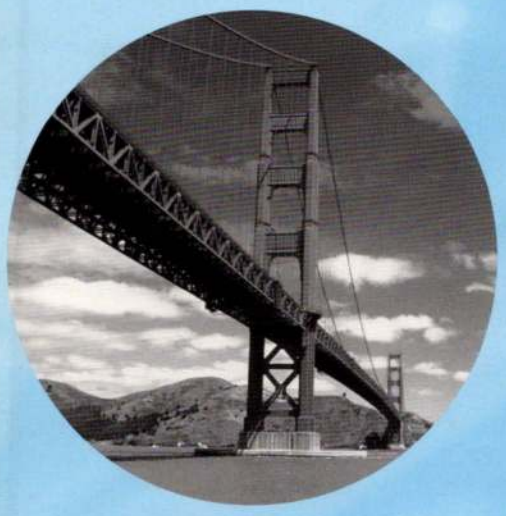
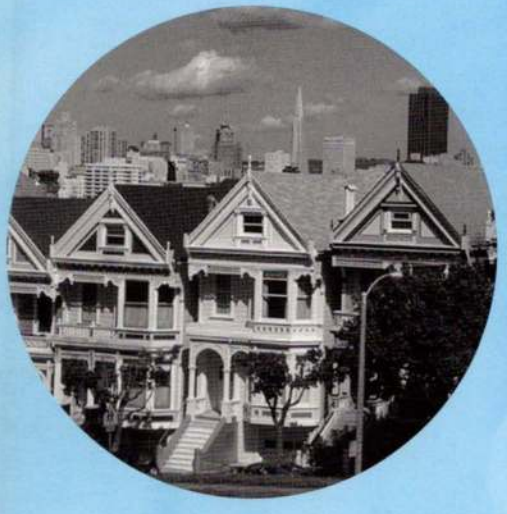








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Copies of papers abstracted in the meeting program are available only from the authors. Requests for papers should be sent to the authors at the addresses shown in the program. Published annually prior to the meeting by the Institute for Operations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

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Dear Colleagues and Friends,

It is with great pleasure (and more than a little relief) that I welcome you to San Francisco, a beautiful city that has graciously embraced us in the wake of hurricane Katrina. I am certain that you will find this to be an informative and stimulating meeting, and I hope you have an opportunity to enjoy some of San Francisco's many attractions while you are here.

Ironically, a motivation for our choice of the conference theme *Ecologies, Economies, and OR* was a desire to focus attention on the staggering loss of Louisiana's coastal wetlands and the potential catastrophic consequences for New Orleans. Sadly, our topic was all too prescient. As part of INFORMS' ongoing commitment to New Orleans, we have organized a drive to raise funds to help rebuild one or more institutions critical to the long-term viability of New Orleans. At press time we are evaluating potential recipients; we will publicize the designated recipients and provide information on how to make donations at the conference. I encourage you to contribute.

Despite the difficulties we have faced in organizing the meeting in the aftermath of Katrina, this conference offers far more technical talks than any preceding INFORMS meeting. This is an amazing testament to the resilience of our organization and the value its members place on this conference. I commend each of you for the contributions you have made. The program covers an incredible range of topics and features several sessions that are practitioner oriented or related to the meeting theme. We are also offering a diverse set of tutorials, interesting and provocative plenaries and keynotes, lunchtime interactive sessions in the exhibit area, and research clinics in which important practical problems that may present research opportunities in operations research and the management sciences are discussed. Finally, we welcome high school teachers, graduate students, and participants of the combined colloquia and the CIST conference.

I wish to publicly acknowledge several individuals. Thanks to the Organizing Committee members – Sila Cetinkaya, Karen R. Chinander, Dwight Collins, John Fowler, Mike Fry, Esma Gel, Dan Guide, Illya Hicks, Xiaoyue Jiang, Mark Lewis, Warren Liao, Chuck McAllister, Michele Pfund, George Polak, Thomas W. Sloan, Cole Smith, Kathy Stecke, Evangelos Triantaphyllou, Jorge Valenzuela, Ken Walsh, and Chris Zappe. If they had not fulfilled their responsibilities so adeptly, relocating this meeting would have been far more difficult. The INFORMS meetings staff rose far above and beyond their normal outstanding efforts to bring this meeting together under extremely difficult circumstances: finding a new venue in a tight time frame, managing the logistics of moving the meeting, and dealing with a myriad of late program changes necessitated by the move. Each handled their additional burdens and stress with uncommon grace and professionalism. Finally, special thanks to Candi Yano, who organized several attractive bay area plant tours in very little time.

Please enjoy all San Francisco has to offer while you are here. Eat at one of the countless fine downtown restaurants, visit Fisherman's Wharf, or take one of the scheduled plant or guest tours we have scheduled. Come to the Welcome Reception on Sunday evening and the Spirit of New Orleans-themed reception (complete with a Dixieland band) on Monday evening. I truly hope this is a worthwhile conference experience for each of you.

James J. Cochran
General Chair

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PROGRAM AT A GLANCE

SATURDAY, NOVEMBER 12

8:00am-5:00pm	Web-DSS Workshop	H – 4th Floor, Union Square 22
8:00am-5:00pm	Organization Science	H – Ballroom Level, Franciscan A & B
8:00am-5:30pm	CIST Conference	H – Ballroom Level, Franciscan C & D
9:00am-5:00pm	Vendor Workshops	Hilton
3:00pm-7:00pm	Registration	H – Grand Ballroom
3:00pm-7:00pm	Email Center	H – Grand Ballroom
5:00pm-6:00pm	INFORMS Membership Meeting	H – Ballroom Level, Imperial Ballroom A

SUNDAY, NOVEMBER 13

7:00am-5:00pm	Registration, Email Center	H – Grand Ballroom
7:30am-5:30pm	CIST Conference	H – Ballroom Level, Franciscan C & D
8:00am-9:30am	Technical Sessions (SA)	Hilton, Parc 55
9:30am-10:00am	Coffee Break	H – Grand Ballroom & South Lounge R – 4th Floor, Parc Ballroom Foyer
10:00am-11:30am	Technical Sessions (SB)	Hilton, Parc 55
11:40am-12:30pm	Plenary Presentation	H – Ballrm Lev., Continental Ballroom 5
12:00pm-5:00pm	Exhibits, Job Fair	H – Grand Ballroom
12:30pm-1:30pm	Lunch Break (on your own)	
1:30pm-3:00pm	Technical Sessions (SC)	Hilton, Parc 55
3:10pm-4:00pm	Plenary Presentation	H – Ballrm Lev., Continental Ballroom 5
4:00pm-4:30pm	Coffee Break	H – Grand Ballroom R – 4th Floor, Parc Ballroom Foyer
4:30pm-6:00pm	Technical Sessions (SD)	Hilton, Parc 55
6:15pm-7:15pm	Subdivision Business Meetings	See p. 9
7:30pm-9:00pm	Welcome Reception	H – Grand Ballroom

MONDAY, NOVEMBER 14

7:00am-5:00pm	Registration, Email Center	H – Grand Ballroom
8:00am-9:30am	Technical Sessions (MA)	Hilton, Parc 55
9:00am-5:00pm	Exhibits, Job Placement	H – Grand Ballroom
9:30am-10:00am	Coffee Break	H – Grand Ballroom R – 4th Floor, Parc Ballroom Foyer
10:00am-11:30am	Technical Sessions (MB)	Hilton, Parc 55
11:40am-12:30pm	Plenary: Welcome & Awards	H – Ballrm Lev., Continental Ballroom 5
12:30pm-1:30pm	Interactive Sessions	H – Grand Ballroom
12:30pm-1:30pm	Lunch Break (on your own)	
1:30pm-3:00pm	Technical Sessions (MC)	Hilton, Parc 55
3:10pm-4:00pm	Plenary Presentation	H – Ballrm Lev., Continental Ballroom 5
4:00pm-4:30pm	Coffee Break	H – Grand Ballroom R – 4th Floor, Parc Ballroom Foyer
4:30pm-6:00pm	Technical Sessions (MD)	Hilton, Parc 55
6:15pm-7:15pm	Subdivision Business Meetings	See p. 9
7:30pm-9:30pm	General Reception	H – Ballroom Level, Continental Ballroom

TUESDAY, NOVEMBER 15

7:00am-5:00pm	Registration, Email Center	H – Grand Ballroom
8:00am-9:30am	Technical Sessions (TA)	Hilton, Parc 55
9:00am-5:00pm	Exhibits, Job Placement	H – Grand Ballroom
9:30am-10:00am	Coffee Break	H – Grand Ballroom R – 4th Floor, Parc Ballroom Foyer
10:00am-11:30am	Technical Sessions (TB)	Hilton, Parc 55
11:40am-12:30pm	Keynote Presentations	H – Ball Lev., Continental Ballroom 5 & 6

NOTE:

Technical sessions are held at the San Francisco Hilton and Renaissance Parc 55. Check the Master Track Schedule on pages 42-45 for specific room locations.

KEY

H-San Francisco Hilton
R-Renaissance Parc 55

BADGES REQUIRED FOR TECHNICAL SESSIONS

INFORMS Annual Meeting 2005 badges must be worn to all sessions and events. Badges will be checked at the entrance to technical session areas, as well as the Exhibit Hall. Attendees without badges will be directed to the INFORMS registration desk to register and pick up their badges. *All attendees, including speakers and session chairs, must register and pay the registration fee.* Lost badges can be replaced at the registration desk.





QUICK REFERENCE including the Master Track Schedule

Don't miss this handy reference. It's a separate flyer that came with your program. The Master Track Schedule is also printed on pages 42-45.

12:30pm-1:30pm	Interactive Sessions	H – Grand Ballroom
12:30pm-1:30pm	Lunch Break (on your own)	
1:30pm-3:00pm	Technical Sessions (TC)	Hilton, Parc 55
3:10pm-4:00pm	Keynote Presentations	H – Ball Lev., Continental Ballroom 5 & 6
4:00pm-4:30pm	Coffee Break	H – Grand Ballroom R – 4th Floor, Parc Ballroom Foyer
4:30pm-6:00pm	Technical Sessions (TD)	Hilton, Parc 55
6:15pm-7:15pm	Subdivision Business Meetings	See p. 9

WEDNESDAY, NOVEMBER 16

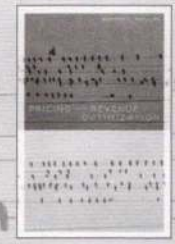
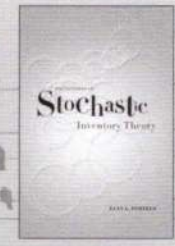
7:00am-5:00pm	Registration, Email Center	H – Grand Ballroom
8:00am-9:30am	Technical Sessions (WA)	Hilton, Parc 55
9:00am-5:00pm	Job Placement	H – Grand Ballroom
9:30am-10:00am	Coffee Break	H – Grand Ballroom & South Lounge R – 4th Floor, Parc Ballroom Foyer
10:00am-11:30am	Technical Sessions (WB)	Hilton, Parc 55
11:40am-12:30pm	Plenary Presentation	H – Grand Ballroom A
12:30pm-1:30pm	Lunch Break (on your own)	
1:30pm-3:00pm	Technical Sessions (WC)	Hilton, Parc 55
3:00pm-3:30pm	Coffee Break	H – Grand Ballroom & West Lounge R – 4th Floor, Parc Ballroom Foyer
3:30pm-5:00pm	Technical Sessions (WD)	Hilton, Parc 55

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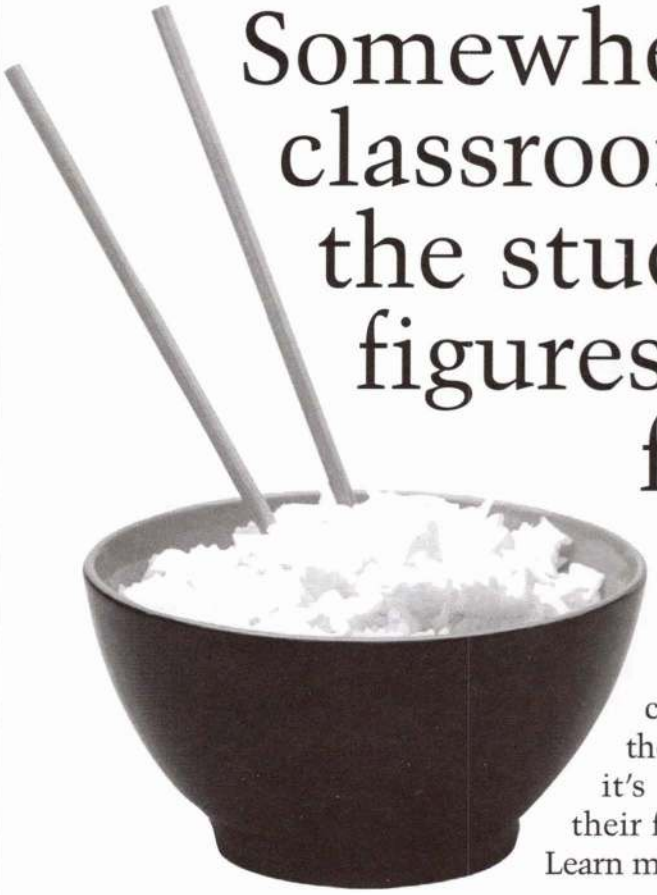
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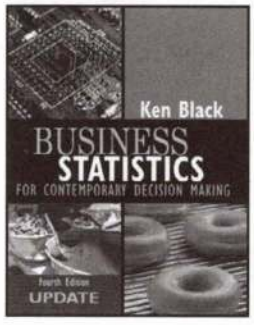
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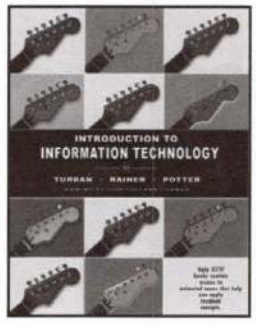
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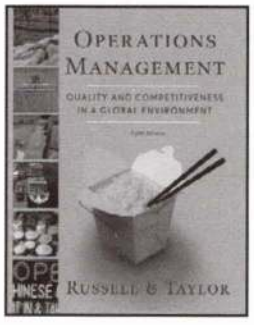


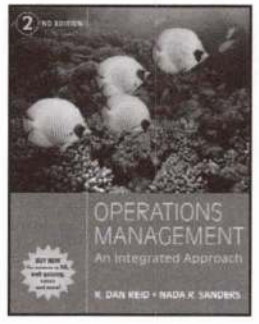
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SCHEDULE OF SPECIAL EVENTS

KEY
H – San Francisco Hilton
R – Renaissance Parc 55

For subdivision business meetings, see page 9.

WHERE TO GO FOR LUNCH?

There's a wide selection of restaurants within a few blocks of our hotels. Here are just a few examples; check with the concierge for a full listing.

At the Hilton
The Café
Lobby Bar
The Daily Cup

At the Renaissance
Barbary Coast
Siam Thai
Barley 'N Hops

Café Mason
320 Mason Street

Lori's Diner
336 Mason Street

Santorini Mediterranean
242 O'Farrell Street

Sunflower Café
284 O'Farrell Street

Boudin Bakery
Macy's Cellar/O'Farrell St.

Lefty O'Doul's
333 Geary Street

Pinecrest Diner
401 Geary Street

FRIDAY, NOVEMBER 11	LOCATION	TIME
Colloquia Registration & Dinner	H – Ballroom Level, Continental Ballroom 5	4:30pm-9:00pm
SATURDAY, NOVEMBER 12		
Combined Colloquia Breakfast	H – Ballroom Level, Continental Ballroom 5	7:45am-8:45am
ISR Editors Meeting	H – Lobby Level, Marina	8:00am-1:00pm
Organization Science Program	H – Ballroom Level, Franciscan A & B	8:00am-5:00pm
Web-DSS Workshop	H – 4th Floor, Union Square 22	8:00am-5:00pm
CIST Conference	H – Ballroom Level, Franciscan C & D	8:00am-5:30pm
Future Academician Colloquium	H – Ballroom Level, Continental Ballroom 6	8:15am-5:00pm
Future Practitioner Colloquium	H – Ballroom Level, Continental Ballroom 7	8:50am-5:00pm
Teaching Effectiveness Colloquium	H – Ballroom Level, Continental Ballroom 9	8:50am-5:00pm
Meetings Committee Meeting	H – Imperial Suite, Bldg. 3-1984	8:30am-5:00pm
Vendor Workshops		
AMPL Optimization	H – 4th Floor, Union Square 1	9:00am-5:00pm
Maximal Software, Inc.	H – Ballroom Level, Continental Ballroom 2	9:00am-5:00pm
Statgraphics Centurion XV	H – 4th Floor, Union Square 5	9:00am-5:00pm
Responsive Learning Technologies	H – 4th Floor, Union Square 13	12:00pm-5:00pm
ILOG, Inc.	H – Ballroom Level, Continental Ballroom 1	12:00pm-6:00pm
Dash Optimization	H – 4th Floor, Union Square 25	1:00pm-5:00pm
LINDO Systems, Inc.	H – 4th Floor, Union Square 2	1:00pm-5:00pm
Subdivisions Council Meeting	H – 4th Floor, Union Square 21	12:00pm-5:00pm
INFORMS Executive Committee Meeting	H – Ballroom Level, Executive Boardroom	12:00pm-5:00pm
Meeting Registration, Email Center	H – Grand Ballroom	3:00pm-7:00pm
INFORMS Membership Meeting/Reception	H – Ballroom Level, Imperial Ballroom A	5:00pm-6:00pm
Roundtable Reception	H – Ballroom Level, Continental Ballroom 4	5:00pm-6:00pm
Roundtable Meeting	H – Ballroom Level, Continental Ballroom 4	6:00pm-7:30pm
Roundtable Dinner	H – Ballroom Level, Continental Ballroom 4	7:30pm-8:30pm
SUNDAY, NOVEMBER 13		
New Member/First-Time Attendee Breakfast	H – Ballroom Level, Imperial Ballroom B	7:00am-8:00am
Meeting Registration, Email Center	H – Grand Ballroom	7:00am-5:00pm
CIST Conference	H – Ballroom Level, Franciscan C & D	7:30am-5:30pm
Guest Breakfast	H – Lobby Level, The Café Restaurant	8:00am-9:00am
INFORMS Board Meeting	R – 4th Floor, Da Vinci	8:00am-5:00pm
Roundtable Meeting	H – Ballroom Level, Continental Ballroom 4	8:00am-5:00pm
Junior Faculty Interest Group Lunch	H – Ballroom Level, Imperial Ballroom B	11:30am-1:00pm
Plenary-IFORS: Luk N. Van Wassenhove	H – Ballroom Level, Continental Ballroom 5	11:40am-12:30pm
Exhibits/Job Fair	H – Grand Ballroom	12:00pm-5:00pm
O.R. Editors Meeting/Lunch	H – Ballroom Level, Executive Boardroom	12:30pm-1:30pm
Omega Rho Executive Comm./Annual Mtg.	H – Lobby Level, Sunset	12:30pm-2:00pm
O.R. Board Meeting	H – Lobby Level, Seacliff	1:30pm-2:30pm
M.S. Editors Meeting	H – Ballroom Level, Executive Boardroom	3:00pm-5:00pm
Plenary-Omega Rho: Stuart L. Hart	H – Ballroom Level, Continental Ballroom 5	3:10pm-4:00 pm
President's Reception-Roundtable	H – Ballroom Level, Continental Ballroom 4	5:00pm-6:30pm
IOL Reception	H – Ballroom Level, Continental Ballroom 9	6:00pm-7:00pm
MSOM Reception	H – Ballroom Level, Franciscan A & B	6:15pm-7:15pm
Welcome Reception	H – Grand Ballroom	7:30pm-9:00pm
Minority Issues Forum Reception	H – Ballroom Level, Yosemite A	8:00pm-9:00pm
Student Reception	H – Ballroom Level, Imperial Ballroom B	8:00pm-10:00pm
Women in OR/MS Forum Reception	Serrano Hotel, Ponzu Restaurant	8:00pm-10:00pm

SCHEDULE OF SPECIAL EVENTS

MONDAY, NOVEMBER 14

Board/Editors/Committee Chair Breakfast	H – Ballroom Level, Continental Ballroom 8	7:00am-8:00am
MSOM Editors Meeting	R – 4th Floor, Da Vinci I	7:00am-8:00am
Meeting Registration, Email Center	H – Grand Ballroom	7:00am-5:00pm
ACORD	R – 4th Floor, Da Vinci II	7:30am-9:00am
Case Competition Committee Meeting	H – Lobby Level, Seacliff	8:00am-9:00am
Guest Breakfast	H – Lobby Level, The Café Restaurant	8:00am-9:00am
San Francisco Area Math Teachers Program	H – Ballroom Level, Continental Ballroom 9	8:00am-4:00pm
Exhibits/Job Placement	H – Grand Ballroom	9:00am-5:00pm
Chapters/Fora Committee Meeting	H – 4th Floor, Union Square 8	9:00am-10:00am
Section/Societies Committee Meeting	H – 4th Floor, Union Square 8	10:00am-11:00am
Plenary: Welcome & Awards	H – Ballroom Level, Continental Ballroom 5	11:40am-12:30pm
COIN-OR Users Meeting	H – 4th Floor, Union Square 24	12:15pm-1:15pm
Colloquia Committee Meeting	H – Lobby Level, Seacliff	12:00pm-1:00pm
Fellows Lunch	H – Ballroom Level, Imperial Ballroom B	12:45pm-2:00pm
Roundtable Lunch	H – Ballroom Level, Continental Ballroom 8	12:30pm-1:30pm
Subdivision Council Meeting	H – Ballroom Level, Executive Boardroom	2:30pm-4:30pm
Plenary-McCord Morse: Alfred Blumstein	H – Ballroom Level, Continental Ballroom 5	3:10pm-4:00pm
Decision Analysis Society Awards Session	R – 4th Floor, Cervantes	4:30pm-6:00pm
CPMS Isolated Practitioners Workshop	H – 4th Floor, Union Square 21	6:15pm-7:15pm
General Reception	H – Ballroom Level, Continental Ballroom	7:30pm-9:30pm

TUESDAY, NOVEMBER 15

Chapters/Fora Officers Breakfast	H – Ballroom Level, Continental Ballroom 9	7:00am-8:00am
Decision Analysis Editors Meeting	H – Lobby Level, Seacliff	7:00am-8:00am
Meeting Registration, Email Center	H – Grand Ballroom	7:00am-5:00pm
Transportation Science Editors Meeting	H – Lobby Level, Sunset	7:30am-8:30am
Student Chapter Officers Meeting	H – Ballroom Level, Continental Ballroom 9	8:00am-8:45am
Guest Breakfast	H – Lobby Level, The Café Restaurant	8:00am-9:00am
Meetings Comm./Future Organizing Comm.	H – Imperial Suite, Bldg. 3-1984	8:00am-5:00pm
Exhibits/Job Placement	H – Grand Ballroom	9:00am-5:00pm
Keynote: Edelman 2005 Reprise	H – Ballroom Level, Continental Ballroom 5	11:40am-12:30pm
Keynote: Erhan Erkut	H – Ballroom Level, Continental Ballroom 6	11:40am-12:30pm
Sections/Societies Officers Lunch	H – Ballroom Level, Continental Ballroom 9	12:00pm-1:30pm
Editors & Publications Committee Meeting	H – Ballroom Level, Continental Ballroom 8	12:00pm-3:00pm
Academic/Practitioner Interface Lunch	H – Ballroom Level, Imperial Ballroom B	12:30pm-1:30pm
Women in OR/MS Business Meeting/Lunch	H – Ballroom Level, Franciscan B & C	12:30pm-1:30pm
Education Committee Meeting	H – Lobby Level, Sunset	2:00pm-4:00pm
Keynote-Panel: Edelman Makeover	H – Ballroom Level, Continental Ballroom 5	3:10pm-4:00pm
Keynote: George B. Dantzig Tribute	H – Ballroom Level, Continental Ballroom 6	3:10pm-4:00pm
Future Organizing Committee Reception	H – Imperial Suite, Bldg. 3-1984	5:00pm-6:00pm

WEDNESDAY, NOVEMBER 16

Meeting Registration, Email Center	H – Grand Ballroom	7:00am-5:00pm
Job Placement	H – Grand Ballroom	9:00am-5:00pm
Plenary: Gary Lorden	H – Grand Ballroom A	11:40am-12:30pm



SCHEDULE OF SUBDIVISION BUSINESS MEETINGS

KEY
H – San Francisco Hilton
R – Renaissance Parc 55



QUICK REFERENCE including the Master Track Schedule

Don't miss this handy reference. It's a separate flyer that came with your program. The Master Track Schedule is also printed on pages 42-45.

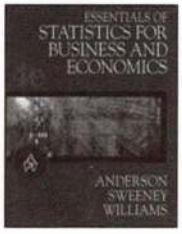
SUNDAY, NOVEMBER 13	LOCATION	TIME
Information Systems	H – Ballroom Level, Franciscan D	5:30pm-6:30pm
Aviation Applications	H – 4th Floor, Union Square 12	6:15pm-7:15pm
Data Mining & Artificial Intelligence	H – 4th Floor, Union Square 21	6:15pm-7:15pm
eBusiness	H – 4th Floor, Union Square 23	6:15pm-7:15pm
Energy, Natural Resources & the Environment	H – 4th Floor, Union Square 14	6:15pm-7:15pm
Forum on Education (INFORM-ED)	H – Ballroom Level, Continental Ballroom 1	6:15pm-7:15pm
Location Analysis	H – 6th Floor, Lombard	6:15pm-7:15pm
Military Applications Society Council	H – 4th Floor, Union Square 6	6:15pm-7:15pm
Minority Issues Forum	H – Ballroom Level, Yosemite A	6:15pm-7:15pm
Railroad Applications	H – 6th Floor, Sutter	6:15pm-7:15pm
Revenue Management & Pricing	H – 4th Floor, Union Square 22	6:15pm-7:15pm
Simulation	H – 6th Floor, Taylor	6:15pm-7:15pm
Spreadsheet Productivity Research	H – Ballroom Level, Continental Ballroom 7	6:15pm-7:15pm
Decision Analysis Society Council	H – Ballroom Level, Executive Boardroom	6:15pm-7:30pm
Revenue Management & Pricing Board	H – 4th Floor, Union Square 22	7:15pm-8:15pm
MONDAY, NOVEMBER 14		
Social Sciences	H – Ballroom Level, Executive Boardroom	5:00pm-6:15pm
Decision Analysis Society	R – 4th Floor, Cervantes	6:00pm-7:15pm
Technology Management	H – 4th Floor, Union Square 13	6:00pm-8:00pm
Applied Probability	H – 6th Floor, Van Ness	6:15pm-7:15pm
Computing Society	R – 4th Floor, Parc Ballroom II	6:15pm-7:15pm
Financial Services	H – 4th Floor, Union Square 18	6:15pm-7:15pm
Health Applications	R – 4th Floor, Dante	6:15pm-7:15pm
Manufacturing & Service Operations Mgt	H – Ballroom Level, Imperial Ballroom A	6:15pm-7:15pm
Military Applications Society	H – 4th Floor, Union Square 6	6:15pm-7:15pm
Public Programs & Processes	H – 4th Floor, Union Square 14	6:15pm-7:15pm
SpORts in OR	H – 6th Floor, Lombard	6:15pm-7:15pm
Telecommunications	H – 4th Floor, Union Square 17	6:15pm-7:15pm
Transportation Science & Logistics	R – 4th Floor, Parc Ballroom III	6:15pm-7:15pm
Accounting, Auditing and Tax	H – 4th Floor, Union Square 19	6:30pm-7:30pm
Quality, Statistics & Reliability	H – 4th Floor, Union Square 20	6:30pm-7:30pm
TUESDAY, NOVEMBER 15		
Women in OR/MS Forum	H – Ballroom Level, Franciscan B & C	12:30pm-1:30pm
Optimization	R – 3rd Floor, Barcelona II	6:15pm-7:15pm



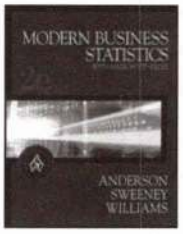
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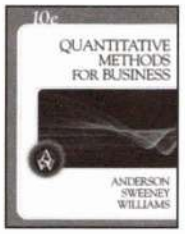
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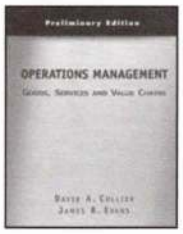
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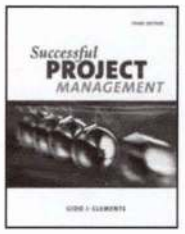
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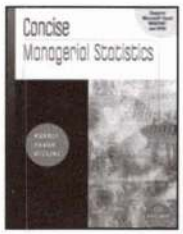
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Successful Service Operations Management, 2e

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The Management of Business Logistics

Coyle/Bardi/Novack
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Cutright/Martin
Operations Management Learning Simulation

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Six Sigma

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SPEAKER GUIDELINES

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

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

Speaker Ready Room
There will be a special Speaker Ready Room available near the Program Information Booth in the Grand Ballroom during the meeting. You can stop by and practice connecting your laptop to the projector. We will also have quick instructions at each session room and technical assistance available for any problems.

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

Guidelines for Session Chairs
The role of the Chair is to coordinate the smooth running of the session. The Chair:

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

COFFEE BREAKS

KEY: H-San Francisco Hilton
R-Renaissance Parc 55

Sunday, Nov. 13

9:30am – 10:00am	H-Grand Ballroom & South Lounge	R – 4th Floor, Parc Ballroom Foyer
4:00pm – 4:30pm	H-Exhibit Hall	R – 4th Floor, Parc Ballroom Foyer

Sponsored by Advantage for Analysts and Babcock & Brown.

Monday, Nov. 14

9:30am – 10:00am	H-Exhibit Hall	R – 4th Floor, Parc Ballroom Foyer

Sponsored by Advantage for Analysts and Babcock & Brown.

4:00pm – 4:30pm	H-Exhibit Hall	R – 4th Floor, Parc Ballroom Foyer

Sponsored by sponsored by SAS.

Tuesday, Nov. 15

9:30am – 10:00am	H-Exhibit Hall	R – 4th Floor, Parc Ballroom Foyer
4:00pm – 4:30pm	H-Exhibit Hall	R – 4th Floor, Parc Ballroom Foyer

Wednesday, Nov. 16

9:30am – 10:00am	H-Grand Ballroom & South Lounge	R – 4th Floor, Parc Ballroom Foyer
3:00pm – 3:30pm	H-Grand Ballroom & South Lounge	R – 4th Floor, Parc Ballroom Foyer

Exhibit Hall
Name badges must be worn for admittance to the Exhibit Hall, located in the Grand Ballroom of the San Francisco Hilton, during the following hours:

Sunday, Nov. 13	12:00pm-5:00pm & 7:30pm-9:00pm*
Monday, Nov. 14	9:00am-5:00pm
Tuesday, Nov. 15	9:00am-5:00pm

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

Email Center–Wireless Areas
There are several options for Internet access available in our Email Center (Grand Ballroom, by registration and exhibits). If you bring your laptop, you can use a wired connection or the wireless access available in the center. If you do not have a laptop, a limited number of computers are also available. Name badges must be worn for admittance to the Email Center. The center will be open during the following hours:

Saturday, Nov. 12	3:00pm-7:00pm
Sunday, Nov. 13	7:00am-5:00pm
Monday, Nov. 14	7:00am-5:00pm
Tuesday, Nov. 15	7:00am-5:00pm
Wednesday, Nov. 16	7:00am-5:00pm

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

Business Center
The San Francisco Hilton Business Center is located in the Main Lobby. It is open on Saturday and Sunday 9:00am-5:00pm and weekdays from 6:00am-6:00pm.

BADGES REQUIRED FOR TECHNICAL SESSIONS

INFORMS Annual Meeting 2005 badges must be worn to all sessions and events. Badges will be checked at the entrance to technical session areas, as well as the Exhibit Hall. Attendees without badges will be directed to the INFORMS registration desk to register and pick up their badges. *All attendees, including speakers and session chairs, must register and pay the registration fee* Lost badges can be replaced at the registration desk.

Duxbury OR/MS
A Tradition of Quality and Innovation

Operations Research

Operations Research: Applications and Algorithms, Fourth Edition
WAYNE L. WINSTON
0-534-38058-1. ©2004.
This market-leading text owes much of its success to its practical orientation and consistent emphasis on model formulation and model building. It moves beyond a mere study of algorithms without sacrificing the rigor that faculty desire.

Mathematical Programming/Optimization

NEW!
Optimization Modeling with Spreadsheets
KENNETH BAKER
0-534-49474-9. ©2006.
Baker's text is a spreadsheet-based introduction to mathematical programming concepts and applications with an emphasis on model building and a focus on formulation principles. The text also includes a comprehensive tutorial on the use of Excel's Solver, and, at a more advanced level, Frontline Systems' Premium Solver.

Introduction to Mathematical Programming: Operations Research, Volume I, Fourth Edition
WAYNE L. WINSTON and MUNIRPALLAM VENKATARAMANAN
0-534-35964-7. ©2003.
Winston and Venkataramanan emphasize model-formulation and model-building skills as well as interpretation of computer software output. Focusing on deterministic models, this book is designed for the first half of an operations research sequence. The book has a strong computer orientation and emphasizes model-formulation and model-building skills.

Probability Models

Probability Models for Economic Decisions
ROGER B. MYERSON
0-534-42381-7. ©2005.
Taking the mystery out of analyzing uncertainty, Myerson shows how probability models can be used within Excel to quantify uncertainty and risk and illuminate the "big picture" of a decision problem. The text emphasizes versatile frameworks, from Monte Carlo simulation to decision trees and game theory.

Introduction to Probability Models: Operations Research, Vollume II, Fourth Edition
WAYNE L. WINSTON
0-534-40572-X. ©2004.
This text covers probability models with recent contributions from financial engineering, computational simulation, and manufacturing. The specific attention to probability models with the addition of recent practical breakthroughs makes this the first text to introduce these ideas together at an accessible level.

Simulation

JUST PUBLISHED!
A First Course in Monte Carlo
GEORGE FISHMAN
0-534-42046-X. ©2006.
A concise explanation of the techniques used to generate random samples, and how to use them to solve problems. Designed for advanced undergraduates and graduate students, this text provides an intermediate-level of understanding for the Monte Carlo Method while offering a taste of how the techniques perform in practice.

Applied Simulation Modeling
ANDREW SEILA, VLATKO CERIC, and PANDU TADIKAMALLA
0-534-38159-6. ©2003.
A conceptual introduction to simulation modeling concepts in the context of decision making, combined with practical experience with real examples using ARENA and @RISK (student editions of both are packaged with the text).

Regression

Applied Regression Analysis: A Second Course in Business and Economic Statistics, Fourth Edition
TERRY E. DIELMAN
0-534-46548-X. ©2005.
Focusing on the application of regression to real data and examples while employing commercial statistical and spreadsheet software, Dielman's text provides all of the core regression topics as well as optional topics including ANOVA, Time Series Forecasting, and Discriminant Analysis.

Forecasting

NEW!
Forecasting: Practice and Process for Demand Management
HANS LEVENBACH and JAMES P. CLEARY
0-534-26268-6. ©2006.
With a focus on how forecast managers and planners create forecasts for products and services for their business, Levenbach and Cleary's text addresses both the macroeconomic forecasting procedures used by economists as well as the specific product-level forecasting techniques that are now widely used by sales and operations planning organizations in corporations.

Decision Support Systems

COMING IN JANUARY!
VBA for Modelers: Developing Decision Support Systems Using Microsoft® Excel, Second Edition
S. CHRISTIAN ALBRIGHT
0-495-10683-6. ©2007.
This handbook helps students learn to use VBA to automate methods and models and create special, user-friendly applications.

Statistical Software

JMP IN®, Version 5.1
SAS INSTITUTE, INC.
0-534-99747-3. ©2005.
Fully featured, with all the capabilities of professional JMP®, JMP IN 5.1 is intelligent, visual, interactive, and easy-to-use software that helps students learn concepts quickly. Powerful enough for advanced courses, yet easy and economical enough for introductory statistics.

Drop by the Duxbury booth at INFORMS for more information about our latest titles and technology, or visit us at www.duxbury.com!

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GUEST PROGRAM

The program for registered guests includes a continental breakfast on Sunday, Monday and Tuesday mornings, the Welcome Reception on Sunday evening 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, Nov. 19 8:00am – 9:00am
Monday, Nov. 20 8:00am – 9:00am
Tuesday, Nov. 21 8:00am – 9:00am

The Café Restaurant at the Hilton, Lobby Level
Identify yourself as an INFORMS Guest and present your ticket when you arrive at the Café. Tickets will be included in the registration packet.

GUEST TOURS

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

San Francisco City Tour

Sunday, November 13
9:00am-1:00pm $27

An in-depth look at the history and culture of San Francisco, the tour points out landmarks including Coit Tower, the Japanese Tea Garden and the Palace of Fine Arts. Three photographic stops are planned: Cliff House, featuring spectacular views of the Pacific Ocean, Vista Point at the Golden Gate Bridge and Twin Peaks. Compare and contrast the architecture and diverse culture of the Nob Hill, North Beach, Pacific Heights, Union Street and Chinatown neighborhoods. Lunch or snack on your own at Pier 39, home to over 135 specialty shops.

Chinatown Walking Tour

Monday, November 14
9:00am-1:00pm $57

The tour proceeds along five scenic blocks from the Hilton through Union Square to the gates of Chinatown. The excursion begins with the exploration of Chinatown, land-marked by the famous red archway. The crowded and bustling 16 blocks truly represent another world and the largest Chinese community outside of Asia. This in-depth tour takes you off the beaten path of the main tourist streets and gives an inside look at Chinatown. See historical Chinese churches, hidden alleyways with symbolic murals, and enjoy the famous fortune cookie factory. There will be an opportunity for lunch or snack on your own in Chinatown.

Golden Gate Park-de Young Museum-Conservatory of Flowers

Tuesday, November 15
9:00am-1:00pm $67

The de Young Museum has been an integral part of the cultural fabric of the city for over 100 years. Newly reopened, the de Young provides San Francisco with a landmark art museum to showcase the museum's priceless collections of American art from the 17th through the 20th centuries, and art of the native Americas, Africa and the Pacific. There will be an opportunity for lunch or snack on your own at the museum café. After the museum, the tour continues to the nearby Conservatory of Flowers, a spectacular living museum of rare and beautiful tropical plants.

PLANT TOURS

A limited number of openings may still be available for the following plant tours. Go to the INFORMS registration desk for information on availability. Buses for 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 Taylor Street entrance of the Hilton.

U.S. Geological Survey

Monday, November 14
9:00am-1:00pm $30

Established 120 years ago, the U.S. Geological Survey is the nation's premier scientific organization that focuses on natural hazards, resources and the environment, aiming to resolve complex natural resource problems across the nation and around the world. This private tour will showcase ongoing research on earthquakes, and if time permits, also on tsunamis.

Port of Oakland

Monday, November 14
1:00pm-4:30pm $30

After traveling over the San Francisco Bay Bridge, you will see terminal operations at one of the four largest ports in the U.S. at a busy time of year when last-minute deliveries of holiday goods are making their way to market. The Port of Oakland owns 19 miles of waterfront along the eastern border of San Francisco Bay and manages maritime operations and related truck and rail facilities, aviation operations (Oakland International Airport) and a lively waterfront retail area. **Picture ID is required to participate in this tour.**

Jelly Belly Factory Tour

Tuesday, November 15
8:30am-1:00pm $30

Whether you need to carbo-load for your next marathon, or simply want to see the surprisingly complex process of making a jellybean, you will enjoy this walking tour of an operating candy-making factory. Started by the Goelitz family in 1869, Jelly Belly is the world's #1 maker of gourmet jellybeans in over 100 different flavors, including some with chocolate inside!

Anchor Brewing

Tuesday, November 15
3:00pm-6:00pm $30

Established in San Francisco in 1896, this award-winning brewery is best known for its Anchor Steam beer. All of its beers are virtually handmade in the company's handcrafted copper brew house, combining old-world tradition with state-of-the art manufacturing processes. The tour will include a comprehensive view of the brewing process and a tasting of Anchor's products. **Participants must be 21 years and older.**

NETWORKING & SOCIAL EVENTS

SATURDAY, NOVEMBER 12

INFORMS Membership Meeting & Reception
5:00pm-6:00pm
Hilton–Ballroom Level, Imperial Ballroom A

The INFORMS Board of Directors encourages all members to bring their ideas, opinions and suggestions to this annual membership meeting. Current business and future directions for INFORMS are on the agenda. Wine and cheese will be served.

SUNDAY, NOVEMBER 13

Breakfast for New Members & First-Time Attendees
7:00am-8:00am (Ticket Required)
Hilton– Ballroom Level, Imperial Ballroom B

The INFORMS Board and Meetings Committee will host this breakfast to welcome and orient people who are new to INFORMS and the meeting. Representatives from a number of INFORMS subdivisions will be on hand to provide information about their member services. Continental breakfast will be served. New members and first-time attendees will receive a ticket for the breakfast with their registration materials.

Junior Faculty Interest Group Luncheon
11:30am-1:00pm
Hilton – Ballroom Level, Imperial Ballroom B
$15.00 – *A limited number of tickets will be available on-site. Go to the INFORMS registration desk for information on availability.*

All junior faculty are invited to participate. This event gives junior faculty in engineering and business schools the opportunity to discuss career development and exchange ideas. A buffet lunch will be served.

Sponsored by the University of New South Wales, Australian Graduate School of Management, University of Iowa and Lehigh University. University of Southern California is sponsoring the JFIG paper competition.

INFORMS Online Reception
6:00pm-7:00pm
Hilton – Ballroom Level, Continental Ballroom 9

Meet the INFORMS Online editorial staff and preview the next generation of the INFORMS Online Web site.

Welcome Reception
7:30pm-9:00pm
Hilton – Exhibit Hall, Grand Ballroom

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 $65 guest fee also includes the General Reception and continental breakfast Sunday-Tuesday.

Minority Issues Forum Reception
8:00pm-9:00pm
Hilton – Ballroom Level, Yosemite A

Come meet old friends or make new ones while talking about minority issues and other intellectual issues and opportunities. Also, enjoy poster presentations from minority doctoral students from different departments from across the United States.

Reception is sponsored by the National Science Foundation; Northwestern University, Dept. of Industrial Engineering and Management Science; and Texas A&M University, Dept. of Industrial and Systems Engineering.

Women in OR/MS Forum Reception
8:00pm-10:00pm
Ponzu Restaurant, Serrano Hotel

Please come join us for the WORMS reception (open to all INFORMS members). The Ponzu restaurant is adjacent to the Hilton, and features contemporary Asian cuisine and one of the few female head chefs in San Francisco. The reception will feature a variety of hors d'oeuvres, a Naan table, desserts and wine.

Sponsored by the University of Maryland R.H. Smith School of Business, Georgia Institute of Technology, SAS and ILOG.

Student Reception
8:00pm-10:00pm
Hilton – Ballroom Level, Imperial Ballroom B

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, NOVEMBER 14

Welcome & Awards Ceremony
11:40am-12:30pm
Hilton – Ballroom Level, Continental Ballroom 5

Join the INFORMS Board and Annual Meeting 2005 Organizing Committee to honor and celebrate the achievements of our colleagues and all they have contributed to the field of OR/MS. The following awards will be presented: INFORMS Prize, George B. Dantzig Dissertation Awards, John von Neumann Theory Prize, Frederick W. Lanchester Prize, Philip McCord Morse Lectureship Award, INFORMS President's Award, INFORMS Prize for the Teaching of OR/MS Practice, George E. Kimball Medal, George E. Nicholson Student Paper Competition Awards, INFORMS Expository Writing Award and the Bonder Scholarships for Health Care and Applied OR in Military Applications.

COIN-OR Members & Users Meeting & Bag Lunch
12:15pm-1:15pm
Hilton – 4th Floor, Union Square 24

Anyone interested in open-source software tools, open standards, and data and model repositories for OR is encouraged to attend the members and users meeting of the Computational Infrastructure for OR (COIN-OR). Bring your own lunch and your ideas. The agenda for the meeting is posted on www.coin-or.org/informs05.html.

CPMS Isolated Practitioner Workshop & Reception
6:15pm-7:15pm
Hilton – 4th Floor, Union Square 21

CPMS, The Practice Section of INFORMS, sponsors this workshop on topics of interest to isolated practitioners, the "Lone Rangers" of OR/MS. The 22nd 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: Spirit of New Orleans
7:30pm-9:30pm
Hilton–Ballroom Level, Continental Ballroom

Celebrate the indomitable Spirit of New Orleans at this year's General Reception. We will pay tribute to the original host city of the INFORMS Annual Meeting 2005 with an evening of music, food and entertainment in the inimitable Crescent City style. The buffet menu features andouille gumbo, red beans and rice, muffalattas and all the classic New Orleans fare. The Spirit of '29 Dixieland Band will provide the accompaniment, with fortune tellers, caricaturists and playing-card magicians on hand to entertain you. Cash bar, complimentary soft drinks and water.

Take the opportunity to contribute to the INFORMS Katrina Relief Fund (see box on this page for all the details)...and enter a drawing for great prizes. Dinner for two at Cityscape (Hilton's fine dining restaurant), fun New Orleans and San Francisco gifts, and a spa treatment are just a few of the prizes. You must be present to win.

Wear badge for admission. If your guest would like to accompany you, a guest registration must be purchased (guests will receive a special badge). The $65 guest fee also includes the Welcome Reception and continental breakfast Sunday-Tuesday.

TUESDAY, NOVEMBER 15

Women in OR/MS Forum Business Meeting & Luncheon
12:30pm-1:30pm
Hilton – Ballroom Level, Franciscan B & C

Interested in issues related to women professionals in OR/MS? Come join us for lively conversation at our business meeting and lunch.

Sponsored by Stanford University-Graduate School of Business, Stanford University-Management Science and Engineering, and the University of Florida.

Academic/Practitioner Interface Luncheon
12:30pm-1:30pm
Hilton-Ballroom Level, Imperial Ballroom B
$25 – *Ticket required - sign up at the INFORMS registration desk.*

Don't miss this opportunity to network with colleagues, both in the practice and academic arenas. Members of the INFORMS Roundtable will facilitate roundtable discussions focusing on academic-practitioner collaboration during this sit-down luncheon. The event is organized and sponsored by the INFORMS Roundtable, an INFORMS subdivision whose purpose is to promote OR/MS excellence in practice.

Sponsored by the INFORMS Roundtable

INFORMS KATRINA RELIEF FUND

INFORMS has a special connection with the people and institutions of New Orleans, the original host city of the 2005 Annual Meeting. In acknowledgement of the personal and economic losses suffered by the city (conservatively, our meeting alone would have contributed at least $2.5 million to the local economy) and admiration of the resiliency and spirit of its citizens, our organization has established the INFORMS Katrina Relief Fund to assist New Orleans as it begins rebuilding. The INFORMS Board of Directors earmarked up to $25,000 to match donations made to the INFORMS Katrina Relief Fund.

Where will these donations go? Because the need is so great and there are many worthy beneficiaries, the selection of specific recipients was extremely difficult. The Board used the following four criteria to make these decisions:

- To make donations that are consistent with INFORMS' mission as a scientific/ technical professional society.
- To make donations that will address the unprecedented economic and social impact of the disaster.
- To focus on the long-term rebuilding and strengthening of New Orleans.
- To allocate funding where it will have the greatest impact, particularly by identifying beneficiaries that are less likely to receive significant government or private support.

The Board has selected three New Orleans institutions to be recipients of the funding:

Dillard University, a private, historically black university affiliated with the United Methodist Church/United Church of Christ.

Medical Center of Louisiana at New Orleans, part of the state university health care services division, and the parent entity for Charity Hospital and University Hospital in New Orleans.

Xavier University of Louisiana, a private, historically black university affiliated with the Roman Catholic Church.

Donate... and Win Prizes!

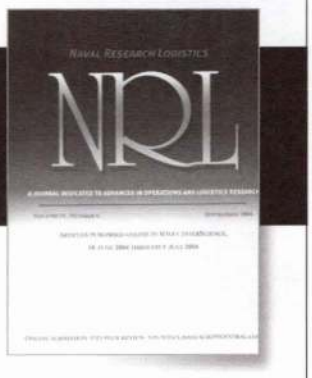
We encourage you to contribute to the INFORMS Katrina Relief Fund during the Annual Meeting. You can make donations at the INFORMS booth in the exhibit hall (booths 6-7) during regular conference hours and at a table outside the General Reception on Monday evening. Cash, checks and credit card donations are accepted.

When you donate, you will be entered into a drawing featuring some great prizes: a three-night stay at the Hilton, with an upgrade to a Luxury Suite; dinner for two at Cityscape (Hilton's fine dining restaurant); complimentary registration to the 2006 Pittsburgh Annual Meeting; fun New Orleans and San Francisco gifts; a spa treatment, and more. You must be present at the General Reception to win (the drawing will take place at 8:30 pm).

Special Rates for INFORMS Members!

NRL
A Journal Dedicated to Advances in Operations and Logistics Research

Only $89.00 in North America
$129.00 outside North America



Editor-in-Chief:
David Simchi-Levi, *Massachusetts Institute of Technology, Cambridge, MA, USA*

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

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

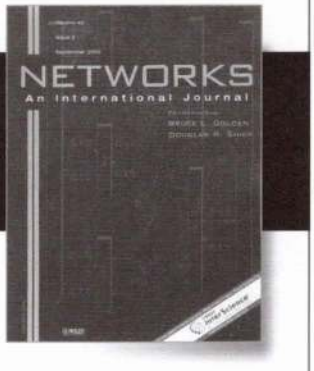
NRL is interested in research that cuts across functional areas such as operations, marketing and finance or research that brings together practices such as manufacturing, transportation, logistics, pricing and procurement.

Recent articles:
- A logistics scheduling model: Inventory cost reduction by batching *(Vol. 52, No. 4)*
- The continuous-time single-sourcing problem with capacity expansion opportunities *(Vol. 52, No. 3)*
- Outsourcing warranty repairs: Dynamic allocation *(Vol. 52, No. 5)*

For more information: **www.interscience.wiley.com/journal/nrl**

Networks
An International Journal

Only $150.00 in North America
$190.00 outside North America



Editors-in-Chief
Dr. B. L. Golden, *University of Maryland, College Park, MD, USA*
Dr. D. R. Shier, *Clemson University, Clemson, SC, USA*

Networks provides a central forum for the distribution of timely information about network problems, their design and mathematical analysis, as well as efficient algorithms for carrying out optimization on networks. The nonstandard modeling of diverse processes using networks and network concepts is also of interest. Consequently, the disciplines that are useful in studying networks are varied, including applied mathematics, operations research, computer science, discrete mathematics, and economics.

Networks publishes material on the modeling of problems using networks, the analysis of network problems, the design of computationally efficient network algorithms, and innovative case studies of successful network applications. Since the audience for this journal is then necessarily broad, articles that impact multiple application areas or that creatively use new or existing methodologies are especially appropriate. ***Networks*** accepts original, well-written research papers that make a substantive contribution to the knowledge base. In addition, tutorial and survey articles are welcomed.

Recent articles:
- Design of Survivable Networks: A survey *(Vol. 46, No. 1)*
- Strong formulations for network design problems with connectivity requirements *(Vol. 45, No. 2)*
- Exact solution of the centralized network design problem on directed graphs *(Vol. 45, No. 4)*

For more information: **www.interscience.wiley.com/journal/networks**

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DISCOVER SOMETHING GREAT

INFORMS Meetings

2006

April 30-May 2
INFORMS Practice Conference:
Applying Science to the Art of Business
Hotel Intercontinental
Miami, Florida
Chair: Karl G. Kempf
www.informs.org/Conf/Practice06

June 25-28
INFORMS International Hong Kong 2006
Sheraton Hotel & Towers Hong Kong
Hong Kong, China
In conjunction with the Hong Kong Operational Research Society and the Operations Research Society of China
Chair: Chung-Yee Lee
www.informs.org/Conf/Hongkong06

July 13-16
INFORMS Teaching of Management Science Workshop
San Francisco State University
San Francisco, California
Chair: Stephen G. Powell
www.informs.org/Edu/TMSWorkshop/TMS06/

November 5-8
INFORMS Annual Meeting 2006 Pittsburgh
Pittsburgh Convention Center & Westin Convention Center Hotel
Pittsburgh, Pennsylvania
Chair: Michael A. Trick
www.informs.org/Conf/Pittsburgh06

2007

April 29-May 1
INFORMS Practice Conference:
Applying Science to the Art of Business
Sheraton Vancouver Wall Centre
Vancouver, BC, Canada

July 8-11
INFORMS International Puerto Rico 2007
Westin Rio Mar Beach Resort & Spa
Rio Grande, Puerto Rico
Chair: Karla Hoffman
khoffman@gmu.edu

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

2008

INFORMS Practice Conference:
Applying Science to the Art of Business
Spring 2008: Dates and location to be announced.

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

INFORMS Subdivision Meetings

2005

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

2006

February 3-5
INFORMS Optimization Society Conference on Optimization and Health Care 2006
La Quinta Convention Center
San Antonio, Texas
Chairs: Allen Holder, Eva Lee
http://www2.egr.uh.edu/~ginolim/informsOpt/

March 30-April 2
8th INFORMS Telecommunications Conference
Melrose Hotel
Dallas, Texas
Chair: Joakim Kalvenes
http://telecom.section.informs.org/conference/

June 8-10
INFORMS Marketing Science Conference
The Westin Convention Center Pittsburgh
Pittsburgh, Pennsylvania
Co-Chairs: Rabikar Chatterjee, Jeffrey Inman, R. Venkatesh,
http://www.katz.pitt.edu/mks2006

June 19-20
11th INFORMS MSOM Conference
Georgia Institute of Technology
Atlanta, Georgia
Chair: Pinar Keskinocak
www.isye.gatech.edu/msom2006

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

COFFEE BREAKS

KEY: H-San Francisco Hilton
R-Renaissance Parc 55

Sunday, Nov. 13

9:30am – 10:00am	H-Grand Ballroom & South Lounge	R – 4th Floor, Parc Ballroom Foyer
4:00pm – 4:30pm	H-Exhibit Hall	R – 4th Floor, Parc Ballroom Foyer

Sponsored by Advantage for Analysts and Babcock & Brown.

Monday, Nov. 14

9:30am – 10:00am	H-Exhibit Hall	R – 4th Floor, Parc Ballroom Foyer

Sponsored by Advantage for Analysts and Babcock & Brown.

4:00pm – 4:30pm	H-Exhibit Hall	R – 4th Floor, Parc Ballroom Foyer

Sponsored by sponsored by SAS.

Tuesday, Nov. 15

9:30am – 10:00am	H-Exhibit Hall	R – 4th Floor, Parc Ballroom Foyer
4:00pm – 4:30pm	H-Exhibit Hall	R – 4th Floor, Parc Ballroom Foyer

Wednesday, Nov. 16

9:30am – 10:00am	H-Grand Ballroom & South Lounge	R – 4th Floor, Parc Ballroom Foyer
3:00pm – 3:30pm	H-Grand Ballroom & South Lounge	R – 4th Floor, Parc Ballroom Foyer

SALFORD SYSTEMS

Data Mining Software from the Creators of CART® and MARS®

Leo Breiman
University of California, Berkeley

Richard Olshen
Stanford University

Jerome Friedman
Stanford University

Charles Stone
University of California, Berkeley

The standard against which all other data mining tools are judged

Winner KDDCup 2000 Data Mining Competition

TreeNet Most Accurate KDDCup 2004

Winner Duke/NCR Teradata Churn Modeling Competition

CART®

Salford Systems' CART is the only classification and regression tree software based on the original proprietary source code developed by Breiman, Friedman, Olshen, and Stone. We have been working with these researchers since 1990 to perfect the engine to give you a celebrated and award-winning system.

MARS®

Jerome Friedman's MARS (Multivariate Adaptive Regression Splines) is stepwise regression done right for the first time. MARS does variable selection, variable transformation, interaction detection, and self-testing to prevent overfitting, all automatically. Like CART, there is only one trademarked MARS and it is available exclusively from Salford Systems.

TREENET™

TreeNet, Jerome Friedman's latest data mining tool, is based on boosted decision trees. TreeNet is an astonishingly accurate model builder and function approximation system that also serves as a powerful initial data exploration tool. Use TreeNet to extract the most important relationships in your data and calibrate how predictable the outcomes are. Then either use the TreeNet model directly or incorporate the results in CART, MARS, or conventional statistical models.

Random Forests™

Random Forests, Leo Breiman's latest data mining technology, is based on learning ensembles of CART trees. By judiciously injecting randomness into the tree building process and then combining hundreds of these trees, RF is able to deliver high performance predictive models and a variety of novel exploratory data analysis results. RF also incorporates new metric free CLUSTER analyses that automatically select the variables used to define each cluster, with potentially different variables defining each cluster.

Salford Systems Data Mining Conference
"Focusing on Solving Real World Challenges"
March 27-31, 2006
San Diego, California

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www.salford-systems.com

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

Focus on Practice
Sunday–Wednesday

Real-world applications are the focus of 23 practice-oriented sessions, designed for both practitioners and academics. You can hear presentations on O.R. projects at Amazon.com, Procter & Gamble, IBM, Ford, Intel, UPS, American Airlines, Cendant, AMD, Schneider National, HP and many others. In addition, professors from leading universities–such as Stanford, MIT, University of Michigan and others–will discuss their applied work. Take a close look at Tracks 27, 31 and 50 for many of these special sessions.

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

Daniel H. Wager Prize Competition
Sponsored by CPMS, The Practice Section of INFORMS
Monday–Tuesday
Track 4
Hilton-Ballroom Level, Continental Ballroom 2

Contestants from IBM T.J. Watson Research, Intel Corporation, Mayo Clinic, University of Maryland, University of Dayton and other organizations present their best projects in this competition that emphasizes the quality and coherence of implemented O.R. work.

2005 Franz Edelman Award Reprise
General Motors: Increasing Production Throughput at General Motors
Sponsored by CPMS, The Practice Section of INFORMS
Tuesday, November 15
11:40am-12:30pm
Hilton-Ballroom Level, Continental Ballroom 5

CPMS Isolated Practitioner Workshop & Reception
Monday, November 14
6:15pm–7:15pm
Hilton-4th floor, Union Square 21

CPMS, The Practice Section of INFORMS, sponsors this workshop on topics of interest to isolated practitioners, the "Lone Rangers" of OR/MS. The 22nd workshop in this series will address timely issues that affect the isolated practitioner community. All are welcome to participate in the workshop, discussion and reception. Wine and cheese will be served.

Tutorials
Sunday–Wednesday
Track 1
Hilton-Lobby Level, Plaza A

These 90-minute sessions offer an in-depth look at current methodologies. INFORMS will publish ten of the tutorials in a book available for purchase at the INFORMS booths 6 – 7 in the Exhibit Hall. Topics include decision analysis, simulation methodology, revenue management, stochastic programming, active learning, adaptive memory programming and other key topics

Software Demonstrations
Sunday–Tuesday
Track 13
Hilton-4th Floor, Union Square 5

See new product releases, case studies, and software presented by leading vendors and solution providers.

Academic/Practitioner Interface Luncheon
Tuesday, November 15
12:30pm-1:30pm
Hilton-Ballroom Level, Imperial B
$25 – *Ticket required – sign up at the INFORMS registration desk.*

Don't miss this opportunity to network with colleagues, both in the practice and academic arenas. Members of the INFORMS Roundtable will facilitate roundtable discussions focusing on academic-practitioner collaboration during this sit-down luncheon. The event is organized and sponsored by the INFORMS Roundtable, an INFORMS subdivision whose purpose is to promote OR/MS excellence in practice.
Sponsored by the INFORMS Roundtable

Save the dates!
April 29-May 2, 2006
InterContinental Miami
Miami, Florida

Call for Presentations

The must-attend conference for:

Analytic practitioners in all applications areas.

Academics interested in practice-oriented O.R.

INFORMS CONFERENCE ON O.R. PRACTICE
APPLYING SCIENCE TO THE *Art of Business*

Learn how to deploy O.R. strategies in mission-critical business applications.

Discover the best of O.R. in practice–the Edelman Award Competition.

Hear top-quality talks from leading practitioners and academics on how O.R. delivers value.

Exchange ideas and strategies with analytic professionals across the enterprise.

Call for Presentations

Submit a presentation proposal and join us as a speaker. Selected speakers will receive a discounted registration rate of $490. Both presentation content and speaking expertise are considered in selection, with priority given to:
– Real-world business topics, with technical content included.
– High-quality academic work geared to real situations.
– Applications reports, case studies, best practice examples, emerging topics and tutorials with a practice orientation.
Submission deadline: December 16, 2005

Young Researcher Roundtable

Nominate a junior faculty member for this select program within the conference. Registration at a special rate of $345. Nomination deadline: March 3, 2006.

INFORMS Professional Colloquium

Recommend a master's or PhD student for this interactive colloquium, designed to provide real-world career guidance for practice-oriented students.

For complete information:
www.informs.org/Conf/Practice06

informs®

SPECIAL PROGRAMS

2005 Combined Colloquia
Friday-Saturday
Hilton – Ballroom Level,
Continental Ballroom 5, 6, 7, 9

The 2005 Combined Colloquia will feature the 7th Teaching Effectiveness Colloquium and the Future Academician and Future Practitioner Colloquia. Participants in the various colloquia will join together for a welcome dinner on Friday evening, as well as breaks and meals on Saturday. *Participation in the colloquia is by nomination only.*

Sponsored by Omega Rho, University of Michigan-Ross School of Business, Texas A&M University, Clemson University-Dept. of Industrial Engineering, Duxbury/Thomson, McGraw-Hill/Irwin, South-Western/Thomson and Wiley.

CIST 2005 – 10th Conference on Information Systems and Technology
Saturday-Sunday
Hilton – Ballroom Level, Franciscan C & D

The theme of the 2005 conference is *Management and Evolution of IT in the Networked World*. The goal of this conference is to engage academic and industry researchers in a dialogue that examines a broad range of topics consistent with the main thrust of this theme.

Organization Science Program
Saturday-Sunday
Hilton – Ballroom Level, Franciscan A & B

The program begins on Saturday with a Dissertation Proposal Competition (8:30am-5:00pm), The technical program begins with sessions on *Managing Interfirm Relations* (1:00pm-2:30pm) and *The Role of Knowledge and Learning in Innovation* (3:00pm-4:30pm). Sessions continue all day on Sunday (Track 16, Hilton-4th Floor, Union Square 10).

Welcome & Awards Ceremony
11:40am-12:30pm
Hilton – Ballroom Level, Continental Ballroom 5

Join the INFORMS Board and Annual Meeting 2005 Organizing Committee to honor and celebrate the achievements of our colleagues and all they have contributed to the field of OR/MS. The following awards will be presented: INFORMS Prize, George B. Dantzig Dissertation Awards, John von Neumann Theory Prize, Frederick W. Lanchester Prize, Philip McCord Morse Lectureship Award, INFORMS President's Award, INFORMS Prize for the Teaching of OR/MS Practice, George E. Kimball Medal, George E. Nicholson Student Paper Competition Awards, INFORMS Expository Writing Award and the Bonder Scholarships for Health Care and Applied OR in Military Applications.

San Francisco Area Math Teachers Program
Monday
8:00am-4:00pm
Hilton – Ballroom Level, Continental Ballroom 9

This program, geared to middle/high school/community college math and science teachers, will consist of introductory O.R. and computer application presentations followed by hands-on participation. Participants are also welcome to attend technical sessions, and will receive copies of all program materials.



JOB PLACEMENT SERVICES

Job Fair – New Hours!
Sunday, November 13
12:00pm-5:00pm
Hilton – Grand Ballroom
The Job Fair provides an opportunity for job seekers to meet participating employers in an informal atmosphere and to discuss employment opportunities within those organizations. Employers meet and collect resumes from many job seekers in a short period of time early in the conference, giving them the chance to set up interviews during the conference.

Job Placement Panel Discussions
Sunday, November 13
Track 5
Hillton – Ballroom Level, Continental Ballroom 3

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

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

INFORMS Job Placement Service
Monday-Wednesday, 9:00am-5:00pm
Hilton – Grand Ballroom
This service provides employers and applicants a convenient venue for on-site interviews to explore opportunities in academia, industry and government. In addition, the job placement service offers:

-Online access to job listings and applicant files,
-Expanded information about jobs and applicants,
-Weekly updates of the database,
-Improved database search capabilities,
-Online data entry for applicants and employers,
-Extended availability of the database.

www.informs.org/JPS/

WEB-DSS WORKSHOP

8:00am-5:00pm $75
Hilton – 4th Floor, Union Square 22

This is a hands-on workshop where participants will learn database design principles, MS Access, VB.NET and ASP.NET technologies to develop decision support systems. Guidance on how to offer courses using this material will be provided. Workshop participants are encouraged to bring their laptops.

VENDOR WORKSHOPS

AMPL Optimization
Linear, Nonlinear and Stochastic Programming Using AMPL and Its Extensions
9:00am-5:00pm
Hilton – 4th Floor, Union Square 1

Cormac Lucas, Robert Fourer and Richard Waltz present optimization modeling with AMPL, AMPL Studio and KNITRO. Participants will gain an understanding of how to use the AMPL modeling language to formulate problems, to test algorithmic approaches and to implement decision support systems. The SAMPL stochastic extensions to AMPL and the SPInE stochastic modeling environment will be illustrated. The workshop concludes with a description of the KNITRO solver, its several optimization methods and its key options.

Maximal Software, Inc.
Optimization Modeling with MPL
9:00am-5:00pm
Hilton – 4th Floor, Continental Ballroom 2

The workshop is designed to teach participants how to develop their own optimization models and solve them using state-of-the-art, industrial-strength solvers. Bjarni Kristjansson presents an introduction to the MPL Modeling System. Alan King will discuss stochastic programming from the perspective of a practitioner who has developed an optimization model of an underlying resource allocation problem. Janos D. Pinter will present a concise introduction to global optimization.

StatPoint, Inc.
STATGRAPHICS Centurion XV
9:00am-5:00pm
Hilton – 4th Floor, Union Square 5

With more than 150 statistical procedures, including ANOVA, regression, DOE, SPC, time series analysis, forecasting and more, STATGRAPHICS Centurion has unrivaled capability to empower any O.R., R&D, quality improvement or Six Sigma program. The workshop will cover basic operation of STATGRAPHICS Centurion XV, including data management, performing analyses, use of StatFolios, modifying graphs, report generation and interfacing with other applications.

ILOG, Inc.
ILOG Optimization Technologies Workshop
12:00pm-6:00pm
Hilton – 4th Floor, Continental Ballroom 1

See new products and understand best approaches for your optimization needs. Irv Lustig and members of the ILOG CPLEX R&D team present a half-day technical workshop for both beginners and advanced users, followed by a social mixer. Learn about the major advancements in the new ILOG OPL Development Studio 4. See a special inside preview of the new upcoming release of ILOG CPLEX.

Responsive Learning Technologies
Online Games for Courses in Operations and Supply Chain Management
12:00pm-5:00pm
Hilton – 4th Floor, Union Square 13

Two structured sessions will each consist of an introduction and learning objectives, followed by a 45-minute game that participants will play in real time. (1) Supply Chain Game (1:30pm-2:45pm), for courses focusing on supply chain management. (2) Littlefield Technologies (3:30pm-4:45pm), for introductory courses in operations management or production and inventory control. Shorter software demonstrations will be available any time during the workshop on a walk-in basis.

Dash Optimization
Fast Track Optimization Modeling Using Xpress-MP
1:00pm-5:00pm
Hilton – 4th Floor, Union Square 25

This workshop will provide participants with an insight into new modeling and optimization techniques, and first-hand accounts of leading business practitioners on how they are currently using optimization to solve practical problems. The workshop will feature modeling experts from Dash Optimization and Dash Optimization customers.

LINDO Systems, Inc.
Exciting New Features in Modeling Systems from LINDO
1:00pm-5:00pm
Hilton – 4th Floor, Union Square 2

Presenters will describe and illustrate exciting new enhancements in the LINGO modeling language, the What'sBest spreadsheet optimizer and the LINDO API callable optimization library. Versions of LINDO API, as well as LINGO, are now available on a wide range of platforms in addition to Windows. Recent additions to the platform list are 64-bit versions for machines from AMD, Intel and Sun.

HIGHLIGHTS

THEME-ORIENTED SESSIONS

The technical program features 21 sessions related to the Annual Meeting theme, *Ecologies, Economies and O.R.* These special presentations focus on the role operations research can play in the interaction between ecological concerns and economic growth.

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

FOCUS ON PRACTICE

Sunday-Wednesday

Real-world applications are the focus of 23 practice-oriented sessions, designed for both practitioners and academics. You can hear presentations on O.R. projects at Amazon.com, Procter & Gamble, IBM, Ford, Intel, UPS, American Airlines, Cendant, AMD, Schneider National, HP and many others. In addition, professors from leading universities–such as Stanford, MIT, University of Michigan and others–will discuss their applied work. Take a close look at Tracks 27, 31 and 50 for many of these special sessions.

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

Also, be sure to check out all 50 technical session tracks, particularly those sponsored by INFORMS subdivisions, which offer many applications-oriented papers and sessions. You'll find presentations on aviation applications, data mining, e-business, manufacturing, revenue management, transportation and many others.

NEW! RESEARCH CLINICS

A new feature of the Annual Meeting, the Research Clinics are incorporated into sponsored tracks on the technical program. The objective of these clinics is to increase the relevance and practical nature of O.R. research, and to foster discussion between academics and practitioners, particularly those unfamiliar with O.R. problem solving techniques.

Sunday, November 13

10:00am-11:30am
Track SB29
Hilton - 4th Floor, Union Square 23

Joint Session: JFIG Research Clinic – Operations Management with Weather Forecasts
Eva Regnier, Naval Postgraduate School; Tuell Green, Michael Petrie, Ron Sznaider, David Titley

1:30pm-3:00pm
Track SC29
Hilton - 4th Floor, Union Square 23

Joint Session: QSR Research Clinic – Quality and Statistics in Healthcare Modeling and Decision Making
Harriet Black Nembhard, The Pennsylvania State University; Christopher Hollenbeak, Julie Simmons Ivy, Elissa Ozanne, Scott Ransom

4:30pm-6:00pm
Track SD30
Hilton - 4th Floor, Union Square 24

Joint Session: Revenue Management Research Clinic – Pricing for Computer Distributors
Harun Ahmet Kuyumcu, Zilliant, Inc.; Massoud Ashrafi, Guillermo Gallego, Anton Kleywegt, Garrett van Ryzin

Monday, November 14

1:30pm-3:00pm
Track MC18
Hilton - 4th Floor, Union Square 12

Joint Session: Aviation Applications Research Clinic – Experts' Perspectives on Aviation
Diego Klabjan, University of Illinois at Urbana-Champaign; Eric Anderson, Norm Fujisaki

1:30pm-3:00pm
Track MC49
Renaissance - 4th Floor, Medici

Joint Session: Decision Analysis Research Clinic – Decision Analysis in Portfolio Management and Capital Budgeting
Jeffrey Keisler, University of Massachusetts Boston; Roger Burk, Craig Kirkwood, Jack Kloeber, James Matheson, Miley Merkhofer, James Smith

Tuesday, November 15

Track TC50
Renaissance – 4th Floor, Cervantes

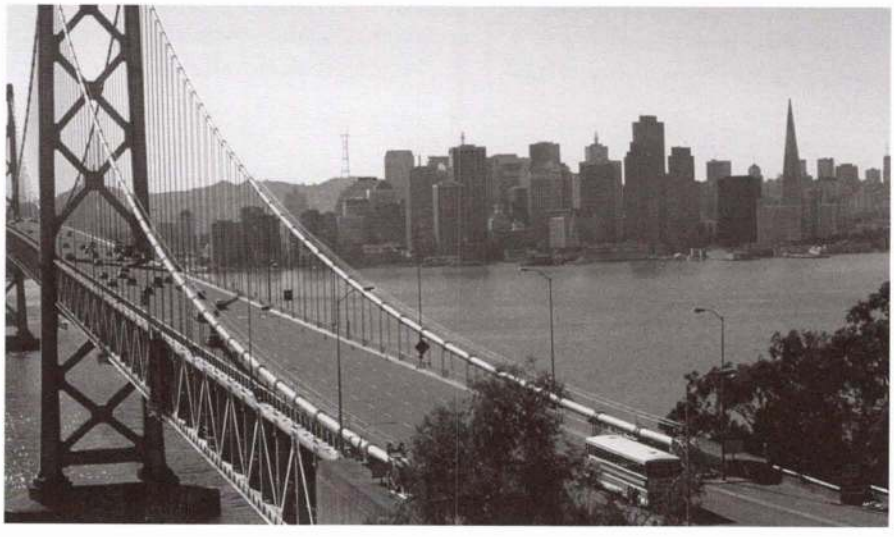
The Future of Decision Analysis Research
Jason Merrick, Virginia Commonwealth University; Bob Clemen, L. Robin Keller, Howard Kunreuther, Jacqueline Meszaros, Larry Phillips

HISTORY OF OR/MS

Tuesday, November 15
10:00am-11:30am
Track TB39
Renaissance – 3rd Floor, Aragon

Learn more about the history of OR/MS in this special session featuring four presentations sponsored by the History and Traditions Committee of INFORMS, including:

- Reflections on an Annotated Timeline of Operations Research
- British Military O.R. after 1945
- The Case of O.R. in Germany (1955-2005)
- The Dawn of Production Control in the Early 19th Century



IFORS DISTINGUISHED LECTURE

Sunday, November 13
11:40am-12:30pm
Hilton-Ballroom Level, Continental Ballroom 5

Closed-Loop Supply Chains: Past, Present and Future

Luk N. Van Wassenhove
The Henry Ford Chaired Professor of Manufacturing, Professor of Operations Management
INSEAD

In this presentation we focus on product recovery as a viable business proposition, the premise being that if we can design a profitable business model, companies will engage in reuse. This would help divert products from landfills without too much need for strict legislation. The presentation is not dealing with environmental issues or end-of-life recycling. It is a mixture of problem motivation using industrial examples; an illustration of the power of simple O.R. modelling to resolve design as well as tactical/operational problems, an overview and critique of the literature, and a look into the research needs for the future. The presentation is aimed at a general audience and represents the personal views of the speaker (i.e., it is heavily biased).



Luk Van Wassenhove holds the Henry Ford Chaired Professor of Manufacturing at INSEAD. Before joining INSEAD, he was on the faculty at Erasmus University and at the Katholieke Universiteit Leuven. His research and teaching are concerned with operational excellence, supply chain management, quality, continual improvement and learning. His recent research focus is on closed-loop supply chains (product take-back and end-of-life issues) and on disaster management (humanitarian logistics). He is departmental editor for *Production and Operations Management* and associate editor for *Technology and Operations Review* and *International Journal of Production Economics*. He publishes extensively in *Management Science, Operations Research, The International Journal of Production Research, The European Journal of Operations Research* and in many other academic as well as management journals (*Harvard Business Review, California Management Review*). He is the author of several books and many teaching cases and regularly consults for major international corporations.

OMEGA RHO DISTINGUISHED LECTURE

Sunday, November 13
3:10pm-4:00pm
Hilton-Ballroom Level, Continental Ballroom 5

Creating Sustainable Value

Stuart L. Hart
S. C. Johnson Professor of Sustainable Global Enterprise
S. C. Johnson Graduate School of Management
Cornell University

Just as the creation of shareholder value requires performance on multiple dimensions, the global challenges associated with sustainable development are also multifaceted, involving economic, social and environmental concerns. Indeed, these challenges have implications for virtually every aspect of a firm's strategy and business model, including its technology and R&D agendas. Yet, most managers frame sustainable development not as a multidimensional opportunity, but rather as a one-dimensional nuisance, involving regulations, added cost and liability. This leaves firms ill equipped to deal with the issue in a strategic manner. Accordingly, in this presentation I develop a sustainable value framework that links the challenges of global sustainability to the creation of shareholder value by the firm. Specifically, I show how the global challenges associated with sustainable development, viewed through the appropriate set of business lenses, can help to identify strategies and practices that contribute to a more sustainable world while simultaneously driving shareholder value; this I define as the creation of sustainable value by the firm.



Stuart L. Hart is one of the world's top authorities on the implications of sustainable development and environmentalism for business strategy. Before coming to the Johnson School, he taught strategic management and founded both the Center for Sustainable Enterprise (CSE) at the University of North Carolina's Kenan-Flagler Business School, and the Corporate Environmental Management Program (CEMP) at the University of Michigan. He has consulted or served as management educator for many corporations and organizations throughout the world. Hart has published over 50 papers and authored or edited five books. He wrote the seminal article "Beyond Greening: Strategies for a Sustainable World", which won the McKinsey Award for Best Article in *Harvard Business Review* in 1997 and helped launch the movement for corporate sustainability. With C.K. Prahalad, Hart also wrote the path breaking 2002 article "The Fortune at the Bottom of the Pyramid", which provided the first articulation of how business could profitably serve the needs of the four billion poor in the developing world. Dr. Hart is also the author of *Capitalism at the Crossroads: The Unlimited Business Opportunities in Solving the World's Most Difficult Problems* (Wharton School Publishing).

OMEGA RHO

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

Honorary Membership in Omega Rho is bestowed upon individuals who provide leadership and extraordinary support for the encouragement of operations research and management science through their professional activities. Prior to delivering the Omega Rho Distinguished Lecture, Stuart L. Hart will be inducted as the 39th Honorary Member of Omega Rho.

INFORMS WELCOME & AWARDS CEREMONY

Monday – 11:40am-12:30pm
H-Ballroom Level, Continental Ballroom 5

PLENARY & KEYNOTE PRESENTATIONS

PHILIP MCCORD MORSE LECTURE

Monday, November 14
3:10pm-4:00pm
Hilton-Ballroom Level, Continental Ballroom 5

An O.R. Missionary's Visits to the Criminal Justice System

Alfred Blumstein
University Professor and J. Erik Jonsson Professor of Urban Systems and Operations Research
H. John Heinz III School of Public Policy and Management
Carnegie Mellon University

Just as Phil Morse was a missionary bringing O.R. to military operations, my task as INFORMS' Morse Lecturer is to review some of the insights that an O.R. professional can bring to one of society's most important and complex systems – the criminal justice system that is charged with dealing with crime and criminals. That system is much more often driven by ideological rather than rational or analytical considerations. I intend to link analysis of the flow of offenders through the criminal justice system including their recidivist feedback, the modeling of individual criminal careers, analysis of the incapacitation effects of incarceration, factors contributing to the dramatic growth of incarceration in the U.S. over the past 30 years, understanding the racial disproportionality of prison populations, examination of the drug war and its unintended consequences increasing the rate of violence, and an analysis of factors contributing to the crime drop of the 1990s.



Alfred Blumstein is a University Professor and the J. Erik Jonsson Professor of Urban Systems and Operations Research and former Dean (1986-1993) at the H. John Heinz III School of Public Policy and Management at Carnegie Mellon University. He has been president of ORSA, TIMS, and INFORMS, VP of IFORS for NORAM, and also president of the American Society of Criminology. He is a member of the U.S. National Academy of Engineering. His research over the past twenty years has covered many aspects of criminal-justice phenomena and policy, including crime measurement, criminal careers, sentencing, deterrence and incapacitation, prison populations, demographic trends, juvenile violence and drug-enforcement policy.

Reprise Presentation
EDELMAN COMPETITION 2005 AWARD WINNER

Tuesday, November 15, 11:40am-12:30pm
Hilton-Ballroom Level, Continental Ballroom 5

Increasing Production Throughput at General Motors

Presenters:
Jeffrey M. Alden, Group Manager, General Motors

Jonathan H. Owen, Staff Research Engineer, GM

David J. Vander Veen, Executive Director, Global Manufacturing Systems Implementation for Product Development, General Motors

David S. Kim, Associate Professor, Industrial and Manufacturing Engineering, Oregon State University

Co-authors:
Lawrence D. Burns, Theodore Costy, Richard D. Hutton, Craig A. Jackson, Kevin A. Kohls, General Motors
Mark A. Turnquist, Cornell University

Predicting and improving production throughput performance is a significant challenge in the complex manufacturing environment of the automotive industry. Realizing the opportunity for productivity improvements throughout the company's manufacturing operations, a long-term project was initiated within General Motors Corporation in the late 1980s with the objective of providing GM a strategic competitive advantage through quantifying throughput performance and focusing improvement efforts in the design and operations of its manufacturing systems. This objective has been achieved through coordinated activities in three key areas: (1) algorithms for estimating throughput performance, identifying bottlenecks and optimizing buffer allocation, (2) real-time plant-floor data collection systems to support the algorithms, (3) common processes for identifying opportunities and implementing performance improvements. These activities have led to over $2.1 billion in documented savings and increased revenue in over 30 vehicle plants and 10 countries.

The Franz Edelman Award for Achievement in Operations Research and the Management Sciences calls out, recognizes and rewards outstanding, high-impact applications of OR/MS. Every year, six to seven finalists compete in the "Super Bowl" of O.R. in practice. The 2005 finalists included the Athens 2004 Olympic Games Organising Committee; Proctor & Gamble and CombineNet, Inc.; Swift & Company and Aspen Technology, Inc.; Eli Lily and Company; and Nanzan University.

KEYNOTE

Tuesday, November 15
11:40am-12:30pm
Hilton-Ballroom Level, Continental Ballroom 6

Big Can Be Beautiful: O.R. in a Large Class

Erhan Erkut
Dean of the Faculty of Business Administration
Bilkent University

Many professors resent and resist teaching large classes. They assume the idea is to "stack'em deep, teach'em cheap." Increasing class sizes are typically considered to be a sign of deterioration in education. Dr. Erkut's experience at the University of Alberta is radically different. In the case of their introductory operations course, he and his colleagues transformed it from "the course from Hell taught by the Anti-Christ" to "the most rewarding course in the faculty." This was the result of a major course redesign that took place over several years. Large classes of 300+ students were an integral part of this transformation. In this talk, Dr. Erkut will describe how one can combine an engaging teaching style with in-class activities and aggressive use of technology to make a large class work better than a collection of small classes. Many of the techniques employed are transferable across countries, institutions, faculties, programs and class sizes. No matter what you teach, it is more than likely that you will walk away from this session with ideas on how to improve your own teaching.



Erhan Erkut is the Dean of the Faculty of Business Administration at Bilkent University in Ankara, Turkey. Before coming to Bilkent, he taught large introductory OR/MS courses in the School of Business at the University of Alberta, where he held the first University Chair in teaching. In recognition of his commitment to excellence in teaching, he received a Faculty Teaching Award in 1997, a University Teaching Award in 1998, a Canada-wide 3M Teaching Fellowship in 1999 and the INFORMS Prize for the Teaching of OR/MS Practice in 2004. Dr. Erkut is the founder and first president of INFORM-ED (INFORMS Forum on Education), and the Founding Editor-in-Chief of *INFORMS Transactions on Education*. He received his Ph.D. in Industrial Engineering from the University of Florida in 1986.

KEYNOTE

Tuesday, November 15
3:10pm-4:00pm
Hilton-Ballroom Level, Continental Ballroom 5

Extreme Makeover of the Edelman Competition: From Internally Distinguished to Externally Celebrated



Moderator:
Richard C. Larson, President, INFORMS; Co-Chair, Science-of-Better Committee; Professor, Massachusetts Institute of Technology

Panelists:
Philip Johnson, Consultant to the Science-of-Better Committee; President, Philip Johnson Associates

R. John Milne, Chair, 2006 Franz Edelman Award Committee; Senior Technical Staff Member, IBM

Irvin J. Lustig, Co-Chair, Science-of-Better Committee; Manager, Technical Services, ILOG, Inc.

By showcasing examples of outstanding O.R. practice, the Edelman competition has become a crown jewel of our profession. Should we tamper with this proven success? Come learn why the answer is yes. The panel will explain, and discuss with the audience, the exciting role envisioned for the Edelman competition in the INFORMS Science-of-Better program to market the profession. No significant change is planned in the competition itself. But the award ceremony and new related activities will be red-carpet affairs designed to attract attention outside the profession. Through means such as increased publicity, co-sponsors, special educational sessions and a gala award-presentation event, we will transform the competition to make it much better known among executives and leaders. May I have the envelope please? And the winner is ...

KEYNOTE

Tuesday, November 15
3:10pm-4:00pm
Hilton-Ballroom Level, Continental Ballroom 6

George Bernard Dantzig: An Unfinished Biography



1914-2005

Chair:
James J. Cochran, Assistant Professor, Department of Marketing and Analysis, Louisiana Tech University

Presenters:
John R. Birge, Jerry W. and Carol Lee Levin Professor of Operations Management, Graduate School of Business, University of Chicago

Richard W. Cottle, Professor Emeritus, Department of Management Science and Engineering, Stanford University

Saul I. Gass, Professor Emeritus, Decision and Information Technologies, Robert H. Smith School of Business, University of Maryland

Thomas L. Magnanti, Dean, School of Engineering, Massachusetts Institute of Technology

George Dantzig, a truly legendary figure in the history of operations research, passed away on May 13, 2005 at the age of 90. One of the most revered figures in the history of operations research, Professor Dantzig conceived the linear programming model and created the simplex method for solving it. He is widely acknowledged as the "father of linear programming," and is further recognized for his extraordinary broad and deep contributions to operations research. In this session, four of Professor Dantzig's most distinguished students deliver short panegyrics detailing his research, publications, and awards. The speakers will cover i) the early years, ii) his time at the RAND Corporation, iii) his academic life, and iv) the impact of his work. Join us as we celebrate the life and accomplishments of George Dantzig.

PLENARY

Wednesday, November 16
11:40am-12:30pm
Hilton-Grand Ballroom A

Mathematical Heroics: Working with Numb3rs

Gary A. Lorden
Professor of Mathematics, Caltech
Technical Advisor, *Numb3rs*

When Dr. Lorden was asked to become a technical advisor to a new CBS television show called "Numb3rs" and to help them tell stories about the heroic efforts of a math consultant, a young professor who works with his FBI agent brother to solve crimes, he had several questions: Is this going to be some sort of totally fake "TV math"? Is there going to be an opportunity to actually explain some mathematical methods? Will it be fun? Now, twenty-some episodes later, he can answer "yes" to two out of the three questions. Dr. Lorden will use clips from the episodes, stories of his work with them, and examples from his own experience as a consultant, to illustrate his new-found realization that doing math in the real world and in the television world are two surprisingly similar activities–even though one of them is quicker, sexier, and a lot more heroic.



Gary A. Lorden
Gary A. Lorden is Professor of Mathematics and department head at Caltech, where he has taught for 37 years, specializing in probability and statistics. He attended Caltech as an undergraduate and received his Ph.D. from Cornell University in 1966. Dr. Lorden has been active as a mathematical and statistical consultant throughout his career, and has used his experience with real-world problems to motivate his research and teaching. None of this prepared him fully for the challenge of teaching writers and actors how to portray mathematical consulting on television! But he has enjoyed learning with them.

NEW Applications NEW Theory NEW Models NEW Directions

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of Operations Research

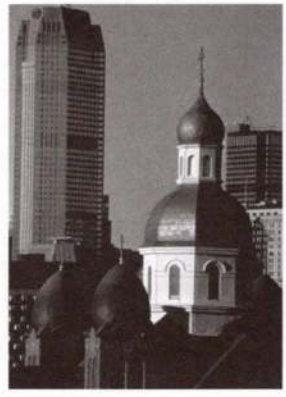


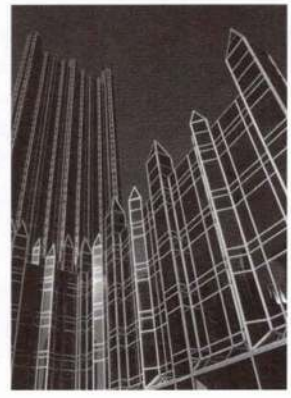
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INFORMS ANNUAL MEETING PITTSBURGH 2006

November 5-8, 2006
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Hilton-Lobby Level, Plaza A

SUNDAY NOVEMBER 13

■ SA01
8:00am-9:30am
Decision Analysis = Decision Engineering *
James Matheson, SmartOrg, Inc.

Decision analysis is an engineering approach to helping decision makers reach rational decisions. It incorporates systems engineering and decision theory to build value-based models and carry out computations needed to deal with complexity, uncertainty and dynamics, as well as the processes for reaching good decisions with real people and gaining their commitment to carry them out. Decision analysis is a discipline with underlying principles and procedures adaptable to diverse situations.

■ SB01
10:00am-11:30am
Transforming Railroads Through Cutting-Edge Operations Research *
Ravindra Ahuja and Guvenc Sahin, University of Florida, Claudio Cunha, University of Sao Paulo

The past few decades have witnessed numerous applications of operations research in logistics. However, the US railroad industry has not benefited from the advances. This tutorial describes cutting-edge operations research algorithms that use state-of-the-art ideas from linear and integer programming, network flows, discrete optimization, heuristics and very large-scale neighborhood (VLSN) search, and demonstrates potential benefits from tens to hundreds of millions of dollars annually.

■ SC01
1:30pm-3:00pm
Useful Recent Trends in Simulation Methodology
Shane Henderson, Cornell University

This tutorial is aimed at experienced users of simulation who are curious about useful recent trends in simulation methodology. We will discuss, and probably argue about, the following topics.
1. Simulation optimization - how can we optimize a function that is evaluated by simulation?
2. Input uncertainty - what happens when some (most?) of the input distributions are only known approximately? 3. Dependence modeling - how can we model dependent random variables?

■ SD01
4:30pm-6:00pm
Therapeutic Optimization via Markov Decision Processes
Andrew Schaefer, University of Pittsburgh

Models that create patient-specific treatment plans, known as therapeutic optimization models, are becoming increasingly important. In this tutorial, we describe how an enormous number of such decisions occur in a stochastic and dynamic environment, and lend themselves naturally to Markov decision process (MDP) formulations. We discuss various questions that arise in applying MDPs to practical therapeutic optimization problems, such as parameter estimation and structural properties. Finally, we describe ways of developing research relationships with clinicians.

MONDAY, NOVEMBER 14

■ MA01
8:00am-9:30am
Attractive Formulations of Integer Programs
Warren Adams, Clemson University, and Richard Forrest, Dickinson College

The mathematical representation of a decision problem can greatly affect solution strategies. We discuss reformulation and linearization techniques for 0-1, nonlinear continuous and general discrete problems that can promote efficient optimization algorithms. Emphasis is given to program size and relaxation strength. General theoretical results will be provided, as well as detailed computational experience for a variety of problem classes.

■ MB01
10:00am-11:30am
An Introduction to Revenue Management *
Garrett van Ryzin, Columbia University, and Kalyan Talluri, Universitat Pompeu Fabra

Revenue management refers to the collection of strategies and tactics firms use to scientifically manage demand for their products and services. It has gained attention recently as one of the most successful application areas of operations research (OR). This tutorial provides an introduction to this increasingly important subfield of OR.

TutORials 2005
Ten of the tutorials presented in San Francisco (*) are published in *TutORials 2005*, as part of the INFORMS Tutorials in Operations Research Series. This volume is available in hard-copy book form and on CD. You can place your order at the INFORMS booth in the exhibit hall (booths 6 & 7). If you ordered *TutORials 2005* when you registered for the meeting, stop by the INFORMS Booth to pick up your copy.

■ MC01
1:30pm-3:00pm
Stochastic Programming: Optimization When Uncertainty Matters *
Julia Higle, University of Arizona

Since SP was first introduced in the 1950s, tremendous progress toward an understanding of properties of SP models and the design of algorithmic approaches for solving them has been made. As a result, SP is gaining recognition as a viable approach for large-scale models of decisions under uncertainty. In this tutorial, we present an introduction to stochastic programming models and methodology at a level that is intended to be accessible to the breadth of members within the INFORMS community.

■ MD01
4:30pm-6:00pm
Bi-level Models for Protecting Critical Infrastructure *
Kevin Wood, Naval Postgraduate School

We describe new bi-level programming models to (1) help make a country's critical infrastructure more resilient to attacks by terrorists, (2) help government and business plan necessary improvements and (3) help influence related public policy on regulations, investment incentives, etc. These models assume an intelligent attacker and defender, along with information transparency. We illustrate with applications to electric power grids, subways, airports and more.

TUTORIALS

TUESDAY, NOVEMBER 15

■ TA01
8:00am-9:30am
Active Learning in the OR Classroom *
James Cochran, Louisiana Tech University

This tutorial provides an overview of active learning for quantitative courses such as operations research, management science, production and operations management, probability and statistics. The potential risks and benefits of active learning exercises are discussed, types of active learning exercises are reviewed, and several interesting and creative active learning exercises are described and demonstrated.

■ TB01
10:00am-11:30am
Integrated Production and Demand Planning Models *
Joseph Geunes, Yasemin Merzifonluoglu, Edwin Romeijn, University of Florida, and Kevin Taaffe, Clemson University

Effective demand planning has recently become recognized as an important source of competitive advantage from an operations perspective. A variety of planning and design contexts involve a supply chain stage selecting a subset of demands (either through pricing or explicit order acceptance/rejection) from a collection of potential downstream demands. This tutorial discusses optimization models for addressing degrees of demand selection flexibility in integrated production and demand planning.

■ TC01
1:30pm-3:00pm
Solving Difficult Optimization and Counting Problems via the Cross-Entropy Method
Dirk Kroese, The University of Queensland

In this tutorial, we give a gentle introduction to the cross-entropy method, emphasizing its simplicity and effectiveness in solving difficult combinatorial optimization and counting problems. Examples are #P-complete problems such as counting the total number of Hamilton cycles, determining the permanent of a matrix, and computing the number of self-avoiding random walks. We demonstrate that the CE method provides an important advancement in these types of problems.

■ TD01
4:30pm-6:00pm
Branch and Tree Decomposition Techniques for Discrete Optimization *
Illya Hicks, Texas A&M University, and Arie Koster, Zuse Institute Berlin

This tutorial gives a general overview of two emerging techniques for discrete optimization: branch decompositions and tree decompositions. We will discuss basic definitions, the Graph Minors Theorem, algorithms for constructing the decompositions and how to utilize branch decompositions and tree decompositions in a practical setting for solving NP-hard problems such as domination, the traveling salesman problem, general minor containment, and frequency assignment problems.

WEDNESDAY, NOVEMBER 16

■ WA01
8:00am-9:30am
Adaptive Memory Programming: A Key to Breakthroughs for Solving Hard Problems
Cesar Rego, University of Mississippi

The concept of adaptive memory coupled with advances in neighborhood structures derived from dynamic and adaptive search constructions has been the source of numerous important developments in metaheuristic optimization throughout the last decade. These innovations have been the key to the most successful results in a wide range of applications in business, industry and life sciences. This talk will review some of these major advances and discuss potential directions for future developments.

■ WB01
10:00am-11:30am
Stochastic Dynamic Optimization with Model Uncertainty and Learning
George Shanthikumar and Andrew Lim, University of California, Berkeley

In stochastic optimization, it is customary to assume that a full probabilistic characterization is known. In reality, only an estimate of the probabilistic characterization is known. We will demonstrate that this can lead to inefficient solution to the real problem. We will discuss the formulation of such problems by a collection of models and solve it to obtain robust solutions. We will develop robust formulations to inventory control, revenue management, and portfolio selection with and without benchmarked objectives. Notions of learning under model uncertainty will be discussed.

■ WC01
1:30pm-3:00pm
The COIN-OR Branch and Cut Solver *
Robin Lougee-Heimer, IBM Research, T.J. Watson Research Center

The Computational Infrastructure for Operations Research (COIN-OR) Branch and Cut solver (CBC) is an open-source mixed-integer program solver. CBC provides operations research professionals with a well-tested, robust, re-useable code base for experimenting with advanced customizations of branch-and-cut algorithms. This tutorial introduces CBC, and illustrates how to implement a variety of common branch-and-cut customizations in CBC.

■ WD01
3:30-5:00
Empirical Versus Optimal Decision-Making in Sequential Search Problems *
Neil Bearden, Duke University, and Amnon Rapoport, University of Arizona

This tutorial reviews some of the uses of operations research (OR) methods in experimental psychology. We begin by describing some basic methodological issues that arise in the study of human decision-making. Next, we describe research in experimental psychology that uses methods common to OR (e.g., dynamic programming) to understand sequential observation and selection behavior. We then suggest ways in which experimental psychology and OR can each provide the other with new research questions.

Ten of these tutorials (*) are published by INFORMS. The book and CD are available for purchase at the INFORMS booths 6 & 7 in the Exhibit Hall.

MONDAY AND TUESDAY

12:30pm-1:30pm
Hilton – Grand Ballroom

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

MONDAY, NOVEMBER 14

The Harmonic Consistency Index
William Stein, Texas A&M University; Philip Mizzi

Gene Expression for Improved Solution Representation
Srinivasan Anandan, Clemson University

Demand Source Selection for a Risk-Averse Newsvendor
Deepak Tirumalasetty, Clemson University; Kevin Taaffe

An SDP Decision Model for Cost-Minimization of Erosion Control on Logging Roads
Matthew Thompson, Oregon State University; William Baxter, Teresa Ish, David Tomberlin

A Software Architecture for Manufacturing Systems Modeling and Analysis at GM
Craig Jackson, General Motors Corporation; Jonathan H. Owen

CO2 Price Dynamics: The Implication of EU Emission Trading on the Price of Electricity
Yihsu Chen, Johns Hopkins University; Benjamin Hobbs, Wietze Lise, Jos Sijm

Optimizing Oil Cargo Heating Practices
Ian Fichtenbaum, University of British Columbia; Jack Chong, Eric Cope, Neda Salehirad

The Effect of Reputation on the Strategic Interaction and Optimal Valuations of Real Estate Agents
Hilde Patron, Louisiana Tech; Kenneth Roskelley

Decentralized Algorithms for Search and Routing in Sensor Networks
Hari Prasad Thadakamalla, The Pennsylvania State University

Comparing Simulation Efficiency for Discrete Power Series Distributions with Their Finitized Counterparts
James Cochran, Louisiana Tech University; Saeed Golnabi

Ski Industry Pricing: Daily Tickets Versus Season Passes
Eric Huggins, Fort Lewis College; Michael Fry

Community Bus Maintenance Strategy
Ryan Quee, University of British Columbia; Ximena Cerda Salzmann, Mats Gerschman, Jeff Kroeker, Shanshan Wang

Economic versus Statistical Inference: Asset Return Predictability
Kenneth Roskelley, Louisiana Tech University

CUSUM Control Charts for Monitoring Auto-Correlated Binary Observations
Shabnam Mousavi, Penn State University; Marion R. Reynolds

TUESDAY, NOVEMBER 15

Coordination of Marketing and Production for Price and Lead-Time Decisions
Pelin Pekgun, Georgia Institute of Technology; Paul Griffin, Pinar Keskinocak

Identifying Leading Indicators for Workers' Injury Rate
Mingming Lu, McMaster University; Zhong Liu, Shanshan Wang, Anming Zhang

The Missing Piece in Multimedia Tutorials for Spreadsheet Modeling
Linda Leon, Loyola Marymount University; Kala C. Seal

Using Simulation as Decision Tool for Capacity Planning at a Heart Investigations Unit
Lei Wang, University of Minnesota; Amiram Gafni, Diwakar Gupta, Madhu Natarajan, Salim Yusuf

Optimal Income Taxation with Multidimensional Taxpayer Types
Che-Lin Su, Northwestern University; Kenneth Judd

Allocating Funds to HIV Interventions in Sub-Saharan Africa: How Many Lives Could You Save?
Arielle Lasry, University of Toronto; Michael Carter, Hui Zhang

Djinni: A C++ Framework for Heuristic Optimization
Jeffrey Ohlmann, University of Iowa; Robert Hansen, Barrett Thomas

Employment Protection and Labour Market Demand
Jussi Keppo, University of Michigan; Tim Maull

A Parallel Algorithm for Coordinated Traffic Signal Control and Dynamic Route Guidance
Shih-Fen Cheng, University of Michigan; Marina Epelman, Robert Smith

Experiments with the RAMP Approach on Solving the Capacitated Minimum Spanning Tree Problem
Frank Mathew, University of Mississippi; Fred Glover, Cesar Rego

A General Queuing Network Model to Optimize Refurbishing Policies for Returned Products
Jumpol Vorasayan, Iowa State University; Sarah Ryan

Optimization of Production Allocation and Transshipment for a Leading Canadian Forest Products Company
Mehmet Aydinel, University of British Columbia; Eric Cope, Mats Gerschman, Ximena Cerda Salzmann, Taraneh Sowlati, Qing Wu

Heuristic and Exact Techniques for Solving a Temperature Estimation Model
Darrall Henderson, United States Military Academy; Al Ortega, Cole Smith

Integrated Reconfiguration and Age-Based Preventive Maintenance Policy
Jing Zhou, University of Michigan; Dragan Djurdjanovic, Julie Ivy, Jun Ni

Simulation of Healthcare Facilities
Christos Alexopoulos, Georgia Tech; David Goldsman, John Fontanesi

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Hilton – 4th Floor, Union Square 5

SUNDAY, NOVEMBER 13

■ SA13
8:00am-9:30pm
Advantage for Analysts
Mahmut Karayel
advantage@AdvantageForAnalysts.com
Dennis Moritz
dennis@AdvantageForAnalysts.com

Advantage for Analysts™ Tames Complexity and Eases Optimization
See how Advantage for Analysts™ software helps you build complex financial models faster and more accurately. Relationships can be created and changed graphically, similar to drawing on a white board. The intuitive formula language seamlessly integrates linear and integer optimization and advanced search methods. Learn more at www.AdvantageForAnalysts.com.

■ SB13
10:00am–10:45am
StatPoint, Inc.
Neil Polhemus, neil@statgraphics.com

Statistical Analysis Using STATGRAPHICS Centurion XV
Dr. Polhemus will demonstrate the capabilities of STATGRAPHICS Centurion XV, the most powerful and intuitive statistical software available for Windows. The session will illustrate the trademark tools that are designed for anyone who wishes to do serious data analysis without investing weeks learning how to use a statistical package, and will include performing statistical analyses such as time series analysis and automatic forecasting.

10:45am-11:30am
Business Simulations
David A. Jordan, dave@bussim-ed.com

Business Simulations for Manufacturing and Operations Management
In this session three simulations will be overviewed, including an Operations Management, a Manufacturing Management and a Transportation/ Supply Chain Management Simulation. These simulations are intended for use by instructors who want applications based teaching tools to accompany text materials. These simulations are downloadable from our website.

■ SC13
1:30pm–2:15pm
Maximal Software, Inc.
Bjarni Kristjansson
bjarni@maximalsoftware.com

Introducing the New Release 5.0 of MPL Modeling System for Optimization
We will be demonstrating the newest release of MPL, one of the fastest and most scalable modeling languages on the market today. The innovative OptiMax 2000 Component Library, which allows MPL models to be easily embedded into end-user applications, has been augmented to include several new objects and methods. Several new solvers (COIN, GLPK, LGO, PATH) have been added and existing solvers updated (CPLEX, XPRESS, XA, CONOPT). Data access has been improved with new native drivers (ORACLE, SAP) and offers now full XML/SOAP support for Internet connectivity.

2:15pm–3:00pm
AMPL Optimization LLC
Robert Fourer, 4er@ampl.com

A Practical Guide to Acquiring AMPL® for Applications in Large-Scale Optimization
AMPL has set the standard for an optimization modeling language that handles complex models naturally and large models efficiently. As a result it is available from many more sources and for many more solvers than competing products. Bob Fourer, AMPL's co-developer, will give a quick but lucid tour of the current state of AMPL, with emphasis on the practical issues that come up in deciding to purchase an algebraic modeling language. Topics will include 64-bit versions, AMPL's new extra-flexible floating license manager, the AMPL Studio graphical interface and COM objects for Windows, and the range of AMPL/solver packages and distributors.

■ SD13
4:30pm–5:15pm
Lumina Decision Systems, Inc.
Max Henrion, henrion@lumina.com

Analytica: Beyond the Spreadsheet
A rare chance to see Analytica demonstrated by its originator: users prefer Analytica to spreadsheets because of its transparency, flexibility for multiple dimensions, efficient Monte Carlo, scalability and its powerful new Optimizer. Analytica models are typically 10 to 100 times more compact than equivalent spreadsheets, and correspondingly easier to build, understand and audit.

MONDAY, NOVEMBER 14

■ MA13
8:00am–8:45am
Palisade Corporation
Shawn Harahush, sharahush@palisade.com

Overview of Excel Add-Ins
DecisionTools, StatTools, NeuralTools and more... We will give an overview of the many Palisade Excel add-ins: @RISK, StatTools, and the newly released NeuralTools. @RISK uses Monte Carlo simulation to show you 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. NeuralTools is the latest add-in technology that gives the user an easy-to-use neural networks tool for spreadsheets, no prior knowledge of neural networks necessary for application. Come see for yourself!

8:45am–9:30am
Imagine That, Inc.
Dave Krahl, davek@imaginethatinc.com

Simulation with Extend
Based on close collaboration with leading universities, government agencies and corporations, Extend continues to revolutionize the simulation field. Extend's sophisticated simulation engine provides the ease of use, quick turnaround, and interactivity desired by new modelers and the scalability and robustness required for large-scale, complex systems. Extend... the simulation software of choice.

■ MB13
10:00am-10:45am
Frontline Systems, Inc.
Daniel H. Fylstra, dfylstra@frontsys.com

Rapid Application Development with Solver Platform SDK
With Frontline's new Solver Platform SDK, you can rapidly develop and deploy applications using optimization and Monte Carlo simulation, in C#, VB.NET, Java, MATLAB, C/C++ and Visual Basic. Watch us create a Web application in minutes, with Wizards and IntelliSense in Microsoft Visual Studio. Solve huge models with world-class speed.



SOFTWARE DEMONSTRATIONS

10:45am-11:30am
AIMMS
A Product of Paragon Decision Technology B.V.
Marcel Roelofs, marcel.roelofs@paragon.nl

AIMMS in Real-Life, Large-Scale Production Environments
In this demonstration we will show how AIMMS is much more than just a prototyping tool for optimization applications. Based on real-life scenarios we will demonstrate the advanced features of AIMMS that allow AIMMS-based solutions to be the optimization engine at the heart of large-scale industrial production systems.

■ MC13
1:30pm–2:15pm
GAMS Development Corp.
Michael Bussieck, mbussieck@gams.com
Steve Dirkse, steve@gams.com

The General Algebraic Modeling System
The General Algebraic Modeling System (GAMS) is a commercial modeling system for mathematical programming problems. In this presentation we will combine new and old GAMS features that demonstrate how rapidly complex applications can be put together. GAMS even meets challenging requirements posed by grid computing environments and massive computational demands.

2:15pm–3:00pm
LINDO Systems, Inc.
Mark Wiley, mwiley@lindo.com

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

■ MD13
4:30pm–5:15pm
SAS Institute, Inc.
Ed Hughes, ed.hughes@sas.com

Introducing OPTMODEL, the New Face of SAS Optimization
OPTMODEL, the new SAS algebraic and symbolic optimization modeling language, delivers a quantum leap in accessibility, clarity and power for SAS optimization. As part of the SAS language, OPTMODEL enables you to build and solve optimization models easily and directly and still take advantage of SAS' full suite of analytic capabilities.

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

TreeNet/MART: A State-of-the-Art Approach for Building Predictive Models in Data Mining
Salford Systems will demo TreeNet/MART, Stanford University Jerome Friedman's new advance to classification and regression trees. TreeNet enables the modeler to construct predictive models of extraordinary accuracy. Models are built up gradually through a large collection of small trees, each of which improves on its predecessors through an error-correcting strategy.

TUESDAY, NOVEMBER 15

■ TA13
8:00am–8:45am
Syncopation Software
Chris Dalton, cdalton@syncopationsoftware.com

From Project to Portfolio Analysis
See how easy it is to use DPL to develop a full decision analysis from a cash flow spreadsheet. The demonstration covers decision trees, influence diagrams and sensitivity analyses. A preview of DPL's portfolio capabilities will also be demonstrated from defining a portfolio in DPL to risk/reward and productivity ratio charts.

8:45am–9:30am
Dash Optimization
Nitin Verma, nitin.verma@dashoptimization.com
Horia Tipi, horia.tipi@dashoptimization.com

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

■ TB13
10:00am–10:45am
Responsive Learning Technologies, Inc.
Sam Wood, wood@responsive.net

An Award-Winning Online Game to Teach Operations
Littlefield Technologies is a competitive factory simulator developed at Stanford University. It has been successfully used at dozens of universities to improve student enthusiasm and understanding of traditional operations topics like capacity management, lead time management and inventory control. It is very easy to learn and displaces minimal lecture time.

10:45am–11:30am
MINITAB, Inc.
David McClelland, dmcclelland@minitab.com

MINITAB 14
MINITAB® Release 14 is the leading statistical software package used in education. More than 4,000 colleges, universities and high schools worldwide choose MINITAB because it: contains all the methods students need and is easy to learn and use; parallels the approach used in virtually all the leading textbooks, making it compatible with any curriculum; produces stunning graphs that are simple to make, edit and update; is used by thousands of distinguished companies students will want to work for, including GE, 3M, Toshiba, Bank of America and Ford. Free demo: www.minitab.com/minitab14.

■ TC13
1:30pm–2:15pm
ILOG, Inc.
Irv Lustig, ilustig@ilog.com

New ILOG OPL Development Studio 4 and Special Inside Preview of the Next CPLEX
Join Irv Lustig, and members of the R&D team, to see the new ILOG OPL Development Studio 4 - The fastest way to develop, tune and deploy CPLEX-based optimization models. This session will also include a special inside preview of the upcoming new CPLEX. Simply incomparable. Come see why.

2:15pm–3:00pm
Decisioneering, Inc.
Larry Goldman, lgoldman@crystalball.com

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

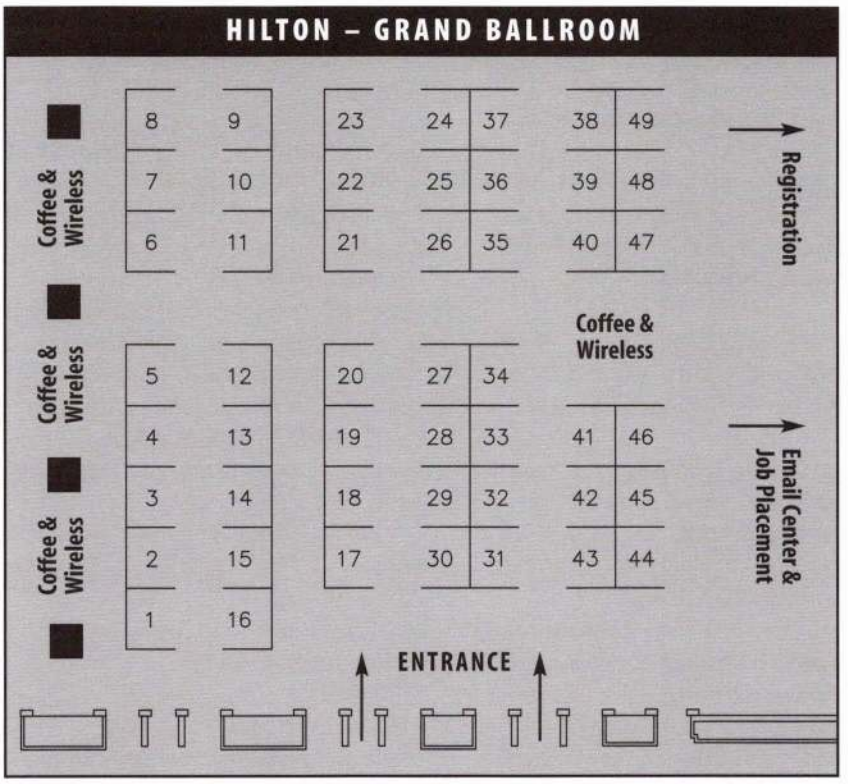
■ TD13
4:30pm–5:15pm
AdapChain, Inc.
Svenne Juul, sjuul@adapchain.com

Using AdapLink to Connect Supply Chain Data to Supply Chain Optimization
Commerce is full of supply chain problems and the marketplace offers a wide variety of software designed to solve these problems. Unfortunately, many implementation projects suffer under the burden of integrating the application with the data. AdapLink is designed to provide a cost effective solution for that specific problem.

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

Exhibits Open:

Sunday, Nov. 13,	12:00pm-5:00pm
	7:30pm-9:00pm
Monday, Nov. 14,	9:00am-5:00pm
Tuesday, Nov. 15,	9:00am-5:00pm



AdapChain, Inc. **Booth # 48**
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West Chester, PA 19382
610-470-3879
www.adapchain.com
AdapChain is a supply chain solutions company. We don't build the optimization engine; we connect it to your data. We accomplish this by partnering with our customers and other suppliers in assessing, designing, enhancing, implementing, integrating and supporting new or existing supply chain solutions

Advantage for Analysts LLC **Booths # 18, 19**
2 Harrison St., 6th Fl.
San Francisco, CA 94105
415-267-1551
www.advantageforanalysts.com
See how Advantage for Analysts™ software helps you build complex financial models faster and more accurately. Relationships can be created and changed graphically, similar to drawing on a white board. The intuitive formula language seamlessly integrates linear and integer optimization and advanced search methods. Learn more at www.AdvantageForAnalysts.com.

AIMMS **Booth # 17**
A Product of Paragon Decision Technology B.V.
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www.aimms.com
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Go to www.aimms.com for more information and a free trial copy of AIMMS.

AMPL Optimization LLC **Booth # 5**
900 Sierra Place SE
Albuquerque, NM 87108-3379
847-846-8486
www.ampl.com
AMPL Optimization LLC develops and supports the AMPL modeling language, and distributes several large-scale solvers including Ziena Optimization's KNITRO, ARKI Development's CONOPT, and OptiRisk Systems' FortMP/QP/SP and SAMPL/SPInE. Over 30 other solvers work with AMPL, as do the AMPL Studio graphical interface and Windows COM objects developed by OptiRisk Systems.

The Bionetics Corporation **Booth # 38**
2001 Jefferson Davis Hwy., #1211
Arlington, VA 22202-3619
703-412-2800
www.ketronms.com
KMS Optimization Products specializes in design, development and application of mathematical programming optimizers and model management software. The software is used as an optimization toolkit by analysts in every sector of the economy. KMS also provides support for users of the software: support ranges from hotline assistance through complete application-system development.

Business Simulations **Booth # 39**
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Beaver Falls, PA 15010
724-847-1339
www.bussim-ed.com
BusSim is an integrated business instruction system designed to help students understand the complex set of decisions made by business practitioners. These active-learning programs provide hands-on training in all the functional areas of business. Featured at this conference are specialized programs in Operations/Manufacturing Management and Transportation and Supply Chain Management.

EXHIBITORS

COIN-OR **Booth # 23**
www.coin-or.org
Visit the Computational Infrastructure for Operations Research booth to learn about free, open-source tools for O.R. professionals and students. COIN-OR is celebrating its fifth year as a community initiative to build an open infrastructure of algorithms, models, data and other digital tools. COIN-OR is hosted on-line by INFORMS.

Combined Book Display **Booth # 8**
Review titles and special offers from EDP Sciences and MIT Center for Transportation & Logistics.

Darden Business Publishing **Booth # 12**
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Charlottesville, VA 22903
800-246-3367
www.dardenpublishing.com
Darden Business Publishing will be featuring a strong portfolio of business-education materials that make use of the technology available to the contemporary classroom. From text and multimedia case studies to simulations, videos and e-learning products, Darden's quality, classroom-tested products will enhance your teaching presentation and engage your students.

Dash Optimization **Booth # 49**
560 Sylvan Ave.
Englewood Cliffs, NJ 07632
201-567-9445
www.dashoptimization.com
Dash Optimization develops and markets Xpress-MP, the world's leading software product for modeling and optimization. The booth will feature live demonstrations of Dash's Xpress-MP products. Dash offers linear, mixed integer, quadratic, non-linear and stochastic programming capabilities. These components will be showcased along with Dash's modeling and programming language Mosel, Xpress-IVE development environment, and Xpress-Application Developer, Dash's new API for GUI development using Mosel.

Decisioneering, Inc. **Booth # 25**
1515 Arapahoe St., Ste. 1311
Denver, CO 80202
303-534-1515
www.crystalball.com
Crystal Ball® is a suite of Microsoft® Excel-based applications for Monte Carlo simulation, forecasting, optimization and real options analysis. Crystal Ball transforms your spreadsheets into dynamic models that solve almost any problem involving uncertainty, variability and risk. We provide software, training and consulting services to understand, communicate and manage risk.

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GAMS Development Corp. **Booth # 21**
1217 Potomac St. NW
Washington, DC 20007
202-342-0180
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 the user to build large maintainable models that can be adapted quickly to new situations.

ILOG, Inc. **Booth # 20**
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LINDO Systems will highlight recent enhancements to our optimization modeling software including updates to the linear, integer and global solvers. We will be demonstrating LINDO API, our powerful solver engine, LINGO, our integrated modeling language and solvers, and What'sBest!, our large scale Excel solver. Stop by for a free trial CD.

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In addition to its flagship Analytica line of software, about which *PC Week* said, "All the problems of the conventional PC spreadsheet are fixed in Analytica," Lumina offers rapid development of custom decision-support systems, and a unique service to audit and verify mission-critical spreadsheets.

Maximal Software, Inc. **Booth # 40**
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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.

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

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Palisade Corp. **Booth # 35**
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www.palisade.com
Since 1984, Palisade Corporation has published software tools for risk analysis, decision analysis, optimization and data analysis. Palisade products include: @RISK, Evolver, RISKOptimizer, PrecisionTree, StatTools and the DecisionTools Suite. This year at INFORMS the company will demonstrate its newest product NeuralTools, the neural networks add-in for Excel.

EXHIBITORS

Planisware USA **Booth #4**
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SIAM **Booth # 13**
Society for Industrial and Applied Mathematics
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Philadelphia, PA 19104
215-382-9800
www.siam.org
Visit the SIAM booth to check out our new publications, including titles in the MPS-SIAM Series on Optimization. Peruse sample issues of SIAM's renowned journals, including SIOPT, and pick up SIAM membership information and applications. SIAM was organized in 1951 to advance the application of mathematics to science and industry.

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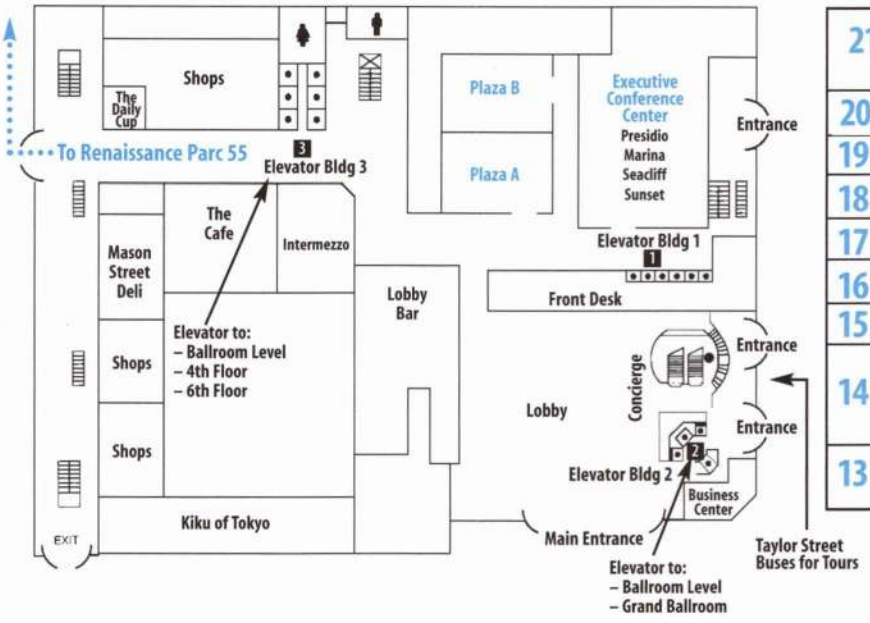
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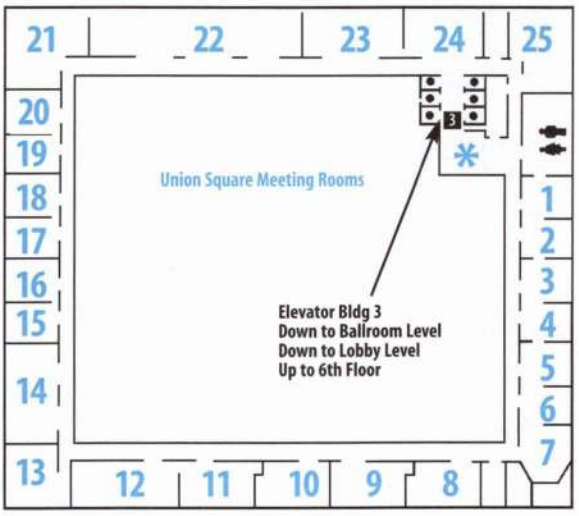
HILTON SAN FRANCISCO

✻ Session Monitor Desk

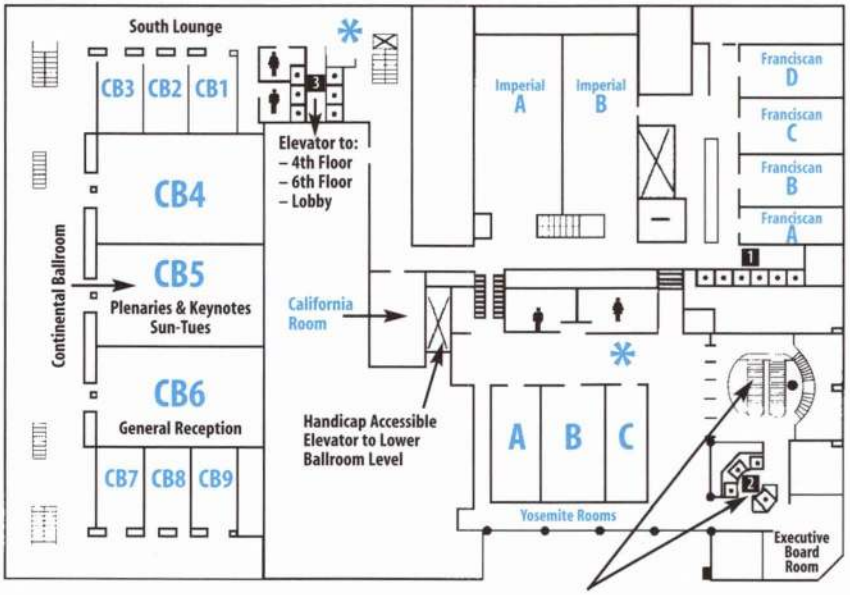
LOBBY LEVEL BUILDINGS 1,2 & 3



4TH FLOOR BUILDING 3



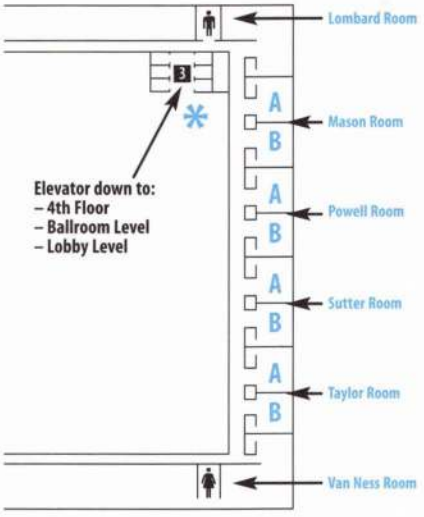
BALLROOM LEVEL BUILDINGS 1,2 & 3



Elevator & Escalator to Grand Ballroom:

- Registration
- Exhibits
- Email Center
- Job Placement
- Interactive Sessions
- Welcome Reception
- Coffee Breaks
- Program Information
- Speaker Ready Room

6TH FLOOR BUILDING 3

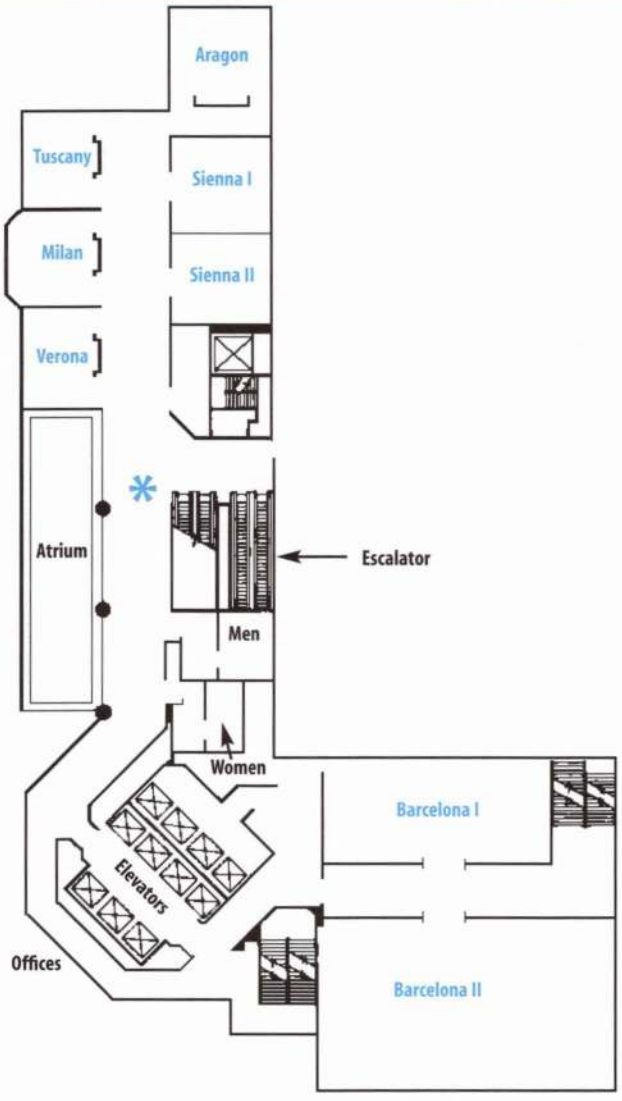


Bldg. 3 Elevators
Best access to meeting rooms on Lobby Level, Ballroom Level, 4th Floor, 6th Floor.

