in Saudi Arabian Financial Institutions
Ghassan Filimban, George Mason University, 4216 Jefferson Oaks Cir # C, Fairfax, VA, United States, gfilimba@gmu.edu

"This paper is related to the ongoing research of End User Computing Satisfaction (EUCS). We will measure the impact of task uncertainty, computer utilization, organizational support, EU computing support, EU computing security & integrity, and EU performance on EUCS in Saudi Arabian financial institutions. Results from this research could guide organizations to measure returns on information technology investments and to better fit technologies to users."G.Filimban, E.Sibley, M.Habib

■ TD31.4

4 — Portfolio Optimization for Wealth-Dependent Risk Preferences
Luis Rios, Ph. D. Student, University of Illinois at Urbana-Champaign, 507 E Clark St Apt 32, Champaign, IL, 61820, United States, luisrios@uiuc.edu, Nick Sahinidis

We consider the problem of optimizing the portfolio of an investor with an indefinite quadratic utility function. The convex and concave segments of this utility reflect the investor's attitude towards risk, which changes based on deviations from a fixed goal. The model allows for short sales. Extensive computations are presented.

■ TD37.4

4 — Monotone Comparative Statics of Optimal Contracts in a Dynamic Principal-Agent Model
Hao Zhang, Stanford University, Graduate School of Business, 518 Memorial Way, Stanford, CA 94305, United States, haozhang@stanford.edu, Stefanos Zenios

A dynamic principal-agent model with hidden states (observed by the agent only) generalizes Markov decision processes by introducing information asymmetry. An optimal long-term contract in such model induces truthful state revelation by the agent. To further understand the contracts, we need to study their monotone comparative statics. It is shown that the optimal contracts are increasing in states if certain supermodularity (single crossing) conditions are imposed on the model parameters.

■ TD41.3

3 — Multiple Measures for Productability Analysis
Katariina Kemppainen, Helsinki School of Economics, P.O. Box 1210 (Lapuankatu 6), Helsinki, Finland, kakemppa@hkkk.fi, Ari Vepsalainen

The primary issue in operations strategy concerns the ability to produce certain type of products in a specific type of facility. This property of the manufacturing line, call it productability, has escaped our attention because it is – as a technical structure – easily specified in managerial designs but very hard to verify empirically as indicated by the extensive attempts to test the product-process matrix. We discuss the concept, the measures and applications.

■ TD41.4

4 — A Diagnostic Tool for Checking the 'Manufacturing System Compatibility' for a Supply Chain
Gangarju Vanteddu, Ph.D Student, Wayne State University, #1073 IME Bldg, Detroit, MI 48202, United States, ak3180@wayne.edu

Achieving the strategic fit between 'business strategy' and 'supply chain strategy' is possible only when 'manufacturing system compatibility' exists through out the supply chain. The diagnostic tool presented checks for the inconsistencies in the mfg.systems of the Supply chain and suggests some remedial measures.

CANCELLATIONS

■ TD04

Best Practices in Transportation, Ram Pandit

■ TD12.1

Factors Affecting the Variability of Traffic Flow Measures across Freeway Lanes, Angshuman Guin

■ TD25.2

Aggregate Models of Association and Fusion with Varying Degrees of Classification, Mark Youngren

■ TD37.2

Statistical Techniques for Estimating High Dimensional Value Functions in Dynamic Programming, Warren Powell

■ TD41.1

Integrated Supply Chain Strategic Optimization using MIP and ABC, Javier Holguin de la Cruz

REVISIONS

■ TD25

New Chair:
Military Applications III, Steve Henderson, Captain, United States Military Academy, Department of Systems Engineering, West Point, NY, 10996, United States, steven.henderson@us.army.mil

Wednesday, October 22, 2003

WA

NEW PRESENTATIONS

■ WA15.3

3 — Impairment-Aware Routing for Tansparent Optical Networks
David Shallcross, Telcordia Technologies, MCC 1J-306B, 445 South Street, Morristown, NJ, 07960, United States, davids@research.telcordia.com

In optical networks, signals are subject to impairments such as chromatic dispersion, amplifier noise, and crosstalk. With the introduction of all-optical (transparent) switches, these impairments can accumulate over successive links. I shall discuss algorithms for routing subject to the constraint that overall signal impairment on a route be acceptable, and touch lightly on design questions.

■ WA15.4

4 — Selfish Provisioning of Communication Networks
Pedro Ferreira, PhD Candidate, Carnegie Mellon University, 5000 Forbes Avenue, Baker Hall 129, Pittsburgh, PA 15213, United States, pferreira@cmu.edu.

We model a network of ISPs that interconnect to exchange IP traffic through transit and peering agreements. Each ISP, assumed to behave rationally, provisions the best network possible to meet traffic demand selfishly. The resulting network can be seen as the Nash configuration that arises from the non-cooperative game among ISPs. We analyze the properties of this network, particularly the extra cost ISPs incur to build it relative to the best coordinated network that a single ISP would build.