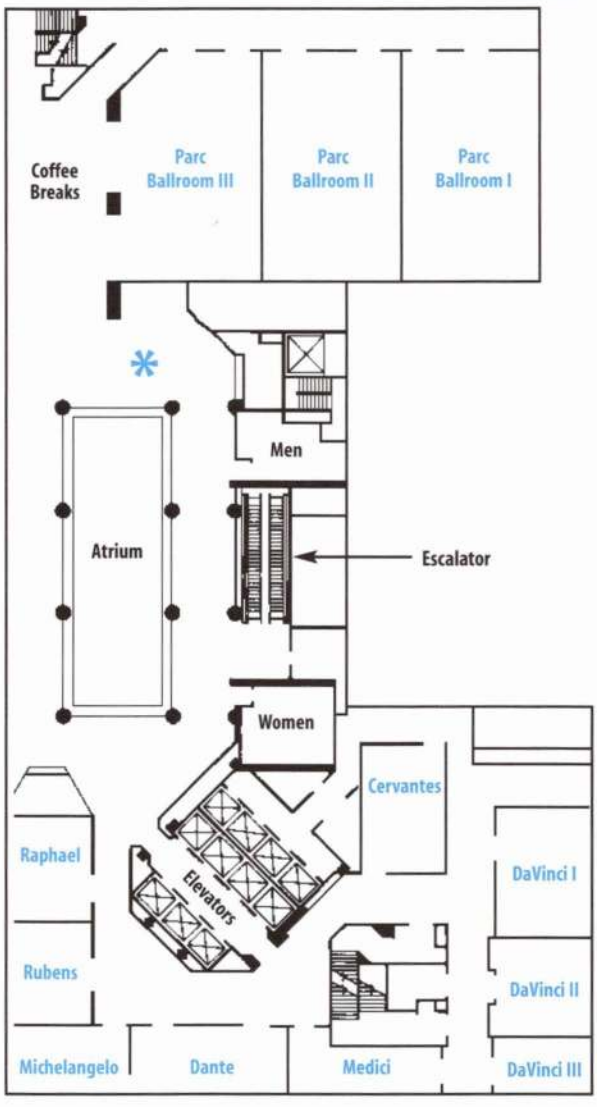
Bldg. 2 Elevators
Best access to Grand Ballroom.

✻ Session Monitor Desk

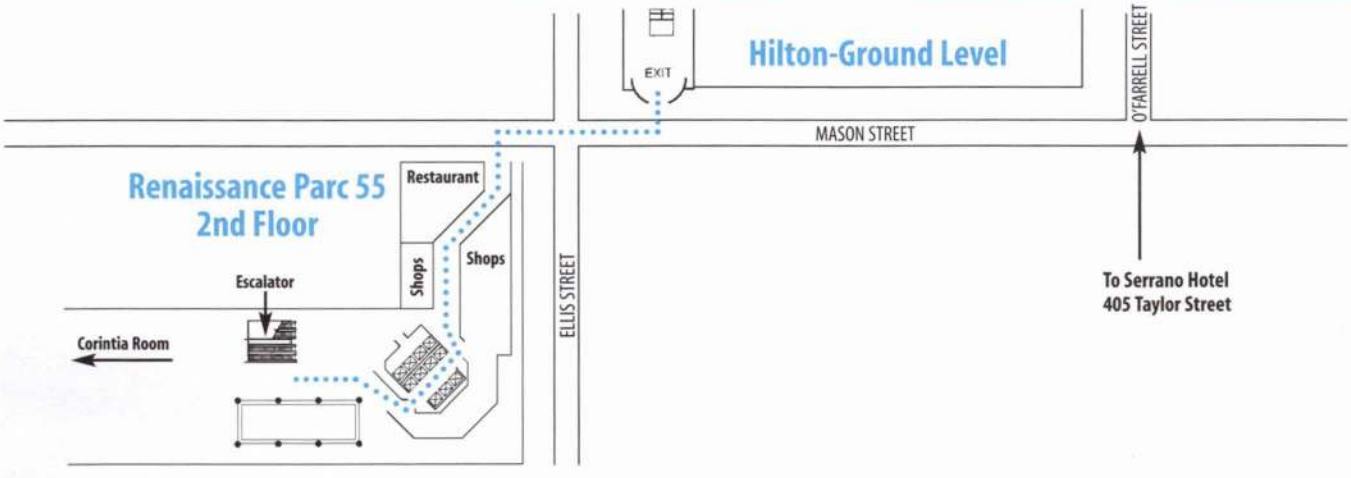
3RD FLOOR



4TH FLOOR



HILTON-RENAISSANCE CONNECTION



MASTER TRACK SCHEDULE– Sunday

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

Track	Room	SA 8:00-9:30	SB 10:00-11:30	Plenary 11:40-12:30	SC 1:30-3:00	Plenary 3:10-4:00	SD 4:30-6:00
1	H-Lobby Lev, Plaza A	Tutorial	Tutorial		Tutorial		Tutorial
2	H-Lobby Lev, Plaza B	Environment-Natural Resources	Environment-Natural Resources		Nicholson Student Paper Comp.		Nicholson Student Paper Comp.
3	H-Ballroom Lev, CB1	Education	Education		Education		Education
4		No Session	No Session		No Session		No Session
5	H-Ballroom Lev, CB3	Academic Job Search	Industry Job Search	IFORS Lecture	Service Industry	Omega Rho Lecture	Service Sector Ops.
6	H-Ballroom Lev, CB7	SPRIG-Spreadsheet Productivity Research Interest Group		Luk Van Wassenhove	SPRIG	Stuart Hart	SPRIG
7	H-Ball Lev, California	MSOM-Manufacturing & Service Oper. Mgmt.		Closed-Loop	MSOM	Creating	MSOM
8	H-Ball Lev, Imperial A	MSOM-Manufacturing & Service Oper. Mgmt.		Supply Chains	MSOM	Sustainable Value	MSOM
9	H-Ball Lev, Yosemite A	Supply Chain Management	Supply Chain Management	H-Ballroom Lev, CB 5	Supply Chain Management.	H-Ballroom Lev, CB 5	Supply Chain Management
10	H-Ball Lev, Yosemite B	Supply Chain Management	Supply Chain Management		Supply Chain Management.		Supply Chain Management
11	H-Ball Lev, Yosemite C	Supply Chain Management	Supply Chain Management		Supply Chain Management		Supply Chain Management
12	H-4th Floor, US 1	Auction & Game Theory Apps	Auction & Game Theory Apps		Auction & Game Theory Apps.		Auction & Game Theory Apps.
13	H-4th Floor, US 5	Software Demonstrations	Software Demonstrations		Software Demos		Software Demos
14	H-4th Floor, US 6	Military Applications	Military Applications		Military Apps.		Military Apps.
15	H-4th Floor, US 9	Scheduling	Scheduling		Scheduling		Scheduling
16	H-4th Floor, US 10	Organization Science	Organization Science		Organization Science		Organization Science
17	H-4th Floor, US 11	New Product Development	New Product Development		New Product Development		New Product Development
18	H-4th Floor, US 12	Trans. Science/Logistics	Aviation Apps.		Aviation Apps.		Aviation Apps.
19	H-4th Floor, US 13	Technology Management	Technology Management		Technology Management		Technology Management
20	H-4th Floor, US 14	ENRE – Energy, Natural Res. & the Env. - Energy			ENRE-Energy		ENRE-Energy
21	H-4th Floor, US 15	Data Mining	Data Mining		Data Mining		Data Mining
22	H-4th Floor, US 16	Information Systems	Information Systems		Information Systems		Information Systems
23	H-4th Floor, US 17	Financial Services	Financial Services		Financial Services		Financial Services
24	H-4th Floor, US 18	Financial Engineering	Financial Engineering		Financial Engineering		Financial Engineering
25		No Session	No Session		No Session		No Session
26	H-4th Floor, US 20	JFIG – Junior Faculty Interest Group			JFIG		JFIG
27	H-4th Floor, US 21	Dantzig Dissertation Award Finalists			CPMS-Practice		CPMS-Practice
28	H-4th Floor, US 22	Revenue Management & Pricing	Revenue Management & Pricing		Revenue Management & Pricing		Revenue Management & Pricing
29	H-4th Floor, US 23	Computing Applications	Research Clinic – JFIG		Research Clinic – QSR		E-Business
30	H-4th Floor, US 24	Finance	Finance		Finance		Research Clinic – Rev. Mngt.
31	H-4th Floor, US 25	OR Practice	OR Practice		Auctions Apps.		OR Practice
32	H-6th Floor, Lombard	OR in Sports	Logistics		Quality Management		OR in Sports
33	H-6th Floor, Mason	QSR-Quality, Statistics & Reliability			QSR		QSR
34	H-6th Floor, Powell	QSR-Quality, Statistics & Reliability			QSR		QSR
35	H-6th Floor, Sutter	Railroad Applications	Railroad Applications		Railroad Apps.		Railroad Apps.
36	H-6th Floor, Taylor	Simulation	Simulation		Simulation		Simulation
37	H-6th Floor, Van Ness	Applied Probability	Applied Probability		Applied Probability		Applied Probability
38	R-2nd Floor, Corintia	Linear/Nonlinear Programming	Linear/Nonlinear Programming		Linear/Nonlinear Programming		Linear/Nonlinear Programming
39	R- 3rd Floor, Aragon	Optimization/Linear Prog. & Complementarity			Nonlinear Prog.		Optimization/Linear Prog.
40	R- 3rd Floor, Barcelona I	Optimization/Network Optimization			Network Optimization		Network Optimization
41	R- 3rd Floor, Barcelona II	Optimization/Integer Programming			Integer Programming		Integer Programming
42	R- 4th Floor, Parc I	Optimization/Stochastic Programming			Stochastic Programming		Stochastic Programming
43	R- 4th Floor, Parc II	Computing/Constraint & Integer Programming			Computing/OR		Constraint & Integer
44	R- 4th Floor, Parc III	Computing/OR	Computing/Optimization		Computing/Computing		Computing/Heuristic
45	R- 4th Floor, Raphael	TSL-Transportation Science & Logistics			TSL		TSL
46	R- 4th Floor, Rubens	TSL-Transportation Science & Logistics			TSL		TSL
47	R- 4th Flr, Michelangelo	TSL-Transportation Science & Logistics			TSL		TSL
48	R- 4th Floor, Dante	Health Applications	Health Applications		Health Apps.		Health Apps.
49	R-4th Floor, Medici	Decision Analysis	Decision Analysis		Decision Analysis		Decision Analysis
50	R-4th Floor, Cervantes	Decision Analysis	Decision Analysis		Decision Analysis		Decision Analysis

MASTER TRACK SCHEDULE- Monday

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

	Track Room	MA 8:00-9:30	MB 10:00-11:30	Plenary Interactive Session	MC 1:30-3:00	Plenary 3:10-4:00	MD 4:30-6:00
1	H-Lobby Lev, Plaza A	Tutorial	Tutorial		Tutorial		Tutorial
2	H-Lobby Lev, Plaza B	Data Envelopment Analysis	Data Envelopment Analysis		Data Envelopment Analysis		Data Envelopment Analysis
3	H-Ballroom Lev, CB1	Education	Education		No Session		Education
4	H-Ballroom Lev, CB2	Public Programs & Processes	Public Programs & Processes		Daniel H. Wagner Prize		Daniel H. Wagner Prize
5	H-Ballroom Lev, CB3	Service Sector Operations	Service Sector Operations	11:40-12:30	Service Sector Operations	Philip McCord	Service Sector Operations
6	H-Ballroom Lev, CB7	Logistics	Logistics	Welcome & Awards	Reverse Supply Chains	Morse Lecture	Reverse Supply Chains
7	H-Ball Lev, California	MSOM-Manufacturing & Service Oper. Mgmt.		H-Ballroom Lev, CB 5	MSOM	Alfred Blumstein	MSOM
8	H-Ball Lev, Imperial A	MSOM-Manufacturing & Service Oper. Mgmt.			Research Clinic – Aviation Apps.	OR in Criminal Justice	MSOM
9	H-Ball Lev, Yosemite A	Supply Chain Management	Supply Chain Management		Supply Chain Management	H-Ballroom Lev, CB 5	Supply Chain Management
10	H-Ball Lev, Yosemite B	Supply Chain Management	Supply Chain Management		Supply Chain Management		Supply Chain Management
11	H-Ball Lev, Yosemite C	Supply Chain Management	Supply Chain Management		Supply Chain Management		Supply Chain Management
12	H-4th Floor, US 1	Auction & Game Theory Apps.	Auction & Game Theory Apps.		Auction & Game Theory Apps.		Auction & Game Theory Apps.
13	H-4th Floor, US 5	Software Demos	Software Demos		Software Demos		Software Demos
14	H-4th Floor, US 6	Military Applications	Applied Probability		Pricing/Rev. Mgt.-Non-Travel		Military Apps.
15	H-4th Floor, US 9	Scheduling	Scheduling		Scheduling		Scheduling
16	H-4th Floor, US 10	Scheduling	Workforce		Workforce		Workforce
17	H-4th Floor, US 11	New Product Development	New Product Development		New Product Development		New Product Development
18	H-4th Floor, US 12	Aviation Applications	Aviation Applications		Aviation Apps.		Aviation Apps.
19	H-4th Floor, US 13	Technology Management	Technology Management		Technology Management		Technology Management
20	H-4th Floor, US 14	ENRE-Energy, Natural Res. & the Env. - Energy			ENRE-Energy		ENRE-Energy
21	H-4th Floor, US 15	Data Mining	Data Mining		Data Mining		Data Mining
22	H-4th Floor, US 16	Information Systems	Information Systems		Information Systems		Information Systems
23	H-4th Floor, US 17	Financial Services	Financial Services		Mfg. & Service Oper. Mgmt.		Telecommunications
24	H-4th Floor, US 18	Multicriteria Decision Making	Multicriteria Decision Making		Financial Engineering		Financial Engineering
25	H-4th Floor, US 19	Logistics	Cost/Performance Analysis	12:30-1:30	Supply Chain Management		Auctions/Competitive Bidding
26	H-4th Floor, US 20	QSR – Quality, Stats & Reliability	QSR	Interactive Sessions	Stats and Quality		QSR
27	H-4th Floor, US 21	OR Practice	OR Practice	H-Grand Ballroom	Project Management		Project Management
28	H-4th Floor, US 22	Revenue Management/Pricing	Revenue Management/Pricing		Revenue Management/Pricing		Revenue Management/Pricing
29	H-4th Floor, US 23	E-Business	E-Business		E-Business		E-Business
30	H-4th Floor, US 24	Women in OR/MS	Women in OR/MS		Women in OR/MS		Sustainable Development & OR
31	H-4th Floor, US 25	OR Practice	OR Practice		OR Practice		OR Practice
32	H-6th Floor, Lombard	OR in Sports	Location Analysis		Location Analysis		INFORMS Publications
33	H-6th Floor, Mason	QSR-Quality, Statistics & Reliability			QSR		QSR
34	H-6th Floor, Powell	QSR-Quality, Statistics & Reliability			QSR		QSR
35	H-6th Floor, Sutter	Railroad Applications	Railroad Applications		Minority Issues		Minority Issues
36	H-6th Floor, Taylor	Simulation	Simulation		Simulation		Simulation
37	H-6th Floor, Van Ness	Applied Probability	Applied Probability		Applied Probability		Applied Probability
38	R-2nd Floor, Corintia	Optimization/Global Optimization			Global Optimization		Global Optimization
39	R- 3rd Floor, Aragon	Optimization/Linear Prog. & Complementarity			Linear/Nonlinear Prog.		Linear Programming
40	R- 3rd Floor, Barcelona I	Optimization/Network Optimization			Network Optimization		Network Optimization
41	R- 3rd Floor, Barcelona II	Optimization/Integer Programming			Integer Programming		Integer Programming
42	R- 4th Floor, Parc I	Optimization/Stochastic Programming			Stochastic Programming		Stochastic Programming
43	R- 4th Floor, Parc II	Computing/OR	Computing/Heuristic		Computing/Optimization		Constraint & Integer
44	R- 4th Floor, Parc III	Computing/Computing	Computing/Optimization		Computing/Computing		Computing/Heuristic
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47	R- 4th Floor, Michelangelo	TSL-Transportation Science & Logistics			TSL		TSL
48	R- 4th Floor, Dante	Health Applications	Health Applications		Health Apps.		Health Apps.
49	R-4th Floor, Medici	Decision Analysis	Decision Analysis		Research Clinic – Decision Analysis		Decision Analysis
50	R-4th Floor, Cervantes	Decision Analysis	Decision Analysis		Decision Analysis		Decision Analysis

MASTER TRACK SCHEDULE– Tuesday

* Room Change

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

Track	Room	TA 8:00-9:30	TB 10:00-11:30	Keynotes Interactive Session	TC 1:30-3:00	Keynotes 3:10-4:00	TD 4:30-6:00
1	H-Lobby Lev, Plaza A	Tutorial	Tutorial		Tutorial		Tutorial
2	H-Lobby Lev, Plaza B	Data Envelopment Analysis	Data Envelopment Analysis		Data Envelopment Analysis		Data Envelopment Analysis
3	H-Ballroom Lev, CB1	Education	Education		Education		Education
4	H-Ballroom Lev, CB2	Daniel H. Wagner Prize	Military Applications		Military Apps.		Military Apps.
5	H-Ballroom Lev, CB3	Service Sector Operations	Service Sector Operations	11:40-12:30	Service Sector Operations	Keynote	Service Sector Operations
6	H-Ballroom Lev, CB7	Reverse Supply Chains	Reverse Supply Chains	Keynote	Reverse Supply Chains	Extreme Makeover:	Reverse Supply Chains
7	H-Ball Lev, California	MSOM-Manufacturing & Service Oper. Mgmt.		Edelman (reprise)	Manufacturing	Edelman Competition	Manufacturing
8	H-Ball Lev, Imperial A	MSOM-Manufacturing & Service Oper. Mgmt.		Increasing Production	MSOM	H-Ballroom Lev, CB 5	MSOM
9	H-Ball Lev, Yosemite A	Supply Chain Management	Supply Chain Management	Throughput at GM	Supply Chain Management		Supply Chain Management
10	H-Ball Lev, Yosemite B	Supply Chain Management	Supply Chain Management	H-Ballroom Lev, CB 5	Supply Chain Management		Supply Chain Management
11	H-Ball Lev, Yosemite C	Supply Chain Management	Supply Chain Management		Supply Chain Management		Supply Chain Management
12	H-4th Floor, US 1	Auction & Game Theory Apps.	Auction & Game Theory Apps.	11:40-12:30	Auctions/Competitive Bidding	Keynote	Auction & Game Theory Apps.
13	H-4th Floor, US 5	Software Demos	Software Demos	Keynote	Software Demos	George Dantzig:	Software Demos
14	H-4th Floor, US 6	Military Applications	Military Applications	Erhan Erkut	Multicriteria Decision Making	Unfinished Biography	Military Apps.
15	H-4th Floor, US 9	Scheduling	Scheduling	OR in a Large Class	Scheduling	H-Ballroom Level, CB6	Scheduling
16	H-4th Floor, US 10	Scheduling	Scheduling	H-Ballroom Lev, CB 6	Production & Scheduling		Scheduling
17	H-4th Floor, US 11	New Product Development	New Product Development		Information & Knowledge		Inventory Mngt.
18	H-4th Floor, US 12	Aviation Applications	Aviation Applications		Aviation Apps.		Aviation Apps.
19	H-4th Floor, US 13	Technology Management	Technology Management		Technology Management		Technology Management
20	H-4th Floor, US 14	ENRE-Energy, Natural Res. & the Env. - Energy			ENRE-Energy		ENRE-Environment
21	H-4th Floor, US 15	Data Mining	Data Mining		Data Mining		Data Mining
22	H-4th Floor, US 16	Information Systems	Information Systems		Data Mining		Data Optimization
23	H-4th Floor, US 17	Telecommunications	Telecommunications		Telecommunications		Telecommunications
24	H-4th Floor, US 18	Financial Engineering	Financial Engineering		Financial Engineering		Financial Engineering
* 25	H-Ball Lev, Franciscan D	OR in Sports	OR in Sports	12:30-1:30	Education		Computing
* 26	H-Ballroom Lev, CB4	Reliability	Reliability	Interactive Sessions	Statistics & Quality		Optimization/OR and Medicine
27	H-4th Floor, US 21	CPMS, The Practice Section	OR Practice	H-Grand Ballroom	Business Apps.		Business Apps.
28	H-4th Floor, US 22	Revenue Management & Pricing	Revenue Management & Pricing		Revenue Management/Pricing		Revenue Management/Pricing
29	H-4th Floor, US 23	E-Business	E-Business		RM for Non-Travel Ind.		RM for Non-Travel Ind.
30	H-4th Floor, US 24	Sustainable Development & OR	Sustainable Development & OR		Sustainable Development		Inventory Management
31	H-4th Floor, US 25	OR Practice	OR Practice		OR Practice		OR Practice
32	H-6th Floor, Lombard	Location Analysis	Location Analysis		Location Analysis		Location Analysis
33	H-6th Floor, Mason	QSR-Quality, Statistics & Reliability			QSR		QSR
34	H-6th Floor, Powell	QSR-Quality, Statistics & Reliability			QSR		QSR
35	H-6th Floor, Sutter	Marketing	Minority Issues		Marketing		Marketing
36	H-6th Floor, Taylor	Simulation	Simulation		Simulation		Simulation
37	H-6th Floor, Van Ness	Applied Probability	Applied Probability		Applied Probability		Applied Probability
38	R-2nd Floor, Corintia	Optimization/Global Optimization			Optimization/Nonlinear Prog.		Optimization/Nonlinear Prog.
39	R- 3rd Floor, Aragon	Linear Programming	History of OR/MS		Operations Mgmt.		Operations Mgmt.
40	R- 3rd Floor, Barcelona I	Optimization/Network Optimization			Network Optimization		Network Optimization
41	R- 3rd Floor, Barcelona II	Optimization/Integer Programming			Integer Programming		Integer Programming
42	R- 4th Floor, Parc I	Optimization/Stochastic Programming			Stochastic Programming		Stochastic Programming
43	R- 4th Floor, Parc II	Computing/Constraint & Integer Programming			Constraint & Integer		Computing/Optimization
44	R- 4th Floor, Parc III	Computing/Computing	Computing/Computing		Computing/Optimization		Computing/Heuristic
45	R- 4th Floor, Raphael	TSL-Transportation Science & Logistics			TSL		TSL
46	R- 4th Floor, Rubens	TSL-Transportation Science & Logistics			TSL		TSL
47	R- 4th Floor, Michelangelo	TSL-Transportation Science & Logistics			TSL		TSL
48	R- 4th Floor, Dante	Health Applications	Health Applications		Health Apps.		Health Apps.
49	R-4th Floor, Medici	Health Care	Health Care		Health Care		Health Care
50	R-4th Floor, Cervantes	Decision Analysis	Decision Analysis		Research Clinic – Decision Analysis		Decision Analysis

MASTER TRACK SCHEDULE- Wednesday

*** Room Change**

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

	Track	Room	WA 8:00-9:30	WB 10:00-11:30	Plenary 11:40-12:30	WC 1:30-3:00	WD 3:30-5:00
	1	H-Lobby Lev, Plaza A	Tutorial	Tutorial		Tutorial	Tutorial
	2	H-Lobby Lev, Plaza B	Data Envelopment Analysis	Data Envelopment Analysis		Business Application	Business Application
*	3	R- 3rd Floor, Sienna II	Supply Chain Management	Supply Chain Management		Supply Chain Management	Supply Chain Management
	4		No Session	No Session		No Session	No Session
*	5	H-6th Floor, Powell B	Service Sector Operations	No Session	Gary A. Lorden	Supply Chain Management	Supply Chain Management
*	6	H-Ballrm Lev, Imperial B	Reverse Supply Chains	Reverse Supply Chains	Mathematical	Reverse Supply Chains	Reverse Supply Chains
	7	H-Ballrm Lev, California	Mfg. & Service Oper. Mgmt.	Information Systems	Heroics: Working	Information Systems	Information Systems
	8	H-Ballrm Lev, Imperial A	Mfg. & Service Oper. Mgmt.	Operations Management	with Numb3rs	Mfg. & Service Oper. Mgmt.	Operations Management
	9	H-Ballrm Lev, Yosemite A	Supply Chain Management	Supply Chain Management	* Hilton	Supply Chain Management	Supply Chain Management
	10	H-Ballrm Lev, Yosemite B	Supply Chain Management	Supply Chain Management	Grand Ballroom A	Supply Chain Management	Inventory Management
	11	H-Ballrm Lev, Yosemite C	Supply Chain Management	Supply Chain Management		Supply Chain Management	Supply Chain Management
	12	H-4th Floor, US 1	No Session	Auction & Game Theory Apps.		Transportation/Logistics	Transportation/Logistics
	13	H-4th Floor, US 5	Decision Analysis	Decision Analysis		Scheduling	E-Commerce
	14	H-4th Floor, US 6	Military Applications	Military Applications		Military Apps.	Military Apps.
	15	H-4th Floor, US 9	Scheduling	Scheduling		Scheduling	Scheduling
	16	H-4th Floor, US 10	Production & Scheduling	Economics		Facilities Planning & Design	Economics
	17	H-4th Floor, US 11	Inventory Management	Inventory Management		Inventory Management	Inventory Management
	18	H-4th Floor, US 12	Aviation Applications	Aviation Applications		Aviation Apps.	Aviation Apps.
*	19	R- 3rd Floor, Sienna I	Technology Management	Analytic Hierarchy		Analytic Hierarchy	Decision Support Systems
*	20	H-6th Floor, Mason B	ENRE-Energy, Natural Res. & the Env. - Environment			ENRE-Environment	ENRE-Environment
	21	H-4th Floor, US 15	Optimization & Data Mining	Optimization & Data Mining		Opt. & Data Mining	Opt. & Data Mining
	22	H-4th Floor, US 16	Data Mining	Data Mining		Data Mining	Data Mining
*	23	H-4th Floor, US 2	Telecommunications	Telecommunications		Telecommunications	Decision Analysis
*	24	H-4th Floor, US 8	Financial Engineering	Group Decisions		Decision Analysis	Decision Support Systems
	25		No Session	No Session		No Session	No Session
*	26	H-6th Floor, Sutter B	Optimization/OR and Medicine	Production & Scheduling		Health Apps.	Statistics & Quality
*	27	H-6th Floor, Taylor B	Artificial Intelligence	Artificial Intelligence		Artificial Intelligence	Artificial Intelligence
*	28	R-4th Floor, Da Vinci I	Revenue Management & Pricing	Revenue Management & Pricing		Revenue Management/Pricing	Telecommunications
*	29	R-4th Floor, Da Vinci III	RM/Pricing for Non-Travel Industries			RM/Pricing for Non-Travel Ind.	Optimization Techniques
*	30	R-4th Floor, Da Vinci II	Risk Analysis	Organization Theory		Organization Theory	Organization Theory
	31	H-4th Floor, US 25	OR Practice	OR Practice		Industry Applications	Decision Analysis
	32	H-6th Floor, Lombard	Location Analysis	Location Analysis		Computer Science & OR	Computer Science & OR
	33	H-6th Floor, Mason A	QSR-Quality, Statistics & Reliability			QSR	QSR
	34	H-6th Floor, Powell A	Simulation-Optimization	Quality, Statistics & Reliability		QSR	QSR
	35	H-6th Floor, Sutter A	Supply Chain Management	Supply Chain Management		Marketing	Marketing
	36	H-6th Floor, Taylor A	Flexible Mfg. Systems	Stochastic Processes		Applied Probability	Applied Probability
	37	H-6th Floor, Van Ness	Applied Probability	Applied Probability		Applied Probability	Applied Probability
	38	R-2nd Floor, Corintia	Manufacturing	Optimization/Nonlinear Prog.		Optimization/Nonlinear Prog.	Optimization/Nonlinear Prog.
	39	R- 3rd Floor, Aragon	Operations Management	Operations Management		Operations Mgmt.	Operations Mgmt.
	40	R- 3rd Floor, Barcelona I	Optimization/Network Optimization	Networks & Graphs		Networks & Graphs	Networks & Graphs
	41	R- 3rd Floor, Barcelona II	Optimization Techniques	Optimization Techniques		Optimization Techniques	Scheduling
	42	R- 4th Floor, Parc I	Stochastic Programming	Technology Mgmt		Forecasting	System Analysis
	43	R- 4th Floor, Parc II	Computing/Computing	Computing/Optimization		Computing/Heuristic	Inventory Mgmt.
	44	R- 4th Floor, Parc III	Computing/OR	No Session		Computing/Optimization	Computing/Optimization
	45	R- 4th Floor, Raphael	TSL-Transportation Science & Logistics			TSL	TSL
	46	R- 4th Floor, Rubens	TSL-Transportation Science & Logistics			TSL	TSL
	47	R- 4th Floor, Michelangelo	TSL-Transportation Science & Logistics			TSL	TSL
	48	R- 4th Floor, Dante	Health Applications	Health Applications		Metaheuristics	Metaheuristics
	49	R-4th Floor, Medici	Health Care	Health Care		Health Care	Health Care
	50	R-4th Floor, Cervantes	Decision Analysis	Decision Analysis		Decision Analysis	Decision Analysis

PLANNER

SUNDAY	MONDAY	TUESDAY	WEDNESDAY
SA 8:00 - 9:30	**MA** 8:00 - 9:30	**TA** 8:00 - 9:30	**WA** 8:00 - 9:30
SB 10:00 – 11:30	**MB** 10:00 – 11:30	**TB** 10:00 – 11:30	**WB** 10:00 – 11:30
Plenary – IFORS 11:40 – 12:30 Luk N. Van Wassenhove Hilton-Ballroom Level, Continental Ballroom 5	**Welcome & Awards** 11:40 – 12:30 Hilton-Ballroom Level, Continental Ballroom 5	**Keynotes** 11:40 – 12:30 Edelman Reprise Hilton-Ballroom Level, Continental Ballroom 5 Erhan Erkut Hilton-Ballroom Level Continental Ballroom 6	**Plenary** 11:40 – 12:30 Gary A. Lorden Hilton-Grand Ballroom A
SC 1:30 – 3:00	**MC** 1:30 – 3:00	**TC** 1:30 – 3:00	**WC** 1:30 – 3:00
Plenary – Omega Rho 3:10 - 4:00 Stuart L. Hart Hilton-Ballroom Level, Continental Ballroom 5	**Plenary – McCord Morse** 3:10 - 4:00 Alfred Blumstein Hilton-Ballroom Level, Continental Ballroom 5	**Keynotes** 3:10 - 4:00 Edelman Makeover Hilton-Ballroom Level, Continental Ballroom 5 G.B. Dantzig Tribute Hilton-Ballroom Level Continental Ballroom 6	**TD** 3:30 – 5:00
SD 4:30 – 6:00	**MD** 4:30 – 6:00	**TD** 4:30 – 6:00	

How to Navigate the INFORMS Technical Sessions

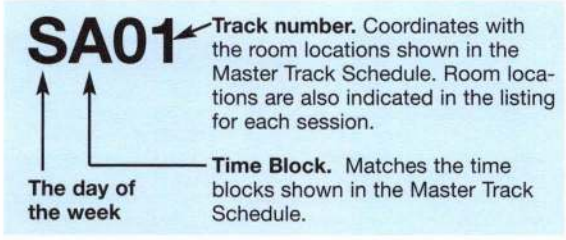
There are four primary resources to help you understand and navigate the INFORMS Technical Sessions:

- This technical session listing (pages 47-303), 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 305-336).
- The Floor Plans on pages 40-41 show you where technical session tracks are located.
- The Master Track Schedule on pages 42-45. 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 309-328) — 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

On Wednesday, D block is 3:30-5:00pm.
Plenaries, keynotes and lunch breaks are interspersed among the technical session time blocks.

Room Locations/Tracks

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

H - 4th Floor, Union Square 17

R - 3rd Floor, Aragon

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

H - Lobby Level, Plaza A

Tutorial: Decision Analysis = Decision Engineering

Cluster: Tutorials
Invited Session

1 - Tutorial: Decision Analysis = Decision Engineering
James Matheson, Chairman and CFO, SmartOrg, Inc., jmatheson@smartorg.com

Decision analysis is an engineering approach to helping decision makers reach rational decisions. It incorporates systems engineering and decision theory to build value-based models and carry out computations needed to deal with complexity, uncertainty, and dynamics, as well as the processes for reaching good decisions with real people and gaining their commitment to carry them out. Decision analysis is a discipline with underlying principles and procedures adaptable to diverse situations.

■ SA02

H - Lobby Level, Plaza B

Optimization Modeling in Environmental/Natural Resources Planning

Contributed Session

Chair: Jose Cruz, Assistant Professor, University of Connecticut, 2100 Hillside Road, Unit 1041, Storrs, CT, 06269-1041, United States, jcruz@business.uconn.edu

1 - Evaluating the Effects of ISO 14001 Certification: A Concept Mapping Approach

Gyula Vastag, Kelley School of Business, Indiana University, 801 West Michigan Street, BS 4027, Indianapolis, United States, gvastag@iu.edu

Using case studies of manufacturing plants in North America and Europe, we examine the effects of the certification. A structured conceptualization method, involving managers and environmental team members from the plant, was used to define and analyze the conceptual domain of the impacts. As a result of the certification process, employees and managers experienced attitudinal changes and the plants realized operational improvements.

2 - Implications of Pollutant Trading on Mercury Waste Management
Yogendra Shastri, Graduate Research Assistant, University of Illinois, Chicago, Dept. of Bioengineering, 851, S. Morgan, University of Illinois, Chicago, Chicago, IL, 60607, United States, yshast1@uic.edu. Urmila Diwekar, Sanjay Mehrotra

The work proposes an optimization technique based decision making framework for regulators and industries when pollutant trading is a waste management option. Deterministic and stochastic models are analyzed and health care cost is incorporated in decision making. The model is applied on mercury waste management case study of Savannah river basin. Results indicate significant cost savings but also highlight the importance of health care cost and uncertainty consideration in problem solution.

3 - Forest Planning with Timber Species Balancing in Southern Brazil
Fabrizio Marodin, ExecutiveOfficer, Kybernetics / Unisinos, Guaiba 3040, Porto Alegre, 91900-420, Brazil, fmarodin@terra.com.br, Denis Borenstein, Giuliano Marodin

This paper addresses the problem of determining the management activities and flow of timber products from a forest composed of several stands, which vary in age, species composition and production potencial. We propose a harvest scheduling linear programming model that maximizes earnings subject to minimum flow and timber species balancing constraints. The system can provide a very useful decision support tool for long-term forest and operations planning of verticalized companies.

4 - Optimizing Water Irrigation System with Environmental Considerations
Zichao Li, Mr, National University of Singapore, The Logistics Institute Asia Pacific, National University of Singapore, Singapore, 119081, Singapore, zichao.li@nus.edu.sg, Guangyu Xu

The World Bank has invested massively to increase irrigation coverage in Northern China.However,the design of irrigation ditches and pipelines never considers the water leakage speed on different types of soil and pipeline material.This objective is to choose optimal combination of ditch and pipe diameters so as to minimize cost of a looped water distribution system as well as minimizing water leakage and environmental damage.The author used a two-level multi-objective genetic algorithm(MOGA).

5 - Supply Chain Networks with Corporate Social Responsibility through Integrated Environmental Decision

Jose Cruz, Assistant Professor, University of Connecticut, 2100 Hillside Road, Unit 1041, Storrs, CT, 06269-1041, United States, jcruz@business.uconn.edu

We develop a dynamic framework for the modeling and analysis of supply chains networks with corporate social responsibility through integrated environmental decision-making. We model the multicriteria decision-making behavior of the various decision-makers (manufacturers, retailers, and consumers), which includes the maximization of net return, the minimization of waste, and the minimization of risk. We explore the dynamic evolution of the product flows, and the associated product prices.

■ SA03

H - Ballroom Level, Continental Ballroom 1

Advances in Teaching Operations Research and Management Science

Sponsor: Education (INFORM-ED)
Sponsored Session

Chair: Matt Drake, Doctoral Student, Georgia Institute of Technology, School of Industrial and Sys Engineering, 765 Ferst Drive, Atlanta, GA, 30332, United States, gtg148k@prism.gatech.edu

1 - The Outsourcing Game

Andy Tsay, atsay@stanfordalumni.org, Jason Amaral

Traditional OM/SCM courses do not do a very good job of addressing the "wheeling and dealing" aspect of inter-firm interactions and procurement. This has motivated the creation of a role-playing simulation called "The Outsourcing Game," to illustrate the changed nature of decision-making in an outsourced supply chain environment. This game was introduced in an MBA elective at Santa Clara University, and has since been run at ASU, MIT, Purdue, and in internal training inside Hewlett-Packard.

2 - A New Excel Tool for Teaching Sensitivity Analysis

Susan Palocsay, palocssw@jmu.edu

Sensitivity analysis is one of the most important and valuable concepts taught in introductory OR/MS courses. To emphasize its practical relevance in the business environment, we have begun teaching our students to use the Scenario Manager in Excel. We will demonstrate how to use this tool with several types of spreadsheet models and discuss the potential pedagogical benefits.

3 - A Global Supply Chain Project by International Student Teams

Jo Min, Associate Professor, IMSE/Iowa State University, 2019 Black Engineering, Ames, IA, 50011, United States, jomin@iastate.edu, Leopoldo C·rdenas-Barròn, Peter Ball, John Jackman, Cheng-Kang Chen

For a team project of students from several countries in an undergraduate course, we consider a global supply chain problem. Each team relies on an Internet-based collaboration platform with gradually constructive delivery of information for interaction. The progress and future direction, including assessment of students' learning, will be discussed.

4 - The Building Blocks of Supply Chain Management

Matt Drake, Doctoral Student, Georgia Institute of Technology, School of Industrial and Sys Engineering, 765 Ferst Drive, Atlanta, GA, 30332, United States, gtg148k@prism.gatech.edu, John Mawhinney

We discuss a classroom simulation designed to introduce undergraduate business and operations research students to the challenges of managing and coordinating a supply chain. The activity simulates a manufacturing supply chain with a raw material supplier, three manufacturing plants, a distributor, and a customer with Lego pieces as a product. We provide an activity overview as well as our experiences in using the simulation in business and industrial engineering classes.

■ SA05

H - Ballroom Level, Continental Ballroom 3

Panel Discussion: The Academic Job Search

Cluster: Job Placement Committee
Invited Session

Chair: David Kim, Oregon State Univ, 121 Covell Hall, Corvallis, OR, 97331, United States, david.kim@orst.edu

1 - Panel Discussion: The Academic Job Search

Moderator: David Kim, Oregon State Univ, 121 Covell Hall, Corvallis, OR, 97331, United States, david.kim@orst.edu, Panelists: Joyendu (Joy) Bhadury, Zelda Zabinsky, Lawrence W. Robinson, Reha Uzsoy

The panel will discuss the academic interview process and do's and don'ts associated with the job search. In addition to comments by current or former search chairs, time will be provided for questions and answers.

■ SA06

H - Ballroom Level, Continental Ballroom 7

Joint Session Practice/ CPMS: Spreadsheets in Practice

Sponsor: Spreadsheet Productivity Research, CPMS, The Practice Section of INFORMS
Sponsored Session

Chair: Mary Crissey, Analytical Strategist, SAS Institute, 17030 Vista Park Dr, San Antonio, TX, 78247, United States, mary.crissey@sas.com

1 - Implementing Large-scale OR Models with Genetic Algorithms and Spreadsheets

Claudio Cunha, Prof Dept of Transp Engineering, University of Sao Paulo, Sao Paulo, SP, Brazil, cbcunha@usp.br, Flavio Galvão

This session will cover some real-world problems in logistics and transportation, including recent work implementing a Genetic Algorithm with spreadsheet for solving a multi-period vehicle scheduling problem for wood waste collection. Due to the complexity of the problem, we had to decompose it in order to properly solve it. The GA is used in an integrated fashion with Excel Solver for a problem with dozens of thousands of decision variables.

2 - Excel Add-ins for Application and Education

Paul Jensen, Professor Emeritus, University of Texas, Austin, TX, United States, pjensen@mail.utexas.edu

We describe an extensive collection of Excel add-ins that implement a variety of the analytical procedures from operations research ranging from mathematical programming to project management. The add-ins make complicated procedures immediately and easily available so that analysts can focus on data and modeling rather than formulas and algorithms. The add-ins are free and can be found at www.ormm.net.

3 - The U.S. Army Uses Network Optimization to Designate Career Fields for Officers

Alexandra Newman, Colorado School of Mines, Division of Economics and Business, Golden, CO, United States, anewman@mines.edu, Daniel Shrimpton

The United States Army's career-progression pattern assigns, or "designates," Army officers to specialized roles in which the officers must serve. Manually assigments are impossible due to the size of the problem. Therefore, we develop a network optimization model, the Career-Field Designation Model, that runs in a spreadsheet and makes these assignments in minutes on a personal computer. The Army continues to use the model to designate about 1,500 officers each year.

4 - Launch Complex NLP with SAS from a Microsoft Excel Interface

Mary Crissey, Analytical strategist, SAS Institute, 17030 Vista Park Dr, San Antonio, TX, 78247, United States, mary.crissey@sas.com

As the Science of Better marketing campaign states, business leaders today lack awareness of the value our profession offers. Break through this ignorance and fear by embedding complex optimization models under a familiar spreadsheet GUI. By keeping them in their comfort zone (microsoft office environment) we can empower them to point and click their way through a challenging cost minimization problem.

■ SA07

H - Ballroom Level, California

Pricing and Revenue Management in Operations

Sponsor: Manufacturing & Service Oper Mgmt
Sponsored Session

Chair: Philipp Afeche, Asst. Prof., University of Chicago, 5807 South Woodlawn Avenue, Chicago, IL, 60637, United States, pafeche@gsb.uchicago.edu

1 - Various Learning Schemes under Dynamic Pricing for Non-perishable Products

Victor Araman, Asst. Prof., NYU Stern School of Business, 44W 4th Street, New York, NY, 10012, United States, varaman@stern.nyu.edu, Rene Caldentey

A retailer sells a fixed amount of units of a non-perishable product. A terminal value is achieved when all units are sold. A stochastic Poisson demand process is considered which rate is partially unknown. Through a dynamic control of prices, we consider different learning schemes ranging from active to passive learning. We look at optimal policies but also suboptimal ones that are easy to implement and lead to robust results.

2 - Dynamic Pricing with Changeover Costs
Sergei Savin, Associate Professor, GSB, Columbia University, 404 Uris Hall, 3022 Broadway, New York, NY, 10027, United States, svs30@columbia.edu, Alp Muharremoglu, Sabri Celik

We consider a problem of dynamic pricing of inventories in the settings where price changes are costly. We formulate the inventory pricing problem as a finite-horizon stochastic dynamic program and partially characterize optimal pricing policies. Several pricing heuristics are introduced, and their effectiveness is studied through extensive numerical experiments.

3 - Strategic Capacity Rationing When Customers Learn
Garrett van Ryzin, Professor, Columbia University, gjv1@columbia.edu, Qian Liu

Rationing risk provides an incentive for customers to buy early at higher prices. In such cases, under-stocking products may be an optimal selling strategy. Yet customers may only learn about availability through repeat experience. We investigate how the dynamics of customer learning impact optimal capacity rationing decisions.

4 - Dynamic Pricing and Bayesian Learning of Customer Time-Sensitivity in Queues
Philipp Afeche, Asst. Prof., University of Chicago, 5807 South Woodlawn Avenue, Chicago, IL, 60637, United States, pafeche@gsb.uchicago.edu, Baris Ata

Virtually the entire revenue management literature for queues assumes that providers know the distribution of customer demand attributes. We relax this assumption and consider the case of unknown customer impatience. We characterize the dynamic pricing policy that optimally trades off revenue generation and learning customer demand. We analytically evaluate how the value of perfect demand information depends on operational and economic system characteristics.

■ SA08

H - Ballroom Level, Imperial A

Global Production and Innovation Management

Sponsor: Manufacturing & Service Oper Mgmt
Sponsored Session

Chair: Cuihong Li, Assistant Professor, University of Connecticut, School of Business, 2100 Hillside Road, Storrs, C, 06269, United States, Cuihong.Li@business.uconn.edu

Co-Chair: Jiong Sun, Carnegie Mellon University, Tepper School of Business, Pittsburgh, PA, 15213, United States, jiongs@andrew.cmu.edu

1 - Strategic Technology Investment: Tacit Collusion and Information Time Lag
Tao Yao, Stanford University, Terman 464, Stanford, CA, 94305, United States, taoyao@stanford.edu, John Weyant

This paper develops a stochastic differential game framework for analyzing strategic exercise of options under technical and market uncertainty. We characterize a collusion (cooperative) equilibrium based on the use of a trigger strategy with an information time lag. We analyze the role of information and uncertainty on the likelihood of tacit collusion and provide implications of strategic effects for antitrust and merger control in innovation markets.

2 - Optimal Stopping Policy for New Product Positioning
Zuobing Xu, graduate student, University of California, Santa Cruz, 1156 High St., Santa Cruz, CA, 95060, United States, zbxu@soe.ucsc.edu, Ram Akella

One of the key marketing decisions a firm entering a new market is how to position its product. Reduction of new product development cycle time and improvements in product attributes level become strategic objectives for many technology-driven firms. These goals may conflict, however, and firms must explicitly consider the tradeoff between them. Our paper gives an analytic model to help the managerial executive to make right decision in R&D process.

3 - Global New Product Introduction
Jiong Sun, Carnegie Mellon University, Tepper School of Business, Pittsburgh, PA, 15213, United States, jiongs@andrew.cmu.edu, Cuihong Li, Sunder Kekre

We study strategies for a firm having a presence in different countries to supply these markets with continuously improved versions of a base product. Each time an improved product version is generated in a lead market, the firm's decisions are whether to make the new version available in the lag markets, whether the supporting technology should be transferred to the lag markets, and which product version each affiliate should produce for the local market and/or for export.

■ SA09

H - Ballroom Level, Yosemite A

Retail Operations Management

Cluster: Supply Chain Management
Invited Session

Chair: Narendra Agrawal, Santa Clara University, Leavey School of Business, OMIS Department, Santa Clara, CA, 95053, United States, nagrawal@scu.edu

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

1 - Assortment Planning and Inventory Management Under Consumer Choice with Dynamic Substitution
Vishal Gaur, New York University, 44 West 4th St., 8-72, New York, NY, 10012, United States, vgaur@stern.nyu.edu, Sridhar Seshadri, Dorothee Honhon

We consider assortment planning and inventory decisions for a retailer serving random demand from a population of heterogeneous customers. A customer visiting the retailer chooses an item from the assortment available at the time of her visit (dynamic substitution). We establish the optimal solution for a one-period model for a restricted choice model, and use the structural insights to construct heuristics for general preferences.

2 - Contracting for Improved Retail Supply Chain Execution
Nicole DeHoratius, Asssistant Professor, University of Chicago, Graduate School of Business, 5807 S. Woodlawn Ave., Chicago, IL, 60637, United States, ndehorat@chicagogsb.edu, Sergio Chayet, Canan Savaskan

We examine the incentives supply chain parties have to invest in the quality of order delivery (on-time, right quantity, right product, etc.) in a single manufacturer - single retailer supply chain. In particular, we investigate some of the contracts used in practice (linear wholesale, buy back, revenue sharing, and quantity discounts) and study the impact of supplier monitoring on supply chain profits.

3 - Retail Assortment Planning under Category Captainship
Mumin Kurtulus, Visiting Assistant Professor, Vanderbilt University, Owen Graduate School of Management, mumin.kurtulus@insead.edu, Beril Toktay

Retailers in consumer goods industry often rely on their leading manufacturers in the product categories for recommendations on retail assortment selection, a practice often referred to as category captainship. We investigate the impact of category captainship on the retail assortment and retail profitability under various category captainship strategies. We provide recommendations for the retailers as how to best implement category captainship.

4 - Optimizing Retail Assortments Based on Customer Choice Models
Stephen Smith, Professor, Santa Clara University, OMIS Department, 500 El Camino Real, Santa Clara, CA, 95053-0382, United States, SSmith@scu.edu

This paper develops a methodology for optimizing retail assortments based on various product choice models for a set of potential customers with heterogeneous preferences. Predicted market shares and expected profits are determined, as well as the sensitivity of the results to making incorrect customer choice assumptions. A data set of customer utilities developed through conjoint analysis of responses collected at an Internet website is used to illustrate the methods.

■ SA10

H - Ballroom Level, Yosemite B

Manufacturing Flexibility in the Automotive Industry

Cluster: Supply Chain Management
Invited Session

Chair: Stephan Biller, Group Manager, General Motors R&D, MC: 480-106-359, 30500 Mound Road, Warren, MI, 48090, United States, stephan.biller@gm.com

1 - Chaining: Robust Cross-Training Strategies for Manufacturing Flexibility
Dennis Blumenfeld, Staff Research Scientist, General Motors, MC: 480-106-359, 30500 Mound Road, Warren, MI, 48090, United States, dennis.blumenfeld@gm.com, Robert Inman, William Jordan

Training workers to perform multiple tasks can improve workforce flexibility, but is costly and limited by learning capacity. We investigate how cross-training impacts work performance in the context of maintenance at an automotive manufacturing plant. Results show that chaining, in which some workers are strategically cross-trained, can yield most of the benefits of cross-training all workers and is very robust with respect to task assignments, chain formation, and changing plant conditions.

2 - Global Capacity Investment Decisions for Product Variants
Chen Xiang, PhD Candidate, Carnegie Mellon University, Tepper School of Business, 5000 Forbes Avenue GSIA A-19b, Pittsburgh, PA, 15213, United States, ccx@cmu.edu, Bahar Biller

We study the capacity investment decision faced by a firm that customizes its product to satisfy product regulations in different markets. The firm invests in "base capacity" for producing the common features of the product and "customizing capacity" for fulfilling the market specific regulations. Our analysis provides the structure of the firm's optimal investment strategy in base and customizing capacities and measures its sensitivity to model primitives.

3 - Impact of Price Postponement on Capacity and Flexibility Investment Decisions
Stephan Biller, Group Manager, General Motors R&D, MC: 480-106-359, 30500 Mound Road, Warren, MI, 48090, United States, stephan.biller@gm.com, Yongmei Zhang, Ana Muriel

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

4 - A Real Option Approach to Valuation of Flexibility with 2 State Variables and Regime Switching
Chi-Guhn Lee, Assistant Professor, University of Toronto, 5 King's College Road, Toronto, ON, M5S 3G8, Canada, chi@mie.utoronto.ca, M.I.M. Wahab

A real option approach is proposed to quantify the value of flexibility in a manufacturing system, where the capacity level is optimally adjusted to maximize the total expected profit over a planning horizon. The demands for two products are assumed to follow correlated Wiener processes and to evolve through 2-stage product life. A lattice is constructed, once the original processes are transformed to uncorrelated ones, upon which the NPV is computed.

■ SA11

H - Ballroom Level, Yosemite C

Queuing and Other Stochastic Models in Supply Chain Management

Contributed Session

Chair: Diederik Claerhout, University of Antwerp, Prinsstraat 13, Antwerp, 2000, Belgium, diederik.claerhout@ua.ac.be

1 - Incentive-Compatible Allocation Policy: Individual Versus Social Optimization
Kwan Wee, Assistant Professor, Singapore Management University, 469 Bukit Timah Road, Singapore, 259756, Singapore, kewee@smu.edu.sg

We consider two customer allocation policies for a two-server queuing system: one induced by individuals' self-interest while the second based on social benefits. We show that in the equilibrium, when the servers incur penalty with respect to customers' waiting time, there is a threshold such that when the per unit time penalty exceeds the threshold, the social optimum induces higher service rates from the servers than the individual optimum; otherwise the result is reversed.

2 - Queuing Models for Networks with Assembly Operations
Ram Ramakrishnan, Dept of DSES, Rensselaer Polytechnic Institute, 110 8th Street, Troy, NY, 12180, United States, ramakr@rpi.edu, Ananth Krishnamurthy

We consider assembly systems where end products are produced from multiple components. The components are supplied by independent manufacturing facilities and the system operates under pull control. The system is modeled as a closed queuing network with fork join stations and new parametric decomposition based methods are developed to evaluate system performance.

3 - Policy Iteration Formulations For Optimizing Service Facilities Modeled as M/M/s Queues
Avi Giloni, Assistant Professor, Sy Syms School of Business, Yeshiva University, 500 West 185th Street, New York, NY, 10033, United States, agiloni@ymail.yu.edu, Phil Troy

We study the problem of optimizing organizational service facilities modeled as M/M/s queues via a policy iteration framework. We derive policy iteration formulations to socially optimize and revenue maximize service facilities. These formulations avoid many of the standard restrictions/assumptions and lead directly to important characterizations of the optimal policies.

4 - Analysis and Comparison of Queues with Different Levels of Delay Information: A General Model
Pengfei Guo, Ph.D. Candidate, Duke University, P.O. Box 368, Fuqua School of Business, Durham, NC, 27708, United States, pg18@duke.edu, Paul Zipkin

To explore effects of delay information on queues, we consider a queue with balking under three levels of delay information: no information, partial information (the system occupancy) and full information (the exact waiting time). We show that when the distribution of customers' delay sensitive parameter satisfys an elastic condition, telling information is good for the server. We also do some stochastic comparisons of the stable distributions of the queues under different delay information.

5 - The Allocation of Safety Time in Queueing Networks
Diederik Claerhout, University of Antwerp, Prinsstraat 13, Antwerp, 2000, Belgium, diederik.claerhout@ua.ac.be, Nico Vandaele

Open queueing networks have been used to model the performance of a variety of manufacturing environments. Currently, we are translating the output of these models into operational decisions by setting release authorizations. Incorporating these release authorizations into queueing networks allows us to study the opportunity to reduce total lead times by imposing minimal lead times on the queues.

■ SA12

H - 4th Floor, Union Square 1

Empirical Analysis of Online Auction Marketplaces

Cluster: Applications of Auction and Game Theory
Invited Session

Chair: Robert Zeithammer, Assistant Professor, Graduate School of Business, University of Chicago, 5807 South Woodlawn Ave, Chicago, IL, 60637, United States, rzeitham@gsb.uchicago.edu

1 - Empirical Tests of Information Aggregation
Pai-Ling Yin, Assistant Professor, HBS, Morgan Hall 241, HBS - Soldiers Field, Boston, MA, 02163, United States, pyin@hbs.edu

This paper empirically examines information aggregation in auction prices. Tests are based on comparative statics with respect to the number of bidders and dispersion of information signals and comparison of actual to predicted Nash equilibrium prices. eBay computer auctions partially aggregate information but do not converge to the common value. Even partial information aggregation may represent a potential efficiency gain over 1-to-1 trade of used goods with uncertain common values.

2 - Vettes and Lemons on EBay
Christopher Adams, Economist, Federal Trade Commission, 601 New Jersey Ave, NW, Washington, DC, 20580, United States, cadams@ftc.gov, Laura Hosken, Peter Newberry

The paper tests the "lemons" hypothesis using bidding data for 'Vettes. The paper measures the discount for a used 'Vette over a new 'Vette. The paper also tests whether auctions for 'Vettes are common value auctions. The data includes information on characteristics of the car, the price that the car sold at, and the number of bidders who bid on the car. The paper finds some limited evidence to support Akerlof's lemons hypothesis for used 'Vettes sold on eBay.

3 - Auctions vs. Posted Prices: Which Selling Format to Use?
Robert Zeithammer, Assistant Professor, Graduate School of Business, University of Chicago, 5807 South Woodlawn Ave, Chicago, IL, 60637, United States, rzeitham@gsb.uchicago.edu

eBay provides a clean institutional framework for studying the age-old question of how to sell a good. Three selling formats are currently available: posted prices, auctions, and a "Buy-It-Now" auction format. Are these three distinct formats, or is Buy-It-Now "between" posted price and a pure auction? How should the seller decide which format to use? How do eBay sellers seem to decide? What can we learn about the theoretical limits to the scope of auctioning?

4 - When and Why Nobody Buys it Now? An Empirical Investigation of the Signaling Effect of Buy-Now Price
Chun Qiu, University of Alberta, School of Business, Edmonton, AB, T6H4M5, Canada, cqiu@ualberta.ca, Peter Popkowski-Leszczyc, Yongfu He

This paper presents a model explaining the severe asymmetric usage of buy-now prices among bidders and auctioneers in the online auctions for some product categories. It is argued that when the good is difficult to assess, bidders will rely on a buy-now price to update their values rather than paying the price. Therefore, it is advantageous for auctioneers to set a high buy-now price to signal the quality. We test the existence of a signaling effect of the buy-now price in two empirical studies.

■ SA13

H-Union Square 5

Software Demonstration

Cluster: Software Demonstrations
Invited Session

1 - Advantage for Analysts- Advantage for Analysts™ Tames Complexity and Eases Optimization

Mahmut Karayel, Advantage for Analysts, 2 Harrison St., 6th Fl., San Francisco, CA 94105, United States, advantage@AdvantageForAnalysts.com,Dennis Moritz

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■ SA14

H - 4th Floor, Union Square 6

Optimization and Simulation Approaches for Some Military Applications

Contributed Session

Chair: Karthik Thyagarajan, PhD Student, University at Buffalo (SUNY), 341 Bell Hall, UB North Campus, Buffalo, NY, 14214, United States, kt25@eng.buffalo.edu

1 - A Two-Stage Facility Location, Multi-Echelon Inventory Model with Capacitated Service

Ben Van Roo, Doctoral Candidate, University of Wisconsin-Madison, 975 University Avenue, Madison, WI, 53706, United States, bdvanroo@wisc.edu, James Rappold

We discuss the design and placement of repair capacity to support a multi-echelon, -item, -indentured inventory system in a military setting. Formulated as a MINLP problem, we discuss a two-stage solution approach that exploits the major cost drivers of the problem. Furthermore, we incorporate testing network solution robustness through the use of simulation.

2 - An Experimental Design with Combat Simulations for Finding Optimal Strategy

Yoon G. Hong, Professor, Hansung University, 389, 3-Ga, Samsun-Dong, Sungbuk-Ku, Seoul, 136-792, South Korea, yhong@hansung.ac.kr

It is important for commanders to search a reliable and effective way to get an optimal strategy in a combat. Taguchi method as an experimental design is introduced and explains a way to find the initial optimal condition for combat parameters. The simulation models are used and this method makes the analysis easier or simple, and reduces the total number of experiments. The suggested method might be useful in such a case that input parameters can not be represented quantitatively.

3 - Transforming US Army Logistics: A Strategic Supply Chain Approach

Greg Parlier, COL, USA Retired, University of Alabama in Huntsville, 230 Fieldridge Lane, Harvest, AL, 35749, United States, parlieg@email.uah.edu

This paper presents a systems approach guiding an ongoing project addressing significant challenges confronting Logistics Transformation. A multi-stage supply chain model is used to segment and guide this effort, to diagnose structural disorders and prescribe remedies. An "analytical architecture" is developed, icluding an "engine for innovation" and a "dynamic strategic logistics planning" process, to guide Logistics Transformation for the Army.

4 - Modeling Army Force Generation Using Simulation

Steven Stoddard, Operations Research Analyst, Center for Army Analysis, 6001 Goethals Road, Fort Belvoir, VA, 22060, United States, steven.stoddard@caa.army.mil, Mark Brantley

The Army developed the AFGM simulation to determine the best size for the force. We simulate the flow of units through lifecycles. AFGM allows us to examine force structure by illustrating gaps or redundancies, and associated deployment tempos. It also allows us to examine force generation options, such as how long rotations should last and when to mobilize reserves. The Army has adopted AFGM to analyze its force structure for the Quadrennial Defense Review and other analytical efforts.

5 - Routing of Multiple UAVs to Maximize the Chance of Escape During Mission Ingress

Karthik Thyagarajan, PhD Student, University at Buffalo (SUNY), 341 Bell Hall, UB North Campus, Buffalo, NY, 14214, United States, kt25@eng.buffalo.edu, Rajan Batta, Mark Karwan

This work addresses the problem of routing UAVs over a network to maximize the chance of escape during mission ingress. The problem is formulated as a MILP and a column generation based algorithm is then developed to generate the desired routes. An example is provided and computational results are reported.

■ SA15

H - 4th Floor, Union Square 9

Scheduling and Optimization

Cluster: Scheduling
Invited Session

Chair: Lei Lei, Associate Professor, Rutgers University, MSIS Dept., Rutgers Business School, 180 University Avenue, Newark, NJ, 07102, United States, llei@business.rutgers.edu

1 - Inventory Control and Scheduling with Facilities in Parallel and in Series

Vladimir Krasik, New York University, IOMS-Operations Management, Stern School of Business, New York, NY, 10012, United States, vkrasik@stern.nyu.edu, Jiawei Zhang, Joseph Leung, Michael Pinedo

We consider a framework for models with inventory control as well as scheduling aspects which encompasses many existing inventory models and scheduling models. We present polynomial time algorithms for several models within our framework.

2 - Scheduling for Optic-Fiber Financial Networks

Uday Rao, Associate professor, University of Cincinnati, 528 Carl H. Lindner Hall,, P.O. Box 0130,, Cincinnati, OH, 45221, United States, uday.rao@uc.edu, Ramesh Bollapragada, Ozgur Ozluk

We consider the scheduling of maintenance activities on links of an optic-fiber network (for financial services). We formulate an MILP model that optimizes total downtime while scheduling activities within certain time windows. The constraints incorporate activity categories, priorities, and precedence relations. We also present and evaluate heuristic solution approaches.

3 - Frameworks For Integrating Short Run Operations And Long-Term Distribution And Supply Chain Planning

Tan Miller, Director of Logistics, Pfizer, 201 Tabor Road, Morris Plains, NJ, 07950, United States, Tan.Miller@pfizer.com

This presentation will focus on some of the key components required to facilitate effective planning and management of both large-scale and small-scale supply chains. Specifically, we will review general frameworks that have been applied in industry for organizing a firm's supply chain planning and management activities.

4 - On the Integrated Port-Vessel Scheduling Problem

Yao Zhao, Assistant Professor, Rutgers University, Dept. of MSIS, Rutgers Business School, 180 University Avenue, Newark, NJ, 07102, United States, yaozhao@andromeda.rutgers.edu, Lei Lei, Hua Zhong

We study the problem of scheduling the operations of an ocean port and container vessels with conflict objectives. The port aims to minimize the space requirement and the land cost of its container yard, while the shipping company aims to maximize the vessel utilization. We propose a search algorithm that finds an integrated operation schedule to optimally compromise two objectives.

5 - New Approaches to Call Center Agent Scheduling

Turgut Aykin, ac2 Solutions, 1 Bethany Rd., Suite 52, Hazlet, NJ, 07730, United States, taykin@ac2solutions.com

Over the past decade, call centers have become the major point of contact between public and private enterprises and their customers. Effective scheduling of call center agents is a critical management function that affects customer service, operating costs, and customer satisfaction. This session will focus on the new approaches to the call center agent scheduling problem and present information on their industrial applications.

■ SA16

H - 4th Floor, Union Square 10

R&D and Product Performance

Sponsor: Organization Science
Sponsored Session

Chair: Laura Cardinal, Tulane University, A. B. Freeman School of Business, 7 McAlister Drive, New Orleans, LA, 70118, United States, cardinal@tulane.edu

1 - Multi-Dimentional Product Differentiation Strategy and Incumbent Survival During Market Fusion

Raja Roy, Tulane University, A. B. Freeman School of Business, 7 McAlister Drive, New Orleans, LA, 70118, United States, rroy@tulane.edu

Hotelling's model suggests that horizontal differentiation on a one-dimensional scale is beneficial for the performance of the incumbents. I investigate incumbents' product differentiation strategies during market fusion in the US machine tool industry during the 1970s and 1980s. My results suggest that during market fusion, horizontal differentiation alone does not lead to the improved survival chances.

2 - Modular Design: Effects on the Speed of Performance Improvement and Imitation

Susan McEvily, Assistant Professor, University of Pittsburgh, Katz School of Business, 252 Mervis Hall, Pittsburgh, PA, 15260, United States, smcevily@katz.pitt.edu, Frits Pil

We find evidence in the automobile industry that modular product design accelerates performance improvement, but little to suggest it facilitates imitation. Performance improves faster on quality items that originate in modular sources. Yet, the dispersion of quality performance across competing products, and the stability of their quality rankings are higher for modular criteria, suggesting that imitation remains imperfect.

3 - Managing the Tension from Geographic Search

Laura Cardinal, Tulane University, A. B. Freeman School of Business, 7 McAlister Drive, New Orleans, LA, 70118, United States, cardinal@tulane.edu, Donald Hatfield

March's (1991) insight on exploration and exploitation has been the focus of much research. We build on this literature by developing and testing hypotheses regarding not only the direct effects of accessing external knowledge, but also the indirect effects of coordination. We examine the impact of geographic dispersion on patent behavior and new drug development. In doing so, we are able to examine how organizational structure impacts firm learning.

■ SA17

H - 4th Floor, Union Square 11

Models for Pharmaceutical R&D Management

Cluster: New Product Development
Invited Session

Chair: Stefanos Zenios, Stanford University, 518 Memorial Way, Stanford, CA, United States, Stefzen@leland.stanford.edu

1 - Real Options in Partnership Deals: The Perspective of Cooperative Game Theory

Stefan Scholtes, Judge Business School, University of Cambridge, Cambridge, CB2 1AG, United Kingdom, s.scholtes@jims.cam.ac.uk, Nicos Savva

Pharmaceutical co-development deals form the practical background for this paper. We study the effect of phased investments and optionality on the negotiation set, the core, of a cooperative game. The valuation focuses on two cases: (i) the uncertainty can be fully hedged and (ii) hedging opportunities are discarded and preferences are expressed by certainty equivalents. In both cases the stochastic game can be reduced to an equivalent deterministic game. We discuss managerial implications.

2 - Optimal Licensing for R&D Projects

Bert De Reyck, London Business School, Regent's Park, London, UK, NW1 4SA, United Kingdom, bdereyck@london.edu, Pascale Crama, Zeger Degraeve

We design optimal licensing contracts for R&D projects with milestone payments and royalties. We maximize the licensor's expected NPV for diverse states in terms of information on the licensee's valuation and control over the licensee's effort. The optimal contract depends on the scenario and in the case of incomplete information and control, the licensor uses trade-offs between milestones and royalties to screen the licensee and vary the incentives. We conclude with managerial insights.

3 - Toward Optimizing R&D Allocation in the Pharmaceutical Industry

John Cavallaro, PhD Candidate, Stanford University, Mangement Science & Engineering, Stanford, CA, United States, john.cavallaro@stanford.edu, Stefanos Zenios

We model the optimal budget allocation between pharmaceutical R&D and marketing. Regression against observed returns is significant but weak. However, when the firms are clustered into two groups, those high in both therapeutic area (TA) intensity and US sales (vs. low in both), significance and strength improve. The cluster with high TA intensity and high US sales correlates well with the model, suggesting that for some firms, adjusting the R&D allocation could improve return.

■ SA18

H - 4th Floor, Union Square 12

Large Scale Problems in Transportation

Contributed Session

Chair: Ahmad Jarrah, Assistant Professor of Decision Sciences, University of Wyoming, Department of Management and Marketing, College of Business, Laramie, WY, 82071, United States, jarrah@uwyo.edu

1 - A Variant of the Continuous Network Design Problem Solvable for Large-Scale Systems

Gary Davis, Professor, University of Minnesota, 122 CivE, 500 Pillsbury Drive SE, Minneapolis, MN, 55455, United States, drtrips@umn.edu, Kate Sanderson

We describe a variant of the continuous network design problem (NDP), where the objective is to find the minimum amount of new lane-miles of highway capacity needed to satisfy quality of service constraints. We demonstrate an equivalence between the Karush-Kuhn-Tucker points of our NDP and the solutions to a set of nonlinear equations. A version of the method of successive averages is used to solve these equations, and is applied tothe freeway system of the Twin Cities.

2 - Factors that Impact Solution Run-times of Arc-based Formulations of the Vehicle Routing Problem

Ilgaz Sungur, Ph.D. Candidate, University of Southern California, Industrial Engineering Department, 3715 McClintock Avenue GER 240, Los Angeles, CA, 90089-0193, United States, sungur@usc.edu, Fernando Ordonez, Maged Dessouky

It is well known that the VRP becomes more difficult to solve as the problem size increases, however little is known about what makes a VRP difficult or easy to solve for problems of the same size. In this paper we investigate the effect of formulation and data parameters on the efficiency with which we can obtain exact solutions to the VRP by a commercial IP solver. We show experimentally how solution run-times of five different arc-based formulations are affected by data parameters.

3 - Convergence to Neologism-Proof Equilibria

Amy Taylor, University of New Hampshire, 217-F McConnell Hall, Durham, NH, 03824, United States

The vexing problem of multiplicity of equilibria in cheap-talk games has spurred research on refinements but equilibrium selection remains an as-yet unresolved theoretical issue. In the present paper we test neologism proofness in cheap-talk games with costless messages.

4 - Heuristic Approaches for a TSP Variant: Meter Reading Shortest Tour Problem

Jing Dong, University of Maryland, Department of Civil & Environmental Eng., 1173 Glenn Martin Hall, College Park, MD, 20742, United States, jdong@mail.umd.edu, Ning Yang, Ming Chen, Bruce Golden

We propose a TSP variant, Meter Reading Shortest Tour Problem (MRSTP), which has applications in Automatic Meter Reading. We seek a minimal length tour in a Euclidean plane that covers (within a distance) all the customer nodes (meters). Two heuristic algorithms are proposed and computational results are provided.

5 - Load Plan Design for Large LTL Carriers

Ahmad Jarrah, Assistant Professor of Decision Sciences, University of Wyoming, Department of Management and Marketing, College of Business, Laramie, WY, 82071, United States, jarrah@uwyo.edu, Luke Neubert, Ellis Johnson

We present a novel formulation for the problem of designing the planned flow of freight for large less-than-truckload carriers. The model uses a one-week repeating planning horizon and addresses practical operational considerations including empty repositioning costs and hub processing capacities. We present an effective solution algorithm that makes use of load planning tree generation in conjunction with a search heuristic. Computational results are provided.

■ SA19

H - 4th Floor, Union Square 13

KLIC I — Individual-Organizational Linkages (Knowledge, Learning & Intellectual Capital)

Sponsor: Technology Management
Sponsored Session

Chair: Charles Weber, Assistant Professor, Portland State University, Post Office Box 751, Department of Engineering and Technology, Portland, OR, 97207-0751, United States, charles.weber@etm.pdx.edu

1 - Characterizing the Value-Driven Learning Curve
Charles Weber, Assistant Professor, Portland State University, Post Office Box 751, Department of Engineering and Technology, Portland, OR, 97207-0751, United States, charles.weber@etm.pdx.edu

The traditional cost-driven learning curve does not satisfactorily explain many high tech organizational learning phenomena such as learning high-velocity environments (Eisenhart & Bourgeois) learning before doing (Pisano), yield-driven learning, (Bohn & Terwiesch) learning while ramping (Terwiesch & Bohn), designing for learning, platform leadership (Gawer & Cusumano) and increasing returns (Arthur). A promising value-based alternative is presented.

2 - Agent-based Social Simulation in Organizational Learning: A Micro Perspective
Brent Capps-Zenobia, Ph.D. Student, Portland State University - ETM, bcapps@hevanet.com, Charles Weber

Historically, organizational learning has focused on the macro-perspective (learning curve, Lotka-Volterra equations). The the point of view of the individual has not been discussed exhaustively. Agent-based social simulation, an approach in which human behavior is simulated by automata, presents itself as an alternative. A case from innovation adoption is presented.

3 - A Dynamic Model of Transactive Memory Systems
Edward Anderson, University of Texas at Austin Business School, McCombs School of Business, 1 University Station B6500, Austin, TX, 78733, United States, Edward.Anderson@mccombs.utexas.edu, Kyle Lewis

A key determinant of any product development group's performance is its transactive memory system (TMS): its shared, tacit memory system for managing and communicating information relevant to the group. We build a system dynamics model relating TMS to productivity by leveraging the theory of learning-by-doing at both the group and individual levels. We also include the effects of "group forgetting," specialization, and knowledge obsolescence.

4 - Individual-Organization Link and Knowledge
Teppo Felin, Visiting Assistant Professor, Emory, 1300 Clifton Road, Atlanta, GA, 30322, United States, teppo_felin@bus.emory.edu, William Hesterly

In this paper we address the individual-organization link as it relates to knowledge, and we explicate the problem of transformation between levels. Specifically - how, when, and why can we meaningfully talk about organizational knowledge? We also address some of the fallacies associated with specifying the organization as the repository knowledge and move toward explicating the underlying theoretical mechanisms and micro-foundations. Finally we outline critical future directions related to the micro-macro link for knowledge-based work in organization science.

■ SA20

H - 4th Floor, Union Square 14

Equilibrium and Simulation Models for Power Generation Planning in Wholesale Electricity Markets

Sponsor: Energy, Natural Resources & the Environment / Energy
Sponsored Session

Chair: Alvaro Baillo, Professor, Universidad Pontificia Comillas, Santa Cruz de Marcenado 26, Madrid, 28015, Spain, alvaro.baillo@iit.upco.es

1 - Option-Based Valuation of Electricity Generation Facilities
Valeriy Ryabchenko, PhD student, University of Florida, 473 Weil Hall, Gainesville, FL, 32611-6595, United States, valeriy@ufl.edu, Stan Uryasev

The paper considers a new algorithm for pricing spark spread options. It is based on linear programming approaches. We price electricity generation facilities under various assumptions (start-up costs, ramp up time, etc.).

2 - Joint Determination of Electric Energy and Reserves via Stochastic Linear Programming
David Fuller, Department of Management Sciences, University of Waterloo, Waterloo, ON, N2L 3G1, Canada, dfuller@engmail.uwaterloo.ca

The ISO solves a stochastic LP: first stage variables are generators' capacities to be made ready; second stage variables are energy outputs, and line flows, in each scenario, as defined by equipment outages, and demand. Outputs include energy spot and day-ahead prices. Reserve prices cannot be defined easily.

3 - Hydroelectric System Scheduling by Simulation
Andrés Ramos, Professor, Universidad Pontificia Comillas, Alberto Aguilera 23, Madrid, 28015, Spain, Andres.Ramos@iit.icai.upco.es, Jesùs Latorre, Alejandro Perea, Rafael Bellido, Santiago Cerisola

Simulation is a suitable tool for modeling the hydro system operation. The main reasons are complexities and interdependencies in the operation rules, cascaded topology of hydro basins, and stochastic hydro inflows. Some conflicting objectives must be considered: to avoid spillage from reservoirs, to satisfy the non electric uses of water, to keep a minimum downstream flow, and to maximize the profit of electricity sale. An object oriented simulation model has been developed with these features.

4 - Electricity Market Equilibrium Model with Risk Constraints via Benders Decomposition
Jordi Cabero, Ph. D. Student, Universidad Pontificia Comillas, Santa Cruz de Marcenado 26, Madrid, 28015, Spain, Jordi.Cabero@iit.upco.es, Alvaro Baillo, Mariano Ventosa, Santiago Cerisola

In this paper we propose a model to address the medium term hydrothermal coordination problem faced by a generation company when operating in an electricity market. The model measures the market risk faced by the company by means of CVaR. Our formulation leads to stochastic complementarity problems that we solve using Benders decomposition technique.

■ SA21

H - 4th Floor, Union Square 15

Learning to Rank: ROC Optimization in Data Mining

Sponsor: Data Mining
Sponsored Session

Chair: Nick Street, Associate Professor, University of Iowa, S232 Pappajohn Business Bldg., Iowa City, IA, 52241, United States, nick-street@uiowa.edu

1 - How to Predict the Best ROC
Rich Caruana, Assistant Professor, Cornell University, 4157 Upson Hall, Ithica, NY, 14853, United States, caruana@cs.cornell.edu

We present results from an empirical comparison of the ROC performance of ten learning methods: SVMs, neural nets, logistic regression, naive bayes, memory-based learning, random forests, decision trees, bagged trees, boosted trees, and boosted stumps. We not only show which learning methods predict good ROC, but also show that any model that predicts good ROC can be converted to a model that predicts good probabilities by calibrating the model with Platt's Method or Isotonic Regression.

2 - Rank Optimization by Maximizing the Area Under the ROC Curve using Linear Programming
Kaan Ataman, University of Iowa, Pappajohn Business Bldg., Iowa City, IA, 52242, United States, kaan-ataman@uiowa.edu, Nick Street

We introduce and analyze different linear programming formulations for directly optimizing an approximation to the area under the ROC curve (AUC). We also introduce techniques for reducing the geometrically increasing number of constraints in the model to make the LP scalable to larger problems.

3 - Regional Optimization of ROC Curves by Boosting
Yi Zhang, University of Iowa, Pappajohn Business Bldg., Iowa City, IA, 52242, United States, yi-zhang-2@uiowa.edu, Nick Street

ROC curves are often used to evaluate the ranking performance of learning models. Usually, however, people are only interested in a certain area of the ROC curve. We modify the standard boosting algorithm so that the resulting ensemble is able to optimize a fixed point on an ROC curve.

■ SA22

H - 4th Floor, Union Square 16

Information Systems Economics

Sponsor: Information Systems
Sponsored Session

Chair: Vidyanand Choudhary, Prof., University of California Irvine, GSM, UC Irvine, Irvine, CA, 92617, United States, VeeCee@uci.edu

1 - Impact of Software Vulnerability Announcements on the Market Value of Software Vendors
Rahul Telang, Carnegie Mellon University,, rtelang@andrew.cmu.edu, Sunil Wattal

While software vendors have been getting bad press for poor security of their products, we do not understand their incentives to provide secure software. Using the event study methodology, we collect data by searching for reports on published software vulnerabilities and show that vulnerability disclosures lead to about six percent loss in the market value of a software vendor. The change in stock price is more negative if the vendor fails to provide a patch at the time of disclosure.

2 - Profiting from Partial Allowance of Ticket Resale
Xianjun Geng, Assistant Professor, University of Washington, UW Business School, Box 353200, Seattle, WA, 98195, United States, gengxj@u.washington.edu

Prior research on ticket resale implicitly deems a resale market a unity, and so argues either for or against it. This paper argues that there is a third option - acknowledging that a resale market is often continuous and buyers often arrive

at different times, it is possible to divide the resale market into two segments, then allowing resale in the first segment and denying it in the second. We also discuss how the use of online resale venues facilitates partial allowance of resale.

3 - Consumer Privacy and Marketing Avoidance

Il-Horn Hann, Marshall School of Business, USC, 3670 Trousdale Parkway, Los Angeles, CA, United States, hann@marshall.usc.edu, Kai-Lung Hui, Ivan Png, Tom Lee

We introduce consumer avoidance into analytical marketing research. We show that consumer efforts to conceal themselves and to deflect marketing have a crucial impact on sellers' marketing strategy. Seller marketing is a strategic complement with consumer concealment. Policies that encourage consumers to conceal their identities would lead sellers to increase marketing. By contrast, policies that encourage consumers to deflect seller marketing would lead sellers to reduce marketing.

■ SA23

H - 4th Floor, Union Square 17

Best Financial Services Student Paper Competition

Sponsor: Financial Services
Sponsored Session

Chair: Suresh Nair, Professor, University of Connecticut, School of Business, Storrs, CT, 06269, United States, suresh.nair@uconn.edu

1 - The Impact New Jersey Home Ownership Security Act on Subprime Mortgage Loans

Wei Yu, Rutgers Business School, kellyyu@pegasus.rutgers.edu

This paper examines the impact of New Jersey Home Ownership Security Act on subprime mortgage lending. We study the impact at both the neighborhood and individual loan level in different stages of the law. By matching four different data sources, we control for a broad set of borrower, lender, property and loan characteristics. Simultanous equation and Heckman's selection correction model are used to address the endogeneity and sample selection bias problems. Different results are compared.

2 - Dynamic Hedging of Options with Transaction Costs Using Stochastic Programming and Horizon Control

Peter Meindl, Stanford University, pmeindl@stanford.edu, James Primbs

Dynamically hedging a short option in discrete time with transaction costs has generally been approached through either an instantaneous horizon sub-optimal analytical solution or a long horizon dynamic program whose solution is often computationally prohibitive. We propose a new methodology combining stochastic programming and receding horizon control that results in significantly reduced mean absolute hedging error vs. analytic solutions.

3 - Linking Stochastic Program and Policy Simulator for the U.S. Defined-Benefit Pension System

Zhuojuan Zhang, Princeton University, zhuojuan@Princeton.EDU

This paper presents a risk-based and anticipatory modeling framework to integrate an industry with its defined-benefit pension system. We develop an approach for risk-neutral valuation of contributions by plan sponsors. By linking stochastic program with a policy simulator, we study the problem of finding optimal policy rules such as pension investment and contribution rules. Empirical analysis indicates that pension decisions need to be tailored to the characteristics of different industries.

4 - Modern Portfolio Management with Conditioning Information

I-Hsuan Ethan Chiang, Boston College, chiangih@bc.edu

This paper considers how active portfolio managers may use conditioning information in forming portfolios to optimize performance measures. We provide explicit solutions for multiple risky assets, either with or without a risk free asset and also consider various constraints on portfolio risk. Abstracting from misspecification and estimation errors, our solutions improve the performance measure by four times when compared with the portfolios ignoring conditioning information.

■ SA24

H - 4th Floor, Union Square 18

Financial Models and Analysis I

Cluster: Financial Engineering
Invited Session

Chair: Xin Guo, Assistant Professor, Cornell University, School of ORIE, Cornell University, Ithaca, NY, 14853, United States, xg29@cornell.edu

1 - Robust Portfolio Selection Problems

Garud Iyengar, Associate Professor, Columbia University, garud@ieor.columbia.edu, Emre Erdogan

In this talk we survey some of our recent work on using robust optimization techniques in the context of portfolio selection. The intent of the robust optimization framework is to systematically correct for parameter uncertainties in optimization problems.

2 - Portfolio Optimization Via Approximate Dynamic Programming

Benjamin Van Roy, Stanford University, Terman 315, Stanford University, Stanford, CA, 94305-4023, United States, bvr@stanford.edu, Jiarui (Jared) Han, Xiang (Robbie) Yan

We will discuss approximate dynamic programming methods for portfolio optimization. Applications include long-term investment management and transaction cost optimization in high-frequency trading.

3 - Long Term Portfolio Optimization with Stochastic Programming and Receding Horizon Control

Peter Meindl, Stanford University, 1038 Guinda Street, Palo Alto, CA, 94301, United States, peter.meindl@stanfordalumni.org, James Primbs

Long term portfolio optimization is central to investment management, yet no generally accepted solution currently exists due to high computational hurdles. We approach the problem through a combination of stochastic programming and receding horizon control in an environment with many dynamic assets and transaction costs. Our methodology's advantages are its ability to optimize in realistically complex environments over a long horizon, while at the same time remaining computationally feasible.

4 - Revenue Management of Callable Products

Guillermo Gallego, Professor, Columbia University, 326 S.W. Mudd Building, New York, NY, 10027, United States, ggallego@ieor.columbia.edu, Haengju Lee

Providers of perishable capacities sold through a low-to-high booking process can significantly increase revenues by inducing low fare customers to grant them call options on capacity at a given strike price. This enables providers to resell this capacity to high fare customers. In this talk we investigate optimal booking and option exercise policies when the options expire before the end of the booking process.

■ SA26

H - 4th Floor, Union Square 20

JFIG- Paper Competition I

Sponsor: JFIG, Junior Faculty Interest Group
Sponsored Session

Chair: Joseph Geunes, Associate Professor, University of Florida, 303 Weil Hall, Gainesville, FL, 32611, United States, geunes@ise.ufl.edu

1 - Semi Continuous Cuts for Mixed Integer Programming

Ismael de Farias, Assistant Professor, University at Buffalo, SUNY, 403 Bell Hall, United States, defarias@buffalo.edu

We study the convex hull of the feasible set of the semi-continuous knapsack problem, in which the variables belong to the union of two intervals. Besides being important in its own right, the semi-continuous knapsack problem is a relaxation of general mixed-integer programming. We show how strong inequalities valid for the semi-continuous knapsack polyhedron can be derived and used in a branch-and-cut scheme for mixed-integer programming and problems with semi-continuous variables. We present computational results that demonstrate the effectiveness of these inequalities, which we call collectively semi-continuous cuts. Our computational experience also shows that dealing with semi-continuous constraints directly in the branch-and-cut algorithm through a specialized branching scheme and semi-continuous cuts is considerably more practical than the textbook approach of modeling semi-continuous constraints through the introduction of auxiliary binary variables in the model.

2 - Inspection and Replenishment Policies for Systems with Inventory Record Inaccuracy

Gurhan Kok, Assistant Professor, Duke University, 1 Towerview Dr., Durham NC 27708, United States, gurhan.kok@duke.edu, Kevin Shang

For many companies, inventory record inaccuracy is a major obstacle to achieving operational excellence. In this paper, we consider an inventory system in which inventory records are inaccurate. The manager makes inventory inspection and replenishment decisions at the beginning of each period. There is a fixed cost associated with each inspection. If an inspection is performed, inventory records are aligned with physical inventory. The objective is to develop a joint inspection and replenishment policy that minimizes total costs in a finite horizon. We show that an inspection adjusted base-stock (IABS) policy is near-optimal. Under this policy, the manager performs an inspection if the recorded inventory level is less than a threshold level and orders up to a base-stock level that depends on the inspection decision. In addition to this structural result, our study (1) provides guidelines for managers to design effective inspection schedules, (2) shows that the commonly-practiced cycle count policy can be effective if the right inspection cycle is chosen, and (3) quantifies the true value of RFID systems.

3 - Compound Poisson Disorder Problem

Savas Dayanik, Princeton University, sdayanik@princeton.edu Semih Sezer

In a compound Poisson disorder problem, arrival rate and/or jump distribution of some compound Poisson process change suddenly at some unknown and unobservable time. The problem is to detect the change (or disorder) time as quickly as possible. A sudden regime-shift may require some counter-measures be taken promptly, and a quickest detection rule can help with those efforts. We describe complete solution of compound Poisson disorder problem with several standard Bayesian risk measures. Solution methods are feasible for numerical implementation and are illustrated on examples.

■ SA27

H - 4th Floor, Union Square 21

2005 Dantzig Dissertation Award Finalists

Cluster: Dantzig Dissertation Prize
Invited Session

Chair: Linda Green, Professor, Columbia University, 3022 Broadway, New York, NY, 10027, United States, lvg1@columbia.edu

Dantzig Dissertation Prize

The Dantzig Prize is offered for the best PhD in Operations Research with applied content. The winner will likely offer a presentation, as will some of the strongest finalists.

1 - First Place - Randomization and Heavy Traffic Theory: New Approaches to the Design and Analysis of Switch Algorithms
Devavrat Shah, MIT, devavrat@MIT.EDU

High speed data networks, such as the Internet, present the algorithm designer with highly constrained problems: the algorithms need to work at a very high speed while providing good performance and accessing limited computing resources. Consequently, only the simplest algorithms are implementable. But such algorithms may perform rather poorly. This tension between implementability and goodness of performance is acutely experienced by the designer of switch scheduling algorithms. In the first part of my talk I will show how randomization may be used to simplify the implementation of switch schedulers. Specifically, I will exhibit a simple randomized scheduling algorithm that delivers 100% throughput while providing low delay. The second part of my talk concerns a new approach for analyzing the packet delay induced by an algorithm. I shall explain why traditional approaches based, for example, on queueing and large deviation theories are inadequate, and advance a new approach based on Heavy Traffic Theory. This approach helps explain some intriguing observations other researchers have made about the delay of scheduling algorithms based on simulations. It also leads to the characterization of a delay-optimal scheduling algorithm.

2 - Lot-Sizing and Scheduling for Flexible Flow Lines
Daniel Quadt, Daniel.Quadt@gmx.net

We consider the lot-sizing and scheduling problem for flexible flow lines. Flexible flow lines are flow lines with parallel machines on some or all production stages. The objective is to minimize setup, inventory holding and back-order costs as well as the mean flow time. The lot-sizing and the scheduling problem are interdependent. An integrative, three-phased solution approach is presented. In its first phase, a lot-sizing and scheduling problem for the bottleneck stage is solved on product family level. The phase is based on a novel MIP-model, which uses integer instead of binary variables. In the second phase, the schedule is rolled out to the other production stages. The third phase employs two nested Genetic Algorithms with a novel representation scheme to compute a detailed schedule on product level. The approach has been implemented in a semiconductor back-end.

3 - Uncertainty in Emergency Response - Estimating Ambulance Travel Times
Susan Budge, sbudge@ualberta.ca

An important component of virtually any model of emergency operations, is the travel time of the vehicles, especially of those vehicles enroute to a call. This is true because often the most critical performance measure for such a system is the time it takes to respond to an emergency, and the travel time of the vehicle to the scene of the emergency is typically a large portion of this response time. On the surface, the problem of estimating travel times may seem trivial, one might think it is simple - just divide the travel distance by the speed. However, if we look beyond the surface, it quickly becomes apparent that the problem is much more complicated than it first appears. This paper provides a thorough empirical analysis of ambulance travel times, focusing on the distribution (and in particular the variability) of actual travel times for ambulances, and how to incorporate that distribution into methods for estimating the travel time.

■ SA28

H - 4th Floor, Union Square 22

Consumer-Based Revenue Management

Sponsor: Revenue Management & Pricing
Sponsored Session

Chair: Patrice Marcotte, DIRO,, Université de Montréal, CP 6128, Succursale Centre-Ville, Montréal, QC, H3C 3J7, Canada, marcotte@iro.umontreal.ca

1 - An Exact Algorithm for Bilevel Toll Setting
Luce Brotcorne, Maître de Conférences, UVHC, Le Mont Houy, Valenciennes, 59313, France, luce.brotcorne@univ-valenciennes.fr, Fabien Cirinei, Patrice Marcotte, Gilles Savard

We describe a path-based framework for solving a bilevel pricing model, where the leader maximizes the revenue raised from tolls imposed on a set of network links, while taking into account the cost minimizing behaviour of customers. The performance of the algorithm is contrasted against that of a mixed integer formulation.

2 - Design and Positioning of Revenue Management Products
Kalyan Talluri, Universitat Pompeu Fabra, Department of Economics and Business, Barcelona, 08005, Spain, kalyan.talluri@upf.edu

Revenue management products are frequently redesigned (conditions of purchase, prices etc.), and can be almost considered an operational problem. There are very few models however in the literature specifically designed for RM products. We present an additive utility model in product attributes and derive structural results and an optimal solution for the one-dimensional version and then extend some of the results to multi-dimensional problems.

3 - Competitive Supply Chain Contracting: RM for Tour Operators
Benjamin Marcus, Richard Ivey School of Business, 1151 Richmond Street N, London, ON, N6A 3K7, Canada, bmarcus@ivey.uwo.ca, Chris Anderson

Tour operators provide bundled products (airline, hotel, car rental) for resort vacations. Depending on the tour operator they may not own any of this capacity, entering into contracts to secure rooms, seats etc. We will discuss the tour RM problem, presenting some approaches along with the use of contracts used in risk sharing.

4 - Pricing Models based on Reservation Prices
Romy Shioda, University of Waterloo, 200 University Avenue West, Waterloo, ON, Canada, rshioda@math.uwaterloo.ca, Levent Tuncel

We consider revenue management models for pricing a product line with several customer segments. We work under the assumption that every customer's product choice is determined entirely by their reservation price. We formulate a maximum utility and several probabilistic choice models as mixed-integer programming problems and illustrate some computational results. We also highlight key mathematical properties of the maximum utility model.

■ SA29

H - 4th Floor, Union Square 23

OR and Computing

Contributed Session

Chair: Brett Landry, Asst Professor, University of New Orleans, Dept of Management, 2000 Lakeshore Drive, NO, LA, 70148, United States, blandry@uno.edu

1 - A Genetic Algorithm with Adaptive Crossover Probabilities
Patricia Randall, Clemson University, Department of Industrial Engineering, 110 Freeman Hall, Clemson, SC, 29634, pcavedo@clemson.edu, Mary Beth Kurz

The performance of a genetic algorithm is heavily influenced by the choice of crossover operation and its respective rate. An adaptive GA is given that uses one of two crossover selection mechanisms: a regulatory gene added to each chromosome and roulette wheel crossover selection.

2 - Use of Automated Information Systems to Improve Efficiency in HR Management
Mohammad Bsat, Professor, Jackson State University, 5201 Lakeland Dr, Suite 169, Jackson, 39232, United States, mdbsat@yahoo.com, stephen trouard, Astrid Beckers

This research hypothesizes that automated collection,storage,& retrieval of information related to the hr element in any organization helps make more informed,lasting decisions about utilization & retention of its HR which helps the organization in its competitive efforts.A large-scale household appliance manufacturer who implemented an automated process for its hr information gathering & now relies on a completely computerized storage,retrieval,& utilization of the hr-related data was surveyed

3 - An Open Source Algebraic Modeling and Programming Software
Suleyman Karabuk, Assistant Professor, University of Oklahoma, 202 West Boyd, Room 124, Norman, OK, 73019, United States, karabuk@ou.edu

We describe an initiative in designing and developing an open source algebraic modeling and programming software similar to the current commercial products such as AMPL and GAMS among many others. There are two motivations to this effort: (i) cross the bridge between general purpose programming languages and domain specific algebraic modeling languages, (ii) create an open platform for the community to diffuse research in extending the current state of algebraic modeling languages.

4 - Analysis of Semantic Interoperability to Provide Design Guidelines for Interfacing Design and Engineering

Cheolsoon Im, Ph.D. student/ Research Assistant, Wayne State Univ, 80 E. Hancock Apt 702, Detroit, MI, 48201, United States, cim@wayne.edu, Namkyu Park

I plan to achieve semantic interoperability between engineering and design in automotive design process. I identified major inefficiencies at an automotive company. Often, suppliers are on board late and designers tend not to honor detailed design. I would analyze system design specification to define data semantics and construct ontology. Expected benefit would be better communication which will foster trust building, early design freeze and reduction of time spent in design process.

5 - Developing Secure RFID Networks

Brett Landry, Asst Professor, University of New Orleans, Dept of Management, 2000 Lakeshore Drive, NO, LA, 70148, United States, blandry@uno.edu

Organizations that adopt RFID can gain tremendous gains in both efficiency and effectiveness. However, when viruses, worms, spyware, and trojan horses target these resources, the organization can cease to function. Therefore, RFID based networks should be secure, private, and separate from other computing resources. The problem for many organizations is that they do not have the infrastructure necessary to support this division.

■ SA30

H - 4th Floor, Union Square 24

Finance Engineering in Investment Decsion Making

Contributed Session

Chair: Eymen Errais, Stanford University, Terman Engineering, 494, Stanford, CA, 94305, United States, eymen@stanford.edu

1 - Optimizing Portfolio Weights for the Second Degree Stochastic Dominance with Maximum Expected Return

Choonho Ryu, Associate Professor, Hong-ik University, Dep't of Bus. Admin., 72-1 Sangsoo-dong Mapo-gu, Seoul, 121-791, South Korea, ryuch@wow.hongik.ac.kr

Unlike the mean-variance approach, the stochastic dominance approach is to form a portfolio that stochastically dominates a predetermined benchmark portfolio such as Dow Jones Index and KOSPI. This study is to search a set of portfolio weights for the second degree stochastic dominance with maximum expected return by managing the constraint set and the objective function separately. An algorithm was developed and tested with promising results against Korean stock market data sets.

2 - International Portfolio Choice and Political Instability Risk

K. Smimou, Faculty of Management, University of Lethbridge, Box 21043 Westview P.O., Lethbridge, AB, T1K6X4, Canada, kamal.smimou@uleth.ca

Despite the demonstrated benefits from direct international portfolio diversification into foreign nations including the less developed countries are well documented, the idea is discouraged by market imperfections such as political instability and taxes. Using alternative instability risk proxies in the context of mean-variance framework, two models are proposed and the impact of this type of risk on international portfolio investment decision is corroborated.

3 - Pricing Credit Default Swap Bermudan Options : An Approximate-Dynamic Programming Approach

Eymen Errais, Stanford University, Terman Engineering, 494, Stanford, CA, 94305, United States, eymen@stanford.edu, Damiano Brigo, Hatem Ben Ameur

We define a new credit derivatives product, Credit Default Swap Bermudan option, and devise a numerical method to price it. We model the default event within the doubly stochastic intensity framework where the intensity is defined by an extension of CIR, the CIR++ model. The numerical method developed is based on dynamic programming with finite elements and piecewise linear approximation.

■ SA31

H - 4th Floor, Union Square 25

Joint Session OR Practice/Roundtable: Supply Chain Management in the Automotive Industry

Cluster: OR Practice, Roundtable

Invited Session

Chair: Mark Everson, Ford Motor Company, Infotronics & Systems Analytics Department, SRL Bldg, MD # 2122, 2101 Village Rd., Dearborn, MI, 48124, meverson@ford.com

Co-Chair: Erica Klampfl, Ford Motor Company, Infotronics & Systems Analytics Department, SRL Bldg, MD # 2122, 2101 Village Rd, Dearborn, MI, 48124, United States, eklampfl@ford.com

1 - Supply Chain Network Optimization Model for Commodity Sourcing

Erica Klampfl, Ford Motor Company, Infotronics & Systems Analytics Department, SRL Bldg, MD # 2122, 2101 Village Rd, Dearborn, MI, 48124, United States, eklampfl@ford.com, Oleg Gusikhin, Roger Tenney

Commodity sourcing is a complex problem faced by automotive manufacturers, which must take into account transportation, production, and inventory costs, as well as the capability and capacity constraints of the suppliers. This talk presents a network modeling approach to represent the possible configurations of the supply chain of automotive commodity subassemblies. The mathematical formulation and solution technique will be discussed and illustrated with an application example.

2 - Models and Algorithms for Scheduling in Automotive Stamping Plants

Amy Cohn, University of Michigan, 1205 Beal Avenue, Ann Arbor, MI, 48109-2117, United States, amycohn@engin.umich.edu, Giuseppe Rossi, Yakov Fradkin, Ada Barlatt, Oleg Gusikhin

Automotive stamping plants contain sequential workstations which jobs pass through until each product is fully assembled. Such manufacturing environments have complex production and material handling requirements. We present novel models and algorithms to find minimum cost sequences and batch sizes on each workstation. Preliminary computational results are provided.

3 - Capacity Optimization for the Supply Chain

Mark Everson, Ford Motor Company, Infotronics & Systems Analytics Department, SRL Bldg, MD # 2122, 2101 Village Rd., Dearborn, MI, 48124, meverson@ford.com, David A. Ostrowski

Determining assembly and supply base capacity for a multi-product manufacturer like an automotive company is a problem that has many facets. Important issues include: consumer demand uncertainty characterization, the level of part commonality, and the flexibility of both assembly plants and the supply base. This talk will overview a number of planning models that determine optimal supply base capacity given demand uncertainty.

4 - Measuring Manufacturing Flexibility Value in an Automotive Supply Chain

Charu Chandra, Associte Professor, University of Michigan-Dearborn, 4901 Evergreen Road, 2230 Engineering Complex, Dearborn, MI, 48128, United States, charu@umich.edu, Mark Everson, Janis Grabis

Manufacturing flexibility is a recognized strategy for dealing with demand uncertainty. This paper expands flexibility research by determining flexibility requirements for the entire manufacturing supply chain, focusing on enabling volume flexibility, and analyzing impact of product variety. A stochastic programming model for optimization of flexibility requirements is developed. Model solving approaches are compared. Experimental studies using data from a major automotive company are conducted.

■ SA32

H - 6th Floor, Lombard

Recent Advances in Sports Modeling

Sponsor: OR in SpORts

Sponsored Session

Chair: Michael Trick, Carnegie Mellon University, Tepper School of Business, Pittsburgh, PA, United States, trick@cmu.edu

1 - Scheduling Major League Baseball

Michael Trick, Carnegie Mellon University, Tepper School of Business, Pittsburgh, PA, United States, trick@cmu.edu, Kelly Easton, George Nemhauser

The Sports Scheduling Group has created the schedules for Major League Baseball for the 2005 and 2006 seasons. We outline some of the issues in defining these schedules and some of the approaches we use in creating them.

2 - Beating the Brackets

Joel Sokol, Assistant Professor, Georgia Institute of Technology, School of Industrial & Systems Engineeri, Georgia Institute of Technology, Atlanta, GA, 30332-0205, United States, jsokol@isye.gatech.edu, Paul Kvam

We describe a data-simple logistic regression/Markov chain (LRMC) model for rating NCAA basketball teams. Our most recent compuational results show that our model makes more accurate predictions than expert ranking systems, rating systems, and Las Vegas oddsmakers, even when those other methods are enhanced by dynamic programming. The difference is amplified as the complexity of tournament pool scoring systems increase.

3 - Bill James 'Pythagorean Method Of Baseball' - Some Findings And Potential Alternatives

James Cochran, Department of Marketing and Analysis, College of Administration and Business, Louisiana Tech University, Ruston, LA, 71272, jcochran@cab.latech.edu

In the early 1980's Bill James suggested a relationship between the win/loss percentage of a MLB team and the ratio of squared runs scored to squared runs scored plus squared runs allowed. While the relationship works well, questions still exist - Is another functional form superior? What is the optimal value of the exponent? Has it changed over time? Does it differ between leagues? Does any franchise consistently overachieved or underachieved over a prolonged period? We address these questions.

■ SA33

H - 6th Floor, Mason

Process Monitoring and Diagnosis(2)

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: Fugee Tsung, Associate Professor, Hong Kong University of Science and Techonology, IELM Department of HKUST, Kowloon, Hong Kong, season@ust.hk

1 - A Weighted CUSUM Chart For Detecting Patterned Mean Shifts

Wei Jiang, Assistant Professor, Stevens Institute of Technology, Castle Point of Hudson, Hoboken, NJ, 07030, United States, wjiang@stevens.edu, Lianjie Shu

For monitoring residuals from a time series, conventional control charts may perform poorly as they do not consider the information contained in the patterned mean shift. This paper proposes a weighted cumulative sum (WCUSUM) procedure which first estimates the dynamic mean of the sequence then uses the estimates for weighting the monitoring sequence. The WCUSUM chart performs far superior than the CUSUM chart when forecast recovery is present, and performs similarly otherwise.

2 - A CUSUM Chart with Local Signal Amplification for Detecting a Range of Unknown Shifts

Yanting Li, Hong Kong University of Science and Techonogy, Tower A403,, HKUST, Clear Water Bay, Kowloon, Hong Kong, ielyt@ust.hk, Fugee Tsung, Dong Han

A traditional CUSUM chart can only be optimally designed to detect a pre-specified mean shift. With an aim to enhance the detection of small, medium and large mean shifts range, we propose LSA_CUSUM by combining local signal amplification technique with the CUSUM chart; also we present the optimum design procedures. Simulations are conducted to compare the performance of the proposed LSA-CUSUM chart with other CUSUM-type control charts. The results show that LSA-CUSUM outperforms other schemes.

3 - Estimating the Change Point of Exponentially Distributed Observations in SPC

Marcus B. Perry, Air Force Institute of Technology, Department of Operational Sciences, Marcus.Perry@afit.edu, Sharif Melouk

Following a control chart signal, locating a process change point would simplify the search for and identification of the special cause. This research compares the maximum likelihood estimator (MLE) of the process change point to the change point estimator of the exponential CUSUM control chart. Results show the MLE outperforms the CUSUM estimator across a wide range of change magnitudes.

4 - Multivariate Cuscore Control Charts for Monitoring the Mean Vector in Autocorrelated Processes

Harriet Black Nembhard, Marcus Department of Industrial & Manufacturing Engineering, The Pennsylvania State University, 310 Leonhard Building, University Park, PA, 16802, hbnembhard@psu.edu, Shuohui Chen

A multivariate Cuscore procedure based on the likelihood ratio test and fault signature analysis is proposed. A case study with a reactive ion etch (RIE) process used in the semiconductor manufacturing industry illustrates how the MCuscore is applied.

■ SA34

H - 6th Floor, Powell

Sensor II

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: Yong Chen, University of Iowa, Mechanical and Industrial Engineering, Iowa City, IA, United States, yongchen@engineering.uiowa.edu

1 - Enemy Track Based Threat Evaluation for Military Sensor/Fusion Networks

Rajan Batta, Professor, University at Buffalo (SUNY), 438 Bell Hall, Department of Industrial Engineering, Buffalo, NY, 14260, United States, batta@eng.buffalo.edu, Abhay Joshi, Rakesh Nagi

In a recent paper, Patel et al. (2005) proposed a dynamic maximal expected coverage model for sensor networks operating under a uniform threat environment. This is applicable at a strategic level. At a tactical level enemy track information is available, which can be used to obtain refined threat probabilities, which vary in space and time. The first part of our work is in the calculation of these time/space dependent probabilities. We then enhance Patel et al.'s model and study the benefit.

2 - Range-free Localization for Ad Hoc Sensor Networks Using Range Means

Ming-En Wang, Assistant Professor, University of Pittsburgh, 1034 Benedum Hall, Pittsburgh, PA, 15261, United States, MEWang@engr.pitt.edu

Knowing node locations is critical to many applications of ad hoc sensor networks. A popular approach to ad hoc localization is to determine node locations based on estimated distances between nodes and location-aware anchors. We propose a range-free, distributed distance estimation scheme based on the probability distribution of the location of h-hop nodes. Simulations show that the proposed range-mean method consistently outperforms the well known DV-hop method in various network settings.

3 - Sensors and Data Fusion for Traffic Monitoring

Pitu Mirchandani, Professor, University of Arizona, Systems and Industrial Engineering, P.O. Box 210020, Tucson, AZ, 85721, United States, pitu@sie.arizona.edu

We will briefly discuss various sensors available for monitoring vehicular traffic on transportation networks. Some models for data analysis and traffic parameter estimation will be presented, with clear indication of how these may be applied for traveler information systems and embedded in real-time traffic monitoring systems.

4 - Monitoring of Process and Sensor Fault Based on a Fault-quality Model

Yong Chen, University of Iowa, Mechanical and Industrial Engineering, Iowa City, IA, United States, yongchen@engineering.uiowa.edu, Yu Ding, Shan Li

Linear fault-quality models have been developed in recent years for quality modeling and improvement. Changes on quality characteristics are typically due to process faults and/or sensor faults. An SPC strategy is developed in this research to online monitor both process and sensor faults. The process faults and sensor faults can be monitored separately by projecting observations of quality characteristics to two orthogonal spaces based on the fault-quality model.

■ SA35

H - 6th Floor, Sutter

Rail Applications Academic Session

Sponsor: Railroad Applications
Sponsored Session

Chair: Christopher Barkan, Associate Professor & Director - Railroad Engineering Program, Department of Civil and Environmental Engineering, University of Illinois at Urbana-Champaign, 205 N Mathews Ave., 1201 NCEL, MC-250, Urbana, IL, 61801, United States, cbarkan@uiuc.edu

1 - A Risk-Cost Approach to Rail-Truck Intermodal Transportation of Mixed Freight

Manish Verma, Memorial University, mverma@mun.ca, Vedat Verter

Rail-truck intermodal transportation of hazardous and regular freight is discussed. Tradeoff analyses driven by the element of "time" dictate the evaluation of drayage and train make-up. Mathematical models, a general case and two special cases, developed to capture the time-based rail-truck intermodal transportation of mixed freight are presented.

2 - Genetic Algorithm to Minimize Earliness and Tardiness of Outbound Trains in a Rail Yard

Rob Randall, Clemson University, 110 Freeman Hall, Clemson University, Clemson, SC, 29633, United States, rrandal@clemson.edu, Mary Beth Kurz

We develop a genetic algorithm to solve the rail yard scheduling problem to minimize earliness and tardiness of outbound trains. This problem is np-complete and it is therefore necessary to find a method to approximate the optimal value for realistic problem instances. We consider a hump yard with multiple switch and yard engines and allow delay to be inserted between trains.

3 - Optimization of the Loading Patterns of Intermodal Freight Trains
Yung-Cheng Lai, Graduate Research Assistant, University of Illinois at Urbana-Champaign, B118 Newmark Lab., 205 N. Mathews Ave., Urbana, IL, 61801, United States, lai3@uiuc.edu, Hayri Onal, Christopher Barkan

Intermodal trains incur greater aerodynamic penalties and increased fuel consumption than other trains due to constraints imposed by equipment design and loading patterns. Gap length and position-in-train are the two most important factors; hence, minimizing the gaps and placing loads with shorter gaps near the front generates lower aerodynamic resistance. We present a model for determining optimum loading patterns which minimize aerodynamic resistance and yield the highest fuel efficiency.

4 - A Decision Support System for Train Scheduling Problem
Krishna Jha, Research Director, Innovative Scheduling, 2153 SE Hawthorne Road, Suite 128, Gainesville, FL, 32641, United States, krishna@innovativescheduling.com, Ravindra Ahuja, Pooja Dewan, Arvind Kumar

For a class I railroad in US, the train scheduling problem is extremely large,complex, and multi-objective combinatorial optimization problem. Mathematically,it is very difficult to generate an implementable train schedule without user intervention. We have developed a decision support system, which is empowered with highly efficient network flow heuristics at the back end, to assist users in creating implementable train schedule.

■ SA36

H - 6th Floor, Taylor

Joint Session Simulation/ QSR: Design and Analysis of Simulation Experiments

Sponsor: Simulation, Quality, Statistics and Reliability
Sponsored Session

Chair: Bruce Ankenman, Associate Professor, Northwestern Univeristy, 2145 Sheridan Rd., Evanston, IL, 60208, United States, ankenman@northwestern.edu

1 - Controlled Sequential Factorial Design for SImulation Factor Screening
Hong Wan, Assitant Professor, Purdue University, Industrial Engineering Department, 315 N. Grant Street, West Layfayette, IN, 47907, United States, hwan@purdue.edu, Hua Shen

We propose controlled sequential factorial design for discrete-event simulation factor screening. It combines a sequential hypothesis-testing procedure with the traditional factorial design to control the Type I Error and power for each factor under heterogeneous variances conditions. The method requires minimum assumptions and demonstrates robust performance with different system conditions.

2 - Estimation of Percentiles of Cycle Time in Manufacturing Simulation
Barry Nelson, Professor, Northwestern University, Dept. of Industrial Engr. & Mgmt. Sci., 2145 Sheridan Road, Evanston, IL, 60208-3119, United States, nelsonb@northwestern.edu, Bruce Ankenman, Feng Yang

We presents a simulation-based method for estimating percentiles of the cycle time distribution of a manufacturing system as a function of the factory throughput and percentile of interest. The method fits metamodels to the first three moments of cycle time as a function of throughput, and then uses a moment-based approximation to obtain the percentiles of interest.

3 - Estimating Cycle-Time Quantiles in Manufacturing Systems
Jennifer McNeill, Graduate Student, Arizona State University, Department of Industrial Engineering, Tempe, AZ, 85287, United States, Jennifer.Mcneill@asu.edu, John Fowler, Gerald Mackulak, Barry Nelson

Previous cycle-time quantile estimation work has suggested that the Cornish-Fisher expansion (CFE) can be used effectively to provide cycle-time quantile estimates. However, when dispatching rules are implemented, the shape of the cycle time distribution may change severely. In such situations, the accuracy of the CFE can degrade, motivating the need for a modification to the expansion. A solution approach combining a data transformation, the maximum transformation, with the CFE is presented.

4 - An Adaptive Method for Factor Screening for Simulation Experiments
Bruce Ankenman, Associate Professor, Northwestern Univeristy, 2145 Sheridan Rd., Evanston, IL, 60208, United States, ankenman@northwestern.edu, Russell Cheng, Sue Lewis

The sequential method is based on an orthogonal array, but assumes that some factor effects have a known direction. The rows of the orthogonal array are run in a strategic order to allow for group factor screening of these factors. If the group screening is effective in eliminating null factors, then the orthogonal array is reduced in size and the procedure continues. Methods for adding power control and detection of dispersion effects to the screening procedure will also be discussed.

■ SA37

H - 6th Floor, Van Ness

Joint Session AP/ Workforce: Queueing Systems with Flexible Servers I

Sponsor: Applied Probability, Workforce Flexibility
Sponsored Session

Chair: Sigrun Andradottir, Professor, Georgia Institute of Technology, School of ISyE, Atlanta, GA, 30332, United States, sa@isye.gatech.edu

1 - Discretionary Task Completion: A Key Difference between White-Collar and Blue-Collar Work System
Gigi Yuen, Northwestern University, 2145 Sheridan Road, C229, Evanston, IL, 60208, United States, gigiyuen@northwestern.edu, Seyed Iravani, Wally Hopp

We study models that capture characteristics of white-collar work systems, particularly workers' level of discretion on task completion. The optimal work structure and effectiveness of various heuristics are investigated for single and multiple class systems. Contrary to traditional blue-collar framework, congestion may intensify when capacity increases. Moreover, information about job types in queue is less useful in systems discretionary task completion system.

2 - Dynamic Routing of Generic Customers to Stations with Dedicated Traffic
Serhan Ziya, Assistant Professor, University of North Carolina, Department of Statistics and Operations, Chapel Hill, NC, United States, ziya@email.unc.edu, Nilay Argon, Kevin Glazebrook, Li Ding

We consider a network of parallel heterogeneous service stations each modeled as a single server queue. Each station serves its own dedicated customers as well as generic customers who are routed from a central controller. Both dedicated and generic customers incur waiting costs for the time they spend in the system. We develop heuristic routing policies that minimize the long-run average cost and provide numerical results that compare the performance of different heuristics.

3 - Evaluating Robustness of Networks with Flexible Servers
Douglas Down, McMaster University, Department of Computing and Software, Hamilton, ON, Canada, downd@mcmaster.ca, Hayriye Ayhan, Sigrun Andradottir

We investigate how server flexibility can decrease sensitivity to disturbances in the underlying system (due to causes such as demand variability and errors in parameter estimation). We first identify desirable properties of flexibility structures. We then propose a means for quantifying the ability of a particular flexibility structure to mitigate the effects of such disturbances.

4 - Impulse Control of Brownian Motion: The Constrained Average Cost Case
Melda Ormeci, Georgia Institute of Technology, School of Industrial & Systems Eng., Atlanta, GA, 30332, United States, ormecime@isye.gatech.edu, John H. Vande Vate, Jim Dai

Consider a storage system whose content fluctuates as a Brownian motion in the absence of control. Inventory level can be adjusted by any quantity at a fixed plus proportional cost. A linear holding cost is incurred continuously. We show control band policies are optimal and calculate the optimal policy parameters. Developing techniques based on Lagrangian relaxation we show that this type of policy is optimal even with constraints on the size of adjustments and on the maximum inventory level.

■ SA38

R - 2nd Floor, Corintia

Applications of Semidefinite and Second-Order Cone Programming

Cluster: Linear/Nonlinear Programming
Invited Session

Chair: Stephen Wright, Professor, University of Wisconsin, Computer Sciences Department, 1210 W. Dayton Street, Madison, WI, 53706, United States, swright@cs.wisc.edu

1 - SOCP Methods for Total Variation-based Image Restoration and Cartoon-texture Decomposition
Donald Goldfarb, Professor, Columbia University, Department of IEOR, 500 West 120th Street, New York, NY, 10027, United States, goldfarb@columbia.edu, Wotao Yin

We present methods for image restoration and cartoon-texture decomposition based on the total variation minimization framework of Rudin, Osher and Fatemi and second-order cone programming. Analyical results will be presented as well as computational results illustrating the effectiveness of our approach.

2 - Approximating K-means-type Clustering via Semidefinite Programming

Jiming Peng, Assistant Professor, McMaster, Department of Coputing and Software, McMaster University, Hamilton, ON, L8P4K1, Canada, pengj@mcmaster.ca, Yu Wei

K-means is the most intuitive and popular clustering algorithm and is the working horse for clustering. In this talk, we first show that the classical K-means clustering can be modelled as 0-1 semidefinite programming. Our new model provides an unified framework for several different clustering approaches. By using singular value decomposition, we obtain a rounding procedure that can provide a 2-approximation to the oriiginal problem.

3 - Optimal MRI Tissue Segmentation using Sequential Semidefinite Optimization

Christopher Anand, Assistant Professor, McMaster University, Department of Computing and Software, 1280 Main St. West, ITB-202, Hamilton, ON, L8S 4K1, Canada, anand@cas.mcmaster.ca, Renata Sotirov, Tamas Terlaky, Zhuo Zheng

We propose a novel method of reconstructing quantitative tissue densities from Magnetic Resonance Imaging data, based on a model of tissue component properties, and a novel semidefinite merit function. For the special case of Steady-State Free Precession experiments, we formulate a non-linearly constrained SD problem and solve it using sequential semidefinite optimization.

4 - A Framework for Kernel Regularization with Application to Protein Clustering

Stephen Wright, Professor, University of Wisconsin, Computer Sciences Department, 1210 W. Dayton Street, Madison, WI, 53706, United States, swright@cs.wisc.edu, Fan Lu, Sunduz Keles, Grace Wahba

We develop a novel framework for extracting a positive definite kernel matrix from possibly noisy and incomplete dissimilarity information between pairs of objects. Semidefinite and second-order cone programming formulations result in a kernel that places the objects in a Euclidean space to fit the observed dissimilarity information while controlling complexity. An application to protein clustering is presented.

■ SA39

R - 3rd Floor, Aragon

Modern Gradient Methods for Large-scale Optimization Problems

Sponsor: Optimization/ Linear Programming and Complementarity
Sponsored Session

Chair: Yurii Nesterov, Professor, CORE/INMA, UCL, 34 voie du Roman Pays, Louvain-la-Neuve, 1348, Belgium, nesterov@core.ucl.ac.be

1 - Improved Approximation Schemes for Linear Programming Relaxations of Combinatorial Problems

Fabian Chudak, Dr., IFOR ETHZ, ETH-Zentrum, CLP, Zurich, CH 8092, Switzerland, chudak@math.ethz.ch

We consider a generic paradigm to design improved approximation schemes for linear programming relaxations of combinatorial optimization problems. In essence, the improvements are due to the fact that our algorithms are gradient-based as opposed to the previously known subgradient-based algorithms. Our results build mainly on work of Nesterov and extend the work of Bienstock and Iyengar.

2 - Maximum Margin Matrix Factorization using Smooth Semidefinite Optimization

Alexandre d'Aspremont, Assistant Professor, Princeton University, E-Quad E-424, ORFE Princeton University, Princeton, NJ, 08544, United States, aspremon@princeton.edu

We present a semidefinite relaxation for the maximum margin matrix factorization problem, i.e. the problem of fitting a target matrix Y with a low-rank matrix X by minimizing a hinge-loss function. We show how Nesterov's smooth minimization algorithm can be used on a related binary search problem and reconstruct a solution to the original problem.

3 - Mirror-Prox Algorithm with O(1/t) Rate of Convergence for Large-scale Smooth Saddle Point Problems

Arkadi Nemirovski, Professor, School of Industrial and Systems Engineering, Georgia Institute of Technology, 765 Ferst Drive NW, Atlanta, GA, 30332-0205, United States, nemirovs@isye.gatech.edu

We present a prox-type method with O(1/t) rate of convergence for approximating saddle points of smooth convex-concave functions and solutions of variational inequalities with monotone Lipschitz continuous operators. We discuss a number of large-scale numerical experiments with matrix games, Support Vector Machines, computing Lovasz capacity number and sum-of-squares representation of polynomials.

4 - Minimizing Functions with Bounded Variation of Subgradient

Yurii Nesterov, Professor, CORE/INMA, UCL, 34 voie du Roman Pays, Louvain-la-Neuve, 1348, Belgium, nesterov@core.ucl.ac.be

In many applications it is easy to justify a reasonable bound for possible variation of subgradients of objective function rather than for their uniform magnitude. In this talk we present a new class of efficient primal-dual subgradient schemes for such problems.

■ SA40

R - 3rd Floor, Barcelona I

Computational Game Theory and the Price of Anarchy

Sponsor: Optimization/ Network Optimization
Sponsored Session

Chair: Nicolas Stier-Moses, Assistant Professor, Columbia Business School, Uris Hall, Room 418, 3022 Broadway, New York, NY, 10027, United States, ns2224@columbia.edu

1 - Complexity and Computability in Congestion Games

Carol Meyers, Massachusetts Institute of Technology, 77 Massachusetts Avenue, Office E40-130, Cambridge, MA, 02139, carol@mit.edu, Andreas S. Schulz

Congestion games are a broad class of games in which the cost of using a resource depends solely on the number of users of that resource. We address complexity and computability issues relating to such games, and properties of Nash equilibria. Complexity results are presented for the problem of finding a minimum cost solution to a congestion game, under a variety of different cost functions. We also discuss the existence and computability of equilibria in weighted congestion games, in which users may have varying amounts of demand.

2 - A Network Design Game with Fixed and Variable Edge Costs

Fei Qian, Industrial and Systems Engineering, Georgia Institute of Technology, Atlanta, GA, 30332, gtg120s@mail.gatech.edu, Ozlem Ergun

We consider a collaborative game induced by a general network design problem. In this game every player wants to connect to a set of terminals and hence build a subnetwork with minimum cost to satisfy their demands. There exists fixed and variable cost s on the edges. It is NP-complete to test the emptiness of the core of this game. However, in some cases the core is nonempty if and only if an LP formulation of the problem has no integrality gap. We also consider how much cost we can allocate fairly and efficiently when the core is empty or not.

3 - Oligopoly Competition : Bertrand versus Cournot

Amr Farahat, Assistant Professor, Johnson Graduate School of Management, Cornell University, Ithaca, NY, 14853, United States, aaf33@cornell.edu, Georgia Perakis

We study an oligopoly where firms compete on differentiated products. Each firm proposes a contract specifying what information it communicates to the market (Bertrand and Cournot models are special cases). We compare Bertrand and Cournot prices and payoffs for substitutable as well as complementary products. We highlight extensions that incorporate a multi-period setting and allow finite capacities.

4 - The Inefficiency of Equilibria in Nonatomic Congestion Games

Nicolas Stier-Moses, Assistant Professor, Columbia Business School, Uris Hall, Room 418, 3022 Broadway, New York, NY, 10027, United States, ns2224@columbia.edu, Andreas S. Schulz, Jose R. Correa

We present a short geometric proof to bound the price of anarchy in nonatomic congestion games. This novel proof also provides new insights that allow us to give pseudo-approximation results that depend on the allowed cost functions and to derive improved bounds that help to explain why the price of anarchy in empirical observations of vehicular traffic networks do not match the theoretical worst-case bounds.

■ SA41

R - 3rd Floor, Barcelona II

Joint Session Optimization/Minority: Cutting Planes in Mixed Integer Programming

Sponsor: Optimization/ Integer Programming, Minority Issues
Sponsored Session

Chair: Jean-Philippe Richard, Assistant Professor, Purdue University, 315 North Grant Street, West Lafayette, IN, 47907, United States, jprichar@ecn.purdue.edu

1 - 3-Separations and the Stable Set Polytope

Illya Hicks, assistant professor, Texas A&M University, 237K Zachry Engineering Center, 3131 TAMU, College Station, TX, 77843-3131, United States, ivhicks@tamu.edu, Sandeep Sachdeva

A k-separation of a graph G is a pair of edge disjoint subgraphs whose union of nodes and edges form G and whose intersection of vertices has order k. We offer preliminary research for a facet generation procedure for the well-studied stable set polytope of a graph G that contains a 3-separation. The procedure is based upon the composition of polyhedra corresponding to two subgraphs of G related to a 3-separation of G. This work is based upon the earlier work of Barahona and Mahjoub.

2 - Facets of the Lot-Sizing Poyhedron with Backlogging

Simge Kucukyavuz, University of Arizona, Systems and Industrial Engineering, Tucson, AZ, United States, simge@sie.arizona.edu, Alper Atamturk

The convex hull of feasible solutions to the uncapacitated lot-sizing problem with backlogging, in its original space of production, inventory and backlogging variables, has been an open problem for many years. In this talk, we give a class of facets that generalize the known inequalities for this problem. We give exact separation algorithms for some special cases.

3 - Extending Superadditive Valid Inequalities to Mixed-integer Programs by Lifting Continuous Variables

Yanjun Li, Assistant Professor, Purdue University, West Lafayette, IN, 47907, United States, li14@purdue.edu, Lisa Miller, Jean-Philippe Richard

Johnson (1974) extended the superadditive theory of cutting planes to MIPs to obtain mixed-integer cutting planes. Richard, de Farias and Nemhauser (2003) developed the theory and algorithm for continuous variable lifting and introduced the concept of superlinear lifting. Using a superlinear approximation of the continuous lifting function of superadditive inequalities, we derive Johnson's mixed-integer cutting planes. Conditions for achieving better approximations are also discussed.

4 - Polyhedral Combinatorics of Some Capacity-constrained Ordering Problems

Herve Kerivin, Assistant Professor, Laboratoire LIMOS, CNRS UMR 6158, Universite Clermont-Ferrand II, Complexe scientifique des Cezeaux, Aubiere, 63177, France, kerivin@math.univ-bpclermont.fr, Renaud Sirdey

We study several models of a capacity-contrained ordering problem with application to distributed systems dynamic reconfiguration procedures. We investigate the polyhedral structure of these models and report computational results.

■ SA42

R - 4th Floor, Parc Ballroom I

Solving Specially Structured Stochastic Programs

Sponsor: Optimization/ Stochastic Programming
Sponsored Session

Chair: Andrew Schaefer, Assistant Professor, University of Pittsburgh, Department of Industrial Engineering, Pittsburgh, PA, United States, schaefer@ie.pitt.edu

1 - Column Generation within the L-shaped Method for Stochastic Linear Programs

Mehmet Demirci, University of Pittsburgh, 1048 Benedum Hall, Pittsburgh, PA, 15261, United States, mcd21@pitt.edu, Andrew Schaefer, Jay Rosenberger, Brady Hunsaker

We develop a method for incorporating column generation within a stochastic programming framework. This method generates columns for the master problem and the subproblems of the L-shaped method. It also generates feasibility and optimality cuts based on the current columns in the master problem. We present different algorithmic strategies, discuss computational results and explore two-stage stochastic versions of the cutting stock and multi-commodity flow problems.

2 - Inverse Stochastic Linear Programming

Gorkem Saka, PhD Student, University of Pittsburgh, 1048 Benedum Hall, Pittsburgh, PA, 15261, United States, gos2@pitt.edu, Andrew Schaefer

An inverse optimization problem consists of making a minimum adjustment to the objective function so that a specific feasible solution becomes an optimal solution. We apply this technique to two-stage stochastic linear programs. We then discuss several solution methodologies such as different decomposition algorithms to solve the resulting inverse stochastic linear program.

3 - Totally Unimodular Stochastic Programs

Nan Kong, Assistant Professor, University of South Florida, 4202 E. Fowler Ave, ENB118, Tampa, FL, 33620, United States, kong@eng.usf.edu, Andrew Schaefer, Shabbir Ahmed

We consider a class of totally unimodular stochastic programs (TUSPs), that is, stochastic integer programs whose extensive forms have TU constraint matrices. Several necessary and sufficient conditions are given to characterize TUSPs. When solving TUSPs using the L-shaped method it is not clear whether the integrality restrictions should be imposed on the master. Our computational results investigate this trade-off.

■ SA43

R - 4th Floor, Parc Ballroom II

Integrated Methods for Optimization I

Sponsor: INFORMS Computing Society/ Constraint and Integer Programming
Sponsored Session

Chair: John Hooker, T. Jerome Holleran Professor of Business Ethics and Social Responsibility, Professor of Operations Research, Carnegie Mellon University, Tepper School of Business, Pittsburgh, PA, 15213, United States, john@hooker.tepper.cmu.edu

1 - Shorter Path Constraints for the Resource Constrained Shortest Path Problem

Meinolf Sellmann, Assistant Professor, Brown University, P.O. Box 1910, Providence, RI, 02912, United States, sello@cs.brown.edu

Recently, new cost-based filtering algorithms for shorter-path constraints have been developed. We provide the first extensive experimental evaluation of the new algorithms in the context of the resource constrained shortest path problem. We investigate the impact of required-edge detection, undirected versus directed filtering, and the choice of the algorithm optimizing the Lagrangian dual.

2 - Reductions for the Stable Set Problem

Edward Sewell, Professor, Southern Illinois University Edwardsville, Department of Mathematics & Statistics, Edwardsville, IL, 62026-1653, United States, esewell@siue.edu, Sheldon Jacobson, Hemanshu Kaul

This paper introduces several new reductions for the maximum stable set (MSS) problem, extends several well-known reductions to the weighted MSS problem, demonstrates how reductions for the generalized stable set problem can be used in conjunction with probing to produce powerful new reductions, and shows how hypergraphs can be used to generalize clique projections. The effectiveness of these techniques is illustrated on challenging MSS problems arising from Steiner Triple Systems.

3 - Scheduling and Routing of Automated Guided Vehicles: A Hybrid Approach

Louis-Martin Rousseau, Professor, Ecole Polytechnique de Montréal, CP 6079 Succ Centre Ville, Montréal, QC, H3C 3A7, Canada, louis-martin.rousseau@polymtl.ca, André Langevin, Ayoub Insea Correa

This problem consists in the simultaneous assignment, scheduling and conflict-free routing of AGV. Our approach consists in a decomposition method where the master problem (scheduling) is modelled with Constraint Programming and the sub problem (conflict-free routing) with Mixed Integer Programming. Logic cuts are generated and used to prune optimal scheduling solutions whose routing plan exhibits conflicts.

4 - A Search-infer-and-relax Framework for Integrating Solution Methods

John Hooker, T. Jerome Holleran Professor of Business Ethics and Social Responsibility, Professor of Operations Research, Carnegie Mellon University, Tepper School of Business, Pittsburgh, PA, 15213, United States, john@hooker.tepper.cmu.edu

We present a framework for integrating solution methods that combines search, inference, and relaxation. Many OR, constraint programming, global optimization and heuristic methods are special cases. The framework allows elements of different solution methods to be combined. These include continuous relaxations for global constraints in CP, the linking of CP and MILP via Benders, constraint propagation in global optimization, and relaxation bounds in local search and GRASPs.

■ SA44

R - 4th Floor, Parc Ballroom III

Joint Session Computing/Health: Computational Biomedicine

Sponsor: INFORMS Computing Society/ OR and Biomedicine, Health Applications
Sponsored Session

Chair: Ariela Sofer, Professor and Chair, George Mason University, SEOR Dept, MS 4A6, Fairfax, VA, 22030, United States, asofer@gmu.edu

1 - Inference and Analysis of Regulatory Mechanisms in Genetic Systems using Micro-Array data

Sanjay Mehrotra, Professor, Northwestern University, 2145 Sheridan Rd., Room C140, Evanston, IL, 60601, United States, mehrotra@iems.northwestern.edu, Reuben Thomas

We consider the problem of model-based inference of regulatory interactions from DNA micro-array data. We develop Integer Programming based inference frameworks for three classes of experiments - those that involve biophysical perturbations, gene knockouts and gene over-expression assuming S-system formalism of the genetic system. The inference framework is tested on E.coli bacteria.

2 - LAD-based Diagnosis of Ischemic Structure

Peter L. Hammer, Director, RUTCOR, Rutgers University, 640 Bartholomew Road, Piscataway, NJ, 08854, United States, hammer@rutcor.rutgers.edu, Joseph Azok, Gerard Hoehn, King Li, Gabriela Alexe, Alison Baird, Vimla Gulabani, Anupama Reddy, Pierre Lemaire, Hua Yu, Neal Jeffries, Violet Wright

Application of Logical Analysis of Data to protein expression profiling of plasma allows identification of a support set of five peptides, and of a diagnostic system which accurately distinguishes stroke patients from controls. Moreover, the patterns provide new information on the importance and nature of peptides, and identify new classes.

3 - Prediction of Chemotherapy Response in High Risk AML Patients Using Gene Expression Profile

Rajesh Ganesan, Assistant Professor, George Mason University, Fairfax, VA, 22030, United States, rganesan@gmu.edu, Tapas K. Das, Wandaliz Torres-Garcia

Low rates of success of chemotherapy of Acute Myeloid Leukemia (AML) patients and high treatment related mortality have made prediction of chemotherapy response a critical translational research issue. We present a methodology for identifying gene expression patterns in a cancer cell that would indicate chemotherapy performance. Samples will be procured from high-risk AML patients enrolled in a Moffitt Cancer Center clinical trial.

4 - Large-Scale Biocomputing for Cancer Diagnosis

Eva Lee, Associate Professor & Director, Center for Operations Research in Medicine, Georgia Institute of Technology, Industrial & Systems Engineering, Atlanta, GA, 30332-0205, United States, evakylee@isye.gatech.edu, Zorina Galis

The cardiovascular system provides oxygen/nutrients to the body. Tissue ischemia, due to obstruction of arterial blood flow, can result in serious effects (vision/limb loss). Development of new vessels can fuel the progression of cancer and macular degeneration. We present a pattern recognition algorithm and an optimization-based predictive model to analyze artery patterns. We illustrate its use for disease diagnosis/monitoring via classification of healthy vs diseased microvascular networks.

■ SA45

R - 4th Floor, Raphael

Urban Transportation Planning Models V: Transportation Planning

Sponsor: Transportation Science & Logistics
Sponsored Session

Chair: Thad Usowicz, usowicz@sfsu.edu

1 - Transportation Modeling for Enhancing Emergency Preparedness

Daiheng Ni, Georgia Institute of Technology, 790 Atlantic Dr., Atlanta, GA, 30332-0355, United States, daiheng.ni@ce.gatech.edu, John Leonard

The main objective of this paper is to develop a transportation modeling framework to assist emergency management agencies to make decisions in terms of maximizing the capabilities of transportation facilities in the process of emergency evacuation. Other objectives include identifying key issues (e.g., policy and institutional) that can potentially further improve transportation capabilities and indentifying future directions and improve the functionality of this research.

2 - Multiple Scenario Modeling of User Costs Associated with Innovative Highway Contractual Methods

Peter Martin, Associate Professor, University of Utah, Civil and Environmental Engineering, 122 South Campus Dr. Rm 104, Salt Lake City, UT, 84112-0561, United States, peter@trafficlab.utah.edu, Aleksandar Stevanovic

Incentive driven construction highway contracts are likely to reduce overall delay to road users. This paper presents the findings of a traffic assignment modeling assessment of several road improvements under a variety of construction scenarios. The projects are taken from the Utah Department of Transportation Statewide Transportation Improvement. They show that potential user cost savings in delay associated with innovative construction contracts can be significant.

■ SA46

R - 4th Floor, Rubens

Urban Transportation Planning Models I: Urban System Design and Modeling

Sponsor: Transportation Science & Logistics
Sponsored Session

Chair: David Boyce, Northwestern University, 2149 Grey Avenue, Evanston, IL, 60201, United States, dboyce@uic.edu

1 - Estimation and Analysis of an Integrated Travel Choice Model for the Tucson Region

David Boyce, Professor, Northwestern University, 2149 Grey Avenue, Dept. of Civil and Environmental Engrg., Evanston, IL, 60201, United States, d-boyce@northwestern.edu, Yuhwa Lee, Hillel Bar-Gera, Mark Hickman

An integrated (combined) multiclass model of origin-destination, mode and auto user-optimal route choice was implemented for the Tucson, Arizona, Region. Parameters were estimated, and the results analyzed. The findings and lessons learned from this research will be presented.

2 - A Multi-Resolution System Dynamic Framework for Urban System of Systems Modeling

Yi-Chang Chiu, Assistant Professor, University of Texas at El Paso, Engrg Bldg E201P, 500 W University Ave, El Paso, TX, 79968, United States, chiu@utep.edu, Jorge Villalobos

We present a Multi-Resolution System Dynamic (MRSD) modeling methodology to assist in urban transportation policy decision making. The unified High-Level with Operational/Planning-Level methodology, integrated by a system dynamics framework, is aimed to capture interactions of different urban systems with varying temporal and spatial resolutions.

3 - An MPCC Model for Continuous Network Design Problem under Asymmetric User Equilibrium

Henry Liu, Assistant Professor, University of Minnesota, Department of Civil Engineering, 500 Pillsbury Drive SE, Minneapolis, MN, 55455, United States, henryliu@umn.edu, Michael Ferris, Jeff Ban

The Continuous network design problem (CNDP) under asymmetric user equilibrium can be formulated as a mathematical program with complementarity constraints, This is a special case of a mathematical program with equilibrium constraints with a general variational inequality simplified by a nonlinear complementarity problem in the lower level. The MPCC based CNDP model can be solved by a combination of the relaxation and decomposition schemes due to the special structure of the proposed MPCC model.

4 - Solving Asymmetric User Equilibrium by Decomposition and Synchronization Schemes

Michael Ferris, Professor, University of Wisconsin, Computer Sciences, Madison, WI, 53706, United States, ferris@cs.wisc.edu, Henry Liu, Jeff Ban

The asymmetric user equilibrium can be formulated as a multi-commodity network flow problem with non-separable cost and as a nonlinear complementarity problem defined on disaggregated link flows. The NCP formulation has a special structure such that the defining set is a Cartesian product of a number of lower-dimension sets. A synchronization scheme is developed in which an optimal step size is computed via a synchronization nonlinear programming problem. Numerical examples are provided.

■ SA47

R - 4th Floor, Michelangelo

Optimization Models for Traffic Signal Priority

Sponsor: Transportation Science & Logistics
Sponsored Session

Chair: Larry Head, Research Professor, University of Arizona, Systems & Industrial Engineering Dept., P.O. Box 210020, Tucson, AZ, 85721, United States, larry@sie.arizona.edu

1 - Modeling Adaptive Transit Signal Priority on Actuated Control Systems

Meng Li, Assistant Development Engineer, California PATH, Universtiy of California, Berkeley, 1357 S. 46th Street, Bldg 452, Richmond, CA, 94804-4603, United States, meng_lee@uclink.berkeley.edu, Yafeng Yin

We propose a quadratic optimization model that determines real-time signal timings for transit signal priority, based on current signal status and predictions of bus arrival times and traffic flows. The model formulates the typical eight-phase ring-barrier structure of NEMA actuated controllers, and is able to achieve explicitly a tradeoff between bus intersection delay and other traffic delay. A numerical example is presented to demonstrate and validate the model.

2 - Scheduling Priority Service at Actuated Traffic Signals

Larry Head, Research Professor, University of Arizona, Systems & Industrial Engineering Dept., P.O. Box 210020, Tucson, AZ, 85721, United States, larry@sie.arizona.edu, Zhiping Wei

This paper presents a model for scheduling service for multiple priority requests that can be generated from emergency vehicles, heavy rail, or transit. An optimization model is formulated that considers the traditional dual-ring traffic signal controller with constraints for safety and pedestrian service.

3 - Traffic Signal Priority Control with Colored Petri Nets

Lefei Li, Graduate Research Associate, Systems & Industrial Engineering Dept., P.O. Box 210020, Tucson, AZ, 85721-0020, United States, lefeil@email.arizona.edu, Hongchao Liu, Wei-Hua Lin

A Colored Petri Net (CPN) model for traffic signal priority is described. The model incorporates the priority request of transit vehicles into traffic signal control. Compared with 'uncolored' Petri Nets (PN), CPN provides a broader modeling capability for traffic signal priority control. A simple priority evaluation procedure is proposed to provide different priorities under multiple priority requests.

4 - Strategies for Integrated Real-time Signal Control and Dynamic Vehicle Route Assignment

Stacy Eisenman, Maryland Transportation Initiative, University of Maryland, College Park, MD, 20742-3021, United States, eisens@umd.edu, Hani Mahmassani

Strategies for integrated real-time signal control in conjunction with dynamic vehicle route assignment are developed for congested network traffic management. Implementation is achieved through an iterative process with a feedback loop for the dynamic routing of vehicles through the network, while adjusting signal controls to quasi-optimally serve the resulting flows. Results of numerical experiments are discussed to illustrate and evaluate the strategies.

■ SA48

R - 4th Floor, Dante

Operating Room Management

Sponsor: Health Applications
Sponsored Session

Chair: Michael Carter, Professor, University of Toronto, Mech & Ind Engineering, 5 King's College Rd, Toronto, ON, M5S 3G8, Canada, carter@mie.utoronto.ca

1 - Modeling Patient Flow in a Cardiac Surgery Department for Operating Room Management

Michael Carter, Professor, University of Toronto, Mech & Ind Engineering, 5 King's College Rd, Toronto, ON, M5S 3G8, Canada, carter@mie.utoronto.ca, Hai Ein (Jean) Yong

A discrete-event simulation model was developed to model the patient flow in an in-patient cardiac surgery department to determine surgical booking policy for the expansion of operating room. Working with hospital managers and clinicians from participating hospital, a patient classification technique was adopted to produce statistically and clinically meaningful patient groups to drive model.

2 - Scheduling Surgical Service Block Time to Improve Patient Flow

Tom Rohleder, Haskayne School of Business, University of Calgary, Calgary, AB, T2N 1N4, Canada, tom.rohleder@haskayne.ucalgary.ca

We present a mixed integer programming formulation that allocates operating time blocks to surgical services. Our model addresses improved patient flow, extended time horizons, and schedule consistency. In particular we consider the effect of surgeon specific productivity levels on patient flows within the hospital. Data from a hospital are used to evalute the effectiveness of the scheduling methods. Patient flow performance is determined via a patient flow simulator.

3 - An Outpatient Capacity Planning Model: Estimation of Stakeholder Costs

David Strum, Queen's University, Department of Anesthesiology, KGH, 76 Stuart Street, Kingston, ON, K7L 2V7, Canada, dstrum1@cogeco.ca, Luis G. Vargas

We modeled capacity planning and investigated its effect on stakeholders. To allocate outpatient (OP) capacity, we used a newsvendor model and rescheduling heuristics. Historical cases were parsed into inpatient and OP facilities to minimize total institutional costs and patient wait time. Total stakeholder costs were compared using linear regression. This study is proof of concept of an optimization model based on scheduling heuristics and used to plan capacity for OP facilities.

4 - Forecasting Outpatient Surgery No-Shows

Timothy Butler, Wayne State University, 5201 Cass Avenue, Detroit, MI, 48202, United States, ad4518@wayne.edu, Marc Basson, Harish Verma

No-Shows for outpatient surgery contribute to inefficiency because hospital personnel such as surgeons, anesthesists, surgery technicians, and nurses are left idle. We reviewed OR utilization at the John D. Dingell VA Hospital in Detroit and found patient no-shows to be a substantial source of surgical cancellations. We propose models to help administrators plan surgery schedules.

■ SA49

R - 4th Floor, Medici

Dynamic Programming Applications

Sponsor: Decision Analysis
Sponsored Session

Chair: Laura Kornish, Leeds School of Business, University of Colorado, 419 UCB, Boulder, CO, 80309, United States, kornish@duke.edu

1 - Adopting a Technology of an Uncertain Value

Canan Ulu, The Fuqua School of Business, Duke University, Box 90120, Durham, NC, 27708-0120, United States, canan.ulu@duke.edu, James E. Smith

We consider a discrete-time dynamic programming formulation of a technology adoption problem where the firm is offered a technology whose value is uncertain and may be non-stationary. The firm can choose to adopt, reject or gather more information. After receiving the information, the firm updates beliefs in a Bayesian manner. We use the probability distribution of the uncertain value as a state variable and obtain very general structural results.

2 - Optimal Sequential Exploration: A Binary Learning Model

Eric Bickel, Assistant Professor, Department of Industrial and Systems Engineering, Texas A&M University, 236B Zachry Engineering Center, 3131 TAMU, College Station, TX, 77843-3131, United States, ebickel@tamu.edu, James E. Smith

In many situations (e.g., oil and gas exploration and pharmaceutical drug development), value can created through optimal sequencing of exploration activities. This sequencing takes advantage of information learned via previous results (e.g., drilling a dry hole). To effectively model this learning and solve for the optimal policy, we employ information-theoretic techniques in conjunction with dynamic programming.

3 - Optimal Franchising or Scale-up Policy

Neda Farzinnia, Ph.D. candidate, The Anderson School at UCLA, 110 Westwood Plaza, Box 951481,, Los Angeles, CA, 90095, United States, neda@stat.ucla.edu, Kevin McCardle

A firm is contemplating entering a new line of investment that could be franchised or scaled-up in one of the two ways, and is uncertain about its profitability and the optimal franchised (scale-up) policy. As the firm continues to implement the investment it updates its belief about the profitability of the investment. We provide optimal thresholds rules.

4 - Repeated Commit-or-Defer Decisions with an Inventory Deadline: The Influenza Vaccine Composition

Laura Kornish, Leeds School of Business, University of Colorado, 419 UCB, Boulder, CO, 80309, United States, kornish@duke.edu, Ralph Keeney

We study a dynamic decision problem for a seasonal good with time-intensive production, in which the decision maker must balance information collection and production time in the pre-season. We frame our model using the annual influenza vaccine composition decision: deciding between strains of the virus to include, which must happen in a timely manner to allow for vaccine production before the flu season begins.

■ SA50

R - 4th Floor, Cervantes

Applications of Decision Analysis to Homeland Security

Sponsor: Decision Analysis
Sponsored Session

Chair: Vicki Bier, Professor, University of Wisconsin-Madison, 3158 Engineering Centers Building, 1550 Engineering Drive, Madison, WI, 53705, United States, bier@engr.wisc.edu

1 - Using Risk Analysis to Counter Terrorism

Detlof von Winterfeldt, Professor, USC, School of Policy, Planning, and Developm, RGL 312 University Park, Los Angeles, CA, 90089, United States, detlof@aol.com

This presentation will review several risk analysis approaches to analyze and evaluate terrorism threats and it will describe two applications of risk analysis to reduce the risks of missile attacks on airplanes and of dirty bomb attacks of a major harbor in the US.

2 - National Center for the Study of Terrorism and Responses to Terrorism (START)

Kathleen Tierney, tierneyk@colorado.edu

START, a DHS-funded center of excellence at the University of Maryland, has been given a 3-year grant to develop social science knowledge and provide research, training, and guidance on the life cycle of terrorism; i.e., its origins, dynamics, and societal impacts. The consortium includes more than 15 universities and approximately 3 dozen U.S. researchers and international partners. This presentation will discuss START's organization, research plan, and educational and outreach activities.

3 - Risk Management Strategies for Interdependent Security

Howard Kunreuther, Cecilia Yen Koo Professor, 556 & 559 Jon M. Huntsman Hall, 3730 Walnut Street, Philadelphia, PA, 19104-6340, United States, kunreuth@wharton.upenn.edu, Geoffrey Heal

In an interdependent world, the failure of one agent to take action can impact on others. For example, the terrorism risks faced by any given airline are affected by lax security at other carriers or airports. This talk examines game theoretic aspects of interdependent security and indicates the importance of public-private partnerships for improving the expected profits of individual firms as well as social welfare.

4 - Choosing What to Protect: Strategic Defense Allocation against an Unknown Attacker

Santiago Oliveros, University of Wisconsin, Madison, 6473 Social Science Building, 1180 Observatory Drive, Madison, WI, 53706, United States, soliveros@students.wisc.edu, Vicki Bier, Larry Samuelson

We study a defender-attacker game in which the defender does not know the attacker's preferences. The defender's problem generates negative externalities that are useful to manipulate the attacker's behavior, sometimes leaving a location undefended. We show that, as the number of possible targets grows, only the attacker's preferences matter for the defensive allocation (spying is useful), that centralization is desirable, and that the defender prefers to disclose the defensive structure.

Sunday, 10:00am - 11:30am

■ SB01

H - Lobby Level, Plaza A

Tutorial: Transforming Railroads Through Cutting-Edge Operations Research

Cluster: Tutorials
Invited Session

1 - Tutorial: Transforming Railroads Through Cutting-Edge Operations Research

Ravindra Ahuja, Professor, University of Florida, Dept. of Industrial and Systems Eng., 303 Weil Hall P.O. Box 116595, Gainesville, FL, 32611, United States, ahuja@ufl.edu, Guvenc Sahin, Claudio Cunha

The past few decades have witnessed numerous applications of operations research in logistics. However, the US railroad industry has not benefited from the advances. This tutorial describes cutting-edge operations research algorithms that use state-of-the-art ideas from linear and integer programming, network flows, discrete optimization, heuristics, and very large-scale neighborhood (VLSN) search, and demonstrates potential benefits from tens to hundreds of millions of dollars annually.

■ SB02

H - Lobby Level, Plaza B

Special Topics in Environmental/Natural Resourses

Contributed Session

Chair: Chialin Chen, Queen's University, Queen's School of Business, Kingston, ON, K7L 3N6, Canada, cchen@business.queensu.ca

1 - Coupling Reserve Constraints in the Unit Commitment Problem

Jose Restrepo, Research Assistant, McGill University, 3480 University St., Room 633, Montreal, QC, H3A 2A7, Canada, jose.restrepo@mail.mcgill.ca, Francisco D. Galiana

The security-constrained unit commitment problem in a power system defines the on/off status of generating units such that they securely meet the demand at lowest cost. Security is accomplished by scheduling different types of generation reserves, each following different control schemes and time constants. This presentation highlights the strong coupling that can exist between different types of reserves when solving the unit commitment problem.

2 - Strategic Decision Making in Transmission Investment for Deregulated Power Systems

Sevin Sozer, Auburn University, 207 Dunstan Hall, Industrial and Sys. Eng. Dept., Auburn, AL, 36849, United States, sozerse@auburn.edu, Chan S. Park

Two important goals of the transmission investment are to ensure reliability and to facilitate competition. Transmission expansion planning process is studied from the perspective of the System Operator (SO) considering both reliability criteria and economic incentives. Interdependencies of market agents' strategic decisions are introduced into the transmission investment model and a detailed economic analysis is provided.

3 - Benefits, Drawbacks, and Applications of Ranked Set Sampling

Barry Nussbaum, Chief, Analytical Products Branch, US Environmental Protection Agency, 1200 Pennsylvania Ave, NW, Mail Code 2842T, Washington, DC, 20460, United States, nussbaum.barry@epa.gov, Deborah Rachlin

Ranked set sampling estimates the mean of a population based on measurements of some secondary variable. RSS provides a more efficient estimate compared to traditional simple random sample, even if the measurement of the ancillary variable is not very good. In this paper, some basics of RSS will be presented along with an important environmental application using RSS for a low-cost estimate of gasoline's Reid Vapor Pressure, and resultant hydrocarbon emissions.

4 - Market Based Decision Model for Ecologically Sustainable Product Development

Dawood Abugharbieh, Portland State U, 15 SW Hamilton Ct. #2, Portland, OR, 97239, United States, dawood@pdx.edu, Robert Harmon

Ecologically Sustainable Development is emerging as an issue with potential to impact new product innovation. New strategies to reduce the ecological footprint of new products are needed. Existing research seems primarily focused on corporate policy and environmental management, with little insight into innovative approaches for development of ecologically and economically sustainable products. We posit a model for ecologically sustainable product development to favorably impact market outcomes.

5 - Analyzing Simulataneous and Sequential Games for Green Product Development

Chialin Chen, Queen's University, Queen's School of Business, Kingston, ON, K7L 3N6, Canada, cchen@business.queensu.ca, Kilsun Kim

We develop models of simultaneous and sequential games to analyze the pricing, quality, and entry decisions for green product development. We identify the conditions for a sub-game perfect equilibrium where two firms enter with distinct efficient quality sets to engage in Bertrand competition. One major result shows that the first mover in quality choice will introduce a green product with less than 50% of green customers in a market if a desirable arrangement of price leadership can be reached.

■ SB03

H - Ballroom Level, Continental Ballroom 1

New Cases in Supply Chain Management and Information Technology

Sponsor: Education (INFORM-ED)
Sponsored Session

Chair: Eric Johnson, Professor, Tuck School of Business, Dartmouth College, Hanover, NH, 03755, United States, M.Eric.Johnson@dartmouth.edu

1 - Structured and Unstructured IT

Andrew McAfee, Associate Professor, Harvard Business School, Harvard University, Boston, MA, 02163, amcafee@hbs.edu

Some information technologies faciliate unstructured inter-group interactions, while others impose new structured interactions (i.e. business processes). This session explores the impacts and managerial challenges of these two different technology categories, and presents teaching cases about each.

2 - Excellence in Supply Chain Collaboration: Evidence from the German Retail and FMCG Industry

Arnd Huchzermeier, Professor, WHU, Otto-Beisheim GSM, Burgplatz 2, Vallendar, 56179, Germany, Arnd.Huchzermeier@whu.edu, Daniela Burkhardt

We present 6 case studies on 10 years of ECR implementation in Germany. In the past, Category Management and Supply Chain Integration were the main levers. In the future, strategy, collaborative shopper value creation, product identification and communication standards, RFID technology and exchanges are the new drivers of performance.

3 - Building a Customer-Focused Supply Chain

Eric Johnson, Professor, Tuck School of Business, Dartmouth College, Hanover, NH, 03755, United States, M.Eric.Johnson@dartmouth.edu

After the successful launch of its first major drug, Biogen needed to re-examine its supply chain to support future growth. This biotech firm chose to make a significant IT investment in CRM. Using the systems, case managers could build an intimate relationship with patients, supporting them throughout their therapy with information and timely product shipments.

■ SB05

H - Ballroom Level, Continental Ballroom 3

Panel Discussion: The Industry Job Search

Cluster: Job Placement Committee
Invited Session

Chair: David Kim, Oregon State Univ, 121 Covell Hall, Corvallis, OR, 97331, United States, david.kim@orst.edu

1 - Panel Discussion: The Industry Job Search

Moderator: David Kim, Oregon State Univ, 121 Covell Hall, Corvallis, OR, 97331, United States, david.kim@orst.edu, Panelists: Jeffrey Alden, Rajiv Saxema, Jack Griffin, Lisa Szytel

The panel will discuss the industry interview process and do's and don'ts associated with the job search. In addition to comments by current or former industrial recruiters, time will be provided for questions and answers.

■ SB06

H - Ballroom Level, Continental Ballroom 7

Research About Spreadsheets

Sponsor: Spreadsheet Productivity Research
Sponsored Session

Chair: Thomas Grossman, Ph.D., Associate Professor, School of Business & Management, University of San Francisco, 2130 Fulton St., San Francisco, CA, 94117-1045, United States, tagrossman@usfca.edu

1 - Critically Important Spreadsheets

Thomas Grossman, Ph.D., Associate Professor, School of Business & Management, University of San Francisco, 2130 Fulton St., San Francisco, CA, 94117-1045, United States, tagrossman@usfca.edu, Ozgur Ozluk, Vijay Mehrotra

Spreadsheets are perceived as ubiquitous in business world, but are almost invisible in the research literature, in part because the vital importance of spreadsheets is known only anecdotally. We demonstrate the vital importance of spreadsheets by documenting diverse and compelling examples of essential spreadsheets. We provide examples of spreadsheets as commercial applications, for senior executive decision making, for complex analytics, and integrated with essential key business processes.

2 - A Survey of Spreadsheet Users

Stephen Powell, stephen.g.powell@dartmouth.edu

This paper summarizes the results of a survey of spreadsheet users, covering their practices with respect to designing, building, testing, documenting, using, sharing, modifying, and archiving spreadsheet models. In addition, the survey probed the organizational use of standards, training, and incentives surrounding spreadsheet activities.

3 - Online Spreadsheet Forums: What Are They Talking About?

Roger Grinde, Associate Professor of Management Science, University of New Hampshire, Whittemore School of Business & Econ, 15 College Road/McConnell Hall, Durham, NH, 03824, United States, roger.grinde@unh.edu

Many of the millions of spreadsheet users are not aware of the huge virtual help system available worldwide, in the form of other spreadsheet users. The focus of this research is to begin to quantify the types of topics discussed in online forums devoted mostly to the Microsoft Excel spreadsheet. Given that users of online forums are probably more advanced spreadsheet users, this research provides a glimpse into how often more advanced features of Excel are used and/or discussed.

■ SB07

H - Ballroom Level, California

Auction

Sponsor: Manufacturing & Service Oper Mgmt
Sponsored Session

Chair: Rachel Chen, Assistant Professor, University of California at Riverside, 146 Anderson Hall, 900 University Ave., Riverside, CA, 92521, United States, rachel.chen@ucr.edu

1 - Combinatorial Coalition Formation and Cost Sharing for Group-Buying

Cuihong Li, Assistant Professor, University of Connecticut, School of Business, 2100 Hillside Road, Storrs, C, 06269, United States, Cuihong.Li@business.uconn.edu, Junichi Yamamoto, Katia Sycara, Alan Scheller-Wolf

In group-buying, combinatorial coalition formation (CCF) allows buyers to announce reservation prices on item bundles when valuations of items are not additive. Determining the optimal coalitions in CCF to maximize the total utility of buyers is NP-hard. We present a heuristic algorithm for CCF, and a cost sharing mechanism in the core of the resulting coalitions. Insights are then generated on when group-buying is most effective for buyers and sellers.

2 - The Buyer-Determined Multi-Attribute Auction Theoretical and Empirical Characterization

Elena Katok, Associate Professor, Penn State University, 5F BAB, State College, PA, United States, ekatok@psu.edu, Ernan Haruvy, Richard Engelbrecht-Wiggans

Reverse auctions used for many procurement activities. In the past, the majority of such auctions have been price-based, but recently multi-attribute procurement auctions have started to gain momentum. We investigate two mechanisms commonly used by FreeMarkets, a major provider of reverse auction services, in a setting in which buyer's welfare is affected by non-price attributes.

3 - Sealed-Bid Auctions of Split-Awards

Kemal Guler, Senior Scientist, Hewlett-Packard Laboratories, 1501 Page Mill, Palo Alto, CA, 94304-1100, United States, kemal.guler@hp.com

A common procurement practice is split-awards ®C total requirements are purchased under two or more contracts from multiple suppliers. Two common methods for auctioning multiple contracts are (i) single-lot ®C each bidder submits a single bid and the contracts are awarded to the two bidders with the best bids,(ii) multiple-lots ®C each bidder submits two bids, one for each contract. We analyze and compare the sealed-bid equilibrium outcomes of both options under various market settings.

4 - Payment to the Auctioneer in Multi-Unit Vickrey Auctions

Rachel Chen, Assistant Professor, University of California at Riverside, 146 Anderson Hall, 900 University Ave., Riverside, CA, 92521, United States, rachel.chen@ucr.edu, Rachel Zhang

We consider the charge system set by the auctioneer in multi-unit Vickrey auctions for procurement in supply chain settings. The auctioneer charges a two-part tariff, commission plus entry fee, to both the buyer and the sellers. The buyer and the sellers may change their bidding strategies depending on their payments to the auctioneer. We examine how the charge system affects bidding behavior as well as the exchange efficiency of the auction.

■ SB08

H - Ballroom Level, Imperial A

Dynamic Models of Imperfect Competition I

Sponsor: Manufacturing & Service Oper Mgmt
Sponsored Session

Chair: Benjamin Van Roy, Stanford University, Terman 315, Stanford University, Stanford, CA, 94305-4023, United States, bvr@stanford.edu

1 - Avoiding the Curse of Dimensionality in Dynamic Stochastic Games

Ulrich Doraszelski, Department of Economics, Harvard University, Littauer Center, Cambridge, MA, 02138, United States, doraszelski@harvard.edu, Kenneth Judd

Discrete-time stochastic games suffer from a curse of dimensionality. We show that continuous-time stochastic games avoid the curse of dimensionality and are orders of magnitude faster to solve.

2 - Strategic Experimentation and Disruptive Technological Change

Martin Schneider, New York University and Federal Reserve Bank of Minneapolis, 50 Hennepin Avenue, Minneapolis, MN, United States, ms1927@nyu.edu, Fabiano Schivardi

This paper studies the diffusion of a new technology that is brought to market while its potential is still uncertain. In a dynamic game, firms improve both a new and a rival old technology while learning about the relative potential of both. The model helps understand historical evidence on diffusion and market structure. It explains why a change in market leadership often goes along with slow diffusion. It also provides a rational explanation for observed "incumbent inertia".

3 - Markov Perfect Industry Dynamics with Many Firms

Gabriel Y. Weintraub, Management Science and Engineering Dept., Stanford University, Terman Engineering Center, 3rd Floor, Stanford University, Stanford, CA, 94305, United States, gweintra@stanford.edu, C. Lanier Benkard, Benjamin Van Roy

We propose an approximation method that dramatically reduces the computational complexity of solving stochastic dynamic models of imperfect competition. We provide conditions under which our method closely approximates an equilibrium as the market size becomes large. We derive a performance bound that can assess accuracy for any given market size. Experimental results demonstrate how our method greatly expands the set of economic problems that can be analyzed computationally.

■ SB09

H - Ballroom Level, Yosemite A

Analyzing Competitive and Cooperative Behavior in Supply Chains

Cluster: Supply Chain Management
Invited Session

Chair: Eda Kemahlioglu Ziya, University of North Carolina at Chapel Hill, Campus Box 3490, Chapel Hill, NC, 27599, United States, Eda_KemahliogluZiya@unc.edu

1 - Stability of Information-Sharing Alliances in a Three-Level Supply Chain

Greys Sosic, Assistant Professor, University of Southern California, Marshall School of Business, Bridge Hall 401, Los Angeles, CA, 90089, United States, sosic@marshall.usc.edu

We analyze a three-level supply chain, consisting of a supplier, a manufacturer, and a retailer, which faces a nonstationary end demand. Supply chain members can share demand information, which reduces information distortion and thus decreases their inventory holding and shortage costs. We distribute the savings from information sharing among the supply chain members according to Shapley value, and we use these allocations to determine farsighted stable information-sharing alliances.

2 - Process Innovation and Knowledge Sharing in Supply Networks

Fernando Bernstein, Associate Professor, Duke University, The Fuqua School of Business, 1 Towerview Drive, Durham, NC, 27708, United States, fernando@mail.duke.edu, Gurhan Kok

We consider general decentralized assembly networks, in which suppliers invest in process innovation and cost reduction, while the buyer may partly subsidize those activities. We investigate how the investment levels depend on the structure of the supply network. We also explore the impact of knowledge sharing among suppliers on their investments in process innovation and on their ability to reduce costs.

3 - The Competitive Start-up: Capacity, Pricing, and Uncertain Demand

Serguei Netessine, Assistant Professor, University of Pennsylvania, 3730 Walnut St. Suite 500, Philadelphia, PA, 19104, United States, netessin@wharton.upenn.edu, Robert Swinney, Gerard Cachon

We model competition between two firm that either maximize the expected profit or minimize the probability of bankruptcy (as a start-up company would do). We allow firms to select whether they want to lead or follow in the game. We find that when profit maximizing firms compete the companies are likely to make decisions simultanously while if a start-up firm competes against a profit maximizing firm or against another start-up, the only equilbria are sequential.

4 - Collaboration to Improve Inventory Availability under Demand Spillover

Eda Kemahlioglu Ziya, University of North Carolina at Chapel Hill, Campus Box 3490, Chapel Hill, NC, 27599, United States, Eda_KemahliogluZiya@unc.edu, Almula Camdereli, Jay Swaminathan

We consider a supply chain with a single supplier and two retailers. A percentage of the customers who cannot find the product at one retailer will look for it at the other retailer. In addition, a percentage of the stock at both of the retailers is unavailable for sale due to problems such as misplacement. We answer questions such as: How will each party's profits change if the retailers invest in technology to improve availability? How should the benefits be shared to ensure participation?

■ SB10

H - Ballroom Level, Yosemite B

Sales Channel

Cluster: Supply Chain Management
Invited Session

Chair: Ozalp Ozer, Management Science and Engineering, Stanford University, Stanford, CA, United States, ozalp@stanford.edu

1 - Dating and Marriage between a Manufacturer and a Reseller

Kay-Yut Chen, Principal Scientist, Hewlett-Packard Laboratories, 1501 Page Mill Road, MS 1u-2, Palo Alto, CA, 94304, United States, kay-yut.chen@hp.com, Teck Ho, Murat Kaya

Consider a two period model of a manufacturer selling a new product via a reseller. Initially, neither firm knows how the retailer will perform (compatibility). However, both will learn, asymmetrically, about the reseller's compatibility from the result in the first period. Product sales is a function of the manufacturer's investment, the retailer's compatibility, and his sales effort. We characterize how the retailer manipulates the manufacturer's learning under different scenarios.

2 - Coordination in a Dual-Channel Distribution System with Service Competition

Murat Kaya, Stanford Univerisity, Management Science and Engineering Dept., Stanford, CA, 94305, United States, mkaya@stanford.edu, Ozalp Ozer, Kay-Yut Chen

We consider the coordination problem of a manufacturer who sells through direct and retailer channels that compete in service. Service is defined as product availability in the traditional retailer channel and as waiting time in manufacturer's direct online channel. Customers, who differ in their aversion to waiting time, consider service levels as well as search costs in their purchase decision. We study different scenarios to quantify the value of the dual channel to the firms and consumers.

3 - Optimal Pricing in Customer-Pull Channels

Robert Phillips, Founder, Nomis Solutions, 1150 Bayhill Dr., Suite 305, San Bruno, CA, 94066, United States, robert.phillips@nomissolutions.com

We consider the common practice of pricing on a "customer-pull" basis. Customer-pull pricing both enables greater customization of prices but it also provides "win loss" information that can be used to separate price-response effects from secular demand changes. We describe algorithms for optimizing customized prices and applications to business-to-business and business-to-consumer markets.

■ SB11

H - Ballroom Level, Yosemite C

Optimization Models for Inventory System in Supply Chain Management

Contributed Session

Chair: Ajay Natarajan, Penn State University, 310 Leonhard Building, State College, PA, 16802, United States, azn110@psu.edu

1 - Product Variety Management in a Supply Chain

Renato de Matta, Associate Professor, University of Iowa, 108 PBB, Iowa City, IA, 52241, United States, renato-dematta@uiowa.edu, Lifang Wu, Timothy Lowe

The product substitution by customers when their preferred products run out poses a challenge which complicates a firm's product variety decision in a supply chain. We formulate a single period, stochastic programming problem to find the profit maximizing product design, order quantity, and retail pricing decisions when stochastic demand and product substitution are both present. A heuristic procedure is proposed to solve this problem. Computational results are presented.

2 - Joint Price and Inventory Decisions in Revenue Management

Michael Zhang, Mr., Richard Ivey School of Business, 1151 Richmond St N, London, ON, Canada, mzhang@ivey.uwo.ca

In this study, we address simultaneous determination of prices and inventory decisions for the single item newsvendor problem, where the item can be sold to different demand classes. We consider a booking limit type of policy structure for sequentially realized demands. Specifically, a portion of the initial stock is protected or reserved for the higher priced demand class. Our problem here is to find the optimal inventory, booking limit as well as prices charged for different demand classes.

3 - Inventory Rationing in a Capacitated Supply Chain with Two Demand Classes

Weihua Zhou, IEEM, HKUST, Clear Water Bay, Hong Kong, China, larry@ust.hk, Chung-Yee Lee, David Wu

A capacitated production and inventory control problem with single product, two demand classes in a periodical review environment is studied. Customers of the first class are backlogged if not satisfied immediately by on-hand product, while customers of the second class are lost when meeting stock out. We prove that the optimal production policy is of the modified base stock type and there exists a rationing level in each period below which the second class customers are rejected.

4 - Finite Horizon Optimal Inventory Decision
Jian Li, Purdue University, Krannert School of Management, W. Lafayette, IN, 47906, United States, li53@mgmt.purdue.edu, Suresh Chand

We examine a stochastic multi-period inventory decision problem with limited order opportunities. Our focus is on the structure of the optimal policy. The form of optimal policy is developed under appropriate conditions.

5 - A Multi Criteria Model for Joint Inventory-Transportation Policies in Supply Chains.
Ajay Natarajan, Penn State University, 310 Leonhard Building, State College, PA, 16802, United States, azn110@psu.edu, A. Ravi Ravindran

The Single Warehouse Multi Retailer system is treated as a multi-criteria optimization problem where transportation cost is explicitly considered as one of the criterion. A modified base period policy is developed to solve the multi-criteria problems. Closed form solutions are obtained at each retailer and the warehouse. Numerical examples are presented to illustrate the methodology.

■ SB12

H - 4th Floor, Union Square 1

Auctions, Games and Equilibria in Industry

Cluster: Applications of Auction and Game Theory
Invited Session

Chair: Tapas K. Das, Professor, University of South Florida, United States, das@eng.usf.edu

1 - Procurement Mechanism Design: An Operations Perspective
Fuqiang Zhang, Assistant Professor, University of California, GSM 433, Irvine, CA, 92697, United States, fzhang@uci.edu

We study a buyer's procurement strategy when both price and responsive delivery are considered. The suppliers have private cost information and can hold inventories to improve service. We identify the optimal mechanism for the buyer and propose several simple mechanisms. It is demonstrated that the simple mechanisms perform very well.

2 - Linear Production Inventory Games
Ziming Guan, University of Auckland, Auckland, New Zealand, z.guan@auckland.ac.nz

We consider a class of linear production-inventory games of many players over many periods with several products. We study subgame-perfect equilibria in these games and a number of different assumptions on the game structure and data. We give an example of the application of these games to the international market for dairy products.

3 - Must-run Auctions in Electricity Markets
Geoff Pritchard, University of Auckland, Auckland, New Zealand, geoff@stat.auckland.ac.nz

We consider a wholesale spot market for electricity, of the type operated in New Zealand, Australia, and some parts of the UK and USA. In these markets there are circumstances in which generators may wish to offer energy at negative prices, e.g. to avoid being shut down for a short period. Such behaviour creates some severe computational difficulties. The "must-run auction" is a system used to handle such cases in New Zealand; we consider its properties under stochastic demands.

4 - Equilibrium Experiments Over the New Zealand Electricity Market
Golbon Zakeri, g.zakeri@auckland.ac.nz, Andy Philpott, Geoff Pritchard

We consider equilibrium models of electricity offers into the New Zealand market in the context of MPECs. The long term models consider stochastic demand and aim to produce accurate prices and optimal network expansion policies.

■ SB13

H - 4th Floor, Union Square 5

Software Demonstration

Cluster: Software Demo
Invited Session

1 - StatPoint, Inc.- Statistical Analysis Using STATGRAPHICS Centurion XV
Neil Polhemus, CTO, StatPoint, Inc., 2325 Dulles Corner Rd., Suite 500, Herndon, VA, 20171, United States, neil@statgraphics.com

Dr. Polhemus will demonstrate the capabilities of STATGRAPHICS Centurion XV, the most powerful and intuitive statistical software available for Windows. The session will illustrate the trademark tools that are designed for anyone who wishes to do serious data analysis without investing weeks learning how to use a statistical package, and will include performing statistical analyses such as time series analysis and automatic forecasting.

2 - Business Simulations- Business Simulations for Manufacturing and Operations Management
David A. Jordan, Business Simulations, 139 Oak Drive, Beaver Falls, PA, 15010, United States, dave@bussim-ed.com

In this session three simulations will be overviewed, including an Operations Management, a Manufacturing Management and a Transportation/Supply Chain Management Simulation. These simulations are intended for use by instructors who want applications based teaching tools to accompany text materials. These simulations are downloadable from our website.

■ SB14

H - 4th Floor, Union Square 6

Sensor and Search Problems for Military Applications

Contributed Session

Chair: Marc Thibault, George Mason University, 4400 University Drive, Fairfax, VA, United States, mthibau1@gmu.edu

1 - Modeling Urban Operations for Data Fusion and OR Applications
Justin Yates, SUNY Buffalo, 415 Lawrence D. Bell Hall, Buffalo, NY, 14260, United States, jtyates@buffalo.edu

Military operations in asymmetric warfare necessitate the fusion of data from many diverse sources to support decision making. Given fusion results, the OR analyst can conduct mission planning: game theoretic routing of troops under uncertainty. We focus on GIS-based modeling and simulation of urban operations to support development of scalable fusion technologies and operational algorithms.

2 - Stochastic Network Interdiction with Asymmetric Information
Halil Bayrak, University of Pittsburgh, 1048 Benedum Hall, Pittsburgh, PA, 15213, United States, hab8@pitt.edu, Matthew Bailey

We consider the sensor placement problem. We formulate this as a shortest path network interdiction problem. We introduce information asymmetry, i.e. the evader and the interdictor have different information about the arc lengths (detection probabilities). We solve the problem for both deterministic and stochastic arc lengths. We also consider the cases where there is uncertainty about the origin and destination nodes, and the evader's intelligence about the locations of the interdicted arcs.

3 - A Model of Human Interpretation of Multisensory Images for Military Applications
Amanda Muller, Ph.D. Candidate, Wright State University, BIE Department, 207 Russ Center, 3640 Colonel Glenn Highway, Dayton, OH, 45432, United States, muller.4@wright.edu, S. Narayanan

The cognitive processes of the human operator should be taken into account in the design of any decision aid. This is particularly true for military applications, where the cost of human error can be high. To this end, a concurrent protocol analysis was used to determine how humans interpret information from multiple, disparate sensors. Both high-stress and low-stress situations were modeled. The model will be used to create a mutisensor data fusion system for pilots in high-stress situations.

4 - Optimum Search for a Set of Uniformly Distributed Immobile Entities on a Network
Arun Jotshi, Doctoral Student, University at Buffalo (SUNY), 438 Bell Hall, Department of Industrial Engineering, Buffalo, NY, 14260, United States, aajotshi@buffalo.edu, Rajan Batta

We are concerned with searching for a set of uniformly distributed immobile entities on a network. The goal is to find a search path that minimizes the expected search time. Theoretical results, examples, and computational results will be highlighted. We draw a comparison of this problem with the Chinese Postman Problem and utilize this relationship in the development of our solution method. Extensions of the basic problem for non-uniformly distributed entities will be briefly discussed.

5 - Efficiency Analysis of U.S. Coast Guard's Small Boat Search and Rescue Stations
Marc Thibault, George Mason University, 4400 University Drive, Fairfax, VA, United States, mthibau1@gmu.edu

The purpose of this is study is to use Data Envelopment Analysis and other Efficiency-Analysis techniques to help determine how the U.S. Coast Guard can minimize the loss life while maximizing the effectiveness of its small boat forces. It is anticipated that the study will help the USCG save lives, reduce rescue costs and help place fewer Coast Guard personnel at risk. This study will be conducted with the assistance of search and rescue experts from the U.S. Coast Guard.

■ SB15

H - 4th Floor, Union Square 9

Scheduling Models and Systems

Cluster: Scheduling
Invited Session

Chair: Bryan Norman, Associate Professor, University of Pittsburgh, 1033 Benedum Hall, Pittsburgh, PA, 15261, United States, banorman@engrng.pitt.edu

1 - Personnel Scheduling Models to Optimize Human and System Performance

Bryan Norman, Associate Professor, University of Pittsburgh, 1033 Benedum Hall, Pittsburgh, PA, 15261, United States, banorman@engrng.pitt.edu, Emmett Lodree

Personnel are critical components of many systems. Properly considering human capability and the man-machine interface is essential in order to maximize system effectiveness. The overall performance of the system is often directly related to how system personnel are scheduled. In this talk we summarize research related to scheduling personnel where the objective is to optimize system performance while considering human performance limitations and personnel well being.

2 - Integrating Assignment and Sequencing of Product Families on Multiple Lines to Minimize Set-up

Susan Monkman, University of Texas at Austin, McCombs School of Business, United States, Susan.Monkman@mccombs.utexas.edu, Douglas Morrice, Jonathan Bard

We develop an optimization model that both assigns and sequences product families on parallel assembly lines to minimize complex sequence-dependent set-up costs for an ATO electronics manufacturer. Due to special factory requirements and spatial constraints, we model it as a traveling salesman subtour problem (TSSP). We combine the assignment of families to lines with a TSSP for each line to minimize set-up costs and solve the model using a GRASP heuristic.

3 - Single Machine Scheduling Equal Length Jobs with Release Dates to Minimize Total Weighted Tardiness

John Fowler, Professor, Arizona State University, Department of Industrial Engineering, Tempe, AZ, 85287, United States, john.fowler@asu.edu, Hari Balasubramanian, Andrew Gamalski, Vinayak Muralidhar

We consider the single machine total weighted tardiness scheduling problem where jobs have unequal release dates but the same processing time. The complexity of the problem has not yet been established. We formulate the problem as integer program and propose heuristics that produce optimal or near-optimal solutions.

4 - Performance Prediction and Preselection for Optimization Procedures

Nicholas Hall, Professor, The Ohio State University, Fisher College of Business, Columbus, Oh, 43210-1144, United States, hall.33@osu.edu, Marc Posner

This work demonstrates how existing optimization procedures can be used more effectively. We predict the relative performance of alternative optimization procedures, using easily computed problem characteristics. This methodology enables us to preselect optimization procedures for a specific data set, without the need for extensive computational testing. We apply this methodology to the 0-1 Knapsack Problem, for which competing optimization procedures are available.

■ SB16

H - 4th Floor, Union Square 10

Evolution, Innovation & Competitive Heterogeneity

Sponsor: Organization Science
Sponsored Session

Chair: Tammy Madsen, Associate Professor, Santa Clara University, Management Department, Santa Clara, CA, 95053, United States, tmadsen@scu.edu

1 - Managing Returns to Investments in Capabilities: A Conceptual Framework

Catherine Maritan, Syracuse University, Whitman School of Management, 721 University Avenue, Syracuse, NY, 13244, United States, cmaritan@syr.edu, Todd Alessandri

In this paper, we consider the relationship between the investment decision process and returns to investments in capabilities. First, we integrate arguments from the capabilities and real options literatures to develop a framework that delineates the components of returns to capability investments. We then link these components to the investment decision-making process to identify a set of organizational levers that can strongly influence investment returns.

2 - The Value of Not Being in Sync: Temporal Resource Selection and Product Innovation

Riitta Katila, Assistant Professor, Stanford University, Dept. of Management Science and Engineering, Terman 413, Stanford, CA, 94305, rkatila@stanford.edu

In contrast to the traditional firm-centric view, we examine resource selection relative to competitors. Using product innovation data from worldwide industrial automation organizations over a 15-year period, we confirm the benefits of selecting resources earlier than competitors, but reject the uniform liabilities of moving late.

■ SB17

H - 4th Floor, Union Square 11

New Product/Service Development

Cluster: New Product Development
Invited Session

Chair: Weiyu Tsai, Assistant Professor, University of Utah, 1645 E. Campus Center Dr., #107, Salt Lake City, UT, United States, mgtwt@business.utah.edu

1 - How Component Sharing Impacts Consumer Perceptions about Product Similarity and Product Preferences

Kamalini Ramdas, Associate Professor, UVA-Darden, 189 FOB, 100 Darden Blvd, Charlottesville, VA, United States, ramdask@Darden.virginia.edu, Oleksandr Zhylyevskyy

While many researchers have examined the impact of components sharing on costs, the market impact of components sharing is less well understood. Using data from a simulated test market (STM) experiment using 302 test consumers that we conducted at a major multinational wristwatch manufacturer, we empirically examine the impact of the sharing of different types of components on A) consumer preferences and B) perceived similarity across products.

2 - Technology Markets: The Case of Component Providers

Sanjiv Erat, College of Management, Georgia Institute of Technology, Atlanta, United States, sanjiv.erat@mgt.gatech.edu, Cheryl Gaimon, Stylianos Kavadias

Many firms in technology intensive end-product markets act as component-integrators and buy their core components from outside providers. Such technology providers who sell the components are near-monopolies when compared to the intense competition that characterizes the end-product markets. In such a setting, we examine the two main dimensions of technology provider's development decision - the technological advancement to offer in the component, and the additional functionality to provide.

3 - Customer Activity Chain: The Source of Promise in New Service Development

Weiyu Tsai, Assistant Professor, University of Utah, 1645 E. Campus Center Dr., #107, Salt Lake City, UT, United States, mgtwt@business.utah.edu, Rohit Verma

In today's competitive market, product-oriented as well as service-oriented companies are increasingly seeking service innovation to sustain their growth and long term survival. Especially for manufacturing companies in search of growth in the market flooded with commoditized products, it seems appealing to offer new and novel services peripheral to their core products. We suggest focusing on the "Customer Activity Chain" to define/design/deliver/debug (4-d) the NSD process.

■ SB18

H - 4th Floor, Union Square 12

AGIFORS Spotlight: Anna Valicek Awards and Current Hot Topics

Sponsor: Aviation Applications
Sponsored Session

Chair: Tim Jacobs, Tim.Jacobs@aa.com

1 - A Qualitative Choice Model for the US Airline Network

Dipasis Bhadra, Principal Economist, MITRE/CAASD, 7515 Colshire Avenue, McLean, VA, 22102, United States, dbhadra@mitre.org, Brendan Hogan

We use a multinomial choice model to explore two questions: What are the fundamental factors that determine and drive evolutions in the US airline network? Second, how can temporary or permanent network changes be adequately explained? Answering these questions may provide us with some important insight into understanding the formation and evolution of the US airline network. Furthermore, this may lead us to improved policy-making in the context of the industry that appears to be ever changing.

2 - A New Approach to Solve the Probabilistic Nonlinear Seat Inventory Control Problem

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

The seat inventory control problem is to maximize expected revenue of future scheduled flights by allocating seats to different itinerary / fare classes. We solve the probabilistic version using the Lagrangian dual formulation. We show that the Lagrangian dual can be solved by using a trust region based Newton method, in which the gradient and the Hessian are computed efficiently based on exploiting information from the primal representation. Special cases and schemes to adjust the dual and the primal variables are discussed.

3 - Modeling the Competitive Dynamic among Air-travel Itineraries with Generalized Extreme Value Models

Gregory Coldren, gregorycoldren@yahoo.com, Frank S. Koppelman

We estimate air-travel itinerary share models that capture the underlying competitive dynamic among itineraries along the dimensions of time of day, carrier and level-of-service. Estimation results are intuitive and the advanced models outperform the more basic specifications. Finally, the most basic of the presented models was implemented into a major U.S. carrier's existing itinerary share model, leading to significant improvements in its forecasting accuracy.

■ SB19

H - 4th Floor, Union Square 13

KLIC II — Fundamental Models and Processes (Knowledge, Learning & Intellectual Capital)

Sponsor: Technology Management
Sponsored Session

Chair: David Moore, Assistant Professor, Colorado School of Mines, Economics and Business Division, 814 15th Street, Golden, CO, 80401, United States, dmoore@mines.edu

1 - Linking Learning Services with Business Processes: The Strategic Value of Learning

Thomas Hill, Director, Learning and Knowledge Management, Genetech, 1 DNA Way, South San Francisco, CA, 94080-4990, United States, hill.thomas@gene.com

This work analyzes the programs of companies like Shell, Reuters, HP and Genentech in moving learning from an event orientation to a process one, showing the linkages of learning services to business processes, alignment with corporate business processes and finally positioning and evaluating learning based on strategic business impact.

2 - Production Functional Structures of Additive Production Performance Metrics

David Moore, Assistant Professor, Colorado School of Mines, Economics and Business Division, 814 15th Street, Golden, CO, 80401, United States, dmoore@mines.edu

Existence of additive decompositions of performance metrics such as cycle time, throughput, cost and yield as posited by (Zhangwill and Kantor) will be demonstrated in a production economic framework. We characterize all functional representations of production technologies having performance metrics with additive decompositons, and present empirical tests verifying, and apriori technological conditions implying existence of additive decompositions.

3 - Prior Knowledge in the Learning Curve: An Exploration of Form and Function

Nile Hatch, Marriott School - BYU, 790 TNRB, Provo, UT, 84602, United States, nile@byu.edu, Stefan Reichelstein

It is common to assume that the cost of the first unit is a control for the level knowledge at the beginning of a learning curve. We show that the shape and rate of learning depends on the level of prior knowledge and that the cost of the first unit does not control for this knowledge. We propose a functional form that controls for prior learning and test its performance in estimating learning curves in semiconductor manufacturing.

4 - Evolving Backwards: Technological Knowledge as a Causal Graph

Roger Bohn, Professor, UC San Diego, 9500 Gilman Drive, MC 0519, La Jolla, CA, 92093, United States, Rbohn@UCSD.edu

Technological knowledge can be modeled as a causal knowledge graph (CKG). In this model, knowledge tends to evolve backwards over time, from effect to cause. 200 years of firearms manufacturing at Beretta provide the main example. Strengths and limits of the CKG will be sketched. Among other features, CKGs can be used directly by engineers to learn about, store, and combine knowledge. CKGs and their evolution explain society-wide organization of technological knowledge into firms.

■ SB20

H - 4th Floor, Union Square 14

Electricity Market Modeling

Sponsor: Energy, Natural Resources & the Environment / Energy
Sponsored Session

Chair: Javier Contreras, Universidad de Castilla - La Mancha, Campus Universitario s/n, 13071 Ciudad Real, Spain, Javier.Contreras@uclm.es

1 - An Optimisation Approach for Oligopolistic Electricity Markets Simulation with Network Constraints

Begoña Vitoriano, Doctor, Universidad Pontificia Comillas (IIT), Santa Cruz de Marcenado 26, Madrid, 28015, Spain, bvitoriano@upcomillas.es, Julià n Barqu"n, Félix Fernàndez-Menéndez

An optimisation based model to simulate electricity markets that allows to take into account simultaneously constraints related to network and multiperiod systems (as water management, or start-up and shut-down thermal plants characteristics) will be presented. The oligopolistic nature of the competition is addressed through conjectural variations, and the model will be applied to two different ways of managing the network: capacity auctions versus market splitting.

2 - Locational Marginal Price Sensitivities

Roberto Minguez, Universidad de Castilla - La Mancha, 13071 Ciudad Real, Spain, Roberto.Minguez@uclm.es, Antonio Conejo

Within an optimal power flow market clearing framework, this paper provides expressions to compute the sensitivities of locational marginal prices with respect to power demands. Sensitivities with respect to other parameters can also be obtained. An example and a case study are used to illustrate the expressions derived.

3 - Dynamic Oligopolistic Electric Power Network Competition with Joint Constraints and Ramping Costs

Reetabrata Mookherjee, Doctoral student, Industrial Engineering, Pennsylvania State University, 244 Leonhard Building, University Park, PA, 16802, United States, reeto@psu.edu, Terry Friesz, Benjamin Hobbs, Matthew Rigdon

We articulate a dynamic model of electric power network competition that includes two critical features: (i) ramping costs for changing the power output of generating units and (ii) joint regional sales cap constraints. The resulting problem is a generalized Nash equilibrium that we articulate as a differential quasi-variational inequality. We provide a restricted formulation and an implicit fixed point algorithm to solve it. We discuss a numerical example and some extensions of the model.

4 - Global Optimization of Collusive Games in Transmission-constrained Electricity Markets

Andrew Liu, Dept. Applied Math. & Statistics, The Johns Hopkins University, Baltimore, MD, United States, lliu@jhu.edu, Joe Harrington, Jong-Shi Pang, Benjamin Hobbs

We present an optimization model that describes a collusive game among non-cooperative players. The model is then extended to the case of deregulated electricity markets with linearized DC transmission networks, and is reformulated as a mathematical program with equilibrium constraints (MPECs). A branch-and-bound type algorithm specially tailored to handling the linear complementarity constraints will be presented, along with numerical examples.

■ SB21

H - 4th Floor, Union Square 15

Clustering Methods for Knowledge Discovery

Sponsor: Data Mining
Sponsored Session

Chair: Nick Street, Associate Professor, University of Iowa, S232 Pappajohn Business Bldg., Iowa City, IA, 52241, United States, nick-street@uiowa.edu

1 - Consensus Solutions from Multiple Unsupervised Classifications

Alexander Topchy, Nielsen Media Research, 501 Brooker Creek Blvd, Oldsmar, FL, 34677, United States, Alexander.Topchy@NielsenMedia.com

Data clustering is increasingly focusing on combining multiple partitions as a way to improve the robustness of clustering solutions. We demonstrate how a meaningful consensus in clustering ensemble can be reached by several consensus functions derived from statistical and information-theoretic principles. We give some formal arguments on ensemble convergence and empirical evidence that individual algorithms can be significantly relaxed in favor of weaker and inexpensive partition generation.

2 - Iterative Clustering & Classification to Identify Response-Specific Subpopulations

Ding Yuan, University of Iowa, Pappajohn Business Bldg., Iowa City, IA, 52242, United States, ding-yuan@uiowa.edu, Nick Street

We propose an integrated two-level modeling process that combines supervised and unsupervised learning to build predictive models for different clusters simultaneously. Both the performance of different predictive models and the similarities between the data points in the original feature space are used to guide the cluster construction.

3 - Constraint Clustering, Global Algorithm

Yu Xia, The Institute of Statistical Mathematics, 4-6-7 Minami-Azabu, Minato-Ku, Tokyo, 106-8569, Japan, yuxia@ism.ac.jp

Some existing clustering methods have been adapted to the constraint clustering. However, as the case of unconstraint clustering, it is difficult to find a global solution for the constraint clustering. In this paper, I propose a cutting method for constraint clustering, which find global solution in finite steps theoretically.

■ SB22

H - 4th Floor, Union Square 16

Economic Analysis of Pricing and E-Business

Sponsor: Information Systems
Sponsored Session

Chair: Anindya Ghose, Assistant Professor, New York University, Stern School of Business, New York, NY, United States, aghose@stern.nyu.edu

1 - Market Transparency in Internet-Based Selling: Modeling and Empirical Analysis

Robert J. Kauffman, Director MISRC Research Center, Professor and Chair, University of Minnesota, Information and Decision Sciences Dept., 3-365 Carlson School of Management, Minneapolis, MN, 55455, United States, kauff002@umn.edu, Nelson F. Granados, Alok Gupta

Internet technology brought significant changes in the availability of product and price information to consumers, or the level of market transparency. We model the impact of market transparency on consumers' willingness-to-pay and derive the optimal relative prices and transparency levels for two Internet-based sellers who wish to maximize profits. Based on the guidelines from the model, we evaluate cross-channel transparency strategies in air travel using a large dataset of airline tickets.

2 - Pricing Options Contracts: A Continuous-Time Model

D.J. Wu, Associate Professor, Georgia Institute of Technology, 800 West Peachtree Street NW, Atlanta, GA, 30332, United States, dj.wu@mgt.gatech.edu, Shi-Jie Deng

In a continuous-time setting, we study the pricing of real options on capacity contracts. We compare with earlier theoretical results for the two-period case with continuous-time case. We discuss practical implications of our results for electronic markets in the context of contract manufacturing and hotel channel management.

3 - Pricing and Product Line Strategies of Information Goods: Theory and Evidence from E-Business

Anindya Ghose, Assistant Professor, New York University, Stern School of Business, New York, NY, United States, aghose@stern.nyu.edu, Arun Sundararajan

The adoption of Internet-based commerce has provided researchers with a wealth of new data enabling demand estimation in a number of industries. Based on an ecommerce-based panel data collected between 2004-2005, this paper estimates the extent of quality distortion due to versioning in software and tests existing & new theories on product line offerings using price-elasticities. It also empirically proves the optimality of mixed bundling for software.

■ SB23

H - 4th Floor, Union Square 17

Modeling Financial Services

Sponsor: Financial Services
Sponsored Session

Chair: Aparna Gupta, Asst Prof, Rensselaer Polytechnic Institute, 110 Eighth Street, Troy, NY, 12180, United States, guptaa@rpi.edu

1 - The Adoption of Internet Banking and its Implications for Service Delivery Management

Mei Xue, Assistant Professor, Boston College, xueme@bc.edu, Lorin Hitt, Pei-yu Chen

Though millions of dollars has been invested in building the infrastructure for Internet banking, it is seen that the adoptions of Internet banking by consumers has been relatively slow and far below expectations. In this paper, we study the retail bank customers' adoptions of Internet banking using a large panel data set. The implications of the findings for service delivery management are explored.

2 - Comparing Contribution Schemes for Simulated Portfolios

Harold Schleef, Lewis & Clark College, Social Sciences Division, Portland, OR, schleef@lclark.edu

This paper compares several contribution schemes for personal investment portfolios. Simulation models allow comparison of different asset allocations and evaluation of the risk associated with achieving specific portfolio targets. The risk of failing to reach a specific portfolio value on a target date may be substantial, given constant annual contribution amounts. Other schemes may achieve the desired portfolio value.

3 - Options-based Pricing Strategies for Internet Services

Aparna Gupta, Asst Prof, Rensselaer Polytechnic Institute, 110 Eighth Street, Troy, NY, 12180, United States, guptaa@rpi.edu

Provision of Quality of Service (QoS) guaranteed services on the Internet is inherently risky due to uncertainties caused by competing traffic in the Internet. We develop appropriate models for QoS guaranteed contracts and options-pricing based techniques for pricing the risk in these contracts.

■ SB24

H - 4th Floor, Union Square 18

Computational Methods for Portfolio Optimization

Cluster: Financial Engineering
Invited Session

Chair: John Birge, Professor, University of Chicago, Graduate School of Business, Chicago, 60637, United States, john.birge@gsb.uchicago.edu

1 - Modeling and Computation of Portfolio Optimization Problems with Transaction Costs, Part I

Zhen Liu, Northwestern University, 2145 Sheridan Road, Department of IEMS, Evanston, IL, 60208, United States, zliu@northwestern.edu, John Birge

We discuss portfolio optimization problems with transaction costs under different governing processes. In part I, we discuss the valuation of buy-and-hold strategy. New modeling of the dynamics of a portfolio is proposed. Then the complicated resulting parabolic PDE problem is changed into a heat transfer problem in unbounded region. An exact Artificial Boundary Condition is given and numerical experiments confirm the effectiveness.

2 - Optimal Investment and Order Submission Strategy with Execution Delay

Tim Maull, PhD Student, University of Michigan, Department of IOE, 1205 Beal Avenue, Ann Arbor, MI, 48109-2117, United States, timmaull@umich.edu, Jussi Keppo, Hong Liu

We examine the affects of transaction delays on portfolio value. These transaction delays are similar to transaction costs and can arise from illiquid markets or from technological constraints. Portfolio values and optimal actions with and without delay are discussed. Applications of modeling delays in financial markets are considered.

3 - A Simulation Based Optimization Scheme for Large Portfolios with Transaction Costs

Kumar Muthuraman, Asst. Professor, Purdue University, 315 N Grant St, West Lafayette, IN, 47906, United States, kumar@ecn.purdue.edu, Haining Zha

Solutions to portfolio optimization problems with proportional transaction costs are obtained by solving a related free-boundary PDE (HJB). Runtimes of existing solution methods grow super exponentially with dimension - making them unsuitable for problems with more than even 3 stocks. We describe a scheme that scales polynomially in dimension. The scheme transforms the HJB to a sequence of fixed boundary problems and estimates the solution to the fixed boundary problems by simulation.

■ SB26

H - 4th Floor, Union Square 20

JFIG- Paper Competition II

Sponsor: JFIG, Junior Faculty Interest Group
Sponsored Session

Chair: Joseph Geunes, Associate Professor, University of Florida, 303 Weil Hall, Gainesville, FL, 32611, United States, geunes@ise.ufl.edu

1 -Minimizing Flow Disruption due to Network Maintenance

Yanjun Li, Assistant Professor, Purdue University, West Lafayette IN 47907, United States, li14@purdue.edu, Mohit Tawarmalani

This paper introduces a network maintenance scheduling problem under maintenance capacity restrictions and studies the effect of maintenance operations on productivity loss. The objective is to minimize the flow disruption, a measure of the loss of productivity, during maintenance activities. Unfortunately, this maintenance scheduling problem is intractable even when the underlying network is linear and the flows are allowed to take two different values. Our study first targets linear networks with a special flow structure which includes the uniform flow case. We devise a polynomial-time combinatorial algorithm for solving the minimum disruption network maintenance problem, characterize the structure of the set of all optimal schedules, discuss the impact of maintenance capacities on flow disruption and identify specific types of flow changes that retain optimality of a maintenance schedule. As shown here, the optimal maintenance schedules have a peculiar structure and this structure yields many insights into general maintenance scheduling. Then, with a general flow structure, we develop an integer programming formulation for the acyclic network maintenance problem and a specialized formulation for linear network maintenance problem. We derive valid inequalities, use reformulation-linearization technique to tighten formulation, and conduct polyhedral study of formulations using network flow and primal-dual methods. We computationally demonstrate that our formulations are capable of solving reasonably large instances of the problems. Finally, we extend our model and analysis to the maintenance problems on directed networks and network nodes.

2 -The Optimal Time to Disclose Software Vulnerability

Jeevan Jaisingh, Assistant Professor, The Hong Kong University Of Science and Technology, Clear Water Bay, Kowloon, Hong Kong, Hong Kong, jeevan@ust.hk, Qing Li

Software vulnerability disclosure has been a critical area of concern for social planners. It is well known that while early disclosure may push vendors to create patches sooner, late disclosure reduces the risk of making the vulnerabilities known to malicious users. This paper provides a new view of the problem. We argue that to set an optimal disclosure policy, the social planners must trade off an incentive effect for an information effect. On one hand, because vendors typically have different objectives than the social planners have, social planners need to use disclosure as an incentive scheme for coordination. That is, the incentive effect favors early disclosure. On the other hand, social planners must decide on a disclosure policy before they know when the vulnerabilities would be discovered by benign users, but vendors can postpone their patching decisions until that information is known. Since the vendors are endowed with more accurate information and hence are able to make more informed choices, they should be left unregulated. That is, the information effect favors late disclosure. As a result of this tradeoff, social planners should disclose the vulnerabilities after a finite and non-zero grace period or keep them secret, depending on which effect dominates, but they should never disclose them instantly. Two factors may affect the tradeoff: the vendors' liability for their customers' losses resulting from attacks and the experience that hackers can accumulate on the vulnerabilities over time. We show how these two factors affect the incentive conflict and information asymmetry and hence the optimal disclosure policy.

3 -Stochastic Revenue Management Models for Media Broadcasting

Victor Araman, Asst. Prof., NYU Stern School of Business, 44W 4th Street, New York NY 10012, United States, varaman@stern.nyu.edu
Ioana Popescu

An important challenge faced by media broadcasting companies is how to allocate the limited advertising capacity between upfront contracts and the scatter market in order to maximize profits. We develop stylized optimization models of inventory allocation for one client and one media channel, in the presence of audience uncertainty. Closed form solutions for upfront contract allocation are obtained. Dynamic make-goods allocation are investigated under reversible and irreversible commitment strategies. We provide structural properties and sensitivity analysis for the value function and optimal solution with respect to contract parameters, audience and time. Our results hold under very general performance metrics, and bring out interesting parallels with standard inventory and revenue management frameworks.

■ SB27

H - 4th Floor, Union Square 21

2005 Dantzig Dissertation Award Finalists

Cluster: Dantzig Dissertation Prize
Invited Session

Chair: Linda Green, Professor, Columbia University, 3022 Broadway, New York, NY, 10027, United States, lvg1@columbia.edu

The Dantzig Prize is offered for the best PhD in Operations Research with applied content. The winner will likely offer a presentation, as will some of the strongest finalists.

1 - Optimal Policies for the Acceptance of Living- and Cadaveric-Donor Livers

Oguzhan Alagoz, University of Wisconsin-Madison, Department of Industrial and Systems Engineering, 3162 Engineering Centers Building, 1550 Engineering Drive, Madison, WI, 53706, United States, alagoz@engr.wisc.edu

Transplantation is the only viable therapy for end-stage liver diseases (ESLD) such as hepatitis B. In the United States, patients with ESLD are placed on a waiting list. When organs become available, they are offered to the patients on this waiting list. This dissertation focuses on the decision problem faced by these patients: which offer to accept and which to refuse? A recent analysis of liver transplant data indicates that 60% of all livers offered to patients for transplantation are refused. This problem is formulated as a discrete-time Markov decision process (MDP). This dissertation analyzes three MDP models, each representing a different situation. We derive structural properties of all three models, including several sets of conditions that ensure the existence of intuitively structured policies such as control-limit policies. The computational experiments use clinical data, and show that the optimal policy is typically of control-limit type.

2 - First Place - Communicating Preferences and Determining Outcomes in Combinatorial Auctions

Bob Day, University of Connecticut, 2100 Hillside Rd. U-1041, Storrs, CT, 06269, United States, Bob.Day@business.uconn.edu

In this talk I will summarize the contributions to the study of combinatorial auctions made in my dissertation. I begin by showing an improved technique for the computation of "bidder-Pareto-optimal" prices within the "core." This technique calls for the automated solution of several "winner-determination" problems, and like similar combinatorial auction techniques requires each bidder to submit valuations for all bundles of interest to a proxy. Unfortunately, communicating preferences to a proxy may require an exponential amount of information relative to the number of items being auctioned. To address this exponential communication problem, I introduce two new compact bidding languages, and discuss the details, implementations, and relative merits of these approaches.

■ SB28

H - 4th Floor, Union Square 22

Pricing and Revenue Management in Service Systems

Sponsor: Revenue Management & Pricing
Sponsored Session

Chair: Philipp Afeche, Asst. Prof., University of Chicago, 5807 South Woodlawn Avenue, Chicago, IL, 60637, United States, pafeche@gsb.uchicago.edu

1 - The Effect of Uncertainty on Decision Optimality

Roxy Cramer, Senior Scientist, PROS Revenue Management, 3100 Main Street, Suite 900, Houston, TX, 77002, United States, rcramer@prosrm.com, Ed Kambour, John Salch

The effect of randomness in optimization is typically handled by examining expected revenue. However, the presence of uncertainty in the underlying random process can change things considerably. In this presentation we will describe, in general, some of the ramifications of uncertainty on the decision making process and show the explicit value of additional data gathering. In addition, we will present supporting example cases.

2 - Robust Product Pricing when Customer Preferences are Unknown using a Competitive Ratio Analysis

Costis Maglaras, Columbia Business School, 3022 Broadway, New York, NY, 10027, United States, c.maglaras@gsb.columbia.edu, Serkan Eren, Garrett van Ryzin

We study the monopolist's pricing problem when the firm operates in a market with no information about customer preferences. Adopting a worse-case (competitive ratio) analysis we characterize the structure and performance of the optimal pricing policy in a variety of settings with/without learning and/or capacity constraints.

3 - Pricing Strategies and Service Differentiation in an M/M/1queue - A Profit Maximization Perspective

Akshay Katta, Columbia University, Department of IEOR, 500 West 120th Street, NewYork, NY, 10027, United States, ark2001@columbia.edu, Jay Sethuraman

Consider the problem of designing a profit maximizing pricing-scheduling policy for a service facility serving heterogeneous customers with private information about their service value and time-sensitivity. For the problem where each customer belongs to one of N discrete types, and under certain model assumptions, we give an efficient algorithm to find an optimal policy. For the problem with continuous types, we derive the conditions under which the priority auction is optimal.

4 - Revenue Management and Delay Tactics under Competition and Customer Choice

Philipp Afeche, Asst. Prof., University of Chicago, 5807 South Woodlawn Avenue, Chicago, IL, 60637, United States, pafeche@gsb.uchicago.edu

Consider the problem of two providers who compete for heterogeneous and delay sensitive customers with private information about their delay tolerance. How should they design price-delay menus and schedule their resources? We characterize the price-delay equilibria and discuss how they depend on capacity levels, competition, and the value of market segmentation.

■ SB29

H - 4th Floor, Union Square 23

Joint Session Research/JFIG: JFIG Research Clinic- Operations Management with Weather Forecasts

Cluster: Research Clinics, JFIG, Junior Faculty Interest Group
Invited Session

Chair: Eva Regnier, Naval Postgraduate School, 1 University Circle, Monterey, CA, 93943, United States, eregnier@nps.edu

1 - Operations Management with Weather Forecasts
Eva Regnier, Naval Postgraduate School, 1 University Circle, Monterey, CA, 93943, United States, eregnier@nps.edu, Tuell Green, Ron Sznaider, David Titley, Michael Petrie

Industry and public sector panelists present problems related to use of weather forecasts in planning. These experts will discuss the impact of weather on their operations and decisions, highlighting decision support tools and problems they would like to see solved. Topics will include the design of forecasts for decision support in the transportation sector, the integration of weather data in decision support tools for homeland security managers and the development of quantitative rules for operational decision-making and design of next-generation meteorological products for the U.S. Navy. The purpose of this panel is to build a bridge between a community of operational experts and the OR/MS community whose tools and experience have the potential to make a huge impact in improving the use and value of weather information.

■ SB30

H - 4th Floor, Union Square 24

Problems in the Management of Finance Risk

Contributed Session

Chair: Cigdem Gurgur, Professor, Colorado School of MINES, Business and Economics Division, 1500 Illinois Street, GOLDEN, CO, 80401, United States, cgurgur@mines.edu

1 - Vertical Integration in Banking - Myth or Formula for Success?
Tom Gellrich, JW Goethe University & E-Finance Lab, Bockenheimer Landstr. 42, Frankfurt, HE, 60325, Germany, gellrich@wiwi.uni-frankfurt.de, Markus Holzhaeuser, Andreas Hackethal

We examine vertical integration and its impact on profitability and shareholder value in the global banking industry. We find that Anglo-Saxon banks operate on a less integrated basis. Our results show that banks either operating on highly integrated or highly disintegrated levels of vertical integration display superior performance and stock market figures. We also find an interrelation between vertical integration and outsourcing.

2 - The Role of Financial Institutions and Productivity Growth of Firms
Zhonghua Wu, PhD Candidate, National U of Singapore, BIZ2, Level 6, Research Office, Business link, National U of Singapore, Singapore, 117592, Singapore, g0403303@nus.edu.sg

Based on agency theory, we focus on the effect of ownership held by financial institutions on firm productivity growth by developing a model of endogenous productivity growth and testing its implications against data on 163 Japanese manufacturing firms spanning 1979-2001. We find a U-shaped financial ownership ®C productivity growth relation, which is negatively moderated by the level of financial leverage in a firm.

3 - The Sensitivity Study on Investment Expenditure and Cash Flow of Chinese IT Industrial Company
Yanxi Li, Associate Professor, Management School of Dalian University of Technology ,China, Dalian University of Technology, Dalian, 116024, China, mrliyx@dlut.edu.cn

Using ICF as the indicator to evaluate the internal financing ability of the company, this paper conducts a sensitivity study on the listed companies of Chinese IT industry based on the investment expenditure and ICF when these companies face to various kinds of financing constraints . This study shows that the greater financing constraint the listed company of Chinese IT industry faces, the greater influence it's ICF holds on it's investment expenditures.

4 - Continuous and Dynamic Funding of Warranty Reserves
Cigdem Gurgur, Professor, Colorado School of MINES, Business and Economics Division, 1500 Illinois Street, GOLDEN, CO, 80401, United States, cgurgur@mines.edu

It is common for many companies to create a reserve fund to cover future liabilities arising from product warranties. We propose an optimal warranty reserve policy to determine the funding level at the beginning of a fiscal period, the amount of contribution after each sale; and cash flows at the end of the period.

■ SB31

H - 4th Floor, Union Square 25

Joint Session Practice/ Roundtable: OR at UPS - Making a Difference with Technology

Cluster: OR Practice, Roundtable
Invited Session

Chair: Jeff Winters, OR Division Mgr, United Parcel Service, 2311 York Rd, Timonium, MD, 21093, United States, JWinters@ups.com

1 - Why OR Projects Fail - Or Succeed
Jeff Winters, OR Division Mgr, United Parcel Service, 2311 York Rd, Timonium, MD, 21093, United States, JWinters@ups.com

UPS has a long history of utilizing Operations Research from tactical to strategic planning. This presentation will examine techniques for the successful use and implementation of projects utilizing OR.

2 - OR and Hub Operations at UPS
Doug Mohr, United Parcel Service, 2311 York Rd, Timonium, MD, 21093, United States, dMohr@ups.com

UPS has utilized the hub and spoke concept in package routing and sorting for many years. This presentation will provide an overview of the UPS efforts to utilize operations research in improving the efficiency and effectiveness of hub operations.

3 - OR in Long Haul Operations at UPS
William Boga, Lead Technical User Rep, United Parcel Service, 2311 York Rd, Timonium, MD, 21093, United States, wBoga@ups.com

An examination of the use of operations research to plan and improve UPS over the road long haul operations. The presentation will include a description of the UPS over the road long haul problem, a brief history of the use of OR to solve these problems, and a glimpse into future plans to further leverage operations research in this area.

■ SB32

H - 6th Floor, Lombard

Issues in Logisitcs and Scheduling

Contributed Session

Chair: Johann Hurink, Dr., University of Twente, P.O. Box 217, Enschede, 7500 AE, Netherlands, j.l.hurink@utwente.nl

1 - The Network of Logistics Decisions
James Campbell, Professor, University of Missouri-St. Louis, College of Business Administration, 1 University Blvd, St. Louis, MO, 63121-4499, United States, campbell@umsl.edu, Diane Riopel, André Langevin

Logistics decision-making is challenging due to the complex inter-relationships among decisions. This presentation provides a framework for logistics decision-making by classifying logistics decisions and highlighting the relevant linkages among them. We focus on the precedence relationships among logistics decisions and the resulting sequencing of decision-making that this implies.

2 - Logistics Network Design using Consolidation Hubs
Michelle L.F. Cheong, Practice Assistant Professor, Singapore Management University, 80, Stamford Road, Singapore, 178902, Singapore, michcheong@smu.edu.sg, Rohit Bhatnagar, Stephen Graves

We address the 3PL challenge in consolidating flows when managing suppliers for multiple clients. We locate hubs near the suppliers and consolidate shipments, to improve visibility and lower cost. Using hub shipping options, we perform precomputations to reduce model complexities, and to determine the inventory policy and network design simultaneously.

3 - Meta-Heuristics for Distribution Network Design with Truckload Consolidations
Homarjun Agrahari, Department of Industrial Engineering, Texas A&M University, College Station, TX, United States, homarjun@tamu.edu, Halit Uster

We consider a capacitated network design problem where smaller loads are consolidated into truckloads during their origin to destination transportation. We present heuristics based on SA and TS frameworks and large scale neighborhoods. We also provide a summary of computational results.

4 - A Tabu search for the flowshop scheduling problem
Burak Eksioglu, Assistant Professor, Mississippi State University, PO Box 9542, Miss. State, MS, 39759, United States, beksioglu@ie.msstate.edu, Sandra Eksioglu, Pramod Jain

A Tabu search procedure is developed for the flowshop scheduling problem. To generate an initial solution for tabu search a new heuristic is developed that consideres due dates, release times, and processing times of the jobs on each machine. The initial solution is then improved using a tabu search procedure. Several neighborhood definitions are used to test the effect of the neighborhood size on the solution quality.

5 - Efficiency of Local Search for some Scheduling Problems
Johann Hurink, Dr., University of Twente, P.O. Box 217, Enschede, 7500 AE, Netherlands, j.l.hurink@utwente.nl, Tobias Brueggemann

Local Search methods are nowadays very popular solution methods for solving scheduling problems. In this paper we present some theoretical results on bounds on the quality or computational time for applying local search to some specific scheduling problems. Furthermore, we discuss some results on efficiency of large scale neighborhoods.

■ SB33

H - 6th Floor, Mason

Journal of Quality and Reliability Engineering International

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: Douglas Montgomery, Professor, Industrial Engieering Dept., Industrial Engieering Dept., Arizona State University, Tempe, AZ, 85287, United States, doug.montgomery@asu.edu

1 - Design Strategies for the Multivariate Exponentially Weighted Moving Average Control Chart
Connie Borror, cborror@uiuc.edu

The multivariate exponentially weighted moving average (MEWMA) control chart has received significant attention from researchers and practitioners because of its desirable properties. There are several different approaches to the design of MEWMA control charts: statistical design; economic-statistical design; and robust design. In this paper a review and comparison of these design strategies is provided.

2 - A Change Point Method for Linear Profile Data
Mahmoud Mahmoud, mamahmou@vt.edu, Peter Parker, Douglas Hawkins, Bill Woodall

We propose a change point approach based on segmented regression and maximum likelihood for testing the constancy of the regression parameters in a linear profile data set. We compare the performance in detecting sustained step shifts in the parameters to that of the most effective Phase I control chart approaches using simulation. We provide a calibration application from NASA Langley Research Center.

3 - Process Optimization through Robust Parameter Design in the Presence of Categorical Noise Variables
William A. Brenneman, brenneman.wa@pg.com, Tim Robinson, William R. Myers

When categorical noise variables are present in the robust parameter design context, one can reduce process variance by adjusting the proportions associated with the levels of the categorical noise factors. In this setting, we propose the use of a parts per million defective objective function and use the desirability function approach to determine optimal operating conditions when non-uniform control factors are present. This methodology is illustrated with an example from industry.

■ SB34

H - 6th Floor, Powell

QSR Best Student Paper Competition

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: Yu Ding, Assistant Professor, Industrial Engineering, Texas A&M University, Texas A&M University, MS3131, College Station, TX, 77843, United States, yuding@iemail.tamu.edu

1 - QSR Best Student Paper Competition
Yu Ding, Assistant Professor, Industrial Engineering, Texas A&M University, Texas A&M University, MS3131, College Station, TX, 77843, United States, yuding@iemail.tamu.edu

The Quality Statistics and Reliability (QSR) Section of INFORMS announces the Best Student Paper Award to recognize excellence among its student members. Four finalists for the Best Student Paper Award will be selected to make presentations during the conference. The winner will be announced and the Best Student Paper Award presented annually at the QSR Section business meeting later at the INFORMS annual meeting. All finalists' papers will be posted on the webpage of the QSR Section.

■ SB35

H - 6th Floor, Sutter

RASIG Student Paper Competition

Sponsor: Railroad Applications
Sponsored Session

Pooja Dewan, BNSF Railway, 2400 Western Center, Fort Worth, TX, United States, pooja.dewan@bnsf.com

RASIG Student Paper Competition

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

1 - First Place: Decreasing the Passenger Waiting Times for IC Networks of Belgian Railways
Peter Vansteenwegen

To improve passenger service, a generalized waiting cost, weighting different types of waiting, is minimized. To safeguard important transfers, ideal buffer times are calculated based on the delay distributions of trains, passenger numbers and different waiting types. Linear goal programming is used to construct an improved timetable with suitable transfer times, respecting as much as possible the ideal buffers. Simulation evaluates different LP-generated schedules. For the case of the IC network, the waiting cost is reduced by 40 percent.

2 - Second Place: N-tracked Railway Traffic Rescheduling During Disturbances
Johanna Tornquist

Railway systems are often characterized by high traffic density and heterogeneous traffic that is sensitive to disturbances. Difficulties analyzing how disturbances propagate and which actions to take in order to minimize the consequences for multiple stakeholders have been studied in research projects funded by the Swedish National Rail Administration. An optimization approach to the problem of re-scheduling traffic in an n-tracked network is presented. The theoretical and practical implications of an implementation are also discussed.

3 - Honorable Mention: Revenue Management of Auto Train at Amtrak
Soheil Sibdari

Auto Train offered by Amtrak is a distinctive service in the United States that lets passengers bring their own vehicles on the train. This service is offered daily to shuttle between Lorton, VA and Sanford, FL. Amtrak accepts different types of vehicles including Automobile, VAN/SUV, and Motorcycle to board the train. In addition, Amtrak also provides different types of accommodation for passengers, including Super Coach Seat, Superliner Lower level Coach Seat, Superliner Bedroom Suite, and Family Bedroom. The capacities of these accommodations are fixed and Amtrak starts selling the tickets about 335 days before the train's departure date. In this paper, we study revenue management strategies in order to maximize the expected revenue of this service.

■ SB36

H - 6th Floor, Taylor

Joint Sim/ Artificial Intelligence: Tutorial on Agent-based Modeling and Simulation

Sponsor: Simulation, Artificial Intelligence
Sponsored Session

Chair: Charles Macal, Senior System Engineer, Argonne National Laboratory, Decision & Information Sciences Division, 9700 S. Cass Ave., Argonne, IL, 60439, United States, macal@anl.gov

1 - Tutorial on Agent-based Modeling and Simulation
Charles Macal, Senior System Engineer, Argonne National Laboratory, Decision & Information Sciences Division, 9700 S. Cass Ave., Argonne, IL, 60439, United States, macal@anl.gov, Michael North

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

■ SB37

H - 6th Floor, Van Ness

Joint Session AP/ Workforce: Queueing Systems with Flexible Servers II

Sponsor: Applied Probability, Workforce Flexibility
Sponsored Session

Chair: Hayriye Ayhan, Associate Professor, Georgia Institute of Technology, School of IsyE, Georgia Institute of Technology, Atlanta, GA, 30332-0205, United States, hayhan@isye.gatech.edu

1 - Dynamic Allocation of Flexible Resources in a Serial Line with Reliability Considerations

Mark E. Lewis, Associate Professor, Cornell University, School of ORIE, 206 Rhodes Hall, Ithaca, NY, 14853, United States, melewis@orie.cornell.edu, Cheng-Hung Wu

We describe a heuristic based on a two-station tandem queueing system for allocating reconfigurable rescources in the N-station model. The two-station model is examined via Markov decision processes where monotonicity results for an optimal policy are proved. A detailed numerical study shows that the heuristic performs well when compared to several policies suggested in the literature.

2 - Staffing Decisions for Heterogeneous Workers with Turnover

Rhonda Righter, Professor, Department of IEOR, University of California, Berkeley, CA, 94720, rrighter@ieor.berkeley.edu, Hyun-soo Ahn, J. George Shanthikumar

We consider a firm that employs heterogeneous wokers to meet demand for its product or service. Workers differ in their skills, speed, and/or quality, and they randomly leave, or turn over. Each period the firm must decide how many workers of each type to hire or fire in order to meet randomly changing demand forecasts at minimal expense. We explore several different notions of discrete convexity and their impact on structural results for the optimal policy.

3 - Operational and Inventory Flexibility in a Make-to-Stock System with Backorders

Mark van Oyen, Associate Professor, University of Michigan, Industrial and Operations Engineering, 1205 Beal Avenue, Ann Arbor, MI, 48109, United States, MVanOye@orion.luc.edu, Seyed Iravani, Bora Kolfal

A make-to-stock operation has the "operational flexibility" to produce two products. If a stochastically arriving order finds a stockout of the lower-grade product, "inventory flexibility" may be used to upgrade it. We provide insights into optimal dynamic control and the relative value of operational versus inventory flexibility.

4 - Throughput Maximization in Tandem Lines with Flexible Failure-Prone Servers

Hayriye Ayhan, Associate Professor, Georgia Institute of Technology, School of IsyE, Georgia Institute of Technology, Atlanta, GA, 30332-0205, United States, hayhan@isye.gatech.edu, Douglas Down, Sigrun Andradottir

Consider a tandem queueing network with two stations and two or three flexible servers who are subject to failures. We study the dynamic assignment of these servers to stations in order to maximize the long-run average throughput.

■ SB38

R - 2nd Floor, Corintia

Optimization Models in Finance

Cluster: Linear/Nonlinear Programming
Invited Session

Chair: Javier Pena, Associate Professor of Operations Research, Carnegie Mellon University, 5000 Forbes Avenue, Pittsburgh, PA, 15213, United States, jfp@andrew.cmu.edu

1 - Sparse PCA with Applications in Finance

Alexandre d'Aspremont, Assistant Professor, Princeton University, E-Quad E-424, ORFE Princeton University, Princeton, NJ, 08544, United States, aspremon@princeton.edu

We examine the problem of decomposing a covariance matrix into sparse factors (i.e. sparse Principal Component Analysis). This can interpreted as a variance maximization penalized by proportional transaction costs and we detail application to portfolio hedging with fixed and proportional transaction costs.

2 - Closed-form Solutions of Semiparametric Bounds Arising in Finance Applications

Luis Zuluaga, Assistant Professor, University of New Brunswick, P.O Box 4400, Fredericton, NB, E3B 5A3, Canada, lzuluaga@unb.ca, Donglei Du, Javier Pena

Semi-parametric bounds are used in finance to set bounds for option prices under the risk-neutral measure pricing theory and to examine the relationship between option prices and the true distribution of the underlying asset price. These bounds are also used in stochastic programming, inventory theory, and robust optimization. We derive closed-form solutions to some semi-parametric bounds arising in financial applications such as option pricing and risk management.

3 - Modeling Country Risk Ratings Using Partial Order

Miguel Lejeune, Tepper School of Business, Carnegie Mellon University, 5000 Forbes Avenue, Pittsburgh, PA, 15213, United States, mljne@yahoo.com, Peter L. Hammer, Alexander Kogan

To evaluate the creditworthiness of countries, a learning model is induced from S&P country risk ratings, using economic and political indicators. It allows the construction of a partially ordered set describing the relative superiority of countries on the basis of their creditworthiness, and it is shown that the Condorcet linear extensions of this poset match closely S&P's ratings. The model gives excellent ratings when applied to subsequent years or to ratings of previously unrated countries.

■ SB39

R - 3rd Floor, Aragon

Advances in Interior Point Methods for Linear and Cone Programming

Sponsor: Optimization/ Linear Programming and Complementarity
Sponsored Session

Chair: Maziar Salahi, Ph.D. Candidate, McMaster University, 218 Hamilton Hall-Department of Mathematics-McMaster University, Hamilton, ON, l8s 4k1, Canada, msalahi@optserv.cas.mcmaster.ca

1 - A First-Order Algorithm for Convex Program Based on Adaptive Ellipsoid Preconditioning

Zhaosong Lu, Zeev Nehari Visiting Assistant Professor, Carnegie Mellon University, Department of Mathematical Sciences, Pittsburgh, PA, 15213-3890, United States, zhaolu@andrew.cmu.edu, Renato Monteiro

We first develop a first-order algorithm for minimizing a nondegenerate bounded below self-concordant function based on an adaptive ellipsoid preconditioning technique that was developed by Monteiro, O'Neal and Nemirovski (2004). The complexity of this algorithm is established. Following a similar procedure, we develop a first-order algorithm for convex program and the associated complexity is established.

2 - Projective Pre-Conditioners for Improving the Behavior of a Homogeneous Conic Linear System

Alexandre Belloni, MIT, E40-149, 77 Massachusetts Ave., Cambridge, MA, United States, belloni@MIT.EDU, Robert M. Freund

We consider the problem F: Ax = 0, x \in C\{0} where C is a regular convex cone and A a linear operator. F has good computational complexity if an IPM for solving F has a good iteration bound, and has good geometry if the width of the cone of feasible solutions is large. We show how to construct a projective transformation of F to an equivalent system F' which has good complexity and geometry guarantees. Finally, we show how random walks can be used to implement this scheme efficiently.

3 - Overcoming Some Disadvantages of a Mehrotra-Type Interior Point Algorithm for Linear Programming

Coralia Cartis, Dr, University of Oxford, Computing Laboratory Wolfson Bldg, Parks Road, Oxford, OX1 3QD, United Kingdom, ccartis@comlab.ox.ac.uk

We construct a similar algorithm to Mehrotra's highly-popular predictor-corrector algorithm, the Primal-Dual Corrector (PDC), and show that the PDC may fail to converge to a solution of the linear programming problem in both exact and finite arithmetic. Further, we present two ways of modifying the PDC algorithm that lead to theoretically reliable and practical methods.

4 - On Mehrotra-Type Predictor-Corrector Algorithms

Maziar Salahi, Ph.D. Candidate, McMaster University, 218 Hamilton Hall-Department of Mathematics-McMaster University, Hamilton, ON, l8s 4k1, Canada, msalahi@optserv.cas.mcmaster.ca, Jiming Peng, Tamas Terlaky

In this paper we discuss the polynomiality of a variant of Mehrotra-type predictor-corrector algorithms that has been widely used in several IPM based optimization packages. By an example we show that in this variant the usual Mehrotra-type adaptive choice of the parameter μ might force the algorithm to take many small steps to keep the iterates in a certain neighborhood of central path, which is essential to prove the polynomiality of the algorithm.

■ SB40

R - 3rd Floor, Barcelona I

Location and Clustering Problems

Sponsor: Optimization/ Network Optimization
Sponsored Session
Chair: Dorit S. Hochbaum, UC Berkeley

1 - On the Average Case Performance of Some Greedy Approximation Algorithms For the Uncapacitated Facility Location Problem

Juan Vera, Carnegie Mellon University, Wean Hall, Room 6113, Pittsburgh, PA, 15213-3890, jvera@andrew.cmu.edu, Alan Frieze, Abraham D. Flaxman

We analyze the performance of 3 related approximation algorithms for the uncapacitated facility location problem (from [Jain, Mahdian, Markakis, Saberi, Vazirani, 2003] and [Mahdian, Ye, Zhang, 2002]) when each is applied to an instance created by placing n points uniformly at random in the unit square. We find that, with high probability, these 3 algorithms do not find asymptotically optimal solutions, while, a simple plane partitioning heuristic does.

2 - On the Convergence Time of the K-Means Algorithm

Sergei Vassilvitskii, Gates Computer Science Building, 4B, Stanford University, Stanford, CA, 94305-9045, sergei@cs.stanford.edu, Rajeev Motwani, David Arthur

The k-means algorithm first proposed by Lloyd in 1982 is a popular clustering algorithm and is used widely in practice. Although it is known for its speed, up until recently no theoretical bounds were known on its running time. We show that in the worst case the running time of the k-means algorithm can be exponential. However, we explain the observed speed of the algorithm by showing that under very weak assumptions about the underlying distribution, the running time is quadratic in the number of points and the spread of the pointset.

3 - Aggregating Inconsistent Information: Ranking and Clustering

Alantha Newman, Institut fur Mathematik, TU Berlin, alantha@csail.mit.edu, Moses Charikar, Nir Ailon

Given a set of k complete rankings (clusterings) of the same set of n elements, we wish to output a single ranking (clustering) that best represents the input information. One approach is to find the ranking (clustering) that minimizes the "disagreements" with the input. For both these NP-hard optimization problems, we obtain new algorithms using the same simple principle. Our techniques also apply to related problems such as min feedback arc set in tournaments and correlation clustering in complete graphs.

4 - Group Ranking and Multi-criteria Decision Making: Models and Flow-based Algorithms

Dorit S. Hochbaum, UC Berkeley

Models of the aggregation of individual rankings typically lead to NP-hard problems (the Kemeny measure of minimizing the number of rank reversals is one example). We describe similar models that minimize the penalty of deviation from the individual rankings that are polynomial time solvable, and with efficient flow techniques.

■ SB41

R - 3rd Floor, Barcelona II

Joint Session Optimization Integer/Nonlinear Programming: Mathematical Programming in the Petroleum and Chemical Process Industries

Sponsor: Optimization/ Integer Programming, Optimization/ Nonlinear Programming
Sponsored Session
Chair: Kevin Furman, Exxon Mobil, 1545 Route 22 East, Annandale, NJ, 08801, United States, kevin.c.furman@exxonmobil.com

1 - Strategic Capacity Decisions in Manufacturing Stochastic Systems using Adaptive Dynamic Programming

Matthew Realff, Associate Professor, Georgia Institute of Technology, Chemical and Biomolecular Engineering, Atlanta, GA, 30332, United States, Matthew.Realff@chbe.gatech.edu, Nikolaos Pratikakis, Jay Lee

Optimal resource planning and allocation under uncertainty is one of the fundamental challenges of industrial scheduling applications. We consider a general multistage capacity planning and allocation problem of industrial interest. We use Markov chains to model the system uncertainty, and formulate it as a Markov Decision Process. To solve the problem an adaptive dynamic programming approach is developed that improves upon a mathematical programming heuristic for initial policy generation.

2 - Short Term Optimization of the Upstream Natural Gas Supply Chain

Ajay Selot, Massachusetts Institute of Technology, Room 66-365, 77 Massachusetts Avenue, Cambridge, MA, 02139, United States, selot@MIT.EDU, Paul Barton

We present a case study on the short term planning of the upstream natural gas supply chain with contractual rules. The physical model of the system involves nonconvex constraints to represent the flow-pressure relationship in the network and models of processing facilities. The major challenge in the study is to formulate a mathematical representation of complex contractual rules and operational constraints, which in general necessitates the use of binary variables. The resulting mathematical program is a MINLP with nonconvex constraints.

3 - Decomposition Method for Simultaneous Planning and Scheduling of Multiproduct Continuous Plants

Ignacio Grossmann, Professor, Carnegie Mellon University, Dept. Chemical Engineering, Pittsburgh, PA, 15213, United States, grossmann@cmu.edu, Muge Erdirik

We present a rigorous two-level decomposition scheme for optimal planning and scheduling of multiproduct continuous single processing plants. The objective is to maximize profit accounting for sales, inventories and sequence dependent changeovers. The upper level planning and lower level scheduling problems are formulated as aggregated and detailed continuous-time MILP models. The decomposition scheme relies on novel superset, subset and capacity cuts that greatly reduce computation.

■ SB42

R - 4th Floor, Parc Ballroom I

Stochastic Optimization in Transportation

Sponsor: Optimization/ Stochastic Programming
Sponsored Session
Chair: Warren Powell, Professor, Princeton University, Dept of Oper Res and Fin Eng'g, Princeton, NJ, 08544, United States, powell@princeton.edu

1 - Market Optimization for Express Package Carriers

Diego Klabjan, Professor, University of Illinois at Urbana-Champaign, 1206 West Green Street, Urbana, IL, 61801, United States, klabjan@uiuc.edu, Luke Schenk

Express package carriers move large quantities of packages from several stations to the ramp with various conveyance types such us containerized or bulk trucks and aircraft. In this project we streamline the transportation and sorting costs. Large cost savings can be obtained by appropriately forming containers at stations in order to bypass resorting at the ramp. The large-scale optimization problem is solved by approximate dynamic programming.

2 - Computational Experimentation with Two-Stage Stochastic Programs

Huseyin Topaloglu, Assist. Prof., Cornell University, 223 Rhodes Hall, Ithaca, NY, 14853, United States, topaloglu@orie.cornell.edu, Warren Powell, Julia Higle, Lei Zhao

We report on our computational experience on sampling-based methods for large-scale two-stage stochastic programs. In particular, we compare two algorithms. The first one of these algorithms is Stochastic Decomposition. The second one is a heuristic extension of our earlier work and uses separable approximations of the recourse function.

3 - Merging Stochastic Programming and Approximate Dynamic Programming for High Dimensional Problems

Warren Powell, Professor, Princeton University, Dept of Oper Res and Fin Eng'g, Princeton, NJ, 08544, United States, powell@princeton.edu, Abraham George

The management of multiattribute resources (equipment, people) can introduce a curse of dimensionality, producing stochastic programs with millions of rows. Stochastic programming implicitly assumes the rows can be enumerated. We describe the use of techniques from approximate dynamic programming, including hierarchical learning and exploration strategies, that help to overcome this problem, producing practical algorithms for very large-scale problems.

4 - Price-Directed Control of a Closed Logistics Queueing Network

Dan Adelman, Professor, University of Chicago, Graduate School of Business, 5807 South Woodlawn Ave., Chicago, IL, 60637, United States, dan.adelman@gsb.uchicago.edu

Motivated by one of the leading intermodal logistics suppliers in the United States, we consider an internal pricing mechanism for managing a fleet of service units (shipping containers) flowing in a closed queueing network. Nodes represent geographic locations and arcs represent travel between them. Customer requests for arcs arrive over time, and the problem is to find an accept/reject policy that maximizes the long-run time average reward rate from accepting requests.

■ SB43

R - 4th Floor, Parc Ballroom II

Constraint Programming

Sponsor: INFORMS Computing Society/ Constraint and Integer Programming
Sponsored Session

Chair: Laurent Michel, Assistant Professor, University of Connecticut, 371 Fairfield Road, Storrs, CT, 06269, United States, ldm@engr.uconn.edu

1 - Non-Deterministic Control in Hybrid Search
Laurent Michel, Assistant Professor, University of Connecticut, 371 Fairfield Road, Storrs, CT, 06269, United States, ldm@engr.uconn.edu, Pascal Van Hentenryck

Hybrid algorithms combining local and systematic search often use nondeterminism in fundamentally different ways. This talk presents nondeterministic control structures to express a variety of hybrid search algorithms concisely and elegantly. These abstractions are compiled in terms of first-class continuations. The resulting search language is high-level, flexible, and directly extensible. The abstractions are illustrated on an hybrid jobshop scheduling algorithm.

2 - Exploiting Temporal Flexibility to Obtain High Quality Schedules
Stephen Smith, Research Professor, Carnegie Mellon University, 5000 Forbes Avenue, Pittsburgh, PA, 150213, United States, sfs@cs.cmu.edu, Xiaofang Wang, Angelo Oddi, Nicola Policella

We consider a schedule optimization problem where each activity to be scheduled has a duration-dependent quality profile, and activity durations must be determined that maximize overall quality within given deadline and resource capacity constraints. We develop and empirically evaluate two precedence constraint posting algorithms. Following from experimental results, we discuss potential synergy between the scheduling objectives of maintaining temporal flexibility and maximizing quality.

3 - Edge Finding for Cumulative Scheduling
Pascal Van Hentenryck, Brown University, Box 1910, Providence, RI, United States, pvh@cs.brown.edu, Luc Mercier

Edge-finding algorithms for cumulative scheduling are at the core of commercial constraint-based schedulers. This paper shows that Nuijten's edge finder for cumulative scheduling, and its derivatives, are incomplete. It then presents an edge-finding algorithm running in time O(n^2 k), where n is the number of tasks and k is the number of different capacity requirements of the tasks. Finally, it also proposes the first extended edge-finding algorithm running in time O(n^2 k).

4 - On Global Warming: Flow Based Soft Global Constraint
Louis-Martin Rousseau, Professor, Ecole Polytechnique de Montréal, CP 6079 Succ Centre Ville, Montréal, QC, H3C 3A7, Canada, louis-martin.rousseau@polymtl.ca, Gilles Pesant, Willem-Jan van Hoeve

We describe soft versions of the global cardinality constraint and the regular constraint, with efficient filtering algorithms maintaining domain consistency. For both constraints, the softening is achieved by augmenting the underlying graph. The softened constraints can be used to extend the meta-constraint framework for over-constrained problems

■ SB44

R - 4th Floor, Parc Ballroom III

Panel Discussion: Creating an Testbed of Industry Problems for OR Model and Algorithm Development

Sponsor: INFORMS Computing Society/ Optimization Services and Open Source Software
Sponsored Session

Chair: Robin Lougee-Heimer, IBM Research, TJ Watson Research Center, 1101 Kitchawan Road, Yorktown Heights, NY, 10598, United States, robinlh@us.ibm.com

1 - Panel Discussion: Creating an Testbed of Industry Problems for OR Model and Algorithm Development
Moderator: Robin Lougee-Heimer, IBM Research, TJ Watson Research Center, 1101 Kitchawan Road, Yorktown Heights, NY, 10598, United States, robinlh@us.ibm.com, Panelists: Debasis Mitra, David Heltne, Jeffrey Tew, Suvrajeet Sen, Robert Fourer, Michael Grant, Ranganath Nuggehalli

Many OR researchers are challenged with developing algorithms and models for industrial problems...without industry data. Data access can influence the applicability and impact of research. This panel session will analyze the challenges of sharing industry data and explore viable paths to creating a test bed of industry problems for OR.

■ SB45

R - 4th Floor, Raphael

Urban Transportation Planning Models VI: Microsimulation and Evaluation of Traffic Flow

Sponsor: Transportation Science & Logistics
Sponsored Session

Chair: Henry Liu, Assistant Professor, University of Minnesota, Department of Civil Engineering, 500 Pillsbury Drive SE, Minneapolis, MN, 55455, United States, henryliu@umn.edu

1 - Probabilistic Modeling and Evaluation of Incident Management Strategies for Urban Networks
Kaan Ozbay, Associate Professor, Rutgers University, Civil and Environmental Engineering, 632 Bowser Road, Piscataway, NJ, 08854-8014, United States, kaan@rci.rutgers.edu

This paper focuses on the effective use of resources to reduce the average incident durations. Traffic Management Centers (TMC) have two ways to manage incidents, namely, waiting until an incident is detected and then dispatching a traffic flow restoration unit (TFRU) from the depot to clear it, or having TFRUs patrolling along specific routes and clear the incidents on their patrol routes. We examine the effects of these two alternatives using Rutgers Incident Management Simulation (RIMS).

2 - Evaluation of New Jersey Turnpike Time of Day Pricing Program
Jose Holguin-Veras, Assoicate Professor, Rensselaer Polytechnic Institute, Civil and Environmental Engineering, 4030 Jonsson Engineering Center, Troy, NY, 12180, United States, jhv@rpi.edu, Kaan Ozbay, Ozlem Yanmaz

This paper presents the evaluation results of two stages of the NJ Turnpike (NJTPK) time of day pricing program. Impacts on users will be presented based on the before and after evaluation analysis conducted using observed traffic volumes, microscopic simulation modeling of the NJTPK and commuter surveys.

3 - Microscopic Traffic Flow Simulation Model and Validation
Andrei Boitor, Graduate Student, University of Southern California, Electrical Engineering - Systems, Electrical Engineering Bldg Room 200B, Los Angeles, CA, 90089-2562, United States, boitor@usc.edu, Petros Ioannou, Jarvis Lim

A section of the I-80 freeway is modeled with CORSIM and VISSIM, two microscopic simulation models. The models are validated and the effects of the model parameters on the simulation are analyzed. The possibility of implementing a roadway controller is discussed.

4 - Intelligent Traffic Control Strategies for Incident Management in an Urban Street Network
Suresh Khator, Professor, University of South Florida, ENB 118, Industrial Mgmt & Systems Engrg, Tampa, FL, 33620-5350, United States, khator@eng.usf.edu

The problem of incident congestion on surface street networks is addressed. Microscopic simulation is used to simulate incident scenarios on three corridors in the Tampa Bay area. The incident scenarios are subject to two enhancements—variable speed limits and an appropriate signal strategy that respond to volumes. The interaction between network type, signal strategy and speed strategy is studied. This research provides decision support for planning corridor enhancements and road building.

■ SB46

R - 4th Floor, Rubens

Urban Transportation Planning Models II: Freight Models and Planning

Sponsor: Transportation Science & Logistics
Sponsored Session

Chair: Jay Rosenberger, Assistant Professor, The University of Texas at Arlington, Dept of Industrial & Manufacturing Engg., P.O.Box 19017, Arlington, TX, 76019, United States, jrosenbe@uta.edu

1 - A Network Capacity Model for the Strategic Planning of Multimodal Freight Transportation Systems
Amelia Regan, University of California, Irvine, Institute of Transportation Studies, Computer Science and Civil Engineering, Irvine, CA, United States, aregan@uci.edu, Minyoung Park

We present a network capacity model intended to be used for the strategic planning of multimodal freight transportation systems. A bi-level programming approach incorporates key factors that influence network capacity. The model is tested through application to a test problem, and results are assessed for reasonableness and utility.

2 - Freight Movement Model Development for the State of Oklahoma
Karthik Ayodhiramanujan, Oklahoma State University, 322, Engineering North, Oklahoma State University, Stillwater, OK, 74078, United States, karthik.ayodhiramanujan@okstate.edu, Yasin Yavuz, Ricki Ingalls, Simin Pulat, Manjunath Kamath, Guoqiang Shen

We present a two-tiered approach based on the urban travel demand model to estimate the freight movement for Oklahoma. Tier one includes a regional model that analyzes the freight flow between states to estimate the freight flow in, out and through Oklahoma. Tier two focuses on a state model that analyzes the freight flow within Oklahoma utilizing the outputs of the regional model. The integrated model will part of a decision support system for policy-making and infrastructure planning.

3 - The Production Scheduling and Vehicle Routing Problem for Perishable Goods: Model and Algorithm
Huey-Kuo Chen, Professor, National Central University, No. 300, Jung-Da Road, Jung-Li, TY, 32001, Taiwan, ncutone@cc.ncu.edu.tw, Mei-Shiang Chang, Che-Fu Hsueh

This paper combines production scheduling for perishable goods and vehicle routing with time windows. Demand is probabilistic. The expected profit maximizing production quantity, production start time, and vehicle route plan are determined. We propose a nonlinear mathematical model and a solution algorithm composed of the constrained Nelder-Mead method and a heuristic for the vehicle routing problem with time windows. Computational results indicate our algorithm is effective and efficient.

4 - Computing Shortest Paths with Logistic Constraints
Michael Florian, Professor, University of Montreal, Montreal, QC, H3C 3J7, Canada, mike@crt.umontreal.ca, Teodor Gabriel Crainic

When modeling freight flows it is often required to specify constraints on the paths that may be used to transport a given commodity. Such constraints reflect the particular logistic chain used to transport the product and may involve a sequence of modes or subsets of modes and particular transfer nodes. A polynomial shortest path algorithm is developed for the computation of such shortest paths. The paths so computed may be used in freight network assignment methods.

■ SB47

R - 4th Floor, Michelangelo

Network Routing and Assignment under Uncertainty

Sponsor: Transportation Science & Logistics
Sponsored Session

Chair: Elaine Chang, Assistant Professor, University of South Florida, Dept of Civil and Enviro Engineering, 4204 East Fowler Ave ENB118, Tampa, FL, 33620, United States, echang@eng.usf.edu

1 - Quantifying Impacts of Wireless Information in Stochastic System Optimum Network Assignment Problems
Natalia Ruiz-Juri, Ph.D. Candidate, The University of Texas at Austin, Dept of Civil, Enviro & Architec Eng, 6.508 ECJ Hall, Austin, TX, 78712, United States, nruizjuri@mail.utexas.edu, Travis Waller

This paper analyzes the problem of routing wireless-communication-capable assets over stochastic networks. Marginal cost evaluation is used to explore the effects of different information supply schemes on the expected total system cost. Mathematical formulations for the marginal costs are provided, and expected-cost minimizing algorithms are outlined.

2 - Online Minimum Variance Routing in Stochastic Networks with One-Step Spatial Dependency
Steve Boyles, Graduate Research Assistant, The University of Texas at Austin, Dept of Civil, Enviro and Archi Engineer, 6.202 ECJ Hall, Austin, TX, 78712, United States, sboyles@mail.utexas.edu, Travis Waller

Online network routing under uncertainty is a problem which has important applications in the transportation of critical goods and elsewhere; however, approaches that consider variance in addition to expected cost have not been extensively treated in the literature. We describe the problem for the case of one-step spatial dependence, discuss obstacles which confound the problem, and present methods that find paths with minimum variance.

3 - Vehicle Routing and the Effect of Distance Approximations in a Grid-based City with Numbered Streets
Guiselle Garcia, Vision Software S.A., Bogota D.C., Colombia, Guisselle.Garcia@bizagi.com, German Riano, Andres Medaglia

Bogotà, the fourth largest city in the Americas, is a grid-based planned city and it has most of its streets identified by numbers (instead of names). A rough (but natural) approximation of an address is obtained by simply extracting the numbers of the intersecting streets and forming a point in the Euclidean plane. We illustrate, with a case study of school routing, the existing tradeoff between rough approximations and exact distances obtained through geocoding and exact shortest paths.

4 - Modeling Random Flow Times in Certain Production and Logistics LP Models
German Riano, Assistant Professor, Universidad de los Andes, Carrera 1 No. 18A-10, Bogota, DC, Colombia, griano@uniandes.edu.co, Steve Hackman, Richard Serfozo

We present methods to model non-integer flow times times, and, more generally random flow times in production planning, transportation and other logistics models. The relationship between input and output flows is linear, so the complexity of the model is not dramatically altered. Examples will be presented. The technique is based on a novel Transient Little Law.

5 - Intermodal Hazmat Transportation Problem with Time-Dependent Travel Risk
Vaggelis Floros, University of Thessaly, Mitropoleos 27, Karditsa, Ka, Greece, Floros3@otenet.gr, Thanasis Ziliaskopoulos, Elaine Chang

This paper is concerned with the problem of routing hazardous material on a multimodal network with time varying link travel times and intermodal options. The problem is efficiently formulated and an intermodal/multimodal shortest path algorithm is modified to compute minimum risk paths by combining the available transport modes. It's efficient computational complexity makes it appropriate for use on actual networks

■ SB48

R - 4th Floor, Dante

Recent Advances in Disease Modeling and Treatment

Sponsor: Health Applications
Sponsored Session

Chair: Andrew Schaefer, Assistant Professor, University of Pittsburgh, Department of Industrial Engineering, Pittsburgh, PA, United States, schaefer@ie.pitt.edu

1 - A Class of Matrix Decomposition via Optimization
Gino Lim, Assistant Professor, University of Houston, Department of Industrial Engineering, E206 Engineering Bldg 2, Houston, TX, 77204, United States, ginolim@uh.edu

We present techniques to solve a class of matrix decomposition problem based on a medical application. A matrix must be decomposed into uniquely shaped submatrices such that the sum of the sub-matrices multiplied by integer multipliers equals the original matrix ($A = w'S$). Various optimization problem formulations as well as solution techniques are explored using MINLP and MIP formulations. An iterative approach is introduced to substantially speed up the solution process for a practical use.

2 - Optimizing Testing and Discharge Decisions in the Management of Severe Sepsis
Jennifer Kreke, University of Pittsburgh, Department of Industrial Engineering, Pittsburgh, PA, United States, jekreke@msn.com, Andrew Schaefer, Mark Roberts, Matthew Bailey

We present a Markov decision process that models a clinician's decision of when to discharge a patient with sepsis from the hospital. We then discuss our results and their potential impact on current clinical practice. Finally, we motivate the incorporation of new testing procedures by discussing a partially observable Markov decision process model and our directions for future research.

3 - Optimal Region Design for the Liver Allocation and Transplantation System
Nan Kong, Assistant Professor, University of South Florida, 4202 E. Fowler Ave, ENB118, Tampa, FL, 33620, United States, kong@eng.usf.edu, Andrew Schaefer, Brady Hunsaker, Mark Roberts

Transplantable organ allocation in the U.S. has been a contentious issue for decades. Our objective is to cluster Organ Procurement Organizations (OPOs) such that transplant efficiency is maximized. We model this problem as a set partitioning problem and adapt branch and price to overcome inherent computational challenges. In our branch and price, intensive study on the column generation will be discussed. An alternative objective to balance tranplant efficiency and equity is also addressed.

■ SB49

R - 4th Floor, Medici

Game Theory and Decision Analysis

Sponsor: Decision Analysis
Sponsored Session

Chair: Robert Nau, Professor, Duke University, Fuqua School of Business, Durham, NC, 27708, United States, robert.nau@duke.edu

1 - Embedded Nash Bargaining
Kevin McCardle, Professor, UCLA Anderson School of Management, 110 Westwood Plaza, D-513, Los Angeles, CA, 90095-1481, United States, kevin.mccardle@anderson.ucla.edu, Steven Lippman

In telling the tale of, and analyzing the decisions made by, an heir claimant to a large fortune, Lippman and McCardle (2004) introduce "embedded Nash bargaining", an approach to modeling joint decision making. The purpose of the current paper is to provide theoretical underpinnings for that approach and to establish some general results regarding the existence, uniqueness, and comparative statics (with respect to risk aversion and time discounting) of the embedded Nash bargaining solution.

2 - Individual Behavior and Group Membership
Luca Rigotti, Professor, Duke University, Fuqua School of Business, Durham, NC, 27708-0120, United States, rigotti@duke.edu, Gary Charness, Aldo Rustichini

We consider an experimental environment in which an audience is sometimes present when strategic choices are made. We show that the audience presence affects behavior, and that participants anticipate this effect. The audience presence increases the hosts' aggressiveness. The effect on the outcomes depends on the game. In Battle of the Sexes, hosts aggressiveness leads to coordination on an efficient outcome; in the Prisoner's Dilemma, it leads to conflict and inefficient outcomes.

3 - Subsidized Security and Stability of Equilibrium Solutions in an N-Player Game with Errors
Jun Zhuang, University of Wisconsin-Madison, 3155 Engineering Centers Building, 1550 Engineering Drive, Madison, WI, 53706, United States, jzhuang@wisc.edu, Vicki Bier

Optimizing resource allocation in interdependent security problems is a serious challenge for U.S. homeland security. In this paper, game theory is applied to this challenge in the case where investment by one defender has positive externalities for other players. We explore how to target subsidized security to achieve the best results from tipping. We show that subsidization of security investments can increase the stability of equilibrium solutions, and also decrease the total social costs.

4 - Bayesian Decision Analysis, Game Theory, and Finance: A Synthesis
Robert Nau, Professor, Duke University, Fuqua School of Business, Durham, NC, 27708, United States, robert.nau@duke.edu

Decision analysis, game theory, and the theory of financial markets under uncertainty all have roots in Bayesian theory, but traditionally they have been only loosely integrated, with somewhat different views of subjective probability and different interactive rationality standards and knowledge assumptions. This paper presents a synthesis in which the common rationality standard is the no-arbitrage principle and the common parameters of belief and knowledge are risk neutral probabilities.

■ SB50

R - 4th Floor, Cervantes

Decision Analysis Practice

Sponsor: Decision Analysis
Sponsored Session

Chair: Mazen A. Skaf, Partner, Strategic Decisions Group, 735 Emerson St., Palo Alto, CA, 94301, United States, mskaf@sdg.com

1 - Board Decision Quality
Carl Spetzler, Chairman, Strategic Decisions Group, 735 Emerson St., Palo Alto, CA, 94301, United States, cspetzler@sdg.com

There are fundamental flaws in the current advocacy/approval approach to board decision-making. Boards need to engage seriously in the few truly strategic decisions using a Board Decision Quality (BDQ) process. BDQ uses a dialog that engages the board in the choice among alternatives. BDQ brings significant benefits to both the CEO and the board. It helps the board to meet its a trust obligation. Decisions become better. Boards "own" the decision along with the CEO, a great asset when the going gets rough. BDQ provides a clear audit trail for later defense of a decision. BDQ also prevents or resolves the dysfunctional power relationships that are emerging between boards and managements.

2 - Teaching Decision-Making From the Classroom to the Boardroom
Bruce Judd, Executive Director, Decision Education, SDG, 735 Emerson St., Palo Alto, CA, 94301, United States, bjudd@sdg.com

After 25 years teaching decision-making to MBAs, consultants, and executives, I have found six common elements of successful courses. These work well for me and for my students; will they work for you?

3 - Earnings-at-Risk: System and Process for Financial Risk Management in a Corporation
Mazen A. Skaf, Partner, Strategic Decisions Group, 735 Emerson St., Palo Alto, CA, 94301, United States, mskaf@sdg.com

We present a system and process for measuring, monitoring, and managing financial risk in a corporation with operations involving a range of commodities on the raw materials and finished goods sides. The system supports decision-making for decisions ranging from the level of investment in a specific industry as part of the corporate portfolio to hedging transactions related to a specific commodity. We conclude with a case study to illustrate the features and benefits of the approach.

Sunday, 1:30pm - 3:00pm

■ SC01

H - Lobby Level, Plaza A

Tutorial: Useful Recent Trends in Simulation Methodology

Cluster: Tutorials
Invited Session

1 - Tutorial: Useful Recent Trends in Simulation Methodology
Shane Henderson, Cornell University, School of ORIE, 230 Rhodes Hall, Cornell University, Ithaca, NY, 14853, United States, sgh9@cornell.edu

This tutorial is aimed at experienced users of simulation who are curious about useful recent trends in simulation methodology. We will discuss, and probably argue about, the following topics. 1. Simulation optimization - how can we optimize a function that is evaluated by simulation? 2. Input uncertainty - what happens when some (most?) of the input distributions are only known approximately? 3. Dependence modeling - how can we model dependent random variables?