■ WA20.4

4 — Robust Markov Decision Problems (MDPs) with Uncertain Transition Matrices
Arnab Nilim, Graduate Student, University of California, Berkeley, 262m Cory Hall, Berkeley, CA, 94720, United States, nilim@eecs.berkeley.edu, Laurent El Ghaoui

Optimal solutions to MDPs may be very sensitive with respect to the Transition Probabilities (TPs). We propose an algorithm for solving MDPs with finite states and actions, where the solution is guaranteed to be robust w.r.t. the estimation errors of the TPs. Our algorithm involves a statistically accurate yet numerically efficient representation of uncertainty via likelihood or entropy functions. The worst-case complexity of our robust algorithm is the same as the original Bellman recursion.

■ WA23.3

3 — Introducing Interior-Point Methods into the First Operations Research Course
Goran Lesaja, Georgia Southern University, Department of Mathematical Sciences, Department of Mathematical Sciences, Statesboro, GA, 30460-8093, United States, goran@isye.gatech.edu

In recent years the introduction and development of Interior-Point Methods has had a profound impact on optimization theory and practice, and therefore, has impacted the field of Operations Research as a whole. Thus, there has been an increasing need to introduce this new theory and methods into introductory operations research courses. This paper discusses the ways and experiences of doing so.

■ WA30.3

3 — Layout Design for Multitenant Industrial Facilities
Sonia Bartolomei Suarez, Associated Professor, University of Puerto Rico Mayaguez, IE Department, Box 9043, Mayaguez, 00681, Puerto Rico, sonia@ece.uprm.edu, Karina Galan, Agustin Rullan Toro

The Puerto Rico Industrial Development Company (PRIDCO) needs to provide industrial space to small manufacturing industries interested in establishing or expanding operations through the island. Through this project different layout alternatives for a multitenant industrial facility were designed and the best alternative was recommended to PRIDCO. The recommended layout fulfills OSHA, ADA, Planning Board, Local Fire Department and Puerto Rico Rules and Permits Administration requirements.

■ WA31.3

3 — Capacitated Minimax Location-Allocation Models
Halit Uster, Texas A&M University, Industrial Engineering, College Station, TX, United States, uster@tamu.edu, Gurkan Ustunkar

We present a capacitated p-center facilities location problem where the new facilities can be located anywhere on the plane. We provide heuristic solution methods and computational results. The problem is relevant in the context of facilities planning with network applications in communications and logistics.

■ WA43.4

4 — Exploratory Study of Auction-Based Arrival Slot Allocation
Sanaa Kholfi, George Mason University, 7947 Tyson Oaks Circle, Vienna, VA, 22182, United States, skholfi@gmu.edu, C-H. Chen, G.L. Donohue, L.Le

Auctions have been successfully used for radio spectrum allocation and energy distribution. In this paper we introduce a new approach to assure safe aircraft separation, optimize passenger enplanement opportunities, and equitably allocate a limited supply of landing opportunities. A dual approach was also adopted to address the slot-pricing.

CANCELLATIONS

■ WA09.3

Improving an Introductory OR/MS Course in South Africa, Neil Manson

■ WA15.1

Work Forecasting and Resource Planning for the Field Workforce of British Telecommunications plc, Christos Voudouris

■ WA38.2

Continuous Network Design Problem via Bilevel Programming and its Implementations, Suh-Wen Chiou

■ WA41.1

Network Flow Problems with Step Cost Functions, Rui Yang

■ WA43.1

An Allocation Heuristic for Winner Determination in Combinatorial Auctions, Viswanath Gnanasekaran Uma

REVISIONS

■ WA33

New Chair:
Scheduling V, Guruprasad Pundoor, University of Maryland, pundoor@glue.umd.edu

■ WA43

New Chair:
Auctions II, Sanaa Kholfi, George Mason University, skholfi@gmu.edu

PRESENTATIONS MOVED

■ WA33.5

Presentation Moved to TC32.4:
Sequencing with Limited Flexibility, Maher Lahmar

WB

NEW PRESENTATIONS

■ WB12.3

3 — Inventory Models with Partial Backordering
Emre Berk, Assistant Professor, Faculty of Business Administration, Bilkent University, Ankara, Turkey, eberk@bilkent.edu.tr, Ulku Gurler

Consider a single-item single location inventory system under periodic review facing poisson demand with leadtime-dependent backordering. Optimal policy structures are discussed and two models are analyzed. Numerical results are presented.

■ WB36.4

4 — Uniform Discount Policies and the Coordination of Decentralized Distribution Systems
Qinan Wang, Associate Professor, Nanyang Technological University, Nanyang Business School, Nanyang Avenue, Singapore, 639798, Singapore, aqnwang@ntu.edu.sg

We consider a two-echelon distribution system whereby a supplier sells a product to a group of heterogeneous and independent retailers, each facing a downward sloping demand curve of its retail price. By extending traditional quantity discounts that are based solely on lot size,to volume discounts that are based on annual volume, we show that uniform discount policies are able to achieve near-optimality system profit and, hence, provide effective coordination for a decentralized supply chain.

CANCELLATIONS

■ WB32.4

Queuing Model and Linking Equations for a Series of Automated Workstations, David Kim

REVISIONS

■ WB15

New Chair:
Management of Technology, Udo Averweg, averwegu@durban.gov.za

■ WB15.4

Lead Author Revised:
The Impact of Web-Based Technologies on EIS in South Africa: Some Exploratory Findings, Udo Averweg

■ WB32.2

Lead Author Revised:
Distributed Scheduling of Multiclass Manufacturing Systems, Gonzalo Enrique Mejía Delgadillo