■ SC02

H - Lobby Level, Plaza B

Nicholson Student Paper Prize Competition, I

Cluster: Nicholson Student Paper Prize
Invited Session

Chair: Pinar Keskinocak, Associate Professor, Georgia Institute of Technology, School of Industrial and Systems, 765 Ferst Drive, Atlanta, GA, 30345, United States, pinar@isye.gatech.edu

Nicholson Student Paper Prize

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.

1 - Robust Linear Optimization and Coherent Risk Measures
David Brown,MIT, L.I.D.S., 32-D560, Cambridge MA 02139, United States, dbbrown@mit.edu

We propose an axiomatic methodology for constructing uncertainty sets within the framework of robust optimization for linear optimization problems with uncertain data. We take as primitive for such problems a coherent risk measure, and utilize a duality theorem to construct corresponding uncertainty sets in the robust optimization framework.

2 - Mathematical Programming Representations of Discrete-Event System Dynamics
Victor Chan

This paper introduces a methodology for modeling discrete-event system dynamics as mathematical optimization problems and discusses a variety of applications. Discrete-event systems are common in many sectors of modern society. With their mathematical programming representations, techniques and algorithms from mathematical programming can be used to model and analyze the system behaviors. As applications, we derive mathematical programming representations for open and closed tandem queueing networks under various blocking scenarios. We use these formulations to study reversibility and symmetry properties of tandem queues. We also apply the methodology to generate constraint sets for optimal resource scheduling with a specific example of deriving a linear program for optimally scheduling a semiconductor manufacturing cluster tool. The mathematical structure of this linear program leads, in turn, to a more concise simulation model. In addition, optimization representations of discrete-event systems provide a framework for studying stochastic monotonicity and convexity properties. Finally, the methodology is used to derive gradient estimators for system performance measures using dual shadow prices.

3 - Ambiguous Chance Constrained Problems and Robust Optimization
Emre Erdogan,IEOR Department, Columbia University, New York NY, United States, ee168@columbia.edu

We study ambiguous chance constrained problems (ACCP) where the distributions of the random parameters in the problem are themselves uncertain. We assume that the uncertainty set of the distributions is a "ball" centered around a measure Q. The ACCP is approximated by a robust sampled problem where each

sample is drawn according to the central measure Q. Our main contribution is to show that the robust sampled problem is a good approximation for the ambiguous chance constrained problem with a high probability and it can be solved efficiently both in theory and in practice.

■ SC03

H - Ballroom Level, Continental Ballroom 1

Teaching Case Competition I

Sponsor: Education (INFORM-ED)
Sponsored Session

Chair: Tasha R. Inniss, Assistant Professor of Mathematics, Spelman College, 350 Spelman Lane, SW, Box 320, Atlanta, GA, 30314-4399, United States, TInniss@spelman.edu

1 - Presentations of Finalists #1 and #2 for the Sixth Annual INFORMS Case Competition
Tasha R. Inniss, Assistant Professor of Mathematics, Spelman College, 350 Spelman Lane, SW, Box 320, Atlanta, GA, 30314-4399, United States, TInniss@spelman.edu

The four finalists for the 2005 INFORMS Case Competition will deliver final presentations of their cases to a panel of judges and the audience. All are welcome to attend and observe these presentations as well as to ask questions of the finalists. The winner of the competition will be selected by the judges at the end of the four presentations. The winner and runners-up will be announced at the INFORM-Ed Annual Business Meeting in San Francisco.

■ SC05

H - Ballroom Level, Continental Ballroom 3

OR/MS Applications in the Service Industry

Contributed Session

Chair: Adelina Gnanlet, PhD Student, University of North Carolina-Chapel Hill, CB#3490 McColl Bldg,, Kenan-Flagler Busi School, UNC, Chapel Hill, NC, 27599, United States, gnanleta@unc.edu

1 - Use of Options in Service
Antonios Printezis, Assistant Professor, Arizona State University, 4701 West Thunderbird Road, P.O. Box 37100, Phoenix, Az, 85069-7100, United States, AntP@case.edu, Apostolos Burnetas

In supply chains, a tradeoff between customer's flexibility to select service mode and service provider's ability to plan for capacity is often met. We propose a mechanism that addresses this tradeoff by employing options for service. These options are targeted for customers who regularly require service and want to be protected against occasional extensive delays. A customer purchases a number of them and can exercise one to obtain immediate service, after observing current system congestion.

2 - Retail Store Execution
Jayanth Krishnan, Doctoral Student, University of Pennsylvania, The Wharton School/OPIM, Philadelphia, PA, 19104, United States, jayanth@wharton.upenn.edu, Marshall Fisher, Serguei Netessine

We empirically investigate the role of in-store operational execution in influencing customer-satisfaction and financial performance. While the role of inventory management and good supply chain practices has been well documented, the benefits of these practices depend crucially upon the execution of in-store processes. We identify the makeup of good operational policies in different retail segments. We also present some guidance on research paths that derive from our insights.

3 - Service Capacity Competition and Service Networks
Vikram Tiwari, Ph.D. Student, Kelley School of Business, Indiana University, Bloomington, BU570, 1309 E 10th Street, Bloomington, In, 47405, United States, vtiwari@indiana.edu, H. Sebastian Heese

When forming service networks, service providers often simultaneously collaborate on some dimensions while competing on others. Developing a model of capacitated service providers under price competition, we derive general insights into the pricing problem and more specifically analyze the impact of capacity scarcity on the equilibrium outcomes. We then characterize environments under which the formation of alliances is preferable to individual capacity expansions.

4 - Optimal Customer Value Growth with Reacting Customers
Zeynep Aksin, Koc University, Rumeli Feneri Yolu, Istanbul, 34450, Turkey, zaksin@ku.edu.tr, Evrim Gunes, Hazal Ozden, Lerzan Ormeci

The relationship of a customer with a firm, represented as a natural progression through loyalty states and eventual exit are modeled as a Markovian process. The firm has value growing initiatives with which it can influence the upward mobility of the customer. Not all customers like this type of intervention, and excessive value growth actions may result in a negative reaction of the customer, leading to early exit. We analyze the optimal value growth strategy with such customer reaction.

5 - Impact of Productivity on Optimal Cross-Training Decisions
Adelina Gnanlet, PhD Student, University of North Carolina-Chapel Hill, CB#3490 McColl Bldg,, Kenan-Flagler Busi School, UNC, Chapel Hill, NC, 27599, United States, gnanleta@unc.edu, Wendell Gilland

We derive a closed form expression for the optimal amount of cross-training of nurses between two hospital units. We use a two-stage stochastic programming with recourse model that minimizes cost for general demand distributions. We analyze the impact of cross-training cost, demand variation and productivity on optimal nurse flexibility.

■ SC06

H - Ballroom Level, Continental Ballroom 7

Spreadsheets and Sarbanes-Oxley

Sponsor: Spreadsheet Productivity Research
Sponsored Session

Chair: Jeffrey Keisler, Assistant Professor, University of Massachusetts Boston, College of Management, Boston, MA, 02125, United States, jeff.keisler@umb.edu

1 - The Importance and Criticality of Spreadsheets in The City of London
Grenville Croll, member@croll-management.freeserve.co.uk

Spreadsheets have been with us in their present form for over a quarter of a century. We have become so used to them that we forget that we are using them at all. It may serve us well to stand back for a moment to review where, when and how we use spreadsheets in the financial markets and elsewhere in order to inform research that may guide their future development. In this paper I bring together the experiences of a number of senior practitioners who have spent much of their careers working with large spreadsheets that have been and continue to be used to support major financial transactions and manage large institutions in the City of London. The author suggests that the City of London is presently exposed to significant reputational risk through the continued uncontrolled use of critical spreadsheets in the financial markets and elsewhere

2 - Solutions Forum
Janet Wagner, Associate Dean, UMASS Boston, CM Dean's Office, 100 Morrissey Blvd, Boston, MA, 02125, United States, janet.wagner@umb.edu

Various academic and commercial solutions are available to help insure spreadsheet integrity and assist with Sarbannes-Oxley compliance. Vendors and fans will demonstrate and discuss some of the software solutions available in this area.

3 - Spreadsheet Use and Compliance with EU and US Legislation: A Look at Three UK Organizations
Pat Cleary, University of Wales Institute Cardiff, pmcleary@uwic.ac.uk

Research (Panko and Ordway, 2005) indicates that spreadsheets are both widely used and error prone. The Sarbanes-Oxley Act 2002 and other similar European Union regulations attempt to strengthen compliance through corporate governance and to foster investor confidence disillusioned by a series of US corporate and accounting standards (Knights, 2004 cited in Cleary et. al., 2005). This paper examines investigations into spreadsheet development and use in three UK organizations and comments upon the state of compliance of these organizations with EU and US legislation.

■ SC07

H - Ballroom Level, California

Panel Discussion: Research Opportunities at the MS/OM-Finance Interface

Sponsor: Manufacturing & Service Oper Mgmt
Sponsored Session

Chair: John Birge, Professor, University of Chicago, Graduate School of Business, Chicago, 60637, United States, john.birge@gsb.uchicago.edu

1 - Research Opportunities at the MS/OM-Finance Interface
Moderator: John Birge, Graduate School of Business, The University of Chicago, Chicago, IL, 60637, United States, jbirge@gsb.uchicago.edu, Panelists: Panos Kouvelis, David Simchi-Levi, John Buzacott

Recent research trends display an increasing blurring of boundaries across disciplines. The MS/OM-Finance interface is one such example. In this discussion, panelists will present views on research opportunities at this interface and discuss some of the challenges to such interdisciplinary work.

2 - Managing Risk in the Supply Chain
David Simchi-Levi, dslevi@mit.edu

Our objective is to find out whether financial instruments can be used in supply chain management to effectively manage risk and uncertainty. We focus on

financial instruments such as Real Options; Portfolio Optimization; Deviation measures such as Mean-Variance and Conditional-Value-at-Risk; and Utility theory and concepts

■ SC08

H - Ballroom Level, Imperial A

Dynamic Models of Imperfect Competition II

Sponsor: Manufacturing & Service Oper Mgmt
Sponsored Session

Chair: Benjamin Van Roy, Stanford University, Terman 315, Stanford University, Stanford, CA, 94305-4023, United States, bvr@stanford.edu

1 - Investment Dynamics in Electricity Markets
Alfredo Garcia, University of Virginia, P.O. Box 400747, 151 Engineer's Way, Charlottesville, VA, 22904, United States, agarcia@virginia.edu, Ennio Stacchetti

A simple dynamic model of strategic investments is introduced to investigate how firms adjust capacity stocks in electricity markets without regulatory intervention. For a wide range of parameters, there are Markovian (non-collusive) equilibria that sustain negligible or no excess capacity along the outcome path. This suggests that market mechanisms alone produce inadequate incentives for the provision of `security capacity'.

2 - Optimal Rules for Patent Races
Sevin Yeltekin, MEDS Kellogg School of Management , Northwestern University, 2001 Sheridan Road 5th Floor, Evanston, IL, 60208, United States, s-yeltekin@northwestern.edu

There are two important rules in a patent race: what an innovator must accomplish to receive the patent and the allocation of the benefits that flow from the innovation. Most patent races end before R\&D is completed and the prize to the innovator is often less than the social benefit of the innovation. We study the optimal combination of prize and minimal accomplishment necessary to obtain a patent in a dynamic multistage innovation race. A planner, who cannot distinguish between competing firms, chooses the innovation stage at which the patent is awarded and the magnitude of the prize to the winner. We examine both social surplus and consumer surplus maximizing patent race rules. We show that a key consideration is the efficiency costs of transfers and of monopoly power to the patentholder. We show that races are undesirable only when efficiency costs are low, firms have similar technologies, and the planner maximizes social surplus. However, in all other circumstances, the optimal policy spurs innovative effort through a race of nontrivial duration. Races are also used to filter out inferior innovators.

3 - Estimating Dynamic Models of Imperfect Competition
C. Lanier Benkard, Stanford Graduate School of Business, 518 Memorial Way, Stanford, CA, 94305-5015, United States, lanierb@stanford.edu, Patrick Bajari, Jonathan Levin

We describe a two-step algorithm for estimating dynamic games under the assumption that behavior is consistent with Markov Perfect Equilibrium. In the first step, the policy functions and the law of motion for the state variables are estimated. In the second step, the structural parameters are estimated using the optimality conditions for equilibrium. The algorithm applies to a broad class of models, including models with both discrete and continuous controls such as Ericson and Pakes (1995).

■ SC09

H - Ballroom Level, Yosemite A

Empirical Research in Supply Chain Management using Secondary Data

Cluster: Supply Chain Management
Invited Session

Chair: Serguei Netessine, Assistant Professor, University of Pennsylvania, 3730 Walnut St. Suite 500, Philadelphia, PA, 19104, United States, netessin@wharton.upenn.edu

Co-Chair: Gerard Cachon, University of Pennsylvania, The Wharton School, 500 JMHH, Philadelphia, PA, 19104, United States, cachon@wharton.upenn.edu

1 - Some New Operational Drivers of Financial Performance: A Cross-Industry Empirical investigation
Serguei Roumiantsev, PhD candidate, Wharton Business School, box 500 JMHH Walnut st 3730, Philadelphia, PA, 19104, United States, roumiant@wharton.upenn.edu, Serguei Netessine

We are analyzing the historically weak link between operational activities of companies and their bottom lines. Using panel data, we develop a statistical methodology that looks not only at firm-level controls in explaining variability of accounting returns but also at the characteristics of managerial decisions (imputed from the data using inventory models). We find that superior earnings are associated with the speed of change of inventory with respect to various exogenous parameters.

2 - Information Sharing, Incentives and Supply Chain Performance
Taylor Randall, University of Utah, David Eccles School of Business, Salt Lake City, UT, United States, acttr@business.utah.edu, Susan Kulp, Shoshanah Cohen

This study investigates the information flows and incentive conflicts that occur between the sales, forecasting, production, and inventory management functions. We are interested in how increased information availability throughout the chain affects performance and what types of information would have benefited the company most. Additionally, we will analyze whether information sharing alone would have prevented the problem or whether incentives are necessary to change employee behavior.

3 - In Search of the Bullwhip Effect
Gerard Cachon, University of Pennsylvania, The Wharton School, 500 JMHH, Philadelphia, PA, 19104, United States, cachon@wharton.upenn.edu, Taylor Randall, Glen Schmidt

The objective of this study is to document the existence of the bullwhip effect in industry level U.S. data. We find the bullwhip effect among wholesalers, but little evidence of the bullwhip effect among retailers and only some with manufacturers. We explain why our results are apparently at odds with the existing literature.

4 - Delays in New Product Introduction and Long-term Corporate Performance
Vinod Singhal, College of Management Georgia Institute of Technology, 800 West Peachtree Street NW, Atlanta, GA, 30332, United States, vinod.singhal@mgt.gatech.edu, Kevin Hendricks

This paper investigates the long-term shareholder value and operating performance consequences of delays in new product introductions. The evidence is based on an analysis of more than 600 publicly announced new product introduction delays made during 1985-2003. We provide evidence on the magnitude of the economic impact of delaying the introduction of new products as well as how long does it take firms to recover from the negative effect of delays.

■ SC10

H - Ballroom Level, Yosemite B

Empirical Research in OM using Primary Data

Cluster: Supply Chain Management
Invited Session

Chair: Vinayak Deshpande, vinayak@exchange.purdue.edu

1 - An Empirical Study of Ordering Behavior of Retail Stores
Vishal Gaur, New York University, 44 West 4th St., 8-72, New York, NY, 10012, United States, vgaur@stern.nyu.edu, Karel van Donselaar, Tom van Woensel, Rob Broekmeulen, Jan Fransoo

We study the impact of logistical and product characteristics, such as case pack size, excess shelf space, variety, margin, etc. on ordering behavior of retail stores in a supermarket chain. Using orders and shipments data, and POS sales data for 8884 items in three stores, we analyze various aspects of ordering behavior relative to a computerized replenishment system. We find that stores deviate systematically from the system and determine the reasons for deviation.

2 - Performance Based Logistics in a Multi-Echelon Defense Context: A Framework for Empirical Research
Morris Cohen, The Wharton School, 3730 Walnut St. Suite 500, Philadelphia, PA, 19104, United States, cohen@wharton.upenn.edu, Sang-Hyun Kim, Serguei Netessine

Traditional contracting mechanisms are based on the sale of the product and high margin support services. The PBL approach requires customers to pay only for actual use/up-time of the products. Such "power by the hour" payment mechanisms are expected to lead to more reliable products with a lower cost of ownership and improved overall supply chain performance. In this talk, we will review a framework that has been developed to analyze the impact PBLs in an Aerospace and Defense context.

3 - Closed Loop Supply Chain Management of Repairable Service Parts: An Empirical Analysis
Vinayak Deshpande, vinayak@exchange.purdue.edu, Asima Mishra, Ananth Iyer

We present an analysis of repair capacity management for repairable service parts supply chain based on empirical data obtained from the US Coast Guard for the following questions: How should repair capacity be managed during an aircraft upgrade from an old to new version? What is the optimal conversion schedule and mix of service parts to support the old and new aircraft versions? What is the impact of priority repair and inventory allocation schemes in a closed loop supply chain?

4 - Productivity and Technological changes in the Indian Auto Component Industry
Ananth Iyer, Purdue University, Rawls Hall, West Lafayette, IN, 47907, United States, aiyer@exchange.purdue.edu, Sridhar Seshadri, Haritha Saranga

We study the impact of certification and quality awards on productivity gains in the Indian auto component industry during the period 1993-2003. We separate technical change from productivity change and compute the change in relative efficiency for each firm by using a Data Envelopment Analysis approach. The data analysis suggests that productivity improvement and profitability was affected by management choices regarding certification or award based changes.

■ SC11

H - Ballroom Level, Yosemite C

Inventory Management in Supply Chain Management

Contributed Session

Chair: Mustafa Dogru, PhD Student, Technische Universiteit Eindhoven, Department of Technology Management, PAV. E-16, Eindhoven, 5600 MB, Netherlands, m.k.dogru@tm.tue.nl

1 - Vendor Managed Inventory Programs: A Comparative Study

Peter Salzarulo, Doctoral Candidate, Indiana University, 3960 Whitewood Way, Bloomington, IN, 47404, United States, psalzaru@indiana.edu

This paper investigates three replenishment strategies in a two echelon serial supply chain. Under the first strategy, Vendor Managed Inventory, a manufacturer makes production and shipping decisions by setting signal points which are based on the customer's inventory levels. Traditional Make-to-Order and Make-to-Stock replenishment systems are also investigated. Probability models are developed for each strategy and numerical analysis is used to compare performance in various environments.

2 - Channel Power Analysis Under Vendor-Managed Inventory and a General (Q, R) Inventory Policy

Bogdan Bichescu, PhD student, University of Cincinnati, Department of QAOM, College of Business, University of Cincinnati, Cincinnati, OH, 45221, United States, bichesbc@email.uc.edu, Michael Fry

We analyze decentralized supply chains that function according to general (Q, R) policies which allow the decision-making responsibilities to be split between supply chain agents. We compare a traditional RMI scenario with a VMI scenario, in which the retailer chooses the service level, R, and the supplier chooses the order quantity, Q. Within the VMI scenario, we explore several channel power distribution schemes. A numerical analysis is performed to explore the effects of channel power.

3 - An Investigation of the Impacts of Consignment and VMI on Supply Chain Performance

Chungsuk Ryu, Ph.D. Student, SUNY at Buffalo, 320 Jacobs Management Center, SUNY at Buffalo, Buffalo, NY, 14260, United States, cryu@buffalo.edu, Nallan Suresh

This study investigates the impacts of two supply chain coordination initiatives on supply chain performance: consignment and vendor managed inventory (VMI) systems. Based on profit-based models, two coordination initiatives are compared with the traditional supply chain system. Numerical examples of the proposed supply chain models imply that the supply chain coordina-tion initiatives can be beneficial to the buyer as well as the supplier.

4 - An MIP Model with Lot-Sizing that Generates Obsolescence and Inventories

Ileana Castillo, Assisstant Professor, ITESM Toluca, Eduardo Monroy Càrdenas No. 2000, Toluca, MX, 50110, Mexico, castillo_ileana@hotmail.com, Itzel Càrdenas, Manuel Robles

With this MIP model we show that batch ordering causes obsolescence and inventory. The model is motivated by a study of the bullwhip effect in three pharmaceutical companies located in the central part of Mexico, and because of its operating restrictions we assume a unique supplier and a manufacturer that sales its products to a distributor. We also assume deterministic demand, products with different deterministic life times, and several transportation modes with deterministic lead times.

5 - The Effect of Balance Assumption on Expected System Costs in One-Warehouse Multi-Retailer Systems

Mustafa Dogru, PhD Student, Technische Universiteit Eindhoven, Department of Technology Management, PAV. E-16, Eindhoven, 5600 MB, Netherlands, m.k.dogru@tm.tue.nl, Geert-Jan van Houtum, Ton De Kok

The balance (allocation) assumption is a widely used presupposition in the analysis of one-warehouse multi-retailer inventory systems under periodic review. This assumption leads to a relaxed version of the original problem for which the structure of the optimal policy is known. First, we characterize the optimal policy partially without making the balance assumption. Then solving the original problem using stochastic DP, we show the precise impact of the balance assumption.

■ SC12

H - 4th Floor, Union Square 1

Applications of Auctions to Supply Chains

Cluster: Applications of Auction and Game Theory

Invited Session

Chair: Gustavo Vulcano, New York University, 44 West 4th Street, Suite 8-76, New York, NY, 10012, United States, gvulcano@stern.nyu.edu

1 - Is it Always Optimal to Bid in Last Minutes?

Gangshu Cai, Assistant Professor, Texas A&M International University, The Business School, Laredo, TX, United States, gangshu@gmail.com

Online auctions with fixed deadlines have become popular. Sniper websites tout that bidding in the last minute is the optimal strategy for buyers even with traffic congestion. This work studies the stochastic impacts e.g. stochastic entrants and traffic congestion, on buyers' behaviors in online auctions. We conclude that it is not always optimal for buyers to bid in last-minute online auctions with stochastic impacts when bidders are risk-neutral.

2 - Kemeny Rule for Preference Aggregation

Jayant Kalagnanam, jayant@us.ibm.com, Andrew Davenport

One drawback of majority voting procedures when three or more alternatives are being ranked is the presence of cycles in the majority preference relation. The Kemeny order is a social welfare function which has been designed to tackle the presence of such cycles in majority graphs. We develop mathematical formulations that provide a model for this problem and discuss the properties of these models.

3 - Auctions with Bidder Qualification Checks

Damian Beil, Ross School of Business at the University of Michigan, 701 Tappan Street, D8204, Ann Arbor, MI, 48109, United States, dbeil@umich.edu, Zhixi Wan

We consider a manufacturer who uses a reverse auction in combination with qualification checks to determine which qualified supplier will be awarded a contract. While suppliers can be qualified prior to the action (pre-qualification), we allow the manufacturer to delay all or part of the qualification until after the auction (post-qualification). Using an optimal mechanism approach we explore the tradeoffs between varying levels of pre- and post-qualification.

4 - Effects of Information Disclosure of First- and Second-Price Auctions in a Supply Chain Setting

Ying-Ju Chen, PhD Candidate, IOMS-Operations Management, Stern School of Business, New York University, 44 West 4th Street, KMC 8-152, New York City, NY, 10012, United States, ychen0@stern.nyu.edu, Gustavo Vulcano

We analyze a two-stage supply chain setting, where two retailers bid for the capacity of a seller, and then compete in the consumer market. The seller's capacity is sold as a bundle, and retailers can get additional items in a spot market. We study this model under a first and second price auction, and analyze the impact of the information elicited by the seller in the first stage of the game.

■ SC13

H - 4th Floor, Union Square 5

Software Demonstration

Cluster: Software Demo

Invited Session

1 - Maximal Software, Inc. - Introducing the New Release 5.0 of MPL Modeling System for Optimization

Bjarni Kristjansson, Maximal Software, Suite 700, Suite 700, Arlington, VA, 22201, info@maximalsoftware.com

We will be demonstrating the newest release of MPL, one of the fastest and most scalable modeling languages on the market today. The innovative OptiMax 2000 Component Library, which allows MPL models to be easily embedded into end-user applications, has been augmented to include several new objects and methods. Several new solvers (COIN, GLPK, LGO, PATH) have been added and existing solvers updated (CPLEX, XPRESS, XA, CONOPT). Data access has been improved with new native drivers (ORACLE, SAP) and now offers full XML/SOAP support for Internet connectivity.

2 - AMPL Optimization LLC- A Practical Guide to Acquiring AMPL® for Applications in Large-Scale Optimization

Robert Fourer, Professor, Northwestern University, Dept of Industrial Eng & Mgmnt Sciences, 2145 Sheridan Road, Evanston, IL, 60208-3119, United States, 4er@iems.northwestern.edu

AMPL® has set the standard for an optimization modeling language that handles complex models naturally and large models efficiently. As a result it is available from many more sources and for many more solvers than competing products. Bob Fourer, AMPL's co-developer, will give a quick but lucid tour of the current state of AMPL, with emphasis on the practical issues that come up in deciding to

purchase an algebraic modeling language. Topics will include 64-bit versions, AMPL's new extra-flexible floating license manager, the AMPL Studio graphical interface and COM objects for Windows, and the range of AMPL/solver packages and distributors.

■ SC14

H - 4th Floor, Union Square 6

Air Mobility

Sponsor: Military Applications
Sponsored Session

Chair: LtCol Raymond W Staats, Division Chief, Operations Research, Air Force Institute of Technology, 2950 Hobson Way, Wright-Patterson AFB, OH, 45433, United States, raymond.staats@afit.edu

1 - An Advanced Tabu Search Heuristic for Solving the Theater Distribution Problem

LTC Robert Burks, AFIT, 2950 Hobson Way, Wright-Patterson AFB, OH, 45433, United States, Robert.Burks@afit.edu

The theater distribution problem is a military operational problem that requires synchronizing all elements of the logistics system to ensure the correct delivery of the "right things" to the "right place" at the "right time". This research seeks to blend the characteristics of both the pickup and delivery problem with time windows (PDPTW) and location routing problem (LRP) to formulate a location pick-up and delivery problem with time windows (LPDPTW) to solve the theater distribution problem.

2 - Theater Aerial Refueling Vehicle Routing Models

Maj Jeffrey Havlicek, AFIT, 2950 Hobson Way, Wright-Patterson AFB, OH, 45433, United States, jeffrey.havlicek@afit.edu

The Theater Aerial Refueling Vehicle Routing Problem (TARVRP) is the task of finding k weighted-arc-and-node-capacitated cycles on a general graph originating from one of a set of source nodes, traversing a subset of demand nodes, and returning to its origin that maximizes customers served while minimizing the arc travel costs subject to time windows, node-path incompatibilities, and network cycle constraints.

3 - A Value-Focused Selection Model for the Global En-Route Airfield Location Problem

LtCol Raymond W Staats, Division Chief, Operations Research, Air Force Institute of Technology, 2950 Hobson Way, Wright-Patterson AFB, OH, 45433, United States, raymond.staats@afit.edu, Marykathryn Tharaldson

The Global War on Terrorism (GWOT) has yielded new challenges to the United States' strategic airlift infrastructure. The network of en-route airfields that serve as refueling and maintenance stops were designed primarily to service relatively static Cold War requirements. We use "value focused" methodology to identify and select a portfolio of en-route airfield locations that simultaneously maximizes cargo throughput capability while possessing a high degree of adaptability.

■ SC15

H - 4th Floor, Union Square 9

Contemporary Scheduling

Cluster: Scheduling
Invited Session

Chair: Chung-Yee Lee, Professor and Head, Department of IEEM, Hong Kong UST, Clear Water Bay, Kowloon, HK, Hong Kong, cylee@ust.hk

1 - Rescheduling for Job Unavailability

Nicholas Hall, Professor, The Ohio State University, Fisher College of Business, Columbus, Oh, 43210-1144, United States, hall.33@osu.edu, Chris N. Potts

We consider problems where the processing of jobs has been planned, assuming they are all available initially. If the availability of some jobs is then delayed, the decision maker needs to adjust the existing schedule but without causing excessive disruption to the planned schedule. For four classical scheduling objectives, we provide a computationally efficient optimal algorithm, an intractability proof which shows that this algorithm is the best possible, exact worst case analysis of a simple heuristic and a fully polynomial time approximation scheme.

2 - Survey of Integrated Production-Distribution Scheduling Models and Results

Zhi-Long Chen, Associate Professor, Robert H. Smith School of Business, University of Maryland, College Park, MD, 20742, United States, zchen@rhsmith.umd.edu

We present a survey of existing models and results in the area of integrated production-distribution scheduling. There are existing surveys on production-distribution models. However, all existing surveys address strategic- or tactical-level decisions. The focus of this survey is on production-distribution models at the detailed scheduling level. We will also identify several sub-areas for future research.

3 - Optimal Policies to Schedule Jobs with Due Dates and Subject to an Unknown Deadline

Xiaoqiang Cai, Professor, The Chinese University of Hong Kong, Department of Systems Eng. & Eng. Mgmt, Hong Kong, China, xqcai@se.cuhk.edu.hk, Xian Zhou

A set of jobs are to be processed by a single machine. In addition to their due dates, the jobs are subject to an unknown deadline. There is a tardy cost if a job is completed before the deadline but after its due date. Moreover, there is a substantial loss if a job is unable to be completed before the deadline. We obtain optimal policies to minimize the expected total loss.

4 - Minimizing Total Completion Time for UET Systems

Joseph Leung, Professor, New Jersey Institute of Technology, Department of Computer Science, Newark, NJ, 07102, United States, leung@cis.njit.edu, Yumei Huo

We propose that Hu's algorithm be used for minimizing total completion time for unit-execution-time task systems with intree precedence constraints, and that Coffman-Graham algorithm be used for arbitrary precedence constraints. It is shown that Hu's algorithm gives a performance guarantee of 3/2, and that Coffman-Graham algorithm has a performance guarantee of 2.

■ SC16

H - 4th Floor, Union Square 10

Engineering Networks

Sponsor: Organization Science
Sponsored Session

Chair: Santiago Mingo, Harvard Business School, Sherman Hall, Soldiers Field Park, HBS, Boston, MA, 02163, United States, smingo@hbs.edu

1 - Networks and Knowledge Sharing: The Search Transfer Problem Revisited

William J. McEvily Jr., bmcevily@andrew.cmu.edu, Ray Reagans

Current research treats the structural characteristics that facilitate search as being in opposition to those that promote transfer. However, empirical research has yet to examine: the associations between social networks and search and transfer directly, or the links between social networks and both search and transfer. To shed light on how social networks affect the search-transfer problem, we analyze how range and closure affect search behavior and the ease of knowledge transfer.

2 - Brokerage and Collaborative Creativity

Santiago Mingo, Harvard Business School, Sherman Hall, Soldiers Field Park, HBS, Boston, MA, 02163, United States, smingo@hbs.edu, Lee Fleming

In this paper, we explore empirically the mechanism through which brokerage and cohesion influence an individual's creativity. We argue that brokerage confers contingent benefits, based on the level of trust and non-redundant information between collaborators, the creative experiences of the individual, and whether the outcome is initial creativity or its impact upon future creative search. We present supporting evidence using the structural career histories of over 100,000 inventors.

3 - Private Benefit from Public Good? Startup Strategies for Participation in an Open Standards Community

David M. Waguespack, Assistant Professor, Robert H. Smith School of Business, University of Maryland, College Park, MD, 20742, United States, dwag@iname.com, Lee Fleming

We examine U.S. based IT startups that participate in the IETF, a volunteer organization that creates and approves internet standards. We compare the hazard of a liquidity event (an IPO or Acquisition) for IETF community participants and non-participants. Three types of participation are evaluated: passive monitoring, technical contribution, and community leadership. IETF participation of any sort decreases time to IPO or acquisition, unless the startup possesses a strong patent portfolio.

4 - Broadcast Search and Solution Attraction in Scientific Problem Solving

Karim R. Lakhani, Lecturer, MIT Sloan School of Management, 50 Memorial Drive, E52-557, Cambridge, MA, United States, lakhani@mit.edu, Lars Bo Jeppesen

We study problem solving via broadcast search, a method by which organizations draw on diverse set of problem solvers outside their own organization and as a alternative to local search. Application to 170 scientific problems shows high solving rates (30%) with novel solutions arriving from a dispersed pool of solvers. The probability of solving a problem is dependent upon the number of different intellectual interests of solvers and learning by seeker firms on how to articulate problems.

■ SC17

H - 4th Floor, Union Square 11

Experimental and Empirical Research in NPD

Cluster: New Product Development
Invited Session

Chair: Svenja Sommer, Purdue University, Krannert School of Management, 403 W. State Street, W. Lafayette, IN, 47907, United States, ssommer@krannert.purdue.edu

1 - Social Goals, Emotions, and Motivation of Professional Workers
Christoph Loch, Professor of Technology Management, INSEAD, Boulevard de Constance, Fontainebleau Cedex, 77305, France, Christoph.Loch@insead.edu, Julie Urda

R&D professionals have autonomy and cannot be fully monitored; thus, motivation is important for their performance. Work in psychology has shown that people pursue social goals—status, reciprocity, and group identity—for their own sake. We present evidence from laboratory experiments that the social goals work through the triggering of emotions: their fulfillment or denial causes happiness, anger, sadness, etc. These results have implications for managerial actions to motivate R&D workers.

2 - Preliminary Results from an Empirical Analysis of Managing Outsourced Product Design
Edward Anderson, University of Texas at Austin Business School, McCombs School of Business, 1 University Station B6500, Austin, TX, 78733, United States, Edward.Anderson@mccombs.utexas.edu, Geoffrey Parker, Davis-Blake

We present preliminary statistical results from a survey studying how firms manage and integrate outsourced 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.

3 - Valuing R&D Projects in the Pharmaceutical Industry
Christian Terwiesch, Associate Professor, The Wharton School, 548 Jon M. Huntsman Hall, Philadelphia, PA, 19104.6366, United States, terwiesch@wharton.upenn.edu, Karan Girotra, Karl Ulrich

We present an empirically grounded valuation of R&D projects in the pharmaceutical industry. Our data is based on a multi-year research collaboration with a large pharmaceutical company as well as a proprietary database of several thousand compounds.

4 - Flexibly Managing Start-Ups: A Method for Monitoring Progress and Overcoming Crises
Svenja Sommer, Purdue University, Krannert School of Management, 403 W. State Street, W. Lafayette, IN, 47907, United States, ssommer@krannert.purdue.edu, Christoph Loch

Managers of start-ups face many unforeseen challenges and are often forced to make decisions without having a clear idea of the likely outcomes. This requires a degree of flexibility beyond what standard risk management techniques would recommend. We present preliminary results of a survey trying to identify planning and monitoring methods that are adjusted to different levels of complexity and uncertainty that various new ventures face.

■ SC18

H - 4th Floor, Union Square 12

OR Applications for Off-Schedule Operations (OSO) in the Airline Industry

Sponsor: Aviation Applications
Sponsored Session

Chair: Tuell Green, Principal Operations Research, American Airlines, 4333 Amon Carter Blvd, MD 5358, Fort Worth, TX, 76155, United States, Tuell.Green@aa.com

1 - Flight Cancellation Management at American Airlines
Remi Salam, Sr. Analyst Operations Research, American Airlines, 4333 Amon Carter Blvd, MD 5358, Fort Worth, TX, 76155, United States, remi.salam@aa.com, Tim Niznik

Off-Schedule-Operation (OSO) management has risen to be a critical airline function in the current low-fare environment where operating with lower costs is just as important as higher revenues. Flight cancellations are very disruptive OSO manifestations. This talk highlights an optimization solution currently in production at American Airlines that recommends the "least disruptive" set of cancellations. We present some modeling considerations, solution approach and potential future directions.

2 - Automated Passenger Re-accommodation for Real-time, Day-of-ops Passenger Recovery
Tuell Green, Principal Operations Research, American Airlines, 4333 Amon Carter Blvd, MD 5358, Fort Worth, TX, 76155, United States, Tuell.Green@aa.com, Murali Ande

We present an optimiztion model that assigns alternate itineraries to customers affected by flight cancellations and/or delays. The model maximizes the total number of rebooked customers while giving the best options to those customers deemed most valuable to the airline. A description of the optimization model, the re-accommodation application, and current stats are included.

3 - Scenario-based Air Traffic Flow Management: From Theory to Practice
P. Barry Liu, PhD Student, University of California at Berkeley, 107E McLaughlin Hall, UC Berkeley, Berkeley, CA, 94720, United States, barryliu@berkeley.edu, Mark Hansen, Avijit Mukherjee

Recent developments in solving the single airport ground holding problem use static or dynamic optimization to manage the uncertainty of how airport capacities will evolve. Scenario trees of airport arrival capacity profile provide the basis for formulating multistage recourse problems. We present methodologies for generating scenario trees from empirical data and examine the performance of scenario-based models in a real-world setting.

4 - A/C Maintenance Compliance Optimization with Manpower and Work-slot Constraints
Goutham Ekollu, Lead Programmer Analyst, United Airlines, 1200 E Algonquin Rd, Elk Grove, IL, 60007, United States, goutham.ekollu@united.com, Ram Narasimhan

Various maintenance items need to be accomplished at regular (but varying based operational schedule, control type etc.) intervals in order to comply with FAA safety mandates. A/C routers schedule these maintenance items with the goal to minimize the green time wasted. They are constrained by the limited manpower and work-slots available on each day at various stations. We present a maintenance assignment optimization model which optimizes the assignments for all the A/C over a 7 day period.

■ SC19

H - 4th Floor, Union Square 13

KLIC III — Knowledge Transfer Decision Support (Knowledge, Learning & Intellectual Capital)

Sponsor: Technology Management
Sponsored Session

Chair: David Moore, Assistant Professor, Colorado School of Mines, Economics and Business Division, 814 15th Street, Golden, CO, 80401, United States, dmoore@mines.edu

1 - Managing Employee Knowledge through External Knowledge Transfer and Learning-by-Doing
Cheryl Gaimon, Regents Professor, Georgia Institute of Technology, 800 West Peachtree St. NW, Atlanta, GA, United States, cheryl.gaimon@mgt.gatech.edu, Gulru Ozkan

We consider the situation where employee training is needed. We analyze dynamic strategies pursued by a firm that increases employee knowledge through learning-by-doing (internal source of knowledge creation) and by hiring consultants (external source for knowledge transfer). Key issues we address include the appropriate duration of consultancy engagement, the rate of pursuit in knowledge transfer, and the effect of learning-by-doing on the knowledge transfer process.

2 - The Economics of Speed
Rob Leachman, Professor, University of California, Berkeley, 4135 Etcheverry Hall, Berkeley, CA, 94720-1777, United States, leachman@ieor.berkeley.edu, Shengwei Ding

A delay cost model is introduced that quantitatively assesses revenue gains resulting from increased speed of manufacturing deployment and execution. Costs of projects or investments that increase speed may be weighed against revenue gains calculated using the model. The model is demonstrated on semiconductor industry data.

3 - Targeted Knowledge Transfer and Accelerated Organizational Learning
David Moore, Assistant Professor, Colorado School of Mines, Economics and Business Division, 814 15th Street, Golden, CO, 80401, United States, dmoore@mines.edu

The functional structure of production technologies having additively decomposible performance metrics may be exploited to accelerate learning. We present a general mathematical and economic framework for identifying productivity-enhancing knowledge transfer opportunities and evaluating the potential economic impact of successful knowledge transfer. Efficient data collection and analysis strategies, and differences between input-reducing and output-expanding learning will be highlighted.

4 - The Effect of Information Technology on Organizational Learning and Knowledge Transfer
Linda Argote, Professor, Carnegie Mellon University, Tepper School of Business, 5000 Forbes Ave., Pittsburgh, PA, 15213, United States, argote@andrew.cmu.edu, Michael J. Ashworth, Tridas Mukhopadhyay

We examine whether information technology affects organizational learning and knowledge transfer. We conducted an analysis of monthly data spanning five years at six financial institutions. Information technology was found to have a positive impact on productivity and quality as well as increase the rates at which the units improve their productivity and quality with experience. Information technology significantly enhances the transfer of productivity-enhancing knowledge.

■ SC20

H - 4th Floor, Union Square 14

Electricity Markets Development & Planning

Sponsor: Energy, Natural Resources & the Environment / Energy
Sponsored Session

Chair: Uday Shanbhag, University of Illinois, Mechanical and Industrial Engg, Urbana, IL, 61801, United States, udaybag@stanford.edu

1 - Market Architecture and Relevant Markets

Yves Smeers, CORE, Universite' Catholique de Louvain, Louvain-la-Neuve, Belgium, smeers@core.ucl.ac.be, Andreas Ehrenmann

Competition authorities traditionally begin their investigation of concentration cases by assessing the relevant market of the involved companies. We examine the extent to which the yet undefined organisation of cross border trade can have an impact on the definition of the geographic relevant market. We conduct the analysis on a stylised example, and compare results from nodal pricing, market splitting, coordinated auction and market coupling.

2 - A Look at Simple, Learnable Pricing Policies in Electricity Markets

Steve Kimbrough, University of Pennsylvania, Wharton School, Philadelphia, PA, 19104, United States, sok@wharton.upenn.edu, Fred Murphy

We model aspects spot markets and day ahead markets as indefinitely repeated games played by small numbers of players. Players are agents with repertoires of comparatively simple pricing and supply policies. The agents engage in straightforward learning (e.g., reinforcement learning, use of Hernnstein's matching law) in this policy space. We compare the behavior of this agent-based model with the behavior of current models pertaining to the electricity markets in question.

3 - A Framework for the Analysis of Transmission Planning in the Market Environment

Javier Contreras, Universidad de Castilla - La Mancha, Campus Universitario s/n, 13071 Ciudad Real, Spain, Javier.Contreras@uclm.es, George Gross

The need for investment in and maintenance of the transmission grid has not been met in the competitive environment. A framework for the analysis of issues in the planning of transmission in the competitive environment is proposed that extends congestion analysis. The principal notion is to evaluate the relevant metrics with and without the transmission asset investment(s). We apply the framework to investigate transmission expansion scenarios from the ISO point of view.

4 - A Complementarity Framework for Forward Contracting under Uncertainty

Uday Shanbhag, University of Illinois, Mechanical and Industrial Engg, Urbana, IL, 61801, United States, udaybag@stanford.edu, Peter Glynn, Gerd Infanger

We construct a two-period oligopolistic model in which agents have access to spot and forward markets. Uncertainty exists in generation capacity, spot-market demand and network capacity. We play a simultaneous stochastic Nash game in forward decisions and recourse-based spot decisions. A decomposition-based iterative method is proposed for solving the resulting stochastic complementarity problem. Some results are provided for a 6-node network under uncertainty.

■ SC21

H - 4th Floor, Union Square 15

Joint Session DMA/CPMS/DM: Data Mining in Ecology and the Environment

Cluster: Data Mining Applications, CPMS,
The Practice Section of INFORMS; Data Mining
Invited Session

Chair: Mary Crissey, Analytical strategist, SAS Institute, 17030 Vista Park Dr, San Antonio, TX, 78247, United States, mary.crissey@sas.com

1 - Quantification of Representative Monitoring Sites of PM2.5 using False Discovery Rate

Seoung Bum Kim, Assistant Professor, Manufacturing and Industrial Systems Engineering, University of Texas at Arlington, Arlington, TX, United States, sbkim@isye.gatech.edu

Quantifying the representatives of monitoring sites provides the guideline of air quality assessment and public health study. In this study we propose multiple testing procedures controlling false discovery rate to quantify the representativeness of 1206 monitoring sites of PM2.5 over the United States.

2 - What Started as Simple Goal of Reducing Lapsing Fishing Licenses

Kenneth Fritz, Deputy CIO, Ohio Dept Natural Resources, 2035 Morse Rd, building I, Columbus, OH, 43229, United States, Ken.Fritz@dnr.state.oh.us

Who'd have imagined? Tackling the challenge of Predicting which fishing licenses might Lapse would net an increase of $500,000 in revenue! The Recreational user data warehouse combined with analytical intelligence gave Wildlife division managers ability to target and segment their customers. Collaborative efforts are underway with other state agencies to leverage what we're doing with to improve our internal decision support so that they too can deliver improved recreational services.

3 - Mining to Model State Transitions for Ozone Pollution Control Strategies

Victoria Chen, Associate Professor, University of Texas at Arlington, Dept. of Ind. & Manuf. Sys. Eng., Campus Box 19017, Arlington, TX, 76019-0017, United States, vchen@uta.edu, Michael Chang, Zehua Yang

Exploration of potential strategies for controlling ozone pollution requires a model of how the state of the relevant air chemistry changes subsequent to applied controls. The EPA's Urban Airshed Model may be employed for this purpose, but is computationally intensive. Instead, a mining and metamodeling process is developed to efficiently approximate these state transitions. These are incorporated into a stochastic dynamic programming formulation to identify promising control strategies.

4 - Copula Model Selection Procedures for Flood Forecasting

Kobi Abayomi, Columbia University, Environmental Eng. and Statistics, New York, NY, 10027, United States, kabayomi@ciesin.columbia.edu, Upmanu Lall, Victor de la Peña

Copulas model dependencies in multivariate data. We investigate model selection procedures for the purpose of capturing mutual information between flood incidence and its predictors - which include precipitation, ground cover, water table, etc.

■ SC22

H - 4th Floor, Union Square 16

The Economics of Information Exchange

Sponsor: Information Systems
Sponsored Session

Chair: Neveen Awad, Wayne State University, 300 Prentis Hall, Cass Ave, Detroit, MI, 48202, United States, nawad@wayne.edu

1 - Competition and Vertical Integration in the Search Engine Market

Kartik Hosanagar, The Wharton School, Penn, 3730 Walnut St, Suite 500, philadelphia, pa, 19104, United States, kartikh@wharton.upenn.edu, Karthik Kannan, Rahul Telang

The search engine market has witnessed considerable in the recent past, including decisions by Yahoo and MSN to stop outsourcing their search technology and instead own their own search algorithms. This paper analyzes the dynamics of competition between two search engines and the incentives for vertical integration. We find that the primary drivers of technology integration by search engines are similarity in service features across search engines and ratio of their cost of quality.

2 - Strategic Manipulation of Internet Opinion Forums

Chrysanthos Dellarocas, R. H. Smith School of Business, University of Maryland, College Park, MD, 20742, United States, dell@mit.edu

There is growing evidence that consumers are influenced by Internet-based opinion forums before making a variety of purchase decisions. Firms whose products are being discussed in such forums are, therefore, tempted to manipulate consumer perceptions by posting costly anonymous messages that praise their products or that bad-mouth their competitors. This paper offers a theoretical analysis of the impact of such behavior on firm profits and consumer surplus.

3 - Efficient Dynamic Allocation with Uncertain Valuations

Thomas Weber, Assistant Professor, Stanford University, 442 Terman, Stanford, CA, 94305-4026, United States, webert@stanford.edu, Abhishek Bapna

We provide a solution to the problem of efficiently allocating an object of initially unknown value to one of N agents. Agents may learn about the object's value from experience with it. Applications include the repeated sale of a paid referral or the dynamic allocation of an exclusive R&D facility in a firm.

4 - Information Exchange, Network Structure and Technology Adoption

Arun Sundararajan, New York University, 44 West 4th Street, KMC 8-93, New York, NY, 10012, United States, asundara@stern.nyu.edu

Information sharing patterns between agents often determines technology adoption. I model how the structure of complex networks that describe these patterns and the intensity of inter-agent information sharing affect optimal and Bayes-Nash equilibrium outcomes in a general technology adoption game, towards contrasting centrally mandated and decentralized IT governance policies.

■ SC23

H - 4th Floor, Union Square 17

Stochastic Modeling in Financial Services

Sponsor: Financial Services
Sponsored Session
Chair: James Primbs, Stanford University

1 - Linking Stochastic Program and Policy Simulator for the U.S. Defined-Benefit Pension System
Zhuojuan Zhang, Princeton University, zhuojuan@Princeton.EDU

This paper presents a risk-based and anticipatory modeling framework to integrate an industry with its defined-benefit pension system. We develop an approach for risk-neutral valuation of contributions by plan sponsors. By linking stochastic program with a policy simulator, we study the problem of finding optimal policy rules such as pension investment and contribution rules. Empirical analysis indicates that pension decisions need to be tailored to the characteristics of different industries.

2 - Pricing Barrier Options with Stochastic Volatility and Local Volatility Models
Rongwen Wu, Freddie Mac, rongwen_wu@freddiemac.com

We consider the valuation of barrier options using stochastic volatility and local volatility models. The stochastic volatility models are based on time changing Levy processes. Empirically we show the existence of model risk.

3 - A New Stochastic Control Approach to Robust Portfolio Optimization
James Primbs, Assistant Professor, Stanford Unversity, 444 Terman Engr. Ctr., Mail Code 4026, Stanford, CA, 94305, United States, japrimbs@stanford.edu, Chang Hwan Sung

Long term portfolio optimization is central to investment management, yet no generally accepted solution currently exists due to high computational hurdles. We approach the problem through a combination of stochastic programming and receding horizon control in an environment with many dynamic assets and transaction costs. Our methodology™ advantages are its ability to optimize in realistically complex environments over a long horizon, while at the same time remaining computationally feasible.

■ SC24

H - 4th Floor, Union Square 18

Financial Models and Analysis II

Cluster: Financial Engineering
Invited Session
Chair: Xin Guo, Assistant Professor, Cornell University, School of ORIE, Cornell University, Ithaca, NY, 14853, United States, xg29@cornell.edu

1 - Irreversible Investment under Dynamic Capacity Constraints
Peter Bank, Assistant Professor, Columbia University, Department of Mathematics, 2990 Broadway, New York, NY, 10027, United States, pbank@math.columbia.edu

We study irreversible investment problems where the overall investment up to any point in time may not exceed a given time varying threshold, thus imposing a dynamic capacity constraint. We derive a first order characterization of optimal policies based on the Snell envelope of the objective functional's gradient at the optimum. The optimal control policy is constructed explicitly in terms of the solution to a representation theorem for stochastic processes.

2 - A Robust Risk Measure
Steven Kou, Columbia University, 312 Mudd Building, Dept. of IEOR, New York, NY, United States, sk75@columbia.edu, Chris Heyde

In this talk, we first review some controversies over tailweight of distributions, and then present a robust risk measure. The talk is based on the papers by Heyde and Kou (2004, 2005).

3 - Dynamic Portfolio Optimization, Duality and Security Design
Ashish Jain, Columbia Business School, 130 Morning Side Drive #47A, NYC, NY, 10027, United States, aj2109@columbia.edu, Martin Haugh

Haugh, Kogan & Wang (HKW) showed how duality theory could be used to evaluate sub-optimal solutions to dynamic portfolio optimization problems. In the examples considered by HKW, only the trading strategies were used to compute the upper bounds as their value functions were not known. We extend this earlier work by evaluating new sub-optimal trading strategies and by explicitly computing their value functions. We also use these trading strategies to draw some conclusions for security design.

4 - Time-Changed Hawkes Processes and Tranche Pricing
Kay Giesecke, Cornell University, 237 Rhodes Hall, Ithaca, NY, 14853, United States, giesecke@orie.cornell.edu

We consider single-tranche collateralized debt obligations and other multi-name credit derivative instruments as options on cumulative portfolio default losses. The dynamics of cumulative losses are modeled by a time-changed Hawkes process. Options on this process are valued based on an explicit representation of the characteristic function of the process.

■ SC26

H - 4th Floor, Union Square 20

Panel Discussion: Research and Publications

Sponsor: JFIG, Junior Faculty Interest Group
Sponsored Session
Chair: Feryal Erhun, Assistant Professor, Stanford University, Management Science&Engineering, Stanford, CA, 94305, United States, ferhun@stanford.edu

1 - Panel Discussion: Research and Publications
Moderator: Candace Yano, Professor, UC Berkeley, 4141 Etcheverry Hall, Berkeley, CA, 94720-1777, United States, yano@ieor.berkeley.edu, Panelists: Garrett van Ryzin, Kalyan Singhal, Wallace Hopp

In this panel discussion, we will discuss the role of publishing in academia. We plan to: 1) provide an overview of the publication outlets for Engineering and Business School faculty; 2) describe how the publishing process works; 3) present strategies for picking topics for publication; and 5) discuss the research/practice interface.

■ SC27

H - 4th Floor, Union Square 21

Panel Discussion: How to Have an OR Career

Sponsor: CPMS, The Practice Section of INFORMS
Sponsored Session
Chair: Stephen Strauss, AT&T Labs, 180 Park Avenue, Building 103 Room A009, Florham Park, NJ, 07932, United States, sstrauss@att.com

1 - Panel Discussion: How to have an OR Career
Moderator: Stephen Strauss, AT&T Labs, 180 Park Avenue, Building 103 Room A009, Florham Park, NJ, 07932, United States, sstrauss@att.com, Panelists: Brandi Goodman, Harlan Crowder

Panelists from a range of industries; experience; and educational levels and backgrounds will discuss how they got into OR, how they got some of their positions and what kind of career paths they have followed.

■ SC28

H - 4th Floor, Union Square 22

The Re-solving Issue in Revenue Management

Sponsor: Revenue Management & Pricing
Sponsored Session
Chair: Nicola Secomandi, Assistant Professor of Operations Management & Manufacturing, Tepper School of Business, Carnegie Mellon University, 5000 Forbes Avenue, Pittsburgh, PA, 15213, United States, ns7@andrew.cmu.edu

1 - Is It Better To Re-Optimize?
William Cooper, University of Minnesota, 111 Church St. SE, Minneapolis, MN, 55455, United States, billcoop@me.umn.edu

In revenue management it is common practice to repeatedly re-solve a static optimization problem throughout the booking horizon in order to obtain booking controls. Such optimization problems typically do not take into account the fact that the revenue manager plans to re-solve in the future. In this talk, I discuss a simple example that shows the revenue manager may be better off in expectation by not re-optimizing.

2 - Multi-Stage Stochastic Programming Models in Revenue Management
Tito Homem-de-Mello, tito@northwestern.edu, Lijian Chen

We discuss the use of stochastic programming models in revenue management, focusing on the seat allocation problem. We present a non-linear multi-stage stochastic program and describe some characteristics of it (notably lack of convexity). A re-solving strategy is proposed for obtaining approximating solutions to the problem and assessing their quality. Numerical results are presented to illustrate the approach.

3 - Dynamic Pricing Strategies for Multi-Product Revenue Management Problems

Joern Meissner, 2840 Broadway #284, New York, NY, 10027, United States, joe@meiss.com, Costis Maglaras

We consider a firm that owns a fixed capacity of a resource that is consumed in the production of multiple products. We show how this well-studied revenue management problem can be reduced to a common formulation where the firm controls the aggregate rate at which products jointly consume capacity. In this context, we suggest several static and dynamic pricing heuristics. In particular, we show that "resolving" the fluid heuristic achieves asymptotically optimal performance under fluid scaling.

4 - An Analysis of the Re-Solving Issue in Network Revenue Management

Nicola Secomandi, Assistant Professor of Operations Management & Manufacturing, Tepper School of Business, Carnegie Mellon University, 5000 Forbes Avenue, Pittsburgh, PA, 15213, United States, ns7@andrew.cmu.edu

Most network-revenue-management policies are based on math programs that are periodically re-solved during the booking period. The effect of this re-solving on the performance of the booking policy is not well understood in theory. The talk presents a theory of re-solving and analyzes the re-solving behavior of booking-limit and bid-price policies.

■ SC29

H - 4th Floor, Union Square 23

Joint Session Research/ QSR: QSR Research Clinic-Quality and Statistics in Healthcare Modeling and Decision Making

Cluster: Research Clinics, Quality, Statistics and Reliability
Invited Session

Chair: Harriet Black Nembhard, Marcus Department of Industrial & Manufacturing Engineering, The Pennsylvania State University, 310 Leonhard Building, University Park, PA, 16802, hbnembhard@psu.edu

1 - Quality and Statistics in Healthcare Modeling and Decision Making

Harriet Black Nembhard, Marcus Department of Industrial & Manufacturing Engineering, The Pennsylvania State University, 310 Leonhard Building, University Park, PA, 16802, hbnembhard@psu.edu, Christopher Hollenbeak, Julie Simmons Ivy, Elissa Ozanne, Scott Ransom

Abstract not available at this time.

■ SC30

H - 4th Floor, Union Square 24

Risk Analysis

Contributed Session

Chair: Xia Pan, Assistant Professor, University of Illinois at Springfield, One University Plaza, Springfield, IL, 62703, United States, xpan1@uis.edu

1 - Designing the Stock Trading Processes by Utilizing Six Sigma Method

Hsueh-Ming Stev Wang, Assistant Professor, Chang Gung University, 259 Wen Hua 1st Rd, Kwei-Shan, Tau-Yuan, Taiwan, steve@mail.cgu.edu.tw

This research uses Six Sigma method to construct a new trading process in the Proprietary Trading Department of a securities house. the empirical operating benefits through testing of samples, from Taiwan 50 Exchange Traded Funds in two different periods were analyzed. The results show that RSI is the important key factor for the stock trading process. Six Sigma methods not only can apply in the industry well but also can be used in financial institutions as well.

2 - Application of Risk Analysis to Economic Factors

Marc Rose, Manager, OR Division, MCR, LLC, 600 Maryland Ave, SW, Suite 700, Washington, DC, 20024, United States, mrose@mcri.com, Gabriela Rohlck

Application and demonstration of risk analysis techniques applied to economic analysis/return on investment. Included is a synopsis of cost & benefits risk analysis with the application of correlation to develop high confidence estimates. We will then use these results to perform component allocation and return on investment (B/C, NPV, IRR) estimates.

3 - The Similairties between SPC and VaR: Applying Quality Control Methods in Risk Control.

Xia Pan, Assistant Professor, University of Illinois at Springfield, One University Plaza, Springfield, IL, 62703, United States, xpan1@uis.edu

Statistical process control (SPC) method has been a popular methods used in Quality control for decades in production and manufacturing. On the other hand, Value-at-Risk (VaR) has just about ten year history in financial industy specifically in banking business, started from JP Morgan's introduction of RiskMetric and the rugualtions by Bank of International Settlement. However, ther are a lot of similaritis between these two methods. This paper will discuss the similarities and differences.

4 - Efficient Monte Carlo Methods for Convex Risk Measures

Stefan Weber, Cornell University, 279 Rhodes, ORIE, Ithaca, NY, 14853, United States, sweber@orie.cornell.edu, Joern Dunkel

We discuss efficient MC methods for the estimation of convex risk measures in portfolio credit risk models. We focus on the Utility-based Shortfall Risk measures (SR) which do not share the deficiencies of the current industry standard VaR. The analysis of large financial losses in realistic portfolio models requires extensive numerical simulations. In the present paper we demonstrate that importance sampling can be used to construct efficient estimators for SR.

■ SC31

H - 4th Floor, Union Square 25

Auctions in the Supply Chain

Cluster: Applications of Auction and Game Theory
Invited Session

Chair: David Wu, Lehigh University, 27 Memorial Drive West, Bethlehem, Pa, United States, david.wu@lehigh.edu

1 - Procurement in the Presence of Learning by Doing

Wedad Elmaghraby, University of Maryland, Wedad_Elmaghraby@rhsmith.umd.edu, Se-Kyoung Oh

Under an erosion rate policy, the buyer initially competitively awards production to the lowest-bid supplier via an auction. Before the auction takes place, the buyer makes it clear to the suppliers that, if chosen, a sequence of price reductions will be mandatory in subsequent periods. In this paper, we study the design of the optimal eroding price schedule. We go on to compare the performance of the erosion rate policy against other popular procurement mechanisms.

2 - Procurement Auctions with Supply Constraints

G. Anandalingam, University of Maryland, Van Munching Hall, College Park, MD, 20742, United States, ganand@rhsmith.umd.edu, Abhishek Pani

Many organizations conduct repeated auctions to procure goods, materials and services. Suppliers with capacity constraints who win procurement deals in one auction may be too strapped to participate in a subsequent auction. We present a model that determines an optimal bidding schedule for suppliers with capacity constraints. We examine the impact on the buying organization as well.

3 - Procurement Auctions for Capacity-Bound Suppliers

Serkan Ozkan, Ph. D. Candidate, Lehigh University, 200 W. Packer Ave, Bethlehem, PA, 18015, United States, seo4@lehigh.edu, David Wu

In this study, we conduct a competitive equilibrium analysis for the repeated (sequential) procurement auctions. We consider capacitated suppliers (bidders), each with a U-shaped cost function that captures the economies (and diseconomies) of scale in bidding quantity. Cases with both homogenous and non-homogenous bidders are considered in a symmetric incomplete information setting. We derive key mechanism design results for this repeated auction using Myerson's framework.

■ SC32

H - 6th Floor, Lombard

Quality and Reliability

Contributed Session

Chair: HyunWoo Cho, Research Associate, University of Tennessee, 307 East Stadium Hall, Knoxville, TN, 37996, United States, hwcho@postech.ac.kr

1 - Development of the Dining Experience Scorecard

Tsu-Hong Yen, Associate Professor, San Jose State University, One Washington Square, San Jose, CA, 95192-0211, United States, yen@casa.sjsu.edu, Gonzaga da Gama, John R. Collins, Colin Johnson

The transition from service economies to experience economies in the post-industrial era (Pine and Gilmore, 1999) has resulted in changing service operations priority from customer services to customer experience. This study, using a restaurant as an example, develops the "Dining Experience Scorecard" which integrates the customer's dining experience and managerial financial performance. Results from the study could be applied to service design, service operations, and revenue management.

2 - How Did TQM Affect Customer Satisfaction Among Quality Award Winners In Europe?
Mehmet Ceyhan, Ph.D. Student, Northeastern University, 360 Huntington Avenue, Boston, MA, 02115, United States, erkanceyhan2000@yahoo.com, Fatma Pakdil, Emanuel Melachrinoudis

TQM is one of the most effective management strategies to reach high-level corporate performance for organizations aiming to gain competitive advantage. This study examines the impact of TQM on customer-related performance based on an empirical study performed among EFQM and TUSIAD-KalDer Quality Award Winners between 1993 and 2003.

3 - A Multicriteria Decision Framework for Customer-preference Based Process Target Optimization
Srikrishna Govindaluri, Assistant Professor of Management, Ramapo College of New Jersey, 505 Ramapo Valley Rd., Mahwah, NJ, 07430, United States, sgovinda@ramapo.edu

The process target problem as studied in the literature involves selecting a process mean that minimizes sum of rejection costs and quality loss with respect to prespecified specification limits. Although this problem is widely discussed from a monetary viewpoint customer preferences are often neglected. Therefore, a multiobjective decision framework is proposed to integrate customer preferences in to the process target problem with multiple quality characteristics.

4 - ISO 9000: A Proposed Model of Indirect Financial Performance Benefits
Victor Wayhan, Ph.D., Assistant Professor of Management, Sam Houston State University, Box 2056, Huntsville, TX, 77341, United States, vwayhan@shsu.edu, Erica Balderson

Empirical research that has explored the impact of ISO 9000 certification on financial performance has presumed and tested direct effects, often with contradictory findings. As an alternative, an indirect model is proposed that links ISO 9000 certification with financial performance through two intervening constructs: cost structure and productivity.

5 - Use of Kernel Based Nonlinear Discriminant Analysis for Classifying Fault Data
HyunWoo Cho, Research Associate, University of Tennessee, 307 East Stadium Hall, Knoxville, TN, 37996, United States, hwcho@postech.ac.kr, Myong K. Jeong

For productivity and quality improvement, multivariate statistical techniques such as principal component analysis (PCA) and Fisher discriminant analysis (FDA) have been developed to solve a fault diagnosis problem of batch processes. In this work we propose a kernel based nonlinear diagnosis model using kernel FDA. A case study on two batch processes has been conducted, and the performance of the proposed method was compared with that of an existing diagnosis method based on linear FDA.

■ SC33

H - 6th Floor, Mason

Panel Discussion: New Research Directions in Process Monitoring

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: Fugee Tsung, Associate Professor, Hong Kong University of Science and Techonology, IELM Department of HKUST, Kowloon, Hong Kong, season@ust.hk

1 - Panel Discussion: New Research Directions in Process Monitoring
Moderator: Fugee Tsung, Associate Professor, Hong Kong University of Science and Techonology, IELM Department of HKUST, Kowloon, Hong Kong, season@ust.hk, Panelists: Bill Woodall, Douglas Montgomery, Joe H. Sullivan, George Runger, Tze Leung Lai, Jan Shi

This panel will invite six research leaders in the statistical process control (SPC) area to share their views on new challenges, methodologies, and visions in quality control research.

■ SC34

H - 6th Floor, Powell

Reliability Testing and Modeling

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: Yong Chen, University of Iowa, Mechanical and Industrial Engineering, Iowa City, IA, United States, yongchen@engineering.uiowa.edu

1 - Multi-Component Degradation Modeling in Large Scale Systems
Yong Chen, University of Iowa, Mechanical and Industrial Engineering, Iowa City, IA, United States, yongchen@engineering.uiowa.edu, Nagi Gebraeel

This research develops multi-component degradation models for monitoring degradation of large scale systems. Specifically, we investigate several classes of stochastic degradation models coupled with a random effects linear model to compute residual life distributions of partially degraded components. This methodology is validated using real world vibration-based degradation data from rolling element bearings.

2 - Reliability Inference Based on A Class of Nonhomogeneous Gaussian Processes
Xiao Wang, Department of Statistics, University of Michigan, Ann Arbor, MI, United States, wangxiao@umich.edu, Vijay Nair

Recent advances in sensing and measurement technologies are making it feasible to collect extensive amounts of data on degradation. We propose a class of models, which are based on non-homogeneous Gaussian processes obtained through appropriate transformations of the Wiener process, for degradation data and describe their application for reliability inference.

3 - X-Testing using Binary Data with Applications to Reliability
David Mease, dmease@stat.berkeley.edu, Vijay Nair

Reliability demonstration plans are used to verify that reliability exceeds a specified target. When this target is close to 100%, traditional plans require extremely large sample sizes and have low power. In this talk, we consider the use of extreme testing, or "X-testing", to deal with these problems.

4 - Semi-parametric Likelihood Estimation with Estimating Equations in Accelerated Life Testing
Ni Wang, Ph.D. Student, Georgia Institute of Technology, Industrial and Systems Engineering, 765 Ferst Drive NW, Atlanta, GA, 30332, United States, gtg586c@mail.gatech.edu, Jye-Chyi Lu, Paul Kvam, Di Chen

This paper uses the empirical likelihood to model accelerated life test data. Structures about acceleration function and distribution moments are included in estimating equations for improving estimating efficiency and inference accuracy. Impact of mis-specifying the acceleration function or lifetime distribution is investigated via asymptotic derivations. A real-life example illustrates the potential of the proposed method.

■ SC35

H - 6th Floor, Sutter

RASIG Roundtable: Part I

Sponsor: Railroad Applications
Sponsored Session

Chair: Michael Gorman, Assistant Professor, University of Dayton, Dept. of MIS/OM/DSC, 300 College Park, Dayton, OH, 45469-2130, United States, michael.gorman@udayton.edu

1 - Service Design and Capacity Planning at BNSF
Richard Margl, BNSF, richard.margl@bnsf.com

I will discuss capacity planning from a service design perspective at BNSF. Capacity planning generally occurs at three levels: 1) strategic capital planning, 2) development of a base service plan and 3) operations tactical planning. I will present a brief summary of the challenges that pose difficulties for efforts to manage and optimize capacity utilization, as well as a perspective on the areas of greatest opportunity for Operations Research methodologies.

2 - Yield and Capacity Management
Reilly McCarren, jrmccarren@comcast.net

I will relate my experiences conducting yield and capacity management at Wisconsin Central.

3 - Integrated Capacity and Financial Modeling
Larry Shughart, Innovative Scheduling, larry@InnovativeScheduling.com

Mr. Shughart will present a model that links railroad capacity utilization to the financial performance of a railroad. He will examine the relationship of Pricing, Network and Productivity Capacity to the Operating Ratio. We will empirically examine the important capacity drivers, and indicate if each driver is largely a management/strategic variable or if the driver can be significantly improved with the application of OR techniques

4 - Capacity Planning at CSX
Lawrence Ratcliffe, CSX, Lawrence_Ratcliffe@csx.com

I will discuss my experience at CSX conducting capacity planning from a financial perspective.

■ SC36

H - 6th Floor, Taylor

Simulation Optimization Methods and Applications In The Medical, Voting, and Software Industries

Sponsor: Simulation
Sponsored Session

Chair: Theodore Allen, Associate Professor, The Ohio State University, 1971 Neil Avenue, 210 Baker Systems, Columbus, OH, 43210, United States, allen.515@osu.edu

1 - Simulation In Scientific Software Development
Mike Bernshteyn, Partner, Sagata Ltd., 6205 Somerled Ave, Suite 407, Montreal, QC, H3X2B5, Canada, mberns@sagata.com, Theodore Allen

We will describe challenges and solutions relating to Monte Carlo and other forms of simulation in the development of statistical software. Issues will include the development and deployment of test cases, time predictions for scientific calculations, and the associated user interface issues.

2 - Multi-Fidelity Technology For Discrete Event Simulation Optimization with Applications In Hospitals
Deng Huang, Principal Research Scientist, Scientific Forming Technologies Corporation, 5038 Reed Road, Columbus, OH, 43220, United States, dhuang@deform.com, Theodore Allen, Jason Schenk, Ning Zheng

It is expensive to make highly detailed simulation models to explore different design options. Simpler models are cheaper, but there is a loss. This talk describes "multi-fidelity" technology that can keep optimization costs down by supplementation using simpler models, while producing high quality solutions. Applications in hospitals illustrate the methods.

3 - A Simulation Optimization Method For Maximizing Success Probabilities
Ning Zheng, Graduate Teaching Assistant, The Ohio State University, 1971 Neil Avenue, 210 Baker Systems, Columbus, OH, 43210, United States, zheng.481@osu.edu, Theodore Allen

The problem of finding the binomial population with the highest success probability is considered when the number of binomial populations is large. The first rigorous indifference zone subset selection procedures and genetic algorithm extensions are proposed. Computational comparisons are also described focusing on optimal experimental planning applications.

4 - Optimally Allocating Voting Machines to Precincts In Future Presidential Elections
Steven Hertzberg, Project Director, Election Sciences Institute, 2269 Chestnut Street, Suite 611, San Francisco, CA, 94123, United States, steven@electionscience.org, Mike Bernshteyn, Theodore Allen, Fritz Scheuren

During the 2004 Presidential Election voters in Franklin County, Ohio experienced some of the longest wait times in the country. This collaborative research between the Franklin County Board of Elections and the Election Science Institute will explore the optimal allocation of machines to precincts using available data. A method including input analysis and optimization will be described. U.S. nation-wide deployment issues will be discussed together with remaining challenges.

■ SC37

H - 6th Floor, Van Ness

Queueing Networks Approximations

Sponsor: Applied Probability
Sponsored Session

Chair: John Hasenbein, Professor, University of Texas at Austin, 1 University Station, C2200, Austin, TX, 78712, United States, jhas@mail.utexas.edu

1 - Dynamic Scheduling in a Fading Downlink Channel Driven by a Mean-Reverting Diffusion
Konstantinos Zachariadis, Ph.D. Student, Northwestern University, kez@chione.ece.northwestern.edu, Baris Ata

We consider a novel model of a dynamic scheduling problem in a multi-user downlink channel, where each user's channel state follow a mean reverting diffusion process, effecting the quality of service. We derive a non-greedy optimal policy that minimizes the long-run average delay penalties. A fast-fading asymptotic regime is also discussed.

2 - A Diffusion Approximation for a Many Server Queue with a Finite Population
Otis Jennings, otisj@duke.edu, Francis de Vericourt

Consider a sequence of closed queueing networks, each with a finite population of jobs that alternate between up and down states. Jobs in the up state shift spontaneously to the down state. Upon achieving the down state, jobs enter a many-server queue and, once processed, are restored to the up state. Shifting times and processing times are exponential. We prove a heavy traffic limit theorem in the Halfin-Whitt regime and explore the asymptotic system performance under various staffing schemes.

3 - Congestion Collapse in Load-Sensititve Processing Networks
David Alderson, Postdoctoral Scholar, California Institute of Technology, 1200 E. California Blvd., MC 107-81, Pasadena, CA, 91125, United States, alderd@cds.caltech.edu

I will review recent work on the behavior and control of load-sensitive processing networks—systems with stations that are susceptible to "congestion-induced collapse", in the sense that their output rate tends toward zero as their system workload gets large. Leveraging stochastic flow models and their deterministic (fluid) counterparts, we characterize key features of system behavior and consider several different management policies for achieving optimal throughput while preventing collapse.

4 - Optimal Draining of Fluid Networks with Stochastic Parameters
Burak Buke, PhD Student, The University of Texas at Austin, 1 University Station C2200, Austin, TX, 78712, United States, bukeb@mail.utexas.edu, John Hasenbein, David Morton

When parameters of the system are deterministically known, close-form solutions can be found to drain a fluid network in minimum time. However, things can get complicated when the deterministic parameters assumption is relaxed. In this work, we analyze the similarities and differences between the deterministic and stochastic settings. We also employ stochastic programming techniques to solve the stochastic parameters case.

■ SC38

R - 2nd Floor, Corintia

Applications in Cone Programming

Cluster: Linear/Nonlinear Programming
Invited Session

Chair: Samuel Burer, Assistant Professor, University of Iowa, Department of Management Scienes, S346 Pappajohn Business Building, Iowa City, IA, 52242-1000, United States, samuel-burer@uiowa.edu

1 - A New Algorithm for Solving the Hypergraph Bisection Problem with Semidefinite Programming
Changhui Choi, Graduate Student, University of Iowa, Department of Management Scienes, S210 Pappajohn Business Building, Iowa City, IA, 52242-1000, United States, laplacia@hotmail.com, Samuel Burer

Hypergraph bisection is an important problem in computer circuit design. We present a method to formulate this problem as a quadratically constrained quadratic programming problem, which is equivalent to the original problem. Then, we relax it as a semidefinite program (SDP). We present a new approach for heuristically solving the hypergraph bisection problem using SDP.

2 - The Computation of Steiner Minimal Trees in Euclidean d-Space
Marcia Fampa, UFRJ, UFRJ - COPPE/PESC, CT, Bl. H, s. 319, Cidade Universitaria, C.P. 68.511, Rio de Janeiro, RJ, 21941-972, Brazil, marcia-fampa@uiowa.edu

We present a mathematical programming formulation for the Euclidean Steiner problem, which asks for the shortest network interconnecting a set of terminals in d-space. We consider the computation of lower bounds on the length of Steiner minimal trees and discuss their incorporation into a branch-and-bound framework.

3 - A Semidefinite Optimization Approach for Row Layout Problems
Miguel Anjos, Assistant Professor, University of Waterloo, 200 University Avenue West, Waterloo, ON, N2L 3G1, Canada, anjos@cheetah.vlsi.uwaterloo.ca, Anthony Vannelli

The row layout problem is concerned with finding a placement of facilities with varying dimensions on one or more parallel rows so as to minimize the total cost arising from their pairwise connectivities. We propose a semidefinite programming approach that provides feasible placements as well as a global lower bound on the optimal value of the problem. Computational results show that the placements obtained are consistently within a few percentage points of the global optimal solution.

■ SC39

R - 3rd Floor, Aragon

Special Topics in Nonlinear Programming

Contributed Session

Chair: Bogumila Lai, Assistant Professor, St. Joseph's College, 155 West Roe Boulevard, Patchogue, NY, 11772, United States, blai@sjcny.edu

1 - Curve Smoother for an Autonomous Vehicle

Holly Jin, Postdoctoral Researcher, Stanford University, Terman Engineering Building, Stanford University, Stanford, CA, 94305, United States, hollyjin@stanford.edu, Michael Saunders

The DARPA Grand Challenge is an off-road robot competition to promote research on autonomous vehicles. In this year's race, vehicles must navigate 175 miles through desert terrain in less than 10 hours with no human intervention. We describe an optimization model and an iterative algorithm to generate a smooth curve for a vehicle to follow, given corridor data released two hours before the race. The model is solved by SNOPT.

2 - An Optimal Learning Algorithm for Purchasing Assets Over Time

Warren Powell, Professor, Princeton University, Dept of Oper Res and Fin Eng'g, Princeton, NJ, 08544, United States, powell@princeton.edu, Juliana Nascimento

We describe an adaptive learning algorithm for the problem of purchasing assets at randomly varying prices over time to meet an uncertain demand in the future. We generalize the SPAR algorithm for two-stage problems to this multistage setting, where piecewise linear functions are estimated from exogenous information. We prove convergence, combining concepts from approximate dynamic programming and stochastic programming. Convergence does not require explicit exploration strategies.

3 - Generalized Poincare-Hopf Theorem for Compact Nonsmooth Regions

Alp Simsek, MIT, 77 Massachusetts Avenue, Cambridge, MA, 02142, United States, alpstein@mit.edu, Daron Acemoglu, Asu Ozdaglar

We present an extension of the Poincare-Hopf Theorem to generalized critical points of a function on a compact region with nonsmooth boundary, M, defined by a finite number of smooth inequality constraints. We use the extended Poincare-Hopf Theorem to present sufficient conditions for the uniqueness of stationary points of nonconvex optimization problems.

4 - Dual Methods for Probabilistic Optimization Problems

Bogumila Lai, Assistant Professor, St. Joseph's College, 155 West Roe Boulevard, Patchogue, NY, 11772, United States, blai@sjcny.edu, Darinka Dentcheva, Andrzej Ruszczynski

We consider nonlinear stochastic optimization problems with probabilistic constraints. The concept of a p-efficient point of a probability distribution is used to derive equivalent problem formulations. Two algorithms are developed for solving the dual problem. Numerical illustration will be presented to solve a bond portfolio problem with probabilistic liquidity constraint.

■ SC40

R - 3rd Floor, Barcelona I

Networking Issues

Sponsor: Optimization/ Network Optimization

Sponsored Session

Chair: Ramesh Johari, Assistant Professor, Stanford University, Mgmt. Sci. and Eng., Terman Eng. Ctr., Room 319, Stanford, CA, 94305, United States, ramesh.johari@stanford.edu

1 - Using Symmetry To Compute In Faulty Networks

David Pritchard, University of Waterloo, 290 Westcourt Place, Waterloo, ON, N2L 2R7, Canada, daveagp@gmail.com, Santosh Vempala

Motivated by sensor nets and amorphous computing, we investigate fault-tolerant distributed computing. Many known algorithms for dynamic networks rely on symmetry: at each point in time, all nodes perform the same symmetric local computation. We show several fault-tolerant algorithms following this design principle, including ones for leader-based clustering, biconnectivity, and network traversal. We show how agents are useful, and give a simple description of Tarjan's maximum flow algorithm.

2 - Triangulation and Embedding using Small Sets of Beacons

Alex Slivkins, Computer Science Dept, Cornell University, Ithaca, NY, 14853, slivkins@cs. cornell.edu, Jon Kleinberg, Tom Wexler

Node-to-node latencies is a notion of distance in the Internet. For emerging peer-to-peer applications it is useful to represent this distance via coodinates in a low-dimensional Euclidean space and, moreover, compute these coordinates in a decentralized fashion, with low overhead on participating nodes. In particular, each node is allowed only a near-constant #distance measurements. This is in sharp contrast with the theoretical work on metric embeddings which assumes full (and centralized) access to the distance matrix. Here we bridge this gap between theory and applications.

3 - Power Optimization for Connectivity Problems

Vahab S. Mirrokni, MIT, Computer Science and Artificial Intelligence Laboratory, 32 Vassar Street, Room 32G-580, Cambridge, MA, 02139, mirrokni@theory.lcs.mit.edu

In this talk, we study power optimization problems motivated by applications in fault-tolerant wireless multi-hop networks. Given an edge-weighted graph, the power of each node is the cost of the maximum edge connected to this node and the power of the graph is the sum of the powers of the nodes of this graph. We design $\min(4k,O(\log^4(n))$ and $\sqrt(n)$-approximation algorithms for the minimum power k-connected and k-edge connected subgraph problems. We also present hardness results for different variants of this problem.

4 - Contract-Based Models for Network Formation

Ramesh Johari, Assistant Professor, Stanford University, Mgmt. Sci. and Eng., Terman Eng. Ctr., Room 319, Stanford, CA, 94305, United States, ramesh.johari@stanford.edu, Shie Mannor, John Tsitsiklis

We consider a network game where the nodes of the network wish to form a graph to route traffic between themselves. We present a model where costs are incurred for routing traffic, as well as for a lack of network connectivity. We study the structure of connected stable networks, best response dynamics, and efficiency properties for several special cases.

■ SC41

R - 3rd Floor, Barcelona II

QUBO: Quadratic Unconstrained Binary Optimization

Sponsor: Optimization/ Integer Programming

Sponsored Session

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

1 - Preprocessing QUBO Problems

Peter L. Hammer, Director, RUTCOR, Rutgers University, 640 Bartholomew Road, Piscataway, NJ, 08854, United States, hammer@rutcor.rutgers.edu, Endre Boros, Gabriel Tavares

We present applications of roof-duality and other techniques for determining optimal values of subsets of variables, finding binary relations between optimal values of pairs of variables, and decomposing problems into pair-wise disjoint smaller ones. Applications include optimal solutions of stability problems in planar graphs with 500,000 vertices.

2 - Local Optimization of Quadratic Pseudo-Boolean Functions

Endre Boros, Professor, Rutgers University, RUTCOR, 640 Bartholomew Road,, Piscataway, NJ, 08854, United States, boros@rutcor.rutgers.edu, Gabriel Tavares, Peter L. Hammer

We propose a family of heuristics which start from a possibly fractional point and change iteratively the values of variables. Comparative computational studies on problems with thousands of variables and hundreds of thousands of terms indicate both the efficiency and effectiveness of the proposed methods.

3 - Exact Methods for QUBO

Gabriel Tavares, Rutgers University, RUTCOR, Piscataway, NJ, 08854, United States, gtavares@rutcor.rutgers.edu, Endre Boros, Peter L. Hammer

We propose an exact branch-and-bound type algorithm for quadratic 0-1 optimization using a combination of theoretical results, repeated preprocessing, and fast heuristics. The efficiency of the proposed method is demonstrated in a comparative study on benchmarks and on randomly generated problems.

■ SC42

R - 4th Floor, Parc Ballroom I

Risk-Averse Stochastic Optimization

Sponsor: Optimization/ Stochastic Programming

Sponsored Session

Chair: Andrzej Ruszczynski, Rutgers University, 94 Rockafeller Road, Piscataway, NJ, 00854, United States, rusz@business.rutgers.edu

1 - Optimization Under Stochastic Dominance Constraints

Andrzej Ruszczynski, Rutgers University, 94 Rockafeller Road, Piscataway, NJ, 00854, United States, rusz@business.rutgers.edu, Darinka Dentcheva

We consider optimization problems with stochastic dominance constraints of first and second order. We develop optimality and duality theory for these problems. We show that von Neumann utility functions play the role of Lagrange multipliers associted with these constraints. We show that the second order dominance constraint is a convexification of the first order constraint. We also discuss the construction of numerical methods for these problems.

2 - Valid Inequalities for First Order Stochastic Dominance Constraints

Nilay Noyan, Graduate Assistant, RUTCOR Rutgers, the State University of New Jersey, 640 Bartholomew Road, Piscataway, NJ, 08854, United States, noyan@rutcor.rutgers.edu, Andrzej Ruszczynski

We introduce a mixed 0-1 knapsack formulation of a discrete first-order dominance constrained optimization model. The main challenge is the potential non-convexity of the feasible region. By restating the inequalities arising from the underlying combinatorial structure as logical conditions simple disjunctions are obtained. We generate cuts that are valid inequalities for the corresponding disjunctive relaxations by applying the lift-and-project procedure, developed by Balas et al., 1993.

3 - A Dual Approach to Linear Stochastic Optimization Problems with Second Order Dominance Constraints

Gabor Rudolf, Graduate Assistant, RUTCOR - Rutgers University, 640 Bartholomew Rd, Piscataway, NJ, 08854, United States, grudolf@rutcor.rutgers.edu, Andrzej Ruszczynski

We develop a duality theory for linear stochastic optimization problems involving second-order dominance constraints. The main feature of our approach is the reduction of the index space of dual variables by applying Strassen's theorem on the existence of measures on product spaces with given marginals. In particular, in the discrete case this leads to a dual solution method via column generation featuring a quadratic reduction in the number of variables.

4 - Deviation Measures in Optimization and Risk Analysis

Michael Zabarankin, assistant professor, Stevens Institute of Technology, Department of Mathematical Sciences, Hoboken, NJ, 07030, United States, mzabaran@stevens.edu, R. Tyrrell Rockafellar, Valeriy Ryabchenko

The role of deviation measures and risk measures in optimization is analyzed, and the possible influence of "acceptably free lunches" is thereby brought out. Optimality conditions based on concepts of convex analysis, but relying on the special features of risk envelopes, are derived in support of a variety of potential applications, such as portfolio optimization and variants of linear regression in statistics.

■ SC43

R - 4th Floor, Parc Ballroom II

Joint Session Computing/ Health: Computational Biology and Bioinformatics

Sponsor: INFORMS Computing Society/ OR and Biomedicine, Health Applications
Sponsored Session

Chair: J. MacGregor Smith, Professor, University of Massachusetts, Elab Building, Amherst, MA, 01003, United States, jmsmith@ecs.umass.edu

1 - New Advances on Solving the Protein Folding Protein in 3D HP Lattice Model

Cesar Rego, Associate Professor, University of Mississippi, University, Oxford, MS, 38677, United States, crego@bus.olemiss.edu, Haitao Li, Fred Glover

A new dynamic and adaptive search method has proved to be highly successful for solving the two-dimensional HP lattice model. We extend this method to the three-dimensional model, yielding a new advance for handling practical applications in 3D protein folding.

2 - Novel Approaches for Analyzing Biological Networks

Wel Wilhelm, Professor, Texas A&M University, TAMUS 3131, College Station, TX, 77843-3131, United States, wilhelm@tamu.edu, Balabhaskar Balasundaram, Svyatoslav Trukhanov, Sergiy Butenko

This paper proposes clique relaxations to identify clusters in biological networks. In particular, the maximum n-clique and maximum n-club problems on an arbitrary graph are introduced and their recognition versions are shown to be NP-complete. In addition, integer programming formulations are proposed and the results of sample numerical experiments performed on biological networks are reported.

3 - Steiner Minimal Trees, Twist Angles and the Protein Folding Problem

J. MacGregor Smith, Professor, University of Massachusetts, Elab Building, Amherst, MA, 01003, United States, jmsmith@ecs.umass.edu

The Steiner Minimal Tree (SMT) problem determines the minimal length tree network for connecting a given set of vertices in 3-dimensional space. SMTs are also useful in modelling minimum energy configurations such as though in proteins. With the SMT topologies, we can define planes within the amino acids and in the backbone topology that have a surprising regularity property. Computational experience with these twist angle properties is demonstrated for the protein folding problem.

■ SC44

R - 4th Floor, Parc Ballroom III

Vehicle Routing

Sponsor: INFORMS Computing Society
Sponsored Session

Chair: Edward Wasil, Professor of Management Science, American University, Kogod School of Business, Washington, DC, 20016, United States, ewasil@american.edu

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

1 - Multiple-Penalty Compressed Annealing with Application to the VRPTW

Jeffrey Ohlmann, Assistant Professor, Department of Management Sciences, University of Iowa, Iowa City, IA, 52242, United States, jeffrey-ohlmann@uiowa.edu, Barrett Thomas

This talk describes a variant of simulated annealing incorporating a variable penalty method with multiple penalty multipliers. After an analytic discussion of the behavior of this stochastic search algorithm, we consider its application to the VRPTW. We relax time window constraints and vehicle capacity constraints with two distinct penalty terms. Appropriately varying the two corresponding penalty multipliers, we search the relaxed solution space for the optimal solution.

2 - An Efficient Variable Neighborhood Search Heuristic for Huge Scale Vehicle Routing Problems

Michel Gendreau, Professor, Center for Research on Transportation, University of Montreal, Montreal, Canada, michelg@crt.umontreal.ca, Olli Braysy, Jari Kytojoki, Teemu Nuortio

We present a variable neighborhood search heuristic for the capacitated VRP that is specifically aimed at solving very large scale real-life instances. Computational results on existing benchmarks, as well as on 20 new huge scale instances, show that the method can find high-quality solutions for instances with up to 20,000 customers within reasonable CPU times.

3 - A New Heuristic and Test Problems for the Vehicle Routing Problem with Split Deliveries

Si Chen, Robert H. Smith School of Business, University of Maryland, College Park, MD, 20742, United States, Si_Chen@rhsmith.umd.edu, Bruce Golden, Edward Wasil

In the split delivery vehicle routing problem (SDVRP), a customer's demand can be split between two or more vehicles. We describe a new heuristic for the SDVRP that is based on integer programming and apply it to test problems taken from the literature and to new benchmark problems that we have developed. The computational results indicate that our new heuristic generally outperforms well-known SDVRP heuristics including tabu search.

4 - Solving the Open Vehicle Routing Problem: New Heuristic and Test Problems

Feiyue Li, Department of Mathematics, University of Maryland, College Park, MD, 20742, United States, lify@math.umd.edu, Edward Wasil, Bruce Golden

In the open vehicle routing problem (OVRP), a vehicle does not return to the depot after servicing the last customer on a route. We describe a new heuristic for the OVRP that is based on record-to-record travel and apply it to sixteen test problems taken from the literature and to new benchmark problems that we have developed. The computational results indicate that our new heuristic performs well when compared to existing OVRP heuristics including threshold accepting and tabu search.

■ SC45

R - 4th Floor, Raphael

Vehicle Routing

Sponsor: Transportation Science & Logistics
Sponsored Session

Chair: Karen Smilowitz, Northwestern University, 2145 Sheridan Rd, Dept of IE/MS, Evanston, IL, 60208, United States, ksmilowitz@northwestern.edu

1 - Vehicle Routing Problem with Time Windows

Marius Solomon, College of Business Administration, Northeastern University, m.solomon@neu.edu, Brian Kallehauge, Jesper Larsen, Oli B.G. Madsen

In this paper we discuss advances in the column generation approach for Vehicle Routing Problem with Time Windows. We address cuts, master problem acceleration strategies and the subproblem solution and report recent computational results for the classic Solomon test sets.

2 - Seaport Drayage Routing Given a Time Slot Appointment System
Rajeev Namboothiri, Georgia Tech, rnamboot@isye.gatech.edu, Alan Erera

We study truck operations for a seaport drayage company serving a port where access is controlled via a time-dependent slot appointment system. For a given operational period, the drayage company is allotted a fixed number of container gate moves during each half-hour time slot during the day. We develop heuristic algorithms based on column generation for determining near-optimal container slot selections and truck routing plans.

3 - The Pickup and Delivery Problem Split Loads
Maciek Nowak, mnowak@georgiasouthern.edu, Ozlem Ergun, Chelsea C. White, III

We generalize the Pickup and Delivery Problem to allow for multiple vehicles to service a common load requiring delivery. We find the upper bound on the benefit of allowing split loads. A heuristic is developed to solve large scale problems, with experimental results supporting the structural results. Finally, the heuristic is applied to a real world problem.

4 - The Multiple Choice Elementary Constrained Shortest Path Problem
Karen Smilowitz, Northwestern University, 2145 Sheridan Rd, Dept of IE/MS, Evanston, IL, 60208, United States, ksmilowitz@northwestern.edu, Guangming Zhang

This paper considers a variation of the Elementary Constrained Shortest Path Problem (ECSPP) in which nodes are separated into subsets and a feasible path through the network may contain at most one node from each subset. This problem arises as a subproblem in a column generation solution method for a variation of the vehicle routing problem.

■ SC46

R - 4th Floor, Rubens

Urban Transportation Planning Models III: Travel Demand Experiments and Models

Sponsor: Transportation Science & Logistics
Sponsored Session

Chair: Shinya Kikuchi, Professor, University of Delaware, Civil and Environmental Engineering, Newark, DE, 19716, United States, kikuchi@ce.udel.edu

1 - Observability and Path Choice in Urban Networks
George List, Professor, Rensselaer Polytechnic Institute, JEC 4052, 110 Eighth St, Troy, NY, 12180, United States, listg@rpi.edu

GPS and RFID make it possible for vehicles to become probes. Flow patterns can be observed in real time. Optimal decisions can be made about signal timing, variable message signs, tolls, route guidance, etc. In an ATIS experiment, a fleet of 200 vehicles shared data about network congestion and made real time path choice decisions. New paths avoided incidents and congestion. This presentation describes the experiment, results, and challenges ahead.

2 - Improved Sampling and Prediction Techniques for Spatial Econometric Models
Chris Frazier, Analyst, PB Consult, 6100 Uptown Blvd. NE, Albuquerque, NM, 87110, United States, rawls@pbconsult.com

Due to the large computational demands of spatial econometric models, sampling is often necessary for feasible model estimation. This paper examines a sampling technique which exploits the assumptions of spatial econometric models by breaking the region being modeled down into smaller, more localized areas. Also explored is utilizing the model results for predictions, as well as how this sampling method compares with random techniques. Results for population and land use models are presented.

3 - Sensitivity Analysis of the Combined Travel Demand Model with Applications
Zhong Zhou, Ph.D Student, Civil and Environmental Engineering Department, Utah State University, Logan, UT, 84341, United States, zhongzhou@cc.usu.edu, Chao Yang, Anthony Chen

A sensitivity analysis for the combined travel demand model will be presented in this talk. Analytical expressions are explicitly derived for Oppenheim's model, which combines travel-destination-mode-route choice. Applications of the sensitivity expressions will also be presented.

■ SC47

R - 4th Floor, Michelangelo

Optimization in Airline Planning I

Sponsor: Transportation Science & Logistics
Sponsored Session

Chair: Diego Klabjan, Professor, University of Illinois at Urbana-Champaign, 1206 West Green Street, Urbana, IL, 61801, United States, klabjan@uiuc.edu

1 - Robust Fleet-assignment and Crew Integrated Planning Imposing Station Purity
Chungua Gao, Georgian Institute of Technology, 765 Ferst Drive, Atlanta, GA, United States, cgao@isye.gatech.edu, Ellis Johnson, Barry Smith

We study integrated fleet-assignment and crew planning problems, aiming at developing robust solutions relative to operations. Fleet purity and crew base purity are imposed, by limiting the number of fleet types and crew bases allowed to serve each airport. Taking advantage of airline network structure, the station decomposition method is extended to solve the problem, where the spoke plan includes connections, fleet type and crew base type assignment. Computational results are presented.

2 - Faster Pairing Solver by Solving Multiple Shortest Paths Simultaneously
Curt Hjorring, Carmen Systems, Odinsgatan 9, SE-411 03, Gothenburg, Sweden, curt.hjorring@carmensystems.com, Johan Ivarsson

The current practice at airlines is to solve a crew pairing problem for a single planned timetable. On the actual day of operation many changes to the timetable occur, due to mechanical failures, weather, and crew sicknesses. In this work we investigate various approaches that attempt to take this timetable uncertainty into account, and evaluate their effectiveness by running a simulation of the airline's operations, along with various recovery options. Over the last 20 years CPU performance has increased by 50% per year, while main memory speed has only increased by 7%. This relative slow down in memory speed has been partially compensated for by the addition of caches. However, for many programs the bottleneck is now memory access. We show that Carmen's pairing pricing algorithm is memory bound, but can be reorganised to significantly reduce the number of memory accesses, and thus improve overall performance.

3 - Dynamic Airline Scheduling: Models and Algorithms
Hai Jiang, MIT, 77 Massachusetts Ave, Room 1-235D, Cambridge, MA, United States, haijiang@mit.edu, Cynthia Barnhart

We develop flight schedule and fleet assignment models and methods to adjust airline networks dynamically during the booking process to adjust market capacity to match passenger demand. We utilize data from revealed and future demand forecasts and conduct experiments to investigate the benefits of our models and methods.

4 - Collaborative Logistics in the Air Cargo Industry
Lori Houghtalen, Ozlem Ergun, Joel Sokol

What are the characteristics of a profitable alliance among carriers and forwarders in the air cargo industry? We use various revenue allocation mechanisms and combinations of collaborators (carriers only, forwarders only, or both) to explore different alliance structures. First we determine, for a given network, a system optimal flow. We then vary system parameters (such as penalties paid by a carrier for the use of another carrier's leg, or capacity available to a specific forwarder) to achieve an equilibrium revenue allocation among collaborators.

■ SC48

R - 4th Floor, Dante

Healthcare Decision Making

Sponsor: Health Applications
Sponsored Session

Chair: Liam ONeill, Asst Prof, Cornell University, 105 MVR Hall, PAM Dept., Ithaca, NY, 14853, United States, lo22@cornell.edu

1 - A Decision Analytic Model to Identify High-Cost, Uninsured Patients
Jami DelliFraine, jami.dellifraine@med.va.gov, Tiffany Radcliff, Murray Côté

We use internal claims and accounting data for calendar years 1999-2001 from a representative safety net facility to describe the distribution of costs and any characteristics that distinguish high-cost cases from other uninsured patients. Based on this data, we develop a decision analytic model to identify these high-cost, uninsured patients.

2 - Integrating DEA and GIS as Tools for Hospital Marketing
Liam ONeill, Asst Prof, Cornell University, 105 MVR Hall, PAM Dept., Ithaca, NY, 14853, United States, lo22@cornell.edu, Franklin Dexter

While some US hospitals have excess capacity, others are over-extended, without evidence that this relates to the latter providing higher quality or lower cost care. In this paper, Data Envelopment Analysis (DEA) is used to assess hospitals' "market capture" for inpatient, elective surgery. Geographic Information Systems (GIS) are used to identify geographic patterns of patient choice of hospitals, as well as the relative competitiveness of rural hospital markets.

3 - Bayesian Methods for Predicting Anesthesia and Radiological Times
Franklin Dexter, Professor, University of Iowa, Dept. of Anesthesia, Iowa City, IA, 52242, United States, franklin-dexter@uiowa.edu

Some radiological procedures rely on general anesthesia. Inaccurate anesthesia times for radiology hindered integration of anesthesia into enterprise-wide scheduling for radiology. Anesthesia times estimated by expert judgment had better face validity, internal consistency, and accuracy. Bayesian methods were also developed and validated to estimate upper and lower prediction bounds from the expert estimates. Bayesian methods were also accurate for operating room times.

4 - Calibrating an Individual Health Evolution Model for Long-term Care Decisions

Aparna Gupta, Asst Prof, Rensselaer Polytechnic Institute, 110 Eighth Street, Troy, NY, 12180, United States, guptaa@rpi.edu, Zhisheng Li

Quantifying uncertainties in the evolution of an individual's health is essential for planning of long-term healthcare financing. After constructing a comprehensive health indicator index and a health risk factor system, this paper calibrates a stochastic health evolution model using the National Health Interview Survey data.

■ SC49

R - 4th Floor, Medici

Using the Precise Decision Language

Sponsor: Decision Analysis
Sponsored Session

Chair: Ron Howard, Professor, Stanford University, Terman Engineering Center 700-420, Stanford, CA, 94305-4026, United States, rhoward@sdg.com

1 - Learning, Teaching, and Using the Precise Decision Language

Ali Abbas, Assistant Professor, UIUC, 104 S Matthews Ave, Urbana, IL, 61801, United States, aliabbas@Stanford.edu

In this talk I will present my views learning the Precise Decision Language, then teaching it to graduate students at Stanford and UIUC, as well teaching it to high school students and high school math teachers with the Decision Education Foundation, and also to business executives.

2 - Experiential Learning and Strictly Proper Scoring Rules

Eric Bickel, Assistant Professor, Department of Industrial and Systems Engineering, Texas A&M University, 236B Zachry Engineering Center, 3131 TAMU, College Station, TX, 77843-3131, United States, ebickel@tamu.edu

Experiential learning is perhaps the most effective way to teach decision making. One such example of this is the scoring method used for exams in some decision analysis programs. This grading scheme is strictly proper and provides great insight into students' understanding of course material. We will discuss the properties of this scoring rule and demonstrate the insights that can be achieved by both students and instructors.

3 - Decision Concepts and Language in Practice

Ron Howard, Professor, Stanford University, Terman Engineering Center 700-420, Stanford, CA, 94305-4026, United States, rhoward@sdg.com

Organizations often confuse information issues and preference issues. Boards finding an alternative "too risky" may question either its characterization or their willingness to take on an alternative so characterized. Characterization concerns may be that "the probability of success is too high" or "the probability of failure is too low". With appropriate characterization, the question is desirability given company risk preference: "whether they have the stomach for it".

4 - Decision Analysis Terminology

Ross Shachter, Associate Professor, Stanford University, Terman Eng Ctr 416, 380 Panama Street, Stanford, CA, 94305-4026, United States, shachter@stanford.edu

I teach decision analysis to a class, including freshman undergraduates and graduate students in industry, using Ron Howard's lecture notes. Clarity in language plays a central role in the course and it applies to the course content as well. I will reflect on my experiences and some challenges we face.

■ SC50

R - 4th Floor, Cervantes

Risk Analysis vs. Decision Analysis

Sponsor: Decision Analysis
Sponsored Session

Chair: Robin Dillon Merrill, Assistant Professor, Georgetown University, McDonough School of Business, 418 Old North, Washington, DC, 20057, United States, rld9@georgetown.edu

1 - Using Decision and Risk Analysis for Managing Low Probability Events

Howard Kunreuther, Cecilia Yen Koo Professor, 556 & 559 Jon M. Huntsman Hall, 3730 Walnut Street, Philadelphia, PA, 19104-6340, United States, kunreuth@wharton.upenn.edu

In evaluating alternatives for low probability high consequence events, limited available data to estimate the risks often leads to disagreements among experts. This talk illustrates the role that catastrophe models can play in characterizing the nature of the uncertainties associated with these risks and reconciling expert differences. Risk and decision analysts can then develop and choose between strategies for managing the risks associated with natural and technological hazards.

2 - Speaking the Truth in Maritime Risk Assessment

Jason Merrick, Associate Professor, Virginia Commonwealth University, P.O. Box 843083, 1001 W. Main St., Richmond, VA, 23284, United States, jrmerric@vcu.edu, Rene van Dorp

Several major risk studies have been performed in recent years in the maritime transportation domain. However, the National Research Council found our approach to be promising but incomplete, as the uncertainty in its results was not assessed. We combine two previously developed pieces of methodology to perform a full-scale assessment of risk and uncertainty for two case studies, studies of ferries in San Francisco Bay and the Washington State Ferries.

3 - Evaluating the Viability of 100 Percent Container Inspection at America's Ports

Susan Martonosi, MIT, sem18@mit.edu

As US maritime security adapts to the terrorist threat, we argue that quantitative analysis should be used to evaluate security initiatives and present a case study of one proposed measure - 100% scanning of containers entering the US. By assessing the minimum attack likelihood required to justify increased inspection costs, we conclude that 100% scanning is cost effective only if the attack damages or likelihood of an attack are quite high.

4 - Interpreting Near-Miss Events

Robin Dillon Merrill, Assistant Professor, Georgetown University, McDonough School of Business, 418 Old North, Washington, DC, 20057, United States, rld9@georgetown.edu

We examine how, why, and to what degree project managers incorporate precursor events (specifically, near-misses) into their decision-making process at key points in a program or mission, and whether an attention to these near-miss events influences interpretations of probabilities and propensity towards risk. This research will present results from a NASA-sponsored series of student experiments where the decision-maker had to make daily operations decisions for a Mars rover.

Sunday, 4:30pm - 6:00pm

■ SD01

H - Lobby Level, Plaza A

Tutorial: Therapeutic Optimization via Markov Decision Processes

Cluster: Tutorials
Invited Session

1 - Tutorial: Therapeutic Optimization via Markov Decision Processes

Andrew Schaefer, Assistant Professor, University of Pittsburgh, Department of Industrial Engineering, Pittsburgh, PA, United States, schaefer@ie.pitt.edu

Models that create patient-specific treatment plans, known as therapeutic optimization models, are becoming increasingly important. In this tutorial, we describe how an enormous number of such decisions occur in a stochastic and dynamic environment, and lend themselves naturally to Markov decision process (MDP) formulations. We discuss various questions that arise in applying MDPs to practical therapeutic optimization problems, such as parameter estimation and structural properties. Finally, we describe ways of developing research relationships with clinicians.

■ SD02

H - Lobby Level, Plaza B

Nicholson Student Paper Prize Competition, II

Cluster: Nicholson Student Paper Prize
Invited Session

Chair: Pinar Keskinocak, Associate Professor, Georgia Institute of Technology, School of Industrial and Systems, 765 Ferst Drive, Atlanta, GA, 30345, United States, pinar@isye.gatech.edu

Nicholson Student Paper Prize

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.

1- Large Scale Semidefinite Programming with a Saddle Point Mirror-prox Algprithm

Zhaosong Lu,Zeev Nehari Visiting Assistant Professor, Carnegie Mellon University, Department of Mathematical Sciences, Pittsburgh PA 15213-3890, United States, zhaolu@andrew.cmu.edu

We first demonstrate that positive semidefiniteness of a large well-structured sparse symmetric matrix can be represented via positive semidefiniteness of a bunch of smaller matrices linked, in a linear fashion, to the matrix. We derive also the "dual counterpart" of the outlined representation, which expresses the possibility of positive semidefinite completion of a well-structured partially defined symmetric matrix in terms of positive semidefiniteness of a specific bunch of fully defined submatrices of the matrix. Using the representations, we then reformulate well-structured large-scale semidefinite problems into smooth convex-concave saddle point problems, which can be solved by a Prox-method developed by Nemirovski (2004) with efficiency {\cal O}(\epsilon^{-1}). Implementations and some numerical results for large-scale Lov{\'a}sz capacity and MAXCUT problems are finally presented.

2- Two-Stage Robust Network Flow and Design under Demand Uncertainty

Muhong Zhang,University of California-Berkeley, 4141 Etcheverry Hall, Berkeley CA 94720, United States, mhzhang@ieor.berkeley.edu

Abstract not available at this time.

■ SD03

H - Ballroom Level, Continental Ballroom 1

Teaching Case Competition II

Sponsor: Education (INFORM-ED)
Sponsored Session

Chair: Tasha R. Inniss, Assistant Professor of Mathematics, Spelman College, 350 Spelman Lane, SW, Box 320, Atlanta, GA, 30314-4399, United States, TInniss@spelman.edu

1 - Presentations of Finalists #3 and #4 for the Sixth Annual INFORMS Case Competition

Tasha R. Inniss, Assistant Professor of Mathematics, Spelman College, 350 Spelman Lane, SW, Box 320, Atlanta, GA, 30314-4399, United States, TInniss@spelman.edu

The four finalists for the 2005 INFORMS Case Competition will deliver final presentations of their cases to a panel of judges and the audience. All are welcome to attend and observe these presentations as well as to ask questions of the finalists. The winner of the competition will be selected by the judges at the end of the four presentations. The winner and runners-up will be announced at the INFORM-Ed Annual Business Meeting in San Francisco.

■ SD05

H - Ballroom Level, Continental Ballroom 3

New Applications of Revenue Management

Cluster: Service Sector Operations
Invited Session

Chair: Diwakar Gupta, Professor and IE Director of Graduate Studies, University of Minnesota, Department of Mechanical Engineering, Minneapolis, MN, 55455, United States, guptad@me.umn.edu

1 - Revenue Management in Railways - Current Status and Future Directions in Indian Railways

Goutam Dutta, Professor, Indian Institute of Management Ahmedabad, Ahmedabad-380 015, Gujarat, India, goutam@iimahd.ernet.in

This paper starts with a survey of revenue management in railways. It discusses two major success stories in Europe (SNCF and Deutche Bahn). In the third part, it discusses the current practices of revenue management in the second largest railway in the world, Indian Railways. The paper concludes with the scope of application of future research in this area of transportation industry in the Indian context.

2 - Revenue Management for a Primary Care Clinic

Diwakar Gupta, Professor and IE Director of Graduate Studies, University of Minnesota, Department of Mechanical Engineering, Minneapolis, MN, 55455, United States, guptad@me.umn.edu, Lei Wang

Patients calling to book appointments at a primary care clinic make different choices. Some want an appointment on the same day, others prefer to schedule one for a future date; some visit only their designated doctor, others visit any doctor at the convenient time. This talk will describe various models for managing appointment systems to maximize clinic revenue. We also study the effect of patient loyalty, load imbalance and physicians' willingness to flex capacity.

3 - Profit Maximization in a B2B Cargo Overbooking Problem

Lama Moussawi, Ph.D. Candidate, The University of Texas at Dallas, 2601 N. Floyd Rd., SM30, School of Management, Richardson, TX, 75080, United States, lam018100@utdallas.edu, Metin Cakanyildirim

We formulate a two dimensional cargo overbooking problem. We discuss the weight and volume dependent revenues and costs. We show that the detailed problem is bounded and we provide formulations for the lower and upper bound problems. We solve the lower and upper bound models, compare their optimal solutions and perform a simulation to analyze their performances. Our results indicate that the lower bound model is a good approximation of the detailed model and is easy to implemented in practice.

4 - Allocation Policies based on Demand Aggregation in an Assemble-to-Order System

Fernando Bernstein, Associate Professor, Duke University, The Fuqua School of Business, 1 Towerview Drive, Durham, NC, 27708, United States, fernando@mail.duke.edu, Gregory DeCroix, Yulan Wang

We consider an assemble-to-order system where one or more components are common to multiple products. The common components are allocated based on demands and contribution margins for the products. We propose a collection of allocation mechanisms that differ in how demands are aggregated and satisfied, and explore their impact on sales revenues.

■ SD06

H - Ballroom Level, Continental Ballroom 7

Managing Spreadsheet Risks

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 - Verifying Documentation Standards in Spreadsheet Analysis

Larry LeBlanc, Professor, Vanderbilt University, Owen Graduate School of Management, 401 21st Avenue South, Nashville, TN, 37203, United States, Larry.Leblanc@owen.vanderbilt.edu, Michael Galbreth

We describe VBA procedures for verifying documentation in Excel spreadsheet models. These include cell comments that accurately reflect the formulas in the corresponding cells, appropriate borders and shading, and (in the case of optimization models) correct Solver options. The procedures mark all cells not meeting the required standards for further evaluation by the instructor. This approach enables the instructor to check the documentation of student spreadsheet models very efficiently.

2 - Developing an Auditing Protocol for Spreadsheet Models

Stephen Powell, stephen.g.powell@dartmouth.edu

We report on a detailed, step-by-step auditing protocol we are developing and testing for auditing spreadsheets. The protocol uses two software tools (Spreadsheet Professional and XLAnalyst) to assist the auditor in locating potential errors. Our research is designed ultimately to provide insight into which auditing procedures, used in what sequence and combination, are most effective across a wide range of spreadsheet applications.

3 - Operations Research, Meet the Sales Force! Designing a Spreadsheet Tool That Even a Spreadsheet Neophyte Can Use

Susan Cholette, San Francisco State University, cholette@sfsu.edu

A third-party logistics provider for direct-to-consumer wine shipments needed to demonstrate their value to prospective clients. The author developed a spreadsheet model to quantify potential cost savings based on industry data and user inputs. The primary users were to be sales reps, who would not be proficient with the model itself. Also, the tool was intended for field use during customer calls to provide an immediate on-site analysis. Thus the tool had to be made as simple and as foolproof as possible, and the author will share some of the techniques used in its design and maintenance.

4 - The Relevance of Human Factors to the Management of Spreadsheet Risks

S. Thorne, University of Wales Institute Cardiff, sthorne@uwic.ac.uk, D. Ball

Human Factors, Overconfidence and Complexity may all contribute to poor quality spreadsheet models. We consider human factors affect a simplified development cycle and what the potential consequences may be. The relationship between systems failure in End User Development (EUD) (e.g. spreadsheets) and human factors is then highlighted. We scrutinize the human/computer relationship to demonstrate the need for alternative development methods in EUD and review a proposed concept of interaction that exploits machine-learning techniques via Example Driven Modelling (EDM).

■ SD07

H - Ballroom Level, California

The Interface Between Operations Management and Finance

Sponsor: Manufacturing & Service Oper Mgmt
Sponsored Session

Chair: Nicola Secomandi, Assistant Professor of Operations Management & Manufacturing, Tepper School of Business, Carnegie Mellon University, 5000 Forbes Avenue, Pittsburgh, PA, 15213, United States, ns7@andrew.cmu.edu

1 - Operational Hedge under Global Competition
Ping Su, Olin School of Business, Washington University in St. Louis, St. Louis, MO, 63130, United States, sup@olin.WUSTL.EDU, Panos Kouvelis, Lingxiu Dong

We study the effect of operational hedge for a global firm who has a competitor in the foreign market. The firm has to invest in capacity in the face of the currency exchange rate uncertainty and the competition uncertainty in the foreign market. We study how operational flexibility (hedge) affects the competition equilibrium in this global environment.

2 - The Interaction of Resource Flexibility and Financial Hedging under Costly External Financing
Onur Boyabatli, INSEAD, Boulevard de Constance, Fontainebleau, France, onur.boyabatli@insead.edu, Beril Toktay

This paper analyzes the interaction between resource flexibility and financial risk management under costly external financing. Our analysis contributes to the understanding of the role of resource flexibility as part of a firm's overall risk management strategy. We delineate the value and limitations of resource flexibility in the firm's overall risk management strategy, identify its impact on a firm's financial risk management strategy, and quantify its value under financial constraints.

3 - Shipper Valuation and Hedging of Network Contracts for Natural Gas Pipeline Transport Capacity
Nicola Secomandi, Assistant Professor of Operations Management & Manufacturing, Tepper School of Business, Carnegie Mellon University, 5000 Forbes Avenue, Pittsburgh, PA, 15213, United States, ns7@andrew.cmu.edu, Xiaofang Wang

In the U.S., natural gas shippers buy the commodity at supply market hubs and contract with pipeline companies to transport it to demand market hubs where they sell it. We develop models to value and hedge pipeline network contracts, consisting of multiple receipt points directly connected to multiple delivery points.

■ SD08

H - Ballroom Level, Imperial A

Inventory Management

Sponsor: Manufacturing & Service Oper Mgmt
Sponsored Session

Chair: Doug Thomas, Penn State, 463 Business Building, University Park, PA, 16802, United States, dthomas@psu.edu

1 - Virtual Pooling with Multiple In-Cycle Transshipments
Nagihan Comez, Ph.D Student, The University of Texas at Dallas, 2601 N Floyd Rd, SM 30, School of Management, Richardson, TX, 75083-0688, United States, nxc023100@utdallas.edu, Metin Cakanyildirim, Kathryn E. Stecke

We study two retailers, replenished periodically. A retailer may get transshipment from the other retailer not to incur backlog delay cost, but incurs a transshipment delay cost due to transshipment time. Allowing transshipments any time during the period, one question is when to request a transshipment and when to accept one. We show that there exists an interesting non-stationary transshipment policy. The model is altered by end of cycle holding costs, which induces more a dynamic policy.

2 - Inventory and Effort Choice with Sales Agents
David Huff, Penn State University, 436 Business, Smeal College of Business, University Park, PA, 16802, United States, dhuff@psu.edu, Phil Lederer

We model dependencies between inventory levels and sales-force compensation. We present a single-agent two-way moral hazard model with effort-driven demand and a supply constraint. We derive closed-form solutions and find comparative statics that run counter to those of previous research that ignored supply constraints. Next we study a multiple-agent model. Here commission rates sometimes respond differently to parameter changes when compared to the single-agent model.

3 - Computing Optimal Policies in Generalized Joint Replenishment
Dan Adelman, Professor, University of Chicago, Graduate School of Business, 5807 South Woodlawn Ave., Chicago, IL, 60637, United States, dan.adelman@gsb.uchicago.edu, Diego Klabjan

We present the first known algorithm for computing epsilon-optimal policies for the generalized joint replenishment problem.

4 - Inventory Management with Retail Pre-Packs
Doug Thomas, Penn State, 463 Business Building, University Park, PA, 16802, United States, dthomas@psu.edu, Long Gao, Mike Freimer

The use of prepacks (batch orders) is a common practice in the retail industry because of efficiencies in shipping and handling. We develop optimal inventory strategies involving prepacks containing one or several products, and we use these results to address issues in prepack design.

■ SD09

H - Ballroom Level, Yosemite A

Dynamic Models of Imperfect Competition III

Cluster: Supply Chain Management
Invited Session

Chair: Benjamin Van Roy, Stanford University, Terman 315, Stanford University, Stanford, CA, 94305-4023, United States, bvr@stanford.edu

1 - Dynamic Competition under Supermodularity
Hyun-soo Ahn, Ross School of Business, University of Michigan, D8203 701 Tappan Street, Ann ARbor, MI, 48109, United States, hsahn@umich.edu, Tava Olsen

We consider a general non-linear framework for competition in a stochastic multi-period setting. Unlike traditional models in the operations literature, we do not assume a linear structure for costs and state transitions. We prove the existence of a Markov perfect Nash equilibrium and demonstrate supermodular properties of this equilibrium. We show how these properties lead to insights regarding operational decisions.

2 - Information Acquisition in a Limit Order Market
Uday Rajan, Ross School of Business, University of Michigan, 701 Tappan Street, Ann Arbor, MI, 48109, United States, urajan@umich.edu, Ronald Goettler, Christine Parlour

We model a market for a financial asset as a dynamic stochastic game with asymmetric information. The asset has both a common and a private value. Traders choose whether to buy information about the common value. On arriving at the market, they may post prices or accept previously posted prices. Traders with unexecuted orders randomly reenter the market to change their orders. We numerically solve for the equilibrium of the trading game and characterize equilibria with information acquisition.

3 - Finite State Dynamic Games With Assymetric Information: A Framework for Applied Work
Ariel Pakes, Department of Economics, Harvard University, Rm. 117 Littauer Center, Cambridge, MA, 02138, United States, ariel@ariel.fas.harvard.edu, Chaim Fershtman

The paper presents a framework for the applied analysis of dynamic games with asymmetric information. The framework consists of a definition of equilibrium, and an algoirthm to compute it. For specificity we present our results in the context of a dynamic oligopoly game with collusion in which the outcome of firms' investments are random and only observed by the inverting agent.

■ SD10

H - Ballroom Level, Yosemite B

Pricing, Capacity and Competition in Supply Chains

Cluster: Supply Chain Management
Invited Session

Chair: Candace Yano, Professor, UC Berkeley, 4141 Etcheverry Hall, Berkeley, CA, 94720-1777, United States, yano@ieor.berkeley.edu

1 - Strategic Dynamic Sourcing from Competing Suppliers: The Value of Commitment
Cuihong Li, Assistant Professor, University of Connecticut, School of Business, 2100 Hillside Road, Storrs, C, 06269, United States, Cuihong.Li@business.uconn.edu, Laurens Debo

Building a long-term relationship by committing to source from a single supplier over time is risky for a buyer. Without commitment, the buyer has the option to switch, at a certain cost, to a more efficient supplier. We develop a model that analyzes when a buyer, facing uncertainty about market demand and supplier cost, should commit to source from a single supplier over a long term.

2 - Effect of Slotting Fees on Variety and Supplier Competition
Roman Kapuscinski, University of Michigan, 701 Tappan St., Ann Arbor, MI, United States, Roman.Kapuscinski@umich.edu, Ravi Anupindi, Ling Wang

We investigate how slotting fees affect product variety offered by retailer. We consider a game, where retailer decides on slotting fees first. Then, sequential entry decisions of two asymmetric suppliers follow. We find that the slotting fees typically lead to smaller variety and an increase in the total channel profit under certain conditions.

3 - Incentive Alignment through Performance Based Logistics (PBL)
Serguei Netessine, Assistant Professor, University of Pennsylvania, 3730 Walnut St. Suite 500, Philadelphia, PA, 19104, United States, netessin@wharton.upenn.edu, Sang-Hyun Kim, Morris Cohen

Performance Based Logistics (PBL) is reshaping service parts supply chain management in the defense industry. We formulate a principal-agent model of backorder-based resource allocation problem and compare several widely-used contracts including PBL. We provide managerial insights on the impact of environmental characterstics, especially of the role of cost and performance uncertainties.

4 - Supplier Pricing of National and Store Brands under Capacity Constraints
Candace Yano, Professor, UC Berkeley, 4141 Etcheverry Hall, Berkeley, CA, 94720-1777, United States, yano@ieor.berkeley.edu

We consider a supply chain with a retailer that sells a store brand and a competing national brand. The supplier of the national brand independently sets its price recognizing competition from the national brand. The supplier of the store brand sets its wholesale price, possibly under the influence or control of the retailer. The retailer sets prices to optimize total profit from both products. We examine optimal pricing by the suppliers when both suppliers are capacity constrained.

■ SD11

H - Ballroom Level, Yosemite C

Pricing Strategies in Supply Chain Management

Contributed Session

Chair: Felipe Villegas, University of Edinburgh, 231 Nithsdale Road, Glasgow, G415HA, United Kingdom, f.a.villegas-moran@sms.ed.ac.uk

1 - Vendor-Buyer Coordination for Multiple Items using Volume and Quantity Discounts
Ajay Mishra, Assistant Professor, SUNY-Binghamton, School of Management, Binghamton, NY, 13902, United States, amishra@binghamton.edu

We study the sales of multiple items by a vendor to a buyer in a deterministic environment. The vendor and buyer incur procurement, ordering or order processing, and holding costs. The buyer's demand is known but price-sensitive. We study the use of volume discounts and quantity discounts from the supplier to improve channel profits and share the gains. In addition, we study coordination when joint replenishment costs are also incurred.

2 - Supply Chain Coordination with Sales Promotions and Price Contracts
Jiang Zhang, Assistant Professor, School of Business, Adelphi University, Garden City, NY, 11530, United States, zhang@adelphi.edu, Joseph Szmerekovsky

We develop models for determining equilibrium marketing and investment efforts for manufacture and retailer of a supply chain. Manufacture uses co-op promotion mechanism to motivate sales at the retailer and promotes its product nationally and help develop brand knowledge and preference. Retailer's local promotion brings actual sales. We address the impact of band name investments, local promotion, price deduction on co-op programs in these models.

3 - Analyzing Terminal Pricing Strategies for Petroleum Supply Chains
Hui Wang, Cornell University, School of ORIE, Cornell University, Rhodes Hall, Ithaca, NY, 14853, United States, hwang@orie.cornell.edu, Jack Muckstadt, John Muckstadt, Jr

In a petroleum supply chain, terminals' prices can greatly impact their spot sales. If over priced, a terminal may suffer insufficient demand; otherwise if under priced, it may run out on spot sales and fail to meet contractual obligations. We will examine response patterns of spot demand to price, analyze the impact of various pricing strategies, and present models which determine the optimal prices that maximize spot revenue while not undermining the contractual business.

4 - Group Buying: Volume Discounted and Combinatorial Cases
Ertunga Ozelkan, Professor, University of North Carolina at Charlotte, 9201 University City Blvd, Charlotte, NC, 28223, United States, ecozelka@uncc.edu

Group-buying is a business process that brings small businesses together to increase their buying power. This paper provides a mathematical programming model for group-buying in a B2B framework for volume discounted and combinatorial procurement cases. The objective is to identify the suppliers and the procurement quantities such that total procurement cost is minimal while the customer demand is met and additional business requirements are satisfied.

5 - Transfer Pricing in Multinational Supply Chains, Under Duty Drawback and Transport Costs
Felipe Villegas, University of Edinburgh, 231 Nithsdale Road, Glasgow, G415HA, United Kingdom, f.a.villegas-moran@sms.ed.ac.uk

Multinational Supply Chains (MNSC) operate in more than one tax jurisdiction with the problem to decide on trade flows of products and services, transfer prices and transport cost between their divisions and facilities. They should optimise profits given corporate and governmental parameters such as dividends and royalties, subsidiaries' ownership, income taxes, duties and quotas, etc. This research generalizes and extends the Theory of the Multinational Firm for the particular case of MNSC.

■ SD12

H - 4th Floor, Union Square 1

Special Topics in Auction/Bidding

Contributed Session

Chair: Shanshan Hu, Ph.D Candidate, University of Michgan, Business School, 701 Tappan Street D2201, Ann Arbor, MI, 48104, United States, husz@bus.umich.edu

1 - A Branch and Price Algorithm for CAMBO
Dries Goossens, K.U.Leuven, Naamsestraat 69, Leuven, 3000, Belgium, Dries.Goossens@econ.kuleuven.be, Frits Spieksma

In combinatorial auctions, bidders are allowed to bid on sets of items. It is well-known that the winner determination problem for these auctions is NP-hard, and that, in the unrestricted case, the bid data are of exponential size. Day (2004) presented a restricted-preference combinatorial auction using matrix bids with order (CAMBO). We present a branch-and-price algorithm for the CAMBO winner determination problem, and show that the corresponding pricing problem is a shortest path problem.

2 - Brand Valuation-case Study of Crocin-was it a Best Buy?
Raghavi Pampule, Rajesh Srivastava

If the valuation techniques are straitjacketed then why do different buyers pay different values for the same asset? Consider the above case, the most talked about deal i.e. the takeover of the Brand Crocin by Glaxo SmithKline, for Rs 45 Crore.

3 - Modeling and Analysis of a Logistics Auction Market
Semra Agrali, University of Florida, Department of Industrial and Systems Engineering, Gainesville, FL, United States, sagrali@ufl.edu, Baris Tan, Fikri Karaesmen

We consider a logistics market where the orders from a number of customers with goods to transport to various destinations are matched with carriers through a reverse auction. In order to analyze the effects of various system parameters on the transportation costs, we develop a queueing-based stochastic model. We then evaluate various performance measures in the steady state. We discuss various estimation and implementation issues in an application at an industrial zone in Turkey.

4 - Antecedents of Online Auction Bidding Behaviors: A Fuzzy Set Theory Approach
Jennifer Zhang, Assistant Professor, University of Toledo, 2801 W. Bancroft St. MS#103, Toledo, OH, 43615, United States, jennifer.zhang@utoledo.edu, Ilya Lipkin

To analyze the bidders' behaviors in online auctions, two methods are presented. One is a statistical analysis of online bidder behavior through a hedonic regression model. Another method is through the use of Fuzzy Logic auto rule generation techniques, to come up with a predictor model based on knowledge rules. The two models will then be compared and cross validated. This paper presents a better understanding of what drives bids and what makes some sellers more successful than the others.

5 - Competitive Price-Quantity Bidding in Electricity Markets
Shanshan Hu, Ph.D Candidate, University of Michgan, Business School, 701 Tappan Street D2201, Ann Arbor, MI, 48104, United States, husz@bus.umich.edu, Roman Kapuscinski, William Lovejoy

This paper considers a price-quantity bidding game where electricity distributors facing exogenous demand processes procure their supply from multiple electricity plants with fixed costs and capacities. Characterizing the Nash equilibrium structurally, we derive the competitive pricing curve and interpret the predicted price dispersion at varying levels of industry utilization.

■ SD13

H - 4th Floor, Union Square 5

Software Demonstration

Cluster: Software Demo
Invited Session

1 - Lumina Decision Systems, Inc.-Analytica: Beyond the Spreadsheet

Max Henrion, Lumina Decision Systems, Inc., 26010 Highland Way, Los Gatos, CA, 95033, United States, henrion@lumina.com

A rare chance to see Analytica demonstrated by its originator: users prefer Analytica to spreadsheets because of its transparency, flexibility for multiple dimensions, efficient Monte Carlo, scalability and its powerful new Optimizer. Analytica models are typically 10 to 100 times more compact than equivalent spreadsheets, and correspondingly easier to build, understand and audit.

■ SD14

H - 4th Floor, Union Square 6

Urban Operations Modeling and Simulation

Sponsor: Military Applications
Sponsored Session

Chair: MAJ John Willis, TRADOC Analysis Center, ATTN: ATRC-RDM, Box 8695, Monterey, CA, 93940, United States, john-willis@us.army.mil

1 - Mobility Throughput Representation in Urban Environments

Dr. George Mason, Research Civil Engineer, ERDC, 3909 Halls Ferry Road, Vicksburg, MS, 39180-6199, United States, George.L.Mason@erdc.usace.army.mil, John Green

Vehicle pass rates are computed as part of the Theater-Level Logistical Network Aggregation (nominated as an AMSO standard SRD-00060). These theater-level M&S trafficability rates are only for roads on open country terrain. Factors for roads located in urban terrain are not considered. An approach is presented for assigning military vehicle throughput rates through urban environments.

2 - Research Plan Management for Modeling and Simulation of Urban Operations

MAJ John Willis, TRADOC Analysis Center, ATTN: ATRC-RDM, Box 8695, Monterey, CA, 93940, United States, john-willis@us.army.mil

To combat deficiencies in urban operations (UO) representation in M&S, the US Army created a UO Focus Area Collaborative Team (FACT). The UO FACT employs a systematic approach that is designed to (1) identify the best UO M&S projects that will address prioritized deficiencies and (2) identify potential collaboration opportunities, and (3) provide stewardship of ongoing projects. This paper details the methodology and results of the UO FACT including details of current priorities and projects.

■ SD15

H - 4th Floor, Union Square 9

Recent Advances in Machine Scheduling

Cluster: Scheduling
Invited Session

Chair: Chung-Lun Li, Professor, The Hong Kong Polytechnic University, Department of Logistics, Hung Hom, Kowloon, Hong Kong, China, lgtclli@polyu.edu.hk

1 - Job Formation and Scheduling in Semiconductor Manufacturing

Erhan Kutanoglu, Assistant Professor, The University of Texas at Austin, 1 University Station C2200, Austin, TX, 78712, United States, erhank@mail.utexas.edu

We investigate a scheduling problem motivated by challenges in semiconductor manufacturing wafer fabs. Individual orders with different due dates and weights are grouped into jobs (job formation), which are then scheduled over time (job scheduling). The overall performance depends on both formation and scheduling. We extend our earlier models to stochastic settings, develop solution techniques, and present our preliminary results.

2 - Bicriteria Scheduling on a Batch Processing Machine

Chi-To Daniel Ng, The Hong Kong Polytechnic University, Department of Logistics, Hung Hom, Kowloon, Hong Kong, China, lgtctng@polyu.edu.hk, Lili Liu, T. C. Edwin Cheng

In this talk, we consider the problems of scheduling jobs on a single batch processing machine so as to minimize a primary and a secondary criterion. We provide optimal algorithms and/or NP-completeness proofs for various combinations of primary and secondary criterion.

3 - Bin-Packing Problem with Concave Costs of Bin Utilization

Chung-Lun Li, Professor, The Hong Kong Polytechnic University, Department of Logistics, Hung Hom, Kowloon, Hong Kong, China, lgtclli@polyu.edu.hk, Zhi-Long Chen

We consider a generalized one-dimensional bin-packing model where the cost of a bin is a nondecreasing concave function of the utilization of the bin. Four popular heuristics from the literature of the classical bin-packing problem are studied. We analyze their worst-case performances when they are applied to our model.

4 - Coordinating Production and Distribution of Jobs with Bundling Operations

George Vairaktarakis, Case Western Reserve University, Department of Operations, Cleveland, OH, 44106, United States, gxv5@case.edu, Chung-Lun Li

Jobs completed in 2 bundling machines are batched and delivered to customers at different locations. The objective is to minimize the sum of arrival times of jobs plus the total transportation cost. We develop solutions for direct versus milk-run deliveries and compare them computationally.

■ SD16

H - 4th Floor, Union Square 10

Organization Science: Perpectives on the Journal

Sponsor: Organization Science
Sponsored Session

Chair: Linda Argote, Professor, Carnegie Mellon University, Tepper School of Business, 5000 Forbes Ave., Pittsburgh, PA, 15213, United States, argote@andrew.cmu.edu

1 - Organization Science: Current Status and Future Directions

Linda Argote, Professor, Carnegie Mellon University, Tepper School of Business, 5000 Forbes Ave., Pittsburgh, PA, 15213, United States, argote@andrew.cmu.edu

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

2 - Organization Science: Aiming for a Successful Experience

Richard Burton, Professor, Duke University, Fuqua School of Business, 1 Towerview Drive, Durham, NC, 27708, United States, rmb2@mail.duke.edu

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

3 - Transactive Memory Systems, Learning, and Learning Transfer

Kyle Lewis, Asst. Professor, University of Texas, McCombs School of Business, 1 University Station B6300, Austin, TX, 78712, United States, Kyle.Lewis@mccombs.utexas.edu, Donald Lange, Lynette Gillis

We present a framework for understanding TMSs as learning systems that affect group learning and learning transfer, and we test major outcomes of the framework in an empirical study. Findings show that TMSs help groups develop transferable knowledge about the task domain after performing two similar tasks. We found little evidence that TMSs influence learning transfer after a single task. Implications for TMS and learning theories are discussed.

4 - Cognition and Hierarchy: Rethinking the Microfoundations of Capabilities' Development

Giovanni Gavetti, Professor, Harvard Business School, 237 Morgan Hall, Boston, MA, 02164, ggavetti@hbs.edu

My research identifies gaps in microfoundations of capabilities research and argues that it focused excessively on the quasi-automatic, routine-based aspects of capability development, and neglected the roles played by cognition and organizational hierarchy. Through a model that considers both how routine-based and cognitive logics of action coexist within organizational hierarchy to affect capability development, this article leads to novel propositions and sets an agenda for future research.

■ SD17

H - 4th Floor, Union Square 11

Panel Discussion: New Product Development, Innovation and Technology Management

Cluster: New Product Development
Invited Session

Chair: Janice Carrillo, Assistant Professor, University of Florida, P.O. Box 117169, Gainesville, FL, 32611-7169, United States, janice.carrillo@cba.ufl.edu

1 - Panel Discussion: New Product Development, Innovation and Technology Management

Moderator: Janice Carrillo, Assistant Professor, University of Florida, P.O. Box 117169, Gainesville, FL, 32611-7169, United States, janice.carrillo@cba.ufl.edu, Panelists: Cheryl Gaimon, Wallace Hopp, Vish Krishnan, Christoph Loch, Christian Terwiesch, Garrett van Ryzin

A panel of editors will convene to discuss research opportunities in the areas of New Product Development, Innovation and Technology Management. The panel will identify current trends in this important field of inquiry, and discuss publishing opportunities within the Management Science community.

■ SD18

H - 4th Floor, Union Square 12

Airline Pricing and Revenue Management

Sponsor: Aviation Applications
Sponsored Session

Chair: Laurie Garrow, Assistant Professor, Georgia Institute of Technology, School of Civil & Environmental Engr., 790 Atlantic Drive, Atlanta, GA, 30332-0355, United States, Laurie.Garrow@ce.gatech.edu

1 - Optimizing with Respect to User Preferences

François Gilbert, Ph D student, Université de Montréal, CP 6128, Succursale Centre-Ville, Montréal, QC, H3C 3J7, Canada, gilbertf@iro.umontreal.ca, Patrice Marcotte, Gilles Savard

We consider an airline that maximizes revenue over its network, taking into account competitors' price schedules as well as customer behaviour, the latter characterized by utility maximization. We analyze two situations, one where customer choice is dictated by a discrete choice model, another where utility maximization leads to a bilevel formulation. We emphasize the parallels between both nonconvex models, and propose algorithms for solving them to optimality or ear-optimality.

2 - Airline Passengers' On-line Searching and Booking Behavior

Laurie Garrow, Assistant Professor, Georgia Institute of Technology, School of Civil & Environmental Engr., 790 Atlantic Drive, Atlanta, GA, 30332-0355, United States, Laurie.Garrow@ce.gatech.edu, Roger Parker

We assess the viability of using stated preference choice surveys to develop price elasticity models for airline customers searching for flights on SideStep, an on-line low-fare search engine. Preliminary results suggest SideStep customers are very price sensitive and are influenced by choice set presentation. Further, econometric modeling techniques that integrate a "reference dependent" approach from psychology tend to exibit the best predictive power.

■ SD19

H - 4th Floor, Union Square 13

KLIC IV — Organizing for Learning (Knowledge, Learning & Intellectual Capital)

Sponsor: Technology Management
Sponsored Session

Chair: Nile Hatch, Marriott School - BYU, 790 TNRB, Provo, UT, 84602, United States, nile@byu.edu

1 - Managing Customer Outrage: Focus Organizational Learning Efforts on Service Failure or Recovery?

Michael Lapre, Vanderbilt University, Owen Graduate School of Management, 401 21st Avenue South, Nashville, TN, 37203, United States, michael.lapre@owen.vanderbilt.edu

Firms must be prepared to recover from service failures to turn angry customers into loyal customers. Using mishandled-baggage data for 9 major US airlines over 11 years, I find that dissatisfaction with recovery contributes 88% to the variation in customer outrage, whereas service failure contributes only 12%. A U-shaped learning-curve effect and heterogeneity in learning curves are more important for recovery than for service failure. Hence, firms should pay more attention to service recovery.

2 - Towards a Behavioral Theory of Core-Periphery Evolution in Networks: A Model Based Analysis

Nitin Joglekar, BU School of Management, 595 Commonwealth Avenue, Boston, MA, United States, joglekar@bu.edu, N. Venkatraman

We model the evolution of the core and the periphery of a social-network by extending the tenets of firm level behavioral decision making (i.e. target setting, expectations and choices that guide organizational learning) into network level constructs: embeddedness and interdependence. Our results document the efficacy of exploration and exploitation heuristics for building positional advantage and illustrate that performance of these heuristics is crucially affected by behavioral biases.

3 - Organizing for Innovation in the Motor Sports (NASCAR) Industry Cluster in Charlotte, NC

Carlos Martinez-Vela, MIT, 292 Main St, E38-104, Cambridge, MA, 02139, United States, camv@mit.edu

In this case study I examine how NASCAR teams located in Charlotte, NC integrate knowledge to innovate and coordinate change. I find that integration is a social process that occurs when product development teams can initiate and sustain collaboration and conversations across occupational and organizational boundaries. I illustrate how NASCAR teams organize this process and propose a grounded theory model for organizing innovation and integration.

4 - Managerial Knowledge, Learning, and Intellectual Capital.

Margaret Peteraf, Professor, Tuck School of Business, Dartmouth, 100 Tuck Hall, Hanover, NH, 03755, United States, margaret.a.peteraf@dartmouth.edu, Mark Shanley

Managerial knowledge is a resource for firms. At the same time, the accumulation and deployment of that knowledge constitutes an important organizational capability. Coming to grips with a resource and capability set that is part of the entire firm's resource configuration and yet determines that configuration and how it evolves is a major task for theory development.

■ SD20

H - 4th Floor, Union Square 14

Valuation and Risk Management in Energy Markets

Sponsor: Energy, Natural Resources & the Environment / Energy
Sponsored Session

Chair: Shi-Jie Deng, Asst. Professor, Georgia Inst. of Tech., 765 Ferst Dr, Atlanta, GA, 30332, United States, deng@isye.gatech.edu

1 - Investment Timing and Optimal Size of Small Hydropower Projects

Stein-Erik Fleten, Associate professor, SINTEF, Technology and Society, SP. Andersensv. 5, Trondheim, NO-7465, Norway, stein-erik.fleten@sintef.no, Thor Bockman, Erik Juliussen

We take the view of a river resource owner that has an option to invest in a hydropower plant and sell the output to an open electricity market. We find the optimal (continuous) plant scale as a function of uncertain electricity prices, and evaluate the deferrable opportunity to invest. We find a lower bound for the price triggering project initiation. Above this bound one invests according to the optimal scale function.

2 - Risk-Constrained Electricity Procurement for a Large Consumer

Antonio Conejo, Professor, University Castilla - La Mancha, Ciudad Real, Spain, Antonio.Conejo@uclm.es, Carrion Miguel

This paper formulates and provides a solution technique for the electricity procurement problem faced by a large consumer. The objective of this consumer is to minimize procurement cost while limiting the risk of cost fluctuation due to pool price volatility. Electricity sources include the pool, bilateral contracts and self-production. Uncertainty is related to electricity pool prices. A realistic case study is analyzed and results presented. Conclusions are duly drawn.

3 - Optimal Design of an Interruptible Electric Load Service Scheme

Shi-Jie Deng, Asst. Professor, Georgia Inst. of Tech., 765 Ferst Dr, Atlanta, GA, 30332, United States, deng@isye.gatech.edu, Youyi Feng

An interruptible load service program is often offered by an electricity service provider to its large industrial customers. The objective is to minimize the total electricity procurement costs for serving all demands by inducing certain customers to voluntarily reduce their power consumption in times of unexpected demand surge. Taking the best response by customers into consideration, we investigate the structure of an optimal design for a stylized demand responese program.

4 - Optimal Management of Oil Lease Inventory: Option Value and New Information

Michael Rothkopf, Professor, Rutgers University, MSIS Department, 640 Bartholomew Road, Piscataway, NJ, United States, rothkopf@rutcor.rutgers.edu, Radford Schantz, Lee Upton

Companies buy oil leases that expire undrilled. Rational explanation of this depends upon option values. We present a model based upon changes in the

likelihood of discovering oil rather than in oil prices. It optimizes the number of leases to buy, hold, drill, and farm out. It fits Gulf of Mexico data and explains response to government polices.

■ SD21

H - 4th Floor, Union Square 15

Data Mining in Market Research

Sponsor: Data Mining
Sponsored Session

Chair: Julia Tsai, Research Lead, Information Resources, Inc., 150 North Clinton Street, Chicago, IL, 60661, United States, Julia.Tsai@infores.com

1 - New Store Brands: How Do Consumers Learn?
Hui-ming Deanna Wang, Assistant Professor, San Francisco State University, College of Business, 1600 Holloway Ave, San Francisco, CA, 94132, United States, wang00@purdue.edu, Julia Tsai

Store brands have been gaining market shares in many product categories. By exploiting a rich panel dataset that contains consumer purchase records prior to and post store brand entries, this study aims to examine how a consumer™ quality perception of a new store brand evolves over time.

2 - Forecasting SKU data
Konstantinos Nikolopoulos, Research Associate, Lancaster University, Lancaster University Management School, Dept. of Management Science, Lancaster, LA14YX, United Kingdom, k.nikolopoulos@lancaster.ac.uk, Robert Fildes, Paul Goodwin

The size and complexity of forecasting at the Stock Keeping Unit (SKU) level, in most companies, necessitates the use of a Forecasting Support System (FSS). The present study reports the findings of a research project examining monthly and weekly demand data and forecasts for SKUs collected from 10 major U.K. companies. The paper discusses: a) the level of homogeneity of SKU data, and b) a competition of company forecasts versus to classical extrapolation techniques, as well as established FSSs.

3 - A Neural Network-Based Algorithm for Monitoring the Wholesale Power Prices in Ohio
Hisham Choueiki, Senior Energy /Telecommunications Specialist, PUCO, 180 E. Broad Street, 3rd floor, Columbus, OH, 43215, United States, hisham.choueiki@puc.state.oh.us, David Wang

A model employing a neural network-based algorithm has been developed by the PUCO staff to monitor the reasonableness of prices in wholesale electricity markets. This model builds a relationship between published index prices on the one hand, and several independent variables; such as temperature, power plant production, type of day, and historical wholesale prices of electricity and natural gas on the other hand. Preliminary results indicate a model accuracy of +/- 5 to 6%.

4 - Statistical Approach for Anomaly Detection in Retail Sales Data
Julia Tsai, Research Lead, Information Resources, Inc., 150 North Clinton Street, Chicago, IL, 60661, United States, Julia.Tsai@infores.com, Michael Kruger, Arvid Johnson, Trevor Mason

This paper describes a statistical approach to detect anomalous patterns in retail sales data. This statistical approach is implemented in the quality control (QC) system to ensure the quality of the data. The procedure of the QC system is presented, and various distributions for the measures are investigated. The use of a parametric distribution provides a forum in which other statistical techniques may be explored to detect abnormality of the data and hence to build an effective QC system.

■ SD22

H - 4th Floor, Union Square 16

Behavioral Issues in IS

Sponsor: Information Systems
Sponsored Session

Chair: Waleed Muhanna, The Ohio State University, Fisher College of Business, 2100 Neil Avenue, Columbus, OH, 43210, United States, wmuhanna@cob.ohio-state.edu

1 - Insights into the Adaptive Behavior of Alternate Learning Classifier System Models
David A. Gaines, University of Kentucky, dgaines@uky.edu, Ramakrishnan Pakath, Cidambi Srinivasan

We describe the design of, and findings from, a set of experiments comparing the performances of a series of Learning Classifier System-based artificial agents, ranging from the traditional LCS to the more modern XCS, in the Iterated Prisoner's Dilemma game-playing environment. This environment allows us to model realistic business/social situations including coping with non-Markov environments, asymmetric knowledge-base updates, and consciously opting for irrational behavior.

2 - Trust Formation in Online Markets: An Experimental Investigation
James R. Wolf, Ohio State University, wolf_206@cob.osu.edu, Waleed Muhanna

Extant literature on trust in online marketplaces, such as eBay, has largely focused on seller's feedback ratings as the sole determinant of buyer trust. Drawing on theories from economics and psychology, we extend existing models by identifying attitudinal and other psychological antecedents that influence buyer trust in individual sellers. We examine in a laboratory setting the differential effects of these factors on trust as well as their role as moderators of the relationship between seller reputation and buyer trust.

3 - Evaluating Web Accessibility Guidelines for the Cognitively Disabled
Clyde W. Holsapple, University of Kentucky, cwhols@uky.edu, Sharath Sasidharan, Ramakrishnan Pakath

Despite the proliferation of the WWW and E-commerce, only recently has the access of websites by the disabled begun to receive attention. The WWW Consortium and the US Government have proposed guidelines to help foster accessibility and implementation efforts are underway. We propose a theoretically-grounded framework to help assess value added, by guideline adherence, to existing best practices and report preliminary experimental findings in the context of cognitive disabilities.

■ SD23

H - 4th Floor, Union Square 17

Basel Accord and Portfolio Management

Sponsor: Financial Services
Sponsored Session

Chair: Lyn Thomas, University of Southampton, School of Management, United Kingdom, L.Thomas@soton.ac.uk

1 - Multi Period Expected Loss Prediction
Catalina Stefanescu, Assistant Professor of Decision Sciences, London Business School, Regent's Park, London, United Kingdom, cstefanescu@london.edu, Stuart Turnbull, Sudheer Chava

We investigate modeling of the expected loss over multi year horizons, focusing on the joint determinants of default probability and of the loss given default. The unobserved heterogeneity is modelled using frailties, while the recovery rate varies over the credit cycle and is negatively correlated with the frequency of default. Lastly, we examine some implications of a multi factor expected loss model for risk management.

2 - Loan Rate Optimization as a Convex Programming Problem
Frank Bria, Khimetrics, Inc, fbria@khimetrics.com

We explore different ways the problem of maximizing profit on a loan portfolio can be constructed as a convex programming problem when you take different business requirements into consideration. Several strategic business scenarios are presented along with their respective structural and computational challenges.

3 - Risk Management for International Portfolios
Kurtay Ogunc, Alpha Dynamics Group, Dallas, TX, kurtay@alphadynamicsgroup.com

We incorporate behavioral issues as it relates to the management of risk in international portfolios. First, we introduce separate risk aversion parameters for asset and currency markets, and conclude that lower hedge ratios would arise due to the asymmetric nature of the compensation structure of currency managers. Then, we evaluate the problem in an axiomatic framework, and conclude that the more disappointment-averse the investor becomes, the less likely it is to have higher hedge ratios.

4 - Impact of Basel New Accord on Credit Risk Models of Consumer Loan Portfolios and Practice
Lyn Thomas, University of Southampton, School of Management, United Kingdom, L.Thomas@soton.ac.uk

The Basel New Accord imposes a corporate credit risk model on portfolios of consumer loans and there are questions whether such models are appropriate. This talk will discuss the New Accord rules governing consumer credit risk modeling, and it will point out the lack of a model that can justify these rules. It proposes a structural model for the credit risk of consumer loan portfolios which possibly can support these rules.

■ SD24

H - 4th Floor, Union Square 18

Recent Developments in Financial Engineering

Cluster: Financial Engineering
Invited Session

Chair: Ronnie Sircar, Associate Professor, Operations Research and Financial Engineering, Princeton University, sircar@princeton.edu

1 - Minimizing the Probability of Lifetime Ruin under Borrowing Constraints
Erhan Bayraktar, T.H. Hildebrandt Research Assistant Professor, Department of Mathematics, University of Michigan, 525 East University, Ann Arbor, MI, 48109, United States, erhan@umich.edu

We determine the optimal investment strategy of an individual who targets a given rate of consumption and who seeks to minimize the probability of going bankrupt before she dies. We impose two types of borrowing constraints: First, we do not allow the individual to borrow money to invest in the risky asset nor to sell the risky asset short. Second, we allow the individual to borrow money but only at a rate that is higher than the rate earned on the riskless asset.

2 - A Top Down Approach to Multi-Name Credit
Lisa Goldberg,MSCI Barra, 2100 Milvia Street, Berkeley CA 94704, United States, lisa.goldberg@mscibarra.com, Kay Giesecke

We examine multi-name credit models from the perspective of point processes. We pursue a top down approach: the economy as a whole is modeled first. Random thinning consistently generates sub-models for individual firms or portfolios. A candidate for this approach is a self-exciting process, whose intensity at any time depends on the events observed up to that time.

3 - Bounds and Approximations for Multifactor Portfolio Credit Risk
Sira Suchintabandid, Columbia University, 4W Uris Hall, Columbia Business School, New York, NY, 10027, United States, ss1855@columbia.edu, Paul Glasserman

We develop bounds and approximations for the loss-distribution in the multifactor normal copula model of credit risk. Our bounds and approximations are expressed in terms of low-factor (primarily independent-obligor or single-factor) models. While a suitable single-factor model can sometimes approximate a multifactor model, this paper uses several single-factor models for possible improvement. We discuss the performance of our approximation through numerical examples.

■ SD26

H - 4th Floor, Union Square 20

Panel Discussion: Do's and Do Not's of NSF Grant Proposals

Sponsor: JFIG, Junior Faculty Interest Group
Sponsored Session

Chair: Ana Muriel, Assistant Professor, University of Massachusetts, 160 Governors Drive, Amherst, MA, 01003, United States, muriel@ecs.umass.edu

1 - Panel Discussion: Do's and Do Not's of NSF Grant Proposals
Moderator: Ana Muriel, Assistant Professor, University of Massachusetts, 160 Governors Drive, Amherst, MA, 01003, United States, muriel@ecs.umass.edu, Panelists: Ozlem Ergun, Abhijit Deshmukh, Matthew Realff

Panel members will discuss their experiences in writing and reviewing NSF proposals, to give junior faculty a perspective on what works and what doesn't. Questions and lively interaction will be most welcomed.

■ SD27

H - 4th Floor, Union Square 21

Panel Discussion: How to Write a Good Practice Paper. What Makes a Good Practice Paper, Why You Should Write One, Who is the Audience and What are You Trying to Accomplish.

Sponsor: CPMS, The Practice Section of INFORMS
Sponsored Session

Chair: Stephen Strauss, AT&T Labs, 180 Park Avenue, Building 103 Room A009, Florham Park, NJ, 07932, United States, sstrauss@att.com

1 - Panel Discussion: How to Write a Good Practice Paper. What Makes a Good Practice paper, Why you Should Write One, Who is the Audience and What are You Trying to Accomplish
Moderator: Stephen Strauss, AT&T Labs, 180 Park Avenue, Building 103 Room A009, Florham Park, NJ, 07932, United States, sstrauss@att.com, Panelists: Fred Murphy, Jeffrey Camm, Stephen Graves, Terry Harrison, Barry List

The panel consists of past and present editors of Interfaces and the Interfaces special editions as well as the PR director for INFORMS who will address the following issues: * What makes a good practice paper. * Why you should write a practice paper. * Who is the audience. * What can/should you be trying to accomplish. In addition we will make a general practice paper template available via the web. (web link to follow)

■ SD28

H - 4th Floor, Union Square 22

Modeling and Optimization in Revenue Management

Sponsor: Revenue Management & Pricing
Sponsored Session

Chair: Dan Zhang, University of Chicago, 5807 S Woodlawn Ave, Chicago, IL, 60637, United States, dan.zhang@chicagogsb.edu

1 - Managing Clearance Sales in the Presence of Strategic Customers
Dan Zhang, University of Chicago, 5807 S Woodlawn Ave, Chicago, IL, 60637, United States, dan.zhang@chicagogsb.edu, William Cooper

We study the effect of strategic customer behavior on pricing, rationing, and capacity decisions of a supplier selling a single product. The product is sold in two periods, and the supplier may ration the quantity offered in the second period. Some customers are "smart" and respond to the pricing and rationing decisions by timing their purchases. We study the impact of customer behavior on supplier revenue under various assumptions on supplier capacity and pricing flexibility.

2 - On the Choice-Based Linear Programming Model for Network Revenue Management
Qian Liu, Graduate School of Business, Columbia University, New York, NY, United States, ql2002@columbia.edu, Garrett van Ryzin

Gallego et. al recently proposed a customer-choice-based LP model for network RM which parallels the widely-used deterministic LP model. We explore applications of their approach. First, we characterize optimal offer sets using a notion of "efficiency" and show only efficient sets are optimal asymptotically. Second, we propose a practical decomposition heuristic to generate a dynamic control policy, which significantly improves on the performance of the static LP solution.

3 - An Asymptotically-Optimal Policy for a Quantity-Based Network Revenue Management Problem
Marty Reiman, Bell Laboratories, Room 2C-315, 600 Mountain Ave., Murray Hill, NJ, 07974, United States, marty@research.bell-labs.com, Qiong Wang

We consider a canonical revenue management problem on a finite time horizon. Each resource has a fixed capacity. Each customer class has an associated arrival process, route and price. We introduce an admission control policy motivated by fluid and diffusion limits (as the capacities and arrival rates grow large) that involves solving two linear programs. We show that this policy is asymptotically optimal on diffusion scale, and that other approaches such as booking limits are not.

4 - Transforming Pricing Problems
Maarten Oosten, Senior Scientist, PROS Revenue Management, 3100 Main Street Suite 900, Houston, TX, 77002, United States, moosten@prosrm.com, Darius Walczak

The pricing problems we will discuss assume that demand behaves according to the lowest open fare model: when multiple price classes are available, all customers opt for the lowest price. We define a certain data transformation and demonstrate that under plausible conditions this more general revenue optimization model is equivalent to the traditional revenue management model. After investigating the theoretical underpinnings, we will illustrate the approach and address some practical issues.

■ SD29

H - 4th Floor, Union Square 23

Product Strategy

Sponsor: E-Business
Sponsored Session

Chair: Aydin Alptekinoglu, Assistant Professor, University of Florida, Warrington College of Business, 358 Stuzin Hall, Gainesville, FL, 32611-7169, United States, aalp@ufl.edu

1 - Standard and Custom Products: Duopoly Analysis
Sampath Rajagopalan, Professor, USC, IOM Department Marshall School of, Business, BRI 400D, USC, Los Angeles, CA, 90089-0809, United States, Srajagop@marshall.usc.edu, Nan Xia

Standard products are available immediately but only in a few variants of an attribute specification. Custom products match the customer's attribute preference exactly but are available after a finite lead time. We study variety, price and lead time decisions of firms offering standard and custom products in various competitive scenarios.

2 - A Static Approximation for Dynamic Demand Substitution with Applications in a Competitive Market
Xiaowei Xu, Assistant Professor, Department of Management Science & Information Systems, The State University of New Jersey, Newark, NJ, 07102, United States, xiaoweix@andromeda.rutgers.edu, Wally Hopp

We propose a static approximation of dynamic demand substitution behavior based on a fluid network model and a service-inventory mapping. Then we study a price and service competition between single-product retailers. We find that competition results in overstock. Finally, we study a duopolistic competition on price, service and product assortment. We find that competition on product assortment may result in shorter product lines and less inventory than in an analogous monopolistic market.

3 - Immediate Gratification and Network Externalities
Kerem Tomak, University of Texas at Austin, 1 University Station, Austin, TX, 78712, United States, kerem.tomak@mccombs.utexas.edu

We model impatience in consumption for digital goods via hyperbolic discounting approach. We find that as network externalities effect become more salient, by serving the "impatient" consumers, the monopolist can decrease the downward price pressure in the first period while increasing its overall profits; hence mass customization is a solution to Coase conjecture.

4 - When Mass Customization Entails Hidden Variety
Subhajyoti Bandyopadhyay, Assistant Professor, University of Florida, 364 Stuzin Hall, Gainesville, FL, 32611, United States, shubho.bandyopadhyay@cba.ufl.edu, Aydin Alptekinoglu

Motivated by Lab21, a company that sells custom skincare products based on a DNA test, we develop an address model of product differentiation with consumers highly uncertain about their preferences and the extent of product variety on offer. The consumers' inability to specify their desired product in terms of attributes lie at the heart of an information asymmetry that some firms engaged in mass customization are taking advantage of. We explore the market implications of this asymmetry.

■ SD30

H - 4th Floor, Union Square 24

Joint Session Research/ Revenue Management & Pricing: Revenue Management Research Clinic-Pricing for Computer Distributors

Cluster: Research Clinics, Revenue Management & Pricing
Invited Session

Chair: Harun Ahmet Kuyumcu, Chief Scientist, Zilliant, Inc., 3815 South Capital of Texas Highway, Suite 300, Austin, TX, 78704, United States, ahmet.kuyumcu@zilliant.com

1 - Pricing for Computer Distributors
Harun Ahmet Kuyumcu, Chief Scientist, Zilliant, Inc., 3815 South Capital of Texas Highway, Suite 300, Austin, TX, 78704, United States, ahmet.kuyumcu@zilliant.com, Garrett van Ryzin, Anton Kleywegt, Guillermo Gallego, Massoud Ashrafi

Consider the problem of optimally pricing desktop/laptop computers and related products (such as printers) for a computer distributor. The problem has the following characteristics:

- The computer components experience fast technological changes.
- Product lifecycle is very short for a specific configuration of components in a system
- Price is subject to rapid erosion as components become obsolete.
- The industry is extremely competitive with few barriers to entry.
- Margins on low-end systems are extremely slim (~1-2%).
- Price of a base model affects sales of other base models and complementary products
- List prices for base models are generally published monthly, but negotiated discounts, upgrades and other promotions are commonly leveraged to increase sales.
- Available supply is a factor in deciding when to discount/promote.
- The cost of each component is available and rapidly changing (usually eroding). In this session, we will describe the overall problem for the computer distributor industry and discuss the potential application of operations research techniques.

■ SD31

H - 4th Floor, Union Square 25

Joint Session Practice/ Roundtable: Applying OR/MS in the Public Sector to Benefit Citizens

Cluster: OR Practice, Roundtable
Invited Session

Chair: Arnie Greenland, IBM Distinguished Engineer, IBM, 6710 Rockledge Drive, Bethesda, MD, 20902, United States, arnold.greenland@us.ibm.com

1 - Reducing Burdens on Disabled Citizens and Improving Administrative Efficiency
Arnie Greenland, IBM Distinguished Engineer, IBM, 6710 Rockledge Drive, Bethesda, MD, 20902, United States, arnold.greenland@us.ibm.com

A major responsibility of the Social Security Administration is to administer the nearly $100 million in disability payments to those eligible under the Social Security Act. In recent years, SSA has used advanced analytic methods to improve the administrative efficiency of the program. This paper describes the business challenge, reviews the specific statistical and data mining methods used, and evaluates the impacts on beneficiaries and the government.

2 - The Use of Simulation Models in Reducing Taxpayer Compliance Burden
John Guyton, Senior Consultant, IBM, 12902 Federal Systems Park Drive, Fairfax, VA, 22033, United States, john.guyton@us.ibm.com, Michael Chesman

The IRS Office of Taxpayer Burden Reduction, the IRS Office of Research, and IBM, jointly seek to understand the drivers of taxpayer compliance burden. This paper describes the use of burden simulation models at IRS, including methodology and example results. The focus is on microsimulation models currently in use and a process flow model in development. The paper concludes with a discussion of the benefits of these simulation models, lessons learned, and areas for further research.

3 - Do Spreadsheet Errors Harm Decision Making in Public Organizations?
Layne Morrison, MS/PPM Candidate, Carnegie Mellon University, Pittsburgh, PA, United States, layney@cmu.edu, Timothy Weidemann, Jonathan P. Caulkins

Interviews with executives and senior managers/analysts reveal that spreadsheet errors in public organizations can lead to flawed decision making, negatively impacting citizens. Quality control processes were informal, and few formal risk assessment tools were employed. We discuss the implications and comparisons with the private and nonprofit sectors.

4 - Strategic Budgeting for Wildfire Management in the U.S.
Gyana Parija, Research Staff Member, IBM T.J. Watson Research Center, Yorktown Heights, NY, 10598, United States, parija@us.ibm.com, Dan Keller, Brian Booher, Samer Takriti

We will present an optimization model, and a mathematical programming based solution approach for optimizing the initial response (IR) organization needed to maximize the effectiveness of various fire management activities under different annual fire season scenarios. An initial response organization could consist of a set of hand crews, engines, bull-dozers, helicopters, water-tenders and the like.

■ SD32

H - 6th Floor, Lombard

spORts Arcade

Sponsor: OR in SpORts
Sponsored Session

Chair: Eric Bickel, Assistant Professor, Department of Industrial and

Systems Engineering, Texas A&M University, 236B Zachry Engineering Center, 3131 TAMU, College Station, TX, 77843-3131, United States, ebickel@tamu.edu

1 - Automation of the Umpire Crew Scheduling Process for Tennis Tournaments

Jeffrey Smith, Professor, Auburn University, 207 Dunstan Hall, Auburn University, AL, 36849, United States, jsmith@auburn.edu, Adam Farmer

Results of a project with the USTA for scheduling umpires at tennis tournaments are presented. The number and skill levels of umpires needed on a court can differ from court to court and valid assignments must adhere to strict regulations. Matches at a major event are played on up to 18 courts over the course of three weeks. In general, each court has two rotating crews, each filling up-to nine line positions. Results from use of the system at the 2004 and 2005 US Opens will be discussed.

2 - Using Mathematical Modeling to Study Some Claims, Conjectures and Questions Inspired by Moneyball

Bruce Bukiet, Associate Professor, New Jersey Institute of Technology, University Heights, Newark, NJ, 07102-1982, United States, bukiet@oak.njit.edu

Michael Lewis's bestseller, Moneyball, highlights how analytical approaches can help baseball teams of modest means compete against wealthier teams. The values of strategies and relative influence of some performance measures on team success are discussed. Most of the book's conclusions are based on statistical analyses. Here, we apply mathematical modeling, including Markov chains and dynamic programming, to investigate some claims the book makes and some questions inspired by the book.

3 - Modeling a Baseball Game to Optimise Pitcher Substitution Incorporating Handedness of Players

Nobuyoshi Hirotsu, Researcher, Japan Institute of Sports Sciences, 3-15-1 Nishigaoka, Kita-Ku, Tokyo, 115-0056, Japan, hirotsu.nobuyoshi@jiss.naash.go.jp, Mike Wright

We propose a method for identifying the optimal strategy for substituting players in baseball, taking into consideration the handedness of players. Using a Markov chain model we incorporate the effect of the handedness by introducing the concept of the Defensive Earned Run Average as a measure of the defensive ability of pitchers. We then develop a DP formulation including the effect of the handedness. This method is illustrated using a match based on the line-ups of the Rockies and the Giants.

4 - On the Value of Throwing Strikes

Eric Bickel, Assistant Professor, Department of Industrial and Systems Engineering, Texas A&M University, 236B Zachry Engineering Center, 3131 TAMU, College Station, TX, 77843-3131, United States, ebickel@tamu.edu

On old baseball adage is that the first strike is the most important strike of a plate appearance because it is important to "get ahead" of the hitter. In this talk we will use a Markov model, supported by game data, to quantify the value of throwing strikes for each count. While it is always a good idea for the pitcher to try and throw a strike, the 0-0 count is one of the least important counts on which to do so. As we will show, 3-2 is the count on which a strike is the most valuable.

■ SD33

H - 6th Floor, Mason

Research Advancement and Vision in Quality, Statistics, Reliability

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: Judy Jin, Associate Professor, Department of Industrial and Operations Engineering, The University of Michigan, 1205 Beal Ave, Ann Arbor, MI, 48109-2117, United States, jhjin@umich.edu

1 - Recent Advances in Reliability Engineering Research

Elsayed Elsayed, Rutgers University, Department of Industrial and Systems Eng, 96 Frelinghuysen Road, Piscataway, NJ, 08854, United States, elsayed@rci.rutgers.edu

In this presentation we highlight the research directions and its applications in industry. We address research issues in modeling large scale systems, criticality of the systems' components, reliability testing at normal and accelerated conditions, reliability prediction for highly reliable systems and condition-based maintenance issues under the current advances in sensors and communication systems.

2 - Taguchi's Robust Parameter Design: A 25-year Retrospective Look at the Contributions and Impact

Vijay Nair, Department of Statistics, University of Michigan, Ann Arbor, MI, United States, vnn@umich.edu

Genichi Taguchi's ideas on robust parameter design were first introduced in the US in 1980, starting with his visit to Bell Labs. Since then, they have elicited a lot of excitement and controversy, both in industry and in academia. This talk will provide a personal assessment of the novel contributions to and impact on industrial practice as well as statistical methodology relating to design and analysis of industrial experiments.

3 - Stream of Variation For MMP: Review of Current Accomplishments and Future Research Topics

Jan Shi, Professor, The University of Michigan, 1205 Beal Avenue, Ann Arbor, MI, 48109-2117, United States, shihang@umich.edu

Stream of Variation (SoV) methodologies were developed for variation modeling, analysis and control for multistage manufacturing processes (MMP). This presentation summarizes the motivation, challenges, major accomplishments up to date, and some potential research topics in the SoV theory and applications.

■ SD34

H - 6th Floor, Powell

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, 08844, United States, coit@rutgers.edu

1 - Computer Algebra Applications in Reliability

Lawrence Leemis, Professor, Department of Mathematics, The College of William and Mary, P.O. Box 8795, Williamsburg, VA, 23187-8795, United States, leemis@MATH.WM.EDU

Complex reliability problems can be solved using APPL (A Probability Programming Language). Several applications illustrate the versatility of this Maple-based language, including determining the survivor function associated with a system of components, model discrimination for a right-censored data set, and goodness-of-fit testing.

2 - Bayesian Semiparametric Analysis for a Single Item Maintenance Optimization

Elmira Popova, Associate Professor, University of Texas at Austin, 1 University Station C2200, Austin, TX, 78712, United States, elmira@mail.utexas.edu, Timothy Hanson, Paul Damien, Alexander Galenko

In this paper we address the problem of a finite horizon single item maintenance optimization structured as a combination of preventive and corrective maintenance in a nuclear power plant environment. We present two Bayesian semiparametric models to estimate the failure time distribution and costs involved. We show the effectiveness of this research using real data from South Texas Project Nuclear Operating Company.

3 - On Capacitated Two-terminal Reliability and Uncertainty

Jose Ramirez-Marquez, jmarquez@stevens.edu, Wei Jiang

Capacitated two-terminal reliability is defined as the probability that network capacity, generated by capacitated components, between a set of nodes is greater than or equal to a known demand. Reliability depends on the uncertainty associated to the reliability of the network arcs. This study explores interactions between arc and network reliability uncertainty. It provides a structured approach that generates an alpha level confidence interval for capacitated two-terminal network reliability.

4 - Reliable Assignment of Network Services in Ad-Hoc Wireless Networks

Abdullah Konak, Assistant Professor of Information Sciences and Technology, Penn State Berks, Tulpehocken Road, P.O. Box 7009, Reading, PA, 19610, United States, konak@psu.edu

This paper introduces the problem of assigning network services to nodes in wireless ad-hoc networks to maximize a reliability measure. Reliability is defined as the probability that a client has access to all required services. Reliability measures for wireless ad-hoc networks are discussed. In addition, a meta-heuristic algorithm is introduced to solve the defined problem.

■ SD35

H - 6th Floor, Sutter

RASIG Roundtable: Part II

Sponsor: Railroad Applications
Sponsored Session

Chair: Michael Gorman, Assistant Professor, University of Dayton, Dept. of MIS/OM/DSC, 300 College Park, Dayton, OH, 45469-2130, United States, michael.gorman@udayton.edu

1 - Capacity and Yield Management
Reilly McCarren, jrmccarren@comcast.net

I will relate my experience with capacity and yield management at Wisconsin Central.

2 - Service Design and Capacity Management at BNSF
Richard Margl, BNSF, richard.margl@bnsf.com

I will discuss capacity planning from a Service Design perspective at BNSF.

3 - Capacity Planning at CSX
Lawrence Ratcliffe, CSX, Lawrence_Ratcliffe@csx.com

I will share my experiences with financial capacity planning at CSX.

4 - Integrated Financial and Capacity Planning
Larry Shughart, Innovative Scheduling, larry@InnovativeScheduling.com

Mr. Shughart will present a model that links railroad capacity utilization to the financial performance of a railroad. He will examine the relationship of Pricing. Network and Productivity Capacity to the Operating Ratio. We will empirically examine the important capacity drivers, and indicate if each driver is largely a management/strategic variable or if the driver can be significantly improved with the application of OR techniques

■ SD36

H - 6th Floor, Taylor

Input Modeling and Applications

Sponsor: Simulation
Sponsored Session

Chair: Bahar Biller, Assistant Professor, Carnegie Mellon University, Tepper School of Business, 5000 Forbes Avenue Posner Hall 360, Pittsburgh, PA, 15213, United States, billerb@andrew.cmu.edu

1 - The Bootstrap Embedded Sequential Testing (BEST) Algorithm for Identifying the Best System Design
Thomas R. Willemain, Professor, Rensselaer Polytechnic Institute, Decision Science and Engineering Systems, Troy, NY, 12180, United States, willet@rpi.edu, Huaiyu Harry Ma

BEST combines sequential hypothesis testing with two innovations in bootstrapping: mirroring the data series around the zero axis and pooling results when there is more than one independent data sample. Experiments showed BEST improved on the KN++ algorithm, both in probability of correct selection and average number of simulation observations.

2 - Comparing Experiment Designs for Forward-Inverse Metamodels
Russell Barton, Professor, Penn State University, Smeal College of Business, 406 Business Building, University Park, PA, 16802, United States, rbarton@psu.edu

Metamodels provide estimates of simulation output as a function of design parameters. One can use 'inverse' metamodels to map system performance requirements to design parameters. These models can be fitted with the same experimental data used to fit the usual 'forward' metamodels. This talk compares experiment designs for this situation.

3 - Vessel Arrival Process and Queueing in Marine Ports
Tayfur Altiok, Professor, Rutgers University, Department of Industrial Engineering, Piscataway, NJ, 08854, United States, altiok@rci.rutgers.edu, David Jagerman

Vessel arrival process in bulk ports handling either cargo containers or minerals is presented. Impact of lay period on the port performance is discussed. SHIP/G/1 queue is presented to study the queueing behavior at the port. Approximations for asymptotic probabilities of delays and number of vessels are discussed.

4 - Behavior of VARTA in Higher Dimensions
Ismail Civelek, PhD Candidate, Carnegie Mellon University, 4135 Murray Avenue, Pittsburgh, PA, 15217, United States, icivelek@andrew.cmu.edu, Bahar Biller

We study the behavior of VARTA (Vector-Autoregressive-To-Anything) method as the number of components and the order of dependence of the input process increase. We observe that this method fails when the autoregressive coefficients do not satisfy the stability condition, which implies stationarity, or the correlation matrices of base and white noise processes are not positive definite. Our objective is to quantify the failure probability of the VARTA method due to each one of these reasons.

5 - Copula-based Input Models for Stochastic Simulation
Bahar Biller, Assistant Professor, Carnegie Mellon University, Tepper School of Business, 5000 Forbes Avenue Posner Hall 360, Pittsburgh, PA, 15213, United States, billerb@andrew.cmu.edu

Although the Vector-Autoregressive-To-Anything (VARTA) process is a general input model for dependence modeling in the current simulation input modeling literature, they fall short in the simulation of stochastic systems with complex interactions and interdependencies. In this talk, we present a new framework that will enable us to address the shortcoming of the VARTA input model and go beyond the use of linear correlation as a dependence measure.

■ SD37

H - 6th Floor, Van Ness

Asymptotic Analysis of Stochastic Systems

Sponsor: Applied Probability
Sponsored Session

Chair: Sunil Kumar, Stanford Graduate School of Business, 518 Memorial Way, Stanford, CA, 94305, United States, kumar_sunil@gsb.stanford.edu

1 - Customer Abandonment in Heavy Traffic
Joshua Reed, Georgia Institute of Technology, Industrial and Systems Engineering, Atlanta, GA, United States, je-reed@isye.gatech.edu, Amy Ward

We study a single server queue in which each arriving customer independently abandons the queue if his service has not begun within a generally distributed amount of time. Under some mild conditions on the deadline distribution, we identify a limiting heavy traffic regime in which the resulting diffusion approximation contains the entire deadline distribution. In addition, we also derive simple formulae which completely characterize the stationary distribution of the approximating diffusion.

2 - On Exponential Ergodicity in Multiclass Queueing Networks
David Gamarnik, MIT, daveg@us.ibm.com, Sean Meyn

It is known that the stability of the fluid limit model implies stability of an underlying multiclass queueing network. Also, if all the moments of the stochastic primitives are finite, then, all the moments of the queue lengths are finite in steady state. A natural conjecture is that the same holds for exponential moments. Surprisingly, this turns out not to be the case and we provide a counter example.

3 - Asymptotically Optimal Control of a 2-Tier Assemble-to-Order System
Erica Plambeck, Associate Professor of Operations, Information and Technology, Stanford Graduate School of Business, Memorial Way, Stanford, CA, 94305, United States, plambeck_erica@gsb.stanford.edu

This paper derives an asymptotically optimal control policy for an Assemble-to-Order system with capacitated component production, shipping delays, and both fixed and variable shipping costs. The policy is surprisingly simple -independent threshold control of each component. The policy is asymptotically optimal in the regime of high order arrival rates.

4 - Integration of Real-time and File Sharing Internet Traffic: Fluid and Diffusion Limits
Sunil Kumar, Stanford Graduate School of Business, 518 Memorial Way, Stanford, CA, 94305, United States, kumar_sunil@gsb.stanford.edu, Laurent Massoulie

We study the behavior of a communication link that divides its capacity fairly among file transfers and streaming flows. We obtain fluid and diffusion limits in asympotic regimes via weak convergence techniques. These limits provide intuition for the observed behavior of systems, such as long relaxation times.

■ SD38

R - 2nd Floor, Corintia

Linear Programming and Equilibria

Cluster: Linear/Nonlinear Programming
Invited Session

Chair: Yinyu Ye, Stanford University, yinyu-ye@stanford.edu

1 - How Good are Interior Point Methods? Klee-Minty Cubes Tighten Iteration-complexity Bounds
Tamas Terlaky, Professor, McMaster University, Department of Computing and Software, McMaster University, Hamilton, ON, L8S4K1, Canada, terlaky@mcmaster.ca, Eissa Nematollahi, Antoine Deza

By adding redundant inequalities the central path can be forced to visit any small neighborhood of all the vertices of the Klee-Minty cube, in the same order as simplex methods do. A careful refinement and analysis of the example over the Klee-Minty n-cube allows to exhibit a nearly worst-case example for path-following interior point methods.

2 - Solving Linear Optimization Problems with MOSEK
Bo Jensen, MOSEK, Fruebjergvej 3, Box 16, Copenhagen, 2100, Denmark, bo.jensen@mosek.com

MOSEK is a software package intended at solution of large-scale linear and convex nonlinear optimization problems. This talk will present the linear optimization capabilities in MOSEK. In particular we will review the recent advances in the linear optimization algorithms implemented. Finally, we will present numerical results that compares the interior-point and simplex algorithms as implemented in MOSEK.

3 - Design of Price Mechanisms for Network Resource Allocation via Price of Anarchy
Ying-Ju Chen, PhD Candidate, IOMS-Operations Management, Stern School of Business, New York University, 44 West 4th Street, KMC 8-152, New York City, NY, 10012, United States, ychen0@stern.nyu.edu, Jiawei Zhang

In this paper, we propose to use the concept of price of anarchy as a criterion in designing price mechanisms for cost-sharing games. In particular, we investigate the network resource allocation problem studied by Johari and Tsitsiklis [2005], where users gather utilities by sending flows through the communication network with quadratic cost structure. The search of optimal price schemes is confined within the mechanisms characterized by a set of commonly adopted axioms in cost-sharing games.

4 - Paths to Arrow-Debreu Exchange Market Equilibria
Yinyu Ye, Stanford University, yinyu-ye@stanford.edu

We present polynomial-time algorithms for solving the Fisher and Arrow-Debreu competitive market equilibrium problems with linear utilities and n players. We show that, for the first time, these problems admit the same time complexity bound for linear programming of the same dimension and size. We also present continuous paths leading to the set of the Arrow-Debreu equilibrium, similar to the central path developed for linear programming interior-point methods.

■ SD39

R - 3rd Floor, Aragon

Algorithms in Structured Convex Programming

Sponsor: Optimization/ Linear Programming and Complementarity
Sponsored Session

Chair: Osman Guler, Professor, University of Maryland, Baltimore County, 1000 Hilltop Circle, Baltimore, 21250, United States, guler@math.umbc.edu

1 - On the Minimum Volume Ellipsoid Containing Part of a Given Ellipsoid
Filiz Gurtuna, Graduate student, University of Maryland, Baltimore County, 1000 Hilltop Circle, Baltimore, 21250, United States, gurtuna1@math.umbc.edu, Osman Guler

The formulae for the minimum volume ellipsoid containing two—sided cuts of a given ellipsoid is known and the proof is based on a guess and its verification. We formulate the problem as an optimization problem and use KKT conditions and other tools to obtain some insights into its structure. These ellipsoids are used in a recently proposed conjugate gradient algorithm incorporating adaptive ellipsoid preconditioning.

2 - Differentiation of Functions of Hermitian Matrices and Applications to Interior-Point Methods
Olena Shevchenko, Graduate student, University of Maryland, Baltimore County, 1000 Hilltop Circle, Baltimore, 21250, United States, olenshe1@math.umbc.edu, Osman Guler

One of the major difficulties in extending interior-point methods from LP to SDP is noncommutativity of matrix multiplication. One of the approaches is to symmetrize the complementarity condition that leads to symmetric search directions. In this case, the analysis of the methods involves estimations of directional derivatives of a function of a hermitian operator. In this talk, we will discuss the differentiation techniques and their applications in the analysis of the IPMs for SDP.

3 - Noncommutative Analysis in Interior-point Methods
Osman Guler, Professor, University of Maryland, Baltimore County, 1000 Hilltop Circle, Baltimore, 21250, United States, guler@math.umbc.edu

In semidefinite programming, the decision variables are matrices which do not necessarily commute. In fact, this lack of commutation is present in many types of optimization problems beyond linear programming. This causes major difficulties in interior-point methods, both in devising algorithms and in their analysis. In this talk, we present a calculus for noncommuting variables and demonstrate its relevance in sdemidefinite programming.

■ SD40

R - 3rd Floor, Barcelona I

Characterizing and Controlling Congestion

Sponsor: Optimization/ Network Optimization
Sponsored Session

Chair: Lisa K. Fleischer, IBM, T J Watson Research, Yorktown Heights, NY, 10598, United States, lkf@watson.ibm.com

1 - Pricing, Investment, and Market Structure in Industries with Congestion
Gabriel Y. Weintraub, Management Science and Engineering Dept., Stanford University, Terman Engineering Center, 3rd Floor, Stanford University, Stanford, CA, 94305, United States, gweintra@stanford.edu, Ramesh Johari

We model an industry with congestion as a network with parallel links. We analyze a game where firms compete setting prices and investing to modify their latency functions. Consumers traffic is routed according to a Wardrop equilibrium. We characterize industry equilibria, compare equilibrium investment levels to the social optimum, and study market structure as market size increases.

2 - Networks with Heterogeneous Congestion Control Protocols
Steven Low, Professor, Caltech, MC256-80, Caltech, Pasadena, CA, 91125, United States, slow@caltech.edu, Ao Tang, Jiantao Wang, Mung Chiang

When heterogeneous congestion control protocols that react to different pricing signals share the same network, the resulting equilibrium may no longer be interpreted as a solution to the standard utility maximization problem. We develop a model for equilibrium properties of such a network, derive conditions for global uniqueness and stability of the equilibrium, and present experimental results to verify these findings.

3 - Applications of Generalized Poincare-Hopf in Network Optimization
Asu Ozdaglar, MIT, 77 Massachusetts Avenue, 32-D630, Cambridge, MA, 02446, United States, asuman@MIT.EDU, Alp Simsek, Daron Acemoglu

The operation and structure of today's networks necessitate considering nonconvex optimization problems for resource allocation. In this paper, we present an analysis for these problems using the index theory of differential topology. In particular, we show that the recent generalization of the Poincare Hopf theory can be used to establish uniqueness of critical points and stability in a variety of network optimization problems.

4 - Routing Without Regret
Katrina Ligett, Department of Computer Science, Carnegie Mellon University, Pittsburgh, PA, 15213, katrina@cs.cmu.edu, Eyal Even-Dar, Avrim Blum

There has been substantial work on simple, efficient "no-regret" algorithms for a number of adaptive game-playing problems including online routing. There has also been substantial work on analyzing properties of Nash equilibria in routing games. In this talk, we will consider the question: if each player in a routing game uses a no-regret strategy, will behavior converge to a Nash equilibrium, and under what conditions and in what sense?

■ SD41

R - 3rd Floor, Barcelona II

Integer Programming

Sponsor: Optimization/ Integer Programming
Sponsored Session

Chair: Alper Atamturk, University of California, Berkeley, Department of IEOR, Berkeley, CA, United States, atamturk@ieor.berkeley.edu

1 - Computational Experience with Branching on Hyperplane Algorithms for Mixed Integer Programming
Sanjay Mehrotra, Professor, Northwestern University, 2145 Sheridan Rd., Room C140, Evanston, IL, 60601, United States, mehrotra@iems.northwestern.edu, Huanyuan(Wayne) Sheng

We will present our computational experience with branching on hyperplane algorithms for mixed integer programming. Results will be discussed based on the performance of basis reduction algorithms and implementation strategies for different formulations of this approach. Results based on an implementation in a solver system "IMPACT" will be presented on difficult knapsack and market split problems; and depending on the progress, on sparse mixed integer programming problems.

2 - Is Thinner Better?
Gabor Pataki, Dept. of Statistics and Operations Research, University of North Carolina, Chapel Hill, NC, United States, gabor@unc.edu, Bala Krishnamoorthy

We present a class of hard integer programs, called cascade problems, in which branching on directions in which the polyhedron is "thin" is inferior to branching on "less thin", but dominant directions. We also show that this phenomenon appears in some practical instances as well; and why a preconditioning method called column basis reduction provably makes these instances easy for branch-and-bound.

3 - Optimizing over the MIR closure

Sanjeeb Dash, Research Staff Member, IBM Research, IBM T. J. Watson Research Center, 1101 Kitchawan Road, Yorktown Heights, NY, 10598, United States, sanjeebd@us.ibm.com, Oktay Gunluk, Andrea Lodi

We study the problem of separating an arbitrary point from the MIR closure of a polyhedron (finding violated rank-1 MIR cuts). Motivated by the work of Fischetti and Lodi (2005), who gave an MIP model for separating from the Chvatal closure of a polyhedron, we describe an MIP model for separating from the MIR closure of a polyhedron. Our analysis yields a short proof of the result of Cook, Kannan and Schrijver (1990) that the split closure of a polyhedron is again a polyhedron.

4 - 3-state Unconstrained Quadratic Programming

Deepak Rajan, Post Doc, IBM Research, IBM T. J. Watson Research Center, 1101 Kitchawan Road, Yorktown Heights, NY, 10598, United States, drajan@us.ibm.com, Andrea Lodi, Sanjeeb Dash

We study the unconstrained {-1,0,1} Quadratic Programming problem. Our main contributions are cutting planes that strengthen its linearization, and a branching strategy that allows us to add these cuts in the branch-and-bound tree, and yet maintain sufficient problem structure to transform the new formulation into a min-cost network flow (MCF), and eventually to a slightly modified max flow problem. Finally, we present computational results using this approach on real-world problem instances.

■ SD42

R - 4th Floor, Parc Ballroom I

Risk-Averse Stochastic Optimization

Sponsor: Optimization/ Stochastic Programming
Sponsored Session

Chair: Darinka Dentcheva, Associate Professor, Stevens Institute of Technology, 1 Castle Point on Hudson, Hoboken, NJ, 07030, United States, ddentche@stevens.edu

1 - Inverse Stochastic Dominance and Rank Dependent Utility

Darinka Dentcheva, Associate Professor, Stevens Institute of Technology, 1 Castle Point on Hudson, Hoboken, NJ, 07030, United States, ddentche@stevens.edu, Andrzej Ruszczynski

We consider optimization problems with second order stochastic dominance constraints formulated as a relation of Lorenz curves. We characterize the relation in terms of rank dependent utility functions. We develop optimality conditions and duality theory for problems with Lorenz dominance constraints. We prove that Lagrange multipliers associated with these constraints can be identified with rank dependent utility functions.

2 - Portfolio Construction Based on Stochastic Dominance and Target Return Distributions

Gautam Mitra, Professor, Brunel University, Middlesex, Uxbridge, UB8 3PH, United Kingdom, Gautam.Mitra@brunel.ac.uk, Diana Roman, Ken Darby- Dowman

The construction of a portfolio, which is non-dominated with respect to second order stochastic dominance and whose return distribution has specified desirable properties, is considered. The proposed model leads to portfolios which are optimal for rational and risk-averse investors. The model is multi-objective and is transformed into a single objective model by using the reference point method. The performance of the models on real data drawn from the Hang Seng index is also investigated.

3 - Statistical Tests for Stochastic Dominance

Ludmyla Rekeda, Stevens Institute of Technology, Dep. of Math.Sc., Hoboken, NJ, United States, luda.rekeda@novartis.com, Darinka Dentcheva

The comparison of distributions of uncertain prospects has been of considerable interest in various branches of science. One of the most popular stochastic orders is based on the notion of stochastic dominance. Stochastic dominance plays an increasingly prominent role in the decision theory under uncertainty, and has multiple applications. We shall present the comparison between the existing approaches for testing stochastic dominance, and shall propose a new approach.

4 - Most Informative Component Analysis in Application to a Stock Market

Anton Molyboha, Ph.D. student, Stevens Institute of Technology, Department of Mathematical Sciences, Hoboken, NJ, 07030, United States, amolyboh@stevens.edu, Michael Zabarankin, Jeffrey Nickerson

The Most Informative Component Analysis (MICA) for analysis of complex stochastic systems has been developed. The MICA is based on the notion of mutual information and identifies the most informative robust factors for describing stochastic system states and comparing states one to another. It significantly reduces human workload in information processing and latency in decision making. As an example, the MICA is used for analyzing a stock market and a sensor network.

■ SD43

R - 4th Floor, Parc Ballroom II

Robust Search in CP

Sponsor: INFORMS Computing Society/ Constraint and Integer Programming
Sponsored Session

Chair: Gilles Pesant, CRT, University of Montreal, Montreal, Qc, Canada, pesant@crt.umontreal.ca

1 - No-good Learning and Search Restart for Impact Based Strategies

Philippe Refalo, ILOG, Les Taissounieres, 1681, route des Dolines, Sophia Antipolis, 06560, France, prefalo@ilog.fr

Impact-based strategies are general purpose strategies that select variables and values by observing, during search, the effect of instantiations on the reduction of the search space. We have studied primal and dual impact based strategies together with nogood learning and restart. On various problems, such as sport scheduling and multiknapsack, classical strategies are outperformed.

2 - Comparison of Search Methods for the Talent Scheduling Problem

Paul Shaw, Principal Scientist, ILOG, 1681 route des Dolines, Valbonne, France, pshaw@ilog.fr

The talent scheduling problem involves the minimization of talent waiting costs by best ordering the filming of scenes. In this talk, we present various search methods for the problem, including constructive techniques, local search methods, and hybrids, such as large neighborhood search. We compare our methods on problems from the literature and a new larger set of problems that we have created.

3 - Increasing Robustness by Means of Randomization for LP Based Methods

Carla Gomes, gomes@cs.cornell.edu

I will discuss how the accuracy of LP based relaxations can vary dramatically as a function of the problem space and show how randomization can be very effective in increasing the robustness of branch and bound methods.

4 - Multiconsistency and Robustness with Global Constraints

Khaled Elbassioni, Professor, Max-Planck Institute for Informatics, Saarbrucken, 66123, Germany, elbassio@mpi-sb.mpg.de, Irit Katriel

We propose a natural generalization of arc-consistency, which we call multiconsistency: A value v in the domain of a variable x is k-multiconsistent with respect to a global constraint C if there are at least k solutions to C in which x is assigned the value v. We present algorithms that determine which variable-value pairs are k-multiconsistent with respect to several well known global constraints.

5 - Constraint-Based Search Strategies

Gilles Pesant, CRT, University of Montreal, Montreal, Qc, Canada, pesant@crt.umontreal.ca

In constraint programming, tractable substructures of a problem have been encapsulated in constraints and then used to filter the domains of variables. But other information can often be obtained with little extra work, such as the number of solutions of the constraint. We investigate strategies exploiting the evolution of the number of solutions of each constraint to make search more robust.

■ SD44

R - 4th Floor, Parc Ballroom III

Heuristics for Large Scale Computing Systems

Sponsor: INFORMS Computing Society/ Heuristic Search
Sponsored Session

Chair: Pano Santos, HP labs, 1501 Page Mill Road, MS1140, Palo Alto, CA, 94304,
United States, cipriano.santos@hp.com

Co-Chair: Pedro Flores, Universidad de Sonora, Av. Rosales y Blvd. Transversal S/N, Hermosillo, Son., 83000, Mexico, pflores@gauss.mat.uson.mx

1 - A Mapper For Managing Shared, Virtualized Computing and Network

Robert P Ricci, University of utah, ricci@cs.utah.edu, Jay Lepreau

To virtualize shared computing and network resources, it is necessary to map virtual resource specification onto available physical resources. We present design, implementation, and evaluation of a solver for this problem. Our solver uses randomized heuristic techniques to find very good solutions in seconds, and scales on large synthetic topologies.

2 - Applying Bin-Packing Algorithms to Server Consolidation

Alex Zhang, HP Labs, 1501 Page Mill Road, MS1140, Palo Alto, CA, 94304, United States, alex.zhang@hp.com, Fereydoon Safai, Dirk Beyer

We apply bin-packing algorithms to server consolidation based on performance trace data and user-defined consolidation constraints. We extend the deterministic bin-packing heuristics (first-first decreasing and best-fit decreasing) to high-dimensional (20,000+), probabilistic bin capacities, where the dimensions are server performance metrics and time intervals in the trace. We will also present implementation results.

3 - Automated Application Component Placement at a Computing Utility

Pano Santos, HP labs, 1501 Page Mill Road, MS1140, Palo Alto, CA, 94304, United States, cipriano.santos@hp.com, Xiaoyun Zhu, Norman Salazar, Jim Jim Pruyne, Pedro Flores

This paper presents the optimal placement of application components to computing servers. A self-adapting genetic algorithm is used, since it gives more freedom in the definition of objectives and constraints than mathematical programming approaches, and provides reasonably good solution in a satisfactory amount of time.

4 - Solutions for Scheduling Data Recovery Operations after Disasters

Kimberly Keeton, HP Labs, 1501 Page Mill Road, MS1140, Palo Alto, CA, 94304, United States, kimberly.keeton@hp.com, Dirk Beyer, Ernesto Brau, Arif Merchant, Pano Santos, Alex Zhang

When failures occur at dependable storage systems, administrators schedule recovery based on rules of thumb. With multiple workloads and protection techniques, the number of possibilities is large, so the decision process is not trivial. We will describe the data recovery scheduling problem, a mathematical programming and a heuristic solution approaches.

■ SD45

R - 4th Floor, Raphael

Dynamic Routing

Sponsor: Transportation Science & Logistics
Sponsored Session

Chair: Barrett Thomas, Assistant Professor, University of Iowa, Department of Management Sciences, 108 Pappajohn Business Building, Iowa City, IA, 52242, United States, barrett-thomas@uiowa.edu

1 - Robust Formulations for Empty Repositioning Problems

Juan Morales, Graduate Student, Georgia Institute of Technology, School of Industrial and Systems Engineering, 765 Ferst Drive NW, Atlanta, GA, 30332-0205, United States, jmorales@isye.gatech.edu, Alan Erera, Martin Savelsbergh

Dynamic asset repositioning models are used in many freight transportation contexts to enable operators to cost-effectively serve demand which may be both geographically and temporally imbalanced. We develop a new robust approach for dynamic asset repositioning problems with demand uncertainty. Robust formulations will be presented and solution techniques discussed.

2 - Vehicle Routing Problems in a Competitive Environment

Miguel Figliozzi, University of Sydney, miguel@itls.usyd.edu.au, Hani Mahmassani, Patrick Jaillet

In this presentation, we extend a prize collecting TSP to a dynamic environment with time windows and uncertainties in the prizes and/or cities to visit. We model, analyze, and discuss some properties of this problem in a dynamic setting. Different solution strategies are developed and simulated.

3 - A Parallelizable Dynamic Fleet Management Model with Random Travel Times

Huseyin Topaloglu, Assist. Prof., Cornell University, 223 Rhodes Hall, Ithaca, NY, 14853, United States, topaloglu@orie.cornell.edu

We present a dynamic feet management model with random travel times. Our approach decomposes the problem into time-staged subproblems by formulating it as a dynamic program and uses approximations of the value function. In order to deal with random travel times, the state variable of our dynamic program includes all individual decisions over a relevant portion of the history. We show how to approximate the value function in a tractable manner under this new high-dimensional state variable.

4 - Real-time Heuristics for Anticipating Service Requests from Known Customer Locations

Barrett Thomas, Assistant Professor, University of Iowa, Department of Management Sciences, 108 Pappajohn Business Building, Iowa City, IA, 52242, United States, barrett-thomas@uiowa.edu

This talk focuses on real-time heuristics for maximizing the number of previously unknown customer service requests that can be inserted into a prespecified route when the unknown requests arrive throughout the time horizon and all customer locations are known with certainty. The heuristics are derived from analytical results on the structure of the optimal policy, and the heuristic policies are compared to optimal policies for a number of instances.

■ SD46

R - 4th Floor, Rubens

Urban Transportation Planning Models IV: Transit Models and Planning

Sponsor: Transportation Science & Logistics
Sponsored Session

Chair: Grisselle Centeno, Assistant Professor, University of South Florida, Industrial and Management Systems Engine, 4202 E. Fowler Ave. ENB118, Tampa, FL, 33620-5350, United States, gcenteno@eng.usf.edu

1 - Identifying Driver Preferences for Flexible Shifts

Juan Carlos Munoz, Assistant Professor, Universidad Catòlica de Chile, V Mackenna 4860, Santiago, Santiago, 6904411, Chile, jcm@ing.puc.cl, Felipe Miranda

Transit productivity could be considerably improved if drivers were requested to work a combination of short and long shifts since a better match with typical passenger demand fluctuations could be obtained. We develop a methodology for identifying driver preferences regarding these shifts and apply it in Santiago de Chile.

2 - Bidding Process for a Transit System: A Minimum Cost Network Flow Approach

Diego Molina, SECTRA, Santiago, Chile, damolina@ing.puc.cl, Juan Carlos Munoz

The transit system in Santiago de Chile is being completely restructured. The city was divided into 15 subsystems which were open for a bidding process. Each subsystem would be assigned to the firm requesting the lower fare per passenger. However, for strategical reasons, certain sets of subsystems could not be assigned to the same firm. The problem is solved as a Minimum Cost Network Flow Problem. The results of the Santiago bidding process are shown and discussed.

3 - Measuring Uncertainty in the Reasoning Process: A Case of Justifying a Large -Scale Transit Project

Shinya Kikuchi, Professor, University of Delaware, Civil and Environmental Engineering, Newark, DE, 19716, United States, kikuchi@ce.udel.edu, Sharat Chandra Mangalpally

This study measures the logical strength of reasoning chains that are involved in planning a large-scale transit project. The reasoning chains consist of series of "if...then... statements. The strength of the overall logical chain depends on the uncertainty of individual links and how they are connected. We propose a method that measures uncertainty in individual links based on the available information and after aggregation, measures the overall integrity of the logic of the plan.

4 - Integrated Integer Programming and Scheduling Models for Maintenance Decisions

Grisselle Centeno, Assistant Professor, University of South Florida, Industrial and Management Systems Engine, 4202 E. Fowler Ave. ENB118, Tampa, FL, 33620-5350, United States, gcenteno@eng.usf.edu, Paula Lopez-Alvarado

This research combines IP and scheduling models with forecasting techniques to allocate resources in maintenance departments. The information resulting from the models is entered into a support system that generates scenarios that facilitate the process of resource planning and resource allocation. Better planning of job repairs result in cost savings, timely maintenance and reduction of road calls which translates into better and more cost effective transit services.

■ SD47

R - 4th Floor, Michelangelo

Emergency and Security Planning in Transportation Systems

Contributed Session

Chair: Ying Liu, University of Maryland, Department of Civil Engineering, University of Maryland, College Park, 20742, United States, lyng@wam.umd.edu

1 - A Methodology for Identifying Connectivity Disruption Zones in a Transportation Network

Pamela Murray-Tuite, Assistant Professor, Virginia Tech, Northern Virginia Center, 7054 Haycock Road, Falls Church, VA, 22043, United States, murray@alumni.duke.edu

This paper presents a methodology for identifying disruption zones in a surface transportation network. An index defines the network connectivity disruption caused by damage to a particular link. This index, combined with the network structure, defines the connected set of links that form a disruption zone. These zones identify areas in the network that may benefit from additional alternate routes.

2 - Data Integration for Improving Management of Traffic Incidents

Paul Salasznyk, Research Assistant, Rensselaer Polytechnic Institute, CII 5107, 110 Eighth St, Troy, NY, 12180, United States, salasp@rpi.edu, Earl Lee, George List, William Wallace

In the wake of the terrorist attacks of September 11, 2001, incident response must be faster, more integrated, and more intelligent in responding to these events in order to reduce the human, economic and environmental losses. Improving data sharing requires rigorous systems analysis, including what needs to be shared and what common form the shared data must be in.

3 - Emergency Vehicle Routing on an Uncertain Transportation Network

Christopher Rump, Assistant Professor, Applied Stats & Operations Research, College of Business Administration, Bowling Green State University, Bowling Green, OH, 43403, United States, cmrump@bgnet.bgsu.edu, Daniel Chomiakow

We consider the routing of emergency vehicles in the wake of a natural disaster such as a major earthquake. Due to the possibly damaged transportation infrastructure at bridges and highway overpasses, we draw upon concepts in network reliability to obtain expected travel time and variance estimates for a tree of alternative paths. We develop and test our routing algorithms with an eye towards their use as input for higher-level dispatching decisions.

4 - An Optimization/Simulation Model for Emergency Evacuation: Case Study for Ocean City

Ying Liu, University of Maryland, Department of Civil Engineering, University of Maryland, College Park, 20742, United States, lyng@wam.umd.edu, Gang-Len Chang

This study presents an integrated optimization/simulation model for emergency evacuation. The proposed model first employs an MIP module to optimize the initial set of network control parameters, and then executes a microscopic simulation module to identify potential operational issues and network physical constraints. The solution algorithm with the iterative optimization/simulation process can ensure the optimized evacuation plan has taken into account all real-world operational constraints.

■ SD48

R - 4th Floor, Dante

Planning and Evaluating Healthcare Interventions

Sponsor: Health Applications
Sponsored Session

Chair: Elissa Ozanne, Harvard Medical School, 101 Merrimac St., 10th Fl., Institute for Technology Assessment, Boston, MA, 02114, United States, elissa@mgh-ita.org

1 - A Deterministic Simulation Model to Assess the HIV/AIDS Interventions

Christian Viladent, Assistant, HEC Business School-University of Lausanne, BFSH-1 Dorigny, Lausanne, 1015, Switzerland, Christian.Viladent@unil.ch, Ann Van Ackere

We developed a two-sex deterministic simulation model of the Human Immunodeficiency Virus transmission in selected sub-Saharan countries. Calibration will be performed on data from Botswana. We plan to apply our model to assess the local impact of the Highly Active Antiretroviral Therapies delivered during the UNAIDS 3 x 5 Program.

2 - Allocating Funds for HIV/AIDS: The Case of KwaDukuza

Arielle Lasry, Student, University of Toronto, 5 King's College Road, Dept. of Mech. & Industrial Engineering, Toronto, ON, M5S 3G8, Canada, arielle@mie.utoronto.ca, Greg Zaric, Michael Carter

The current HIV prevalence rate in the municipality of KwaDukuza, South Africa, hovers around 33% for a population of 170,000. We conducted 40 interviews to understand the manner in which funds are being allocated towards HIV/AIDS interventions in KwaDukuza. We establish the types of political and social constraints faced by decision-makers when allocating resources to HIV/AIDS programs. Our research aims to suggest strategies for improving the HIV/AIDS resource allocation process in KwaDukuza.

3 - The Physician's Dilemma: Keeping Patients Healthy and Costs Down

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

We develop a model of the physician's decision process for deciding whether to screen a patient for disease. We use the theory of partially observable Markov decision processes for the single patient case and present extensions for the n-patient model for two examples: breast cancer and cervical cancer screening.

4 - The Minimal Risk Partitioning Algorithm: A Bayesian Cure Model for Breast Cancer

Elissa Ozanne, Harvard Medical School, 101 Merrimac St., 10th Fl., Institute for Technology Assessment, Boston, MA, 02114, United States, elissa@mgh-ita.org, Laura Esserman, James Miller

Previous long-term studies of patients with breast cancer have demonstrated that an appreciable proportion is no longer at risk of disease progression after surgery and radiation. We have developed the Minimal Risk Partitioning Algorithm (MRPA) to identify cured patients that integrates Kaplan-Meier analysis, step-wise logistic regression, and step-wise Cox regression in a Bayesian framework. The MRPA was built and then validated using two long-term outcome databases.

■ SD49

R - 4th Floor, Medici

Analysis of Complex Systems for Decision Making

Contributed Session

Chair: Kathleen Whitcomb, Associate Professor, University of South Carolina, Moore School of Business, Columbia, SC, 29208, United States, whitcomb@moore.sc.edu

1 - A Decision Support System for Managing Technological Innovation Process

Sharon Ordoobadi, Assistant Professor, University of Massachusetts-Dartmouth, 285 Old Westport Road, N. Dartmouth, MA, 02747, United States, sordoobadi@umassd.edu

The process of technological innovation in small manufacturing companies is studied to better understand the process and improve it. The study revealed that intuition played a major role in this process. To facilitate the transfer of intuition/experience from one manager to another, a decision support system is developed through the use of Similarity-based reasoning and proverbs.

2 - A Plug and Play Framework for Rapid Decision Modeling

Kim Hua Tan, Dr., Nottingham University Business School, Jubilee Campus, Wollaton Road, Nottingham, United Kingdom, kim.tan@nottingham.ac.uk

This paper proposes a plug & play framework that allows managers to rapidly build simplified models of complex operating situations. These models enable them to understand and experiment with these complex situations. The salient features of the framework are its ability to serve as scaffolding for managers building their own models, and to provide support for knowledge access and re-application. This paper introduces the plug & play principle and discusses the implication of this research.

3 - Revenue Management Models for IT Service Providers using Virtualization Techniques

Thomas Setzer, Research Assistant, Technische Universitat München, Chair of Internet-based Information Systems (IBIS), Boltzmannstr. 3, Garching / Munich, 85748, Germany, setzer@in.tum.de, Bichler Martin

In this paper we propose and evaluate policies for allocating virtualized resources of IT service providers when they are faced with stochastic demand for heterogeneous services. Our models maximize total profits by accepting or rejecting service requests, depending on their profit-opportunity costs ratios. Opportunity costs - high demand may exploit resource pools and entail rejections - are calculated based on service prices, service levels, consumption coefficients and estimated workload.

4 - Using Multiattribute Value Theory as a Manipulation Detection Tool in Stock Market

Dr. Guldal Buyukdamgaci Alogan, Vice President, TUBITAK, Tunus Cd. No:80 Kavakl˜dere, Ankara, 06100, Turkey, mistikler@gmail.com, Ozan Ozcan

Distinguishing legal and manipulated purchasing/selling transactions has vital importance. Deciding if there is manipulation in the market necessitates modeling the decision environment and making transactions on this valid model. In this study a model is developed to detect manipulation by comparing the general situation of the stocks with the market and implemented in capital markets. The method is presented with multiattribute value measurement that is based on Edwards's SMARTS method.

5 - Eliciting Utilities and Similarity Measures for Case Based Decision Theory

Kathleen Whitcomb, Associate Professor, University of South Carolina, Moore School of Business, Columbia, SC, 29208, United States, whitcomb@moore.sc.edu

Gilboa, Schmeidler, and Wakker (2002) showed that, in principle, similarity measures and utilities can be derived based on observed preferences. We describe a procedure for eliciting similarities and utilities for a finite state space based on their results.

■ SD50

R - 4th Floor, Cervantes

DAS Practice Award Finalists

Sponsor: Decision Analysis
Sponsored Session

Chair: Kazuo Ezawa, Senior Director, Daiichi Medical Research Inc, One Maynard Drive, Park Ridge, NJ, 07656-0712, KazuoEzawa@DMR.DaiichiUS.com

DAS Practice Award Finalists

The Decision Analysis Society (DAS) of INFORMS seeks entries for the annual DAS Practice Award competition for every year. The intent of this award is to recognize, promote, and publicize good decision analysis practice. This year's finalists are as follows:

1 - How to Win Friends & Influence Deal Terms

Ajoy Chakrabarti, Assoc. Director Strategic Planning & Decision Analysis, Bristol Myers Squibb Co. (BMS), Ajoy.Chakrabarti@bms.com

Decision analysis techniques were used to value an oncology in-licensing candidate. The key issues involved analyzing the possible launch scenarios, suggesting modifications to the clinical plan and optimizing the milestone payments. Negotiations influenced by our analysis resulted in a set of deal terms that realistically addressed alternative launch scenarios and managed risk for both parties.

2 - Improving Quality of Decision Making — A Collaborative Approach between Universidad de los Andes and BP Exploration Company - Colombia

Mario Castillo, Associate Professor, University of Los Andes, Calle 19A # 1-37 Este Of. W510, Cra. 8 # 85-31 Ap. 801, Bogotà, DC, Colombia, mcastill@uniandes.edu.co, Alvaro Mendoza, Sergio Cabrales

BP Colombia faces high-impact decision making problems such as technology selection, oil exploitation strategies, and reserve estimation. To solve these problems BP and UniAndes have jointly developed methodologies and models based on decision analysis techniques. 60 engineers were trained on such techniques. This development has had a remarkable impact on BP's decision making processes.

3 - Patient Progression through Clinical Trials

James C. Felli, Ph.D, Lilly Research Laboratories, A Division of Eli Lilly and Company, Lilly Corporate Center, Indianapolis, IN, 46285, FELLI_JAMES_C@LILLY.COM, Wesley H. Anderson, James P. Kremidas, Stephen J. Ruberg

Clinical trials constitute large, resource-intensive endeavors for pharmaceutical companies. Accounts have estimated the number of patients involved in U.S. clinical trials as high as 725,000 with costs in excess of $19 billion annually. We designed and implemented a semi-Markov model to estimate a clinical trial's patient population profile to facilitate the framing and evaluation of trial management alternatives.

4 - An Assessment of Oil Market Disruption Risks

Phillip C. Beccue, 2228 Knollcrest Place, Westlake Village, CA, 91361, United States, phil_beccue@baxter.com, Hillard G. Huntington

The Energy Modeling Forum at Stanford developed a risk assessment framework and evaluated the likelihood of at least one foreign oil disruption over the next ten years. Leading geopolitical, military, and oil-market experts provided their expertise on the probability of different events occurring, and their corresponding link to major disruptions in key oil market regions.

Monday, 8:00am - 9:30am

■ MA01

H - Lobby Level, Plaza A

Tutorial: Attractive Formulations of Integer Programs

Cluster: Tutorials
Invited Session

1 - Tutorial: Attractive Formulations of Integer Programs
Warren Adams, Clemson University, wadams@clemson.edu, Richard Forrester

The mathematical representation of a decision problem can greatly affect solution strategies. We discuss reformulation and linearization techniques for 0-1, nonlinear continuous, and general discrete problems that can promote efficient optimization algorithms. Emphasis is given to program size and relaxation strength. General theoretical results will be provided, as well as detailed computational experience for a variety of problem classes.

■ MA02

H- Lobby Level, Plaza B

Software Development and Bank Branch Performance Under the DEA Microscope

Cluster: Data Envelopment Analysis
Invited Session

Chair: Joseph C. Paradi,CMTE, University of Toronto, paradi@mie.utoronto.ca

1- Assessing the Loan Quality and Business Generation Efficiency of a Large Canadian Bank's Branch Network Using DEA
Barak Edelstein,CMTE, University of Toronto, barak@mie.utoronto.ca, Joseph C. Paradi

Intermediation efficiency of the retail branch network of one of Canada's five largest banks are done using three DEA models: to maximize loan quality by minimizing the levels of bad loans produced; to seek to maximize the levels of deposits and loans generated; maximize the levels of potential business that could be generated with no regard to loan quality. Efficiency scores are not only affected by different market characteristics, but a small number of DMUs in a subgroup will generally lead to a higher percentage of efficient DMUs and higher average efficiency scores.

2- Software Production Efficiency Without Size Parameters Using DEA
Christopher McEachern,CMTE, University of Toronto, christopher.mceachern@utoronto.ca, Joseph C. Paradi

This study uses Data Envelopment Analysis (DEA) to evaluate 26 software projects completed at a Canadian bank. Internal measures of project risk, complexity, and customer satisfaction are used to assess three facets of the software process: time-to-market, cost estimation, and cost minimization. Very few DEA studies have accounted for risk/complexity in modeling software development; as well, this study does not rely upon an explicit measure of size to account for software development output.

3- The Use of DEA in the Measurement of Software Development Efficiency: A Quality Focused Approach
Joseph C. Paradi,CMTE, University of Toronto, paradi@mie.utoronto.ca, D. Schmidt

New DEA models for measuring software development efficiency were introduced using end-user quality experience as the main output instead of traditional size metrics. Projects with higher quality were found to be more efficient while larger, riskier, more complex projects had slightly lower efficiency. The relationship between size/risk/complexity and project quality was found to be negligible. DEA based software development productivity measurement offered managerially useful results.

4- Measuring and Incorporating Meaningful Proportional Slacks in Radial DEA Models, and Aspects of Non-Discretionary DEA Models
Barak Edelstein,CMTE, University of Toronto, barak@mie.utoronto.ca, Joseph C. Paradi

The Full Proportional Slack (FPS) radial DEA model proposes a new methodology for calculating slacks in radial DEA models. The measured slacks represent the full amount by which the corresponding variable needs to be adjusted, thus giving meaning to the slack to variable ratio. The proposed Proportional Slack Adjusted (PSA) DEA model incorporates these slacks into the overall efficiency score. The models are fully units invariant and produce optimal slack selection should alternative optimal solutions exist.

■ MA03

H - Ballroom Level, Continental Ballroom 1

Innovation in Teaching OR/MS

Contributed Session

Chair: Elia Chepaitis, echepaitis@mail.fairfield.edu

1 - Design and Use of a Continuing Case in a Course on Opns Mgmt - and also Project and Information Mgmt
James Stewart, Collegiate Professor, University of Maryland University College, Business & Executive Programs Department, 3501 University Boulevard East, Adelphi, MD, 20783, United States, jstewart@umuc.edu, Joseph D'Mello

The challenges of designing and using a continuing case in an online, internationally-oriented MBA course in operations, project and information management are addressed. It is found possible to address selected tools and techniques in each field so that students become managerially familiar with them and apply them in an integrated way that improves organizational performance in a new country.

2 - Supporting Self-Studying of Students with a Spreadsheet-Based Tutoring Software
Ralph Scheubrein, University of Hohenheim, Dept. 510A, Stuttgart, 70593, Germany, ralph@scheubrein.com

Students can deepen their understanding of quantitative methods if they implement the method on his/her own. In this presentation the simple spreadsheet-based tutoring system ExcelTutor is presented which supports the student to learn the steps which are necessary to compute the result of a specific method. The system provides the student with feedback about the correctness of the result and the time necessary to find the solution.

3 - Project Scheduling in Agile Product Development
Abdelghani Elimam, Professor, American University in Cairo, 113 Kasr el Aini Street, Cairo, 11511, Egypt, aelimam@aucegypt.edu, Bajis Dodin

Product development involves a large number of sequential activities leading to extended cycle time. We propose an approach to allow overlapping of activities that could reduce this cycle time. By starting an activity before completing its predecessors we run the risk of reworking part of this activity. We study the impact of overlapping on project duration and the expected amount of rework. A stochastic project network model is developed and computationally tested.

4 - Reengineering The Capstone IS Course: Leading Group Inquiry into Mission and the General Good
Elia Chepaitis, echepaitis@mail.fairfield.edu

This paper describes a radical departure from the traditional capstone course in the information systems (IS) major—away from individual projects toward a group inquiry into the profession's mission and the general good. The intent of the course is to explore and discuss the widening scope of IS in areas that involve the general welfare: security and privacy, misinformation, vice, the protection of intellectual property, the adequacy of the information infrastructures, economic development, disaster management, and information ethics, for example. By and large, due diligence has been left to the market and to business organizations, with occasional public funding, oversight, and coordination—such as in the rare case of Y2K. Strategies for the greater good, in areas noted above, have been ill-defined and uncoordinated, and this course will scrutinize these in the light of the University's Jesuit mission and ideals.

■ MA04

H - Ballroom Level, Continental Ballroom 2

Emergency Preparedness, Disaster Response, and Homeland Security

Sponsor: Public Programs & Processes
Sponsored Session

Chair: John Hall, National Fire Protection Association, 1 Batterymarch Park, Quincy, MA, 02169-7471, United States, jhall@NFPA.org

1 - Emergency Response and Follow-Up to the 9/11 Pentagon Crash: Lessons Still Unlearned
Doug Samuelson, InfoLogix, Inc., samuelsondoug@yahoo.com

In the emergency response to the 9/11/01 crash at the Pentagon, although much went well, serious problems of communication and coordination created additional, unnecessary hazards to life and safety. Follow-up regarding secondary health effects has been largely neglected. We present several recommendations for improvement.

2 - Building Evacuation Guidance, An Optimization with a Simulation Component
Mike Walters, Vice President for Modeling and Analysis, Regal Decision Systems, Inc., 2309 Belair Road, Third Floor, Fallston, MD, 21047, jmwalters@RegalDecision.com

Building evacuation can be a very confusing, disorganized exercise particularly in a large, multiple story office building. The authors present a real world case study of an "Evacuation Guidance System" that solves for the set of routes that occupants should follow to evacuate a building, in the least amount of time under a bio-chem attack. The solution routes are communicated to a "system integrator" that signals the evacuation routes via directional lighting installed in the building.

3 - Preventing the Spread of a Contagious Disease within a Military Population

Hillary Richardson, Systems Analyst, SAIC, richardsonhi@saic.com, Brian Phillips, Allison Hinds

An attack on a military base utilizing a biological weapon has the potential to accumulate significant numbers of casualties. If the weapon used during a bioterrorism event employed a contagious agent, an outbreak may occur with the potential for even greater numbers of casualties. Containment of the outbreak would be paramount. This paper discusses the analysis and modeling approach used to understand and quantify effects of an operational disease containment plan on a military installation.

4 - Terrorism Preparedness for Fire Departments

John Hall, National Fire Protection Association, 1 Batterymarch Park, Quincy, MA, 02169-7471, United States, jhall@NFPA.org

As every community's emergency first responders, fire departments are key to improved preparation for terrorist attacks. This talk will describe an assessment approach, emphasizing needs identification through consensus standards and analysis of resources versus needs. Results of a 2001 survey assessment with costing of needs will also be summarized.

■ MA05

H - Ballroom Level, Continental Ballroom 3

Interface between Marketing and Service Operations Management

Cluster: Service Sector Operations
Invited Session

Chair: Mei Xue, Assistant Professor, Boston College, xueme@bc.edu, Co-Chair: Mor Armony, NYU, 44 West Fourth Street, New York, NY, 10012, United States, marmony@stern.nyu.edu

1 - Acquisition and Retention Pricing in Service Systems Under Operational Constraints

Mor Armony, NYU, 44 West Fourth Street, New York, NY, 10012, United States, marmony@stern.nyu.edu, Avi Mandelbaum, Oded Koenigsberg, Oded Netzer

We consider a subscriber based service in which negative externalities pertain with respect to the quality of service experienced by individuals. Examples include: Direct banking, Video rental and Modem pools. The firm can affect acquisition and retention through pricing and service quality. We study joint pricing, staffing and control decisions that maximize system profit and performance.

2 - Collaboration and Joint Production in Services: Competition, Pricing and Design

Uday Karmarkar, Professor, Times Mirror Chair in Management & Policy, The Anderson School of Management, UCLA, Gold Hall, Suite B-407, 110 Westwood Pla, Los Angeles, CA, 90095, United States, uday.karmarkar@anderson.ucla.edu, Scott Carr

Many services involve joint production or collaboration between the supplier and the customer. The management of joint production can pose problems, because the objectives of customers and providers are different. Sometimes these issues are addressed through the service contract, and sometimes through the design of the service. We develop a framework for modeling and analyzing joint production processes, and investigate the relationships to the contracting and principal-agent literature.

3 - Operations as Marketing - Manufacturing and Service Management Perspectives

Aleda Roth, W. P. Carey Chair of Supply Chain Management, Arizona State University, W. P. Carey School of Business, Tempe, AZ, 85287-4106, United States, aleda.roth@asu.edu

In this session, I will compare and contrast trends related to operations and marketing interfaces from the perspective of manufacturing and service management. I will highlight trends and provide some recent research on the topic. Challenges and opportunities for future research will be presented.

4 - Customer Efficiency, Service Demand and Firm Performance in Retail Banking

Mei Xue, Assistant Professor, Boston College, xueme@bc.edu, Lorin Hitt, Patrick Harker

Innovations in technology and service design have increasingly enabled firms to incorporate self-service technology into service delivery systems. As a result the performance of the delivery system and customers' choice of service channels can be affected by their efficiency in service co-production (customer efficiency). Using detailed data for a large retail bank, we characterize the interrelated demand for service channels and examine how customer efficiency affects firm performance.

■ MA06

H - Ballroom Level, Continental Ballroom 7

Modeling and Algorithms in Logistics I

Contributed Session

Chair: Whitney Conner, Dept. of Industrial Engineering Graduate Student, The Pennsylvania State University, Industrial and Manufacturing Engineering, 310 Leonhard Building, University Park, PA, 16802, United States, wac129@psu.edu

1 - Integrated Modeling for Supply Chain Network

Joungho Lee, Doctoral Student, Hong-ik University, Dep't of Business Administration, 72-1 Sangsoo-dong Mapo-gu, Seoul, 121-791, South Korea, leejoungho@hanmail.net, Choonho Ryu

This paper introduces an integrated supply chain network problem in which facilities and links have the capacities on their spplies and flows, respectively. We present a mixed integer programming formulation of the problem and consider its Lagrangean relaxation schemes. Computational experiments with problems and its sensitivity analysis on a couple of parameters are reported.

2 - The Multistage Stochastic Integer Load Planning Problem

Cheng-Chang Lin, Professor and Chairman, Dept. of Transportation Science, National Cheng Kung University, 1 University Road, Tainan, Taiwan, cclin@mail.ncku.edu.tw, Jeffery Lin

Under uncertain demands, the multistage stochastic integer load planning for the freight delivery industry is to determine multistage freight paths and distribute trailers over time while meeting operational and service requirements. We developed a heuristic approach, scenario aggregation with embedded branching on the binary variables. The numerical experiments showed a proactive operations strategy with a lower operating cost than the conventionally deterministic approach.

3 - A Multi-product, Multi-depot Periodic Distribution Problem, under Limited Supply Environment

Parthana Parthanadee, Kasetsart University, 50 Phahonyothin Rd., Lat Yao, Jatujak, Bangkok, Thailand, parthana.p@ku.ac.th, Rasaratnam Logendran

We present a multi-product, multi-depot periodic distribution problem, where depots operate interdependently to satisfy demands. Three tabu-search heuristics with different long-term memory applications are developed. The heuristics are evaluated and found that they provide optimal or good solutions in reasonable time. Applying the heuristics, the results reveal that the interdependent operations provide significant cost savings over the independent operations, especially for large problems.

4 - Stochastic Demand and Capacity Assignments with Multiple Facilities

Kevin Taaffe, Assistant Professor, Clemson University, 110 Freeman Hall, Clemson, SC, 29634, United States, taaffe@clemson.edu, Joseph Geunes, Edwin Romeijn

We study a class of capacity acquisition and assignment problems with stochastic demands often found in operations planning contexts. Assume a supplier utilizes a set of facilities to satisfy the demands of different customers or markets. Our model simultaneously assigns customers to each facility and determines the best capacity level per facility. This results in a new class of stochastic assignment and capacity planning problems, for which we propose a branch-and-price solution approach.

5 - Solving the Minimax Sensor Location Problem: Towards the Largest Peak

Whitney Conner, Dept. of Industrial Engineering Graduate Student, The Pennsylvania State University, Industrial and Manufacturing Engineering, 310 Leonhard Building, University Park, PA, 16802, United States, wac129@psu.edu, Tom Cavalier, Enrique del Castillo

A sensor location problem is investigated with the objective of minimizing the maximum probability of non-detection of a planar event. A heuristic method is developed which evaluates the objective at Voronoi points and moves sensors towards the points of maximum probability of non-detection. Results are compared with MATLAB's fminimax solver.

■ MA07

H - Ballroom Level, California

Operations Research and Homeland Security

Sponsor: Manufacturing & Service Oper Mgmt
Sponsored Session

Chair: Lawrence Wein, Professor, Stanford University, 518 Memorial Way, Stanford, CA, United States, wein_lawrence@gsb.stanford.edu

1 - Operational Effectiveness of Suicide Bomber Detector Schemes: A Best-Case Analysis

Edward Kaplan, William N and Marie A Beach Prof of Mgt Sciences and Public Health, Yale School of Management; Yale School of Medicine, Box 208200, New Haven, CT, 06520-8200, United States, edward.kaplan@yale.edu, Moshe Kress

Standoff explosives detection technologies allow for the detection of pedestrian suicide bombers in principle, though such sensors are not yet sufficiently affordable and reliable to justify widespread deployment. What if they were? We analyze best-case operational effectiveness of sensor-based detector schemes in reducing casualties from random suicide bombing attacks. Under optimistic assumptions, deploying suicide bomber detectors will not reliably result in meaningful casualty reductions.

2 - An Effective Two-finger, Two-stage Biometric Strategy for the US-VISIT Program

Manas Baveja, Graduate Student, Stanford University, 127 Running Farm Lane, Apt. 103, Stanford, CA, 94305, United States, manas@stanford.edu, Lawrence Wein

We analyze two two-stage biometric strategies for the US-VISIT Program. The first stage sets quality-dependent threshold limits and generates a list of poor-quality candidates for the second stage, where further screening is performed by either face recognition or a slower, more thorough fingerprint matching algorithm.

3 - A Queueing Analysis of the Detention and Removal of Illegal Aliens: How Many Beds Are Needed?

Lawrence Wein, Professor, Stanford University, 518 Memorial Way, Stanford, CA, United States, wein_lawrence@gsb.stanford.edu, Yifan Liu

Due to lack of detention capacity, tens of thousands of apprehended illegal aliens are released into the U.S. interior each year instead of being removed. We construct a queueing model of the INS's detention and removal operations and use 2003 government data to determine that the number of beds should be increased from 21,000 to 35,000.

■ MA08

H - Ballroom Level, Imperial A

Health Care

Sponsor: Manufacturing & Service Oper Mgmt
Sponsored Session

Chair: Xuanming Su, University of California, Berkeley, 545 Student Services Bldg # 1900, Berkeley, CA, 94720, United States, xuanming@haas.berkeley.edu

1 - Designing Appointment Systems for Outpatient Healthcare Facilities

Sergei Savin, Associate Professor, GSB, Columbia University, 404 Uris Hall, 3022 Broadway, New York, NY, 10027, United States, svs30@columbia.edu, Linda Green

We consider the general appointment management problem for an outpatient facility that only accepts appointments within certain "appointment window". The rationale behind this approach is that the facility needs to balance the potential gains from accepting an appointment and potential losses which may result if the appointment is cancelled. We formulate this problem as a stochastic dynamic program and study the properties of the optimal appointment rules.

2 - Mathematical Modeling of Dynamic Breast Cancer Screening Policies

Julie Simmons Ivy, Assistant Professor, University of Michigan, 701 Tappan Street, Ann Arbor, MI, United States, jsimmons@umich.edu, Lisa Maillart

We present a partially observed Markov decision process model for advancing the understanding of dynamic breast cancer screening. This model incorporates the dynamic nature of breast cancer incidence, breast cancer aggression and mammogram-efficacy between the pre- and post-menopausal phases. The value of this model lies in its ability to evaluate different screening policies, and construct informative tradeoff curves that plot some measure of "policy effort" versus mortality risk.

3 - Pandemic Flu: Catch Me If You Can

Joseph Wu, Assistant Professor, Georgia Tech, School of Industrial and Systems Engineering, Atlanta, GA, 30332, United States, joseph.wu@isye.gatech.edu

In the event of a pandemic flu outbreak, contact-tracing coupled with quarantine or antiviral prophylaxis or both is our first line of defense when a vaccine is not available. The short incubation time of influenza means that contact-tracing must be very specific and efficient to be effective. We propose a contact-tracing policy that is driven by diagnostic test results. A discrete-event simulator is built to assess the effectiveness of this policy.

4 - Models for Optimizing Dialysis Initiation Strategies

Chris Lee, PhD Candidate, Stanford University, 185 Estancia Drive, #440, San Jose, CA, United States, cpclee@stanford.edu, Stefanos Zenios

Currently, little is known about the timing of dialysis and its impact on cost-benefit. Outcomes of the therapy remain poor. In this study, we look at computationally-intensive models for optimizing timing. One model is based on Stochastic Shortest-Path and integrates sub-models of disease progression, hospitalization, transplants, etc. In another model, we forego fine details for tractability, and solve (sequentially) an optimal stopping problem and an ODE. The focus is on policy-setting.

■ MA09

H - Ballroom Level, Yosemite A

Flexibility and Pricing in Operations Management

Cluster: Supply Chain Management
Invited Session

Chair: Ebru Bish, Assistant Professor, Virginia Tech, Dept. of Industrial and Systems Engg., Blacksburg, VA, 24061-0118, United States, ebru@vt.edu

1 - Mix Flexibility and Dual Sourcing under Unreliable Supply

Yimin Wang, University of North Carolina, McColl Building, CB3490, Chapel Hill, NC, 27599, United States, yimin_wang@unc.edu, Brian Tomlin

We study unreliable supply chains that produce multiple products. We show that a product-dedicated strategy may be strictly preferred over a flexible strategy even if dedicated resources are more expensive than the flexible resource. We also investigate the influence that resource attributes, firm attributes, and product-portfolio attributes have on the attractiveness of various supply-chain structures that differ in their levels of mix-flexibility and supplier diversification.

2 - Capacitated Production Planning with Price-Sensitive Demand and General Concave Revenue Functions

Joseph Geunes, Associate Professor, University of Florida, 303 Weil Hall, Gainesville, FL, 32611, United States, geunes@ise.ufl.edu, Yasemin Merzifonluoglu, Edwin Romeijn

We develop a solution approach for discrete-time, finite-horizon production planning problems with economies of scale in production, price-sensitive demand, and time-invariant production capacities. Our model considers general concave revenue functions in each period, and seeks to maximize total revenue less production and inventory holding costs. Under mild conditions on the revenue function properties, we provide a polynomial-time solution method for this problem class.

3 - A Periodic Review Inventory Model with Two Freight Modes and Continuous Cost Accounting

Aditya Jain, PhD Candidate, University of Rochester, CS 4341, Carol Simon Hall,, Simon Shcool, University of Rochester, Rochester, NY, 14627, United States, JAINA1@simon.rochester.edu, Nils Rudi, Harry Groenevelt

We first characterize the optimal combination of two freight modes, differing in lead-time and variable/fixed costs, for a given order size. Using this, we formulate a dynamic program and study the optimal replenishment decisions, and also perform stationary analysis of the problem assuming an (s,S) policy. The analysis provides a link between the optimal policy and fill rate, and is compared to models with single freight mode.

4 - Impact of Postponement and Demand Substitution on the Optimal Capacity of the Flexible Resource

Ebru Bish, Assistant Professor, Virginia Tech, Dept. of Industrial and Systems Engg., Blacksburg, VA, 24061-0118, United States, ebru@vt.edu, Rawee Suwandechochai

We study the impact of price/quantity postponement and demand substitution on the optimal capacity of the flexible resource considering a two-product firm. We model the firm's resource investment decision under the different postponement strategies as two-stage stochastic programming problems, and characterize the structure of the optimal capacity investment.

■ MA10

H - Ballroom Level, Yosemite B

Empirical Research in Supply Chain Management

Cluster: Supply Chain Management
Invited Session

Chair: Murat Kristal, Assistant Professor, York University, 4700 Keele Street, Toronto, ON, M3J 1P3, Canada, MKristal@schulich.yorku.ca

1 - The Impact of IT Agility of Organizational and Supply Chain Performance
Andrea Masini, Assistant Professor, London Business School, Sussex Place, London, NW1 4SA, United Kingdom, amasini@london.edu

Business organizations increasingly rely on IT systems and applications to maximize agility and improve supply chain effectiveness. Yet, the returns on these investments are often questioned. To shed light on this issue this paper provides a characterization of IT agility and analyses its impact on organizational and supply chain performance.

2 - An Empirical Analysis of Newsvendor Decision Making
Christian Terwiesch, Associate Professor, The Wharton School, 548 Jon M. Huntsman Hall, Philadelphia, PA, 19104.6366, United States, terwiesch@wharton.upenn.edu, Marcelo Olivares

We analyze empirically how people act in Newsvendor-type decision situations. Our study is based on experimental data as well as actual decision making at a large catalog retailer. We compare normative and descriptive decision models. We also derive several new estimation methods that can be used in the empirical analysis of supply chains.

3 - Organic Production Systems
Lieven Demeester, Assistant Professor of Operations Management, INSEAD, 1 Ayer Rajah Avenue, Singapore, 138676, Singapore, Lieven.demeester@insead.edu, Christoph Loch, Knut Eichler

An analogy between the biological cell and industrial manufacturing is used to learn about the latter. Similarities such as lean production, bottleneck control, quality at the source and component commonality indicate that the analogy has merit. The cell's more unusual production principles such as localized production, a limited set of building blocks, advanced recycling and just-in-time tools combine to form a potential model for industrial manufacturing that we label ' organic production'.

4 - The Effect of Supply Chain Adpativity on Combinative Competitive Capabilities & Business Performance
Murat Kristal, Assistant Professor, York University, 4700 Keele Street, Toronto, ON, M3J 1P3, Canada, MKristal@schulich.yorku.ca, Aleda Roth

In this study, we investigate the underlying structure of supply chain adaptivity, which using a grounded-theory approach defines as a portfolio of exploration and exploitation supply chain activities. Using survey-based data from 294 supply chain managers, we subject to rigorous empirical scrutiny how supply chain adaptivity influences combinative competitive capabilities and firms' performance.

■ MA11

H - Ballroom Level, Yosemite C

Strategies Issues in Supply Management

Contributed Session

Chair: Craig Hill, Assistant Professor, Georgia State University, Dept of Managerial Sciences, P. O. Box 4014, Atlanta, GA, 30302-4014, United States, chill4@gsu.edu

1 - Supply Chain Structure: A Key Driver of Product Variety in Retailing
Praneet Singh, University of Rochester, CS 4-341, Simon School, University of Rochester, Rochester, NY, 14627, United States, singhpr@simon.rochester.edu, Nils Rudi, Harry Groenevelt

We study the assortment and stocking problems in traditional and drop-shipping channels. The optimal assortment in both channels is of a single threshold type. The drop-shipping channel supports a higher variety over a wide range of parameters. For a firm that fulfills customer orders from multiple retail locations and a central warehouse, the optimal assortment is of a two-threshold type. The firm offers a larger aggregate assortment than a firm that fulfills orders only from retail locations.

2 - Supply Chain Visibility: Definition and Characteristics
Vernon Francis, Associate Professor, University of Dallas, 1845 E. Northgate Drive, Irving, TX, 75062-4736, United States, vfrancis@gsm.udallas.edu

Supply chain visibility is generally recognized as one of the most important issues for supply chain management today. Much has been written about it, including surveys indicating its importance to effective logistics operations. However, there is not a generally accepted definition for supply chain visibility, nor a characterization of this concept. This talk proposes such a definition and summarizes the salient characteristics of supply chain visibility.

3 - Distribution System Consolidation: When Do Supply Chain Synergies Exist?
Iqbal Agha, Professor of Operations Management and Management Sciences, University of Massachusetts Amherst, 121 Presidents Drive, University of Massachusetts, Amherst, MA, 01003, United States, aiali@som.umass.edu, Shenghan Xu

The recent spate of mergers, has spanned the consumer goods, food and beverage, and apparel industries (for example, K-Mart and Sears, November 2004; Proctor& Gamble and Gillette, January 2005; Coors and Molson, January 2005; Federated and May, April 2005). We examine whether such mergers can tap potential supply chain synergies to advantage. Our results reveal critical characteristics of constituent companies that determine the effectiveness of such consolidation.

4 - Outsourcing: Forecasting and Replenishment
Eva Molnar, Manager, Implementation & Site Support, Exel Logistics, eva.molnar@exel.com

Our client terminated the relationship with their wholesale suppliers and became self-distributed. The client realized that they needed to find a partner who could offer a proven yet innovative approach to meet the requirements of 3rd party provider of supply chain and logistics services. Our company was very successful in providing such service resulting in 33% reduction of inventory dollars and 1.3% increase in service level. This is just one of our few success stories in the field of demand planning and replenishment services we offer.

5 - Predicting Performance Improvement in Supply Chains Through EDI Usage
Craig Hill, Assistant Professor, Georgia State University, Dept of Managerial Sciences, P. O. Box 4014, Atlanta, GA, 30302-4014, United States, chill4@gsu.edu, Peter Zhang, Yusen Xia

The use of electronic data interchange (EDI) and related coordination activities among supply chain members can improve supply chain performance. This study aims to predict the performance improvement with a number of EDI usage variables in the food supply chain. The relationship between the performance measure and the EDI usage is investigated through neural network models.

■ MA12

H - 4th Floor, Union Square 1

Joint Session Auction and Game Theory/ JFIG: Auction and Game Theory in Supply Chains

Cluster: Applications of Auction and Game Theory, JFIG, Junior Faculty Interest Group
Invited Session

Chair: Woonghee Tim Huh, Assistant Professor, Columbia University, 338 Seeley W. Mudd Bldg MC4704, 500 West 120th Street, New York, NY, 10027, United States, th2113@columbia.edu

1 - Inventory Sharing in a Repeated Newsvendor Game
Greys Sosic, Assistant Professor, University of Southern California, Marshall School of Business, Bridge Hall 401, Los Angeles, CA, 90089, United States, sosic@marshall.usc.edu, Xiao Huang

We analyze the impact of repeated interactions on the retailers who face a newsvendor problem and share their residual inventories/demands. We assume that the retailers distribute the profit from inventory sharing according to the dual solutions of the corresponding transshipment game. This allocation satisfies core property, and is therefore myopically stable. We characterize subgame-perfect Nash equilibria for some special cases, and provide some conditions for achieving a first-best solution.

2 - Auction Design for Deliberative Agents
Kate Larson, Assistant Professor, School of Computer Science, University of Waterloo, 200 University Ave W, Waterloo, ON, N2L 3G1, Canada, klarson@cs.uwaterloo.ca

We study the problem of designing auctions explicitly for bidders who's preferences depend on the results of information gathering. We propose a set of intuitive properties which we argue are desirable in these deliberative settings. We show that these properties are mutually incompatible, and that many approaches to mechanism design are not robust against undesirable behavior from deliberative bidders.

3 - Optimal Vendor Selection and Negotiation.
Mahesh Nagarajan, University of British Columbia, 2053 Main Mall, Vancouver, BC, V6T 1Z2, Canada, mahesh.nagarajan@sauder.ubc.ca

Consider a buyer faced with N potential vendors who have private information that is not contractible. Events ocur in the following sequence: 1. The buyer picks a vendor and decides terms of trade. (2) The state of the world is realized (3) The terms of trade are renegotiated. Using a formal model of negotiation in stage 3, we characterize the optimal mechanism and terms of trade in stage 1.

4 - Price Competition with the Attraction Demand Model
Woonghee Tim Huh, Assistant Professor, Columbia University, 338 Seeley W. Mudd Bldg MC4704, 500 West 120th Street, New York, NY, 10027, United States, th2113@columbia.edu, Guillermo Gallego, Wanmo Kang, Robert Phillips

We show the existence of Nash equilibria in a Bertrand oligopoly price competition game using a possibly asymmetric attraction demand model with convex costs. We show that the equilibrium is unique and globally stable. In addition, we guarantee the linear convergence rate of tatonnement. We illustrate the applicability of this approach with several examples arising from detailed operational considerations that are often ignored in the economics literature.

■ MA13

H - 4th Floor, Union Square 5

Software Demonstration

Cluster: Software Demo
Invited Session

1 - Palisade Corporation
Shawn Harahush, StatTools Product Manager, Palisade Corporation, 798 Cascadilla Street, Ithaca, NY, 14850, United States, sharahush@palisade.com

We will give an overview of many Palisade Excel add-ins: @RISK, StatTools, and the newly released NeuralTools. @RISK uses Monte Carlo simulation to show you 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. NeuralTools is the latest add-in technology that gives the user an easy-to-use neural networks tool for spreadsheets. No prior knowledge of Neural Networks is necessary for application. Come see for yourself!

2 - Imagine That, Inc.- Simulation with Extend
Dave Krahl, Imagine That, Inc., 6830 Via Del Oro, Ste. 230, San Jose, CA, 95119, United States, davek@imaginethatinc.com

Based on close collaboration with leading universities, government agencies and corporations, Extend continues to revolutionize the simulation field. Extend's sophisticated simulation engine provides the ease of use, quick turnaround, and interactivity desired by new modelers and the scalability and robustness required for large-scale, complex systems. ExtendÖ the simulation software of choice.

■ MA14

H - 4th Floor, Union Square 6

Industry Solutions Applied to Military Problems

Sponsor: Military Applications
Sponsored Session

Chair: COL Darrall Henderson, Academy Professor, United States Military Academy, Department of Mathematical Sciences, 626 Swift Road, West Point, NY, 10996, United States, Darrall.Henderson@usma.edu

1 - Business Transformation using Lean Six Sigma
Douglas Matty, MAJ, U.S. Army, 5625 Hobsons Choice Loop, Manassas, VA, 20112, United States, douglas.matty@hqda.army.mil

The U. S. Army is implementing the most dramatic changes to its operational forces in an uncertain international security environment. The Institutional Army supports these forces by providing the people, training, resources, quality of life, and infrastructure critical to success will be adapted, and the Army will change its culture to one of continuous measurable improvement leveraging Lean Six Sigma. This discussion will detail the Army's progress to Transform the Way It Does Business.

2 - Postdoctoral Opportunities at West Point: The Davies Fellowship
LTC Garry Lambert, Department of Mathematics, United States Military Academy, West Point, NY, 10996, United States, ag5548@usma.edu

The Department of Mathematical Sciences, United States Military Academy in partnership with the U.S. Army Research Laboratory and the Natick Soldier Center has established a postdoctoral teaching and research associateship, the Davies Fellowship, administered by the National Research Council. This presentation will provide an overview of the program and highlight opportunities for teaching/research as a Davies Fellow.

3 - Effects of Posture and Body Armor on Rifle Marksmanship
Gary Kramlich, Captain, United States Military Academy, Department of Mathematical Sciences, Thayer Hall Room 218, West Point, NY, 10996, United States, ag6296@usma.edu

How does body armor affect soldier performance? While body armor saves lives, it is not well documented how it affects soldier and unit performance. The study looks at the coupled effects of body armor and soldier shooting posture, producing a model that predicts Probability of Hit. The study shows that for targets closer than 150 meters, Soldiers shoot better while wearing body armor than they did without. These effects change, however, as target distance increases.

■ MA15

H - 4th Floor, Union Square 9

Supply Chain Scheduling

Cluster: Scheduling
Invited Session

Chair: Chelliah Sriskandarajah, Professor, University of Texas at Dallas, School of Management, P.O. Box 830688, Richardson, TX, 75083-0688, United States, chelliah@utdallas.edu

1 - Efficient Cash Supply Chain Models in Response to New Federal Reserve Policies
H. Neil Geismar, Assistant Professor, Prairie View A&M University, College of Business, P.O. Box 638, Prairie View, TX, 77446, United States, Neil_Geismar@pvamu.edu, Milind Dawande, Divakar Rajamani, Chelliah Sriskandarajah

The Federal Reserve has implemented new rules to encourage banks to recirculate the money it receives from customers. These rules will raise banks operating costs and costs of holding money. We determine a bank's optimal policy to minimize these costs and the Fed's optimal fee structure to encourage the desired behavior.

2 - Supply Chain Scheduling: Just-in-Time Environment
U. V. Manoj, The Universityof Texas at Dallas, Schoolof Management, Richardson, TX, 75083-0688, United States, muv031000@utdallas.edu, Chelliah Sriskandarajah, Jatinder N. D. Gupta, Sushil Gupta

We study conflict and cooperation issues arising in a supply chain where a JIT manufacturer makes products which are shipped to customers by a distributor. The manufacturer and the distributor each has an ideal schedule, determined by cost and capacity considerations. However, these two schedules are in general not well coordinated, which leads to poor overall performance. We demonstrate that the cost savings provided by cooperation between the decision makers is usually significant.

3 - Optimal Fleet Size of an Integrated Production and Distribution Scheduling Problem for a Perishable Product
Priyantha Devapriya, Clemson University, Department of Industrial Engineering, 110 Freeman Hall, Clemson, SC, 29634, United States, ddevapr@clemson.edu, William G. Ferrell, Chelliah Sriskandarajah

This paper solves the problem of selecting a fleet size for an integrated production and distribution system with a perishable product. An algorithm is given to find the fleet size that minimizes the total cost of transportation while satisfying the customers' demand within a given planning horizon. This paper also addresses the issue of finding the production schedule and the distribution sequence to minimize the total cost.

4 - Machine Scheduling with Pickup and Delivery
Jinwen Ou, The Hong Kong Polytechnic University, Department of Logistics, Hung Hom, Kowloon, Hong Kong, China, 03900425R@polyu.edu.hk, Chung-Lun Li

We analyze a single-machine scheduling model that incorporates the scheduling of jobs and the pickup and delivery arrangements of the materials and finished jobs. There is a capacitated pickup and delivery vehicle that travels between the machine and the storage area, and the objective is to minimize the makespan.

■ MA16

H - 4th Floor, Union Square 10

Single Machine Scheduling

Contributed Session

Chair: Susan Slotnick, Cleveland State University, OMS Dept., BU 542, 2121 Euclid Avenue, Cleveland, OH, 44115, United States, s.slotnick@csuohio.edu

1 - Single CNC Machine Scheduling with Controllable Processing Times
M. Selim Akturk, Assoc. Prof., Bilkent University, Dept. of Industrial Engr., Ankara, TR, 06800, Turkey, akturk@bilkent.edu.tr, Sinan Gurel

Most of the existing scheduling algorithms assume that the processing times are fixed and known. However, the time it takes to process each part on a CNC machine is a controllable variable. Our aim is to find an approximate efficient frontier for a bi-criteria scheduling problem. We have two objectives: minimizing the manufacturing cost and minimizing weighted completion time. Consequently, we demonstrate how the process planning and scheduling decisions can be integrated through timing data.

2 - New Sequencing Relationships for the Single Machine Weighted Tardiness Problem

James Holsenback, Associate Professor, Francis Marion University, School of Business, Florence, SC, 29501, United States, jholsenback@fmarion.edu, Jerry Bilbrey

This study identifies four additional sequencing relationships necessary for optimality and points out an error in what was believed to be a sequencing property. It is the intention of the authors to employ these new relationships and all previously identified relationships to construct a branch and bound algorithm capable of solving problems with 50 or more jobs.

3 - Job Shop Scheduling with Setup Times, Deadlines and Precedence Constraints

Neil Simonetti, Assistant Professor, Bryn Athyn College of the New Church, 2895 College Dr, Box 717, Bryn Athyn, PA, 19009-0717, United States, neil.simonetti@brynathyn.edu, Egon Balas, Alkis Vazacopoulos

The presence of sequence-dependent setup times creates a hurdle for most Job Shop Scheduling algorithms cannot overcome. We adapt one of the best known heuristics, the Shifting Bottleneck Procedure, to the case when sequence dependent setup times play an important role, by transforming the single machine problems into Traveling Salesman Problems with time windows, which are solved by an efficient dynamic programming algorithm. Computational results show an advancement to the state of the art.

4 - Scheduling for Stability in Single-machine Production Systems

Roel Leus, Prof. dr., Katholieke Universiteit Leuven, Naamsestraat 69, Leuven, B, 3000, Belgium, roel.leus@econ.kuleuven.ac.be, Willy Herroelen

A stable schedule is a robust schedule that changes little when variations in the input parameters occur. We present a model for single-machine scheduling with stability objective and propose a B&B algorithm for solving an approximate formulation of the model. The algorithm is exact when exactly one job is disrupted during schedule execution. Our computational results show that the output of the procedure is actually quite robust to variations in the expected number of disrupted jobs.

5 - Optimal and Heuristic Methods for Job Acceptance with Weighted Tardiness

Susan Slotnick, Cleveland State University, OMS Dept., BU 542, 2121 Euclid Avenue, Cleveland, OH, 44115, United States, s.slotnick@csuohio.edu, Thomas Morton

Managers of heavily loaded shops with a bottleneck machine and tight deadlines often must decide which of competing jobs to accept and how to sequence them to maximize revenue less tardiness penalties. We develop optimal B&B procedures for this problem and test a number of strong heuristics.

■ MA17

H - 4th Floor, Union Square 11

Models of Human Behavior in New Product Development

Cluster: New Product Development
Invited Session

Chair: Edward Anderson, University of Texas at Austin Business School, McCombs School of Business, 1 University Station B6500, Austin, TX, 78733, United States, Edward.Anderson@mccombs.utexas.edu

1 - Leapfrogged Learning: Design Iteration Timing in New Product Development

Daniel McCarthy, PhD Student, MIT, 44 Offutt Road, Hanscom AFB, MA, 01731, United States, djmc@mit.edu, Nelson Repenning

As the pressure to bring new products to market increases, companies often compress their design iteration cycle times in an effort to develop products more quickly. In many cases, design cycles overlap significantly creating situations where learning opportunities (e.g. through testing) are missed and/or ignored. In this paper, we develop a System Dynamics model of the design-prototype-test cycle to explore the effects of iteration cycle timing on learning.

2 - The Impact of Parts Commonality on Development Lead Times and Costs

Thomas Roemer, MIT, E53-387, Cambridge, Ma, United States, troemer@mit.edu, Sebastian Fixson

We study the impact of common parts across product platforms on product development lead times and cost. We argue that commonality can induce coupling of otherwise independent development processes, and lead to additional design iterations. As a result, new product introduction can experience significant delays and costs under commonality. Based on a simple model we present a framework of how rework frequency and rework intensity impact development lead times and costs.

3 - Miscommunication or Concealment? Game Theoretic Analysis of Information Exchange in Complex Projects

Nitin Joglekar, BU School of Management, 595 Commonwealth Avenue, Boston, MA, United States, joglekar@bu.edu, Lihui Lin

Evidence from complex and distributed projects shows patterns of evolution and rework such that concerned parties may not truthfully reveal their progress. When uncovered late, problems are expensive and time-consuming to solve. We model the impact of parties' strategic behaviors in communicating progress and quality of tasks when their incentives are not aligned. We illustrate conditions when such behaviors will negatively impact project lead-time and solve for optimal development strategies.

4 - Dynamics of Platform-based Product Development

Hazhir Rahmandad, MIT, 30 Wadsworth St., Room E53-364A, cambridge, MA, 02142, United States, hazhir@MIT.EDU, Nelson Repenning

Building on case studies of software development we introduce the concept of "adaptation trap," where intendedly functional adaptation of workload can overload the PD organization and force it into firefighting because there is a delay in seeing the additional resource need from the field and underlying code-base. Moreover, the study highlights the importance of underlying product-base in platform-based PD, through their impact on quality of new models, and resource requirements for bug-fixing.

■ MA18

H - 4th Floor, Union Square 12

Airline Responses to Air Traffic Control Constraints

Sponsor: Aviation Applications
Sponsored Session

Chair: John-Paul Clarke, johnpaul@MIT.EDU

1 - Ground Delay Program Management at American Airlines

Remi Salam, Sr. Analyst Operations Research, American Airlines, 4333 Amon Carter Blvd, MD 5358, Fort Worth, TX, 76155, United States, remi.salam@aa.com, Tim Niznik

Inclement conditions reduce the flight arrival rate of an airport, prompting the FAA to initiate a Ground Delay Program (GDP) by issuing arrival slot times to every arrival into the airport. This can translate into hundreds of delay creating slots. Each slot can be viewed as a disruptive event. Optimization has been a viable, enabling technology for efficient GDP management. We describe the context and technical considerations of a production application currently in use at American.

2 - US Airways Rolling Hub at Philadelphia

Trin Mitra, Trin_Mitra@usairways.com

In Feb 2005, US Airways moved from a traditional hub and spoke operation in Philadelphia to a rolling hub operation that offered an opportunity to offer more flights in PHL with reduced turn times, taxi times and peak staffing and minimal impact on passenger connect times. We describe results of extensive simulation modeling to ensure sustainable flow in PHL and subsequent modeling of gates. We also describe benefits of the rolling operation and feedback from PHL ATC.

3 - Key Performance Indicators

Robin Riedel, robinr@mit.edu, John-Paul Clarke, Stefan Karisch, Michael Mederer

We model airline operations as a feedback control system and develop Key Performance Indicators (KPIs) to characterize inputs to the system (e.g. flight schedule) in terms of their correlation with the outputs of the system (e.g. delays). These KPIs quantify the operational consequences of planning decisions a priori. We explain how KPIs are developed using historical and simulation data, present results of our analyses, and discuss the implication for airline scheduling and recovery.

4 - Towards Optimal Traffic Flow Management and Departure Times

John-Paul Clarke, johnpaul@MIT.EDU

The problem of traffic flow management is one of determining the number of aircraft to send towards a destination with limited capacity so that there are enough aircraft to use critical resources (e.g. runways) but not too many aircraft that there are unnecessary delays. We present a methodology for determining the optimal departure time (the time that aircraft should push back from the gate) of aircraft destined for a capacity constrained airport given uncertainty in taxi and flight times.

■ MA19

H - 4th Floor, Union Square 13

Exploring Product and Process Architecture with the Design Structure Matrix

Sponsor: Technology Management
Sponsored Session

Chair: Tyson Browning, Assist. Prof. of Enterprise Operations, TCU Neeley School of Business, TCU Box 298530, Fort Worth, TX, 76129, United States, t.browning@tcu.edu

1 - Exploring the Architecture of Complex Software Products
Alan MacCormack, Harvard Business School, Boston, MA, United States, amaccormack@hbs.edu

We use Design Structure Matrices to analyze a number of different software products and define metrics that allow us to compare the architectures of these products at the system level. Our results reveal significant differences in modularity consistent with a view that the degree of modularity may be associated with different organizational designs. We also find evidence that purposeful redesign efforts can have a significant impact on modularity, even for reasonably complex designs.

2 - Component Modularity, Structural Holes, and the Attendance to Technical Interdependences
Manuel Sosa, Assistant Professor of Technology and Operations Management, INSEAD, Boulevard de Constance, Fontainebleau, 77300, France, manuel.sosa@insead.edu

We study how both product and organizational network structures impact the capacity of teams to coordinate their technical interdependences. We found that both component modularity and spanning structural holes increase the capacity of teams to attend interdependences. Yet, the effects of structural holes are moderated by component redesign.

3 - Projects with Sequential Iteration: Models and Complexity
Janice Carrillo, Assistant Professor, University of Florida, P.O. Box 117169, Gainesville, FL, 32611-7169, United States, janice.carrillo@cba.ufl.edu, Anand Paul

We analyze the Design Structure Matrix (DSM) problem and establish an integer programming formulation. Because of the complex nature of this problem, several simplified models are proposed and analyzed. Numerical analysis of the original DSM problem and heuristic approaches shows that relatively good solutions can be easily obtained, thereby offering managers efficient alternative solution approach to the original DSM problem.

4 - Using the DSM to Model Impact of Rework across Phase Gates in an Early Product Development Process
Devadatta Kulkarni, General Motors Research & Development Center, United States, datta.kulkarni@gm.com

A DSM model of the early stages of General Motors' PD process identified opportunities for enhancement. A cross-functional team was interviewed to ascertain their roles and interactions in three early phases of PD. Initially, the process proceeds in a highly serial fashion but becomes highly concurrent and iterative in the last two phases. Simulation-based analysis showed that the major block of tasks straddling the last two phases significantly impacted the total process duration.

■ MA20

H - 4th Floor, Union Square 14

Dealing with Risk and Competition in Electricity Markets

Sponsor: Energy, Natural Resources & the Environment / Energy
Sponsored Session

Chair: Jorge Valenzuela, Associate Professor, Auburn University, 211 Dunstan Hall, Auburn, AL, 36830, United States, jvalenz@eng.auburn.edu

1 - Multi-Market Optimal Bidding for a Power Producer
Antonio Conejo, Professor, University Castilla - La Mancha, Ciudad Real, Spain, Antonio.Conejo@uclm.es, Miguel Plazas

This paper considers a profit-maximizing thermal producer that participates in a sequence of spot markets. The producer behaves as a price-taker in the day-ahead market, but as a potential price-maker in the volatile balancing market. The paper provides a stochastic programming methodology to determine optimal bidding strategies. Uncertainty sources include prices for the day-ahead market, and balancing market linear price variations with the production of the producer.

2 - A Multi-objective Optimization Formulation of ISO's Optimal Dispatch Problem
Mainak Mazumdar, Professor, University of Pittsburgh, 1048 Benedum Hall, Pittsburgh, Pa, 15261, United States, mmazumd@engr.pitt.edu, Lizhi Wang

The ISO's optimal dispatch problem is formulated here as a multi-objective optimization problem in which both feasibility and social welfare are maximized. The probability of transmission line failures is explicitly considered in this formulation. A numerical solution using a non-linear integer programming technique is given.

3 - Impact of Auction Rules on Market Power in Day-Ahead Energy Markets
Tapas K. Das, Professor, University of South Florida, United States, das@eng.usf.edu, Vishnuteja Nanduri

In a deregulated electricity market, auction serves as a primary pricing tool. We present a methodology to evaluate the impact of uniform, discriminatory, and second price uniform auction strategies on the market power in a constrained network. The methodology is tested on a sample 12-bus IEEE network. The presence of market power under the three auction strategies is examined through two well known indices, Herfindahl-Hirschmann Index (HHI) and Lerner's Index.

4 - Cournot Competition in Power Generation Expansion
Jorge Valenzuela, Associate Professor, Auburn University, 211 Dunstan Hall, Auburn, AL, 36830, United States, jvalenz@eng.auburn.edu, Pinar Kaymaz

Generation expansion involves increasing electric power generation capacity, which may encounter congestion in transmission lines in the form of thermal and system stability limits. The focus of this presentation is to describe a market competition Cournot model for expanding capacity under stability-constrained generation. An empirical analysis is presented using a 5-bus power network.

■ MA21

H - 4th Floor, Union Square 15

Text Mining/Data Mining: Applications and Theory

Sponsor: Data Mining
Sponsored Session

Chair: Marietta Tretter, Professor, Texas A&M University, TAMUS 4217, Dept INFO, College Station, TX, 77843-4217, United States, MTretter@mays.tamu.edu

1 - Developing Taxonomy for Software Maintenance Patches using Text Analysis
Uzma Raja, PHD student, Texas A&M University, TAMUS 4217, College Station, TX, 77843-4217, United States, uzmaraja@tamu.edu, Marietta Tretter

In this research we use Text Analysis to develop a taxonomy for software maintenance patches. We analyze patches released for Linux over the past 10 years. Using Text analysis and Cluster analysis, we develop a preliminary taxonomy and investigate what effects different patch types have on internal attributes of software.

2 - Enhancing Predictive Models with External Sources of Text
Russell Albright, SAS, Raleigh, NC, United States, russell.albright@sas.com

Some text mining models can be enriched and enhanced by supplementing the initial text with richer sources of unstructured data. We present ideas, methods, and practical tools for locating, retrieving, and using this data programmatically. Examples of predictive models that have been improved with this approach will also be presented.

3 - The Nonnegative Matrix Factorization for Text Mining
Amy Langiville, Professor, College of Charleston, Charleston, NC, United States, anlangvi@unity.ncsu.edu

One of the most common low rank approximations used in Text mining is the singular value decomposition,SVD. A newer technique, the nonnegative matrix factorization (NMF), factors the term-by-document matrix into nonnegative factors, which provide several advantages over the SVD factors. We discuss popular nonlinear optimization algorithms for computing the NMF, and present some new algorithms with examples that are particularly suited to text mining applications.

4 - Experiences in Software Process Discovery in Open Source Software
Chris Jensen, Institute for Software Research, Dept. of Informatics, University of California, Irvine, Irvine, CA, 92697-3425, United States, cjensen@ics.uci.edu, Walt Scacchi

Large scale open source software development (OSSD) project corpora offer a wide range of artifacts evidencing the software processes that have enabled their success. Discovering these processes has been shown to be difficult to achieve automatically. Here, we describe our experiences in data mining open source software development repositories for the purpose of discovering development processes.

■ MA22

H - 4th Floor, Union Square 16

Managing Information Technology

Sponsor: Information Systems
Sponsored Session

Chair: Ritu Agarwal, University of Maryland, ragarwal@rhsmith.umd.edu

1 - IT Human Resource Management Configurations and IT Turnover: Theoretical Synthesis and Empirical Analysis
Tom Ferratt, University of Dayton, ferratt@udayton.edu, Carol V. Brown, Ritu Agarwal, Jo Ellen Moore

We use configurational theory to examine organizational practices related to the management of IT human capital. Based on survey responses from 106 organizations, IT HRM dimensions and configurations are derived and hypotheses relating configurations to IT turnover are tested. A five-configuration solution includes two contrasting configurations consistent with two archetypes found in the prior literature. Theoretical and practical implications of the findings are discussed.

2 - From IT Competence to Competitive Advantage in Turbulent Environment: A Dynamic Capabilities Model
Paul Pavlou, University of California, Riverside, paul.pavlou@ucr.edu, Omar El Sawy

This study proposes a dynamic capabilities model to delineate the process by which IT competence influences competitive advantage in turbulent environments. Data from 180 New Product Development managers validate the indirect role of IT competence on competitive advantage through the mediating role of dynamic capabilities and the moderating role of environmental turbulence.

3 - Understanding the Impact of Collaboration Software on Product Design and Development to Information Systems Research
I. Bardhan, University of Texas, Dallas, Bardhan@utdallas.edu, Ozer Asdemir, Rajiv Banker

We investigate a class of collaboration software for product development called collaborative product commerce (CPC), and estimate its impact on product quality, design cycle time and cost. Based on an empirical study, we find that CPC is associated with greater design collaboration, which improves product quality, and reduces cycle time and development cost.

■ MA23

H - 4th Floor, Union Square 17

Joint Session Financial Services/ Practice: Financial Services Practice

Sponsor: Financial Services, OR Practice
Sponsored Session

Chair: Jack Fuller, Citigroup, Risk Architecture, New York, NY, jack.fuller@citigroup.com

1 - Estimating Deposit Volume Price Sensitivity
Bruce Moore, Credit Union of Texas, Dallas, TX, bmoore@cuoftexas.org

Banks and Credit Unions must set deposit prices (interest rates) to ensure that monthly deposit growth is predictable. In rising and falling rate environments, this is becomes especially important to balance the institution's assets and liabilities at reasonable cost. The deposit price sensitivity for the Credit Union of Texas, a large credit union, is discussed as a stand-alone analysis and as a part of an optimization model for loan (asset) allocation and deposit (liability) pricing.

2 - Parallels between Credit Value-at-Risk and Winning the NCAA Basketball Pool
Jack Fuller, Citigroup, Risk Architecture, New York, NY, jack.fuller@citigroup.com

Value-at-Risk problems in risk management often come down to identifying sets of feasible scenarios, which would prove to be highly adverse for a given portfolio. Likewise NCAA basketball tournament pools often involve identifying sets of teams most likely to progress deep into the tournament. This paper will explore similarities and differences between the two with special attention on "portfolio" effects.

3 - Auto Loan Decision Analysis
Dwight Calkins, Credit Union of Texas, Dallas, TX, dcalkins@cuoftexas.org

The Credit Union of Texas finances auto loans and leases submitted over the Internet by auto dealers. Evaluating and funding an individual application can take from a few hours to several days. An expert system has been designed to front-end this process. It uses rigid criteria decision rules and a loan performance logistic regression model. The system is currently in test and is expected to improve underwriter productivity and loan portfolio performance.

4 - Applications of Options Analysis in Real Asset Valuation and Portfolio Management
Gill Eapen, Decision Options, LLC, 94 Anchorage Circle, Groton, CT, 06340, United States, geapen@decisionoptions.com

Traditional financial analysis based on CAPM makes constraining assumptions that are not valid for real asset valuation and investment decision-making inside companies. This is true in industries that show a high level of uncertainty and management flexibility. Using cases from pharmaceuticals, energy and technology, this paper demonstrates how analysts and managers in these industries can use options based techniques to price, prioritize and manage a portfolio of investment opportunities.

■ MA24

H - 4th Floor, Union Square 18

Multicriteria Decision Making Analysis: Modeling and Applications I

Contributed Session

Chair: Adiel Teixeira Almeida, Professor, Federal University of Pernambuco, Caixa Postal 7462, Recife, PE, 50.630-970, Brazil, aalmeida@ufpe.br

1 - Banning the Curse of Dimensionality in Multi-criteria Decision-making
Alexander Engau, Clemson University, Department of Mathematical Sciences, O-106 Martin Hall, P.O. Box 340975, Clemson, SC, 29634-0975, United States, aengau@clemson.edu, Margaret M. Wiecek

The difficulties associated with deciding among alternatives when being evaluated by a large number of criteria have been very well recognized. We establish conditions and a decomposition methodology to successfully identify an optimal decision to a large-scale problem while focusing on only a small subset of relevant criteria.

2 - An Approach to Applying Quantitative and Qualitative Criteria in Multiple Criteria Problems
Marina Polyashuk, m-polyashuk@neiu.edu

This presentation focuses on decision making situations in which both quantitative and qualitative criteria are used to evaluate alternative solutions. Under the assumption that quantitative criteria are more important than qualitative, a procedure for choosing optimal solutions is proposed.

3 - Perfectly Balanced Multiple Attribute Set Partitioning Problem
Anton Ovchinnikov, PhD Candidate in Operations Management, Joseph L. Rotman School of Management, University of Toronto, 105 St. George Street, Toronto, ON, M5S 3E6, Canada, Anton@Rotman.Utoronto.Ca, Dmitry Krass

Consider a set of objects characterized by a vector of attributes which should be partitioned into a number of groups so that all groups contain similar amount of each attribute. Sufficient conditions for the existence of such partitions are established, and the probability that a perfectly balanced partition exists is quantified. An application for creating MBA student groups is discussed.

4 - Choosing A Waste Management System Using Electre III
Ilgin Poyraz Acar, Research Assistant, Anadolu University, Department of Industrial Engineering, Iki Eylul Campus Muttalip, Eskisehir, 26470, Turkey, ipoyraz@anadolu.edu.tr, Aysun Ozkan, Müfide Banar, Aydin Sipahioglu

It is important that choosing an integrated municipal solid waste management system for healthy cities. But, it is necessary that appropriate criteria and alternatives should have been determined in detail to choose right system. In this study, a waste management system for Eskisehir city has been proposed by using Electre III. To determine the ranking of alternatives an information system, which can be used in similar environmental decision making problems, has been developed based on MS Excel.

5 - Multicriteria Model for Outsourcing Repair Contract Based on Utility Function and ELECTRE Method
Adiel Teixeira Almeida, Professor, Federal University of Pernambuco, Caixa Postal 7462, Recife, PE, 50.630-970, Brazil, aalmeida@ufpe.br

Each alternative for a outsourcing repair contract implies specific results regarding several criteria such as: response time, quality service, dependability and related cost. Therefore, a DM faces a choice among several alternatives contract. This problem has been approached through a multicriteria decision model. The model is based on the utility functions combined with ELECTRE method. The paper presents theoretical aspects and practical implications.

■ MA25

H - 4th Floor, Union Square 19

Modeling and Algorithms in Logistics II

Contributed Session

Chair: Taylan Ilhan, Northwestern University, 2145 Sheridan Road. C210, Evanston, IL, 60208, United States, t-ilhan@northwestern.edu

1 - Supply Chain Management at United Airlines

Nitin Maheshwari, Sr. Analyst, United Airlines, 1200, E Algonquin Road, Elk Grove Village, IL, 60193, United States, Nitin.maheshwari@united.com

Managing supply chains of spare parts is critical to smooth operation of an airline, just as important as maintaining efficiency andlowering the cost of operations. Flight disruptions & delays due to unavailability of parts are very expensive. This talk highlights the optimization solutions that are currently managing the supply chain of spare parts inventory at United Airlines. We present some business problems, modeling considerations andsolution approaches.

2 - An Application of Coloured Petri Nets to Optimize Medical Services

Rodolfo Medina, Head of Department, Universidad Politécnica de Aguascalientes, Prol. Mahatma Gandhi Km.2, Aguascalientes, Ag, Mexico, rrmr@upa.edu.mx

The purpose of this work is to contribute to the optimization of time response with medical services through the application of Coloured Petri Nets. This application has been designed to promote quality assurance and in time availability of critical types of medical services to assure excellent patient care and employee health and safety.

3 - Integrating Production and Distribution in Newspaper Logistics

Robert Russell, Professor, University of Tulsa, 600 S College, College of Business, Tulsa, OK, 74104, United States, rrussell@utulsa.edu, Wen-Chyuan Chiang

This paper investigates the production and distribution of newspapers in a metropolitan area. In addition to the vehicle routing aspect, other relevant issues include production sequence, loading sequence, multiple products, delivery time windows, and zone constraints. A tabu search metaheuristic is developed and computational results are reported. The methodology offers significant improvement compared to current operations.

4 - Worthiness of an Integrated Logistics Optimization Model

Somchai Pathomsiri, PhD Student, University of Maryland, 4309 Rowalt Dr. #201, College Park, MD, 20740, United States, egspt@mail.umd.edu, Ali Haghani

This study formulates an integrated logistics model which simultaneously optimizes the total system cost of locating plants and distribution centers, production and transportation of multiple products over time. From cost saving standpoint, its worthiness is proven by using results from solving the traditional hierarchical model as a benchmark.

5 - The Stochastic Orienteering Problem (SOP)

Taylan Ilhan, Northwestern University, 2145 Sheridan Road. C210, Evanston, IL, 60208, United States, t-ilhan@northwestern.edu, Mark Daskin, Seyed Iravani

Given a graph with a set of nodes with random profits, the SOP finds a route that visits a subset of the nodes and the depot and maximizes the probability that the profit collected within a time limit exceeds a target level. We develop exact and evolutionary algorithms.

■ MA26

H - 4th Floor, Union Square 20

Data-Driven Statistical Techniques in Quality Control

Sponsor: Quality, Statistics and Reliability

Sponsored Session

Chair: Shiyu Zhou, Assistant Professor, University of Wisconsin - Madison, 1513 University Ave., Dept. of Industrial and Systems Engr., Madison, WI, 53706, United States, szhou@engr.wisc.edu

1 - Semi-parametric Regression Analysis of Event Sequence Data Based on Temporal Patterns

Zhiguo Li, zhiguoli@wisc.edu, Shiyu Zhou

A large amount of event sequence data, i.e. events marked with occurring time, is often collected in the manufacturing processes. This paper presents a semi-parametric regression technique to identify patterns in event sequences and to predict the occurrence of key events based on detected patterns.

2 - Bayesian Mean and Variance Thresholdings for Complicated Multiple Curves

Cuizhen Shen, Graduate Student, Georgia Institute of Technology, School of Mathematics, Atlanta, GA, 30332, United States, shenczh@math.gatech.edu, Jye-Chyi Lu, Ming Yuan

This paper presents a Bayesian framework for developing wavelet-based procedures to model complicated functional data in multiple curves. Mean and variance thresholding techniques are proposed for data reduction purposes. Examples taken from manufacturing processes illustrate the proposed methods.

3 - Generation of Random Variates with Autocorrelation that Fit Actual Data

David Bandy, Associate Professor, University of Wisconsin Oshkosh, College of Business Administration, Oshkosh, WI, 54901, United States, bandy@uwosh.edu

A procedure for generating random variates that correspond to values generated from an existing real-world process where there is significant autocorrelation is described. It involves generating random variates from the underlying probability distribution and then sorting them intermittently. Application of the procedure for two sets of data will be described, one set for which the autocorrelation at lag one is significantly positive and the other for which it is significantly negative.

4 - Defect Pattern Classification of Semiconductor Wafers Using Clustering and Statistical Analysis

Chi-Hyuck Jun, Professor, POSTECH, Industrial & Management Eng., San 31 Hyoja-dong, Pohang, KB, 790-784, South Korea, chjun@postech.ac.kr, Seon-Hak Seo, Kyung-Soo Chang, Jong-Seok Lee

Since the defects sometimes form a particular pattern which provides information about a faulty operation in some process or a failure in some equipment, early detection of the patterns is important. This paper proposes a procedure based on clustering combined with some statistical and heuristic methods for recognizing the presence of defect patterns and classifying them into one or more of the predefined types. We evaluate the proposed procedure using real and synthetic defect data.

■ MA27

H - 4th Floor, Union Square 21

Joint Session Practice/ Roundtable: Adapting Supply Chains for Uncertainty

Cluster: OR Practice, Roundtable

Invited Session

Chair: Anne G. Robinson, Cisco Systems, Inc., 170 West Tasman Drive, San Jose, CA, 95134, United States, annerobi@cisco.com

1 - Collaborative Product Positioning and Introduction

Mark Wilkinson, Intel Corporation, 2200 Mission College, Santa Clara, CA, 94054, United States, mark.a.wilkinson@intel.com

Semiconductor manufacturers design and introduce components, such as microprocessors and chipsets, for OEMs to embed within their end products. We present a model where a new component is introduced and offered in one or more of the OEM's end products. While the component supplier chooses component performance, the OEM determines which of his product(s) will use the new component and the price(s) offered to the customers.

2 - Contemporary Logistics: Managing a Global Distribution Network

Ozgur Yazlali, oyazlali@stanford.edu, Anne G. Robinson, Feryal Erhun

An effective distribution network is critical for success in today's marketplace. It must leverage economies of scale and many-to-many relationships between DCs and demand locations while mitigating risk due to stochastic leadtimes. We model a multi-product distribution network that captures these intricacies. The goal is to minimize inventory and transportation costs while satisfying service constraints. We propose a heuristics solution based on the LP relaxation of the original problem.

3 - Risk in Strategic Supply Chain Decision Making

Rick Matty, Director, Planning and Strategy, Align Technology, 881 Martin Ave., Santa Clara, CA, 95050, United States, rmatty@aligntech.com

Discussion centers on risk as an additional measure for evaluating supply chain changes and/or performance. Illustrations of various methods of risk quantifications will be presented, as well as how to integrate risk management into strategic supply chain change decision-making. An integrated system comprised of business continuity management, impact analysis, mitigation, event management, and network resiliency will be presented as a holistic approach to managing risk in supply chains.

4 - Mitigating Uncertainty in HP's Supply Chain

Sitki Timucin, Suppy Chain Strategy and Development Manager, Hewlett-Packard Company, sitki.timucin@hp.com

HP has the world's largest IT Supply Chain: Delivering more than 200,000 SKUs to more than one billion customers is no small task. Continuous demand for greater customer choice and value, accelerated product lifecycles, heightened security and legislation requirements, and social and environmental responsibility continue to drive potential complexity in the supply chain. In this talk we will review in depth a few key processes that enable HP to respond to changes in the above factors.

■ MA28

H - 4th Floor, Union Square 22

Multi-Market Yield Management & Pricing

Sponsor: Revenue Management & Pricing
Sponsored Session

Chair: Michael Z.F. Li, Associate Professor, Nanyang Business School, Nanyang Technological University, Nanyang Avenue, Singapore, 639798, Singapore, ZFLI@ntu.edu.sg

1 - Incorporating Market Information into Pricing Optimization
Darius Walczak, Senior Scientist, PROS RM, 3100 Main St., Suite 900, Houston, TX, 77002, United States, dwalczak@prosrm.com

We use the concept of market priceable demand to model behaviour of consumers who seek the lowest price in the market for an otherwise identical product. A seller captures a portion of that of demand that depends on the state of the market, which in turn is described by an information variable. We show how to include this information in a relatively simple DP formulation of a pricing optimization problem. We present single-resource numerical examples.

2 - Coordinated Pricing and Capacity Planning for a Service Network
Itir Karaesmen, Assistant Professor, University of Maryland, 3457 Van Munching Hall, College Park, MD, 20742, United States, ikaraes@rhsmith.umd.edu, Borga Deniz, Gul Gurkan

We study a problem motivated by telecom and transportation industries where medium term planning decisions involve pricing and network design (capacity). Our model involves two stages: The prices of the services and the network capacity are to be determined in the first stage without knowledge of the demand. The second stage involves routing the traffic over the network once the demand is realized. We discuss structural properties and provide further insights using numerical examples.

3 - Procedures for Identifying Segments Based on Homogeneous Price Sensitivity
Erol Biberoglu, University of Texas at Austin, 405 East 31st Street apt 24, austin, tx, United States, erolbiberoglu@mail.utexas.edu, Serdar Ozkan, Piyush Shrivastav, Harun Ahmet Kuyumcu

Pricing segments should be identified in such way that the price response functions vary among micro-segments. In this presentation, we report results of a simulation study to compare segmentation procedures that utilize a variety of statistical techniques such as clustering, decision tree analysis, and equal bucketing.

4 - The Optimal Airline Seat Inventory Control for Round-trip and Two-leg Problems
Shaoxiang Chen, Nanyang Technological University, Nanyang Business School, Singapore, 639798, Singapore, ASCHEN@ntu.edu.sg, Michael Z.F. Li, Bing Lin

It studies the multi-fare, round-trip/two-leg airline yield management problems. In a round-trip fight booking process, the airline has to decide whether to accept or reject an arriving booking request. There are three types of customers: the first two are for the "go-" and "return-" flight respectively; and the third is for a round trip. A two-leg problem has the same settings. Based on the structural properties derived, the optimal policy is characterized by three monotone switching curves.

5 - The Optimal Seat Allocation for the Two-Flight Problems
Michael Z.F. Li, Associate Professor, Nanyang Business School, Nanyang Technological University, Nanyang Avenue, Singapore, 639798, Singapore, ZFLI@ntu.edu.sg, Shaoxiang Chen, Bing Lin

In this paper, we study a two-flight dynamic model where there are two flights between two cities in a day and booking requests in each fare class arrive according to an arbitrary random process. We prove that the optimal booking policy for this two-flight problem can be characterized by three monotone switching curves for each fare class.

■ MA29

H - 4th Floor, Union Square 23

Supply Chain Networks

Sponsor: E-Business
Sponsored Session

Chair: Yan Dong, University of Minnesota, Carlson School of Management, Minneapolis, MN, 55455, United States, ydong@csom.umn.edu

1 - The Impact of RFID on Supply Chain Decisions
Yan Dong, University of Minnesota, Carlson School of Management, Minneapolis, MN, 55455, United States, ydong@csom.umn.edu, Oliver Yao

Little research has theorized the business value of RFID and its impact on supply chain partners. For example, in what ways may RFID benefit adopters? What factors drive the adoption and use? Our research intends to provide insights on these and other related issues. In particular, we construct a theoretical model to study the source of benefit resulting from RFID, and a design of coordination mechanism on how the generated benefits may be distributed between participants.

2 - Capturing Greater Realism with Agent-Based Supply Network Models
Yifeng Zhang, University of Illinois at Chicago, 2401 University Hall, 601 South Morgan Street, MC 294, Chicago, IL, 60607, United States, Yzhang14@uic.edu, Siddhartha Bhattacharyya

This paper examines the advantages of agent-based models (ABM) in studying supply chains/networks as in e-business exchanges. Analytical approaches applied to supply chains often require a high degree of abstraction. We show how incorporating greater realism in ABMs can yield different results.

3 - A Model of Network Security Challenges in RFID
Jun Shu, junshu@psu.edu

For RFID used in SCM, the tags usually contain the identification number, known as the Electronic Product Code (EPC). We argue against encrypting EPC in tags. At the time of attaching the EPC, it is hard to foresee who all should be allowed to read the tag. It is also hard to manage all the keys in the readers. We propose a network security model for RFID implementation. We propose changes to the RFID information discovery and retrieval schemes proposed by MIT's Auto-ID Center.

■ MA30

H - 4th Floor, Union Square 24

Panel Discussion: Swinging Past Balance

Sponsor: Women in OR/MS
Sponsored Session

Chair: Wedad Elmaghraby, University of Maryland, Wedad_Elmaghraby@rhsmith.umd.edu

Co-Chair: Pinar Keskinocak, Associate Professor, Georgia Institute of Technology, School of Industrial and Systems, 765 Ferst Drive, Atlanta, GA, 30345, United States, pinar@isye.gatech.edu

1 - Panel Discussion: Swinging Past Balance
Moderator: Wedad Elmaghraby, University of Maryland, Wedad_Elmaghraby@rhsmith.umd.edu, Panelists: Ana Muriel, Reha Uzsoy, Pinar Keskinocak, Amy Cohn, Stefanos Zenios

For most people in academia, especially in the early years, balancing work, family, and community poses a serious challenge. Please come listen and discuss with our panelists their experiences and advice on how to reach the ever-illusive balance in life.

■ MA31

H - 4th Floor, Union Square 25

Joint Session Practice/ Roundtable: Semiconductor Manufacturing O.R. Practice

Cluster: OR Practice, Roundtable
Invited Session

Chair: James Wuerfel, Optimization Program Coordinator, Intel, CH3-113, 5000 W. Chandler Blvd, Chandler, AZ, 85226, United States, james.r.wuerfel@intel.com

1 - An Optimization Based Lot Priority Management System
Peng Qu, Advanced Micro Devices, 5204 E Ben White Blvd, M/S 563, Austin, TX, 78741, United States, peng.qu@amd.com, Shekar Krishnaswamy, Farzad Sadjadi, Mike Hillis, Dax Middlebrooks, Vijay Devarajan

Although development lots account for a small percentage of lots in a production fab, they are critical as they enable the market competency. These lots usually have higher priorities to reduce the time to market. Increasing a lot's priority may result in many negative impacts to the fab. It is therefore important to expedite development lots properly so that their impacts to the fab are minimized. This paper describes a web-based Expedite Management System with a linear optimization engine.

2 - Method for Isolating and Exploiting Opportunities in the Supply Chain Process
Alfred Degbotse, Engineer, IBM, 1000 River Road, Essex Junction, VT, 05452, United States, adegbo@us.ibm.com

In supply chain planning there may be instances where opportunities may present themselves due to changes in the supply chain process. Such changes could be in many forms such as changes in Business conditions, improvements in the

supply such as yield improvements or improvements in resource capacity. Sometimes the opportunities may be in form of process improvement. When these opportunities emerge, the organization must be able to capitalize to improve supply chain planning.

3 - Semiconductor Order Selection by Solving a Dynamic Stochastic Multiple Knapsack Problem

Thomas Perry, Wafer Sourcing & Foundry Engineering, Agere Systems, 555 Union Blvd, 24F-116C, Allentown, PA, 18067, United States, tcperry@agere.com, Joseph Hartman

A stochastic dynamic programming (SDP) model is presented that allocates resources among orders that arrive to and depart from the system. This model incorporates a capacity window that represents a capacity utilization vector modeled by a series of knapsacks. As future arrivals are uncertain, a stochastic dynamic program is used to model this situation. A tool (or a set-of-rules) is presented for a semiconductor firm to quickly evaluate the worthiness of an order.

4 - Computational Comparison of Linear and Nonlinear Production Planning Formulations

Reha Uzsoy, Professor, Purdue University, Grissom Hall, 315 N. Grant Street, West Lafayette, IN, 47907, United States, uzsoy@ecn.purdue.edu, Can Hulusi Turkseven

We present the results of simulation experiments comparing the production plans obtained from linear programming formulations and those fron nonlinear models based on clearing functions. The effects of different system parameters on performance is discussed, and recommendations made as to when each formulation is preferable.

5 - Putting OR to Work in a Remotely Operated Semiconductor Factory

Nirmal Govind, Intel Corporation, 5000 W. Chandler Blvd., MS CH3-84, Chandler, AZ, 85226, United States, nirmal.govind@intel.com

The challenges faced by manufacturing technicians responsible for remotely operating a semiconductor factory are not trivial. We discuss the use of Operations Research techniques to address complex decisions that need to be made in this environment, along with a preview of real-world challenges in applying OR to such problems.

■ MA32

H - 6th Floor, Lombard

Enhancing OR Education Through Sports Applications

Sponsor: OR in SpORts
Sponsored Session

Chair: Keith Willoughby, Operations Research Consultant, Health Quality Council, 241-111 Research Drive, Saskatoon, SK, S7N 3R2, Canada, kwilloughby@hqc.sk.ca

1 - Using NCAA Basketball Prediction to Unite OR/MS Modeling Techniques

Joel Sokol, Assistant Professor, Georgia Institute of Technology, School of Industrial & Systems Engineeri, Georgia Institute of Technology, Atlanta, GA, 30332-0205, United States, jsokol@isye.gatech.edu

Optimization, stochastics, statistics, etc. are often perceived by students to be disjoint techniques, even though most real-world OR/MS problems require a combination of analysis methods. We present a modeling lesson to demonstrate the use of several seemingly-unrelated models to analyze a complex problem. The example we use is predicting NCAA basketball tournament outcomes, a topic that will be of interest to many undergraduate students.

2 - Decision Making in Sports Class: Student Project Experiences

Rick Wilson, Professor, Oklahoma State University, 408 Bus, MSIS Department, Stillwater, OK, 74078, United States, rlwilsn@okstate.edu

A 1 credit hour elective module entitled Decision Making in Sports was offered for the first time this past semester at Oklahoma State University. Both undergraduate (primarily) business students and graduate students were allowed to enroll. The presentation will discuss some of the topics covered, potential future topics for an expanded version of the class, and will conclude with a discussion of some of the more innovative student projects completed.

3 - Quantitative Models in Sports: A Capstone Experience Course

Keith Willoughby, Operations Research Consultant, Health Quality Council, 241-111 Research Drive, Saskatoon, SK, S7N 3R2, Canada, kwilloughby@hqc.sk.ca

We recently offered a one-semester capstone experience course on quantitative model-building, specifically using sports-related examples. In this presentation, we discuss the rationale for setting up such a course, the sequence of particular topics covered and a few of the application papers illustrated during the semester. As well, we elaborate on some innovative student team projects completed towards the conclusion of the semester.

■ MA33

H - 6th Floor, Mason

Process Monitoring and Diagnosis (1)

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: Dan Apley, Associate Professor, Northwestern University, Dept. of Industrial Engineering, Evanston, IL, 60208-3119, United States, apley@northwestern.edu

1 - Hierarchical Monitoring of Defectivity

Christina M. Mastrangelo, University of Washington, mastr@u.washington.edu, Naveen Kumar

In semiconductor fabrication, discovering the processes that are attributable to defectivity is a lengthy procedure. We present hierarchical Generalized Linear Models (GLMs) for this purpose. We will demonstrate the hierarchical approach using process data and in-line test to produce estimates of defectivity. A benefit is that the parameters of the model may be interpreted as the relative contributions of the sub-models to the overall yield.

2 - Integration of Causal Modeling and SPC for Process Monitoring and Diagnosis

Jing Li, Industrial and Operations Engineering Department, University of Michigan, Ann Arbor, MI, United States, jinglz@engin.umich.edu, Jan Shi

Successful application of SPC for monitoring and diagnosis in complex manufacturing systems is a challenging problem due to the excessive number of process/product variables and the intricate relationships among them. This paper proposes a methodology to integrate causal modeling with SPC, proven to have enhanced interpretability and diagnostic power.

3 - Optimally Combining Blind Separation Criteria for Identifying Root Causes of Manufacturing Variation

Xuemei Shan, Northwestern University, 2145 Sheridan Rd, Evanston, IL, 60208-311, shan@northwestern.edu, Dan Apley

Blind source separation is emerging as a powerful method for identifying variation patterns in multivariate manufacturing data for root cause identification. There are many different criteria used in blind separation algorithms, the performance and applicability of which depend on conditions that are not known a priori. We present a method for automatically and optimally combining different criteria in order to optimize a suitable measure of estimation accuracy.

4 - Uncertainty and Variability in QFD

Deok-Hwan Kim, thekan@postech.ac.kr, Kwang-Jae Kim

The conventional QFD methodology assumes that all the input information is certain. However, in practice, the uncertainty in the input information is inevitable. This paper proposes an extended QFD methodology, called robust QFD, which considers the uncertainty of the input information and the resulting variability of the QFD output.

■ MA34

H - 6th Floor, Powell

Reliability Research II

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: Yong Chen, University of Iowa, Mechanical and Industrial Engineering, Iowa City, IA, United States, yongchen@engineering.uiowa.edu

1 - Optimal Coordinate Sensor Redundancy Allocation

Yong Chen, University of Iowa, Mechanical and Industrial Engineering, Iowa City, IA, United States, yongchen@engineering.uiowa.edu, Qingyu Yang

Coordinate sensors are widely used in manufacturing processes nowadays for process fault diagnosis. Reliability of a coordinate sensor system for fault diagnosis has been studied in recent research. Based on the reliability model, a sensor redundancy allocation problem is studied in this research to optimize coordinate sensor system reliability.

2 - Pruned Pareto Sets for the Stochastic System Redundancy Allocation Problem

Sadan Kulturel, Assistant Professor, Penn State Berks, Tulpehocken Rd. P.O. Box 7009, Reading, PA, 19610, United States, sadan@psu.edu, David Coit

Multi objective problems are often solved by combining the multiple objectives into one composite function, which is then solved for an optimal solution. Choosing the right weights to combine the objectives usually poses a challenge. Complicating the problem, many real life situations have uncertainty in their objectives or constraints. When both factors are combined, the problem is very difficult. Therefore, a tabu search approach is developed and tested on the redundancy allocation problem.

3 - Data Mining Techniques for Capacitated Network Reliability Analyses

Jose Ramirez-Marquez, jmarquez@stevens.edu, Bethel Assefa

Two-terminal reliability computation for cases requiring delivery of a specified demand between two nodes and where network arcs have a nominal capacity is obscure and intricate. This study proposes an innovative approach for obtaining reliability for capacitated networks. The method described uses CART to generate a classification tree from which minimal cuts/paths for capacitated systems are generated.

4 - Optimal Preventive Maintenance under Decision Dependent Uncertainty

Alexander Galenko, The University of Texas at Austin, 1 University Station, C2200, Austin, TX, 78712, United States, agalenko@gmail.com, Elmira Popova

We present a model for a series system of components with dependent failure times. In addition, the joint failure time distribution changes after each preventive maintenance intervention. The resulting problem falls in the stochastic integer optimization area.

■ MA35

H - 6th Floor, Sutter

Railway Optimized Equipment Distribution: Success or Failure?

Sponsor: Railroad Applications
Sponsored Session

Chair: Carl Van Dyke, President, MultiModal Applied Systems, 125 Village Blvd., Ste 270, Princeton, NJ, 08540, United States, carl@multimodalinc.com

1 - Experience in Using a Dynamic Empty Car Distribution System at CSX

James Snyder, AVP Car Management, CSX Transportation, 500 Water St. J887, Jacksonville, FL, 32202, United States, James_Snyder@csx.com

The author's experience using CSX's Dynamic Car Planning (DCP) system will be discussed. This optimization-based empty car distribution system has been in use at CSX since 1997. Benefits as well as difficulties in using such a network based optimization model in dealing with the tactical issues will be highlighted. Finally, recommendations on how to further enhance this kind of optimization model's capabilities to address a railroad's tactical as well as strategic needs will be presented.

2 - Freight Car Distribution at Canadian Pacific Railway

Clarke Carson, General Manager Car Management, Canadian Pacific Railway, Gulf Canada Square, 401 9th Ave SW, Calgary, AB, T2P-4Z4, Canada, Clarke_Carson@cpr.ca

CPR implemented Dynamic Equipment Logistics Technology and Analysis (DELTA) in January, 2002 with the objective of increasing equipment utilization and velocity by implementing improved processes and systems that optimize the match of empty equipment demand and available supply. Equipment optimization is applied to all fleets except for bulk unit train operations and intermodal. This presentation will provide a summary of CPR's optimization environment, key learnings and go forward strategies.

3 - Using Optimization Tools for the management of Empty Railcars and Locomotive Distribution at NS

Clark Cheng, Manager - Operations Research, Norfolk Southern Corporation, 185 Spring St SW, Atlanta, GA, 30303, United States, Clark.Cheng@nscorp.com, Hardik Shah, Ajith Wijertne

Norfolk Southern has developed optimization-based tools for distributing empty cars and assigning locomotives. So far, the car distribution tool has been applied to one car type, improving transit times and the order fill rate. The tool is now being extended to additional car types. In contrast, challenges were experienced implementing a similar locomotive distribution tool due in part to the lack of reliable data, and the complexity of the dispatching process.

4 - Empty Railcar Distribution at BNSF

Kevin Crook, Manager Operations Research, BNSF Railway, 2650 Lou Menk Drive, Ft. Worth, TX, 76131, United States, Kevin.Crook@bnsf.com

BNSF implemented Equipment Distribution Optimization (EDO) in April of 2000. Since then, EDO has been providing empty disposition for approximately 25% of the 200,000 cars in BNSF's daily inventory. This presentation will provide an overview of EDO, its strengths, its weaknesses, and lessons learned.

■ MA36

H - 6th Floor, Taylor

Simulation Techniques for Practical Applications

Contributed Session

Chair: Venkatesh Sundaresan, The Ohio State University, c/o Dr. Clark A. Mount-Campbell, 210 Baker Systems, 1971 Neil Avenue, Columbus, OH, 43210, United States, sundaresan.10@osu.edu

1 - Evaluating Capacity of Clinical Pathways Through Simulation

Brecht Cardoen, K.U.Leuven, Naamsestraat 69, Leuven, 3000, Belgium, brecht.cardoen@econ.kuleuven.ac.be, Erik Demeulemeester

Clinical pathways describe the sequence of processes a patient has to fulfill during his or her treatment. We developed a simulation model which includes several clinical pathways and investigates the use of joint resources - such as doctors or operation rooms - and its consequences for the patient. The results enable us to suggest improvements for the medical system.

2 - Selecting a Subset of Best Compromise Solutions in Multiobjective Simulation Problems

Hamidreza Eskandari, Research Associate, University of Central Florida, Indus Engr & Mgmt Sys, 4000 Central Florida Blvd, Orlando, FL, 32816, United States, eskandar@mail.ucf.edu, Luis Rabelo, Seyhun Hepdogan

This paper presents a heuristic approach for selecting a subset of best compromise solutions in multiobjective simulation problems when the number of design solutions are quite large, but finite. The heuristic provides systematic elimination of design solutions by using an iterative version of tradeoff/risk method. Proposed method is much more practical than traditional ranking and selection techniques which are inefficient or even impractical in terms of computational time.

3 - Predicting the Outcome of Sports Tournaments using Two-Party Event Simulation

Joshua Benjamin Johnson, Senior Consultant, Deloitte, 180 N Stetson Ave, Chicago, IL, 60601, United States, JBJohnson@deloitte.com, Bahar Biller

We present a simulation model to predict the outcome of single-elimination sports tournaments. Using this model, we predict the outcome of the men's 2004 and 2005 National Collegiate Athletic Association basketball tournaments. We achieve overall prediction accuracy of 79% in 2004 and 81% in 2005, surpassing the simple strategy of picking the higher seeds and demonstrating that the model can be successfully used for office pools.

4 - Estimating Profitability of Agricultural Subsurface Drainage Improvements using Simulation

Venkatesh Sundaresan, The Ohio State University, c/o Dr. Clark A. Mount-Campbell, 210 Baker Systems, 1971 Neil Avenue, Columbus, OH, 43210, United States, sundaresan.10@osu.edu, Marvin Batte, Larry Brown, Clark Mount-Campbell

Improvements in agricultural water management strategies are relevant to sustain agricultural production. To quantitatively estimate the profitability of such improvements correctly, neither a calculation that combines expected values is sufficient nor is a tool based on a sound technique available currently. We present a technique using simulation for making realizations of profitability by considering investment, crop yield, crop price, crop nutrients applied to the soil and income taxes.

5- Evaluating Community Bus Maintenance Strategy through Simulation

Ryan Quee,Centre for Operations Excellence, Sauder School of Business, University of British Columbia, 2053 Main Mall, Vancouver BC V6T 1Z2, Canada, ryan.quee@coe.ubc.ca, Ximena Cerda Salzmann, Mats Gerschman, Jeff Kroeker, Shanshan Wang

This study evaluated the cost effectiveness of integrating small bus maintenance into an existing large bus maintenance setting vs. creating a centralized maintenance center for small buses only. Two simulation models were developed to evaluate different scenarios which were based on the impact on bus availability, route cancellations, and costs. The minimum quantity of spare buses required in order to avoid route cancellations at different sites was also studied.

■ MA37

H - 6th Floor, Van Ness

Analysis and Modeling of Design and Development Activities

Sponsor: Applied Probability
Sponsored Session

Chair: Martin Wortman, Professor, Texas A&M University, Industrial and Systems Engineering, College Station, TX, 77841-3131, United States, wortman@mwx.tamu.edu

1 - Modeling Randomness in Research and Development Projects
Peter Kiessler, Associate Professor, Clemson University, Department of Mathematical Sciences, Clemson, SC, 29634-097, United States, kiesslp@clemson.edu

In this talk, we consider a project for which a large number of firms are engaged in an R&D race. The state of a given firm's project is modeled by a one-dimensional stochastic process, the level of which may be interpreted as the quality of the firm's project relative to the quality of competing firms' projects.

2 - Rational Thinking in the Design of Systems
George Hazelrigg, Program Director DMII/MME, National Science Foundation, 4201 Wilson Boulevard, Arlington, Arlington, VA, 22230, United States, ghazelri@nsf.gov

The design of systems is a matter of choice among system alternatives under conditions of uncertainty. While many approaches to the analysis of such choices have been proposed, only one basic approach is mathematically self-consistent. That method is classical decision theory. This talk will explore the application of classical decision theory to the design of systems and note what can go wrong if one fails to use a rigorous approach.

3 - Enterprise Risk Analysis Techniques For Strategic Fire Protection Decisions
Debra Elkins, Program Manager of Enterprise Risk, General Motors R&D, 30500 Mound Rd., Warren, MI, 48092, United States, debra.elkins@gm.com, Chris LaFleur

We discuss a modeling approach to quantify enterprise fire risk. The methodology permits structured consistent economic evaluation of strategic fire protection options for global manufacturing operations. We also comment on the challenge of integrating process level data and plant level operational interdependencies to support enterprise level decision-making.

4 - Engineering Design: Separating Preferences via Distribution Families
Martin Wortman, Professor, Texas A&M University, Industrial and Systems Engineering, College Station, TX, 77841-3131, United States, wortman@mwx.tamu.edu, Jee Hyuk Park

Making risk encumbered decisions is an essential activity of engineering design. We will set forth an analytical framework addressing how design can be considered within the general theory of decision under risk, with particular emphasis given to providing a computational framework suitable for development of new decision support methodologies.

■ MA38

R - 2nd Floor, Corintia

Joint Session Optimization/ Computing: Computational Global Optimization

Sponsor: Optimization/ Global Optimization, INFORMS Computing Society
Sponsored Session

Chair: Nikolaos Sahinidis, University of Illinois, Dept. of Chemical and Biomolecular Eng., Urbana, IL, 61801, United States, nikos@uiuc.edu

1 - Solving Large Nonconvex Spreadsheet Models to Global Optimality
Tony Gau, LINDO SYSTEMS INC, 1415 N. Dayton, Chicago, IL, 60622, United States, tgau@lindo.com, Linus Schrage

We describe our experience in solving practical nonlinear/nonconvex/nonsmooth/integer spreadsheet models to proven global optimum, based on new methods for reducing the convex relaxation gap and locating good solutions fast. Experience solving large nonconvex spreadsheet models demonstrates the ability to solve 10,000 variable problems arising in: multi-period planning, equilibria/complementarity, financial optimization, nonlinear regression, engineering design, and combinatorial auctions.

2 - Hit-and-Run for MSNLP: A New Global Driver
Zsolt Ugray, Assistant Professor, BIS Dept., Utah State University, 3515 Old Main Hill, Logan, UT, 84322, United States, Zsolt.Ugray@business.usu.edu, Leon Lasdon, John Plummer

We introduce the new Hit-and-Run global driver for MSNLP, a multi-start algorithm for non-linear optimization problems. Comparisons with other global drivers are presented along with computational results on a large set of global optimization problems.

3 - Global Optimization Toolbox for Maple: Introduction and Illustrative Applications
Janos D. Pinter, PCS Inc. & Dalhousie University, Canada, jdpinter@hfx.eastlink.ca

The Global Optimization Toolbox combines Maple's model development capabilities with the LGO global/local solver suite that is seamlessly linked to Maple. We introduce the Toolbox, and illustrate its usage by examples. A special emphasis is placed on the use of global optimization technology in advanced applications.

4 - Improving Solver Success in Reaching Feasibility for Sets of Nonlinear Constraints
John Chinneck, Professor, Carleton University, Systems & Computer Engineering, Ottawa, K1S 5B6, Canada, chinneck@sce.carleton.ca, Walid Ibrahim

Whether a nonlinear solver reaches feasibility for a set of nonlinear constraints depends heavily on the initial point used. We develop inexpensive algorithms that improve an initial point before passing it to the nonlinear solver. This greatly increases the success rate of solvers in reaching feasibility, and reduces their effort in doing so. We also develop a new initial point placement heuristic that improves overall success in conjunction with the point improvement algorithms.

■ MA39

R - 3rd Floor, Aragon

Recent Advances in Interior-Point Methods for Linear Programming and Linear Complementarity Problems

Sponsor: Optimization/ Linear Programming and Complementarity
Sponsored Session

Chair: Goran Lesaja, University Professor, Georgia Southern University, Deaprtment of Mathematical Sciences, P.O. Box 8093, Statesboro, GA, 30460, United States, goran@GeorgiaSouthern.edu

1 - A Class of Large- and Small - Update Primal-Dual Interior-Point Algorithms for Linear Optimization
Goran Lesaja, University Professor, Georgia Southern University, Deaprtment of Mathematical Sciences, P.O. Box 8093, Statesboro, GA, 30460, United States, goran@GeorgiaSouthern.edu, Yanqin Bai, Kees Roos

A class of large- and small- update primal-dual interior-point point algorithms for linear optimization is presented. The calculation of the search direction is based on new kernel function. The kernel function is an extension of the self-regular function; however it is not self-regular due to the fact that its growth term increases linearly. We develop new analysis tools that are used in complexity analysis of the algorithms and obtain favorable polynomial complexity bounds.

2 - Primal-dual Path-following Algorithms Based on a Class of Preconditioned Iterative Linear Solvers
Renato Monteiro, Professor, Georgia Institute of Technology, School of ISyE, 765 Ferst Drive NW, Atlanta, GA, 30332-0205, United States, monteiro@isye.gatech.edu, Zhaosong Lu, Jerome O'Neal

We discuss a class of primal-dual long-step path-following algorithms whose search directions are computed by a preconditioned iterative linear solver applied to a certain augmented normal equation. Strong bounds on the number of iterations performed by the algorithm as well as the preconditioned linear linear solver are derived.

3 - On the Average Complexity of Finding an Epsilon-optimal Solution for LP
Jun Ji, Kennesaw State University, 1000 Chastain Rd., Kennesaw, GA, 30144, United States, jji@kennesaw.edu, Florian Potra

In this talk, we perform a probabilistic analysis for the "pure" interior point method without using any "finite termination" criteria. We will discuss on a probabilistic LP model of Todd the expected value of the number of iterations required by the predictor-corrector algorithm of Mizuno, Todd, and Ye (1993) using some probabilistic results of Huang (2000) as well as the quadratic convergence result for the algorithm.

■ MA40

R - 3rd Floor, Barcelona I

Auctions

Sponsor: Optimization/ Network Optimization
Sponsored Session

Chair: Lisa K. Fleischer, IBM, T J Watson Research, Yorktown Heights, NY, 10598, United States, lkf@watson.ibm.com

1 - Derandomization of Auctions via Hat Puzzles
Nicole Immorlica, One Microsoft Way, Redmond, WA, 98052, nickle@microsoft.com, Gagan Aggarwal, Amos Fiat, Andrew Goldberg, Jason Hartline, Madhu Sudan

We study the problem of designing deterministic revenue-maximizing auctions in a multi-unit setting. Prior to this work, the only auctions known to be approximately optimal in the worst case employed randomization. Our proofs draw upon an analogy between hat puzzles, a brain teaser of independent interest, and truthful auctions, and use flow techniques to solve the hat puzzles.

2 - Single-Value Combinatorial Auctions and Implementation in Undominated Strategies

Ron Lavi, California Institute of Technology, CALTECH, Pasadena, CA, United States, ronlavi@ist.caltech.edu, Moshe Babioff, Elan Pavlov

In single-value Combinatorial Auctions, a player desires any one of several different bundles, but has the same value for each of them. Our first main result provides a deterministic technique to convert {\em algorithms} to truthful ascending {\em mechanisms} that almost preserve the original approximation ratio, for the case where player values are the only private information. Our second main result provides the first polynomial time strategic approximation mechanism for the case where players' bundles are also unknown, using an alternative new notion that is based on "undominated strategies".

3 - Inapproximability Results for Combinatorial Auctions with Submodular Utility Functions

Vangelis Markakis, College of Computing, Georgia Tech, 801 Atlantic Drive, Atlanta, GA, 30332, vangelis@cc.gatech.edu, Aranyak Mehta, Subhash Khot, Richard J. Lipton

In a combinatorial auction, a set of indivisible goods or resources is to be allocated to a set of players, who express preferences over combinations of items through their utility function. We consider the problem of maximizing the economic efficiency of the auction, i.e., finding an allocation of the goods that maximizes the sum of the utilities of the players (social welfare). In the case when the utility of each player is a monotone submodular function, we prove that there is no polynomial time approximation algorithm which approximates the maximum social welfare by a factor better than 1-1/e, unless P =3D NP. Our result is based on a reduction from a multi-prover proof system for MAX-3-COLORING.

■ MA41

R - 3rd Floor, Barcelona II

Robust Optimization

Sponsor: Optimization/ Integer Programming
Sponsored Session

Chair: Alper Atamturk, University of California, Berkeley, Department of IEOR, Berkeley, CA, United States, atamturk@ieor.berkeley.edu

1 - Robust Wardrop Equilibria

Fernando Ordonez, Assitant Professor, University of Southern California, 3715 McClintock Ave, GER-247, Los Angeles, CA, 90089, United States, fordon@usc.edu, Nicolas Stier-Moses

Network users typically prefer the shortest route to their destinations, however identifying such a route can be difficult when faced with uncertain estimates of traversal times. We introduce Robust Wardrop Equilibria(RWE) to address this uncertainty. This extends traditional Wardrop equilibria by considering that each user plans for the worst case through robust optimization. We show that RWE always exist and provide an efficient algorithm based on column generation to compute them.

2 - Solving Robust Supply Chain Problems

Dan Bienstock, dano@columbia.edu, Nuri Ozbay

We present several algorithms for solving robust supply chain problems under a number of models for risk and performance. Our algorithms rely on tools from linear and integer programming, dynamic programming and randomization, and scale well to models with one thousand time periods.

3 - A Min-Max Regret Robust Optimization Approach for 2-Stages MILP with Full Factorial Scenario Design

Tiravat Assavapokee, Assistant Professor, University of Houston, E206 Engineering Bldg 2, Houston, TX, 77204-4008, United States, Tiravat.Assavapokee@mail.uh.edu, Jane Ammons, Matthew Realff

This work presents a deviation robust optimization algorithm for two stages decision making under uncertainty (ambiguity). The structure of the first stage problem is binary MILP and the structure of the second stage problem is LP. Each uncertain parameter can, independently of other parameters' setting, take its value from a finite set of real numbers with unknown probability distribution. The algorithm is shown to be effective for solving large-scale robust optimization problems.

■ MA42

R - 4th Floor, Parc Ballroom I

Stochastic Programming in Finance

Sponsor: Optimization/ Stochastic Programming
Sponsored Session

Chair: John Birge, Professor, University of Chicago, Graduate School of Business, Chicago, 60637, United States, john.birge@gsb.uchicago.edu

1 - Managing Global Supply Chains via Decentralized Stochastic Programs

Hafize Erkan, herkan@princeton.edu

An optimal supply chain model rarely addresses financial uncertainties. Several barriers exist, including model size, tradition, and estimating the stochastic events. We develop a stochastic program to overcome these difficulties. The model integrates operational decisions with the financial capital structure. We illustrate the approach with a global production firm, possessing currency movements. The model is implemented within centralized and decentralized settings.

2 - Simplicial Dynamic Programming Method for Arbitrage Pricing of Contingent Claims

Chanaka Edirisinghe, Professor, University of Tennessee, College of Business, Management Science, Knoxville, TN, 37996, United States, chanaka@utk.edu

Absence of arbitrage profits in multi-period trees of state prices is equivalent to the existence of a martingale probability measure when there are no trading costs. When such trees are use in pricing contingent claims, it reduces to one of solving a generalized moment problem at each node. A new simplicial bounding procedure based on dynamic programming is proposed under multidimensional and continuous state price space. The results are generalized to proportional transactions costs case.

3 - Discrete Time Dynamic Consumption and Investment Optimization with Non-decreasing Consumption

Amit Bhandari, Northwestern University, 2145 N Sheridan Rd, Industrial Engg & Management Scs, Evanston, IL, 60208, United States, amitb@northwestern.edu, John Birge

Dybvig (1995) extended the continuous time dynamic consumption and investment problem to the case where the investor is intolerant of a decline in standard of living. This is interpreted as a constraint that the consumption rate is non-decreasing. We view this work as an extension of Merton's (1969) seminal result for lifetime portfolio selection under uncertainty (continuous time) and seek to provide an equivalent discrete time extension to Samuelson's (1969) corresponding result.

■ MA43

R - 4th Floor, Parc Ballroom II

Joint Session Computing/ Health Applications: Bioinformatics

Sponsor: INFORMS Computing Society/ OR and Biomedicine, Health Applications
Sponsored Session

Chair: Ming-Ying Leung, Professor, University Texas at El Paso, Dept. Mathematical Sciences, 500 W University Avenue, El Paso, TX, 79968, United States, mleung@utep.edu

1 - Predicting Replication Origins in Herpesvirus Genomes using Repeat Frequencies

Ming-Ying Leung, Professor, University Texas at El Paso, Dept. Mathematical Sciences, 500 W University Avenue, El Paso, TX, 79968, United States, mleung@utep.edu, Rhys Adams, Deepak Chandran

A tool for finding the replication origins (ORI) of viral DNA genomes is valuable for studying viruses. Previous works have demonstrated that palindromic sequences in high concentration can be used as an indicator for the location of ORIs in DNA viral genomes. Here, we include not direct and inverted repeats for ORI prediction. When tested against 14 herpesviruses with known ORIs, the best result obtained gave a prediction sensitivity of 96% and specificity of 26%.

2 - Mathematical Modeling in Bioinformatics Research

Hugh Nicholas, Senior Scientific Specialist, Pittsburgh Supercomputing Center, 4400 Fifth Avenue, Pittsburgh, PA, 15213, United States, nicholas@psc.edu

Bioinformatics involves creating a mathematical model of a biological process in a computer program that compares the mathematical model to biological data to discover which of the data best fits the model. I illustrate this process with a model of discrimination among enzyme subfamilies and apply it to the Glutathione Transferase enzyme family important in cancer therapy and environmental bioremediation. This generates hypotheses that can be tested experimentally.

3 - Bioinformatics Approaches to the Identification and Assessment of Nuclear Receptor Target Genes

David Wheeler, Bioninformatics Co-Director, Baylor College of Medicine, One Baylor Plaza, Houston, TX, 77030, United States, wheeler@bcm.tmc.edu

Nuclear Receptors (NR) regulate transcription by binding to specific DNA sequences near the regulated genes. Understanding how NRs control metabolism and physiology at the cellular level requires knowledge of which genes they regulate. Identification of NR target genes takes advantage of the sequence specifici-

ty of the binding site, which can be modeled mathematically. The number of predicted binding sites are greater by an order of magnitude than the 20,000 mammalian genes currently catalogued.

■ MA44

R - 4th Floor, Parc Ballroom III

Genetic Algorithms

Sponsor: INFORMS Computing Society
Sponsored Session

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

1 - A Genetic Algorithm for Designing Resilient Networks
Alice Smith, Professor, Auburn University, Industrial & Systems Engineering, Auburn, AL, 36849, United States, aesmith@eng.auburn.edu, Abdullah Konak

A GA to design 2-node connected networks taking network resilience into account is presented. The network resilience measure is more comprehensive than traditional network reliability measures since it incorporates node failures as well as link failures. The GA uses specialized local search operators and a basic adaptive penalty function to identify good feasible solutions even for very constrained problem instances.

2 - Solving the Concave Cost Supply Scheduling Problem Using a Genetic Algorithm
Xia Wang, AMSC Program, Department of Mathematics, University of Maryland, College Park, MD, 20742, United States, lilywang@math.umd.edu, Bruce Golden, Edward Wasil

We consider two cases of the concave cost supply scheduling problem. In case one, there are multiple providers and one manufacturing unit. A genetic algorithm selects a subset of providers. The quantity provided is determined by a greedy algorithm. In case two, there are multiple manufacturing units and multiple providers.

3 - The Label-Constrained Minimum Spanning Tree Problem
Yupei Xiong, Department of Mathematics, University of Maryland, College Park, MD, 20742, United States, yupei72@yahoo.com, Bruce Golden, Edward Wasil, Si Chen

Given a positive integer k and a connected, undirected graph with labeled and weighted edges, the label-constrained minimum spanning tree (LC-MST) problem seeks a minimum-weight spanning tree with at most k distinct labels. We prove the problem is NP-hard and present local search, genetic algorithm, and IP results.

■ MA45

R - 4th Floor, Raphael

Modeling of Transportation Problems

Contributed Session

Chris Peterson, Graduate Student, Oregon State University, 118 Covell Hall, Dept. of Industrial and Mfgr. Engr., Corvallis OR 97331-2407, United States, cpeterso@wou.edu

1 - An Innovative Approach for the Urban Transit Network Service Analysis
Ruihua Xu, Professor and Dean, Tongji University, Dept. of Transportation Management Engineering, No.500, ZhenNan Road, Shanghai, 200333, China, rhxu@tongji.edu.cn, David Fan

A significant amount of data regarding the demand and supply characteristics about the city transit network are collected in Shanghai, P.R.China. As one of the most popular data mining and unsupervised learning methods, a k-Means clustering analysis algorithm has been used, integrated with GIS, and applied to identify different city transit service levels at the travel demand zone level in Shanghai, P.R.China. Quality results are obtained and are as expected from the industry transit managers.

2 - Analytical Modeling of Adaptive Ramp Meter System
Ning Zou, Research Assistant, SIE Dept. University of Arizona, SIE Dept. University of Arizona, P.O. Box 210020, Tucson, AZ, 85721, United States, zoun@email.arizona.edu, Pitu Mirchandani

Adaptive ramp meter changes its signal setting based on the existing queue size. In this presentation, we built an analytical model of the adaptive ramp meter system with Poisson arrivals. Analytical results of the state probability are achieved. A simulation model is built for comparison. The simulation results match the analytical results well. With this method, we can estimate the average arrival rate based on the measured state probability.

3 - Routing Strategies for Large-scale Automated Material Transport Systems
Raymond Cheung, Hong Kong Univ of Sci & Tech, Dept of IELM, HKUST, Clearwater Bay, Hong Kong, rcheung@ust.hk, Daniel Mo, Dongsheng Xu

In large-scale automated material transport systems, shipments need to go through many pieces of equipment. Motivated by a real case where the waiting time for equipment dominates the total shipment transportation time, we study several routing strategies that consider nonlinear equipment processing time, shipment coordination, the use of multiple alternative paths and re-optimization. We evaluate these strategies through extensive experiments.

4 - Collection and Analysis of Commodity Movement Data Using Global Positioning Systems
Chris Peterson, Graduate Student, Oregon State University, 118 Covell Hall, Dept. of Industrial and Mfgr. Engr., Corvallis, OR, 97331-2407, United States, cpeterso@wou.edu, Donald Helvie, Rasaratnam Logendran, Thanit Puthpongsiriporn, Richard Billo

We investigate the speed and efficiency of commodity movement by trucks in the Portland metropolitan area by data collection and analysis using global positioning systems (GPSs). This presentation will focus on the mechanisms used for data collection on travel time by trucks and the analysis performed at various levels of aggregation in ways that would be most effective in supporting the development of commodity flow models by the Portland Travel Forecasting Group.

■ MA46

R - 4th Floor, Rubens

50th Anniversary of Studies in the Economics of Transportation

Sponsor: Transportation Science & Logistics
Sponsored Session

Chair: Anna Nagurney, Professor, University of Massachusetts Amherst, Department of Finance and Operations Man, Isenberg School of Management, Amherst, MA, 01003, United States, nagurney@gbfin.umass.edu

Co-Chair: David Boyce, Professor, Northwestern University, 2149 Grey Avenue, Dept. of Civil and Environmental Engrg., Evanston, IL, 60201, United States, d-boyce@northwestern.edu

1 - Insights into the Why, How and When of the Network Equilibrium Model
David Boyce, Northwestern University, 2149 Grey Avenue, Evanston, IL, 60201, United States, dboyce@uic.edu

Based on interviews with its creators, and examination of original and contemporary materials, this talk explores why, how and when the formulation of the user-equilibrium model with variable flows occurred, and the relation of its invention to the system-optimal model. The context of the research with respect to the objectives of its sponsors and the unrelated initiation of urban transportation planning studies for American metropolitan areas is also examined.

2 - Network Equilibrium Models: Varied and Ambitious
Michael Florian, Professor, University of Montreal, Montreal, QC, H3C 3J7, Canada, mike@crt.umontreal.ca

The use of network equilibrium models for the static simulation of traffic on urban road networks has become an accepted practice. The user equilibrium principle has been extended to transit route choice models and to dynamic traffic assignment models. Some of these models are quite ambitious and test the limits of the theoretical knowledge.

3 - The Sensitivity of Traffic Equilibria - History and the Current Status
Michael Patriksson, Professor of applied mathematics, Chalmers University of Technology, Department of mathematics, Gothenburg, SE-412 74, Sweden, mipat@math.chalmers.se

Since Braess' paradox became known in the late 1960s the sensitivity of traffic equilibrium flows, demands and travel times to changes in the data of a traffic model has been studied and analyzed. Quantitative theoretical studies in this field began in earnest following the work of Fiacco on the sensitivity analysis of nonlinear programs, among the first publications being the highly influential paper by Tobin and Friesz (1988). The talk presents the history and state-of-the-art of sensitivity analysis of traffic equilibria, with emphasis on the later developments on providing the mildest possible conditions for directional derivatives to exist, and analyses of extensions of the basic model. Numerical examples highlight the strength and possible uses of the most recent results.

4 - A Retrospective on Beckmann, McGuire and Winsten's Studies in the Economics of Transportation
Anna Nagurney, Professor, University of Massachusetts Amherst, Department of Finance and Operations Man, Isenberg School of Management, Amherst, MA, 01003, United States, nagurney@gbfin.umass.edu, David Boyce, Hani Mahmassani

This paper describes the impact and influence of the book, Studies in the Economics of Transportation, by M. Beckmann, C. B. McGuire and C. B. Winsten, published in 1956 by Yale University Press. The focus of this paper is on the book's impacts on innovations in modeling, methodological developments, and applications which continue to this day.

■ MA47

R - 4th Floor, Michelangelo

Hazard Management and Evacuation I

Sponsor: Transportation Science & Logistics
Sponsored Session

Chair: Elise Miller-Hooks, University of Maryland, Department of Civil and Env. Eng., 1173 Glenn Martin Hall, College Park, MD, 20742, United States, elisemh@umd.edu

1 - Optimal Scheduling of Contraflow Operations for Network Evacuation Planning

Hani Mahmassani, Maryland Transportation Initiative, University of Maryland, College Park, MD, 20742, United States, masmah@umd.edu, Hayssam Sbayti

We describe an optimization scheme in conjunction with a dynamic traffic assignment procedure to dynamically reallocate capacity to opposing directions through contraflow operation (or lane reversal) for a subset of (target) links in a network. The result will then constitute a time-dependent contraflow control policy to be deployed at target links during a major evacuation.

2 - Adaptive Control Based Real Time Traffic Management for Emergency Evacuation

Henry Liu, Assistant Professor, University of Minnesota, Department of Civil Engineering, 500 Pillsbury Drive SE, Minneapolis, MN, 55455, United States, henryliu@umn.edu, Jeff Ban, Wenteng Ma, Pitu Mirchandani

Real time traffic management for evacuation aims to dynamically guide (control) traffic flow under evacuation scenarios in such a way that certain system objective (e.g. minimization of overall fatalities or property losses) could be achieved. In this paper, we present a unified real time traffic management framework based on both dynamic network modeling techniques and adaptive control theory, by considering the traffic network under evacuation as a dynamic system.

3 - Mathematical Matrix Formulation and Network Conversion for Solving a Large-Scale No-Notice Evacuation

Pitu Mirchandani, Professor, University of Arizona, Systems and Industrial Engineering, P.O. Box 210020, Tucson, AZ, 85721, United States, pitu@sie.arizona.edu, Brian Wolshan, Yi-Chang Chiu

We applied a mathematical matrix formulation, network conversion technique and the interior point method to solve for the simultaneous decisions of evacuation schedule, destination and traffic assignment for no-notice emergency situation. Performance of the proposed model and solution algorithm on the large-scale network is discussed through the case study of the New Orleans network.

4 - Solving an On-Line Evacuation Problem via Reoptimization

Zhiying (Amy) Chen, University of Maryland, Department of Civil and Environmental En, 1173 Glenn Martin Hall, College Park, MD, 20742, United States, zhychen@umd.edu, Elise Miller-Hooks

Many applications, including the development of on-line evacuation instructions, require the solution of a series of minimum cost network flow problems in which only the attributes along a set of arcs of the network change from one problem instance to the next. A reoptimization algorithm based on concepts of dual ascent algorithms will be presented for updating the minimum cost flows given multiple heterogeneous changes to the arc costs and capacities.

■ MA48

R - 4th Floor, Dante

Innovative Applications of Management Science in Healthcare - 1

Sponsor: Health Applications
Sponsored Session

Chair: John Blake, john.blake@dal.ca,

1 - Division of Labor and Coordination in Medical Office Practices

Edieal Pinker, Simon School, University of Rochester, University of Rochester, Rochester, NY, United States, pinker@simon.rochester.edu, Gregory Dobson, Larry Van Horn

This paper examines the staffing, division of labor, and resulting profitability of primary care physician practices. We develop a theoretical model of how practice profit is determined by the number and mix of support staff and how tasks are delegated to support staff. We also conduct an empirical analysis of survey data that supports our conclusions.

2 - Green O.R.: Examining Component Reuse Policies for the Medical Instruments Industry

Thomas Sloan, University of Massachusetts Lowell, College of Management L53, One University Avenue, Lowell, MA, 01854, United States, Thomas_Sloan@uml.edu

Many firms are "greening" their operations in response to increasing environmental concerns and government regulations. But is remanufacturing and component reuse practical in the medical instruments industry? In addition to cost and environmental issues, medical instruments suppliers must also meet extremely high quality and safety standards. Based on data from a major medical instruments maker, an MDP model is developed to characterize the trade-offs involved with different reuse policies.

3 - Simulating the Natural History of Sepsis Progression in the Genims Cohort

Gorkem Saka, PhD Student, University of Pittsburgh, 1048 Benedum Hall, Pittsburgh, PA, 15261, United States, gos2@pitt.edu, Andrew Schaefer, Jennifer Kreke, Mark Roberts, Derek C. Angus

We present a biologically based simulation model of pneumonia-induced sepsis, a leading cause of death in the U.S. We investigate the incorporation of time-dependent factors and patient health history. We are able to show a high degree of accuracy in predicting patient transitions between health states. Major result of this work demonstrates that the transitions are highly dependent on the duration of the disease, indicating the necessity of incorporating time into models of sepsis progression.

4 - Performance Analysis of Emergency Departments with Patient Class-Dependent Service Rates

Cindy Lin, Graduate Student, University of Florida, 303 Weil Hall, P.O. Box 116595, Gainesville, FL, 32611-6995, United States, cindylin@ufl.edu, Murray Côté, Elif Akcali

Consider an emergency department (ED), with two patient classes and two resource types. The first resource type serves both classes with a class-dependent service rate. The second resource serves only one class. We model the ED as a nonpreemptive priority queueing system, and performance measures are estimated by Power-series algorithm.

■ MA49

R - 4th Floor, Medici

Joint Session Decision Analysis/ Energy, Natural Resources: Decision Analysis and the Environment

Sponsor: Decision Analysis, Energy, Natural Resources & the Environment / Energy
Sponsored Session

Chair: Erin Baker, Asst. Prof., University of Mass. Amherst, 220 Elab, Amherst, MA, 01003, United States, edbaker@ecs.umass.edu

1 - Investment in Risky R&D Programs in the Face of Climate Uncertainty

Erin Baker, Asst. Prof., University of Mass. Amherst, 220 Elab, Amherst, MA, 01003, United States, edbaker@ecs.umass.edu, Kwame Adu-Bonnah

We analyze how the socially optimal technology R&D investment changes with the risk-profile of the R&D program and with uncertainty about climate damages. For R&D into very-low emissions technologies, optimal investment is about 3 1/2 times higher in riskier programs. For R&D programs into fossil-fuel based technologies, our results show that, qualitatively, investment is higher in less-risky programs under most uncertain damage scenarios.

2 - The Impact of Energy and Biomass Prices Dynamics

Eva Regnier, Naval Postgraduate School, 1 University Circle, Monterey, CA, 93943, United States, eregnier@nps.edu

We investigate how the correlation among prices for multiple production inputs and outputs and firm and market returns affects the profitability of production investments. The results indicate that investments in energy conservation and biomass-based production may be systematically undervalued whereas investments in recycling may be overvalued.

3 - Generalized Analysis of the Choice between a Do-Nothing Option and an Act-Now Option

Seth Guikema, sdg4@cornell.edu, Mark Milke

A new generalized approach is presented for analyzing the choice between an act-now option and a do-nothing option, a common environmental policy problem. The problem is described in terms of a set of five independent, dimensionless parameters, and one cost scale parameter. The best choice is given in terms of the five parameters for both a risk-neutral and a risk-averse decision-maker. The approach allows for a deeper analysis of a common environmental decision problem.

4 - EVPI, Cost of Ignoring Uncertainty, and Value of Policy Coordination for the US Power Sector

Benjamin Hobbs, bhobbs@jhu.edu, Ming-Che Hu, Skip Laitner

The stochastic (two-stage) programming version of MARKAL, a widely used LP-based energy economy model, is used to assess the importance of various uncertainties facing power generators over the next 25 years. Several indices are used to compare uncertainties concerning natural gas prices, carbon dioxide limitations, and demand growth. Uncertain CO2 limits appear to matter most because of investments in fossil fuel generation that, under a CO2 cap, could be regretted.

■ MA50

R - 4th Floor, Cervantes

Dana Clyman's Decision Analysis Arcade

Sponsor: Decision Analysis
Sponsored Session

Chair: Jason Merrick, Associate Professor, Virginia Commonwealth University, P.O. Box 843083, 1001 W. Main St., Richmond, VA, 23284, United States, jrmerric@vcu.edu

1 - Using DA-based Methods to Estimate Resources Spent on Drug Safety at FDA

Kara Morgan, Senior Advisor for Risk Analysis, US Food and Drug Administration, 5600 Fishers Lane, Rm 15-62, HFP-20, Rockville, MD, 20857, United States, Kara.Morgan@FDA.GOV, Malcolm Bertoni

Because safety and efficacy analysis are so closely linked at FDA, time reporting data for scientists and managers does not provide the information needed to estimate the time devoted to drug-safety related activities. Using expert elicitation techniques and principles of multi-attribute analysis, we interviewed specialists across the offices and combined that with existing time-reporting data to derive an estimate of time spent on drug-safety related activities in 2004.

2 - Decision Research in Water Resources Management: A Multiple-objective, Multiple-stakeholder Analysis

L. Robin Keller, Professor, University of California, Irvine, Merage School of Business, Irvine, CA, 92697-3125, United States, lrkeller@uci.edu, Craig Kirkwood, Nancy Jones

We used a multiple objective decision modeling approach to create a comprehensive catalog of concerns identified by key stakeholders for guiding water resource policy in Central Arizona. The model informs stakeholder communications and research activities; highlights special interests of important stakeholders; and helps focus discussion and promote constructive interaction for water policy planning in Central Arizona.

3 - Repeat Bidding Strategies for Name-Your-Own-Price Channels

Ali Abbas, Assistant Professor, University of Illinois, Urbana-Champaign, 104 S Mathews Ave, Urbana, IL, 61801, United States, aliabbas@uiuc.edu

Name-Your-Own-Price (NYOP) auctions have found increasing popularity on the internet. While many auction firms allow only a single bid , studies have demonstrated that many internet-bidders engage in repeat bidding. We analyze the value gained by repeat-bidding and determine the optimal repeat bidding strategies given the time preference and risk aversion of the bidders as well as the transaction costs.

4 - Alternative Methods for Estimating Corporate Risk Tolerance - Issues and Dilemmas

Michael Walls, Associate Professor and Chair, Engineering and Technology Management Program, Division of Economics and Business, Colorado School of Mines, Golden, CO, 80007, United States, mwalls@mines.edu

Implementing a comprehensive decision analysis in companies often requires some knowledge of the firm's willingness to take on financial risk. However, measuring corporate risk tolerance can be complicated and challenging. We present three methods for measuring risk tolerance that we implemented in a major oil company. We investigate these results and explore some of the issues and dilemmas that decision analysts face in assessing a corporate utility function.

Monday, 10:00am - 11:30am

■ MB01

H - Lobby Level, Plaza A

Tutorial: An Introduction to Revenue Management

Cluster: Tutorials
Invited Session

1 - Tutorial: An Introduction to Revenue Management

Garrett van Ryzin, Professor, Columbia University, gjv1@columbia.edu, Kalyan Talluri

Revenue management refers to the collection of strategies and tactics firms use to scientifically manage demand for their products and services. It has gained attention recently as one of the most successful application areas of operations research (OR). This tutorial provides an introduction to this increasingly important subfield of OR.

■ MB02

H - Lobby Level, Plaza B

Robust Nonparametric Frontier Estimators: Theoretical and Practical Issues

Cluster: Data Envelopment Analysis
Invited Session

Chair: Abdelaati Daouia, Doctor, University of Toulouse, 118, Route de Narbonne, TOULOUSE, 31062, France, daouia@cict.fr

1 - Robust Nonparametric Estimators of Monotone Boundaries

Abdelaati Daouia, Doctor, University of Toulouse, 118, Route de Narbonne, TOULOUSE, 31062, France, daouia@cict.fr, Léopold Simar

This paper revisits some asymptotic properties of the robust nonparametric estimators of order-m and order-alpha quantile frontiers and proposes isotonized version of these estimators. The new isotonized estimators share the asymptotic properties of the original ones and a simulated example shows, as expected, that these new versions are even more robust than the original estimators. The procedure is also illustrated through a real data set.

2 - Robust Nonparametric Frontier Estimators: Qualitative Robustness and Influence Function

Anne Ruiz-Gazen, Associate Professor, GREMAQ, Université de Toulouse, 21, allée de Brienne, Toulouse, 31000, France, ruiz@cict.fr, Abdelaati Daouia

The most popular nonparametric estimators of a monotone boundary are defined as lowest monotone functions covering all sample points and are very non robust. Two alternatives have been addressed recently by Cazals, Florens and Simar (2002) and Aragon, Daouia and Thomas-Agnan (2005). In this paper we analyze and compare the reliability of the two alternatives from a robustness theory point of view.

3 - On the Interest to use Approximation of Nonparametric Frontiers to Infer Technological Parameters

Anne Vanhems, Doctor, Toulouse Business School, 20 bd Lascrosses BP7010, Toulouse, 31068, France, avanhems@hotmail.com

One of the drawbacks of nonparametric approaches of frontier estimation is the disability to interpret results in terms of returns to scale or substitution elasticities. Following the line of Florens and Simar (2005) of parametric approximation of nonparametric frontiers, we show through an empirical example how technological parameters can be estimated. Main advantages and principal properties of this approach as well as a comparison with alternative frontier approaches are investigated.

■ MB03

H - Ballroom Level, Continental Ballroom 1

Tutorial: Bring OR into your Local High School: Mission Not Impossible

Sponsor: Education (INFORM-ED)
Sponsored Session

Chair: Kenneth Chelst, Chair of Industrial and Manufacturing Engineering, Wayne State University, 4815 Fourth St., Detroit, MI, 48201, United States, kchelst@wayne.edu

1 - Tutorial: Bring OR into your Local High School: Mission Not Impossible
Kenneth Chelst, Chair of Industrial and Manufacturing Engineering, Wayne State University, 4815 Fourth St., Detroit, MI, 48201, United States, kchelst@wayne.edu

We present a collection of OR activities that were specifically designed to enrich the high school math curriculum. The session will provide guidance as to how to reach out to your local high schools and offer short workshops built around these materials. The goal of INFORMS is to create a network of like-minded operations researchers who are interested in outreach and can nurture this mission. We provide an update of our efforts in Colorado and North Carolina. All attendees who commit to reaching out will receive a complimentary copy of the book, *Does this line ever move? Everyday Applications of Operations Research.*

■ MB04

H - Ballroom Level, Continental Ballroom 2

Contemporary Issues in Public Sector OR

Sponsor: Public Programs & Processes
Sponsored Session

Chair: John Hollywood, RAND Corporation, 1200 South Hayes Street, Arlington, VA, 22202, United States, johnsh@rand.org

1 - Does Anti-Israel Sentiment Predict Anti-Semitism In Europe? A Statistical Study
Edward Kaplan, William N and Marie A Beach Prof of Mgt Sciences and Public Health, Yale School of Management; Yale School of Medicine, Box 208200, New Haven, CT, 06520-8200, United States, edward.kaplan@yale.edu

In the discourse surrounding the Israeli-Palestinian conflict, extreme criticisms of Israel coupled with extreme policy proposals spark counter-claims that such "Israel bashing" is anti- Semitic. Our research question differs: based on a survey of 5,000 European citizens, we ask whether those with extreme anti-Israel views are more likely to be anti-Semitic.

2 - A Staffing Decision Methodology For TSA Security Checkpoints At Airports
Joseph Borkoski, President & CEO, Regal Decision Systems, Inc., 1302 Concourse Drive, Suite 400, Linthicum, MD, 21090, jjborkoski@RegalDecision.com

The authors describe a simulation based methodology that has been implemented by the Transportation Safey Administration (TSA) as part of a broader Decision Support System (DSS) that recommends the number of FTE TSA inspectors that should be assigned to an airport. The DSS uses an optimization component that solves for the most cost effective staff allocation based on the demand for staff from a simulation that models the security checkpoint operations and processes.

3 - Flexibility in Dutch Energy Infrastructure: A Perspective for Decision-making under Uncertainty
Darby Grande, Faculty of Technology, Policy and Management, Delft University of Technology, Delft, Netherlands, d.e.grande@tbm.tudelft.nl

Uncertainties of many kinds are present when examining possible transition paths to sustainability in the Netherlands' energy infrastructure system. We explore the implications of literature on flexible manufacturing systems in uncertain environments for the energy infrastructure and its components. An analysis of categories and metrics of flexibility with is performed to identify aids for making decisions regarding investment in new technologies and processes.

4 - Hamlet's Dagger: The Power of Uncertainty in Competition
Doug Samuelson, InfoLogix, Inc., samuelsondoug@yahoo.com

Uncertainty imposes significant extra burdens on decision-makers. Knowing this, sophisticated leaders can use uncertainty, deliberately introduced or amplified, to gain advantage against an adversary. Recent history contains some fairly spectacular and consequential examples. We briefly examine a few of these examples and discuss implications for leadership.

5 - Connecting the Dots: A New Framework for Analyzing the Clues of Terrorist Activities
John Hollywood, RAND Corporation, 1200 South Hayes Street, Arlington, VA, 22202, United States, johnsh@rand.org

We present the "Asymmetric Signal Analysis and Processing" schema for identifying, relating, analyzing, and prioritizing the clues of terrorist activities. We also discuss the development of the schema, and where it has been most usefully applied to date.

■ MB05

H - Ballroom Level, Continental Ballroom 3

Panel Discussion: On the Interface between Marketing and Service Operations Management

Cluster: Service Sector Operations
Invited Session

Chair: Mei Xue, Assistant Professor, Boston College, xueme@bc.edu, Co-Chair: Mor Armony, NYU, 44 West Fourth Street, New York, NY, 10012, United States, marmony@stern.nyu.edu

1 - Panel Discussion: On the Interface between Marketing and Service Operations Management
Moderator: Uday Karmarkar, Professor, Times Mirror Chair in Management & Policy, The Anderson School of Management, UCLA, Gold Hall, Suite B-407, 110 Westwood Pla, Los Angeles, CA, 90095, United States, uday.karmarkar@anderson.ucla.edu, Panelists: Patrick Harker, Dawn Iacobucci, Aleda Roth

A group of leading researchers from Operations Management and Marketing will discuss a wide range of issues regarding the interface between marketing and service operations management. The key topics include: What differentiates Marketing and SOM from Marketing and manufacturing? What are the similarities? What are the main achievements in the past 10 years in the interface between Marketing and SOM? What are the research challenges and opportunities?

■ MB06

H - Ballroom Level, Continental Ballroom 7

Scheduling and Routing Problems in Logistics

Contributed Session

Chair: Pitu Mirchandani, Professor, University of Arizona, SIE, University of Arizona, Tucson, AZ, 85721, United States, pitu@email.arizona.edu

1 - Distribution Network Design for Humanitarian Relief Chains
Burcu Balcik, University of Washington, Industrial Engineering, Box 352650, Seattle, WA, 98195, United States, burcub@u.washington.edu, Benita Beamon

The flow of goods in a humanitarian relief chain can occur through two distribution channels: direct shipment from suppliers to recipients or shipment from suppliers through warehouses to recipients. In this study, we develop a methodology for designing a structure and associated strategy for a humanitarian relief distribution network.

2 - Development of a Methodology for Containership Stowage Planning
Evangelos Kaisar, University of Maryland, 1173 Glen L. Martin Hall, College Park, United States, kaisar@wam.umd.edu, Ali Haghani

The container stowage planning problem concerns the suitable placement of containers on board. A key objective of stowage planning is to minimize the number of container movements. In this work we develop a mathematical model and heuristic approach to minimize the extra movements on a multi-port journey for solving the problem. The model produces a stowage plan with respect to stability, and cargo safety.

3 - LPS (Logistics Planning System) for Empty Containers
Yossi Shiloach, IBM, IBM Haifa Research Lab, Haifa, —, 31905, Israel, shiloach@il.ibm.com, Dagan Gilat, Ariel Landau, Segev Wasserkrug

The logistics of empty containers is a major task in any container shipping company. Its main objective is to provide empty containers to any export point by quantity, type and time required and do it with minimal cost. A medium shipping company may hold hundreds of thousands containers, serving hundreds export ports. The cost of empty container logistics may reach 10% of the annual turn over. The talk will overview a 3 years project that ended recently.

4 - The Inbound Inventory Routing Problem with a Storage Constraint
Jennifer Stacey, PhD Student, University of Alabama, 3156 Trace Way, Trussville, AL, 35173, United States, jrp_ise@yahoo.com

We develop two heuristics for route design and inventory management of inbound parts which are delivered for manufacturing operations. In particular, a facility wishes to coordinate pickups from multiple suppliers but has a limited amount of storage space in which to house inventory. In the case of inbound logistics we show that combining less than full truckload shipments can result in substantial savings by taking advantage of economies of proximity.

5 - Models and Algorithms of Vehicle Rescheduling Problem with Consideration of Rescheduling Cost

Pitu Mirchandani, Professor, University of Arizona, SIE, University of Arizona, Tucson, AZ, 85721, United States, pitu@email.arizona.edu, Denis Borenstein, Jingquan Li

When a vehicle on a scheduled trip breaks down, one or more vehicles need to be rescheduled to serve the customers on that trip. The problem of reassigning vehicles to this cut trip as well as the other prescribed trips with given starting and ending time in real-time, is being referred to as the vehicle rescheduling problem. We present the models and algorithms to solve this problem with the minimum operating, delay and rescheduling cost.

■ MB07

H - Ballroom Level, California

Product Variety and the Operations/Marketing Interface

Sponsor: Manufacturing & Service Oper Mgmt
Sponsored Session

Chair: Terry Taylor, Associate Professor, Columbia University, Graduate School of Business, 3022 Broadway, New York, NY, 10027, United States, tat2002@columbia.edu

Co-Chair: Serguei Netessine, Assistant Professor, University of Pennsylvania, 3730 Walnut St. Suite 500, Philadelphia, PA, 19104, United States, netessin@wharton.upenn.edu

1 - Impact of E-Waste Regulations on Innovation and Pricing by Manufacturers with Strategic Customers

Elana Guslitser, doctoral student, Stanford Graduate School of Business, Memorial Way, Stanford, CA, United States, guslitser@stanford.edu, Erica Plambeck

Electronics constitute the fastest growing portion of the waste stream and improper disposal damages the environment. Governments are adopting different forms of regulation to ensure recycling or safe disposal of electronics. We evaluate the implications for the innovation rate, pricing and profit of manufacturers facing strategic customers with rational expectations.

2 - Incentives and Production/Inventory Planning in a Manufacturer-Dealer Supply Chain

Wenqiang Xiao, Columbia University, 3022 Broadway, Uris Hall 4N, New York, NY, 10027, United States, wx2004@columbia.edu, Fangruo Chen

A manufacturer designs an incentive contract for a dealer. Given this contract, and after observing the market condition in each period, the dealer exerts a selling effort. The selling effort, the market condition, and a random shock together determine the consumer demand for the period. The manufacturer makes production decisions periodically to satisfy consumer demand. The goal is to investigate how the manufacturer's production planning impacts the design of the dealer's incentives.

3 - On the Effects of Consumer Search and Firm Entry in a Multiproduct Competitive Market

Gerard Cachon, University of Pennsylvania, The Wharton School, 500 JMHH, Philadelphia, PA, 19104, United States, cachon@wharton.upenn.edu, Yi Xu, Christian Terwiesch

We study the effects of consumer search and firm entry on multiproduct firms' pricing and product line breadth decisions in a competitive market. Conventional economic intuition suggests that cheaper consumer search should intensify competition, thereby leading to lower prices and narrower product lines. But we find that cheaper search can lead to higher prices, broader product lines and higher firm profits.

4 - Product Line Design and Production Technology

Terry Taylor, Associate Professor, Columbia University, Graduate School of Business, 3022 Broadway, New York, NY, 10027, United States, tat2002@columbia.edu, Serguei Netessine

This paper characterizes the impact of production technology on the optimal product line design. Jointly considering product line design and production decisions leads to insights that differ significantly from the common intuition and the literature, which omits either the demand-side or the supply-side of the equation. E.g.: a firm offering greater product variety may have lower total production costs; more expensive production technology may lead to higher-quality products and lower prices.

■ MB08

H - Ballroom Level, Imperial A

Pricing and Incentive Mechanisms

Sponsor: Manufacturing & Service Oper Mgmt
Sponsored Session

Chair: Pinar Keskinocak, Associate Professor, Georgia Institute of Technology, School of Industrial and Systems, 765 Ferst Drive, Atlanta, GA, 30345, United States, pinar@isye.gatech.edu

Co-Chair: Ozgul Baysar, Ph.D. student, Georgia Institute of Technology, School of Industrial and Systems Eng., 765 Ferst Drive, Atlanta, GA, 30345, United States, gtg680i@mail.gatech.edu

Co-Chair: Julie Swann, Georgia Institute of Technology, Industrial and Systems Engineering, Atlanta, GA, 30332-0205, United States, jswann@isye.gatech.edu

1 - Upselling a Promotional Product Using Customer Purchase Information

Goker Aydin, University of Michigan, Dept. of Industrial and Operations Engr., Ann Arbor, MI, 48109, United States, ayding@umich.edu, Serhan Ziya

Upselling is offering an additional product or service to a customer who just made a purchase. Most catalogers, online sellers and traditional retailers use upselling as a means of increasing revenue and clearing inventories. Thanks to the wealth of customer segmentation data, a firm can tailor upsell offers at the individual customer level. We investigate if and when the firm should offer a discount to a customer as part of an upsell offer and how deep the discount should be when offered.

2 - The Effect of Customer Rebates and Retailer Incentives on Channel Coordination

Ozgun Caliskan Demirag, Ph.D. student, School of Industrial and Systems Eng, 765 Ferst Drive, Atlanta, GA, 30345, United States, gtg501c@prism.gatech.edu, Julie Swann, Pinar Keskinocak, Ozgul Baysar

Manufacturers using non-direct distribution channels to sell their products can control sales by using promotions. Customer rebate is a per unit payment to end customers and retailer incentive is a lump sum payment to the retailer. We examine the impact of retailer incentives and customer rebates on manufacturer's pricing and retailer's sales decisions under different demand and information scenarios where retailers may price discriminate and study which promotion would benefit the manufacturer.

3 - Pricing Policies in a Distribution Channel

Chuck Ingene, Hearin Chair of Business Administration, University of Mississippi, P.O. Box 1848, 220 Holman Hall, University, MS, 38677, United States, cingene@bus.olemiss.edu, Anne T. Coughlan

We model a multi-product, bilateral-monopoly channel in which manufacturer and retailer can select from the simultaneous maximization of profit from all products (product-line pricing: PLP) or maximizing profit from each product individually (non-product-line pricing: NPLP). We prove that PLP is the equilibrium solution for an independent channel and leads to a broader, "me-too" product line; this lowers consumers' surplus.

4 - Developing System Policies to Improve Security in Supply Chains

Emrah Uyar, Julie Swann

Security of products and data in supply chains is an issue in industries such as agriculture, manufacturing, health and others. Investment by individual supply chain members would help ensure security, although contribution to this public good is not always in their best interest. We investigate the security of a general supply chain and study the interactions of the members of the chain and how these interactions affect investment decisions in security. We design incentive mechanisms such as the sharing of destruction costs, price differentiation, and the allocation of public catastrophe costs to encourage supply chain members to invest in security. We also demonstrate that competition between agents can facilitate public security.

■ MB09

H - Ballroom Level, Yosemite A

Competition and Cooperation in Supply Chain Management

Cluster: Supply Chain Management
Invited Session

Chair: Daniel Granot, Professor, University of British Columbia, 2053 Main Mall, Vancouver, BC, V6T1Z2, Canada, daniel.granot@sauder.ubc.ca

1 - A Contest Among Distributors Over Who is the Best Newsvendor
Yigal Gerchak, Tel-Aviv University, ygerchak@eng.tau.ac.il, Oshry Azriel

A supplier shares revenue with retailers, and distributors vendor manage the products at the retailers. Distributors do not compete with each other, but the one whose performance is the best receives a bonus. That is an attempt to align distributors' incentives with those of the supplier. We derive the equilibrium.

2 - Dynamic Pricing under Zigzag Competition
Benny Mantin, University of British Columbia, 2053 Main Mall, Vancouver, BC, V6T1Z2, Canada, benny.mantin@sauder.ubc.ca, Daniel Granot, Frieda Granot

We study a multi-period no-replenishment model of competition between two retailers. Consumers zigzag between the retailers and purchase an identical good once the price is below their valuations. We show that prices decline exponentially and that the loss due to competition is about 30% of the monopolistic profit.

3 - Competiton and Cooperation in Multi-Supplier Single-Assembler Assembly Systems
Shuya Yin, University of California Irvine, Paul Merage School of Business, Irvine, CA, 92697-3125, United States, syin@merage.uci.edu, Daniel Granot

We analyze two contracting systems between an assembler and her suppliers: push and pull. In push, the suppliers are the leaders, while in pull, the assembler is the leader. We investigate various aspects of the two systems, including alliance formation, profit allocation and members' preferences over the two systems.

4 - Variety and Substitution
Feng Chen, University of Southern California, fchen@marshall.usc.edu, Yehuda Bassok

Retailers often face issues of selecting varieties and inventory levels. We model such situation assuming a fixed pool of customers. Each customer makes a choice according to his realized utility and available products. We develop a heuristic approximating the optimal profit. Further, we develop guideline of choosing optimal variety.

■ MB10

H - Ballroom Level, Yosemite B

Optimization in Supply Chain Management

Cluster: Supply Chain Management
Invited Session

Chair: Edwin Romeijn, Associate Professor, University of Florida, 303 Weil Hall, P.O. Box 116595, Gainesville, FL, 32611-6595, United States, romeijn@ise.ufl.edu

1 - One-Warehouse Multi-Retailer Problem with Joint Inventory and Location Decisions
Burcu B. Keskin, Ph.D. Candidate, Texas A&M University, College Station, TX, burcu@tamu.edu, Halit Uster, Sila Cetinkaya

Location and inventory decisions are interconnected through the transportation and fixed ordering costs. Based on this observation, we revisit the one-warehouse N-retailer problem for simultaneous optimization of inventory and warehouse location decisions. Our results are useful for i)identifying the level of interaction between these two types of decisions that have been traditionally optimized separately, and ii)exploitation of interaction for integrating strategic and operational decisions.

2 - Inventory and Facility Location Models with Market Selection
Retsef Levi, Postdoctoral Fellow, IBM Watson Research Center, P.O. Box 218, Yorktown Heights, NY, 10598, United States, retsef@us.ibm.com, Edwin Romeijn, Joseph Geunes, David Shmoys

We consider inventory models with market selection, an important generalization of the traditional models. Given a set of markets, each specified by a sequence of demands and associated revenue, we first select some markets and reject all others. Then we satisfy all the demands of selected markets. The goal is to minimize lost revenue of rejected markets and production costs of satisfying selected markets. We show how to leverage existing approximation results to these more general models.

3 - Modeling Market Entry Decisions for a Single Selling Season under Price-Sensitive Demands
Ismail Serdar Bakal, University of Florida, 303 Weil Hall, Gainesville, FL, 32611, United States, ismailsb@ufl.edu, Joseph Geunes, Edwin Romeijn

Consider a profit-maximizing firm offering a product during a single season. A set of potential markets exists from which the firm can choose. Demand in each market is stochastic and expected demand is decreasing in price. The supplier's demand distribution thus depends on the markets selected and the selling prices offered. We provide models and optimal solution procedures for this problem using single-price and individual market pricing strategies under normally distributed market demands.

■ MB11

H - Ballroom Level, Yosemite C

Supply Chain Management in Practice

Contributed Session

Chair: Owen Wu, Ph.D. Candidate, University of British Columbia, Sauder School of Business, 2053 Main Mall, Vancouver, BC, V6T1Z2, Canada, owen.wu@sauder.ubc.ca

1 - Coordination of Installation Base-Stock Policies in Tree Supply Networks with Batch Demand
Yao Zhao, Assistant Professor, Rutgers University, Dept. of MSIS, Rutgers Business School, 180 University Avenue, Newark, NJ, 07102, United States, yaozhao@andromeda.rutgers.edu

We consider a tree structure supply chain where each stage faces batch demand and utilizes an installation base-stock inventory policy (continuous or periodic). We characterize the stock-out delay for each unit of a demand at each stage of the supply chain, and develop an exact and systematic approach to analyze various material flow topologies. We present approximations for fast system optimization subject to type 2 fill-rate constraints.

2 - Multi-Period, Multi-Customer Options Contracting in the Semiconductor Industry
Paul Kleindorfer, Professor, University of Pennsylvania, The Wharton School/OPIM, Philadelphia, PA, 19104, United States, kleindorfer@wharton.upenn.edu, Aliza Heching, Stefan Spinler, Giuseppi Paleologo, Jayanth Krishnan

We investigate the role of multi-period options-based contracting in a single semiconductor manufacturing facility that supplies multiple customers. We investigate empirically the effects of forecast changes, capacity scheduling, and capacity allocation policies upon the evolution of a dynamic contractual relationship between the supplier and its customer(s). We also present new theoretical results that contribute to the existing literature on multi-period options-based contracting.

3 - Dynamic Rolling Knapsacks: Capacity Management in Multi-Period Make-to-Order Businesses
Sriram Dasu, University of Southern California, Marshall School of Business, Los Angeles, CA, 90089, United States, dasu@marshall.usc.edu, Hiroshi Ochiumi

This paper is motivated by a problem faced by a credit card printing firm. The firm receives two types of orders - normal and urgent. Urgent orders fetch a premium. The company is interested in policies for withholding capacity for urgent orders. We identify optimal capacity rationing rules by modeling the problem by a dynamic rolling knapsack problem.

4 - Dynamic Slaughterhouse Units - Optimal Transportation and Processing in Coastal Areas
Frode Romo, Senior scientist, SINTEF Technology & Society, S.P.Andersens v. 5, Trondheim, 7465, Norway, Frode.Romo@sintef.no, Asgeir Tomasgard, Kristin Tolstad Uggen

The farms in Norway are scattered around the country, and this represent a major logistical challenge in an increasingly competitive European food market. SINTEF has carried out a project to investigate the relevance of a ship-based slaughterhouse concept, serving the farmers along the Norwegian coastline. We have developed an optimization model combining routing the trucks on shore transporting animals, with planning the sailing pattern for the ship.

5 - Inventory Performance of U.S. Retail, Wholesale and Manufacturing Companies from 1981 to 2003
Owen Wu, Ph.D. Candidate, University of British Columbia, Sauder School of Business, 2053 Main Mall, Vancouver, BC, V6T1Z2, Canada, owen.wu@sauder.ubc.ca, Hong Chen, Murray Frank

We study the trends and financial impact of inventories of publicly traded U.S. retail, wholesale and manufacturing companies between 1981 and 2003. We find that manufacturing and wholesale inventory was reduced over time. Retail inventory did not start to decline until about 1995. Firms with abnormally high inventories have abnormally poor long term stock returns. Retailers with very lower inventory, manufacturers and wholesalers with medium-to-low inventory tend to have good stock returns.

■ MB12

H - 4th Floor, Union Square 1

Joint Panel Discussion Auction and Game Theory/ Practice: Combinatorial Auctions for Industrial Procurement

Cluster: Applications of Auction and Game Theory, OR Practice
Invited Session

Chair: Michael Rothkopf, Professor, Rutgers University, MSIS Department, 640 Bartholomew Road, Piscataway, NJ, United States, rothkopf@rutcor.rutgers.edu

1 - Panel Discussion: Combinatorial Auctions for Industrial Procurement

Moderator: Michael Rothkopf, Professor, Rutgers University, MSIS Department, 640 Bartholomew Road, Piscataway, NJ, United States, rothkopf@rutcor.rutgers.edu, Panelists: Tuomas Sandholm, Avner Schneur, Yossi Sheffi, Abigail Hohner

Three of the four panelists have recently been authors of Edelman finalist papers describing different, but highly successful implementations of combinatorial auctions for industrial procurement. The fourth has been studying and writing about combinatorial auctions for procuring trucking services. They will discuss how combinatorial auctions work in practice and what it takes to make them successful.

■ MB13

H - 4th Floor, Union Square 5

Software Demonstration

Cluster: Software Demo
Invited Session

1 - Frontline Systems, Inc.- Rapid Application Development with Solver Platform SDK

Daniel H. Fylstra, President, Frontline Systems, Inc., P.O. Box 4288, Incline Village, NV, 89450, United States, dfylstra@frontsys.com

With Frontline's new Solver Platform SDK, you can rapidly develop and deploy applications using optimization and Monte Carlo simulation, in C#, VB.NET, Java, MATLAB, C/C++ and Visual Basic. Watch us create a Web application in minutes, with Wizards and IntelliSense in Microsoft Visual Studio. Solve huge models with world-class speed.

2 - AIMMS (Paragon Decision Technology)- AIMMS in Real-Life, Large-Scale Production Environments

Marcel Roelofs, Technical Director, AIMMS, P.O. Box 3277, 2001 DG Haarlem, Netherlands, marcel.roelofs@paragon.nl

In this demonstration we will show how AIMMS is much more than just a prototyping tool for optimization applications. Based on real-life scenarios we will demonstrate the advanced features of AIMMS that allow AIMMS-based solutions to be the optimization engine at the heart of large-scale industrial production systems.

■ MB14

H - 4th Floor, Union Square 6

Problems in Applied Probability

Contributed Session

Chair: Ersoy Subasi, RUTCOR, Rutgers University, 640 Bartholomew Rd, Piscataway, NJ, 08854, United States, esub@rutcor.rutgers.edu

1 - Classification of Correlated Binary Data Using Discriminant Analysis

Sang-Ho Lee, POSTECH, Industrial & Management Eng., San 31 Hyoja-dong, Pohang, KB, 790-784, South Korea, samo35@postech.ac.kr, Chi-Hyuck Jun, Hyeseon Lee

Correlated binary data arises when two or more measurements are taken at one time on the same individual. There is a growing interest in the statistical and medical literature concerning the analysis of correlated binary data. This paper proposes a classification method using discriminant analysis considering joint probability mass function of correlated binary data. We evaluate the proposed method using real and synthetic binary data.

2 - Heavy Traffic Optimality of Network under Utility Maximizing Control

Hengqing Ye, Assistant professor, National University of Singapore, 15 Law link, Singapore, 117591, Singapore, bizyehq@nus.edu.sg, David Yao

We study a stochastic network that consists of a set of servers shared by multiple classes of jobs. Each class of jobs requires a concurrent occupancy of several servers while being served for a random amount of time. The allocation of the server capacities among the job classes takes the form of a solution to an optimization problem that maximizes a given utility function of the dynamic network state. We study the optimality of such control when applied to networks under heavy traffic.

3 - Referral Contract under Inventory Competitive Newsvendor Model

Lu Meng, Chinise University of HK, C410 PGH1 CUHK, hongkong, Hong Kong, mlu@se.cuhk.edu.hk

We studied a horizontal contract under the competitive newsvendor scenario, called the referral contract. There is an ordering quantity game between retailers facing the shiftable demand. We demonstrate that by adopting this contract, both retailers can achieve a better expected profit. They can act as one centralized company who optimizes her total expected profit in seperate markets.

■ MB15

H - 4th Floor, Union Square 9

Scheduling and Due Date Quotation

Cluster: Scheduling
Invited Session

Chair: Philip Kaminsky, University of California, IEOR, Berkeley, CA, United States, kaminsky@ieor.berkeley.edu,

1 - Job Shop Scheduling with Earliness, Tardiness and Intermediate Inventory Holding Costs

Kerem Bulbul, Professor, Sabanci University, Manufacturing Systems / Industrial Eng., Orhanli, Tuzla, Turkey, bulbul@sabanciuniv.edu

We consider a job shop scheduling problem with the objective of minimizing the sum of tardiness, earliness (finished goods inventory holding) and intermediate (work-in-process) inventory holding costs. Our goal is to develop scheduling heuristics to minimize the total cost and demonstrate the effectiveness of these heuristics computationally.

2 - Single-Machine Scheduling with Random Processing Times under Compound-Type Distributions

Xiaoqiang Cai, Professor, The Chinese University of Hong Kong, Department of Systems Eng. & Eng. Mgmt, Hong Kong, China, xqcai@se.cuhk.edu.hk, Xianyi Wu, Xian Zhou

We investigate problems of scheduling a set of jobs on a single machine with general stochastic cost functions, which involve stochastic due times and processing times. Our model allows the processing times to follow a class of compound-type distributions. The optimal policies for these scheduling problems, with or without precedence constraints, are derived respectively.

3 - Scheduling and Due-date Quotation in a Make-To-Order Supply Chain

Onur Kaya, UC Berkeley, Department of IEOR, Berkeley, CA, 94720, United States, okaya@ieor.berkeley.edu, Philip Kaminsky

We consider a manufacturer with a single supplier that has to quote due dates to arriving customers in a make-to-order production environment. The manufacturer is penalized for long lead times, and for missing due dates. We consider several variations of this problem, and design effective due-date quotation and scheduling rules for centralized and decentralized versions of the model.

4 - Approximations to Optimal k-unit Cycles for Dual Gripper Robot Cells

H. Neil Geismar, Assistant Professor, Prairie View A&M University, College of Business, P.O. Box 638, Prairie View, TX, 77446, United States, Neil_Geismar@pvamu.edu, Chelliah Sriskandarajah, Milind Dawande

We develop a polynomial-time algorithm that generates a cyclic solution which is a 1.5-approximation to the optimum per-unit cycle time for a practically-common subclass of cyclic solutions in dual gripper cells with constant inter-machine travel-time and the free-pickup criterion. Additionally, this cyclic solution is asymptotically optimal as the number of machines goes to infinity.

■ MB16

H - 4th Floor, Union Square 10

Joint Session Workforce/ Social Science: Behavioral Operations

Cluster: Workforce Flexibility, Social Science Applications
Invited Session

Chair: Kenneth Schultz, Assistant Visiting Professor, S. C. Johnson Graduate School of Management, Cornell University, 321 Sage Hall, Ithaca, NY, 14853, United States, ks28@cornell.edu

1 - Behavioral Operations: Beyond the Beer Game
Fransesca Gino, Lecturer, Post Doctoral Fellow, Harvard Business School, Morgan Hall T86, Soldiers Field, Boston, MA, 02163, United States, fgino@hbs.edu, Gary Pisano

The present work investigates the impact of human behavior on operations management matters. We argue and demonstrate that once behavioral aspects are taken into account, the predictions of the existing operational models and presumptions change. A better understanding of human behavior and how it comes into play in OM contexts might indeed lead to better predictions of the actual working of the operating systems people have to design, implement and use.

2 - A Formal Model of Fair Process and Group Performance
Christoph Loch, Professor of Technology Management, INSEAD, Boulevard de Constance, Fontainebleau Cedex, 77305, France, Christoph.Loch@insead.edu, Yaozhong Wu, Ludo Van der Heyden

Much empirical evidence suggests that "fair process" enhances organizational performance in the context of change and innovation. We build a model of fair process, using a principal-agent approach with extended utility functions. Both actors care about having influence on the contract and about ambiguity. The model predicts benefits from fair process. It also highlights psychological tradeoffs that have not been discussed previously but may explain why fair process is not more widely used.

3 - Functional Similarity and Competition - The Negative Impact of Cross-Training on Knowledge Transfer
Enno Siemsen, Enno_Siemsen@kenan-flagler.unc.edu, Sridhar Balasubramanian, Aleda Roth

Cross-Training and knowledge transfer are drivers of strategic agility. Can cross-training improve knowledge sharing among employees, or does the increased similarity between them lead to competition that prohibits these cooperative behaviors? We draw upon social identity theory to hypothesize that cross-training can - depending on the operational context - drive competition between employees. We test this hypothesis using survey based research.

■ MB17

H - 4th Floor, Union Square 11

New Product Development Topics

Cluster: New Product Development
Invited Session

Chair: Cheryl Druehl, University of MD, College Park, R.H. Smith School of Business, 4318 Van Munching Hall, College Park, MD, 20742, United States, cdruehl@rhsmith.umd.edu

1 - Intra-firm Technology Transfer for Global New Product Development
Jiong Sun, Carnegie Mellon University, Tepper School of Business, Pittsburgh, PA, 15213, United States, jiongs@andrew.cmu.edu, Sunder Kekre, Cuihong Li

Motivated by a problem observed in a global company, we study two strategies of supplying a lag market with new products of superior quality developed in lead markets: transferring technology or exporting components. The former builds local production capabilities, but incurs significant technology transfer costs and may introduce potential competitors; while the latter saves transfer costs, reduces the likelihood of competition, but incurs significant unit landed cost.

2 - Automatic Detection of Characteristic Values from Experimental Data: An application to the Bass Diffusion Model
Patricio Mendez, Assistant Professor, Colorado School of Mines, Dept. Metallurgical and Materials Eng., 1500 Illinois St, Golden, CO, 80401, United States, pmendez@mines.edu, Paulo Goncalves, Fernando Ordonez

Researchers often use simulation to gain insight about nonlinear dynamic systems that cannot be solved in closed form. In this talk, we present an algorithm that integrates dimensional analysis to the backward elimination procedure of multivariate linear regressions to automatically identify scaling laws that predict characteristic values for nonlinear dynamic systems. We present a computational experiment that shows the viability of the method to the diffusion of a new product.

3 - Problem Solving Efficiency in Complex Product Development
Phil Gouel, University of Michigan, Industrial and Operations Engineering, Ann Arbor, MI, United States, pgouel@umich.edu, Sebastian Fixson

The development of complex engineering products involves solving a large number of problems. One measure of the efficiency of these problem solving processes is the duration it takes to solve each individual problem. We study the problem solving processes in an automotive development context and find large variation of this efficiency measure. We identify several causes underlying this phenomenon.

4 - Strategic NPD Portfolio Management in Complex Environments
Raul Chao, Georgia Institute of Technology, 800 West Peachtree Street, Atlanta, GA, United States, raul.chao@mgt.gatech.edu, Stylianos Kavadias

This paper addresses the link between NPD portfolio strategy and firm performance. Firm performance is determined by a set of parameters and their interactions, which define environmental complexity. Our results indicate that the optimal NPD portfolio strategy depends on environmental complexity and environmental stability.

5 - Low-End Encroachment: A Framework to Help Recognize Disruptive Technologies
Cheryl Druehl, University of MD, College Park, R.H. Smith School of Business, 4318 Van Munching Hall, College Park, MD, 20742, United States, cdruehl@rhsmith.umd.edu, Glen Schmidt

While disruptive technologies are often thought of as low-priced, cell phones, initially expensive, appear to be a disruptive technology per Christensen's definition. We offer an explanation, showing how a new product first sells to a detached market segment but later still encroaches on the old product from the low end. We call this type of diffusion the detached-market form of low-end encroachment and contrast it with the fringe-market type of low-end encroachment and high-end encroachment.

■ MB18

H - 4th Floor, Union Square 12

Optimization in Airline Planning II

Sponsor: Aviation Applications
Sponsored Session

Chair: Diego Klabjan, Professor, University of Illinois at Urbana-Champaign, 1206 West Green Street, Urbana, IL, 61801, United States, klabjan@uiuc.edu

1 - Integrated Planning Models for Airline Flight and Crew Schedules with Disruptions
Anne Johnson, University of Arizona, Dept of Systems/Industrial Engineering, Tucson, AZ, 85719, United States, annej@email.arizona.edu, Julia Higle

Proven models exist for the efficient solution of many facets of airline planning, but integrated solution techniques are limited and usually require an initial flight schedule. We present a modeling paradigm that moves toward integrated methods for airline scheduling using surrogate representations of the operational problems. To illustrate, we present a surrogate crew scheduling model that approximates the contribution of crew costs, and also consider the effects of disruptions.

2 - Solving Large Crew Pairing Problems for Integrated and Robust Planning
Amy Cohn, University of Michigan, 1205 Beal Avenue, Ann Arbor, MI, 48109-2117, United States, amycohn@engin.umich.edu, Shervin AhmadBeygi

Solving the passenger airline crew pairing problem for a single fleet type is computationally challenging. When the problem instance is expanded to consider all fleet times simultaneously, such as in integrated or robust airline planning, the traditional methods become intractable. We present computational results based on our use of a novel optimization-based approach to solving this problem and discuss outstanding challenges.

3 - An Integrated Scheduling Model in Fractional Airline Operations
Yufeng Yao, Georgia Institute of Technology, 765 Ferst Drive, Atlanta, GA, 30332-0205, United States, gt6906a@prism.gatech.edu, Ozlem Ergun, Ellis Johnson

Fractional aircraft ownership allows the owner to fly a set number of hours a year with a private jet without a huge investment and operational considerations. We present an integrated model that simultaneously solves the fleet assignment, aircraft routing and crew-scheduling problem. Computational results on real data are also presented.

4 - Solving a Two Stage Stochastic Programming Fleet Assignment Model
Venkata Pilla, pillaprasad@yahoo.com, Jay Rosenberger, Victoria Chen

We propose a two stage stochastic programming formulation to solve the fleet assignment problem. The first stage solution gives an initial crew compatible allocation (CCA) and the second stage assigns specific aircraft within the CCA. The stochasticity of the demand is incorporated by considering various demand scenarios in the second stage. Design and analysis of computer experiments is used to reduce the computation involved in solving the problem. Computational results will be presented.

■ MB19

H - 4th Floor, Union Square 13

2005 TMS Best Dissertation Award

Sponsor: Technology Management
Sponsored Session

Chair: Moren Levesque, Assistant Professor of Entrepreneurship and of Operations, Case Western Reserve University, 10900 Euclid Avenue, Cleveland, OH, 44106, United States, mxl101@cwru.edu

1 - The Interconnected Firm: Evolution, Strategy, and Performance
Dovev Lavie, Assistant Professor of Management, University of Texas at Austin, 1 University Station B6300, McCombs School of Business, Mgmt. Dep., Austin, TX, 78712, United States, dovev.lavie@mccombs.utexas.edu

This dissertation contests the view that valuable resources must be internally owned by considering rent appropriation via sharing/leakage of network resources. A study of the coevolution of Unisys and its alliance network shows how shifts in strategy shape the network configuration, while analysis of 20,779 alliances reveals its performance implications, i.e., partners' bargaining power weakens performance, but their capabilities, inter-partner competition, and alliance-type balance enhance it.

2 - Product Innovation in Heterogeneous R&D Networks: Pathways to Exploration and Exploitation
Oana Branzei, Assistant Professor, York University, 4700 Keele Street, Toronto, ON, M3J 1P3, Canada, obranzei@schulich.yorku.ca

This thesis examines whether, how, and when heterogeneous alliance networks enable firms to convert external variance into desirable firm-level outcomes. For manufacturing firms, diverse R&D ties engender a broad array of learning capabilities, stimulate both exploratory and exploitative product innovation, trigger new pathways for attaining competitive advantage, and, under specific environmental conditions, either complement or act as a lever for internal capability configurations.

3 - Toward Greater Economic Understanding of Entrepreneurial Activity: Examining Specialized Knowledge
Marc Junkunc, Assistant Professor of Management, University of Miami, School of Business Administration, 5250 University Drive / 417 Jenkins Bldg, Coral Gables, FL, 33124, United States, mjunkunc@miami.edu

I introduce an analytical framework of entrepreneurial activity characterized by specialized knowledge resources in team production. The framework predicts that valuable entrepreneurial activity can fail to occur due to differences in the very specialized knowledge components necessary for innovation. Empirically, I test the notion of entrepreneurial transactions failing (using IPO data) when there are greater degrees of specialized knowledge present, and find substantial supporting evidence.

■ MB20

H - 4th Floor, Union Square 14

Investment, Planning and Resource Adequacy in Restructured Electricity Markets

Sponsor: Energy, Natural Resources & the Environment / Energy
Sponsored Session

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

1 - Implementing Resource Adequacy via a Portfolio of Option Contracts
Hung Po Chao, EPRI and Stanford University, 3412 Hillview Ave, Palo Alto, CA, 94303, hchao@stanford.edu, Robert Wilson

We show that in principle a portfolio of option contracts, with a spectrum of strike prices, can implement a regulatory policy in which prices in spot markets are adapted to variations in loads. A secondary effect of a portfolio of options is that it increases the elasticity of the residual demand net of options. Thus an option portfolio serves also to mitigate the market power of large suppliers in the spot market. The decrease in market power in the spot market does not reappear entirely in the forward market for contracts because the forward market is intrinsically more competitive (since there is adequate time for new investments and for entry of new firms).

2 - Model-Based Evaluation of Generation Adequacy Markets
Benjamin Hobbs, bhobbs@jhu.edu, Javier Inon, Ming-Che Hu

Two approaches are used to assess the impact of alternative capacity market designs under consideration by PJM. One is based on a long run equilibrium analysis (with entry), recognizing the stochastic nature of forced outages and load. Both one area and two area (transmission constrained) formulations are considered. Another is a dynamic simulation that considers entry under disequilibrium based on risk averse decision making by a representative agent.

3 - A Stochastic Equilibrium Model for the North American Natural Gas Market
Jifang Zhuang, University of Maryland, 1173 Glenn Martin Hall, Civil Engineering Department, College Park, MD, 20742, United States, zhuang@umd.edu, Steven Gabriel

We develop a stochastic equilibrium model using the recourse method for the North American natural gas market, based on a mixed complementarity formulation. In this model, a variety of market players, either price-takers or Nash-Cournot players, make both planning decisions in the long-term market and daily operational decisions in the spot market so as to maximize their expected profits.

4 - Proactive Transmission Investment in Power Systems
Enzo Sauma, Ph.D. Student, University of California at Berkeley, 4119 Etcheverry Hall, IEOR department, U.C. at Berkeley, Berkeley, CA, 94720-1777, United States, esauma@ieor.berkeley.edu, Shmuel Oren

We propose a three-period model for studying how the exercise of local market power by generation firms affects the equilibrium investment between the generation and the transmission sectors. We compare the transmission investment decisions made by a "proactive" network planner with those decisions made by a "reactive" network planner, by an integrated-resources planner, and by a fully-vertically-integrated social planner. We illustrate our theoretical results in the case of a 30-bus network.

■ MB21

H - 4th Floor, Union Square 15

Tutorial: Data Mining

Sponsor: Data Mining
Sponsored Session

Chair: Tom Au, AT&T Labs, 412 Mt. Kemble Ave., Morristown, NJ, 07962, United States, sau@att.com

1 - Tutorial on Predictive Modeling
Tom Au, AT&T Labs, 412 Mt. Kemble Ave., Morristown, NJ, 07962, United States, sau@att.com, Wei Jiang, Andrew Kusiak

Predictive modeling is one of the most important areas of data mining. The tutorial provides an overview of the algorithms and applications of predictive modeling. It begins with an evaluation of the framework for predictive modeling techniques and industrial applications, discusses different computer science and statistical algorithms. It concludes with examples illustrating and comparing different algorithms.

■ MB22

H - 4th Floor, Union Square 16

Competition in Electronic Markets

Sponsor: Information Systems
Sponsored Session

Chair: Waleed Muhanna, The Ohio State University, Fisher College of Business, 2100 Neil Avenue, Columbus, OH, 43210, United States, wmuhanna@cob.ohio-state.edu

1 - Internet Exchanges for Used Books: An Empirical Analysis of Product Cannibalization and Welfare Impact
Anindya Ghose, Assistant Professor, New York University, Stern School of Business, New York, NY, United States, aghose@stern.nyu.edu, Michael D. Smith, Rahul Telang

Content creators are concerned that Internet used product markets will cannibalize new product sales. Using a unique dataset, we find cannibalization is fairly low: only 16% of used book sales at Amazon cannibalize new book purchases. The remaining 84% of sales apparently would not have occurred at new book prices.

2 - Competing in Markets with Digital Convergence
Ravi Mantena, University of Rochester, mantena@simon.rochester.edu, Arun Sundarrajan

The central tradeoff in converging digital industries is between value effects that increase functionality/breadth and substitution effects that intensify inter-industry competition. Our analysis identifies four subgame-perfect Nash equilibria, each characterizing distinct stages of digital convergence, and demonstrates when strategic scope decisions can sustain pricing power/profitability even as industry boundaries blur.

■ MB23

H - 4th Floor, Union Square 17

Financial Modeling

Sponsor: Financial Services
Sponsored Session

Chair: Malik Magdon-Ismail, magdon@cs.rpi.edu

1 - A Harmonic Analysis Solution to the Static Basket Arbitrage Problem

Alexandre d'Aspremont, Assistant Professor, Princeton University, E-Quad E-424, ORFE Princeton University, Princeton, NJ, 08544, United States, aspremon@princeton.edu

We consider the problem of computing bounds on the price of a European basket call option, given prices on other similar baskets. We focus here on an interpretation of this program as a generalized moment problem. Recent results by Berg on harmonic analysis on semigroups, the K-moment problem and its applications to optimization, allow us to derive tractable necessary and sufficient conditions for the absence of static arbitrage between basket straddles, hence between basket calls and puts.

2 - An Analysis of the Maximum Drawdown Risk Measure

Malik Magdon-Ismail, magdon@cs.rpi.edu, Amir Atiya

The maximum cumulative loss from a peak to bottom, commonly denoted the maximum drawdown MDD, is a measure of how sustained one's losses can be. Large draw-downs usually lead to fund redemptions, and so the MDD is the risk measure of choice for many money management professionals — a reasonably low MDD is critical to the success of any fund. We present analytical results relating the expected MDD to the mean return and the standard deviation of the returns, giving how the MDD varies with time.

■ MB24

H - 4th Floor, Union Square 18

Multi-Objective Approaches in Multicriteria Decision Making

Contributed Session

Chair: Ali Amiri, Professor, Oklahoma State University, 210 CBA, Oklahoma State University, Stillwater, OK, 74078, United States, amiri@okstate.edu

1 - Energy Efficiency Portfolio Design: A Goal-Oriented Optimization Framework

Venkatesh Ravirala, Senior Consultant, Nexant Inc., 101 2nd Street, San Francisco, CA, 94105, United States, vravirala@nexant.com

Three major California utilities are budgeting $2 Billion to implement multiple energy efficiency (EE) programs during 2006-2008. The portfolio of EE programs target specific energy savings goals along with a series of other regulatory mandates and investment objectives. We present a goal-oriented optimization framework that assists with the design of an optimal portfolio constituting EE programs and investments-levels that maximize savings at an appropriate risk level.

2 - Utility Based Allocation

Erdem Kocamustafaogullari, George Washington University, 4816 46th Street NW, Washington, DC, 20016, United States, erdemk@gwu.edu

This study considers the problem of allocating discrete resources to projects according to utility - cost functions reported by different departments. The decision maker's utility aggregation model is analysed. The problems of interdepartmental utility comparisons and the utility - cost comparisons are discussed. The results are applicable from family budget planning to central planning agencies.

3 - A Favorable Weight Based Evolutionary Algorithm for Multiobjective Optimization Problems

Banu Soylu, Research Assistant, METU, Department of Industrial Engineering, Middle East Technical University, Ankara, 06531, Turkey, bsoylu@metu.edu.tr, Murat K^ksalan

We develop an evolutionary algorithm to approximate the efficient frontier in Multiobjective Optimization problems. The algorithm tries to maintain a set of solutions that are close to the efficient frontier, diverse and spread. To achieve this, each member selects its own weights for a Tchebycheff distance function that defines its fitness score. We present computational results.

4 - Synchronizing Production and Retrieval of Perishable Goods in a Retail Supply Chain

Rob Broekmeulen, Asst Prof, Technische Universiteit Eindhoven, P.O. Box 513, Pav. E10, Eindhoven, 5600 MB, Netherlands, r.a.c.m.broekmeulen@tm.tue.nl

We propose a push strategy to supply perishables directly after production to the shelves. Using a simulation model, we examined the effects of different replenishment and retrieval policies on customer service and operating costs. In a case study at a Dutch retailer, we validated the simulation model for ready-to-eat meals.

5 - Customer-Oriented Catalog Segmentation

Ali Amiri, Professor, Oklahoma State University, 210 CBA, Oklahoma State University, Stillwater, OK, 74078, United States, amiri@okstate.edu, Reza Barkhi

We consider in this paper the customer-oriented catalog segmentation problem that consists of designing K catalogs, each of size r products that maximize the number of covered customers. We present algorithms to solve the problem and report the results of a computational study.

■ MB25

H - 4th Floor, Union Square 19

Cost/Performance & Decision Analysis

Contributed Session

Chair: Wei Chen, University of Texas at Austin, CBA 5.202, IROM Dept, UT Austin, 1 University Station Stop B6500, Austin, TX, 78712, United States, wei.chen@phd.mccombs.utexas.edu

1 - Determinants of Firm Performance: Incorporating Accounting Rate of Return and Data Envelopment Analysis

Hung-Pi Cheng, Ph.D. student, Chang Gung University, Dept of Business Administration, Kwei-San, Taoyuan, 333, Taiwan, hungpi.cheng@msa.hinet.net

This study incorporates accounting rate of return and data envelopment analysis to capture the determinants of firm performance. In order to assess the results of different statistic methods, a multivariate linear regression and a generalized estimating equation are employed to analyze the longitudinal data. The results indicate that the economic performance is an exponential function of operating performance and power function of fixed assets.

2 - Dynamic Pricing in an Order Driven Market with Random Demand

Damon Williams, Doctoral Student, University of Michigan, 1205 Beal Avenue, Ann Arbor, MI, 48109-2117, United States, dpwillia@umich.edu, Jussi Keppo, Mark E. Lewis

Consider an investor in an order driven market trading a single commodity. Periodic demand is seen for both purchases and sales based on the prices set by the investor. In each period the investor sets a buy and sell price. Demand for both buys and sales are modeled as additive independent functions of the price. Holding costs are accrued for holding (or backordering) the commodity in inventory. The objective is to minimize the total discounted expected costs yielding a dynamic pricing policy.

3 - Decision Analysis and Portfolio Management Workflow for the Petroleum Industry

Lev Virine, Schlumberger Ltd., 600, 322-11 Ave S.W., Calgary, AB, T2R0C5, Canada, lvirine@slb.com

One of the main challenges in economic evaluation of oil and gas reserves is to provide accurate analysis of portfolios with large numbers of uncertainties. The proposed workflow includes economic evaluation and decline analysis, decision and risk analysis, and capital planning. Uncertainties for each project can be expressed as decision trees, Monte Carlo simulation results, sets of project scenarios, etc. Based on this information, a capital planning engine generates an optimal portfolio.

4 - An Alternative Approach to Weight Restrictions for Confidence Interval by Bootstrap Method in DEA

Kyung Won Lee, Ph.D. candidate, Korea Univ Business School., Anam Dong, Sungbook Gu, Seoul, South Korea, kma6448@korea.ac.kr, Sang Beom Seo, Myung Sup Park

To reflect evaluator's intents, various constraints have been imposed into DEA model. If, after first DEA AR run, more than required numbers of efficient DMUs were appeared, then we should augment additional restrictions. But, the more additional constraints are included, the more evaluation results are liable to be distorted from the evaluator's initial intents. Our research suggests a method to adjust bounds of factor weights which are estimated as a confidence interval by Bootstrap method.

5 - Dynamic Portfolio Formulations of Oil Field Development Problems

Wei Chen, University of Texas at Austin, CBA 5.202, IROM Dept, UT Austin, 1 University Station Stop B6500, Austin, TX, 78712, United States, wei.chen@phd.mccombs.utexas.edu, John Butler, Leon Lasdon, James Dyer

We consider portfolio problems containing several risky projects, each with a sequence of decisions to be made over time. The projects are coupled by joint uncertainties and/or shared resources and requirements. We describe MILP formulations involving oil field development projects, examine problem size and difficulty, and apply Lagrangian Relaxation.

■ MB26

H - 4th Floor, Union Square 20

Reliability Modeling and Analysis

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: Nagi Gebraeel, Assistant Professor, University of Iowa, Mechanical and Industrial Engineering, 2407 Seamans Center, Iowa City, IA, 52242, United States, nagi-gebraeel@uiowa.edu

1 - Modeling System Reliability using Component Covariates and Reliabilities and System Covariates
Christine M. Anderson-Cook, Statistical Sciences Group,, P.O. Box 1663 MS F600, Los Alamos National Laboratory, Los Alamos, NM, 87545, c-and-cook@lanl.gov, Alyson Gabbard Wilson

A system with several components may undergo full system pass/fail testing as well as quality assurance testing at the component level. The component tests are informative about system reliability, although different from the system tests. In addition, systems experience different patterns of usage and storage potentially affecting their performance. We present a Bayesian model or integrating these types of data into a unified model for improved reliability estimates.

2 - Reliability Prediction Using Early Warranty Data
Huairui Guo, Research Scientist, Reliasoft, Harry.Guo@reliasoft.com, Adam Mettas

Reliability model obtained from test data usually is used to predict the product failure behavior in the field. However, the failure behavior in the field may different from the test. Therefore, the model should be dynamically updated. In this presentation, a Bayesian method and process monitoring strategies are applied for model update and change point detection.

3 - Measures for Multi-State Reliability Based on Cumulative Customer's Experience
Yung-wen Liu, Industrial Engineering, University of Washington, Seattle, WA 98195, United States, ywl@u.washington.edu, Kailash Kapur

Any system has a wide range of states in term of their performance. Customer's utility with the system also changes based on different states of performance. In this paper, we develop new measures that capture customer's experience and their properties and demonstrate their applications to evaluate systems from the viewpoint of reliability.

■ MB27

H - 4th Floor, Union Square 21

Dynamic Operating Decisions in Fulfillment Operations

Cluster: OR Practice
Invited Session

Chair: Russell Allgor, Chief Scientist, Supply Chain, Amazon.com, 605 5th Ave S, Seattle, Wa, 98104, United States, rallgor@amazon.com

1 - Using Classical Control Techniques to Load Balance the Amazon Network
Dean Kassmann, Scientist, Operations Research, 605 5th Ave S, Seattle, WA, 98104, United States, Kassmann@amazon.com

Load balancing refers to the ability to actively manage the flow of units in the Amazon supply chain. In particular, it refers to the ability to move or route demand to individual nodes in the Amazon fulfillment network subject to contraints and goals. We present an approach that load balances the multi-node network based on classical PID control techniques that are more commonly used in the manufacturing and process industries. The approach incorprates real-time feedback of the state of the Amazon network and has the property of integral action, guaranteeing offset-free control to network unit demand targets. We present the general methodogy, discuss some of the implementation and scaling challenges, and provide an example of the improvements that can be achieved.

2 - Dynamic Outbound Process Control in an E-Tailer Warehouse
Theophane Weber, theo_w@MIT.EDU, Jeremie Gallien

For e-tailers, warehouse pick-to-ship processes critically impact customer satisfaction and capital expenses. Because of severe gridlock failure modes, their real-time control is particularly important. In collaboration with a large e-retailer, we use a transient queueing model to derive operational release control policies for such a process, and estimate potential implementation benefits using simulation.

3 - Practical Implications of Re-evaluting Real Time Fulfillment Decisions
Russell Allgor, Chief Scientist, Supply Chain, Amazon.com, 605 5th Ave S, Seattle, Wa, 98104, United States, rallgor@amazon.com, Ping Xu, Marcus Hum, Ryan Rawson, Stephen Graves

At the time of a customer order, an e-tailer determines from which fulfillment center or centers to ship each of the ordered items. This fulfillment plan is myopic as it cannot account for future events, such as subsequent customer orders or inventory replenishments. Near optimal heuristics have been designed to re-evaluate a large set of customer orders to minimize the number of customer shipments. We discuss the implementation of these heuristics in the e-tailers environment. We integrate the heuristic algorithm within the software infrastructure that maintains and executes the fulfillment plans in real time. We discuss the implementation challenges, the advantages of the heuristic algorithm, and the benefits obtained by putting the resulting system into production.

4 - Optimal Production Location and Transshipment Policies for a Large Lumber Company
Mehmet Aydinel,Centre for Operations Excellence, 4Sauder School of Business, University of British Columbia, 2053 Main Mall, Vancouver BC V6T 1Z2, Canada, mehmet.aydinel@coe.ubc.ca, Ximena Cerda Salzmann, Eric Cope, Mats Gerschman, Taraneh Sowlati, Qing Wu

The transshipment of lumber products is a significant cost factor for a lumber company with distributed production facilities. In collaboration with a large lumber company, we determine jointly optimal production location and transshipment policies for a variety of products, accounting for costs and efficiencies at the mills, different transportation modes, carriers, and sizes of transportation units, and various restrictions on transport.

■ MB28

H - 4th Floor, Union Square 22

Airline Revenue Management for Less Restricted Fares

Sponsor: Revenue Management & Pricing
Sponsored Session

Chair: Peter Belobaba, Principal Research Scientist, MIT, 77 Mass Ave, 33-217, Cambridge, MA, 02139, United States, belobaba@MIT.EDU

1 - Forecasting and Optimization in Simplified Fare Structures
Peter Belobaba, Principal Research Scientist, MIT, 77 Mass Ave, 33-217, Cambridge, MA, 02139, United States, belobaba@MIT.EDU, Gregory Zerbib

We use the Passenger Origin-Destination Simulator (PODS) to examine the performance of traditional RM methods under less restricted fare structures. Modifications to traditional RM models designed to address the problems of "spiral down" in simplified fare structures are proposed. These modifications include the generation of separate forecasts for "price-oriented" and "product-oriented" demands and the use of dynamic programming for optimization of booking controls.

2 - State-Based Forecasting Investigations
Craig Hopperstad, Hopperstad Consulting, 130 34th Avenue East, Seattle, WA, 98112, United States, cah@gte.net

It has long been proposed that RM forecasts of demand by path/class would be improved if those forecasts accounted for competitor availability. This paper describes a relatively efficient method for accounting for competitor availability that has minimum impact on existing forecasting methodologies. Some comparative Passenger Origin/Destination Simulator (PODS) results are provided.

3 - Revenue Management and Demand Models
Andy Boyd, Chief Scientist and Senior Vice President, PROS, 3100 Main Street, Suite 900, Houston, TX, 77002, United States, aboyd@prosrm.com, Royce Kallesen, Igor Cakulev

As revenue management has evolved, models of customer behavior have of necessity received ever increasing attention, thus bringing about significant changes to forecasting and optimization algorithms. We present recent simulation results that help provide insight into the performance of different algorithms under various models of customer behavior.

■ MB29

H - 4th Floor, Union Square 23

Management/Strategy Issues in e-Business

Sponsor: E-Business
Sponsored Session

Chair: Martin Bariff, Associate Professor of IM, IIT Stuart Graduate School of Business, Illinois Institute of Technology, Chicago, IL, 60611, United States, bariff@mail.stuart.iit.edu

1 - Determinants of Customer Satisfaction with a Mass Customization Experience

Arvind Rangaswamy, Jonas H. Anchel Professor of Marketing, The Smeal College of Business, Penn State University, The Smeal College of Business, University Park, PA, 16802, United States, arvindr@psu.edu, Rajdeep Grewal, Sanjay Rao

Mass customization provides customers a variety of product attribute options for them to choose from. Typically, customers evaluate Universal attributes (e.g., reliability) based on universally accepted standards, whereas their evaluation of variable attributes (e.g., color) is person specific, and therefore, more variable in the value they offer. We experimentally investigate the differential effects of both types of attributes on customer satisfaction with mass customization.

2 - An Economic Model of Investment in Information Security

Subhajyoti Bandyopadhyay, Assistant Professor, University of Florida, 364 Stuzin Hall, Gainesville, FL, 32611, United States, shubho.bandyopadhyay@cba.ufl.edu, Jeevan Jaisingh, Ruyi Ye

We characterize the upper bound of the optimal level of the security investment for a security breach probability function. We find that for a security breach probability function with an unknown functional form, the optimal security investment level should not exceed one half of the expected loss without any protection. The result on the upper bound continues to hold when we incorporate the hacker's response behavior into the economic model.

3 - Digital Enterprise Agility: IT's Sweetspot

Martin Bariff, Associate Professor of IM, IIT Stuart Graduate School of Business, Illinois Institute of Technology, Chicago, IL, 60611, United States, bariff@mail.stuart.iit.edu

Within the complex, dynamic and less predictable environments that most businesses operate, enterprise agility is an essential ingredient for sustainable performance improvement. As more intra- and inter-organizational business processes and rules become digitized, information technology (IT) must respond quickly to changing business needs. A framework for linking enterprise, business process, and IT agility metrics is proposed. Initial results from field research will be presented.

■ MB30

H - 4th Floor, Union Square 24

Serving Communities with OR

Sponsor: Women in OR/MS
Sponsored Session

Chair: Wedad Elmaghraby, University of Maryland, Wedad_Elmaghraby@rhsmith.umd.edu

1 - Improving Emergency Responsiveness with OR/MS

Linda Green, Professor, Columbia University, 3022 Broadway, New York, NY, 10027, United States, lvg1@columbia.edu

While the goal of OR/MS is to aid decision-makers, few published models result in implementation. However, one area that has been significantly impacted by management science is emergency response systems. Over the years, many new policies and practices in policing, firefighting and emergency medicine have resulted from OR/MS work. This talk will describe a few of these models and the factors that led to their successful implementation. The potential for future OR/MS modeling and application to new issues in emergency responsiveness will also be discussed.

2 - "Where Should We Re-Build Affordable and Assisted Housing in Urban Areas Affected by Hurricane Katrina?"

Michael Johnson, Associate Professor, Carnegie Mellon University, Heinz School, 5000 Forbes Ave., Pittsburgh, PA, 15213, United States, johnson2@andrew.cmu.edu, Justin Williams

Hurricane Katrina represents one of the deadliest natural disasters in United States history. Low-income and minority communities were especially hard-hit. In this paper we present a multiobjective planning model to generate policy alternatives for the replacement of low-income housing in New Orleans lost due to the hurricane. Our model addresses a variety of real-life complications associated with housing redevelopment in New Orleans, including environmental and sociodemographic impacts of housing strategies.

3- A Simulation Model of Guinea Worm Disease in Sudan

David Goldsman,Professor, Georgia Tech, School of ISyE, Georgia Tech, Atlanta GA 30332, United States, sman@isye.gatech.edu Paul Goldsman, James A. Zingeser

Major hostilities in the devastating civil war in Sudan have ended, 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 attempt to optimize the efficacy of control measures as 4.5 million transients journey home.

■ MB31

H - 4th Floor, Union Square 25

Student Projects: Learning through Practice

Cluster: OR Practice
Invited Session

Chair: Erhan Erkut, University of Alberta, School of Business, Edmonton, AB, Canada, erhan.erkut@ualberta.ca

1 - Teaching of OR Practice: Real-World Student Projects

Erhan Erkut, University of Alberta, School of Business, Edmonton, AB, Canada, erhan.erkut@ualberta.ca

This session focuses on a quantitative management consulting course for fourth-year students. The first talk discusses the benefits of project courses to students, teachers, and clients. We describe the course parameters with an emphasis on those that differentiate it from other project courses. We provide brief examples of student projects and discuss successes and failures. The remaining talks in the session describe specific applied student projects from the course in some detail.

2 - Student Projects for Prostate Cancer Treatment and Sports Ticket Pricing

Daniel Haight, Manager, University of Alberta School of Business, #705, 11027 - 87 Avenue NW, Edmonton, AB, T6G2P9, Canada, dan.haight@ualberta.ca

We consider two examples of recent student projects: prostate cancer treatment and sports ticket pricing. The prostate project modeled supply and demand using simulation to give resource allocation recommendations to government. The sports ticket project model was used to determine the relative importance of various factors that affect attendance at sporting events. Able to predict attendance beforehand, managers can now adjust the most effective lever - price.

3 - Dynamic Simulation for Rail and Terminal Services Used in Sulphur Distribution

Mark Zschocke, University of Alberta, Suite 2009, 8210 - 111 Street, Edmonton, AB, T6G 2C7, Canada, markz@ualberta.ca

Sultran Ltd transports elemental sulphur by rail from gas plants in Alberta and British Columbia to terminals located in Vancouver. Our dynamic simulation model generates various grades of sulphur at the gas plants, routes the sulphur via rail to the terminals at Vancouver, where vessels with variable demand load product and exit the system. Our model's innovative combination of operational decision algorithms and dynamic stochastic data inputs makes it a powerful strategic tool for Sultran.

■ MB32

H - 6th Floor, Lombard

Location - QAP

Sponsor: Location Analysis
Sponsored Session

Chair: Zvi Drezner, Professor, California State University, College of Business and Economics, Fullerton, CA, 92834, United States, zdrezner@fullerton.edu

1 - Exact Branch and Bound Solution Techniques for the Axial 3 Dimensional Linear Assignment Problem

William Hightower, bhightower@linus.highpoint.edu, Bum-Jin Kim, Peter Hahn

The axial 3D LAP is an integer programming problem with constraints involving sums over planes equaling 1 and values of 0-1. Dropping the 0-1 constraint yields an LP. A transformational approach is used to efficiently approximate the LP for branching purposes. Both strengthening and non-strengthening constraints that yield effective transformations are introduced. A new tree elaboration scheme having branching factor n is detailed and computational experience with it is presented

2 - The Quadratic 3-Dimensional Assignment Problem: Meta-heuristic Solution Methods

Bum-Jin Kim, bumjin@seas.upenn.edu, Peter Hahn, Sebastian Kanthak, Thomas Stützle

We present four meta-heuristic algorithms for the new Quadratic 3-dimensional Assignment Problem (Q3AP): TABU search, Simulated Annealing, Fast ANT search and Iterated Local Search. Q3APs arise in the design of wireless data systems. Results are obtained for three wireless transmission instances and five instances derived from the difficult Nugent QAP. Optimum or near optimum solutions are found in reasonable runtimes and performance of these algorithms is compared to an exact solution method.

3 - Gender-Specific Genetic Algorithms

Zvi Drezner, Professor, California State University, College of Business and Economics, Fullerton, CA, 92834, United States, zdrezner@fullerton.edu, Tammy Drezner

In this paper we propose to incorporate gender in genetic algorithms. Existing genetic algorithms are gender-neutral. Every genetic algorithm which is gender-neutral can be easily constructed as a gender-specific genetic algorithm. We compared the performance of the gender-neutral and its gender-specific counterpart on four optimization problems and the gender-specific algorithm exhibited superior performance. A statistical analysis allows this conclusion to be stated with 99.98% confidence.

4 - The Weighted Euclidean Distance Location Problem in Three Dimensions

P.M. Dearing, Professor, Clemson University, Department of Mathematical Sciences, Clemson, SC, 29634, United States, pmdrn@CLEMSON.EDU

A solution to the weighted one-center (min-max) location problem in three dimensions is presented using a dual algorithm with an efficient replacement rule.

■ MB33

H - 6th Floor, Mason

Technometrics Session: Statistical Techniques for Processes

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: Randy Sitter, Professor, Simon Fraser University, Dept. of Statistics and Actuarial Scienc, Burnaby, BC, V5A 1S6, Canada, sitter@cs.sfu.ca

1 - Wavelet-based Data Reduction Techniques for Process Fault Detection

Myong K. Jeong, Assistant Professor, Univesity of Tennessee, Industrial and Information Engineering, 311 East Stadium Hall, Knoxville, TN, 37996-0700, United States, mjeong@utk.edu, Jye-Chyi Lu, Di Chen, Xiaoming Huo, Brani Vidakovic

To handle potentially large and complicated nonstationary data curves, we present new data reduction methods based on the discrete wavelet transform. The methods minimize objective functions to balance the tradeoff between data reduction and modeling accuracy. Theoretic investigations provide the optimality of the methods and the large-sample distribution of a closed-form estimate of the thresholding parameter. An upper bound of errors in signal approximation (or estimation) is derived.

2 - Optimal Engineering System Design Guided by Data-mining Methods

Yu Ding, Assistant Professor, Industrial Engineering, Texas A&M University, Texas A&M University, MS3131, College Station, TX, 77843, United States, yuding@iemail.tamu.edu, Pansoo Kim

This paper presents a design optimization with data-mining ingredients. If treating design alternatives as data points, optimal design can be viewed as selecting the best among a massive dataset of designs. Data-mining methods can help find valuable design selection rules, which facilitate the finding of satisfactory design results with a considerably reduced time. The methodology can find a design as good as simulated annealing but its computation is faster than a typical local optimization.

3 - Model-Robust Process Optimization using Bayesian Model Averaging

Enrique del Castillo, Professor, The Pennsylvania State University, Industrial & Manufacturing Engineering, 310 Leonhard Bldg, University Park, PA, 16802, United States, exd13@psu.edu, Ramkumar Rajagopal

A Bayesian approach to process optimization is presented for designs with a small number of runs. Traditional approaches start by fitting a model and then optimizing the model to obtain the operating point. These methods do not account for any uncertainty in the form of the model. The technique we present optimizes the model-averaged posterior predictive density (MAP) of the response based on the predictive density of each competing model. Examples are provided to illustrate the approach.

■ MB34

H - 6th Floor, Powell

Design of Experiments with Industrial Applications

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: Roshan Vengazhiyil, Assistant Professor, Georgia Institute of Technology, Industrial & Systems Engineering, 755 Ferst Drive, Atlanta, GA, 30332, United States, roshan@isye.gatech.edu

1 - A Bayesian Approach to the Design and Analysis of Fractionated Experiments

Roshan Vengazhiyil, Assistant Professor, Georgia Institute of Technology, Industrial & Systems Engineering, 755 Ferst Drive, Atlanta, GA, 30332, United States, roshan@isye.gatech.edu

Although a Bayesian approach is very suitable for the design and analysis of fractionated experiments, it found little use in industrial applications mainly due to the difficulty in specifying a prior distribution for the large number of parameters in the statistical model. This article shows that the prior distribution can be induced from a functional prior on the underlying transfer function. Based on it a new approach to the design and analysis of two-level experiments is developed.

2 - Analysis of Experiments Using Functionally Induced Priors

James Delaney, Ph.D. Student, Georgia Institute of Technology, Industrial and Systems Engineering, 755 Ferst Drive, Atlanta, GA, 30332, United States, jdelaney@isye.gatech.edu, Roshan Vengazhiyil

This work extends and develops the idea of using functional priors for the analysis of three and higher level experiments. Developing a prior distribution for model parameters is challenging because a factor can be qualitative or quantitative. We propose appropriate correlation functions and coding schemes so that the analysis is simple and the results interpretable. The usefulness of the new approach is illustrated through the analysis of some real experiments.

3 - Robust Design under Physical Restrictions and Constraints

Jami Kovach, Ph.D. Candidate, Clemson University, 110 Freeman Hall, Box 340920, Department of Industrial Engineering, Clemson, SC, 29634, United States, jkovach@CLEMSON.EDU, Byung Rae Cho

Research in the area of robust design, a powerful and cost-effective method for improving product/process quality, has given little attention to the use of this technique when experiments are subject to physical restrictions and constraints. Therefore, a new design methodology is proposed and its performance is compared to that of traditional robust design approaches.

■ MB35

H - 6th Floor, Sutter

Yield Management in Railroads

Sponsor: Railroad Applications
Sponsored Session

Chair: Michael Gorman, Assistant Professor, University of Dayton, Dept. of MIS/OM/DSC, 300 College Park, Dayton, OH, 45469-2130, United States, michael.gorman@udayton.edu

1 - Yield Management at Wisconsin Central

Reilly McCarren, jrmccarren@comcast.net

In this presentation, I describe my experience at Wisconsin Central implementing yield management practices.

2 - Revenue Management in the Rail Industry

Warren Lieberman, President, Veritec Solutions, 824 Miramar Terrace, Belmont, CA, 94002, United States, warren@veritecsolutions.com

Although some freight and passenger railroads have developed revenue management programs, revenue management is still in its early stages in these industries. In this session we will discuss Revenue Management Opportunities across a variety of industries. Business to Consumer and Business to Business revenue management opportunities will be compared and contrasted. This review will then be leveraged to consider potential applications for the rail industry.

3 - Maximizing Revenue in Amtrak's Northeast Corridor in the Presence of Capacity and Fare Constraints

Masroor Hasan, Senior Associate, CRA International, 200 Clarendon Street, T-33, Boston, MA, 02116, United States, mhasan@crai.com, Ammon Matsuda, Daniel Brand

This work presents an approach to maximizing rail passenger revenue on Amtrak's Northeast Corridor (NEC) by adjusting high-speed rail (HSR) fares. CRA's mode-choice model generates HSR and conventional rail ridership and

revenue volumes for all station pairs in the NEC at varying HSR fare levels. An optimization model is constructed in GAMS and uses the data to identify the HSR fare structure maximizing corridor revenue given existing capacity and fare constraints.

4 - Estimating Predictability in Customer Arrival Patterns

Michael Gorman, Assistant Professor, University of Dayton, Dept. of MIS/OM/DSC, 300 College Park, Dayton, OH, 45469-2130, United States, michael.gorman@udayton.edu

A key ingredient to yield management is the ability to anticipate customer demands. Typically, this takes the form of a reservation. Reservations are not widely used in U.S. freight rail. As such, a key ingredient of yield managment is missing. We evaluate the predictability of customer demand patterns in lieu of reservations, and make recommendations on the likely success of yield management practices given this missing ingredient.

■ MB36

H - 6th Floor, Taylor

Methods and Algorithms in Simulation

Contributed Session

Chair: Young-Jun Son, Assistant Professor, The University of Arizona, Systems and Industrial Engineering, Tucson, AZ, 85721, United States, son@sie.arizona.edu

1 - Influence on Parking Behavior by Providing Parking Guidance and Information System

Yoshihiro Asano, Mr., Nanzan University, 27 Seirei-cho, Seto City, Aichi, Japan, Seto city, 489-0863, Japan, m05mm001@msie.nanzan-u.ac.jp, Toshiharu Hasegawa

In urban road traffic problems, parking space problems play important role. As various systems for ITS (Intelligent Transport System) have been implemented, many parking place information systems have been proposed and implemented. This paper deals with a simulation model and its simulated results to estimate the behavior of drivers trying to use parking place when various information concerning the possible parking places are given to them, using System Dynamics methodology.

2 - A Dynamic Simulation Study to Assess the Impact of Collaboration on the Supply Chain Performance

Amarpreet Kohli, Southwestern College, 100 College St., Winfield, KS, 67156, United States, akohli@sckans.edu, Suraj Alexander

Businesses have now realized that collaboration among trading partners is a more effective process to deal with issues related to inventory management, as compared to the customary approach of shifting the load of inventories. Increased outsourcing, global supply networks, and desire for more precise demand information have given impetus to the initiative called Collaborative Planning Forecasting and Replenishment.

3 - Qualitative Simulation in the Discrete Events Environment

Yen-Ping Leow-Sehwail, PhD Student/Research Assistant, Oklahoma State University, 37 S. University Place Apt. 10, Stillwater, ok, 74075, United States, yenl@okstate.edu, Ricki Ingalls

Qualitative simulation is the modeling of a system when there is a lack of good quantitative information about the system under consideration. The simulation elements are specified qualitatively, leaving rooms for the specification of the uncertainty that is inherited in the system. This paper presents a review of the concepts involving the development of qualitative simulation in the discrete events environment, focusing on the algorithms and distinctive characteristics.

4 - Dynamic Quotation of Price and Leadtime in a Make-to-Order System

Ozgun Baris Bekki, Graduate Student, ASU, 611 E.Colgate Dr., Tempe, AZ, 85283, United States, ozgun.bekki@asu.edu, Esma Gel

In this study, we consider a single station, processing identical jobs in make-to-order mode, with a limited buffer area. Upon arrival of a demand for a new order, the decision maker selects the appropriate price and leadtime and informs the customer. The customer either accepts the price and leadtime and places the order or leaves the system. We formulate this problem as an MDP to maximize the expected discounted net profit.

5 - Development of an Epoch Time Synchronization Method for Distributed Simulation

Young-Jun Son, Assistant Professor, The University of Arizona, Systems and Industrial Engineering, Tucson, AZ, 85721, United States, son@sie.arizona.edu

A new epoch time synchronization approach for distributed simulation federates is proposed. The approach allows federates to advance their times at full speed to the minimum of the estimated next epoch event times, which are calculated at each federate. The proposed approach is demonstrated using a manufacturing supply chain simulation.

■ MB37

H - 6th Floor, Van Ness

Analysis of Queueing Systems

Sponsor: Applied Probability
Sponsored Session

Chair: John Hasenbein, Professor, University of Texas at Austin, 1 University Station, C2200, Austin, TX, 78712, United States, jhas@mail.utexas.edu

1 - Stochastic Job Shop Scheduling: A Fluid Heuristic

Kranthi Mitra Adusumilli, University of Texas, ETC 5.116A, C2200, Austin, TX, United States, kranthi@mail.utexas.edu, John Hasenbein

We consider a job shop scheduling problem in which some of the initial data is not observable by the decision maker. If minimizing makespan is the objective, our problem is a stochastic integer program. Under certain policy restrictions, heuristics based on the solution of the corresponding stochastic fluid program are proposed. These heuristics are shown to be asymptotically optimal.

2 - State Dependent Pricing in Queueing Models with Batch Arrival

Utku Yildirim, University of Texas at Austin, 1 University Station C2200, Austin, Tx, 78712, United States, yildiriu@mail.utexas.edu, John Hasenbein

We will investigate the pricing problem of a firm which is a monopoly and price maker per se. The firm has the ability to change the price depending on the state of the system and size of the arriving batch.Our model is a single server with exponential service times and arrivals follow a compound Poisson process where the number of customers in a batch is a random variable. Our aim is to find the optimum pricing strategy to maximize company's discounted revenue.

3 - Machine Maintenance with Workload Considerations

David Kaufman, Ph.D. Candidate, University of Michigan, Industrial and Operations Engineering, 1205 Beal Avenue, Ann Arbor, MI, 48109-2117, United States, davidlk@umich.edu, Mark E. Lewis

We consider a queueing system where the server deteriorates over time and needs to be repaired. We show the existence of a switching curve to describe the optimal repair policy. Interestingly, the switching curve may not be monotone. In such cases, we compare the optimal policy to monotone heuristics.

4 - Optimal Staffing and Control of Distributed Call Centers

Tolga Tezcan, PhD Candidate, Georgia Institute of Technology, 765 Ferst Drive NW, Atlanta, GA, 30332, United States, ttezcan@isye.gatech.edu

We consider a distributed call center system with a single customer class and multiple parallel server pools residing in geographically dispersed centers. We study the system in the many-server Quality and Efficiency Driven asymptotic regime. We show that a class of control policies achieves complete resource pooling in the diffusion limit and the minimum expected delay-fastest servers first rule asymptotically minimizes the steady state queue length and the virtual waiting time.

■ MB38

R - 2nd Floor, Corintia

Joint Session Optimization/Computing: Global Optimization and Applications

Sponsor: Optimization/ Global Optimization, INFORMS Computing Society
Sponsored Session

Chair: Oleg Prokopyev, University of Florida, 303 Weil Hall, P.O. Box 116595, Gainesville, FL, 32601, United States, oap4ripe@ufl.edu

1 - Complete Solutions to a Class of Polynomial Minimization Problems with Applications

David Gao, Virginia Tech, Department of Mathematics, Blacksburg, VA, 24061, United States, gao@vt.edu

In this talk, the speaker will present a complete set of solutions to a class of polynomial minimization problems. By using the sequential canonical dual transformation developed recently, the speaker will show that the original nonconvex problems in n-dimensional space can be converted into a dual problem in one dimensional space with zero duality gap. The triality theory can be used to identify the global minimizer and local extrma. Applications are illustrated.

2 - Packing Problems and Global Optimization

Ignacio Castillo, University of Alberta School of Business, Edmonton, Canada, ignacio.castillo@ualberta.ca, Frank J. Kampas, Janos D. Pinter

In a general setting, a packing is an optimized non-overlapping arrangement of objects inside a container. Such models typically include a set of non-convex constraints: hence, global optimization is a natural approach to their solution. We

present several known and new practically motivated packing problems, and provide illustrative results computed using MathOptimizer Professional.

3 - An Algorithm for Concave Programming Problems

Altannar Chinchuluun, University of Florida, United States, altannar@ufl.edu, Panos Pardalos

Concave programming problems constitute one of the most important and fundamental classes of problems in global optimization. We discuss a heuristic method for solving concave programming problems with linear constraints. At each iteration of the algorithm, a number of linear programming problems with the same constraints are required to solve and a local search method is required to use. Furthermore, the convergence result is presented.

4 - MathOptimizer Professional for General Nonlinear Optimization: Introduction and Application Examples

Janos D. Pinter, PCS Inc. & Dalhousie University, Canada, jdpinter@hfx.eastlink.ca, Frank J. Kampas

The MathOptimizer Professional (MOP) software combines the model development features of Mathematica with the external LGO solver suite for nonlinear (global and local) optimization. This results in enhanced modeling capabilities, and a solver performance that is comparable to 'pure' compiler-based LGO implementations. We review the key features of MOP, and demonstrate its usage by solving various optimization (test) problems, including also some non-trivial object packing models.

■ MB39

R - 3rd Floor, Aragon

Applications of Mathematical Programs with Equilibrium Constraints

Sponsor: Optimization/ Linear Programming and Complementarity
Sponsored Session

Chair: Mihai Anitescu, Argonne National Laboratory, Math and Computer Science Divisio, 9700 S Cass Avenue, Argonne, IL, 60439, United States, anitescu@mcs.anl.gov

1 - A KKT Sampling Method for Stochastic Programs with Complementarity Constraints

Uday Shanbhag, University of Illinois, Mechanical and Industrial Engg, Urbana, IL, 61801, United States, udaybag@stanford.edu, Walter Murray, Michael Saunders

Interior point methods for mathematical programs with complementarity constraints (MPCC) have been studied extensively in the recent past. We propose a new sampling-based primal-dual method for the stochastic MPCC. Convergence theory is provided for the algorithm and extensive computational results are discussed from a test set of stochastic quadratic programs with complementarity constraints.

2 - An EPEC Algorithm for Solving Sub-game Perfect Nash Equilibrium in Electricity Markets

Ilan Adler, Professor, UC Berkeley, IEOR Dept., Berkeley, CA, 94720, United States, adler@ieor.berkeley.edu, Jian Yao, Shmuel Oren

In this paper, the sub-game perfect Nash equilibrium in two-settlement electricity markets is formulated as an equilibrium problem with equilibrium constraints (EPEC). To solve the problem, we introduce an algorithm which is based on solving sequential quadratic programming problems which are derived parametrically from linear complementarity problems (LCP). Numerical examples demonstrating the effectiveness of the algorithm will be presented

3 - Formulating Generalized Matrix Games

Todd Munson, Argonne National Laboratory, Mathematics & Computer Science Division, Argonne, IL, 60439-4844, United States, tmunson@mcs.anl.gov

We present several formulations of generalized matrix games as nonlinear complementarity problems and discuss the properties of each. The formulation we advocate always has a positive Jacobian matrix when evaluated on the nonnegative orthant, so Lemke's method can solve all linearizations. Progress on convergent algorithms for solving the nonlinear problem will be explored.

4 - Solution of NP-hard Optimization Problems as Mathematical Programs with Complementarity Constraints

Joaquim Judice, University of Coimbra, Largo D. Dinis, Coimbra, CB, 3000, Portugal, judice@co.it.pt, Carmo Bras, Isabel Ribeiro

A mathematical program with Linear Complementarity Constraints (MPLCP) is discussed, where all but the complementarity constraints are linear. Algorithms for finding stationary points and global minima for MPLCP are presented. Application to the solution of Nonconvex Programs with Linear Constraints, Zero-One Integer Programs and Complementarity Eigenvalue Problems is investigated. Computational experience with MPLCP algorithms for solving these problems shows the efficacy of these procedures.

■ MB40

R - 3rd Floor, Barcelona I

Auctions and Assignment Problems

Sponsor: Optimization/ Network Optimization
Sponsored Session

Chair: Lisa K. Fleischer, IBM, T J Watson Research, Yorktown Heights, NY, 10598, United States, lkf@watson.ibm.com

1 - Adwords and Generalized On-line Matching

Amin Saberi, Assistant Professor, Stanford University, 317 Terman Eng. Ctr, Stanford, CA, United States, saberi@stanford.edu, Aranyak Mehta, Umesh Vazirani, Vijay Vazirani

How does a search engine company decide what ads to display with each query so as to maximize its revenue? This turns out to be a generalization of the online bipartite matching problem. We introduce the notion of a tradeoff revealing LP and use it to derive two algorithms achieving competitive ratios of 1 - 1/e for this problem.

2 - Online Auctions with Re-usable Goods

Mohammad Mahdian, Microsoft Corporation, One Microsoft Way, Redmond, WA, 98052, United States, mahdian@microsoft.com

We study online scheduling in a setting where agents bid for access to a re-usable good such as one unit of processing time on a machine. We seek mechanisms that are truthful with respect to agents' values, arrival times, and departure times. We show that if agents cannot overstate their departure time, there is a 2-competitive truthful mechanism, and this is the best possible. Also, we give a general characterization and tight bounds on the revenue of truthful mechanisms in this model.

3 - From Bimatrix Games to Leontief Exchange Economies

Kasturi Varadarajan, 101E, MacLean Hall, University of Iowa, IA, 52241, kvaradar@cs.uiowa.edu, Bruno Codenotti, Amin Saberi, Yinyu Ye

We consider a special case of the Leontief exchange economy, and give a reduction from any two-person (possibly nonzero sum) game to such a Leontief exchange economy with the property that the Nash equilibria of the game and the equilibria of the market are in one-to-one correspondence. As a corollary, we obtain a number of hardness results for questions related to the computation of market equilibria, using results already established for games. In particular, it is NP-hard to say whether a Leontief exchange economy has more than one equilibrium. We also show that it is NP-hard to decide whether a Leontief exchange economy has an equilibrium. We also establish a reduction in the opposite direction, from certain kinds of Leontief economies to two person games.

4 - New Algorithms for Separable Assignment Packing Problems

Lisa K. Fleischer, IBM, T J Watson Research, Yorktown Heights, NY, 10598, United States, lkf@watson.ibm.com, Maxim Sviridenko, Michel Goemans, Vahab S. Mirrokni

A separable assignment packing problem consists of a set of bins, and a set of items. There is a separable, nondecreasing objective function over the item-to-bin assignments, and separable sets of packing constraints, one set per bin. The goal is to find a feasible assignment of items to bins that maximizes the objective function. This problem captures a content distribution problem in 3-G cellular service provider networks. We show separable assignment packing problems are polynomial-time approximable within (1-1/e) and give almost matching hardness. We also describe a 1/2-approximate local search algorithm.

■ MB41

R - 3rd Floor, Barcelona II

Advances in Mixed Integer Programming

Sponsor: Optimization/ Integer Programming
Sponsored Session

Chair: Jean-Philippe Richard, Assistant Professor, Purdue University, 315 North Grant Street, West Lafayette, IN, 47907, United States, jprichar@ecn.purdue.edu

1 - Improved Gomory Cuts for Primal Cutting Plane Algorithms

Santanu Dey, Graduate Student, Purdue University, 315 North Grant Street, West Lafayette, IN, 47907, United States, sdey@purdue.edu, Jean-Philippe Richard

In 1965, R.D. Young proposed a primal all integer algorithm to solve integer programs. Although the theoretical convergence of this algorithm was proven, its computational use has been very limited. In this talk, we describe an LP-based lifting procedure to generate stronger primal cutting planes. We apply this procedure to improve Gomory's fractional cut. We conclude by presenting numerical results that illustrates the computational benefits of the proposed approach.

2 - A Branch-and-Cut Algorithm for a Single Machine Scheduling Problem

Ahmet Keha, Assistant Professor, Arizona State University, P.O. Box 875906, Tempe, AZ, 85287, United States, ahmet.keha@asu.edu

We study the problem of minimizing the weighted total tardiness at a single machine. We first give an improved mixed integer formulation by using two new families of valid inequalities. We next discuss how we can improve the branch-and-cut algorithm by using AI Planning techniques and some well-known heuristics. We finally present some computational experiments that shows the effectiveness of our algorithm.

3 - Facets of Conflict Hypergraphs — Theory and Computation

Eva Lee, Associate Professor & Director, Center for Operations Research in Medicine, Georgia Institute of Technology, Industrial & Systems Engineering, Atlanta, GA, 30332-0205, United States, evakylee@isye.gatech.edu, Siddhartha Maheshwary

In this talk, we present the construction of conflict hypergraphs from independent set and multi-dimensional knapsack polytopes. Valid and facet-defining inequalities will be identified from the hypergraphical structures. Computational results of these strong valid inequalities on real-world MIP-instances will be described.

4 - Fixed-Charge Flow Problem with Precedence Constraints

Muhong Zhang, University of California-Berkeley, 4141 Etcheverry Hall, Berkeley, CA, 94720, United States, mhzhang@ieor.berkeley.edu, Alper Atamturk

We investigate a fixed-charge single-node flow problem with precedence constraints. The corresponding optimization problem is an NP-hard. We study the polyhedral structure of this problem. Using lifting procedures, we obtain a set of facet-defining inequalities. In a special case, we characterize the facets of the convex hull of the feasible solutions.

■ MB42

R - 4th Floor, Parc Ballroom I

Stochastic Programming with Financial Applications I

Sponsor: Optimization/ Stochastic Programming
Sponsored Session

Chair: Gautam Mitra, Professor, Brunel University, Middlesex, Uxbridge, UB8 3PH, United Kingdom, Gautam.Mitra@brunel.ac.uk

1 - Stochastic Integer Programming: A Hybrid Solution Framework

Kristine Rasmussen, CARISMA, Brunel University, Uxbridge, UB8 3PH, United Kingdom, kristine.rasmussen@brunel.ac.uk, Gautam Mitra, Chandra Poojari

We design a hybrid solution framework for SIP problems with recourse by mixing a branch-and-bound method (B&B) with a genetic algorithm (GA). The B&B is used to determine good feasible solution then the GA meta-heuristic is used to locate feasible integer solutions in the neighbourhood. The feasible integer solutions are re-used by the B&B method for bounding and fathoming the tree to obtain a superior solution. We present computational investigations of different test problems.

2 - Treasury Management Model with Foreign Exchange Exposure

Cormac Lucas, Dr., CARISMA, Brunel University, Uxbridge, UB8 3PH, United Kingdom, cormac.lucas@brunel.ac.uk, Konstantin Volosov, Gautam Mitra, Fabio Spagnolo

In this talk we formulate a model for foreign exchange exposure management and cash management taking into consideration random fluctuations of exchange rates. A two stage SP model is formulated using these random parameters values, forward and spot rates. This model computes currency hedging strategies which provide rolling decisions for trading in the forward markets. These decisions are analysed through simulation and backtesting while VaR is computed for different strategies.

3 - Data Structures for Stochastic Programming

Horand I. Gassmann, Professor, Dalhousie University, School of Business Administration, Halifax, NS, B3H 1Z5, Canada, horand.gassmann@dal.ca

This talk explores a number of different data structures needed for the internal representation of an instance of a multistage stochastic linear program. Different problem features (such as continuous distributions, varying problem dimensions, probabilistic constraints, etc.) require different treatment.

4 - Life Cycle Analysis for Individual Investment Decisions

George Sokoloff, Management Science and Engineering, Stanford University, Stanford, CA, United States, gsokoloff@gmail.com, Gerd Infanger

We present a multistage stochastic framework for the life cycle analysis of individual investment decisions. We discuss how major uncertainties in an individual's life impact his/her asset and liability allocation decisions and, as an example, analyze what mortgages are advantageous and if and when they should be refinanced as interest rates and income change over time.

■ MB43

R - 4th Floor, Parc Ballroom II

Heuristic Methods for Timetabling and Rostering

Sponsor: INFORMS Computing Society/ Heuristic Search
Sponsored Session

Chair: Dario Landa Silva, University of Nottingham, School of Computer Sciece and IT, Jubilee Campus, Wollaton Road, Nottingham, NG9 1HX, United Kingdom, jds@cs.nott.ac.uk

1 - A Student-centric Class and Exam Scheduling System at West Point

Monique Guignard, Professor, University of Pennsylvania, The Wharton School, OPIM Department, Philadelphia, PA, 191046340, United States, guignard@wharton.upenn.edu, Alex Meeraus, Michael Bussieck, Fred O'Brien, Siqun Wang

The USMA/West Point operates a novel, student-centric class and exam scheduling system combining MIP with heuristics. A key feature is the identification of impossible scheduling requests and the automatic generation of possible modifications that resolve conflicts. The other key feature is the improvement heuristic that allows formal optimization of a reduced problem. The platform- and solver-independent system has performed flawlessly for several years. It is based on the modeling system GAMS.

2 - Solving Timetabling using iOpt

Raphael Dorne, Principal Research Professional, BT CTO Group, Adastral Park, MLB1/PP12, Martlesham Heath, Ipswich, IP5 3RE, United Kingdom, raphael.dorne@bt.com, Patrick Mills, Christos Voudouris

The Intelligent Optimisation Toolkit (iOpt) can be seen as an advanced software library for rapidly prototyping, building and deploying solutions to combinatorial optimisation problems. The objective of this presentation is to answer one question: "Why use a toolkit like iOpt to solve timetabling problems rather than hard-coding a solution from scratch?" To answer this question, we will look at several aspects of this software engineering process such as performance, code reuse, flexibility.

3 - Constraint-oriented Multi-neighbourhood Search for Nurse Rostering

Dario Landa Silva, University of Nottingham, School of Computer Sciece and IT, Jubilee Campus, Wollaton Road, Nottingham, NG9 1HX, United Kingdom, jds@cs.nott.ac.uk, Edmund Burke

We describe the application of a heuristic multi-neighbourhood approach to the nurse rostering problem. Our algorithm employs a number of local search moves that are targeted to tackle specific groups of constraints. We evaluate the performance of this approach on a number of real-world data sets and show that the approach is effective in producing good schedules.

4 - Crew and Vehicle Scheduling in Ex-urban Public Transit with Irregular Trips

Ingmar Steinzen, University of Paderborn, Warburger Str. 100, Paderborn, 33098, Germany, steinzen@upb.de, Vitali Gintner, Leena Suhl

The crew and vehicle scheduling problem in public transit aims to assign vehicles and crew itineraries to trips. We consider the case where schedules consist of trips serviced every day as well as trips that do not repeat daily. The traditional approach to crew scheduling usually produces irregular crew schedules which are undesired in practice. We present a two phase approach for the partially integrated vehicle and crew scheduling problem that improves regularity of the individual schedules.

■ MB44

R - 4th Floor, Parc Ballroom III

Open Source Modeling Tools

Sponsor: INFORMS Computing Society/ Optimization Services and Open Source Software
Sponsored Session

Chair: Ted Ralphs, Lehigh University, 200 West Packer Avenue, Easton, PA, 18015, United States, tkralphs@lehigh.edu

1 - Model Representation in the COIN-OR Open Solver Interface

Matthew Saltzman, Clemson University, Mathematical Sciences Dept., Martin Hall, Box 340975, Clemson, SC, 29634, United States, mjs@clemson.edu

The COIN-OR OSI v2 includes distinct components for managing models and for communicating with solvers. We describe the API for model management and the relationship between the model management and solver control components.

2 - Automated Tuning of Solver Parameters
Brady Hunsaker, Univeristy of Pittsburgh, Pittsburgh, PA, United States, hunsaker@engr.pitt.edu, Abhijit Gosavi

We explore methods for automated tuning of parameters for software solvers. A user specifies a test set of instances and a set of parameters. Our implementation attempts to identify good settings for the parameters without exhaustively trying every combination. We present experiments with several MIP solvers. Our implementations are available under an open-source license.

3 - Optimization Services (OS) Library and Server
Jun Ma, Northwestern University, Tech. C231, Sheridan Road, Evanston, IL, 60208, United States, maj@northwestern.edu, Robert Fourer, Kipp Martin

The OS library is an open source library based on a set of Optimization Services Protocols (OSP). The library supports the solution of a wide variety of optimization problem types in a loosely coupled distributed environment. Besides the OS library, we provide OS server software for users to host their own Optimization Services. We also mention a general-purpose Optimization Services modeling Language (OSmL).

4 - A Permutation that Maximizes the Block Structure of a Symmetric Matrix
Joseph Young, Joseph Young, 1717 Bissonnet St., Apt 106, Houston, TX, 77005, United States, josyoun@nmt.edu, Miguel Anjos

This talk describes a permutation that maximizes the block structure of a symmetric matrix. Then we present a new code that allows any primal-dual interior point solver for semidefinite programming to take advantage of this permutation without modifying its source. Finally we present computational results illustrating the impact this permutation has on the performance of these codes.

■ MB45

R - 4th Floor, Raphael

Logistics

Sponsor: Transportation Science & Logistics
Sponsored Session

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

1 - Performance and Design of Mobility Allowance Shuttle Transit (MAST) services: Bounds on Velocity
Luca Quadrifoglio, University of Southern California, D.J. Epstein Dept. of I.S.E., 3715 McClintock Avenue, GER 240, Los Angeles, CA, 90089, United States, quadrifo@usc.edu, Randolph Hall, Maged Dessouky

We analyze the performance of MAST services, a new concept in transportation merging flexibility with low cost operability. Buses are allowed to deviate from fixed paths to serve demand within a service area. The velocity along the primary direction of the service should stay above a minimum treshold value. The problem is NP-Hard and we compute bounds to analyze it. The results allow us to evaluate the performance of the service in terms of velocity vs. demand and to help in the design process.

2 - Heuristics for Car Stock Management
Marco Bijvank, Vrije Universiteit, Department of Mathematics, De Boelelaan 1081a, Amsterdam, 1081HV, Netherlands, mbijvank@few.vu.nl, Iris Vis, Ger Koole

When technicians visit customers to repair machinery, they have to take along some spare parts. We have improved the most general heuristic to determine which spares to take and in which quantity. The new solution technique has been developed to be used for cost minimization as well as for service agreements.

3 - Controlling Order Circuity in Pickup and Delivery Problems
Doug Popken, Systems View, 9139 Roadrunner St, Highlands Ranch, CO, United States, dpopken@systemsview.com

This paper examines the effects of constraining order circuity during the course of a dynamic pickup and delivery routing algorithm. Order circuity, the ratio of actual to direct shipping distance, affects shipping performance metrics such as transit time and vehicle utilization. We found that circuity controls are more effective than standard least-cost insertion heuristics alone in producing efficient route solutions with lower frequency of anomalous order routings.

4 - A Tabu Search Algorithm for Network Design in Truckload Industry
Halit Uster, Department of Industrial Engineering, Texas A&M University, College Station, TX, 77843-3131, United States, uster@tamu.edu, Nimish Maheshwari

A major problem faced by the truckload industry is the high driver turnover rate. We provide a network design model that considers multi-zone shipments for driver lane regularity and an efficient tabu search framework for its solution. We present computational results and the impact of the model on other important criteria, e.g. load imbalance and circuitry, in the industry.

■ MB46

R - 4th Floor, Rubens

50th Anniversary of Studies in the Economics of Transportation

Sponsor: Transportation Science & Logistics
Sponsored Session

Chair: Anna Nagurney, Professor, University of Massachusetts Amherst, Department of Finance and Operations Man, Isenberg School of Management, Amherst, MA, 01003, United States, nagurney@gbfin.umass.edu

Co-Chair: David Boyce, Professor, Northwestern University, 2149 Grey Avenue, Dept. of Civil and Environmental Engrg., Evanston, IL, 60201, United States, d-boyce@northwestern.edu

1 - Recent Results on Congestion Toll Pricing of Traffic Networks
Don Hearn, Professor and Chair, U. of Florida, ISE Department, 303 Weil Hall, Gainesville, FL, 32611, United States, hearn@ise.ufl.edu

We will summarize results on congestion pricing for fixed and elastic demand traffic assignment models, as well as results on approximations of toll sets, extensions to second-best pricing, dynamic pricing, and a traffic-transit model that combines tolling on urban streets with the setting of transit fares. This research has been in collaboration with P. Bergendorff, M. Ramana, M. B. Yildirim, L. Bai, S. Lawphongpanich, Y. Hamdouch, A. Nahapetyan, and M. Florian.

2 - Beyond Equilibrium: User Adjustment Processes and Day-to-day Dynamics
Hani Mahmassani, Maryland Transportation Initiative, University of Maryland, College Park, MD, 20742, United States, masmah@umd.edu

This talk highlights BMW's lesser known but no less seminal contribution to the understanding of day to day dynamics of network flows under different user adjustment processes, and discusses recent developments, challenges and opportunities in this exciting area.

3 - Quantifying the Worst-Case Inefficiency of Wardrop Equilibria
Tim Roughgarden, Assistant Professor, Stanford University, Department of Computer Science, 462 Gates Building, 353 Serra Mall, Stanford, CA, 94305, United States, tim@theory.stanford.edu

At least since the book "The Economics of Welfare", published in 1920 by A. C. Pigou, Wardrop equilibria have been known to be inefficient. We discuss recent work, done primarily in the theoretical computer science community, that aims to quantify the worst-possible severity of this inefficiency. We will highlight the role played by the "potential function" for Wardrop equilibria that was originally introduced in the book of Beckmann, McGuire, and Winsten.

4 - Reflections on Our Book and the Past 50 Years
Martin Beckmann, Professor Emeritus, Department of Economics, 64 Waterman Street, Brown University, Providence, RI, 02912, gwenypretzsch@yahoo.com. Professor Emeritus, Goldman School of Public Policy, Univ. of California-Berkeley, 2609 Hearst Ave., Berkeley, CA 94720, bmcguire@uclink4.berkeley.edu
C. Bart McGuire

The two living authors of Studies in the Economics of Transportation will reflect and comment on the writing of their book and offer their reflections on its impact.

■ MB47

R - 4th Floor, Michelangelo

Hazard Management and Evacuation II

Sponsor: Transportation Science & Logistics
Sponsored Session

Chair: Yi-Chang Chiu, Assistant Professor, University of Texas at El Paso, Engrg Bldg E201P, 500 W University Ave, El Paso, TX, 79968, United States, chiu@utep.edu

1 - Improvements in Hospital Evacuation Planning
Kevin Taaffe, Assistant Professor, Clemson University, 110 Freeman Hall, Clemson, SC, 29634, United States, taaffe@clemson.edu, Del Kimbler

What happens when a hospital providing support for first responders needs to be evacuated? While large-scale evacuation policies affecting entire communities have been studied at great length, a hospital's evacuation plan often receives far less attention. In fact, few studies have addressed the issues that a hospital faces when their occupants must vacate. We propose methodologies to improve evacuation planning that consider mathematical modeling, simulation, and other decision support tools.

2 - The Network Evacuation Problem and Solution Algorithms
Hediye Tuydes, Northwestern Universtiy, h-tuydes@northwestern.edu, Thanasis Ziliaskopoulos

The Network Evacuation Problem (NEP) is defined as the problem of computing the optimum departure time, destination and route for every vehicle on the network so that the last vehicle exits as soon as possible (or before a predefined deadline). We analyze the problem and present a Dynamic System Optimum based Mixed Integer Linear Programming formulation as well as heuristic solution algorithms based on the dual of the LP relaxed version of the model. Extensions to formulations that consider supply management issues (contraflow optimization) are also discussed.

3 - Heuristics for the Integral Multicommodity Network Flow Problem
April Kuo, University of Maryland, Department of Civil and Env. Eng., 1173 Glenn Martin Hall, College Park, MD, 20742, United States, aprilkuo@umd.edu, Elise Miller-Hooks

The integral multicommodity network flow problem has been widely applied. The focus of this work is on applications in evacuation and disaster relief. Two approximate solution techniques for this problem and its applications are presented and compared. The first technique is based on tabu-search and the second on a hybrid of a column generation and tabu search. A column generation procedure was implemented to evaluate the performance of the tabu search and hybrid methods.

4 - Model and Algorithm for Solving No-Notice Evacuation Destination and Traffic Assignment Problem
Yi-Chang Chiu, Assistant Professor, University of Texas at El Paso, Engrg Bldg E201P, 500 W University Ave, El Paso, TX, 79968, United States, chiu@utep.edu

We present the modeling techniques for a cell transmission model based linear mathematical program to solve for the no-notice evacuation destination, traffic assignment and shelter problem. Model formulation and solution algorithms are discussed.

■ MB48

R - 4th Floor, Dante

Innovative Applications of Management Science in Healthcare - 2

Sponsor: Health Applications
Sponsored Session

Chair: Anne Davey, Associate Professor, Northeastern State University, Dept. of Business Administration, Tahlequah, OK, 74464, United States, davey@nsuok.edu

1 - Public Health Sealant Programs: Optimal Delivery and the Cost of Practice Acts
Christina Scherrer, Southern Polytechnic State University, Industrial Engineering Technology, Marietta, GA, 30360, United States, cscherre@spsu.edu, Paul Griffin

Each state has its own Dental Practice Act that outlines requirements for sealant screening and application. We use simulation to determine efficient methods of distributing sealants for various program sizes and Practice Acts in public health programs targeted to schools and high-risk communities. We also investigate the financial impact of these Practice Acts.

2 - Physician Attitudes on Collection of Patient Reported Risk Behavior Data Using Wireless Computers
Deena Chisolm, Clinical Assistant Professor, Columbus Children's Research Institute, 700 Children's Drive, Room J1414, Columbus, OH, 43205, United States, chisolmd@ccri.net, Teresa Julian

Primary care physicians are continually challenged to balance the need to conduct comprehensive health assessments for each patient with the need to maximize the number of patients seen each day. Our team is initiating a trial of a wireless touch-screen computer system collecting risk behavior information from patients before they see the doctor. This presentation described the system and summarizes the results of a pre-implementation assessment of physician attitudes about the technology.

3 - Modeling Change in a Health System: Implications on Patient Flows and Resource Allocations
Evrim Gunes, Assistant Professor, Koc University, Rumeli Feneri yolu, Sariyer, Istanbul, TR, 34450, Turkey, egunes@ku.edu.tr, Hande Yaman

This work is motivated from the recent changes in the health -system in Turkey, which is a consolidation of health insurance funds, and its implications on the resource allocations and the flow of patients in the system. A general network flow model for the flow of patients in a health system to several providers is presented. Our aim is to find the best re-allocation of resources between the hospitals and the best patient-hospital match, to minimize the costs.

4 - Optimal Pricing and Advertising Under a Pharmaceutical Risk-sharing Agreement
Hui Zhang, Richard Ivey School of Business, University of Western Ontario, London, ON, N6A 3K7, Canada, hzhang@ivey.uwo.ca, Greg Zaric

We develop a model of a risk sharing agreement between a pharmaceutical manufacturer and a third-party payer. We identify the optimal drug price as well as the manufacturer's optimal level of marketing effort. We investigate how risk sharing plan impactsthe manufacturer's profit and the net social benefit.

■ MB49

R - 4th Floor, Medici

Applications of DA to Environmental Issues

Sponsor: Decision Analysis
Sponsored Session

Chair: Karen Jenni, Principal, Geomatrix Consultants, 1401 Seventeenth St, Suite 600, Denver, CO, 80202, United States, kjenni@geomatrix.com

1 - Incorporating other Stakeholder-focused Decision Aiding Approaches into Decision Analysis
Karen Jenni, Principal, Geomatrix Consultants, 1401 Seventeenth St, Suite 600, Denver, CO, 80202, United States, kjenni@geomatrix.com

In discussing the benefits of applying decision analysis to environmental issues, we are often asked how it differs from some other approach the potential user has heard about. We provide a brief survey of several other "decision aiding" approaches being used or advocated for use on environmental issues within a Federal agency, including Joint Fact Finding, Stakeholder Analysis, Institutional Analysis, and Adaptive Management. We highlight how they differ from but can complement DA.

2 - Developing a Site-wide Remediation Strategy for a Contaminated Perchlorate Site
Tim Nieman, Senior Decision Analyst, Geomatrix Consultants, 2101 Webster Street, 12th Floor, Oakland, CA, 94612, United States, tnieman@geomatrix.com

This paper describes Decision Analysis used for selecting a comprehensive site strategy for a contaminated former ordnance facility. Selection of a strategy was made difficult by complicated geology in the area, multiple contaminant source areas, uncertainties about the effectiveness of technical solutions, and the existence of multiple stakeholders with sometimes competing objectives. This talk will highlight the modeling approach used and its benefit in resolving contentious issues.

3 - Value of Information Analysis at the Nevada Test Site
Hervé Kieffel, Managing Director, Axyom Consulting LLC, 2533 15th Street, Suite 2, San Francisco, CA, 94114-1227, United States, hkieffel@axyomconsulting.com, Lee Merkhofer, Barbara Deshler, Srikanta Mishra

Hydrological models are used to predict how radioactive materials may travel away from test sites along ground water pathways. The parameters of these models are highly uncertain. Various characterization activities, e.g. drilling to test for radioactivity, measuring Darcy flux, and geologic mapping all reduce uncertainty in model inputs. This analysis combines Bayesian methods and cost-benefit portfolio analysis to identify an efficient portfolio of activities subject to a budget constraint.

4 - A Decision Management System for Low-Level Radioactive Waste disposal facilities at the Nevada Test
Paul Black, Neptune and Company, Inc., 2031 Kerr Gulch Road, Evergreen, CO, United States, pblack@neptuneinc.org, Bruce Crowe, Tom Stockton

A decision management system is needed for management and maintenance of the low-level radioactive waste disposal facilities at the Nevada Test Site to inform decisions about disposal options, site closure, institutional controls, and long term monitoring. Probabilistic environmental modeling tracks potential releases of the disposed waste to potential receptors. The decision analysis follows DOE's ALARA guidance, which is fully consistent with Bayesian decision analysis.

■ MB50

R - 4th Floor, Cervantes

Ward Edwards Memorial Session

Sponsor: Decision Analysis
Sponsored Session

Chair: Larry Phillips, Professor, London School of Economics, Operational Research Department, Houghton Street, London, WC2A 2AE, United Kingdom, larry_phillips@msn.co

1 - A Retrospective on Ward Edwards: In his Own Words, and Commentaries

Larry Phillips, Professor, London School of Economics, Operational Research Department, Houghton Street, London, WC2A 2AE, United Kingdom, larry_phillips@msn.com, Detlof von Winterfeldt

We survey the life and work of Ward Edwards, through video clips of an interview with Ward in February 2003 and in commentaries from two of his students. We cover the origins of his classic 1954 Psychological Bulletin paper that started the field of behavioral decision making, through discoveries about human information processing at the University of Michigan, to his later engagement with multi-criteria decision analysis and Bayesian belief networks at the University of Southern California.

Interactive Session
Monday 12:30pm – 1:30pm

Grand Ballroom

Chair: George Polak, Wright State University, george.polak@wright.edu

1- The Harmonic Consistency Index

William Stein,Texas A&M University, Mays Business School, College Station TX 77843-4217, United States, wstein@tamu.edu, Philip Mizzi

A new consistency measure, the harmonic consistency index, is obtained for the Analytic Hierarchy Process. Using simulation, this new index is shown to give numerical values similar to the standard consistency index but it is easier to compute and interpret.

2- Gene Expression for Improved Solution Representation

Srinivasan Anandan,Clemson University, 110 Freeman Hall, Clemson SC, United States, sananda@clemson.edu

We integrate gene expression in a RKGA implementation to find low makespan solutions for scheduling flexible flowlines with sequence-dependent setup times. As motivation, consider polydactyly, in which a person has extra digits which range in appearance from skin tags to fully functional digits. We investigate the quality and the time to find the solutions. A VBA-Excel implementation will be on display.

3- Demand Source Selection for a Risk-Averse Newsvendor

Deepak Tirumalasetty,Student, Clemson University, 110 Freeman Hall, Clemson SC 29634, United States, dtiruma@clemson.edu, Kevin Taaffe

Consider a firm operating within a selective newsvendor framework. Instead of only maximizing expected profit, the firm may wish to minimize the variance from that goal or to minimize variance while meeting some target profit level. We present solution methodologies utilizing mean-variance analysis and simulation to address these objectives.

4- A SDP Decision Model for Cost-Minimization of Erosion Control on Logging Roads

Matthew Thompson,Graduate Student, Department of Forest Engineering, 204 Peavy Hall, Oregon State University, Corvallis OR 97330, United States, matthew.thompson@oregonstate.edu, William Baxter, Teresa Ish, David Tomberlin

A dynamic optimization model suitable for decision support of erosion control planning on logging roads is presented. The model identifies a least-cost policy that minimizes the discounted sum of expected erosion control costs. Our model is represented as an optimal stopping problem solved with SDP, and applied to a logging road on the Jackson Demonstration State Forest.

5- A Software Architecture for Manufacturing Systems Modeling and Analysis at GM

Craig Jackson, Senior Research Scientist, General Motors Corporation, 30500 Mound Road, MC: 480-106-359, Warren MI 48090-9055, United States, craig.jackson@gm.com, Jonathan H. Owen

We describe an extensible software environment for manufacturing system modeling and throughput analysis within GM. This environment is implemented as a set of callable libraries and provides embedded access to identical modeling and analysis capabilities for any number of domain-specific end-user applications, promoting consistency across the organization and allowing disparate user groups to access identical analysis capabilities while sharing and reusing system models.

6- CO2 Price Dynamics: The Implication of EU Emission Trading on the Price of Electricity

Yihsu Chen, Johns Hopkins University, Dept. of Geography and Environmental Engineering, 3400 N. Charles St. AMES Hall 313, Baltimore MD 21218, United States, yschen@jhu.edu, Benjamin Hobbs, Wietze Lise, Jos Sijm

We use the COMPETES model to investigate the degree to which the electricity price will change after the introduction of EU CO2 emission trading. The COMPETES is a game-theoretical static model based on complementarity formulation. The results show that the high pass-through rate is associated with competitive markets with low elasticity.

7- Optimizing Oil Cargo Heating Practices

Ian Fichtenbaum,Centre for Operations Excellence, Sauder School of Business, University of British Columbia, 2053 Main Mall - Room 209, Vancouver BC V6T1Z2, Canada, ian.fichtenbaum@coe.ubc.ca, Ian Fichtenbaum, Jack Chong, Eric Cope, Neda Salehirad

The physical properties of certain crude oils require that they remain at elevated temperatures during transport. Heating oil cargos consumes significant amounts of fuel and hence incurs major costs for the shipper. We developed a decision support tool that recommends the lowest cost heating method for a given cargo profile. The tool employs a statistically validated model of cargo cooling and heating, and incorporates it into an optimization model with related temperature constraints.

8- The Effect of Reputation on the Strategic Interaction and Optimal Valuations of Real Estate Agents

Hilde Patron, 1 Department of Economics and Finance, College of Administration & Business, Louisiana Tech University, P.O. Box 10318, Ruston LA 71272, hpatron@cab.latech.edu, Kenneth Roskelley

We study the incentives of real estate agents to mislead clients regarding property values using a game theory model and a nationwide survey of real estate professionals. We find, among other things, that 78.70% of respondents believe that at least some agents deliberately mislead clients about property values at least once in their career.

9- Decentralized Algorithms for Search and Routing in Sensor Networks

Hari Prasad Thadakamalla,Student, The Pennsylvania State University, 310 Leonhard Blgd., University Park PA 16802, United States, hpt102@psu.edu

Conventional ways to route/search in many decentralized systems is to broadcast to all the neighbors or send the message to a randomly selected neighbor. This is not efficient when the nodes operate in severe power constraints as in sensor networks. In our research, we propose a novel decentralized algorithm for such systems.

10- Comparing Simulation Efficiency for Discrete Power Series Distributions with Their Finitized Counterparts

James Cochran,Department of Marketing and Analysis, College of Administration and Business, Louisiana Tech University, Ruston LA 71272, jcochran@cab.latech.edu, Saeed Golnabi

Finitization is a moment preserving method that converts infinitely supported discrete power series distributions into finitely supported counterpart distributions with specified support size. Finitization uses Aliasing to simulate variables and provide very close approximations to the parent distribution. In this demonstration you can create finitized versions of Poisson and negative binomial distributions, evaluate their closeness to the parent distributions, and conduct horse-races between SAS simulation programs and the Aliased finitized counterparts.

11- Ski Industry Pricing: Daily Tickets Versus Season Passes

Eric Huggins,Assistant Professor of Management, Fort Lewis College, 1000 Rim Drive, School of Business Administration, Durango CO 81301, United States, huggins_e@fortlewis.edu, Michael Fry

Ski resorts typically offer skiers daily tickets or season passes that allow skiers all-season access. We examine lift ticket pricing at a monopolistic ski resort with the objective of optimizing profit while limiting risk. Next, we consider how two competitive ski resorts price tickets graphically and with simplified models.

12- Community Bus Maintenance Strategy

Ryan Quee, Centre for Operations Excellence, Sauder School of Business, University of British Columbia, 2053 Main Mall, Vancouver BC V6T 1Z2, Canada, ryan.quee@coe.ubc.ca, Ximena Cerda Salzmann, Mats Gerschman, Jeff Kroeker, Shanshan Wang

This study evaluated the cost effectiveness of integrating small bus maintenance into an existing large bus maintenance setting vs. creating a centralized maintenance center for small buses only. Two simulation models were developed to evaluate different scenarios which were based on the impact on bus availability, route cancellations, and costs. The minimum quantity of spare buses required in order to avoid route cancellations at different sites was also studied.

13- Economic versus Statistical Inference: Asset Return Predictability

Kenneth Roskelley, Department of Economics and Finance, College of Administration & Business, Louisiana Tech University, P.O. Box 10318, Ruston LA 71272, kennethr@latech.edu

I compare economic and statistical significance by analyzing the portfolio allocation of a Bayesian investor that does not know the data generating process of asset returns. I find that the difference between the inferences of the two metrics is largely an artifact of how model uncertainty is represented.

14- CUSUM Control Charts for Monitoring Autocorrelated Binary Observations

Shabnam Mousavi,Research Associate and Assistant Professor, Penn State University, Department of Statistics, University Park PA 16802-2111, United States, sxm70@psu.edu, Marion R. Reynolds

Traditional control charts for monitoring a proportion p assume independent binary observations.We consider monitoring p for autocorrelated sequence of binary observations.We use a Markov chain model for the observations and derive a CUSUM statistic based on the log likelihood ratio,which is then modeled as a Markov chain,and this allows for designing control charts with specific statistical properties.We show that this CUSUM chart performs better than the standard control charts.

Monday 1:30pm – 3:00pm

■ MC01

H - Lobby Level, Plaza A

Tutorial: Stochastic Programming: Optimization When Uncertainty Matters

Cluster: Tutorials
Invited Session

1 - Tutorial: Stochastic Programming Optimization When Uncertainty Matters

Julia Higle, University of Arizona, Dept of Systems/Industrial Engineering, Tucson, AZ, 85721, United States, julie@sie.arizona.edu

Since SP was first introduced in the 1950's, tremendous progress toward an understanding of properties of SP models and the design of algorithmic approaches for solving them has been made. As a result, SP is gaining recognition as a viable approach for large scale models of decisions under uncertainty. In this tutorial, we present an introduction to stochastic programming models and methodology at a level that is intended to be accessible to the breadth of members within the INFORMS community.

■ MC02

H - Lobby Level, Plaza B

Data Envelopment Analysis Applications

Cluster: Data Envelopment Analysis
Invited Session

Chair: John Ruggiero, University of Dayton, 517 Miriam Hall, Dayton, OH, 45469, United States, John.Ruggiero@notes.udayton.edu

1 - Measuring The Cost of Adequacy in Education

John Ruggiero, University of Dayton, 517 Miriam Hall, Dayton, OH, 45469, United States, John.Ruggiero@notes.udayton.edu

The recent court decision in Ohio requires that school districts spend a sufficient amount to adequately educate students. Adequate spending is complicated by the influence that fixed socioeconomic factors have on outcome provision. Furthermore, measures of adequacy should account for inefficiency in educational production. In this paper, I apply DEA to measure adequacy.

2 - The Performance of China Focused and US Equity Mutuals Funds using Data Envelopment Analysis

Komlan Sedzro, Professor of finance, School of Business, University of Quebec at Montreal, 315 Sainte-Catherine Est, Montreal, QC, H3C 3P8, Canada, sedzro.k@uqam.ca, Jean-Marc Chen

Many investors are more and more interested in investing in China due to the tremendous economic growth of this country in the last and probably in the coming decades. In this paper, using data envelopment analysis, we measure the performance of China focused mutual funds and American deposit receipts compare to US equity mutual funds. Our results show that it would have been highly profitable for US investors to add China stocks in their portfolio in the 1999 to 2003 period.

3 - Performance Evaluation of Software Companies

Shanling Li, Associate Professor, 1001 Sherbrooke Street West, Montreal, PQ, H3A 1G5, Canada, shanling.li@mcgill.ca, Jen Shang

We use a combination of economics, management science tools such as Data Envelopment Analysis (DEA), and formal statistical techniques to evaluate three success indicators: operating efficiency, strategic growth and superior financial performance in the companies of the software industry. Empirical findings provide interesting guidelines to measure the three indicators.

■ MC04

H - Ballroom Level, Continental Ballroom 2

Daniel H. Wagner Prize Competition

Cluster: The Daniel H. Wagner Prize for Excellence in Operations Research
Invited Session

Chair: Joseph H. Discenza, SmartCrane, LLC, 2 Eaton Street Suite 500, Hampton, VA, 23669, United States, jhdiscenza@smartcrane.com

The Daniel H. Wagner Prize for Excellence in Operations Research Practice

CPMS's practice prize, the Daniel H. Wagner Prize for Excellence in Operations Research Practice, is now underway for its sixth competition. Four finalist teams have been selected for 2005 and these will be presented in a single track.

1 - Methods for Solving a Mixed Integer Program for Semiconductor Supply Chain Optimization at IBM

Brian Denton, Mayo Clinic, Division of Health Care Policy Research, 200 First St. SW, Rochester, MN, 55905, United States, briantdenton@yahoo.com, R. John Milne, John Forrest

IBM uses Operations Research models and methodology extensively for advanced planning of its semiconductor supply chain. The large-scale nature of these problems necessitates the development of robust and computationally efficient solution methods. In this presentation we describe our experiences in developing solution methods for solving a mixed-integer-programming (MIP) model for optimizing IBM's semiconductor supply chain.

2 - Investment Analysis and Budget Allocation at Catholic Relief Services

Ioannis Gamvros, Smith School of Business, University of Maryland, igamvros@rhsmith.umd.edu, Richard Nidel, S. Raghavan

In this paper we present a budget allocation problem faced by Catholic Relief Services, a not-for-profit agency that funds humanitarian relief and economic development efforts throughout the world. We develop a mathematical model and a spreadsheet tool that allocates funds based on the impact that these investments will have. The model ensures a fair allocation that is consistent with the agency's priorities and is simple enough for managers to understand. The tool is currently being used to plan for future spending and is considered a great success that has considerably improved the planning process.

■ MC05

H - Ballroom Level, Continental Ballroom 3

Transportation Service

Cluster: Service Sector Operations
Invited Session

Chair: Eva Lee, Associate Professor & Director, Center for Operations Research in Medicine, Georgia Institute of Technology, Industrial & Systems Engineering, Atlanta, GA, 30332-0205, United States, evakylee@isye.gatech.edu

1 - Preemption Traffic Network Design for Fire Services

Ming-En Wang, Assistant Professor, University of Pittsburgh, 1034 Benedum Hall, Pittsburgh, PA, 15261, United States, MEWang@engr.pitt.edu, Bryan Norman

Traffic Signal Preemption (TSP) is an operational strategy that facilitates the movement of emergency vehicles through traffic-signal controlled intersections. Due to the nontrivial cost of TSP equipment, most metropolises can only add TSP to selected intersections. We present a two-tier methodology for designing optimal TSP traffic network in a metropolis for fire services that minimizes the average emergency response time of the first arriving fire company.

2 - An Approximation Method to Solve the Parcel Hub Scheduling Problem

Douglas McWilliams, Assistant Professor, Purdue University, 401 N. Grant Street, West Lafayette, IN, 47906-2021, United States, dmcwilli@purdue.edu

This research addresses the parcel hub scheduling problem (PHSP) in the parcel delivery industry. The PHSP involves scheduling a set of inbound trailers to a fixed number of unload docks with the objective to minimize the time required to unload the trailers and to sort and load the parcels to outbound trailers. A mathematical model to approximate system performance under a given unload schedule is presented.

3 - On Connectivity Properties of Airline Networks

Sergiy Butenko, Assistant Professor, Texas A&M University, 236E Zachry Engineering Center, TAMU 3131, College Station, TX, 77843-3131, United States, butenko@tamu.edu, Balabhaskar Balasundaram

The impact that various connectivity properties of an airline network may have on quality and reliability of service provided by the airline is studied. In particular, several novel clustering models for airline networks are introduced and analyzed theoretically and computationally.

■ MC06

H - Ballroom Level, Continental Ballroom 7

Disassembly, Rework and Remanufacturing

Cluster: Reverse Supply Chains
Invited Session

Chair: Karl Inderfurth, Prof. Dr., University of Magdeburg, Faculty of Economics and Management, P.O.Box 4120, Magdeburg, D-39016, Germany, Karl.Inderfurth@WW.Uni-Magdeburg.DE

1 - Remanufacturing for Spare Parts Acquisition in Post Product Life Cycle

Karl Inderfurth, Professor, University of Magdeburg, Universitaetsplatz 2, Magdeburg, 39106, Germany, inderfurth@ww.uni-magdeburg.de, Kampan Mukherjee

Spare parts acquisition after the end of a product's life cycle (PLC) can rely on three sources: (i) final PLC lot size , (ii) extra production after PLC, (iii) remanufacturing of used components. An optimal strategy for using these options has to consider uncertainties in both spare parts demand and used products returns. By analyzing the underlying stochastic dynamic optimization problem it is revealed how remanufacturing can contribute to spare parts acquisition most efficiently.

2 - Modeling a Multi-Period Disassembly Planning Problem

De-bi Cao, Associate Professor, Tokyo Institute of Technology, 2-12-1 Ookayama Meguro-ku, Tokyo, 152-8550, Japan, caodb@me.titech.ac.jp, Ou Tang

This paper presents a model to deal with a multi-periods disassembly Planning problem (MPDP). Since the problem is NP-complete, we develop a simple heuristic including forward schedule and backward schedule modules. The forward schedule is used to determine the disassembly plan and the backward schedule aims to reschedule when there is insufficient disassembly capacity. Numerical experiments indicate that the heuristic results a good tradeoff of the solution quality and computation time.

3 - Heuristic Algorithm for Disassembly Line Balancing

Fred Lambert, dr.ir., Technische Universiteit Eindhoven, P.O.Box 513, Eindhoven, NL, 5600 MB, Netherlands, A.J.D.Lambert@tm.tue.nl, Surendra M. Gupta

A heuristic algoritm for disassembly line balancing is discussed. It This has been sucecssfully applied to a well-documented problem from practice referring to a cellphone, including 25 tasks and 42 precedence relationships. Using newly written software, the possible tasks assigned to each workstation can be depicted by a divergent graph.

4 - How to Handle Yield Uncertainty in Disassembly Planning

Ian M. Langella, University of Magdeburg, Faculty of Economics and Management, P.O. Box 4120, Magdeburg, D-39016, Germany, ian.langella@ww.uni-magdeburg.de, Karl Inderfurth

Stochastic yields from disassembly complicate the planning for so-called disassemble to order problems, where a specified amount of components must be harvested from various models of returned products. This work will present several newly developed heuristics which can be used (the optimal solution being only calculable for the smallest of problems) and examine the performance of these heuristics using a large battery of randomly generated instances.

■ MC07

H - Ballroom Level, California

Product Design, R&D Expenditures and Licensing

Sponsor: Manufacturing & Service Oper Mgmt
Sponsored Session

Chair: Feryal Erhun, Assistant Professor, Stanford University, Management Science&Engineering, Stanford, CA, 94305, United States, ferhun@stanford.edu

1 - Product-Line Competition: Customization vs. Proliferation

Ali K Parlakturk, Stanford Graduate School of Business, 518 Memorial Way, Stanford, CA, 94305, United States, pturk@stanford.edu, Haim Mendelson

We consider a market with products that differ in their attributes and customers who differ in their preferences for these product attributes. A traditional firm chooses a finite set of product configurations with their prices; a customizing firm chooses a price menu for each product configuration and it can produce any configuration to order. Unlike the traditional firm, the customizing firm does not carry inventories but its customers incur waiting costs while their orders are produced.

2 - Vertical Integration and the Distribution of Product Development Outcomes

Korhan Gurkan, Tepper School of Business, Carnegie Mellon University, 5000 Forbes Ave, Posner 372, Pittsburgh, PA, 15213, United States, kgurkan@cmu.edu

This paper studies the relationship between vertical industrial structure and product development processes, focusing on how the distribution of product development project outcomes affect development investment and the resulting level of innovation. A vertical differentiation model, whereby firms compete in developing and manufacturing products, is advanced. Product development is modeled as a search for the best alternative among development projects with stochastic outcomes.

3 - Making Innovation Profitable by Designing a Coordinated Supply Channel

Francis Zane, Bell Labs, Lucent Technologies, 600 Mountain Avenue, Murray Hill, NJ, United States, francis@research.bell-labs.com, Qiong Wang, Enis Kayis

We discuss an innovator's problem of creating a profit-maximizing supply channel to market its new product in the presence of potential competition from imitators. The situation is modeled as a two-stage supply chain in which the downstream customers have the ability to become their own suppliers. We discuss the incentive issues in this framework and develop coordinating pricing schemes. We discuss strategic implications of the pricing on the innovator's choice of cooperate structure.

4 - New Product Licensing

Enis Kayis, Stanford University, Management Science and Engineering, Stanford, CA, 94305, United States, ekayis@stanford.edu, Mark Wilkinson, Feryal Erhun

Consider a supplier who conducts R&D to develop a custom component, which is to be used by an OEM within his new product. The OEM may require more units of the component than the CS can offer using her own production capacity. Thus, the CS may license some or all of her component production to a second supplier, in exchange for a royalty fee. We show that while licensing her product, the CS may use her capacity as a strategic tool. We also analyze outsourcing as an alternative to licensing.

■ MC08

H - Ballroom Level, Imperial A

Joint Session Research/Aviation Applications: Aviation Applications Research Clinic- Experts' Perspectives on Aviation

Cluster: Research Clinics, Aviation Applications
Invited Session

Chair: Diego Klabjan, Professor, University of Illinois at Urbana-Champaign, 1206 West Green Street, Urbana, IL, 61801, United States, klabjan@uiuc.edu

1 - Experts' Perspectives on Aviation

Diego Klabjan, Professor, University of Illinois at Urbana-Champaign, 1206 West Green Street, Urbana, IL, 61801, United States, klabjan@uiuc.edu, Eric Anderrson, James Diamond, Wilson Felder, Glenn Roberts

The speakers will cover their own perspectives on aviation: from the viewpoints of airline executives, to software vendor experts, aircraft manufacturers, and the FAA leaders. The speakers will focus on the future of aviation and the role of operations research within the industry. Their presentations will be followed by an open discussion.

■ MC09

H - Ballroom Level, Yosemite A

Supply Chain Management

Cluster: Supply Chain Management
Invited Session

Chair: Ravi Anupindi, University of Michigan, Ross School of Business, 701 Tappan, Ann Arbor, MI, 48109, anupindi@umich.edu

1 - Information Systems and Supply Chain Design under Competition

Karan Girotra, The Wharton School, 3730 Walnut St. STE 500 JMHH, Philadelphia, PA, 19104, United States, karang@wharton.upenn.edu, Krishnan Anand

We model two firms competing in a market, and endogenize their choice of Information Systems (IS). We explicitly model both material and information flows in the firms' supply chains. We demonstrate that both supply chain structure and market structure (competition versus monopoly) drive the value (and hence, the optimal choice) of IS.

2 - Offshore and Onshore contracts
Anshul Sheopuri, Student, New York University, 44th West 4th Street, New York, NY, 10012, United States, asheopur@stern.nyu.edu, Eitan Zemel

We study the buyer-seller relationship in a supply chain from the perspective of quality. In particular, we examine situations where quality levels of the product can be observed, yet, conformance cannot be enforced unless the buyer engages in costly, legally binding activity, which we call audit. We examine three types of remedies that can be taken in case an audit confirms the existence of quality problems, namely `Charge-back', `Compensate' and `Repair' contracts.

3 - Consumer-Driven vs. Retailer- Driven Search: Channel Performance and Implications
Li Jiang, University of Michigan, Ross School of Business, 701 Tappan Street, Ann Arbor, MI, 48109, United States, ljiang@umich.edu, Ravi Anupindi

We consider a simple two location supply chain in which price-setting retailers carry stocks to satisfy customer demands. Demand are stochastic resulting in potential stock-outs and imbalance. Ex-post rebalancing via exchange of excess stock or excess demand is possible via search and induces strategic interaction between retailers. We posit two models of search: consumer-driven and retailer-driven compare performance from the perspective of both the retailers and the manufacturer.

4 - A Rebate Mechanism for the Prevention of Gray Markets
Yehuda Bassok, University of Southern California, LA, CA, United States, bassok@marshall.usc.edu, Nan Xia

Gray markets, where a firm's products are sold or unsold through unauthorized channels, have become a prevalent problem to the trademark holders in recent years. We investigate the "channel flow diversion" type of gray market. We propose a mechanism using manufacturer rebate to effectively prevent the gray market and increase the manufacturer's profitability.

■ MC10

H - Ballroom Level, Yosemite B

Inventory and Transportation in Supply Chains

Cluster: Supply Chain Management
Invited Session

Chair: Philip Kaminsky, University of California, IEOR, Berkeley, CA, United States, kaminsky@ieor.berkeley.edu

1 - A Supply Chain Design Model with Unreliable Supply
Zuo-Jun Max Shen, University of California, IEOR, Berkeley, CA, 94720, United States, shen@ieor.berkeley.edu, Lian Qi

There are many uncertainties within a supply chain, and they have big impacts on the performance of the supply chain. We propose a model that takes into consideration the unreliable nature of the supply chain, analyze the properties of its optimal solution and design an algorithm to solve the model efficiently. Computational experiments suggest some interesting managerial insights on how uncertain factors impact key supply chain design decisions.

2 - Integrating Order Assignment, Production, and Distribution in a Supply Chain
Zhi-Long Chen, Associate Professor, Robert H. Smith School of Business, University of Maryland, College Park, MD, 20742, United States, zchen@rhsmith.umd.edu, Guruprasad Pundoor

We consider a make-to-order supply chain consisting of a number of plants and a central DC. We consider a scheduling model that integrates order assignment, production, and distribution decisions with the objective of minimizing total production-distribution cost while maximizing customer service level. We study complexity of several problems, propose heuristics for intractable cases, and analyze performance of the heuristics.

3 - The Multi-facility Multi-retailer Newsvendor Problem
Edwin Romeijn, Associate Professor, University of Florida, 303 Weil Hall, P.O. Box 116595, Gainesville, FL, 32611-6595, United States, romeijn@ise.ufl.edu, Fatma Zeynep Sargut

We consider a problem in which multiple newsvendors must be supplied by a set of capacitated facilities. The objective is to minimize the total transportation costs between facilities and retailers as well as the total expected overage and underage cost at the retailers. We consider variants of the problem with and without single-sourcing constraints.

4 - Transportation Contracts in Stochastic Production/Distribution Systems
Engin Alper, University of California, Berkeley, Department of IEOR, 4141 Etcheverry Hall, Berkeley, CA, 94720-1777, United States, engin@ieor.berkeley.edu, Philip Kaminsky, Hyun-soo Ahn

Third-party logistics contracting has now become a widely utilized practice across many industries. Motivated by this observation, we develop models to analyze the optimal operation of stochastic production/distribution systems with transportation contracts. We characterize the optimal integrated production/distribution policy structures and provide numerical illustrations.

■ MC11

H - Ballroom Level, Yosemite C

Risk Management in Supply Chain Management

Contributed Session

Chair: Hiroshi Ochiumi, Ph.D. Candidate, University of Southern California, BRI400C, Marshall School of Business, Los Angeles, CA, 90089, United States, ochiumi@marshall.usc.edu

1 - Monitoring the Operational Risks in a Multi-Echelon Supply Chain
Min Shi, Rutgers University, Rutgers Business School, Newark, NJ, 07102, United States, minshi@pegasus.rutgers.edu

Quantitative research in supply chain risk management recently received a great deal of attentions. This paper introduces statistical process control methods within the six sigma framework to monitor the operational risks in a multi-echelon supply chain. It is found that the proposed procedure is effective in detecting aberrant supply chain operations.

2 - Robustness and Regulatory Risk in Supply Chains
Eleni Pratsini, IBM Zurich Research Lab, Saeumerstrasse 4, Rueschlikon, CH, 8803, Switzerland, pra@zurich.ibm.com, Olivier Gallay, Michel Bierlaire

We consider the supply chain of a company under regulatory risk. In certain cases the risk can be measured, however, its value is subject to uncertainty. This uncertainty affects the optimal restructuring of the supply chain that attempts to minimize exposure to risk and maximize profit. In this study we examine techniques for handling uncertainty to provide robust restructuring solutions, and apply them to a real problem.

3 - Assessing Information Security Risk in the Supply Chain
Wade Baker, Doctoral Student, Information Security Consultant, Virginia Tech, 1007 Pamplin Hall, Virginia Tech, Blacksburg, VA, 24060, United States, wbaker@vt.edu, Jay Pokorski, Gregory Smtih, Kevin Watson

As modern supply chains grow in scope and complexity, members achieve numerous mutual benefits by adopting practices that emphasize collaboration and integration. IT has facilitated this trend, but has also removed traditional layers of internal and external separation which once formed a protective barrier around organizational assets and processes. Our research examines information risk within the context of supply networks and presents the findings of several recent empirical studies.

4 - Riskiness Increase and Variability Amplification in Supply Chains
Xiaoming Li, Assistant Professor, Tennessee State University, 330 10th Ave. N., Nashville, TN, 37203, United States, xli1@tnstate.edu

This study characterizes the inventory behavior under common inventory policies in the stochastic inventory systems. Our results show how these inventory policies increase demand riskiness and how the demand variability amplification occurs. We then present managerial implications of information sharing and collaborations in supply chain management.

5 - Managing Forcasting Function of a Firm - Organizational Aspects of Forecasting
Hiroshi Ochiumi, Ph.D. Candidate, University of Southern California, BRI400C, Marshall School of Business, Los Angeles, CA, 90089, United States, ochiumi@marshall.usc.edu, Sriram Dasu

We present incentive schemes that are truth-revealing and can order forecasters on the basis of their abilities. In the case where the agent doesn't influence demand, we show that if the number of potential outcomes is countable, then truth-revealing is possible regardless of the agent's risk preference. In the case where the agent can affect demand by exerting effort, we reformulate the classical salesforce compensation problem into a two-stage optimization problem.

■ MC12

H - 4th Floor, Union Square 1

Auctions in Theory versus Practice

Cluster: Applications of Auction and Game Theory
Invited Session

Chair: Wedad Elmaghraby, University of Maryland, Wedad_Elmaghraby@rhsmith.umd.edu

1 - The Effect of Timing on Bid Increments in Ascending Auctions
Elena Katok, Associate Professor, Penn State University, 5F BAB, State College, PA, United States, ekatok@psu.edu, Anthony Kwasnica

We investigate the role of timing in ascending auctions under the premise that time is a valuable resource. When auctions are slow, as internet auctions used for procurement often are, there are significant opportunity or monitoring costs to bidders, and the choice of the bid increment level becomes a strategic decision. We study the choice of bid increments in the experimental laboratory by systematically altering the opportunity costs associated with fast bidding.

2 - The Impact of Public Information on Bidding

Georgia Kosmopoulou, University of Oklahoma, 729 Elm Avenue, Norman, OK, 73019, United States, georgiak@ou.edu, Dakshina DeSilva, Timothy Dunne, Anuruddha Kankanamge

Auction theory suggests that a release of information from the seller can generates aggressive bidding behavior. This result remains largely untested in the empirical literature. We examine the impact of a policy change by the Oklahoma DOT that led to the release of valuable information to the bidders prior to the bid letting. We perform the analysis in comparison to Texas, a state that had a uniform policy of revealing the same information all throughout the period of analysis.

3 - Sealed Bid Auctions of Split Awards and Assurance of Supply

Kemal Guler, Senior Scientist, Hewlett-Packard Laboratories, 1501 Page Mill, Palo Alto, CA, 94304-1100, United States, kemal.guler@hp.com, Ismail Ceylan

We study a sealed bid auction model in which the bidders face uncertainty about the sourcing mode (dual or sole sourcing). The buyer selects between single-sourcing and dual-sourcing based on assurance of supply c onsiderations . We show that two environments, one in which the bidders are uncertain about the award rule and another where that uncertainty is resolved before bids are submitted, are equivalent in terms of expected procurement costs and expected bidder profits. However, the structure of payoffs under the two environments differ in ways important for practical purposes. In particular, resolving sourcing mode uncertainty before or after the bids are taken makes a difference for the probability of 'runner-up's curse' - ex post loss incurred by the winner of smaller contract in single-lot sealed bid auctions split-award contracts.

■ MC13

H - 4th Floor, Union Square 5

Software Demonstration

Cluster: Software Demo
Invited Session

1 - GAMS Development Corp. - Rapid Application Development & Grid Computing Using GAMS

Michael Bussieck, GAMS Development Corporation, 1217 Potomac Street NW, Washington, DC, 20007, United States, MBussieck@gams.com, Steve Dirkse

The General Algebraic Modeling System (GAMS) is a commercial modeling system for mathematical programming problems. In this presentation we will combine new and old GAMS features that demonstrate how rapidly complex applications can be put together. GAMS even meets challenging requirements posed by grid computing environments and massive computational demands.

2 - 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 LINDO API, LINGO and What'sBest - their popular linear, integer, quadratic, general nonlinear and global optimization tools. Find out how easy it is to: quickly build complex optimization models, effortlessly access data in Excel and databases, and seamlessly embed optimization into your own applications.

■ MC14

H - 4th Floor, Union Square 6

Revenue Management with Contracts and Spot Markets

Cluster: Pricing and Revenue Management for Non-Travel Industries
Invited Session

Chair: Ioana Popescu, INSEAD, Blvd de Constance, Fontainebleau, 77300, France, ioana.POPESCU@insead.edu

1 - Revenue Management with Last Minute Getaways

Srinivas Krishnamoorthy, Assistant Professor, Richard Ivey School of Business, The University of Western Ontario, London, ON, N6A 3K7, Canada, skrishnamoorthy@ivey.ca

We show that the opportunity to sell "distressed" inventory through online channels to last minute impulse travelers provides revenue benefits because of greater supply flexibility and demand stimulation. While there is a chance of some revenue leakage because of travelers postponing purchases in anticipation of last minute sales, providers can overall benefit by this selling strategy. The contract between the provider and the online seller ensures that fidelity of prices is maintained.

2 - Pricing and Capacity Rationing in Rentals

Sergei Savin, Associate Professor, GSB, Columbia University, 404 Uris Hall, 3022 Broadway, New York, NY, 10027, United States, svs30@columbia.edu, Noah Gans

We consider a rental firm with two types of customers: contract and walk-in customers. The firm has to decide when to offer service to contract customers and what fees to charge walk-in customers for service. We formulate this rental management problem as a problem in stochastic control, characterize optimal policies, and establish conditions for the optimality of myopic policies.

3 - Operational and Pricing Decisions in Nonprofit Organizations

Miguel Lobo, Fuqua School of Business, Duke University, Durham, NC, 27708, United States, mlobo@duke.edu, Francis de Vericourt

We analyze a multi-period resource management problem with pricing decisions. In each period, the current assets are divided between consumption and investment in service capacity. Demand is stochastic and depends on price. Revenue generated by satisfied demand determines in turn the assets in the next period. The objective is to maximize the total discounted asset consumption. Although it has broader applications, we motivate this model with applications in non-profit organizations.

4 - Stochastic Revenue Management Models for Media Broadcasting

Ioana Popescu, INSEAD, Blvd de Constance, Fontainebleau, 77300, France, ioana.POPESCU@insead.edu, Victor Araman

Allocating advertising capacity between upfront and scatter markets is an important challenge for broadcasting companies. We propose stylized models that maximize profits and meet contract requirements by hedging against audience uncertainty. We contrast these with standard inventory, service and revenue management frameworks. We investigate dynamic "make goods" allocation and provide comparative statics with respect to contract parameters, spot market price and audience distribution.

■ MC15

H - 4th Floor, Union Square 9

Logistics Scheduling

Cluster: Scheduling
Invited Session

Chair: Chung-Yee Lee, Professor and Head, Department of IEEM, Hong Kong UST, Clear Water Bay, Kowloon, HK, Hong Kong, cylee@ust.hk

1 - Allocation of Jobs and Resources to Work Centers

Marc Posner, The Ohio State University, Department of Industrial Engineering, 1971 Neil Avenue, Columbus, OH, 43210, United States, posner.1@osu.edu, Hui-Chih Hung

We examine the stochastic resource allocation problem of partitioning servers into multiple parallel work centers, and simultaneously assigning job types to work centers. Each job type has a distinct Poisson arrival rate and WIP weight, and is assigned to a single work center. The goal is to minimize the total WIP cost. For the identical server case, a heuristic is constructed where the relative error is bounded above by 1+e. When servers are non-identical, heuristics and bounds are constructed for the random available server assignment discipline and fastest available server assignment discipline.

2 - On Some Logistics Scheduling Models

Xiangtong Qi, Assistant Professor, Hong Kong University of Science and Technology, Dept. of IEEM, HKUST, Clear Water Bay, Kowloon, HK, Hong Kong, ieemqi@ust.hk

We will study several logistics scheduling problems. In an inbound logistics scheduling model, we address how to coordinate the raw material acquisition with production scheduling. In an intra-firm logistics scheduling model, we address how to integrate work load assignment, transshipment and production scheduling. Some extensions will also be discussed.

3 - Optimizing the Production and Transportation Schedules in a Zero-inventory Process

Lei Lei, Associate Professor, Rutgers University, MSIS Dept., Rutgers Business School, 180 University Avenue, Newark, NJ, 07102, United States, llei@business.rutgers.edu, Ronald Armstrong, Su Gao

We study the zero-inventory scheduling problem where the supplier's production must be integrated into carrier's shipping schedule. Upon an analysis of the problem properties, we propose a B&B search procedure that optimizes the schedule to maximize the demand to be satisfied subject to delivery time windows, product lifespan, and capacity constraints.

4 - Setting Safety Stocks in Production Systems Subject to Congestion
Reha Uzsoy, Professor, Purdue University, Grissom Hall, 315 N. Grant Street, West Lafayette, IN, 47907, United States, uzsoy@ecn.purdue.edu, Kaijie Zhu, Chung-Yee Lee

The vast majority of exiting inventory models consider replenishment lead times that are unaffected by the quantity ordered. We examine a simple base stock model where the output in a given period is a concave nondecreasing function of the work in process level, and compare its steady-state and transient behavior to those of existing models.

■ MC16

H - 4th Floor, Union Square 10

Worker Cross-training in Production Systems

Cluster: Workforce Flexibility
Invited Session

Chair: Eylem Tekin, Texas A&M University, Department of Industrial Engineering, College Station, TX, United States, eylem@tamu.edu

1 - Hierarchical Worksharing in WIP Constrained Systems
Esma Gel, Assistant Professor, Arizona State University, Department of Industrial Engineering, P.O. Box 5906, Tempe, AZ, 85287, United States, Esma.Gel@asu.edu, Wallace Hopp, Mark van Oyen

We study WIP constrained systems staffed by partially cross-trained workers with hierarchical skill sets. We characterize the optimal worker-to-task assignment policy for small systems and identify the "fixed-before-shared" principle. We draw attention to the impact of WIP levels on the effective implementation of worksharing in such environments.

2 - Chaos and Convergence on Bucket Brigade Assembly Lines
Don Eisenstein, Professor, University of Chicago, don.eisenstein@gsb.uchicago.edu, John Bartholdi, Yun Fong Lim

If properly configured, a bucket brigade assembly line balances itself spontaneously, without management intervention. In new work we show that, if configured improperly, the movement of the workers can be chaotic. Indeed, an observer would find the output from this deterministic system so highly variable as to be indistinguishable from randomness.

3 - Optimal Server Scheduling in Nonpreemptive Repair Environments
Gary Chao, Northwestern University, garychao@iems.northwestern.edu, Seyed Iravani, Vijayalakshmi Krishnamurthy

We consider a finite-population queueing system with heterogeneous classes of customers and a single fully cross-trained server. We characterize the structure of the optimal server scheduling policy, and we derive conditions under which the optimal server scheduling policy is a static priority policy. Furthermore, we show that one of our conditions is general and guarantees the optimality of the static priority policy in both preemptive and nonpreemptive service environments.

4 - Optimal Allocation of Flexible Servers in a Produce-to-Stock Assembly System
Eylem Tekin, Texas A&M University, Department of Industrial Engineering, College Station, TX, United States, eylem@tamu.edu

We consider a Markovian produce-to-stock assembly system with two stages and with flexible servers in the first stage. We investigate how flexible servers should be assigned dynamically to stations in order to minimize the long-run average holding and lost sales costs.

■ MC17

H - 4th Floor, Union Square 11

Joint Panel Discussion New Product/Technology Management: How Organization Science Should Influence New Product Development & Management of Innovation Research

Cluster: New Product Development, Technology Management
Invited Session

Chair: Edward Anderson, University of Texas at Austin Business School, McCombs School of Business, 1 University Station B6500, Austin, TX, 78733, United States, Edward.Anderson@mccombs.utexas.edu

1 - Panel Discussion: Intersection of Organization Science with New Product Development/Mgt. of Innovation
Moderator: Edward Anderson, University of Texas at Austin Business School, McCombs School of Business, 1 University Station B6500, Austin, TX, 78733, United States, Edward.Anderson@mccombs.utexas.edu, Panelists: Linda Argote, Margaret Peteraf, Riitta Katila, Andrew Henderson

The panel of distinguished organization science experts will discuss what they think are under-explored areas of research in the management of technology and product innovation that may be especially fruitful for INFORMS modelers and empiricists to study. Dr. Argote is an expert on learning in organizations; Dr. Henderson on diversification in high-tech environments; Dr. Katila on technology strategy and organizational evolution; and Dr. Peteraf on firm capabilities in dynamic environments.

■ MC18

H - 4th Floor, Union Square 12

Air Traffic Management

Sponsor: Aviation Applications
Sponsored Session

Chair: Michael Ball, Professor, U of Maryland, R H Smith School of Business, College Park, MD, 20742, United States, Mball@rhsmith.umd.edu

1 - Implementing Slot-Exchanges within the Airspace Planning and Collaborative Decision-Making Model
Michael McCrea, Ph.D. Candidate, Grado Department of Industrial and Systems Engineering, Virginia Polytechnic Institute and State University, #5 Staff Village, Radford, VA, 24141, United States, mvmccrea@vt.edu, Hanif Sherali

Vossen and Ball have recently studied slot ownership as formalized by the enhanced GDP, by proposing new ideas on how airlines can improve flight efficiencies through the bartering of slots. We extend this concept by examining the impact of such slot-exchanges on the entire mix of flight paths, while considering sector workloads, airspace conflicts, and overall equity concerns. This is accomplished by modeling this feature within an Airspace Planning and Collaborative Decision-Making Model.

2 - Statistical Analysis of Enroute Flight Speeds
Thomas R. Willemain, Professor, Rensselaer Polytechnic Institute, Decision Science and Engineering Systems, Troy, NY, 12180, United States, willet@rpi.edu, Zhisheng Li

Enroute flight speeds are interesting in their own right and for what they can tell us about terminal area conditions. We report statistical analyses of enroute data including trends and outliers, approximate wind adjustment methods, and linkages to arrival runway loading.

3 - Dynamic and Collaborative Planning of Ground Delay Programs
Avijit Mukherjee, Research Associate, University of Maryland, 3117 A.V. Williams Building, Institute for Systems Research, College Park, MD, 20740, United States, avijit@isrmail.isr.umd.edu, Mark Hansen

We first present a scenario-based optimization model for assigning ground delays to flights in event of a Ground Delay Program. We then present a methodology for allowing airlines to perform flight substitutions and cancellations when slot allocations are scenario-specific. The substitutions are subject to certain non-anticipativity constraints capturing uncertainty in airport capacity. Finally, we present an optimization model that functions analogously to the CDM Compression algorithm.

4 - Assignment-problem-with-side-constraints Models for Offloading Flow Constrained Area
Ming Zhong, University of Maryland, R. H. Smith School of Business, University of Maryland, Collge Park, MD, 20742, United States, mzhong@rhsmith.umd.edu, Michael Ball

The FAA has recently started using Flow Constrained Area (FCA) advisories to address capacity/demand imbalances in the National Airspace System. In this paper, we describe and test bi-criteria assignment-problem-with-side-constraints models to address the FCA demand reduction problem. Included are both a deterministic model and a model with stochastic demand. The model produces system efficiency and user equity tradeoff curves.

■ MC19

H - 4th Floor, Union Square 13

Some Theoretical and Empirical Issues in the Management of Technology

Contributed Session

Chair: Brad Staats, Doctoral Student, Harvard Business School, Sherman Hall 306, Boston, MA, 02163, United States, bstaats@hbs.edu

1 - Inter-functional Collaboration: Effects of Integration Strategy on New Product Development (NPD) Performance
Debasish Mallick, Assistant Professor, University of Minnesota, Carlson School of Management, 321-19th Avenue South #3-150, Minneapolis, MN, 55455, United States, dmallick@csom.umn.edu, Changyue Luo, Roger Schroeder

Although the need for functional integration is well recognized in the New Product Development literature, how to achieve it remains an open question. Using a cross industry survey of 189 new product development projects across six countries, we examine the effects of various integration strategies on new product development performance.

2 - A Valuation Framework For Corporate Non-Commercial E-Portals
Souvik Banerjee, Post Doctoral Fellow, Northwestern University, 633 Clark Street, Evanston, IL, 60208, United States, s-banerjee@kellogg.northwestern.edu, Mark Jeffery

Most corporations maintain e-portals as information conduits to employees and/or customers that do not produce direct revenue. To justify their existence, managers face the problem of transparently communicating its value. We develop a framework for such e-portal valuation. Motivated by real examples, we study two e-portals, one internal and the other external. We derive the value of the former based on its operational effect and the latter based on an intangible asset valuation methodology.

3 - Knowledge Spillovers across Process Innovation Implementations in High-Technology Manufacturing Oper.
Shekhar Jayanthi, Assistant Professor, Rensselaer Polytechnic Institute, 110 8th Street, Troy, NY, 12180, United States, jayans@rpi.edu, Kingshuk Sinha

We investigate knowledge spillovers - essential to realizing the potential of innovations - ensuing from successive process innovation implementations in the context of a high-technology manufacturing plant in the semiconductor industry. Using analysis of longitudinal data, our results provide evidence for spillovers and identify their determinants in both time and frequency domains.

4 - Project Planning for Enterprise Integration
Vamsi Salaka, Graduate Student, Pennsylvania State University, 310 Leonhard Bldg, University Park, PA, 16802, United States, vvs104@psu.edu, Vittal Prabhu

Enterprise Integration (EI) involves the use of a variety of technologies to make people, processes, and information systems work together seamlessly. EI market valued at $7 Billion is strategically important for business to reduce operational cost and improve competitiveness. In this paper we present "Enterprise Integration Project Planning" software that enables the decision makers to compare various EI technologies based on criteria such as cost, reliability, and expected time of completion.

5 - Evidence that IT Matters: Using IT Deployment to Explore the Link Between IT and Firm Performance
Brad Staats, Doctoral Student, Harvard Business School, Sherman Hall 306, Boston, MA, 02163, United States, bstaats@hbs.edu, David Brunner, Marco Iansiti

We sought to unravel the link between IT investment and firm performance by examining deployed IT functionality (ITF). First, ITF appears to be an important link in the IT spend to business value chain. Second, ITF does not seem to be a commodity and has characteristics of a strategic resource. Third, firms with extensive ITF grow faster and on the margin breadth of ITF is more valuable than depth. Lastly, we find that faster growing firms may manage IT more efficiently than slower growers.

■ MC20

H - 4th Floor, Union Square 14

New Developments/Solutions in the Energy Industry

Sponsor: Energy, Natural Resources & the Environment / Energy
Sponsored Session

Chair: Chonawee Supatgiat, IBM Research, Saeumerstrasse 4, Rueschlikon, CH, 8803, Switzerland, CSU@zurich.ibm.com

1 - Fundamentals-Based Modeling and Forecasting in North American Energy Markets
Martin Lin, CitiGroup, CitiGroup, Houston, TX, United States, mlin@coral-energy.com

Energy prices and the issues that influence them can affect not only short term trading markets but also long term investment decisions. To better understand the potential interaction between supply, demand, infrastructure, and prices, numerous techniques are used in modeling and forecasting price movements. Several of these techniques focus on balancing supply and demand while subject to various physical and market constraints. A survey of selected techniques and their application is presented.

2 - Quantitative Analysis in the Commodity Markets: A Practicioners View
Kevin Kindall, Director, Quantitative Analysis, ConocoPhillips, CH 1081 J2, 600 North Dairy Ashford, Houston, TX, 77079, United States, Kevin.G.Kindall@conocophillips.com

Quantitative analysis remains a dynamic part of any trading and marketing organization. It has moved far beyond the mere derivatives pricing problem. We present an overview of the commodity markets, quantitative analysis, and recent events that highlight the mission critical nature of risk management. In particular, we will discuss new problems in commodity risk management, the tools and techniques used by practitioners, and their shortcomings.

3 - Valuation of Natural Gas Storage and Swing Contracts
Pinnamaneni Krishnarao, VP, Citigroup, 1914 Crisfield Dr, Sugarland, TX, 77479, United States, Pinnamaneni.Krishnarao@constellation.com

We discuss models to value contracts in the natural gas industry that provide the users with volume flexibility. We give a simple dynamic programming model to value this flexibility in the context of market price uncertainty and also discuss an interesting property of the optimal value function.

4 - An Empirical Test of Natural Gas Price Distributions
Xianqiao Chen, Analyst, ConocoPhillips, 600 N Dairy Ashford, Houston, TX, 77079, United States, xianqiao.chen@conocophillips.com

The North American energy market has witnessed a structural change in natural gas prices. Understanding the price behavior is important for both market participants and academia studying the energy market. We examine the distributional assumptions for natural gas prices in the current literature and try to answer how realistic those assumptions are. We also investigate the impact of distributional assumptions on such issues as economic capital allocation and Value at Risk estimation.

5 - Designing LNG Tank Size under Supply and Demand Uncertainties
Chonawee Supatgiat, IBM Research, Saeumerstrasse 4, Rueschlikon, CH, 8803, Switzerland, CSU@zurich.ibm.com

Currently 40 LNG terminal projects are being considered by energy companies. One important decision in the LNG terminal design is the design of storage tank capacity. Under the uncertainties of LNG ship arrivals and gas sendout, decision makers must choose a tank size that minimizes the investment and operational cost, while allowing smooth operations. We will show a model for this task.

■ MC21

H - 4th Floor, Union Square 15

Issues in Data Mining

Sponsor: Data Mining
Sponsored Session

Chair: John F. Kros, Assistant Professor of Decision Sciences, East Carolina University, 3206 B Bate Building, Greenville, NC, 28590, United States, krosj@mail.ecu.edu

Co-Chair: Marvin Brown, Assistant Professor of Computer Science, Grambling State University, Grambling, LA, United States, brownm@gram.edu

1 - Data Mining with Imprecise Data
John F. Kros, Assistant Professor of Decision Sciences, East Carolina University, 3206 B Bate Building, Greenville, NC, 28590, United States, krosj@mail.ecu.edu, Marvin Brown, Chien-Hua (Mike Lin)

We intend to test the impact of missing data on the Neural Network Transfer Function type in the Data Mining process. The s-Sigmoid Transfer Function is investigated in this work. Specific imputation methods (case deletion, mean substitution, etc.) for addressing missing data are also compared.

2 - Data Aging and Degradation In Data Warehouses
Hy Sockel, Associate Professor of Management, Youngstown State University, College of Business, Youngstown, OH, United States, hysockel@cc.ysu.edu, Chien-Hua (Mike Lin

This paper analyzes various ways that high quality data can denigrate over time. This is especially true in Data warehouses. The paper first visits what data quality is and how low value poor quality data affects the organization and its information systems on several characteristics: accuracy, consistency, completeness, format, timeliness, reliability, and validity (internal & external). Finally, the paper addresses data mining techniques that can be used to populate historical data with appropriate sensitive values.

3 - Statistical Classification with Limits on Misclassification Rates and a Reserved Judgment Region
Paul Brooks, Piedmont College, P.O. Box 10, Demorest, GA, 30535, United States, pbrooks@piedmont.edu, Eva Lee

In pattern classification, one may wish to limit the degree to which observations with a certain group membership are misclassified as belonging to another group. We describe the performance a two-stage algorithm for deriving classification rules that maximize the probability of correct classification while constraining the confusion of observations between pairs of groups. The consistency of the method is discussed, and performance on simulated and real-world data is presented.

4 - Constructing Multi-source Ensemble Models on Insufficient Data through Semidefinite Programming

Yi Zhang, University of Iowa, Pappajohn Business Bldg., Iowa City, IA, 52242, United States, yi-zhang-2@uiowa.edu, Nick Street

Data scarcity is a common problem for data mining applications. Instead of building predictive models directly on limited amounts of available data, we propose a method that uses the data to select existing models built in closely-related problem domains, through a pruning process that is formulated as a semidefinite program. Computational experiments on a catalog data set are presented.

■ MC22

H - 4th Floor, Union Square 16

Software Development and Piracy

Sponsor: Information Systems
Sponsored Session

Chair: Sumit Sarkar, sumit@utdallas.edu

1 - Managing Piracy: Pricing and Sampling Strategies for Digital Experience Goods in Vertically Segments Markets

Ramnath Chellappa, Emory University, ram@marshall.usc.edu, S. Shivendu

Piracy offers a new (albeit illegal) consumption opportunity for digital goods and thus impacts a market that is not fully informed of a product s fit. This paper develops a two-stage model of piracy for pricing digital experience goods in a segmented market and explores the optimality of sampling as a piracy-mitigating strategy. Our results show that piracy losses are not only more severe for products that don t live up to their hype but also that digital goods sampling is optimal only under narrowly defined circumstances.

2 - How Much Anti-piracy Effort is Too Much? - A Study of the Global Software Industry

Bin Gu, University of Texas, bin.gu@mccombs.utexas.edu, Vijay Mahajan

This paper questions the wisdom of aggressive anti-piracy effort in a competitive environment. We show that piracy attracts the most price sensitive consumers, and by doing so, piracy reduces firms' incentive to engage in self-destructive price competition and can potentially increase industry profit. Using software sales and piracy data from 50 countries, we show anti-piracy effort has indeed hurt the industry profitability.

3 - Optimal Software Development: A Control Theoretic Approach

Yonghua Ji, University of Alberta, yji@ualberta.ca, Vijay Mookerjee, Suresh P. Sethi

We use control theory to optimally construct and debug a system so that the completed system has the fewest number of errors subject to the constraint that N system modules are constructed in a specified duration T. An extended version of the above problem where T is a decision variable is also solved.

■ MC23

H - 4th Floor, Union Square 17

MSOM Fellows 2005

Sponsor: Manufacturing & Service Oper Mgmt
Sponsored Session

Chair: Izak Duenyas, University of Michigan, Stephen M. Ross School of Business, 701 Tappan St., Ann Arbor, MI, 48109-1234, United States, duenyas@umich.edu

1 - Recognizing MSOM Fellows 2005 Research Accomplishments

Izak Duenyas, University of Michigan, Stephen M. Ross School of Business, 701 Tappan St., Ann Arbor, MI, 48109-1234, United States, duenyas@umich.edu

In this session we celebrate the scholarly accomplishments of the winners of the MSOM FELLOW AWARD for 2005.

■ MC24

H - 4th Floor, Union Square 18

Finance and Stochastics

Cluster: Financial Engineering
Invited Session

Chair: Erhan Bayraktar, T.H. Hildebrandt Research Assistant Professor, Department of Mathematics, University of Michigan, 525 East University, Ann Arbor, MI, 48109, United States, erhan@umich.edu

1 - Valuation of Credit Derivatives

Ronnie Sircar, Associate Professor, Operations Research and Financial Engineering, Princeton University, sircar@princeton.edu

We discuss valuation of derivatives contingent on credit events of single and multiple names. In particular, we discuss no-arbitrage and indifference pricing methodologies, and computational and analytic approximations.

2 - Optimal and Nearly-Optimal Strategies for Minimizing the Probability of Ruin in Retirement

Kristen Moore, Assistant Professor, Department of Mathematics,University of Michigan, 2074 East Hall, 530 Church Street, Ann Arbor, MI, 48109-1043, United States, ksmoore@umich.edu, Virginia Young

The increasing risk of poverty in retirement has been well-documented. We study the optimal investment strategy to minimize the probability of lifetime ruin. We derive a free-boundary problem for the ruin probability and optimal strategy, which we solve explicitly for the special case of exponential future lifetime and numerically for more general mortality. In addition, we consider suboptimal strategies that are easier to implement and examine the impact on the ruin probability.

3 - Dependent Events and Changes of Time

Kay Giesecke, Cornell University, 237 Rhodes Hall, Ithaca, NY, 14853, United States, giesecke@orie.cornell.edu, Pascal Tomecek

We propose a dynamic multi-name credit model framework based on time changed point processes. At the center is the sequence of defaults and losses, which we represent as a rescaled marked Poisson process. We construct the time change through the compensator of the default counting process. The dynamics of dependent defaults are governed by the evolution of observable information. We characterize a new class of flexible self-exciting default processes as time-changed Poisson processes.

4 - Financial Equilibria in the Semimartingale Setting

Gordan Zitkovic, Assistant Professor, Department of Mathematics, University of Texas at Austin, Austin, TX, United States, gordanz@austin.utexas.edu

We establish the existence of stochastic financial equilibria giving rise to semimartingale asset prices. These equilibria are expressed in real terms and span complete markets or markets with withdrawal constraints. We deal with random endowment density streams which admit jumps and general time-dependent utility functions on which only regularity conditions are imposed. As an integral part of the proof of the main result, we establish a novel characterization of semimartingale functions.

■ MC25

H - 4th Floor, Union Square 19

Issues in Supply Chain Management I

Contributed Session

Chair: Sricharan Poundarikapuram, University of Wisconsin, Madison, 1513 University Ave, Rm 258, Madison, WI, 53706, United States, poundari@gmail.com

1 - A Two-Stage Newsvendor Problem with a VaR Risk Constraint

Lijun Ma, Ph.D Candidate, The Chinese University of Hong Kong, Room B304,PGH No.5,, The Chinese University of Hong Kong, Hong Kong, Hong Kong, ljma@se.cuhk.edu.hk, Houmin Yan

In the paper,we study a single-period,two-stage risk-constrained supply chain with an information update. The buyer has two replenish opportunities before the demand realization, and he also commits to a VaR risk constraint for the total random profit.We derive his optimal ordering decisions,and analyze the monotonicity behaviors of the critical market signal.For the perfect information case and the useless information case,we investigate the optimal order behavior for the two periods.

2 - Approximation Algorithms for Stochastic Capacity-Expansion Problems

Van Anh Truong, Cornell University, 288 Rhodes Hall, Cornell University, Ithaca, NY, 14853, United States, truong@orie.cornell.edu, Robin Roundy

We develop the first algorithms for stochastic capacity-expansion problems under non-stationary and correlated demands. Our approach is computationally efficient and guaranteed to produce a policy with total expected cost no more than twice that of an optimal policy. We present algorithms of increasing complexity, including those suitable for multiple machines and multiple product types. We introduce as part of our algorithms innovative, dynamic schemes to account for lost sales costs.

3 - Optimal Financial Hedging and Operational Hedging of Risk-averse Firm

Wanshan Zhu, Singapore Management University, 50 Stamford Road, Singapore, Singapore, adamzhu@smu.edu.sg, Roman Kapuscinski

Risk-averse international firm faces exchange rate risk which can be mitigated by either financial or operational hedging. The optimal financial and/or operational hedging is studied in a dynamic and finite production capacity setting. The unique optimal hedging strategies are established theoretically and their relative efficiencies are investigated numerically.

4 - Collaborative Planning in Supply Chains with Limited Information

Sricharan Poundarikapuram, University of Wisconsin, Madison, 1513 University Ave, Rm 258, Madison, WI, 53706, United States, poundari@gmail.com, Raj Veeramani

We develop a distributed multi-attribute decision-making method that can provide optimal solutions during collaborative planning in supply chains without disclosing private local information of the players. Our distributed decision-making framework based on dual decomposition achieves Pareto-optimality without leading to complex cuts using sub-additive duality or disclosure of local information.

5 - The Impact of Mobile Data Communication on Supply Chain Management

Seongchan Yoo, Candidate for Ph.D, Korea University Business School, 1, 5 ga, Anam-dong, Sungbuk-gu, Seoul, 136-701, South Korea, scyoo@korea.ac.kr, Sang Beom Seo, Myung Sup Park

The mobile communication technology would be one of the most appropriate technics for achieving process innovation in the actual business area. This article evaluates effects of introducing a mobile technology to the after service logistics process on electronics firm. The real-world data was collected for this study. The performances, before and after introducing a mobile technology, are examined on operational cost, efficiency and customer service level using a discrete event simulation.

■ MC26

H - 4th Floor, Union Square 20

Forecasting and Prediction in Statistics/Quality Control

Contributed Session

Chair: Shuchun Wang, Student, Georgia Institute of Technology, 324719 Gatech Station, Atlanta, GA, 30332, United States, swang1@isye.gatech.edu

1 - Predicting the Performance of Coordinate Measuring Machines by Probabilistic Method

Ahmad Elshennawy, Professor, University of Central Florida, Industrial Eng. & Management Systems, 4000 Central FL Blvd., Orlando, FL, 32816-2993, United States, ahmade@mail.ucf.edu, Sompoap Talabgaeew

This paper develops an alternative approach for the prediction of uncertainty of coordinate measuring machines (CMMs) using geometric error information in each axis or repeatedly measured coordinates. The model be used for determining an optimal tolerance for the measurement process and provides less costly approach for evaluating CMM performance and has resulted in an improvement in the probability of accepting a measured position compared to previously published models and results.

2 - Bi-criteria Linear Regression: An Alternative to Least Squares Regression

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

Sometimes choice of a criterion is unclear from statistical or other considerations. Under such circumstances, it may be more appropriate to use multiple criteria rather than a single criterion to estimate the parameters in a multiple linear regression model. We illustrate this with an example and outline possible solution procedures.

3 - CUSUM Charts for Finite Horizon Processes

George Nenes, PhD Candidate, Aristotle University, University Campus P.O. Box 461, Thessaloniki, 54124, Greece, gnenes@auth.gr, George Tagaras

We propose a model for monitoring the process mean in short production runs with a CUSUM chart. The model allows the determination of the scheme parameters that minimize the expected quality cost as well as the calculation of several statistical measures of performance. We evaluate the economic effectiveness of the proposed scheme by comparing its expected cost against the expected cost of a CUSUM chart optimized for continuous operation (infinite horizon).

4 - Detecting Lack of Randomness with the Plus-Minus Plot

John Stedl, Professor of Information Systems, Chicago State University, BHS 435, 95th and King Dr., Chicago, IL, 60628, United States, jstedl@csu.edu

Data are frequently time ordered, especially in control charts and regression. I developed a graph, the plus-minus plot, to statistically test the hypothesis of randomness. Points above the median are labeled plus and those below minus. This plus-minus sequence is plotted as a random walk and large deviations from the x-axis indicate a lack of randomness. Critical values are derived and presented for alpha equal to 0.01, 0.05, and 0.10.

5 - Exponential Smoothing with Covariates

Shuchun Wang, Student, Georgia Institute of Technology, 324719 Gatech Station, Atlanta, GA, 30332, United States, swang1@isye.gatech.edu, Kwok Tsui

Exponential smoothing is widely used in industry for forecasting. Empirical studies have shown that accuracy of forecasting can be improved by integrating judgmental forecasts based on domain knowledge and statistical forecasts based on historical data. While valuable as it is, domain knowledge is typically explored in an informal and subjective way. We propose an exponential smoothing method, in which domain knowledge is represented by influencing covariates.

■ MC27

H - 4th Floor, Union Square 21

Selected Topics in Project Management

Contributed Session

Chair: Margaret M. Wiecek, Clemson University, Department of Mechanical Engineering, 201 Fluor Daniel Building, Box 340921, Clemson, SC, 29634-0921, United States, wmalgor@clemson.edu

1 - The Optimal Project Compression Problem with Time-dependent Payments

Jiamin Wang, Assistant Professor, College of Management, Long Island University, 720 Northern Boulevard, Brookville, NY, 11548, United States, jiamin.wang@liu.edu

We study how to compress activity durations so as to maximize the net profit for a project where the amount of payment received at any key event is a non-increasing stepwise function of the realization time. Models and algorithms are developed for the problem with linear and nonlinear activity time-cost trade-off curves.

2 - Exercising Speed-up Options in Projects with Stochastic Durations

Karolina Glowacka, University of Pittsburgh, 343 Mervis, Pittsburgh, PA, 15260, United States, kaglowacka@katz.pitt.edu, Richard Wendell

Managing projects in an uncertain environment is a difficult problem. One approach to managing the risks is to incorporate contingency plans or options into the project. However, even with such options there is a question of when to exercise them. In this paper we consider optimization methods for exercising speed-up options when task durations are stochastic. We consider both exact and heuristic approaches depending on the problem structure and size.

3 - Project Crashing to Maximize Net-Present Value

Joseph Szmerekovsky, North Dakota State University, Putnam Hall, PO Box 5137, Fargo, United States, Joseph.Szmerekovsky@ndsu.edu

A mathematical model is presented for crashing a project to maximize NPV under a variety of payment programs. The model is solved and used to test how the NPV objective and type of payment program affect the resulting activity and payment schedules compared to the schedules resulting from a traditional PERT/CPM approach.

4 - Scheduling Projects with Stochastic Activity Durations to Maximize EPV

Vera Tilson, PhD Candidate, CWRU, 10900 Euclid Avenue, Cleveland, OH, United States, vxt15@po.cwru.edu, Matthew Sobel

Using Markov Project Network model we examine a dynamic setting, where activities can be delayed as project progresses. We develop algorithms to find optimal and near-optimal adaptive policies under different payoff schemes, consider resource constraints and qualitative scheduling rules.

5 - A Portfolio Selection Problem under Conditions of Uncertainty and Risk

Margaret M. Wiecek, Clemson University, Department of Mechanical Engineering, 201 Fluor Daniel Building, Box 340921, Clemson, SC, 29634-0921, United States, wmalgor@clemson.edu, James Reneke

A portfolio selection problem is modeled as a complex system operating under uncertainty. The system performance is random and evaluated by multiple interacting criteria. A stochastic linearization technique is used to model the performance and provide a functional representation of risk while MCDM helps identify the minimum risk portfolio.

■ MC28

H - 4th Floor, Union Square 22

Topics on Revenue Management

Sponsor: Revenue Management & Pricing
Sponsored Session

Chair: Victor DeMiguel, Assistant Professor, London Business School, Regents Park, London, UK, NW14SA, United Kingdom, AVMiguel@london.edu

Co-Chair: Kristin Fridgeirsdottir, Assistant Professor, London Business School, Regent's Park, London, NW1 4SA, United Kingdom, kfridgeirsdottir@london.edu

1 - A Fluid Model for Dynamic Pricing and Inventory Management under Uncertainty and Competition

Elodie Adida, MIT, 1 Amherst Street, Cambridge, MA, United States, eadida@mit.edu, Georgia Perakis

We present a dynamic pricing and inventory control fluid model for a multi-product capacitated setting with no backorders in an oligopoly market. We introduce demand uncertainty using robust optimization and incorporate competition using a differential game formulation. We illustrate existence of a Nash equilibrium and study a relaxation algorithm of best response. We prove its converges to a normalized Nash equilibrium and discuss insights through numerical results.

2 - A Revenue Management Model with Preference Orders

Tito Homem-de-Mello, tito@northwestern.edu, Lijian Chen

We discuss a revenue management model in which customers can choose among several alternatives for their itineraries. We assume that each customer has a certain preferred order for the alternatives, e.g., based on price or length of trip. We present an optimization model for this problem and describe some characteristics of it. Numerical results are presented to illustrate the approach.

3 - Network Revenue Management with Multistage Stochastic Programming

Nishant Mishra, London Business School, Regents Park, London, NW1 4SA, United Kingdom, nmishra.phd2003@london.edu, Victor DeMiguel

We propose a multistage stochastic programming approach for bid price generation in network RM. We numerically investigate various scenario generation methodologies for the MSP model and compare their performance based on in-sample and out-of-sample stability of the trees generated. Our results indicate that the MSP approach performs better than other existing approaches in the literature, and the trees generated using Monte Carlo sampling techniques are stable.

4 - Stochastic Programming Techniques for Network RM

Kalyan Talluri, Universitat Pompeu Fabra, Department of Economics and Business, Barcelona, 08005, Spain, kalyan.talluri@upf.edu

We present some new ideas and results on generating bid-prices for network RM. Our methods are simulation based and also give a way to calculate tighter upper bounds than the classical perfect-hindsight bound.

■ MC29

H - 4th Floor, Union Square 23

Marketing Issues in e-Business

Sponsor: E-Business
Sponsored Session

Chair: Arvind Rangaswamy, Jonas H. Anchel Professor of Marketing, The Smeal College of Business, Penn State University, The Smeal College of Business, University Park, PA, 16802, United States, arvindr@psu.edu

1 - Diffusion of Internet Services: Does Spatial Proximity of Adopters Still Matter?

Sönke Albers, Professor, Christian-Albrechts-University at Kiel, Institute for Research in Innovation, Westring 425, Kiel, 24098, Germany, albers@bwl.uni-kiel.de, Christian Barrot

Successful products with rapid diffusion are characterized by strong word-of-mouth (WOM) effects indicated by geographical clusters of adopters. Our study provides an empirical assessment of such WOM effects based on customer data of a used car trading website. Covering 20,000 adopters throughout Germany, we analyze spatial diffusion of this service We find spatial clusters indicating that geographical proximity and thereby offline WOM still matters for Internet services.

2 - Re-Examining the Buyer-Supplier Relationship in the Electronic Reverse Auctions Environment

Loay Sehwail, PhD Candidate, Oklahoma State University, 322 Engineering North, Oklahoma State University, Stillwater, ok, 74076, United States, sehwail@hotmail.com, Ricki Ingalls

Electronic reverse auctions are becoming a popular purchasing tool for companies. In reverse auctions buyers usually evaluate suppliers based on the lowest price. But for the last two decades, many academicians and practitioners have been advocating the cooperative buyer-supplier strategic alliances. In this paper, the authors examine how electronic reverse auctions affected the buyer supplier strategic alliance based on the criteria developing by Mohr and Spekman (1994).

3 - The Diffusion of Innovations Through Small-World Networks

Arvind Rangaswamy, Jonas H. Anchel Professor of Marketing, The Smeal College of Business, Penn State University, The Smeal College of Business, University Park, PA, 16802, United States, arvindr@psu.edu, Anant Balakrishnan, Nazrul I. Shaikh

In this research we apply the formalisms of small-world networks to explain and predict the diffusion of innovations. We explore two specific issues: (1) Whether and how we can infer the appropriate small-world networks that correspond to the observed time patterns of diffusion of innovations. (2) What are the optimal marketing strategies for given network topologies under different behavioral assumptions about the communication and adoption behaviors of market participants.

■ MC30

H - 4th Floor, Union Square 24

Tutorial: Mentoring: What We've Learned about Effective Practices through the Design and Development of MentorNet

Sponsor: Women in OR/MS
Sponsored Session

Chair: Carol Muller, MentorNet, cbmuller@mentornet.net

1 - Mentoring: What We've Learned about Effective Practices through the Design and Development of MentorNet

Carol Muller, MentorNet, cbmuller@mentornet.net

Mentoring is an age-old process of intergenerational transfer of and addition to knowledge, widely used in organizations and professional development, as well as being a familiar paradigm in graduate education. Mentoring programs attempt to replicate the processes and benefits of mentoring through structuring mentoring relationships where they would not otherwise exist or are imperfectly realized. E-mentoring brings mentoring practice into the Internet age, recognizing that relationships in the twenty-first century typically rely on multiple forms of communication, but also taking advantage of the unique qualities of electronic communications technologies in support of these informal learning relationships to bridge distances of time, location, and even culture. Mentoring has been identified as a key strategy for increasing women's retention and representation in engineering and science, among other fields. Coupling research about and best practices in mentoring with Internet communications and other information technologies, MentorNet (www.MentorNet.net) offers a large-scale online mentoring network that pairs thousands of women with mentors in scientific and technical fields. The founder and CEO of MentorNet will provide an overview of the research and practical experience in developing and implementing a large-scale e-mentoring program. Topics covered include mentoring terms, definitions, and typology, mentoring program design — successes and failure points, e-mentoring, and findings related to effective practice in all of the above. Demonstration of the infrastructure supporting MentorNet will be available, and an interactive session promises lively Q&A and dialogue.

■ MC31

H - 4th Floor, Union Square 25

Joint Session OR Practice/ Roundtable: Transportation Optimization at Roundtable Companies

Cluster: OR Practice, Roundtable
Invited Session

Chair: Ted Gifford, VP -Engineering&Research, Schneider National Inc, P.O. Box 2545, Green Bay, WI, 54306, United States, giffordt@schneider.com

1 - Real Time Revenue Management in the Truckload Industry
Vishvesh Oza, Lead Engineer, Schneider National Inc, P O Box 2545, Green Bay, WI, 54306, United States, ozav@schneider.com

A big challenge for an asset-based truckload operation is to manage the imbalances in their network of freight flows. By not having a truck in the right place at the right time, the company loses the opportunity to earn profit with its truck. This paper presents a Linear programming based approach that estimates the opportunity cost of having a truck in a location at a future time. This helps evaluate the profitability of the decision to accept/reject a unit of demand (load).

2 - Maintenance and Engineering Applications of OR at AA
Nancy Lillo, American Airlines, Sr Mgr, Operations Research, P O Box 619616, MD 5358, DFW Airport, TX, 75261-9616, United States, nancy.lillo@aa.com

This talk will focus on OR applications in the maintenance and engineering area of the airline. While some of the problems are analogous to manufacturing applications (i.e. inventory control, scheduling) the airline maintenance context presents some unique challenges. This talk will provide an overview of recent and on-going OR efforts at AA, providing a sense of the modeling approach, solution strategy and strategic importance of these problems.

3 - Optimal Distribution of Auction Vehicles (ODAV) System with Genetic Algorithm
Jie Du, Sr Mgr Decision Optimization, Power Information Network, 5435 Corporate Dr, Suite 350, Troy, MI, 48098, United States, jie.du@powerinfonet.com, Mike Jay, Lili Xie, Alejandro Silva

ODAV is a Genetic Algorithm-based distribution system that maximizes net auction revenue by generating vehicle distribution plans from marshalling yards to auctions. Various genetic operators are employed to balance the solution diversity and quick convergence. The decoder technique is used to implement hard constraints. ODAV has been in production for over 3 years to manage more than $2 billion in annual assets. This talk will focus on algorithmic developments as well as an actual case study.

4 - Optimization Tools at Work in Distribution Planning
Tom Cork, Logistics Planning Mgr, Cardinal Health-Medical Products and Services, 1450 Waukegan Road, McGaw Park, IL, 60085, United States, tom.cork@cardinal.com

Medical Products and Services, an unit of Cardinal Health, operates a distribution network delivering medical supplies to healthcare providers. A small group of practitioners have applied optimization tools in support of this business for 20+ years. This presentation will describe the project approaches that we have found do work in applying optimization tools in a corporate setting.

■ MC32

H - 6th Floor, Lombard

UPS-SOLA Dissertation Awards

Sponsor: Location Analysis
Sponsored Session

Chair: Michael Johnson, Associate Professor, Carnegie Mellon University, Heinz School, 5000 Forbes Ave., Pittsburgh, PA, 15213, United States, johnson2@andrew.cmu.edu

1- UPS-SOLA Dissertation Award: First Place-Semi-Obnoxious Multifacility Location Problems: Models and Methods
Beryl Castello,John Hopkins University, castello@ams.jhu.edu

Presumably, a facility would not be built at all unless it provided a service that some entity found desirable. Conversely, even the most desirable of facilities also exhibit some undesirable characteristics. The fact is, most facilities cannot be classified as being either purely desirable or purely obnoxious. The location literature defines facilities falling between the two extremes as semi-desirable or semi-obnoxious and it is this type of facility that our discussion will address. We will begin by developing a modeling framework for semi-obnoxious multifacility location problems. Next, we will present three approaches for solving certain classes of location problems. The first algorithm identifies a globally optimal solution via interval bisection. The second technique uses set partitioning to identify optimal solutions for a model wherein the facilities must be pushed as far away as possible from any protected points and customers have specified a minimum threshold distance from which to receive service. The third heuristic is a multifacility generalization of a graphics-based set covering algorithm for single facility location.

2- UPS-SOLA Dissertation Award: Location-Inventory Planning Models: Capacity Issues and Solution Algorithms
Leyla Ozsen, Assistant Professor, Purdue University, 315 N. Grant Street, West Lafayette IN 47907, United States, lozsen@ecn.purdue.edu

This dissertation consists of three integrated location/inventory models. The goals of the first two models are to simultaneously determine the number and location of warehouses, the assignment of retailers to the warehouses, the ordering policy and the safety stock levels at the warehouses without exceeding the capacity restrictions at the warehouses. The second model unlike the first one allows the retailers to be sourced by multiple warehouses. The third model is a continuous approximation to the uncapacitated integrated location/inventory model.

3- UPS-SOLA Dissertation Award: A Sequence-Pair and Mixed Integer Programming Based Methodology for the Facility Layout Problem
Qi Liu,qi.liu@capitalone.com
Abstract not available at this time.

■ MC33

H - 6th Floor, Mason

Panel Discussion: Journal Editor's Vision on Challenges and Trends in Quality, Statistics, and Reliability Research

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: Yong Chen, University of Iowa, Mechanical and Industrial Engineering, Iowa City, IA, United States, yongchen@engineering.uiowa.edu

1 - Panel Discussion: Journal Editor's Vision on Challenges and Trends in Quality, Statistics, and Reliability Research
Moderator: Yong Chen, University of Iowa, Mechanical and Industrial Engineering, Iowa City, IA, United States, yongchen@engineering.uiowa.edu, Panelists: Joe H. Sullivan, Wallace Hopp, Randy Sitter, Douglas Montgomery, Susan Albin

Editors of several top journals on quality, statistics, and reliability (QSR) areas are invited for this panel discussion. The editors will briefly present the basic information and their visions on the future of their journal, including promising topics and how the QSR researchers can contribute to the journal better. A Q&A session and open discussion with the audience on challenges and trends in QSR research will be held following the editors' presentations.

■ MC34

H - 6th Floor, Powell

Degradation Modeling and Replacement Policies

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: Nagi Gebraeel, Assistant Professor, University of Iowa, Mechanical and Industrial Engineering, 2407 Seamans Center, Iowa City, IA, 52242, United States, nagi-gebraeel@uiowa.edu

1 - Periodic Replacement and Service Rate Control of Degrading Queues
Jeffrey Kharoufeh, Assistant Professor, Air Force Inst of Technology, Dept of Operational Sciences, 2950 Hobson Way, Wright Patterson AFB, OH, 45433-7765, United States, Jeffrey.Kharoufeh@afit.edu, Mark Abramson

We consider the simultaneous selection of a periodic, group replacement policy and optimal service rates for a multi-server queue subject to degradation. We derive Laplace transform expressions for the objective function, necessitating a numerical search procedure in conjunction with numerical Laplace transform inversion. The results are illustrated through two examples.

2 - Resource Allocation for Improving System Availability Estimates
Mehmet Miman, Graduate Student, University of Arkansas, Department of Industrial Engineering, Fayetteville, AR, 72701, United States, epohl@engr.uark.edu, Edward Pohl

Availability is often used as the key performance measure for a repairable system. The uncertainty in the availability estimate can be as important as the estimate itself. In this presentation we suggest a methodology for allocating test resources for the next test among the system's components to reduce the uncertainty of the system availability estimate efficiently. The methodology is a heuristic approach that is dependent on the estimate of the next observation for each component.

3 - Predicting Remaining Useful Life Using Proportional Hazards Model and Logistic Regression Model
Haitao Liao, Assistant Professor, Wichita State University, haitaol@uwm.edu

This paper provides an approach for modeling multiple degradation features from sensor signals. To evaluate the reliability of a component over time, proportional hazards model and logistic regression model are presented, which map the degradation features into a reliability index. The integrated models enable us to make a timely maintenance decision. The effectiveness of the two models are compared for various cases.

4 - Sensory Based Prognostic Models for Evaluating Residual Life Distributions of Degraded Components

Nagi Gebraeel, Assistant Professor, University of Iowa, Mechanical and Industrial Engineering, 2407 Seamans Center, Iowa City, IA, 52242, United States, nagi-gebraeel@uiowa.edu

Research on interpreting and utilizing sensory data streams in making critical decisions stands to provide significant advancements across a wide range of application domains. This work develops prognostic models that utilize degradation-based sensory information to estimate residual life distributions of partially degraded components in real time. These distributions are used to compute optimal component replacement times, which are updated as the degradation process evolves.

■ MC35

H - 6th Floor, Sutter

Numerical Optimization and Applications

Sponsor: Minority Issues
Sponsored Session

Chair: Leticia Velazquez, University of Texas at El Paso, 500 W. University Ae., El Paso, TX, 79968-0514, United States, leti@math.utep.edu

1 - A Trust-Region Interior-Point Method for Solving Nonlinear Programs

Maria Cristina Villalobos, Assistant Professor, University of Texas-Pan American, 1201 W. University Drive, Edinburg, TX, 78539, United States, mcvilla@utpa.edu, Yin Zhang

Close to a solution of the nonlinear program, the Jacobian associated with the Karush-Kuhn-Tucker (KKT) system is nonsingular under standard assumptions. However, for points far from a solution of the problem, the Jacobian may be singular. We propose a method that obtains a least-squares solution to the linearized perturbed KKT conditions. As a merit function, we use the Euclidean norm of the KKT conditions and implement trust-region and interior-point methods to solve the nonlinear program.

2 - Modifications of the Lee-Seung Algorithm for Nonnegative Matrix Factorization

Ed Gonzalez, Rice University, Dept. of Computational and Applied Math, 6100 S. Main Street - MS134, Houston, TX, United States, efg@caam.rice.edu, Yin Zhang

Approximate nonnegative matrix factorization is an emerging technique with a wide spectrum of potential applications in data analysis. Currently, the most-used algorithms for this problem are those proposed by Lee and Seung. In this paper we present a variation of one of the Lee-Seung algorithms with a notably improved performance. We also show that algorithms of this type do not necessarily converge to local minima.

3 - Optimization under Uncertainty for Engineering Design Problems

Monica Martinez-Canales, Senior Member of the Technical Staff, Sandia National Laboratories, MS 9159, P.O. Box 969, Livermore, CA, 94551-0969, United States, mmarti7@sandia.gov, Laura Swiler, Timothy Trucano, Patricia Hough

Because conventional modeling and simulation approaches are cost-prohibitive, very few attempts have been made to computationally optimize engineering designs. In this talk, we will explore an optimization under uncertainty approach that uses design exploration, uncertainty quantification, and surrogate models in a multi-fidelity Bayesian hierarchy resulting in computationally-feasible and robust engineering designs.

■ MC36

H - 6th Floor, Taylor

Simulation Optimization

Sponsor: Simulation
Sponsored Session

Chair: Wai Kin Chan, Assistant Professor, Rensselaer Polytechnic Institute, Decision Sciences and Eng. Systems, Troy, NY, 12180, United States, chanw@rpi.edu

1 - Optimal Computing Budget Allocation and Efficient Design Generation for Simulation Optimization

Chun-Hung Chen, Associate Professor, George Mason University, 4400 University Drive, MS 4A6, Fairfax, VA, 22030, United States, cchen9@gmu.edu, Mark Brantley

Optimal Computing Budget Allocation (OCBA) is a technique which can optimally allocate a given simulation budget when a number of alternatives are being simulated for comparison. Combining OCBA with efficient design alternative generation techniques, we develop effective methods for simulation optimization problems.

2 - A Model Reference Adaptive Search Algorithm for Stochastic Global Optimization

Jiaqiao Hu, University of Maryland, jqhu@Glue.umd.edu, Steven Marcus, Michael Fu

We propose a new stochastic optimization algorithm called Stochastic Model Reference Adaptive Search (SMRAS) which is provably convergent to a global optimum. We report preliminary numerical studies using the algorithm.

3 - Retrospective Approximation Algorithms for Multidimensional Stochastic Root-Finding

Raghu Pasupathy, Ph.D., Purdue University, Industrial Engineering, West Lafayette, IN, United States, pasupath@purdue.edu, Bruce Schmeiser

The Stochastic Root-Finding Problem (SRFP) is that of solving a non-linear system of equations when the functions in the system are observable through an oracle. Retrospective Approximation (RA) algorithms solve SRFPs by generating and solving a sequence of sample-path problems. We present Bounding RA algorithms, a sub-family of RA, that solve sample-path problems using bounding polytopes. We discuss convergence, present numerical results and recommend strategies for good performance.

4 - Perturbation Analysis For Stochastic Discrete Event Systems Using Mathematical Programming

Wai Kin Chan, Assistant Professor, Rensselaer Polytechnic Institute, Decision Sciences and Eng. Systems, Troy, NY, 12180, United States, chanw@rpi.edu, Lee Schruben

We provide mathematical programming representations for discrete event systems and establish a framework for estimating Infinitesimal perturbation analysis (IPA) estimators from the shadow prices of the math programs. For finite perturbation analysis, we use this approach to formulate the optimal server selection problem as a set of linear programs and find the optimal solution by comparing the solutions of among these linear programs.

■ MC37

H - 6th Floor, Van Ness

Extensions of Inventory Models

Sponsor: Applied Probability
Sponsored Session

Chair: Eugene Feinberg, Professor, SUNY Stony Brook, Dept of Applied Math and Statistics, Stony Brook, NY, 11794-3775, United States, efeinberg@notes.cc.sunysb.edu

1 - Optimal Inventory Release Using Online Auctions

Fredrik Odegaard, PhD student, Sauder School of Business, UBC, 2053 Main Mall, Vancouver, BC, V6T 1Z2, Canada, odegaard@sauder.ubc.ca, Martin L. Puterman

Consider the problem of selling a fixed inventory over a finite time horizon using a sequence of single item online auctions. We assume the auctions may overlap each other and that the price dynamics per auction will depend on the number of ongoing auctions. Two constraining factors we consider are positive holding cost and discounted revenue. We study the above problem by modeling it as a stochastic control problem and derive structural properties on the optimal release policy.

2 - Extensions of the Stochastic Cash Balance Problem

Eugene Feinberg, Professor, SUNY Stony Brook, Dept of Applied Math and Statistics, Stony Brook, NY, 11794-3775, United States, efeinberg@notes.cc.sunysb.edu, Mark E. Lewis

We consider the stochastic cash balance problem with fixed costs and generally distributed demand. We show that the results established by Chen and Simchi-Levi for finite-horizon problems continue to hold under both the infinite horizon expected discounted cost and average cost criteria. We also discuss several new results of general state and action space Markov decision process theory under the average cost criterion. These results are useful for other extensions of general inventory problems.

3 - Dynamic Pricing in an Order Driven Market with Random Demand

Mark E. Lewis, Associate Professor, Cornell University, School of ORIE, 206 Rhodes Hall, Ithaca, NY, 14853, United States, melewis@orie.cornell.edu, Damon Williams, Jussi Keppo

Consider an investor in an order driven market trading a single commodity. Periodic demand is seen for both purchases and sales based on the prices set by the investor for each transaction. Holding costs are accrued and excess demand backordered. We show through the convexity of the value functions a dynamic pricing policy can be obtained and verify its usefulness via a numerical study.

4 - Optimal Policy for Multi-Echelon System with Periodic Batching and Batch Ordering

Xiuli Chao, Professor, NCSU, Operations Research, Raleigh, NC, 27695, United States, xchao@eos.ncsu.edu, Shaohui Zheng, Sean Xiang Zhou

We consider a single-item periodic-review multi-echelon serial inventory system with periodic batching and batch ordering. For each stage, there is a fixed base ordering quantity, and reorder intervals have to be an integer multipel of a base ordering interval. We characterize the optimal control policy and present the computational algorithm for the optimal reorder points.

■ MC38

R - 2nd Floor, Corintia

Joint Session Optimization/ Computing: Nonlinear and Global Optimization with Applications

Sponsor: Optimization/ Global Optimization, INFORMS Computing Society
Sponsored Session

Chair: Oleg Prokopyev, University of Florida, 303 Weil Hall, P.O. Box 116595, Gainesville, FL, 32601, United States, oap4ripe@ufl.edu

1 - A Novel and Effective Integer Optimization Approach for the NSF Panel Assignment Problem

Christodoulos Floudas, Professor, Princeton University, Department of Chemical Engineering, Princeton, NJ, 08544, United States, floudas@titan.princeton.edu, Stacy Janak, Triantafillos Mountziaris, Maria Burka, Martin Taylor

The NSF panel assignment problem involves selecting an assignment of three or four reviewers to each proposal in a panel so as to optimize the ranking criteria for each reviewer on each proposal while ensuring that each reviewer is assigned to approximately the same number of proposals. This multi-resource and preference-constrained generalized assignment problem is formulated as an integer linear programming problem and can be solved to optimality for several real case studies.

2 - Exchange Market Equilibria with Leontief's Utility

Yinyu Ye, Stanford University, yinyu-ye@stanford.edu

We apply the linear programming analytic center model to show that the solution to a pairing class of Arrow-Debreu exchange market equilibrium problems with Leontief's utility can be reduced to solving a linear complementarity problem, and the equilibrium price is the Perron-Frobenius eigen-vector of a scaled Leontief utility matrix. Consequently, there always exists a rational Arrow-Debreu price—the entries of the price vector are rational numbers.

3 - A New Active Set Algorithm for Large-scale Box Constrained Optimization

Hongchao Zhang, Dr., Math Dept. of UFL, 358 little hall, P.O. Box 118105, Dept. of Math, UFL, Gainesville, FL, 32611-8105, United States, hzhang@math.ufl.edu, William Hager

An algorithm CGCBB is developed for box constrained optimization which combines the projected nonmonotone cyclic Barzilai-Borwein method to move between active constraints and CG_DESCENT to explore the different faces of the feasible region. Global convergence is established,without assuming strict complementarity.When the iterates converge to a stationary point satisfying the SSOS conditions, the algorithm reduces to the CG_DESCENT scheme. Extensive numerical results are provided.

4 - On Fractional 0—1 Programming Problems with Related Applications

Oleg Prokopyev, University of Florida, 303 Weil Hall, P.O. Box 116595, Gainesville, FL, 32601, United States, oap4ripe@ufl.edu, Stanislav Busygin, Panos Pardalos

In this talk we consider single- and multiple-ratio fractional 0-1 programming problems with related applications. We present new results on complexity of these problems including uniqueness, approximability and local search. Linear mixed 0-1 reformulations as well as some simple heuristics approaches are also investigated. In addition, we discuss applications of fractional 0—1 programming in graph theory and data mining. Computational results on microarray data mining problems are reported.

■ MC39

R - 3rd Floor, Aragon

Approximation of Stochastic Programming: A Robust Optimization Perspective

Cluster: Linear/Nonlinear Programming
Invited Session

Chair: Melvyn Sim, Asst Professor, National University of Singapore, BIZ 2, 1 Business link, Singapore, S, 117592, Singapore, dscsimm@nus.edu.sg

1 - A Robust Perspective of Stochastic Programming

Peng Sun, Asst Professsor, Duke, peng.sun@duke.edu, Xin Chen, Melvyn Sim

We introduce an approach for constructing uncertainty sets for robust optimization using new deviation measures of random variables known as the forward and backward deviations. We also propose a tractable robust optimization approach for obtaining approximate solutions to stochastic linear optimization problems with fixed recourse and chance constraints. Finally, we show an application of the framework for solving a project management problem with uncertain activity completion time.

2 - Convex Approximation of Stochastic Progaming under Semi-complete Recourse. Part I.

Melvyn Sim, Asst Professor, National University of Singapore, BIZ 2, 1 Business link, Singapore, S, 117592, Singapore, dscsimm@nus.edu.sg, Xin Chen, Peng Sun, Jiawei Zhang

We propose methods for approximating multistage stochastic programs under semi-complete recourse, which is a less restrictive condition compared to complete recourse. Under the conditions of semi-complete recourse, we show that linear decision rule can be inadequte and propose a modified linear decision rule. Our proposed model is computational friendly in the form of SOCP, which could be solved efficiently both in theory and in practice.

3 - Convex Approximation of Stochastic Progaming under Semi-complete Recourse. Part II.

Xin Chen, Asst Professor, UIUC, xinchen@uiuc.edu, Melvyn Sim, Peng Sun, Jiawei Zhang

In part II of the work, we focus on refinement methods for imporving solutions to the stochastic models. We can achieve better solutions using Beinstein's approximation on risk constraints. As a refinement of linear decision rules, we introduce a "segregated decision rule" that could also improve the approximation. An attractive aspect of our proposal is the scalability to multistage stochastic programs.

4 - A Robust Optimization Framework for Analyzing Distribution Systems with Transshipment

Mabel Chou, Asst Professor, National University of Singapore, National University of Singapore, Singapore, Si, Singapore, bizchoum@nus.edu.sg, Melvyn Sim, Rick So

We devise a robust optimization framework to analyze a two-echelon distribution system with transshipments in order to fulfill demands at all retailers with high probability. We show that the system under the robust optimization framework is analytically tractable. Our results help to provide useful information for management to evaluate whether the potential benefits from transshipments would outweigh the required investments.

■ MC40

R - 3rd Floor, Barcelona I

Network Design

Sponsor: Optimization/ Network Optimization
Sponsored Session

Chair: Chaitanya Swamy, Caltech, 1200 E. California Blvd., Pasadena, CA, 91125, cswamy@ist.caltech.edu

1 - On Non-Uniform Multicommodity Buy-at-Bulk Network Design

Adriana Karagiozova, Princeton University, 35 Olden Street, Princeton, NJ, 08540, karagioz@cs.princeton.edu, Moses Charikar

In the multicommodity buy-at-bulk network design we need to buy capacity on edges of a network so that the demands between a given set of source-sink pairs are satisfied. The goal is to minimize the cost of such a solution. Each edge has its own concave cost function (thus there are economies of scale). We present the first non-trivial approximation algorithm for the general case - a simple randomized greedy algorithm witha guarantee of exp(O(sqrt(log(n)log(log(n))))), where n is the demand.

2 - Design of Networks with Strategic Agents

Elliot Anshelevich, Cornell University, 5139 Upson Hall, Ithaca, NY, 14850, eanshel@cs.cornell.edu, Tim Roughgarden, Anirban Dasgupta, Eva Tardos, Bruce Shepherd, Gordon Wilfong, Jon Kleinberg, Tom Wexler

Network design is a fundamental problem for which it is important to understand the effects of strategic behavior. We consider a network connection game where players seek to connect pairs of nodes as cheaply as possible. We analyze this game using measures such as the price of stability, and show how to construct cheap stable solutions. We also discuss how these tools can be used to formulate and analyze a model for the role of strategic behavior in inter-domain routing on the Internet.

3 - Finding 2-connected Subgraphs
Prabhakar Gubbala, University of Texas at Dallas, Computer Science Department, Richardson, TX, 75083-0688, prabha@utdallas.edu, Balaji Raghavachari

The minimum cardinality 2-connected spanning subgraph problem is considered An approximation algorithm with a performance ratio of 9/7 is presented. This improves the previous best ratio of 4/3 for the problem. An approximation algorithm with a performance ratio of 5/4 in graphs with a minimum-degree of three at every node is also presented. This class includes all 3-connected graphs.

4 - Network Deisgn for Information Networks
Chaitanya Swamy, Caltech, 1200 E. California Blvd., Pasadena, CA, 91125, cswamy@ist.caltech.edu, Ara Hayrapetyan, Eva Tardos

We consider network design problems from the perspective of information aggregation and design approximation algorithms. Whereas in traditional network design, the cost of routing flow for a set of users is a function of simply the total demand of that set of users, we capture the information flow due to a set of users, allowing for information aggregation, by letting the cost function be a submodular set function. This allows us to express much more complex relations between users, and models economies of scale in the cost of aggregation.

■ MC41

R - 3rd Floor, Barcelona II

Strong Formulations for Mixed Integer Programs

Sponsor: Optimization/ Integer Programming
Sponsored Session

Chair: Ismael de Farias, Assistant Professor, University at Buffalo, SUNY, 403 Bell Hall, United States, defarias@buffalo.edu

1 - Recent Progress in Lift-and-Project
Anureet Saxena, Carnegie Mellon University, Tepper School of Business, Carnegie Mellon University, Pittsburgh, PA, 15213, United States, anureet@cmu.edu, Egon Balas

Lift-and-project cuts for mixed-integer programming are obtained from a two-term disjunction by optimizing the disjunctive multipliers in each term and then applying monoidal strenghtening. We examine ways of simultaneously optimizing the disjunctive multipliers and the monoidal strengthening coefficients.

2 - Strong Formulation Heuristics for Big Bucket Production Planning Problems
Kerem Akartunali, University of Wisconsin-Madison, Department of Industrial and Systems Eng, University of Wisconsin-Madison, Madison, WI, 53706, United States, kerema@cae.wisc.edu, Andrew Miller

We discuss a heuristic framework for lot-sizing problems in which multiple product categories or items share a limited capacity, and which often involve multiple machines, a complex bill-of-material structure, and other complicating factors. Our heuristics use strong formulations and are competitive with the best known methods in terms of both the feasible solutions and lower bounds produced.

3 - A Polyhedral Study of the Optimal Organ Allocation Region Design Problem
Nan Kong, Assistant Professor, University of South Florida, 4202 E. Fowler Ave, ENB118, Tampa, FL, 33620, United States, kong@eng.usf.edu, Brady Hunsaker, Andrew Schaefer

In our branch-and-price approach to the optimal organ allocation region design problem, the pricing problem is an NP-hard MIP, which is identified as the bottleneck of the branch-and-price approach. We study the polyhedral structure of the pricing problem and consider cutting planes to improve solution efficiency.

4 - A Branch-and-Cut Algorithm Without 0-1 Variables for Discontinuous Piecewise Linear Optimization
Hongxia Zhao, SUNY BUffalo, Dept. if Ind. Eng., 333 Bell Hall, Buffalo, NY, 14260, United States, zhongxia@buffalo.edu, Ismael de Farias, Ming Zhao

It is well known that SOS2 gives a state-of-the-art approach for piecewise linear optimization when the piecewise linear functions are continuous. We give an extension of the concept of SOS2 for the case of discontinuous piecewise linear functions and show that the model without 0-1 variables is more robust than the MIP model. We also give valid inequalities for the extended SOS2 model, and computational results that show its superiority over the conventional MIP approach.

■ MC42

R - 4th Floor, Parc Ballroom I

Stochastic Programming with Financial Applications II

Sponsor: Optimization/ Stochastic Programming
Sponsored Session

Chair: Gautam Mitra, Professor, Brunel University, Middlesex, Uxbridge, UB8 3PH, United Kingdom, Gautam.Mitra@brunel.ac.uk

1 - Rational Risk Measures: A New Approach to Risk Management in Financial Optimization
Chanaka Edirisinghe, Professor, University of Tennessee, College of Business, Management Science, Knoxville, TN, 37996, United States, chanaka@utk.edu, Maksym Bychkov

A new concept for capturing investor's risk preference is developed based on the so-called "Collection of Rational Level Sets" (RLS). Based on this concept, a new class of risk measures is obtained, termed Rational Risk Measures (RRM), for financial optimization. The advantages of RRM over the well-known coherent risk measures are discussed. Examples of rational risk measures that are not coherent but useful in financial optimization are given.

2 - Mortgage Loan Portfolio Optimization Using Multi Stage Stochastic Programming
Jens Clausen, Prof., Technical university of Denmark, IMM, Bldg. 305, Lyngby, DK, 2800, Denmark, jc@imm.dtu.dk, Kourosh Marjani Rasmussen

We consider the Danish mortgage loan system and propose several models to reflect the choices of a mortgagor. The models are formulated as multi stage stochastic integer programs, which are difficult to solve for more than 10 stages. Scenario reduction and LP relaxation are used to obtain near optimal solutions for large problem instances. The results are that the Danish mortgagor should hold a more diversified portfolio, and that he should rebalance this more frequently than current practice.

■ MC43

R - 4th Floor, Parc Ballroom II

Standards for Optimization Problem Representation

Sponsor: INFORMS Computing Society/ Optimization Services and Open Source Software
Sponsored Session

Chair: Robert Fourer, Professor, Northwestern University, Dept of Industrial Eng & Mgmnt Sciences, 2145 Sheridan Road, Evanston, IL, 60208-3119, United States, 4er@iems.northwestern.edu

1 - OSiL: Optimization Services Instance Language
Jun Ma, Northwestern University, Tech. C231, Sheridan Road, Evanston, IL, 60208, United States, maj@northwestern.edu, Robert Fourer, Kipp Martin

In the area of mathematical optimization, it is becoming increasingly common to separate modeling languages from optimization solvers. This makes it critical to have an open standard for exchanging model instances. We present OSiL (Optimization Services Instance Language), an XML Schema for representing optimization instances. We also describe open-source Java libraries that simplify the exchange of problem-instance and solution information between modeling languages and solvers.

2 - OSiL - Stochastic Extensions
Horand I. Gassmann, Professor, Dalhousie University, School of Business Administration, Halifax, NS, B3H 1Z5, Canada, horand.gassmann@dal.ca, Jun Ma, Kipp Martin, Robert Fourer

This talk presents extensions to an XML schema to allow instance representations of a wide variety of stochastic programs. Included are multistage recourse problems with discrete and continuous distributions, different risk measures (such as VaR and CVaR), robust optimization models, etc. Also included are various means of modelling stochastic processes, including ARMA(p,q) processes.

3 - OptML: A New XML Standard for Representing Optimization Model Instances
Bjarni Kristjansson, Maximal Software, Suite 700, 2111 Wilson Boulevard, Arlington, VA, 22201, United States, bjarni@maximalsoftware.com

With optimization projects, there is often need to store model instances, e.g., for building model libraries, providing technical support, and optimization services over the Internet. With OptML, we propose a new portable, non-solver specific standard, based on XML, which supports multiple problem types, linear, mixed-integer, quadratic, nonlinear, and stochastic.

4 - Panel Discussion: Standards for Optimization Problem Instances
Moderator: Robert Fourer, Professor, Northwestern University, Dept of Industrial Eng & Mgmnt Sciences, 2145 Sheridan Road, Evanston, IL, 60208-3119, United States, 4er@iems.northwestern.edu, Panelists: Kipp Martin, Horand I. Gassmann, Bjarni Kristjansson, Ted Ralphs, Matthew Saltzman

Speakers from this and the preceding session will discuss standards issues that have been (or should have been) raised by the presentations.

■ MC44

R - 4th Floor, Parc Ballroom III

IT Modeling

Sponsor: INFORMS Computing Society
Sponsored Session

Chair: Juan Feng, Assistant Professor, University of Florida, 360 Stuz Hall, P.O. Box 117169, Gainesville, FL, 32611, United States, janefeng@ufl.edu

1 - Marginal Costs, Complementarity, and Product Bundling
Bing Jing, Assistant Professor of Information Systems, Stern School of Business, New York University, 44 West 4th Street, KMC 8-80, New York City, NY, 10012, United States, bjing@stern.nyu.edu

In an Adams and Yellen (1976) model, I study bundling of complementary goods with relatively low marginal costs. The results include: (1) pure bundling may dominate mixed bundling; (2) if the optimal price of either good under unbundled selling is below the synergy between the two goods, then bundling dominates unbundled selling; and (3) for selling a basic good and a supplement, both unbundled sales and mixed bundling are optimal.

2 - Cooperation in a Wireless Ad Hoc Network: A Game Perspective
Subhajyoti Bandyopadhyay, Assistant Professor, University of Florida, 364 Stuzin Hall, Gainesville, FL, 32611, United States, shubho.bandyopadhyay@cba.ufl.edu, Seema Bandyopadhyay

To enable proper functioning of wireless ad hoc networks, all nodes are expected to cooperate in forwarding each other's packets. Since the nodes are energy-constrained, the best response is always not to cooperate. We show that with a suitable punishment mechanism, the nodes can be deterred from selfish behavior, and cooperation can emerge as best response. But generosity by other nodes cannot be part of a credible deterrent mechanism. We test these results empirically in simulated testbeds.

3 - A Utility Theoretic Approach to Determining Optimal Wait Times in Distributed Information Retrieval
Kartik Hosanagar, The Wharton School, Penn, 3730 Walnut St, Suite 500, Philadelphia,PA, 19104, United States, kartikh@wharton.upenn.edu

Distributed IR systems query a large number of IR servers, merge the retrieved results and display them to users. In this paper, we apply utility theory to formulate the broker's decision problem of how long to wait for responses. The problem is a stochastic nonlinear program. We use Monte Carlo simulations to demonstrate how the optimal wait time may be determined in the context of a comparison shopping engine that queries multiple store websites for price and product information.

■ MC45

R - 4th Floor, Raphael

Routing and Management of Hazardous Materials

Sponsor: Transportation Science & Logistics
Sponsored Session

Chair: Elise Miller-Hooks, University of Maryland, Department of Civil and Env. Eng., 1173 Glenn Martin Hall, College Park, MD, 20742, United States, elisemh@umd.edu

1 - Design of a Hospital Waste Management Network in the Department of Boyacà (Colombia)
Andres Medaglia, Assistant Professor, Universidad de los Andes, Departamento de Ingenieria Industrial, Calle 19 # 1 - 37 E, Bogota D.C., BO, Colombia, amedagli@uniandes.edu.co, Juan G. Villegas, Diana Rodriguez-Coca

The Department (state) of Boyacà (Colombia) generates approximately 5 tons of hospital waste per day. About 90% of this waste is disposed in open or shallow landfills, possibly causing a public health hazard. We propose a waste management network configuration based on location and routing models that uses a planned facility in Bogotà with excess capacity.

2 - Routing Multiple Hazmat with Equity Constraints
Rodrigo Garrido, Associate Professor, Pontificia Universidad Catolica de Chile, Casilla 306, Cod 105, Santiago 22, Santiago, RM, Chile, rgarrido@ing.puc.cl

Most of the literature on hazmat routing focuses on the selection of a single path which minimizes a measure of a potential harm. In practice, hazmat are periodically transported and hence, if a single route were chosen, its surrounding population would be exposed to an unfairly high risk. We developed a model that incorporates equity in the spatial distribution of risk, when multiple hazmat have to be routed. A linear fractional programming model was developed and applied in Santiago, Chile

3 - An Analytical Approach to Railroad Transportation of Mixed Freight
Manish Verma, Memorial University, mverma@mun.ca, Vedat Verter, Michel Gendreau

We present a bi-criteria tactical planning model for the transportation of hazardous materials and regular freight in a railroad network. The risk objective is an application of our earlier work and together with the cost objective captures the intricacies of railroad operations. Memetic Algorithm based solution methodology and results of computational experiments will be presented.

4 - Transportation Fleet Planning for Yucca Mountain
Linda Nozick, Cornell University, Ithaca, NY, 14853, United States, lkn3@cornell.edu, Katherine Jones, Dean Jones, Orr Bernstein, Julie Lloyd, Mark Turnquist

The Department of Energy is in the process of attempting to establish a geologic repository for spent nuclear fuel and high-level radioactive waste at Yucca Mountain, Nevada. This talk describes an optimization model for investment planning in transportation equipment to support the movement of these materials to Yucca Mountain.

5 - Routing Hazmat under Real-time Weather and Travel Information
Minseok Kim, Graduate student, University of Maryland, Dept. of Civil & Environmental Engr., 1173 Glenn Martin Hall, College Park, MD, 20742, United States, minseok@umd.edu, Elise Miller-Hooks

This paper addresses the problem of updating routing instructions for the transport of hazardous materials given real-time road weather and traffic information. A heuristic is proposed that explicitly considers the inherent multiobjective and dynamic nature of the problem and the need to produce updated instructions on-line. It is tested on the Washington-Baltimore network, where real-time data are received in a GIS environment. Solutions are compared to the a posteriori Pareto-optimal paths.

■ MC46

R - 4th Floor, Rubens

Urban Transportation Planning Models VII: Fleet and Location Responses to Network Congestion

Sponsor: Transportation Science & Logistics
Sponsored Session

Chair: Laurie Garrow, Assistant Professor, Georgia Institute of Technology, School of Civil & Environmental Engr., 790 Atlantic Drive, Atlanta, GA, 30332-0355, United States, Laurie.Garrow@ce.gatech.edu

1 - Applications of a Transit Assignment Model in Congested Networks
Michael Florian, Professor, University of Montreal, Montreal, QC, H3C 3J7, Canada, mike@crt.umontreal.ca, Shuguang He

In cities of the developing world the public transit services carry most of the urban trips. The congestion in mass transit services such as regional trains is very high. A transit assignment model and algorithm which satisfies the capacity constraints is applied to three large cities. Intersting results are reported in this presentation.

2 - Decentralization of a Post Company
Hamid Pourmohammadi, Assistant Professor, California State University, Dominguez Hills, 1000 East Victoria St., SBS C310, Carson, CA, 90278, United States, hamid@csudh.edu

Postal Services in Iran are carried out by a central organization, which is located in the capital. In this study we employed MILP to decentralize the main company, based on distances among major cities. The outcome is a number of postal companies that each covers several provinces and works independently.

3 - Revisiting Arriving on Time Problem
Yueyue Fan, Assistant Professor, University of California-Davis, Dept. of Civil and Environmental Eng., Engr. III, Room 2001, Davis, CA, 95616, United States, yyfan@ucdavis.edu, Yu Nie

Recently, a dynamic programming formulation for the stochastic on-time arrival (SOTA) problem was proposed. This paper includes further study on the convergence properties of the successive approximation sequence for solving the SOTA problem, an extension of the SOTA formulation to problems considering dependence between link times over adjacent links, and discussion on the connection between SOTA and shortest path problems.

■ MC47

R - 4th Floor, Michelangelo

Auctions in Transportation

Sponsor: Transportation Science & Logistics
Sponsored Session

Chair: Amelia Regan, University of California, Irvine, Institute of Transportation Studies, Computer Science and Civil Engineering, Irvine, CA, United States, aregan@uci.edu

1 - Transportation Procurement Based on Auctions
Gultekin Kuyzu, GA Tech, Ferst Dr, Atlanta, GA, 30332, United States, gkuyzu@isye.gatech.edu, Martin Savelsbergh, Ozlem Ergun

We analyze pricing strategies for a carrier in an auction based transportation procurement market. We consider a setting with multiple carriers and multiple shippers where each shipper requests bids for a single lane at a time. The operating cost of the carrier depends on the set of lanes the carrier wins which cannot be known until the end of the auction. We discuss carrier bidding models for a carrier considering the risk of losing lanes to another carrier.

2 - Determination for Freight Procurement Auctions
Srinivas Nandiraju, UC Irvine, snandira@uci.edu, Amelia Regan

Tendering freight in auction-based procurement marketplaces is becoming increasingly popular, but there is a dearth of decision tools to aid the shippers and carriers or the 3PL firms in these procurement processes. Our research focuses on the issues in these procurement markets in truckload and less-than-truckload transportation services in spot markets and long term contracting.

3 - Optimization Models for Combinatorial Auctions for Transportation Service
Amelia Regan, University of California, Irvine, Institute of Transportation Studies, Computer Science and Civil Engineering, Irvine, CA, United States, aregan@uci.edu, Srinivas Nandiraju

We consider the bid analysis problem faced by shippers with sophisticated business constraints in combinatorial auctions for the procurement of transportation services. We formulate the shipper's business rules as side constraints in an integer-programming model. A Hybrid Lagrangian relaxation based algorithm is developed to provide near optimal solutions. The experimental performance of this approach is further analyzed with empirical benchmarking.

■ MC48

R - 4th Floor, Dante

Pierskalla Award - 1

Sponsor: Health Applications
Sponsored Session

Chair: Murray Côté, Assistant Professor, University of Florida, Health Svc. Res., Mgmt. and Policy, Gainesville, FL, 32610-0195, United States

1 - An Analysis of the Pediatric Vaccine Shortage Problem
Sheldon Jacobson, Professor, University of Illinois, 1206 West Green Street, mc244, Urbana, IL, 61801, United States, shj@uiuc.edu, Ruben Proano, Edward Sewell

Vaccine manufacturers have experienced intermittent vaccine productions interruptions that have created problems in providing a sufficient amount of vaccines to meet the needs of the 4m+ children born in the United States every year. The CDC has recommended that vaccine stockpiles be created to mitigate the impact of such interruptions. This paper presents an analysis of this problem and provides insights into the appropriate stockpile levels that are needed.

2 - Modeling the HIV and Tuberculosis Co-epidemics in Developing Countries
Elisa Long, Stanford University, MS&E Dept., Stanford, CA, 94305, United States, elisa46@stanford.edu

The relationship between HIV and tuberculosis (TB), including co-infection rates, transmission dynamics, and treatment synergies is not well understood. One-third of the world has passive TB and 40 million people are HIV-infected. My research will develop mathematical and economic models to examine policy questions related to controlling these co-epidemics.

2 - Incremental Value of Historical Operating Room Times in Case Scheduling versus Scheduled Times
Franklin Dexter, Professor, University of Iowa, Dept. of Anesthesia, Iowa City, IA, 52242, United States, franklin-dexter@uiowa.edu

Using a Bayesian method to predict OR times, we studied how historical data can improve operating room (OR) management decision-making. When historical data are available, they should be used in combination with (not in lieu of) the scheduled OR time. This is not because historical data substantially improve estimates for average OR times. Rather, historical data provide value in estimating the proportional variation in OR time (e.g., for the probability of finishing more than 1 hour late).

■ MC49

R - 4th Floor, Medici

Joint Session DA/ Research: Research Clinic on Decision Analysis in Portfolio Management and Capital Budgeting

Sponsor: Decision Analysis, Research Clinics
Sponsored Session

Chair: Jeffrey Keisler, Assistant Professor, University of Massachusetts Boston, College of Management, Boston, MA, 02125, United States, jeff.keisler@umb.edu

1 - Joint Session: Research Clinic on Decision Analysis in Portfolio Management and Capital Budgeting
Jeffrey Keisler, Assistant Professor, University of Massachusetts Boston, College of Management, Boston, MA, 02125, United States, jeff.keisler@umb.edu, Miley W. Merkhofer, Roger Burk, Craig Kirkwood, Jack Kloeber, James Matheson, James E. Smith

Resource allocation / portfolio management one of the most successful applications of decision analysis. Practitioner experience is rich enough for researchers to explore new questions. Panelists experienced in both research and practice will discuss: techniques they have used and developed informally; needed knowledge and tools for practice; aspects of the problem that have been studied; and areas where new results could be attained and applied. Audience participation is welcome.

■ MC50

R - 4th Floor, Cervantes

Joint Session DA/ Military Applications: Military Decision Analysis Applications

Sponsor: Decision Analysis, Military Applications
Sponsored Session

Chair: Greg Parnell, United States Military Academy, Department of Systems Engineering, West Point, NY, 10996, United States, Gregory.Parnell@usma.edu

1 - Decision Analysis in the Army Base Realignment and Closure
William Tarantino, Chief, Modeling Team, Army TABS Office, 1400 Key Blvd, Suite #2, Arlington, VA, 22209-1518, United States, william.tarantino@us.army.mil, Paul Ewing, Greg Parnell

Army installations provide facilities and maneuver space to organize, train, and equip the U.S. Army. Four previous Base Closure and Realignment Commission (BRAC) rounds resulted in 97 domestic base closures and 55 realignments. We describe decision analysis methods used to support BRAC 2005 decision-making. We used multiple objective decision analysis to define and evaluate installation military value and developed an optimization model to identify the best Army installation portfolio.

2 - Selecting the Best Mission Assurance Architecture for a US Department of Defense Facility
Donald Buckshaw, Innovative Decisions, Inc., P.O. Box 231660, Centreville, VA, 20120, United States, dbuckshaw@innovativedecisions.com, Greg Parnell, Robin Dillon Merrill

This paper describes the process of creating and evaluating mission assurance options using the Mission-Oriented Risk and Design Analysis (MORDA) process. MORDA is a quantitative risk and design model based on Multiple Objective Decision Analysis. We facilitated decision conferences to create alternative designs. We developed a series of models, elicited weights and showed the value of architecture options based on cost, manpower, mission assurance, security and functionality.

3 - Automatic Target Recognition Classification System Evaluation
William Klimack, william.klimack@usma.edu

Decision analysis techniques are used to improve evaluation of automatic target recognition classification systems by the Air Force Research Laboratory. Data gathered from the Moving and Stationary Target Acquisition and Recognition program demonstrate how the value model may be used to evaluate classification systems. Additionally, a means of evaluating ATR CS self-assessment ability is presented, a new criterion that emerged from this study.

4 - A Simulation-Based Decision Support System for Sensor Employment
William Bland, Program Director, SE Dept, US Military Academy, 237-B Barnard Loop, West Point, NY, 10996, United States, William.Bland@usma.edu, Anthony Costa, Allison Morse, Christopher Larsen, Matthew Thiel, John Reinke

Our DSS is designed to assist in making critical sensor employment decisions. The DSS solicits a value hierarchy regarding the relative importance of sensor coverage, network connectivity, and sensor usage. The DSS then searches a knowledge base, created by running the COMSIM Sensor Network Simulator for a wide spectrum of sensor cluster configurations under various terrain conditions, to identify the specific sensor cluster configuration that best supports the defined value hierarchy.

Monday, 4:30pm - 6:00pm

■ MD01

H - Lobby Level, Plaza A

Tutorial:Bilevel Models for Protecting Critical Infrastructure

Cluster: Tutorials
Invited Session

1 - Tutorial: Bilevel Models for Protecting Critical Infrastructure
Kevin Wood, Professor, Naval Postgraduate School, Monterey, Monterey, CA, United States, KWood@nps.navy.mil

We describe new bilevel programming models to (1) help make a country's critical infrastructure more resilient to attacks by terrorists, (2) help government and business plan necessary improvements, and (3) help influence related public policy on regulations, investment incentives, etc. These models assume an intelligent attacker and defender, along with information transparency. We illustrate with applications to electric power grids, subways, airports, and more.

■ MD02

H - Lobby Level, Plaza B

DEA Applications in Agriculture

Cluster: Data Envelopment Analysis
Invited Session

Chair: Richard Nehring, Economist, ERS/USDA, RM N4093, 1800 M Street, Washington, DC, 20036, United States, RNEHRING@ers.usda.gov

Co-Chair: Agapi Somwaru, agapi@ers.usda.gov

1 - Two-Output Productivity Measures for Selected Countries: The Case of Crops and Livestock
Carlos Arnade, Keithly G. Jones

A programming problem is introduced which calculates distinct efficiency scores for two jointly produced products. These scores, which are related to conditional distance functions, are calculated for the crops and livestock sectors for 27 countries. Malmquist TFP indices for the crops and livestock sectors for 27 countries are also calculated and used to determine both TFP growth and the direction of TFP growth for each of the 27 countries.

2 - Efficiency Comparisons of Countries with Distinct Technologies
Carlos Arnade, Keithly G. Jones

The concept of convergence, which postulates that less developed countries (regions-farm units) grow faster than the more developed countries (regions) which has dominated the international development and trade literature. Eventually even growth rates themselves are believed to converge(Nahar and Inder, 2002). These studies have been grounded in the theory of convergence in economic growth pioneered by Solow (1956). After years of empirical work in this area, economists have come to believe that there may co-exist two sets of countries whose economies converge to two distinct steady state levels of economic development. This is referred to as "twin peaks". Developed countries and some developing countries are believed to converge to one common steady state level of development while the developing countries are believed to converge to a different steady state level of development. This may hold particularly true for agricultural sectors where natural resource endowments play a vital role in production.

3 - Productivity Growth in U.S. Agriculture: The Role of Public Investment in R&D
Eldon Ball, Economist, ERS/USDA, Rm N4095, 1800 M Street, Washington, DC, 20036, United States, eball@ers.usda.gov, S. Grosskopf, D. Margaritis, Rolf Fare

In a recent paper, Dumagan and Ball provide an exact decomposition of growth in revenue using superlative indexes. This decomposition provides the contributions of growth in output prices and input quantities and growth in total factor productivity to growth in revenue. An application to U.S. agriculture shows that productivity growth is the dominant source of growth in revenue. They conclude that measures that spur productivity growth, such as public investment in R&D, may be more effective increasing revenue than are price policies. Here, we use a state-by-year panel to estimate Malmquist productivity indexes which can be decomposed into contributions of technical change and changes in technical efficiency. Using time series techniques, we then investigate the relationship between productivity growth and its components and public R&D at the state level. We test for causality as well as lag structure. Preliminary results suggest the presence of a cointegrating relationship between the two series.

■ MD03

H - Ballroom Level, Continental Ballroom 1

INFORM-ED 10th Anniversary

Sponsor: Education (INFORM-ED)
Sponsored Session

Chair: Mary Beth Kurz, Assistant Professor, Clemson University, 110 Freeman Hall, Clemson, SC, 29631, United States, mkurz@clemson.edu

1 - INFORM-ED 10th Anniversary
Mary Beth Kurz, Assistant Professor, Clemson University, 110 Freeman Hall, Clemson, SC, 29631, United States, mkurz@clemson.edu

INFORM-ED is celebrating its 10th birthday this November with a discussion on the Past, Present and Future of ORMS Education - A Perspective at INFORM-ED's 10th Anniversary. Some of the original 'gang of seven' (Erhan Erkut, Tom Grossman, Salwa Ammar, Ken Baker, Judith Liebman, Amit Monga, Steve Powell, and Ron Wright) [original INFORM-ED members] will discuss good and bad trends, accomplishments of the forum, where we are now, where we should try to be in the future, etc. We will focus on reflection, introspection, and projection - opinions about the past, present, and future of O.R. education. Part of the session will include Q&A.

■ MD04

H - Ballroom Level, Continental Ballroom 2

Daniel H. Wagner Prize Competition

Cluster: The Daniel H. Wagner Prize for Excellence in Operations Research
Invited Session

Chair: Joseph H. Discenza, SmartCrane, LLC, 2 Eaton Street Suite 500, Hampton, VA, 23669, United States, jhdiscenza@smartcrane.com

The Daniel H. Wagner Prize for Excellence in Operations Research Practice

CPMS's practice prize, the Daniel H. Wagner Prize for Excellence in Operations Research Practice, is now underway for its sixth competition . Four finalist teams have been selected for 2005 and these will be presented in a single track.

1 - Rethinking Inventory Policies For Service Vehicles at a Major Appliance Manufacturer
Michael Gorman, Assistant Professor, University of Dayton, School of Business, 300 College Park, Dayton, OH, 45419-2130, United States, Michael.Gorman@notes.udayton.edu, Sanjay Ahire

A major consumer appliance manufacturer needed to manage $7 million in repair part inventories in over 1300 service vehicles by closely managing expensive parts inventories on service vehicles while ensuring that its technicians carried the appropriate parts for completing warranty repairs from unpredictable customer service calls on the first visit. We applied a heuristic solution to this vehicle stocking problem and found that over three million dollars per year could be trimmed from its warranty repair costs and its first-visit repair rate could be improved from 86% to 90%.

2 - Supply Chain Collaboration through Shared Capacity Models
Karl Kempf, Intel Corporation, 5000 W. Chandler Blvd, Chandler, AZ, 85226, United States, karl.g.kempf@intel.com, Shamin Shirodkar

The idea of collaboration between companies in a supply chain has been the subject of an inordinately large volume of discussion supported by a surprisingly small number of documented successful implementations. This contribution describes the application of multiple mathematical optimization models to the procurement of production materials facilitated by the collaborative development of capacity models. Substantial productivity and profitability gains were realized by all parties involved.

■ MD05

H - Ballroom Level, Continental Ballroom 3

Models in Transportation Logistics

Cluster: Service Sector Operations
Invited Session

Chair: Huseyin Topaloglu, Assist. Prof., Cornell University, 223 Rhodes Hall, Ithaca, NY, 14853, United States, topaloglu@orie.cornell.edu

1 - The Value of Service Choice in Period Vehicle Routing Problems

Peter Francis, Northwestern University, 2145 Sheridan Road, Evanston, IL, 60208, United States, pete@northwestern.edu, Karen Smilowitz, Michal Tzur

We examine the impact of service differentiation on the operation of distribution systems, specifically when service quality is defined in terms of the frequency of service provided. We develop a new model, called the Period Vehicle Routing Problem with Service-Choice that fundamentally extends the basic Period Vehicle Routing Problem by allowing additional flexibility in choosing levels of service for customers. We present solution methods and some applications of this problem.

2 - Cost Allocation Mechanisms for a Shipper Collaboration Network

Orsan Ozener, Georgia Institute of Technology, 765 Ferst Drive, Atlanta, GA, 30332, United States, gtg449n@mail.gatech.edu, Ozlem Ergun

We study a logistics network where shippers collaborate to minimize asset repositioning costs. A collaboration is established when shippers come together and submit their requests to the carrier as a bundle to reduce their costs. After routes are determined, total cost is allocated among the members. We develop cost allocation mechanisms with well known properties, such as budget balancedness, fairness etc. Next, we define a set of new properties and propose several cost allocation schemes.

3 - A Network Design Model with Lead Time and Safety Stock Considerations

Karthik Sourirajan, souriraj@ecn.purdue.edu, Leyla Ozsen, Reha Uzsoy

We consider a supply chain in which a single product is replenished at the retailers. We establish service distribution centers (SDCs) such that the sum of the location and inventory costs is minimized. We model lead times at the SDCs using standard queueing analysis and carry safety stock at the SDCs to maintain desired service levels. We capture the trade-off between lead time and safety stock risk-pooling using the model and present a Lagrangian relaxation to obtain near-optimal solutions.

4 - Incorporating Pricing Decisions into the Stochastic Dynamic Fleet Management Problem

Huseyin Topaloglu, Assist. Prof., Cornell University, 223 Rhodes Hall, Ithaca, NY, 14853, United States, topaloglu@orie.cornell.edu, Warren Powell

We show how to coordinate the pricing and fleet management decisions of a freight carrier. We consider a setting where the carrier announces its prices at the beginning of the time horizon and the load arrivals over this horizon depend on the announced prices. We present a tractable method to obtain gradients of the objective function with respect to the prices and use this gradient information to find a "good" set of prices.

■ MD06

H - Ballroom Level, Continental Ballroom 7

Disassembly Operations

Cluster: Reverse Supply Chains
Invited Session

Chair: F. Tevhide Altekin, Sabanci University, Graduate School of Management, Orhanli Tuzla, Istanbul, 34956, Turkey, altekin@sabanciuniv.edu

1 - Analyzing the Effects of Inventory Cost Setting Rules in a Disassembly and Recovery Environment

Elif Akcali, Assistant Professor, University of Florida, 303 Weil Hall, P.O. Box 116595, Gainesville, FL, 32611-6595, United States, akcali@ise.ufl.edu, Z. Pelin Bayindir

We consider a salvaging facility that satisfies the demand for remanufactured parts that can be recovered from the end-of-life products. One of the difficulties faced in planning for such a system is the determination of the opportunity cost associated with carrying recovered parts inventory. In this study we investigate the effect of different rules to determine this opportunity cost on the performance of the system. The performance of several different rules is assessed by a computational study under a proposed approximate inventory control policy.

2 - Adaptive Disassembly Line Balancing

F. Tevhide Altekin, Sabanci University, Graduate School of Management, Orhanli Tuzla, Istanbul, 34956, Turkey, altekin@sabanciuniv.edu, Can Akkan

In disassembly lines, uncertainties in the product structure and part conditions may lead to task failures. Thus the predictive line balance established may not be executed for some products. In this study, we address the problem of selecting a set of disassembly tasks in case of task failures and finding their assignment to stations in an unpaced line so that profit is maximized. The MIP formulation and the resulting performance characteristics of the disassembly line are demonstrated.

3 - The Impact of Part Quality in Hybrid Production Systems

Aybek Korugan, Boğazici University, Boğazici University, Department of IE, Istanbul, 34342, Turkey, aybek.korugan@boun.edu.tr, Nufer Y. Ates

In hybrid production systems when both remanufacturing and new product manufacturing activities are done at the same facility used parts can be remanufactured at the same shop floor as the new products. Here the quality difference between used and new parts being processed impacts both the output quality and the efficiency of shared machines. In order to capture this impact we look at a two machine one buffer tandem system that manufactures both types with distinct process related failure rates.

4 - Role of Work-In-Process Inventory In Disassembly Lines

Can Akkan, Sabanci University, Graduate School of Management, Orhanli Tuzla, Istanbul, 34956, Turkey, canakkan@sabanciuniv.edu, F. Tevhide Altekin

In disassembly lines, uncertainties in the product structure and part conditions may lead to task failures. When a task fails, it may not be feasible to perform some of its successor tasks. The nature of uncertainty created on station workloads by this is quite different from uncertainties in task times and machines states regularly studied in the literature. We study the effects of the number of stations, degree of line balance and buffer allocation on the performance of the line by simulation.

■ MD07

H - Ballroom Level, California

Call Center Service Levels and Staffing

Sponsor: Manufacturing & Service Oper Mgmt
Sponsored Session

Chair: Tava Olsen, Olin School of Business, Washington University, 1 Brookings Drive, St. Louis, MO, United States, olsen@olin.wustl.edu

Co-Chair: Joseph Milner, University of Toronto, 105 St. George street, Toronto, ON, m5s 3e6, Canada, milner@rotman.utoronto.ca

1 - Government Regulation of Service Levels for Telephone Companies in Canada

Armann Ingolfsson, University of Alberta, Edmonton, AB, T6G 2R6, Canada, armann.ingolfsson@ualberta.ca, Samina Khandakar

The Canadian Radio-television and Telecommunications Commission (CRTC) regulates service levels for various services provided by Canadian telephone companies. We discuss the form of the regulation, enforcement, and penalties for non-compliance. We focus on the length of the time period over which service levels are measured and we use queueing models to illustrate the impact of this parameter on cost and waiting times.

2 - Staffing Algorithms for Non-voice Communications in Contact Centers

Sameer Hasija, Simon School, University of Rochester, University of Rochester, Rochester, NY, United States, hasijas1@simon.rochester.edu, Edieal Pinker, Robert Shumsky

We present staffing models for contact center agents who handle faxes and emails. These models were developed for, and implemented by, a contact center outsourcer. We show how the parameters were estimated from aggregate historical data, and compare the performance of the algorithms with previous 'rules of thumb' used by managers.

3 - Call Center Staffing to Exceed Service Expectations

Opher Baron, Rotman School of Management, University of Toronto, 105 St. George Street, Toronto, ON, M5S 3E6, Canada, Opher.Baron@rotman.utoronto.ca, Joseph Milner

Call center customers sign service level agreements to ensure quality. e.g., a contract may state that 80% of all customers be served within 20 seconds with penalties assigned if this is not met. We determine the optimal workforce policy under such a contract. We consider both expected profit as well as the likelihood that the contract parameters are met and compare alternate contracts to investigate how these influence the likelihood of exceeding customer expectations under optimal policies.

4 - Service Level Agreements in Call Centers: Perils and Prescriptions

Joseph Milner, University of Toronto, 105 St. George street, Toronto, ON, m5s 3e6, Canada, milner@rotman.utoronto.ca, Tava Olsen

In a call center with both contract and non-contract customers we show that undesirable behavior from a contract customer's perspective may in fact be rational for the call center, particularly under commonly used delay percentile contracts. We investigate the impact of this behavior on the customer and find that it can, in fact, be highly negative. We then suggest other contracts and compare the performance of the different contracts using both heavy-traffic and numerical analyses.

■ MD08

H - Ballroom Level, Imperial A

Optimal Use of Capacity

Sponsor: Manufacturing & Service Oper Mgmt
Sponsored Session

Chair: Roman Kapuscinski, University of Michigan, 701 Tappan St., Ann Arbor, MI, United States, Roman.Kapuscinski@umich.edu

1 - Optimal Capacity Investment Decisions with Two-sided Fixed Capacity Adjustment

Izak Duenyas, University of Michigan, Stephen M. Ross School of Business, 701 Tappan St., Ann Arbor, MI, 48109-1234, United States, duenyas@umich.edu, Qing Ye

In this paper, we consider the optimal management of capacity when a firm faces fixed costs to purchase and salvage capacity. We introduce a new concept, which we call (K1, K2)-concavity, and show that the profit-to-go function satisfies this property. This enables us to characterize the optimal policy structure, which is rather complex consisting of multiple regions.

2 - Convexity Properties and Comparative Statics for M/M/S Queues with Balking and Reneging

Mor Armony, NYU, 44 West Fourth Street, New York, NY, 10012, United States, marmony@stern.nyu.edu, Erica Plambeck, Sridhar Seshadri

We use sample path arguments to derive convexity properties of an M/M/S queue with impatient customers. First, assuming that the balking and reneging rates are increasing and concave in the queue length, we prove that the expected queue-length is convex decreasing in the capacity. Second, with linear reneging and balking, we show that the expected lost sales rate is convex decreasing in the capacity. Finally, we find that, surprisingly, the optimal capacity is not monotone in the reneging rate.

3 - Advance Selling with Limited Capacity

Hyun-soo Ahn, Ross School of Business, University of Michigan, D8203 701 Tappan Street, Ann ARbor, MI, 48109, United States, hsahn@umich.edu, Man Yu, Roman Kapuscinski

We consider a monopolistic seller who has an option to sell in advance in addition to spot market. We characterize when advance selling becomes optimal and examine how customers' uncertain valuation and finite capacity influence the seller's pricing and capacity allocation strategy in both advance and spot markets.

4 - Shared Capacity Optimization in Process Supply Chains

Sridhar Tayur, Tepper Business School, Carnegie Mellon University, Pittsburgh, PA, United States, STayur@smartops.com, Valerie Tardif

A capacity plan is an important input to multistage inventory optimization. In many supply chains, particularly in process industries, capacity is shared across multiple products and is reduced by long changeovers and periods of idleness when allocation is not properly optimized. In this presentation, we show how we model and solve the shared capacity optimization problem so as to compute feasible target inventory positions that meet desired service levels and minimize inventory cost.

■ MD09

H - Ballroom Level, Yosemite A

Supply Chain Disruptions

Cluster: Supply Chain Management
Invited Session

Chair: Lawrence V. Snyder, Assistant Professor, Lehigh University, 200 West Packer Ave., Mohler Lab, Bethlehem, PA, 18015, United States, larry.snyder@lehigh.edu

1 - On the Value of Advanced Information in Managing Supply-Chain Disruption Risks

Brian Tomlin, University of North Carolina, McColl Building, CB3490, Chapel Hill, NC, 27599, United States, Brian_Tomlin@unc.edu, Lawrence V. Snyder

Although supply chain disruptions may be unpredictable, firms often have advanced warning that the likelihood of a disruption has changed. Advanced warning may come during labor negotiations in the case of strikes, or come through the Department of Homeland Security's terror alert level in the case of terrorist-related disruptions. We investigate the value of such advance warnings, and how they influence a firm's disruption-management strategy.

2 - The Resilent Enterprise

Yossi Sheffi, Professor, MIT, Rm E40-275, MIT, 77 Mass Ave, Cambridge, MA, 02139, United States, sheffi@MIT.EDU

Supply chains are subject to disruptions including terrorism, earthquakes, weather, accidents and sabotage. The talk will highlight lessons learned and published in "The Resilient Enterprise" book. These include the prioritization of threats, principles of security, robust supply chain designs, aligned procurement practices, and the development of the right culture. The book and the talk are based on dozens of case studies, some of which will be described in the talk.

3 - Quick Recovery to Alternative ELSP Cycles

Lawrence W. Robinson, Johnson Graduate School of Management, Cornell University, 433 Sage Hall, Ithaca, NY, 14853, United States, lwr2@cornell.edu, Gongtao (Lucy) Chen

In the rotational Economic Lot Scheduling Problem (ELSP) where each of n products is produced once per cycle, there are (n-1)! alternative optimal schedules. Further, the disposition of a fixed total amount of idle time, throughout the cycle, is also irrelevant. Our research uses both of these sources of flexibility in searching for the least expensive way to recover following an exogenous demand shock to the cycle.

4 - Waiting Times and Inventory in Disrupted Supply Chains

Lawrence V. Snyder, Assistant Professor, Lehigh University, 200 West Packer Ave., Mohler Lab, Bethlehem, PA, 18015, United States, larry.snyder@lehigh.edu, Zuo-Jun Max Shen

We present an approximation for the distribution of waiting times seen by customers to a firm that itself faces non-zero lead times. We then extend this result to consider the waiting time distribution when the firm faces stochastic lead times, possibly caused by disruptions. The key question is, how do upstream lead times affect downstream ones? The resulting distribution can be used to determine inventory levels in a supply chain that is subject to disruptions.

■ MD10

H - Ballroom Level, Yosemite B

Inventory & Capacity Issues in Supply Chain Management

Cluster: Supply Chain Management
Invited Session

Chair: Mahesh Nagarajan, University of British Columbia, 2053 Main Mall, Vancouver, BC, V6T 1Z2, Canada, mahesh.nagarajan@sauder.ubc.ca

1 - Rationing and Expediting in a Service Center Facing Multiclass Demand

Senthil Veeraraghavan, Asst. Professor, Wharton School, University of Pennsylvania, 3730 Walnut St, OPIM Department, Philadelphia, PA, 19104, United States, senthilv@wharton.upenn.edu, Vinayak Deshpande

We analyze a service center that faces stochastic demand that can be classified into multiple classes. The service center faces the decision to serve the demand by using two strategies; expediting the process at a greater expense to reduce the waiting time of all customers, or rationing the product according to customer classes. We seek to combine rationing with expediting literature, and provide insights into scenarios where a firm should invest in capacity, or involve in demand management.

2 - A Comparison of the Optimal Costs of Two Canonical Inventory Systems

Ganesh Janakiraman, Assistant Professor, Stern School of Business NYU, 44 West Fourth St., New York, NY, 10012, United States, gjanakir@stern.nyu.edu, Sridhar Seshadri, J. George Shanthikumar

Consider an inventory system (B) under periodic review, i.i.d demands and a positive lead-time. At the end of a period, there is a holding cost (h) per inventory unit and a penalty cost (b) per unit backordered. Consider another inventory system (L) with the same demands, lead-time and holding cost; but, excess demand is lost and b is the unit cost of a lost sale. (In B, b is a time-weighted cost. In L, it is a one-time cost.) We compare the optimal cost of managing B and L.

3 - Provably Near-Optimal Balancing Policies for Stochastic Multi-Echelon Inventory Control Models

Retsef Levi,Postdoctoral Fellow, IBM Watson Research Center, P.O. Box 218, Yorktown Heights NY 10598, United States, retsef@us.ibm.com, Robin Roundy, Van Anh Truong

We present the first computationally efficient, provably near-optimal policies for the classic period-review, stochastic inventory control problem for serial systems under correlated and non-stationary demands. We use balancing techniques and a novel marginal cost accounting scheme. Our policy is non base-stock and readily implementable on-line.

4 - Approximation Algorithms for Capacitated Stochastic Inventory Control Models

Retsef Levi, Postdoctoral Fellow, IBM Watson Research Center, P.O. Box 218, Yorktown Heights, NY, 10598, United States, retsef@us.ibm.com, Van Anh Truong, David Shmoys, Robin Roundy

Consider stochastic inventory control model where the goal is to coordinate orders of a single item, aiming to supply stochastic non-stationary and correlated demands over T periods with minimum expected holding and backlogging cost. There is a capacity constraint on the size of the order in each period. We present innovative marginal cost accounting of the holding and backlogging costs and cost-balancing techniques to get the first algorithms with worst-case performance guarantees.

■ MD11

H - Ballroom Level, Yosemite C

Multi-Echelon Supply Chain Systems

Contributed Session

Chair: Fuqiang Zhang, Assistant Professor, University of California, GSM 433, Irvine, CA, 92697, United States, fzhang@uci.edu

1 - Optimal Policy for a Two-Echelon System in Presence of Commodity Markets

Ankur Goel, Graduate student, UT-Austin, 3106 Duval street, Austin, TX, 78705, United States, goel@mail.utexas.edu, Genaro Gutierrez

We characterize the optimal procurement policy for a two echelon, periodic review, manufacturing system with stochastic procurement prices under make-to-stock environment, when two modes of supply are available.Under the presence of relevant supply chain related transaction costs, we explore the value of incorporating the marginal convenience yield, and develop conditions for myopic solution to be optimal.Model is extended to the framework of one manufacturer -multiple non-homogeneous retailers.

2 - Distribution Center Location Analysis in a 3-Echelon Supply Chain Facing Various Leadtimes & Demands

Su-Hwa Wu, PhD student, National Dong Hwa University, 1 Sec 2, University Road, Hualien, 970, Taiwan, marina@mail.ndhu.edu.tw, Juhwen Hwang

A three-echelon supply chain facing various lead times and demand patterns is studied. The supply chain is constructed from upstream to downstream stages by supplier, distribution center, and a set of retailers. Costs parameters include inventory holding, ordering, and lost-of-goodwill costs. The delivery between two stages may occur an ordering lead time. Lead times and holding costs will be affected by the distance between two stages.

3 - Production Allocation and Delivery Policies for Multiple Items in Multiple Production Lines

Yushin Hong, Professor, POSTECH, San 31, Hyoja, Pohang, 790-784, South Korea, yhong@postech.ac.kr, Taebok Kim

This paper introduces how to synchronize production and delivery policies to minimize overall cost in a supply chain consisting of a manufacturer and retailers.The retailers place orders on EOQ policies. The manufacturer produces items in parallel lines, and delivers them to the retailers. We presnts how to determine the order quantities, the the rotation cycle length, and allocation of the orders, and the shipping frequencies and quantities of all the items.

4 - The Impact of Modular Assembly on Supply Chain Efficiency

Fuqiang Zhang, Assistant Professor, University of California, GSM 433, Irvine, CA, 92697, United States, fzhang@uci.edu, Tianjun Feng

This paper studies the impact of modular assembly approach on supply chain efficiency. In traditional assembly approach, a manufacturer procures components from independent suppliers; whereas in the modular assembly approach, the manufacturer asks a single supplier to pre-assemble the components and deliver a subassembly. We show that modular assembly approach always benefits the manufacturer in a decentralized system because the subassembly supplier will provide better delivery service.

5 - Determining a Cost-Effect customer Service Level: An Empirical Study

Mariah Jeffery, University of Central Florida, 4000 Central Florida Blvd., Orlando, FL, 32816, United States. mcmurran@mail.ucf.edu. Renee Butler

We present a methodology for determining the relationship between inventory, customer service level, and cost based regression and operations research. The outcome is a methodology for identifying cost-effective inventory and customer service levels, as well as the ability to estimate the imipact of uncontrollable factors such as forecast acuracy and customer lead-times on delivery performance and cost. We present results from an empirical study in the semiconductor industry.

■ MD12

H - 4th Floor, Union Square 1

Auctions with Budget Restrictions

Cluster: Applications of Auction and Game Theory

Invited Session

Chair: Bob Day, University of Connecticut, 2100 Hillside Rd. U-1041, Storrs, CT, 06269, United States, Bob.Day@business.uconn.edu

1 - Decomposition Technique to Solve Constrained Auction

Abhishek Pani, University of Maryland, R. H. Smith School of Business, College Park, MD, 20742, United States, apani@rhsmith.umd.edu, G. Anandalingam

We seek to solve the budget constrained allocation problem using decomposition technique. An iterative auction mechanism, based on dual price feedback from the bidder sub-problems along with an approximation to the knapsack problem to solve the master (auctioneer) problem, will be discussed.

2 - Multi-unit Auctions with Budget-constrained Bidders

Nicole Immorlica, Microsoft, One Microsoft Way, Redmond, WA, 98052, United States, nickle@mit.edu, Mohammad Mahdian, Christian Borgs, Jennifer Chayes, Amin Saberi

We study a multi-unit auction with multiple bidders, each of whom has a private valuation and budget. The truthful mechanisms of such an auction are characterized, in the sense that, under standard assumptions, it is impossible to design a non-trivial truthful auction which allocates all units. We also design an asymptotically revenue-maximizing truthful mechanism which may allocate only some of the units.

3 - A Revealed-Preference Activity Rule for Quasi-Linear Utilities with Budget Constraints

Bob Day, University of Connecticut, 2100 Hillside Rd. U-1041, Storrs, CT, 06269, United States, Bob.Day@business.uconn.edu, Pavithra Harsha, David Parkes

We demonstrate a failure of Ausubel, Cramton, and Milgrom's revealed-preference activity rule when a simple budget constraint may be binding. Given this failure we introduce a new refined activity rule which allows bidders to violate the original rule within limitations, and with consequential budget limitations on future bidding. We illustrate the development of the rule from basic principles, and preliminary computational results are presented.

■ MD13

H - 4th Floor, Union Square 5

Software Demonstration

Cluster: Software Demo

Invited Session

1 - SAS Institute Inc.- Introducing OPTMODEL, the New Face of SAS Optimization

Ed Hughes, Product Manager, SAS Institute Inc., SAS Campus Dr., Office R-5322, Cary, NC, 27513, United States, ed.hughes@sas.com

OPTMODEL, the new SAS algebraic and symbolic optimization modeling language, delivers a quantum leap in accessibility, clarity and power for SAS optimization. As part of the SAS language, OPTMODEL enables you to build and solve optimization models easily and directly and still take advantage of SAS' full suite of analytic capabilities.

2 - Salford Systems- TreeNet/MART: A State-of-the-Art Approach for Building Predictive Models in Data Mining

Mikhail Golovnya, Senior Statistician, Salford Systems, 4740 Murphy Canyon Rd., Suite 200, San Diego, CA, 92123, United States, golomi@salford-systems.com

Salford Systems will demo TreeNet/MART, Stanford University Jerome Friedman's new advance to classification and regression trees. TreeNet enables the modeler to construct predictive models of extraordinary accuracy. Models are built up gradually through a large collection of small trees, each of which improves on its predecessors through an

■ MD14

H - 4th Floor, Union Square 6

Military Operations Research Activities at USMA

Sponsor: Military Applications
Sponsored Session

Chair: LTC Simon Goerger, Director, ORCEN, Operations Research Center, Department of Systems Engineering, US Military Academy, West Point, NY, 10996, United States, Simon.Goerger@usma.edu

1 - Vehicle Mobility Model Fidelity in M&S; Exploring Higher-Order Effects

Dr. Niki Goerger, ERDC Research Assoc., Dept. of Systems Engineering, ATTN: MADN-SE, United States Military Academy, West Point, NY, 10996, United States, Niki.Goerger@usma.edu

Differences in ground vehicle model fidelity generally deal with incorporation of mobility limiters which often impact the outcomes of models and simulations. As follow-on to a FY03 investigation, this research explores higher-order effects that propagate through the simulation to assess impacts of fidelity in mobility representation. Moreover, the focus is on assessing the impact on select metrics relevant to Future Force design and experimentation.

2 - Helping to Select Helicopter Components for the US Army's CBM Program

MAJ Ernest Wong, Instructor and Analyst, Operations Research Center of Excellence, Department of Systems Engineering, United States Military Academy, West Point, NY, 10996, United States, Ernest.Wong@usma.edu

Helicopter parts currently monitored with condition-based maintenance (CBM) technology are providing quantifiable benefits to the US Army, including reduced maintenance man-hours, increased fleet readiness, and potential for savings and cost avoidance. To help further advance the CBM paradigm, I have developed a strategy that assesses the value of prospective aircraft components nominated for CBM. This model serves as a tool for identifying those candidates most appropriate for CBM.

3 - Allied Warrior 2004: Lessons Learned from Applying Effects Based Operations

COL Michael McGinnis, Professor and Head, Department of Systems Engineering, United States Military Academy, West Point, NY, 10996, United States, mike.mcginnis@usma.edu

In October 2003, the North Atlantic Council stood up a new expeditionary-type military organization called the NATO Response Force (NRF). This presentation reports on a November 2004 NRF exercise called Allied Warrior, involving 16 NATO Nations. It explains the application of effects based operations with implications for higher and subordinate commands for conducting effects based operations; and concludes with recommendations for advancing the theory and practice of effects based operations.

■ MD15

H - 4th Floor, Union Square 9

Scheduling Theory and Applications

Cluster: Scheduling
Invited Session

Chair: Nicholas Hall, Professor, The Ohio State University, Fisher College of Business, Columbus, Oh, 43210-1144, United States, hall.33@osu.edu

1 - Online Algorithms for Packet Scheduling

Fei Li, Columbia University, CS Department, New York, NY, United States, lifei@cs.columbia.edu, Jay Sethuraman, Cliff Stein

We discuss packet scheduling problems that arise in the context of buffer management at network switches. We present effective online scheduling algorithms and prove tight bounds on their competitive ratio.

2 - Rescheduling for Multiple New Orders

Zhixin Liu, The Ohio State University, Fisher College of Business, Columbus, OH, 43210-1144, United States, Liu.573@osu.edu, Nicholas Hall, Chris N. Potts

We consider a situation where a set of jobs has been planned on a single machine, but not processed, when sets of new jobs arrive. The decision maker must insert the new jobs without excessively disrupting the schedule. The objective is the minimization of maximum lateness. We describe several heuristics and analyze their worst-case performance. Our branch and bound algorithm solves 99.9% of randomly generated instances with up to 1,000 jobs within 60 seconds.

3 - An Available-to-Promise (ATP) Model for Integrating Order Promising and Shop-Floor Scheduling

Zhenying Zhao, University of Maryland, R.H. Smith School of Business, College Park, MD, 20742, United States, zzhao@rhsmith.umd.edu, Michael Ball

In order to achieve better responsiveness to customer request, ensure on-time delivery, and reduce production waste, we proposed an optimization-based ATP model to simultaneously conduct order promising and shop-floor scheduling for a capacity-dominated assembly-to-order (ATO) environment. We sketch a column generation approach for solving the problem. Experiments and computation results are presented based on data from an injection moduling process in Toshiba.

4 - Sequence Optimization in Block Cave Mining

Anita Parkinson, University of British Columbia, Sauder School of Business, 2053 Main Mall, Vancouver, B.C., V6T 1Z2, Canada, anita.parkinson@sauder.ubc.ca, Tom McCormick, Maurice Queyranne

In Block Cave mining, tunnels are dug deep into a mountain and drawpoints are opened causing ore to fall into the open tunnels. Physical and operational constraints dictate that only K drawpoints be open each period, and the area mined be contiguous. Many subproblems resemble parallel machine scheduling problems with drawpoints as jobs, and the K openings the machines. We are working with a mining software company to optimize the sequence in which drawpoints are opened to maximize NPV.

■ MD16

H - 4th Floor, Union Square 10

Workforce Scheduling in Dynamic Environments

Cluster: Workforce Flexibility
Invited Session

Chair: David Nembhard, Associate Professor, The Pennsylvania State University, 310 Leonhard Bldg., Dept. of Industrial Eng., University Park, PA, 16827, United States, dan12@psu.edu

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

1 - Bucket Brigades When Productivity is Changing

Bryan Norman, Associate Professor, University of Pittsburgh, 1033 Benedum Hall, Pittsburgh, PA, 15261, United States, banorman@engrng.pitt.edu, David Nembhard, Natasa Vidic

We study throughput of a bucket brigade when workers' productivity is changing based on individual learning and forgetting rates. We utilize different rules to sequence the workers along the line and analyze the effects on the overall line throughput. We present results for various test problems.

2 - Mitigating Short Product Life Cycle issues with Workforce Flexibility

Ruwen Qin, PHD Candidate, The Pennsylvania State University, 244 Leonhard Bldg., Dept. of Industrial Eng., University Park, PA, 16802, United States, ruwen@psu.edu, David Nembhard

Many products are characterized by short product life cycles due to periodic updates or technological innovations. We examine whether cross training workers on multiple production systems adds value by smoothing demand variation during process substitution.

3 - Bucket Brigades with Worker Learning

Esma Gel, Assistant Professor, Arizona State University, Department of Industrial Engineering, P.O. Box 5906, Tempe, AZ, 85287, United States, Esma.Gel@asu.edu, Dieter Armbruster, Junko Murakami

We study the dynamics and throughput of a bucket brigade when workers' speeds increase due to learning. We provide several managerial insights, and show that if re-ordering of workers is allowed then the bucket brigade production system is very robust and will typically rebalance to a self-organizing optimal production arrangement.

■ MD17

H - 4th Floor, Union Square 11

OR/MS Issues in New Product Development

Contributed Session

Chair: Ted Klastorin, Professor, Univ of Washington, Box 353200, Dept of Mgt Science, Seattle, WA, 98195-3200, United States, tedk@u.washington.edu

1 - An Integrated Framework for Modular Product Design

Bimal Nepal, Doctoral Candiadte, Wayne State University, 4815 Fourth St., Room #1052, Detroit, MI, 48202, United States, bnepal@wayne.edu, Leslie Monplaisir

This paper presents an integrated framework to develop modular products. A goal programming model is formulated to identify the optimal modules considering product quality, reliability, manufacturability, and modularization costs early in the development process. Fuzzy logic is used to characterize the candidate modules. The model is demonstrated through an automotive climate control case study. The framework is generic hence can also be applied in other products beyond the automotive systems.

2 - A Balanced Methodology for Planning Product Platforms Based on Versatility and Commonality Measures

Yoo-Suk Hong, Assistant Professor, Seoul National University, Dept of Industrial Engineering, San 56-1, Sillim, Kwanak, Seoul, 151-742, South Korea, yhong@snu.ac.kr, Chang-Muk Kang

A platform strategy reduces cost by sharing components and processes, but it also has a risk of restricting differentiation. This paper presents a balanced methodology for developing a platform considering both commonality and versatility. A novel method of assessing the versatility of a platform was proposed, based on the impact of its components and sensitivity of specifications to demand. The commonality measures were adopted from existing research and revised accordingly.

3 - Modelling Component Sharing for Outsourcing

B Joon Park, Assistant Professor, Singapore Management University, 469 Bukit Timah Road, Singapore, Singapore, Singapore, jpark@smu.edu.sg, Siqun Wang

We propose an additional insight of component sharing for outsourcing. Company first develops a component that can be used in many products. Unit price of the component is negotiated with suppliers based on the projected volume. If actual volume falls substantially short to the projected volume, the company compensate suppliers through re-negotiated price. The solution strategy for our model is particularly challenging because it has uncertain parameters, namely, actual demands of products.

4 - New Product Planning in a Monopoly Market

Ted Klastorin, Professor, Univ of Washington, Box 353200, Dept of Mgt Science, Seattle, WA, 98195-3200, United States, tedk@u.washington.edu, Param Singh

We consider a monopolist who introduces a new product that will have multiple versions during the life of the product. The monopolist sets the design/quality level and price for each upgrade as well as the timing of each upgrade's introduction. We develop a game-theoretic model to analyze this new product introduction process.

■ MD18

H - 4th Floor, Union Square 12

Advances in Airline Crew Scheduling

Sponsor: Aviation Applications
Sponsored Session

Chair: Diego Klabjan, Professor, University of Illinois at Urbana-Champaign, 1206 West Green Street, Urbana, IL, 61801, United States, klabjan@uiuc.edu

1 - Progress in Crew Pairing Optimization at Sabre Airline Solutions

Ellis Johnson, Georgia Institute of Technology, School of Industrial and Systems Engineering, 765 Ferst Drive NW, Atlanta, GA, 30332-0205, United States, ellis.johnson@isye.gatech.edu, Tina Shaw

This presentation will update progress and developments in crew pairing optimization at Sabre Airline Solutions since the presentation of the work in the 1990 Edelman Prize competition.

2 - Self-Adapting Heuristics for Airline Crew Rostering Problems

Marek Ozana, Carmen Systems, Odinsgatan 9, Gothenburg SE-411 03, SW, Sweden, marek.ozana@carmensystems.com

Large scale crew rostering problems are typically solved using advanced heuristics methods. One of the drawbacks of heuristic approaches is a large number of parameters that need to be tuned. The main idea of the presented work is to develop a self-adapting algorithm to tune these parameters. In this presentation, we first describe Carmen Systems' approach to large scale crew rostering problems in general, and then the self-tuning algorithm.

3 - Airline Crew Recovery: An Integrated Pairing and Roster Recovery Approach

Tina Shaw, Sabre Holdings, 3150 Sabre Drive, Southlake, TX, 76092, United States, tina.shaw@sabre.com

We present an approach for handling disruptions during irregular operations that simultaneously solves the crew pairing and roster recovery problems to quickly find solutions that are fully deployable. A primary objective during irregular operations is to minimize the impact of disruptions and curtail the down stream ripple effect.

4- Solving Crew Pairing Problems with Credit Cost Objective Function

Johan Ivarsson,Carmen Systems, Odinsgatan 9, SE-411 03, Gothenburg SW, Sweden, johan.ivarsson@carmensystems.com, Fredrik Altenstedt, Lennart Bengtsson, Curt Hjorring

Crew pairing problems are frequently solved using (dynamic) column generation techniques. Here, North American problems pose an extra challenge in the pricing problem due to that the objective function is a maximum over several cost components. Typically, it may be a maximum over pay for flown hours and pay for time away from base. We describe how Carmen's software solves this in an efficient way using a multi-objective k-SP algorithm.

■ MD19

H - 4th Floor, Union Square 13

Technology Management Section Distinguished Speaker

Sponsor: Technology Management
Sponsored Session

Chair: Sarfraz Mian, Professor, SUNY Oswego, Oswego, NY, United States, mian@oswego.edu

1 - Democratizing Innovation

Eric von Hippel, Professor, MIT Sloan School of Mgmt, Cambridge, MA, United States, evhippel@mit.edu

In his lecture, the speaker will argue that innovation is rapidly becoming democratized. This cutting-edge research on innovation process reveals that lead users, both individuals and firms, aided by improvements in computers and communications technology, increasingly can develop their own new products and services; often sharing the results with others. These freely-revealed innovations by users are forming the basis for a user-centric innovation system.

■ MD20

H - 4th Floor, Union Square 14

Environmental & Energy Planning Models

Sponsor: Energy, Natural Resources & the Environment / Energy
Sponsored Session

Chair: Benjamin Hobbs, bhobbs@jhu.edu

1 - A Decision-Making Framework for Ozone Pollution

Victoria Chen, Associate Professor, University of Texas at Arlington, Dept. of Ind. & Manuf. Sys. Eng., Campus Box 19017, Arlington, TX, 76019-0017, United States, vchen@uta.edu, Zehua Yang

A Decision-Making Framework (DMF) was developed to identify efficient and effective ozone pollution control policies. It has two components - the Atmospheric Chemistry Module (ACM) and the stochastic dynamic programming (SDP) optimization. In the ACM, approximate state transition functions are derived using data from the U.S. EPA's Urban Airshed Model. An SDP model is then formulated to optimize the locations and times for reducing emissions that lead to ozone pollution.

2 - Lagrange Multiplier Optimization of Petroleum Refining: Transport Fuels & Environmental Constraints

Donald Hanson, Economist, Argonne National Lab, 9700 S. Cass Avenue, Bldg 900, Argonne, IL, 60439, United States, dhanson@anl.gov, John Marano, Peter Balash, John Ruether, Dale Keairns

A petroleum refinery model is comprised of 25 process steps and multiple modes of operation for key processes. Refinery products include LPG, gasoline, kerosene/jet fuel, diesel fuel, home heating oil, residual fuel oil, asphalt, and petroleum coke. The gasoline and diesel fuels must meet ultra low sulfur constraints. The model also evaluates and chooses input crude oils from a slate of feeds varying by specific gravity, sulfur and other characteristics.

3 - Electrical Systems Expansion Assessment using Simulation Techniques

Efraim Centeno, Doctor, Universidad Pontificia Comillas (IIT), Santa Cruz de Marcenado 26, Madrid, 28015, Spain, efraim.centeno@iit.upco.es, Ignacio Hoyos, Julià Barquìn, Juan José Sànchez

Capacity planning in deregulated electricity markets is subject to a large number of uncertain factors. Simulation techniques allow addressing this problem in a natural and effective way. This work presents a Business Dynamics based model to compare different alternatives for policy makers to properly orient capacity expansion including subsidies given to wind technology plants, capacity payments and CO2 emission allowances prices.

4 - Technical Change that Increases Marginal Abatement Cost: Examples and Implications

Ekundayo Shittu, Research Assistant, University of Massachusetts, Mechanical & Industrial Engineering Dept, Amherst, MA, 01003, United States, eashittu@engin.umass.edu, Erin Baker

It is widely assumed that technical change will decrease the marginal cost of pollution abatement. Yet, we present a number of examples where rationally implemented technical change increases the marginal cost of abatement over some interval. We then present an example of how this assumption can crucially impact policy analysis.

■ MD21

H - 4th Floor, Union Square 15

Data Mining in Planning and Logistics

Cluster: Data Mining Applications
Invited Session

Chair: Siggi Olafsson, Associate Professor, Iowa State University, 2019 Black Engineering, Ames, IA, 50010, United States, Olafsson@iastate.edu

1 - Optimal Instance Selection for Learning Best Scheduling Practices

Xiaonan Li, Iowa State University, 2019 Black Engineering, Ames, IA, 50010, United States, xnli@iastate.edu

Data mining has the potential to improve many production systems. In this paper we discuss how to combine data mining with optimization for effective production scheduling. We use a genetic algorithm to address the optimal instance selection problem, and then induce a decision tree from this subset of instances. The optimal instance selection can be viewed as determining the best scheduling practices, and the data mining can then learn new dispatching rules from those best practices.

■ MD22

H - 4th Floor, Union Square 16

Electronic Markets: Performance and Measurements

Sponsor: Information Systems
Sponsored Session

Chair: Ravi Bapna, UConn, 2100 Hillside Rd, Storrs, CT, United States, rbapna@sba.uconn.edu

1 - Used Good Trade & Adverse Selection: A Cross-Country Comparison of Electronic Secondary Markets

Anindya Ghose, Assistant Professor, New York University, Stern School of Business, New York, NY, United States, aghose@stern.nyu.edu

Adverse selection equilibria exist due to information asymmetry stemming from the inobservability of quality signals. This accrues from both a seller's characteristic (reputation) as well as the product's self-reported quality in secondary markets. Using a unique dataset encompassing 5 categories(Books, CDs, DVDs, Video and Software) and 6 countries(US, UK, Canada, Germany, France and Japan), I investigate trade patterns and adverse selection based on theory from a dynamic model of used goods.

2 - Business-to-Business Electronic Payments Adoption Analysis

Paulo Goes, Professor, University of Connecticut, 2100 Hillside Road, CT, 06268, United States, paulo@sba.uconn.edu, John Zhang

Despite the potential improvements in cost, timeliness, and payment accuracy, electronic payments have not been widely adopted in B2B transactions. In this paper, we investigate, using commercial equipment financing billing data from one of the top Fortune 500 companies, if there is a difference in electronic payments adoption across businesses, and what variables affect the decision of electronic payments adoption within a firm.

3 - Identifying and Forecasting Economic Regimes in Electronic Marketplaces

Alok Gupta, Professor, University of Minnesota, 321 19th Avenue South, 3-365 Carlson School of Management, Minneapolis, MN, 55455, United States, agupta@csom.umn.edu, Wolfgang Ketter, John Collins, Paul Schrater, Maria Gini

We develop methods to detect and predict market regimes, using a Gaussian Mixture Model to represent probabilities of prices. An autonomous trading agent can use our methods to identify and predict market conditions, and to make operational and strategic decisions. We show that regimes have properties that represent different market conditions, and develop a method to predict future regime changes. We validate our method with data from Trading Agent Competition for Supply Chain Management.

■ MD23

H - 4th Floor, Union Square 17

WDM and MPLS Network Design

Sponsor: Telecommunications
Sponsored Session

Chair: S. Raghavan, Smith School of Business, University of Maryland, 4345 Van Munching Hall, College Park, MD, 20742, United States, raghavan@umd.edu

1 - A Branch-and-Price Algorithm for WDM Optical Network Design

Daliborka Stanojevic, dstanoje@rhsmith.umd.edu, S. Raghavan

Optical networks with wavelength division multiplexing require the simultaneous design of two network layers - the logical topology, where we need to construct lightpaths over the physical topology of the optical network, and the routing of traffic over the established logical topology. This corresponds to a two layer integer multicommodity flow problem with side constraints. We propose a branch-and-price algorithm for this problem and present some computational results.

2 - Dynamic Traffic Grooming in WDM Optical Networks

Brigitte Jaumard, Professor, Université de Montréal, FAS/DIRO C.P. 6128, succ Centre-ville, Montréal, QC, H3C 3J7, Canada, jaumard@iro.umontreal.ca, Romaric Boley, Alain Houle

A key feature of WDM networks, referred to as traffic grooming, is to aggregate low speed traffic onto high speed wavelength channels in a resource-efficient way, that is, to maximize the network througput when the resources are given or to minimize the resource consumption when the traffic requests to be satisfied are given. We study the dynamic traffic grooming problem though different scenarios, whether we allow or not some rerouting or the addition of some resources.

3 - Edge Coloring for Wavelength Assignment in WDM Networks

Arie Koster, Zuse Institute Berlin, Takustrasse 7, Berlin, D-14195, Germany, koster@zib.de

We show that wavelength assignment with at most two links per lightpath can be modeled as a generalized edge coloring problem. By this relation, we derive lower and upper bounds for various objectives. For all instances available, the lower bound equals the best known solution value, by this proving optimality.

4 - MPLS Traffic Engineering with Over-Subscription: A Network Optimization Approach

Richard Barr, Chair, EMIS Department, Southern Methodist University, P.O. Box 750123, Dallas, TX, 75275, United States, barr@engr.smu.edu, Richard Helgason, Saib Jarrar

As with airlines' over-booking policies, capacity over-subscription in MPLS telecommunications networks can exploit the stochastic nature of traffic to accommodate additional demand, while risking packet loss. Optimization models for this problem are presented with computational experimentation to demonstrate their value in network capacity planning.

■ MD24

H - 4th Floor, Union Square 18

Financial Engineering: Models and Computation

Cluster: Financial Engineering
Invited Session

Chair: Steven Kou, Columbia University, 312 Mudd Building, Dept. of IEOR, New York, NY, United States, sk75@columbia.edu

1 - Exotic Options under Jump-Diffusion Processes

Liming Feng, Ph.D. Student, Northwestern University, 2145 Sheridan Rd. RM C210, Evanston, IL, 60208, United States, feng@northwestern.edu, Vadim Linetsky

In this talk we will survey our recent work on the pricing of single- and double-barrier options under jump-diffusion processes, including exponential Levy processes.

2 - Credit Spread, Implied Vol and Optimal Capital Structure with Endogenous Default and Jump Risk
Nan Chen, Columbia University, 500 W120th Street, Rm.325, New York, NY, 10027, United States, nc2005@columbia.edu, Steven Kou

A credit risk model is investigated using a double exponential jump-diffusion process. The model can produce non-zero credit spreads as the maturity of a bond tends to zero, can lead to the implied volatility smile for equity options, can provide various analytical solutions, also can give an explanation to an empirical fact that highly risky firms tend to have little debt and can illustrate flexibility of generating various shapes of spread curves and volatility smiles.

3 - Unified Valuation of Corporate Debt, Credit Derivatives, and Equity Derivatives
Vadim Linetsky, Associate Professor, Department of IE/MS, Northwestern University, 2145 Sheridan Rd, Evanston, IL, 60202, United States, linetsky@iems.northwestern.edu

This talk will discuss a framework for unified valuation of corporate debt, credit derivatives, and equity derivatives.

4 - Recent Developments in Pricing Discrete Path-Dependent Options
Steven Kou, Columbia University, 312 Mudd Building, Dept. of IEOR, New York, NY, United States, sk75@columbia.edu

In this talk we shall present results in Giovanni and Kou (2004) and Cao and Kou (2005). The first paper is on pricing discrete barrier and lookback options via Laplace transform under jump diffusion models; and the second one is on continuity corrections for discrete two-dimensional and partial barrier options under the classical Brownian model.

■ MD25

H - 4th Floor, Union Square 19

Auctions and Queues

Contributed Session

Chair: Nathan Sherman, Ph.D. Candidate, Air Force Institute of Technology, Dept of Operational Sciences, 2950 Hobson Way, Wright Patterson AFB, OH, 45433, United States, Nathan.Sherman@afit.edu

1 - Online Auction Design Modelling: One Bid or Multiple Bids
Guoren Zhang, Ph.D. Student, Richard Ivey School of Business, 1151 Richmond Street North, University of Western Ontario, London, ON, N6A3K7, Canada, gzhang@ivey.uwo.ca, John Wilson

We consider an auction design problem, where customers will act strategically according the information the auctioneer release. Specifically, the auctioneer will tell the customers the probability of winning a production if they bid a specific amount of money, and the customers will bid optimally according to this information and the market price of this production. We show how the auctioneer can maximize their return and compare the return from one bid case with return from multiple bids.

2 - Optimum Sequential Bidding on Projects Using Markov Decision Process
Yavuz Canbolat, Wayne State University, 4815 Fourth St., Room #1061, Detroit, MI, 48202, United States, canbolat@wayne.edu, Kenneth Chelst

Sequential bidding by suppliers on complex engineering/manufacturing contracts is a fact of life in many manufacturing industries such as autos. In this paper, we develop a sequential bidding model that incorporate the buyer's satisfaction with earlier supplier performance and learning benefits acquired by the supplier. The supplier's objective is to maximize expected profit over an infinite time horizon. We use Markov Decision Process to derive the optimum bidding strategy for a supplier.

3 - Analysis of M/G/s Queues with Queuing Time Dependent Balking
Liqiang Liu, Student, Dept. of Stat. and OR, 210 Smith Bld., CB#3180, University of North Carolina, Chapel Hill, NC, 27599-3180, United States, liul@unc.edu, Vidyadhar Kulkarni

We propose an approximation for M/G/s queue with balking based on the queuing time. An arriving customer joins the queue and stays until served only if his queuing time is below a fixed level at the time of arrival. The approximation is exact if either s=1 or G=M. In these cases we present analytical and numerical results. In other cases, we study the goodness of the approximation by simulation.

4 - Sensitivity of Optimal Prices for an M/M/s/K Service System
Tuba Aktaran-Kalayci, Georgia Tech ISyE, School of Industrial and Systems Enginee, Georgia Institute of Technology, Atlanta, GA, 30332, United States, taktaran@isye.gatech.edu, Hayriye Ayhan

We consider the problem of maximizing the long-run average reward in a service facility with dynamic pricing. We investigate sensitivity of optimal pricing policies for the service facility which is modelled as an M/M/s/K. Arrival process to the facility is Poisson with arrival rate a decreasing function of the price currently being charged in the facility. We prove some structural results on the optimal pricing policies when the parameters in the facility change.

5 - An Infinite-Capacity Retrial Queue with Unreliable Server
Nathan Sherman, Ph.D. Candidate, Air Force Institute of Technology, Dept of Operational Sciences, 2950 Hobson Way, Wright Patterson AFB, OH, 45433, United States, Nathan.Sherman@afit.edu, Jeffrey Kharoufeh

We analyze an M/M/1 retrial queue with unreliable server in which the retrial orbit and normal queue both have infinite capacity. Using probability generating functions, we obtain the joint distribution of the orbit and normal queue size, as well as simple expressions for all standard queueing performance measures.

■ MD26

H - 4th Floor, Union Square 20

Statistical Quality Control for Processes with Complex Topologies

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: Shiyu Zhou, Assistant Professor, University of Wisconsin - Madison, 1513 University Ave., Dept. of Industrial and Systems Engr., Madison, WI, 53706, United States, szhou@engr.wisc.edu

1 - A Multivariate Procedure for Process Monitoring and Diagnosis in Multistage Manufacturing Processes
Paul Zantek, University of Maryland, Van Munching Hall, College Park, MD, 20742, United States, pzantek@rhsmith.umd.edu, Yong Chen, Shan Li

We show how recent models of product quality may be used to design a procedure for multivariate statistical process control (SPC) that can outperform direct application of multivariate SPC. The procedure may be considered a generalization of several existing multivariate SPC methods in that it permits less restrictive assumptions about the process being monitored. The use of the procedure is illustrated using two examples from automobile assembly operations.

2 - A Data-Driven Method Identifying Complex Interactions in Multistage Manufacturing Processes
Shiyu Zhou, Assistant Professor, University of Wisconsin - Madison, 1513 University Ave., Dept. of Industrial and Systems Engr., Madison, WI, 53706, United States, szhou@engr.wisc.edu, Li Zeng

In this research, the direct interactions among operation units in a multistage manufacturing process are modeled as the partial correlation among the quality outputs of these units. A data driven method is developed to efficiently identify these interactions utilizing graphical model method and physical insights to the process.

3 - Fault Diagnosis of Manufacturing Processes and Navigation Systems: A State Space Approach
Fugee Tsung, Associate Professor, Hong Kong University of Science and Techonology, IELM Department of HKUST, Kowloon, Hong Kong, season@ust.hk, Tze Leung Lai

Quality control techniques for process monitoring and diagnosis are becoming important in competitive industries. With advances in sensing and data capture technology, large volumes of data are being routinely collected over multistage processes, which has a growing impact on the existing methods. This talk will focus on some recent advances in multistage monitoring and diagnosis using a state space approach with the application to multistage manufacturing processes and navigation systems.

4 - Feedback Adjustment of Machining Processes Based on Equivalent Fixture Error Model
Qiang Huang, Assistant Professor, University of South Florida, 4202 E. Fowler Ave., ENB118, Tampa, FL, 33620, huangq@eng.usf.edu, Hui Wang

We develop a control algorithm for detecting process variations and automatically adjusting the machining process. Considering different types of error sources in a machining process, we use only fixture locators to adjust process based on the developed Equivalent Fixture Error model. A Minimum-Mean-Square-Error controller considers the dynamic property of the machining process. The results show that this algorithm can effectively improve the machining accuracy and reduce the feature variation.

■ MD27

H - 4th Floor, Union Square 21

Lessons in Project Management

Contributed Session

Chair: Parijat Dube, IBM T. J. Watson Research Center, NY, 19, Skyline Drive, Hawthorne, NY, 10532, United States, pdube@us.ibm.com

1 - Predictive Gantt Charts for Stochastic Scheduling and Control

Dan Trietsch, University of Auckland, ISOM Department, OCH, 7 Symonds Street, Auckland, New Zealand, d.trietsch@auckland.ac.nz

The almost century-old Gantt charts proved very useful for deterministic planning. Because reality is stochastic, they are weaker for control. Predictive Gantt charts add a simulation-based "21st Century" stochastic planning and control capability. They depict the probabilities of stochastic interactions and of meeting milestones in an intuitive format: Instead of simple rectangular boxes, CDFs depict start- and finish times. For control, progress information is used to generate updated CDFs.

2 - The Adoption of ASP Services by Small Businesses

Farheen Altaf, Temple University, 210 Speakman Hall, Philadelphia, PA, 19122, United States, farheen@temple.edu, David Schuff

Application Service Providers bring advantages like scalability, managerial focus and cost benefits to small businesses. This study focuses on flexibility as key factor that could increase the customer base of ASPs in the small business market. Flexibility implies scaling down applications to provide fewer functions rather than complete applications.

3 - Stochastic Project Duration Analysis using PERT-beta Distributions

Ron Davis, Associate Professor, San Jose State University, College of Business, One Washington Square, San Jose, CA, 95192, United States, ron@mathproservices.com

This three part paper presents formulas and algorithms for using the beta distribution in PERT-based stochastic project duration analysis. Beta shape parameter formulas for Monte Carlo simulation are shown first. The second part shows an approximate analytic stochastic forward pass method that develops the CDF for project duration without simulation. The third part shows how to formulate the Stochastic Project Crashing problem. Example computational results are presented.

4 - How Good Data Goes Bad

Hy Sockel, Associate Professor of Management, Youngstown State University, College of Business, Youngstown, OH, United States, hysockel@cc.ysu.edu

This paper analyzes various ways that high quality data can denigrate over time. The paper first visits what data quality is and how low value poor quality data affects the organization and its information systems. It then addresses several characteristics of good quality data: (accuracy, consistency, completeness, format, timeliness, reliability, and validity (internal & external),).

5 - On the Value of Information About Anticipated Quality of Service in a Competitive Market

Parijat Dube, IBM T. J. Watson Research Center, NY, 19, Skyline Drive, Hawthorne, NY, 10532, United States, pdube@us.ibm.com, Zhen Liu

Information about anticipated delay plays an important role in customer's decision of taking service from a particular firm. Firm's can advertise anticipated delays using different measures (like expected delay, exact delay). We provide a framework to evaluate the performance of different measures in a competitive setting using utility based approach for customer's choice and queueing models for anticipated delay and linking the two models through the market share of firms.

■ MD28

H - 4th Floor, Union Square 22

Cutting Edge Research in Revenue Management

Sponsor: Revenue Management & Pricing

Sponsored Session

Chair: Guillermo Gallego, Professor, Columbia University, 326 S.W. Mudd Building, New York, NY, 10027, United States, ggallego@ieor.columbia.edu

1 - Multi-Period Pricing of Perishable Products; Competition, Uncertainty

Georgia Perakis, Associate Professor of Operations Research, MIT, Cambridge, MA, 02478, United States, georgiap@mit.edu, Dung Tri Nguyen

We discuss a model for dynamically pricing multiple perishable products over a finite time horizon (i.e. each seller has a fixed inventory of each product that she needs to sell over a finite time horizon). We are considering an oligopoly and assume that sellers compete through pricing. Applications include airline pricing, selling seasonal products and others. The model we present addresses competition together with the presence of uncertainty. Finally we discuss insights from the model.

2 - Dynamic Pricing with Loss-Averse Buyers

Ioana Popescu, INSEAD, Blvd de Constance, Fontainebleau, 77300, France, ioana.POPESCU@insead.edu, Yaozhong Wu

In a market with repeated interactions, demand depends on the firm's pricing history, summarized by a reference price. We prove that optimal dynamic pricing policies induce a monotonic perception of prices, with the effect of a skimming or penetration strategy. We identify conditions for optimal monotonic prices. The steady state price decreases with the strength of the reference price effect and with customer's memory. Myopic strategies lead to systematic under-pricing and lower revenues.

3 - Forecasting Models for Correlated Demand

Catalina Stefanescu, Assistant Professor of Decision Sciences, London Business School, Regent's Park, London, United Kingdom, cstefanescu@london.edu

Many RM systems generate demand forecasts using univariate models. In some cases, such as airline RM, demand is correlated across products and time periods. We investigate the impact of misspecified correlation on forecast accuracy, we discuss multivariate demand modelling strategies, and we show how the models are estimated in a maximum likelihood framework using the censored historical sales data usually available. Numerical examples exemplify the improved accuracy of the resulting forecasts.

4 - Strategic Capacity Rationing to Induce Early Purchases

Garrett van Ryzin, Professor, Columbia University, gjv1@columbia.edu, Qian Liu

Dynamic pricing offers the potential to increase revenues. At the same time, it creates an incentive for consumers to strategize over the timing of their purchases; that is, customers, anticipating the entireprice path, may try to optimally time their purchases. In such cases, a firm should ideally account for this behavior in its pricing and stocking decisions. We investigate whether it is optimal for a firm to create a rationing risk by under-stocking products.

■ MD29

H - 4th Floor, Union Square 23

Social and Public Policy Issues

Sponsor: E-Business

Sponsored Session

Chair: Subhajyoti Bandyopadhyay, Assistant Professor, University of Florida, 364 Stuzin Hall, Gainesville, FL, 32611, United States, shubho.bandyopadhyay@cba.ufl.edu

1 - A Proposed Framework for Implementing Privacy (FIP)

Nina Zumel, Quimba Software, 4 W. 4th Avenue, Suite A, San Mateo, CA, 94402, United States, zumel@quimba.com, Robert Dourandish

We propose a framework for expressing and communicating context-dependent privacy constraints. It is an extension of the P3P, developed by the World Wide Web Consortium. It allows individuals to retain control over how and where their information is shared or used, while enabling organizations to use that data in an appropriate but accountable way. Such a framework would create a cooperative and mutually beneficial environment between customers and companies, and citizens and their governments.

2 - Broadband Pricing, Universal Access, and Implications for Public Policy

Subhajyoti Bandyopadhyay, Assistant Professor, University of Florida, 364 Stuzin Hall, Gainesville, FL, 32611, United States, shubho.bandyopadhyay@cba.ufl.edu, Hsing Cheng

Broadband service providers have begun experimenting with differentiated service offerings and pricing policies. We analyze the effect of a novel pricing scheme, called 'liquid bandwidth'. Preliminary results indicate that introduction of such pricing schemes can significantly boost profits for the provider. Further, effective penetration of broadband services in a monopolist market might require regulatory intervention, a finding which has important public policy implications.

■ MD30

H - 4th Floor, Union Square 24

Critical Infrastructure Security, Performance, and Sustainability

Cluster: Sustainable Development and OR
Invited Session

Chair: Michael Casey, Assistant Professor, George Mason University, 4400 University Drive, MS4A6, Fairfax, VA, 22030, United States, mcasey4@gmu.edu

1 - Efficient Heuristics for Congestion Minimization in Dynamic Free Space Optical Networks

Yohan Shim, Research Assisstant, University of Maryland, College Park, MD, 20742, United States, yshim@umd.edu, Aniket Desai, Stuart Milner, Jifang Zhuang, Prawat Sahakij, Steven Gabriel

Free Space Optical (FSO) networks assure high capacity for applications such as critical infrastructure video surveillance. Finding the minimum congestion topology in dynamic FSO networks is computationally hard. The paper focuses on efficient heuristics to obtain a near optimal solution to the problem. We state the problem's integer program formulation and present efficient heuristics, which are computationally less complex than the branch and bound algorithm used to find the optimal solution.

2 - An Overview of Sensor Network Control for Critical Infrastructure Surveillance

Michael Casey, Assistant Professor, George Mason University, 4400 University Drive, MS4A6, Fairfax, VA, 22030, United States, mcasey4@gmu.edu, Stuart Milner, Gregory Baecher

Embedded systems for the control of infrastructure systems are increasingly vital. Sensor networks use algorithms for minimum cost, maximum throughput, and survivable topologies. For high bandwidth transmission over long spans, point-to-point networks such as hybrid FSO-(free space optical) RF meet these multi-criteria. This paper will provide an overview of dynamic network control and introduce technologies for the monitoring/protection of critical infrastructure, especially civil systems.

3 - Evaluating Effectiveness of Cost Minimization Heuristics in Optical Wireless Networks

Jaime Llorca, Research Assistant, University of Maryland, 2307 A.V. Williams bldg, University of Maryland, College Park, MD, 20742, United States, jllorca@umd.edu, Aniket Desai, Yohan Shim, Stuart Milner, Steven Gabriel

Optical wireless networks provide broadband connectivity for applications such as video surveillance. We study the problem of dynamic topology reconfiguration - computation of a new topology upon degradation. Finding the minimum cost topology with limited transceivers per node is an NP-Complete problem. We state the problem's integer program formulation, present the average run-time analysis to find its optimal solution and analyze low complexity heuristics which obtain near optimal solutions.

4 - New Threats to Water Distribution System Security

Mark H Houck, Professor, George Mason University, Civil, Env, and Infrastrucutre Eng, 4400 University Drive, Fairfax, VA, 22030, United States, mhouck@gmu.edu, Zbigniew Skolicki, Tomasz Arciszewski

The threats to water distribution systems since 911 have changed. An organized malicious agent(s) intent on harming or terrorizing the population by breaking or contaminating the water distribution network has not been routinely considered in planning, designing, or managing these systems. An approach to identify the threats that may be posed by malicious agents and also to identify means either to eliminate or reduce these threats is proposed; several examples provided.

■ MD31

H - 4th Floor, Union Square 25

Operations Research Applications in Semiconductor Manufacturing

Cluster: OR Practice
Invited Session

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

1 - Methodology for Simplification of Simulation Models

John Fowler, Professor, Arizona State University, Department of Industrial Engineering, Tempe, AZ, 85287, United States, john.fowler@asu.edu, Gerald Mackulak, Rachel Johnson

Discrete event simulation of semiconductor manufacturing often requires long run lengths. This research seeks to develop a procedure for identifying pieces of a detailed simulation model that can be replaced with more efficient logic to create a fast (abstract) simulation model - that achieves a statistically indistinguishable level of accuracy and precision - as a surrogate for the more detailed model. The procedure will be demonstrated on a real semiconductor manufacturing test bed data set.

2 - Scheduling Practice in Semiconductor Manufacturing: Results of a Comprehensive Survey

Erhan Kutanoglu, Assistant Professor, The University of Texas at Austin, 1 University Station C2200, Austin, TX, 78712, United States, erhank@mail.utexas.edu, John Hasenbein, Joe Qin, Brent Bregenzer

As part of a latest Factory Operations Research Center (FORCe) project jointly supported by SRC and NSF, semiconductor manufacturers participated a survey that assesses the scheduling practice in the industry. This talks presents the major findings of the survey, outlines important research areas, and compares its outcomes with the earlier survey results.

3 - The Generalized Lot Allocation Problem in Semiconductor Supply Chains

Yang Sun, Research Associate, Arizona State University, Dept. of Industrial Engineering, P.O. Box 87-5906, Tempe, AZ, 85287, United States, yang.sun@asu.edu, Dan Shunk, John Fowler

We introduce the Generalized Lot Allocation problem of how to configure and allocate semiconductor product lots to customer orders in order to maximize fill-rate and on-time delivery and to minimize product excess and product down-grade based on multi-day demand and supply visibility. The problem is formulated as an integer program. A genetic algorithm is used in search of better solutions. Computational experiments show that our proposed decision procedure can outperform current practice.

■ MD32

H - 6th Floor, Lombard 4:30 ✗

Panel Discussion: Meet the Editors

Cluster: INFORMS Publications
Invited Session

Chair: Fred Murphy, Temple University, Philadelphia, PA, United States, fmurphy@temple.edu

1 - Panel Discussion: Meet the Editors

Moderator: Fred Murphy, Temple University, Philadelphia, PA, United States, fmurphy@temple.edu, Panelists: Jeffrey Camm, Wallace Hopp, Steven Shugan, Keith Womer

This session is a panel discussion. Editors from several of the INFORMS journals will present short descriptions of their journals both in what they are looking for in articles and how they handle the editorial process. After brief statements by the editors. We will take questions from the audience on publishing in our journals.

■ MD33

H - 6th Floor, Mason

Recent Developments in Computer Experiments

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: Zhiguang Qian, Georgia Institute of Technology, 755 Ferst Ave, Atlanta, GA, 30332, United States, zqian@isye.gatech.edu

Co-Chair: Jeff Wu, jeffwu@isye.isye.gatech.edu

1 - Quantifying Simulation Uncertainty in Computer Experiments for Robust Design

Jun Liu, junliu@northwestern.edu, Dan Apley

With computationally intensive computer experiments, simulations are conducted at only a limited number of design/noise variable combinations. This causes uncertainty in the response mean and variance as a function of the design variables. We discuss approaches for quantifying the effects of these uncertainties within the robust design framework.

2 - Limit Kriging

Roshan Vengazhiyil, Assistant Professor, Georgia Institute of Technology, Industrial & Systems Engineering, 755 Ferst Drive, Atlanta, GA, 30332, United States, roshan@isye.gatech.edu

Kriging is widely used in the analysis of computer experiments. In this work, a new kriging predictor is proposed. It gives a better performance over the existing predictor when the constant mean assumption in the kriging model is unreasonable. The new predictor seems to be more robust to the misspecifications in the correlation parameters and numerically more stable.

3 - Building Surrogate Models Based on High-Accuracy and Low-Accuracy Data

Zhiguang Qian, Georgia Institute of Technology, 755 Ferst Ave, Atlanta, GA, 30332, United States, zqian@isye.gatech.edu, C. F. Jeff Wu

Building surrogate models based on high-accuracy and low-accuracy data is a challenging task. This work proposes Bayesian hierarchical Gaussian process models that make use of flexible location-and-scale adjustments and are capable of producing prediction closer to that from the high-accuracy experiment. The proposed method is illustrated with two examples: one with physical and computer experiments and the other with detailed and approximate finite elements simulations.

4 - Design of Experiments for Integrated Computer and Physical Experiments

Shane Reese, reese@hannibal.byu.edu

Physical experimentation is an expensive endeavor. Computer experiments, which are often a less expensive alternative, provide a reasonably accurate representation of physical experimental results. This work proposes an approach ...

■ MD34

H - 6th Floor, Powell

Sensor I

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: Yu Ding, Assistant Professor, Industrial Engineering, Texas A&M University, Texas A&M University, MS3131, College Station, TX, 77843, United States, yuding@iemail.tamu.edu

1 - Theory and Computation of Semidefinite Programming for Sensor Network

Yinyu Ye, Stanford University, yinyu-ye@stanford.edu, Anthony So, Pratik Biswas

We describe a semidefinite programming (SDP) based model and method for the position estimation problem in Euclidean distance geometry such as wireless sensor network localization. The optimization problem is set up so as to minimize the error in sensor positions to fit incomplete and noisy distance measures. We also develop a gradient-based local search method to round and improve the SDP solution.

2 - RFID and Quality Checking in a Complex Assembly Process

Gary Gaukler, Stanford University, Management Science & Eng'g, MC 4026, Stanford, CA, 94305, United States, gaukler@stanford.edu, Warren Hausman

We examine a manual assembly process with a wide variety of parts and subassemblies. In such a process it is imperative to have quality checks in place that verify that the correct parts are assembled into the end product. Current technology does this assembly verification through manual barcode scans. We show how RFID can be used to improve assembly verification significantly, and we present an economic analysis of the costs and benefits of an RFID implementation for this process.

3 - Automated Population Separability Assessment for Automated Inspection Systems

Rene Villalobos, Arizona State University, Department of Industrial Engineering, Tempe, AZ, United States, rene.villalobos@asu.edu, Hugo Garcia

A problem in automated inspection is the level of discrimination between two given populations. This can be measured directly by using of the Misclassification Error Rate (MER) and indirectly through the statistical distance of the populations. If this distance is small the inspection system will render unacceptable high levels of MER. This problem is called population separability. We address different methods to find relationships between class separability and the MER.

4 - Redundancy Analysis of Linear Sensor Systems and Its Applications

Yu Ding, Assistant Professor, Industrial Engineering, Texas A&M University, Texas A&M University, MS3131, College Station, TX, 77843, United States, yuding@iemail.tamu.edu, Jung Jin Cho, Yong Chen

In-process quality improvements presumably rely on the accuracy of sensor measurements. Robust control procedures that can tolerate potential sensor reading anomalies are always desirable in practice. The existence of sensor redundancy is one of the fundamental reasons enabling the fault tolerance capability of a sensor system. This paper presents a redundancy analysis of linear sensor systems so as to quantify its effect on the system robustness.

■ MD35

H - 6th Floor, Sutter

General Optimization Problems

Sponsor: Minority Issues
Sponsored Session

Chair: Douglas McWilliams, Assistant Professor, Purdue University, 401 N. Grant Street, West Lafayette, IN, 47906-2021, United States, dmcwilli@purdue.edu

1 - A Discrete EOQ Model with Unequal Order Quantities

Emmett Lodree, Assistant Professor, Auburn University, Department of Industrial and Systems Eng, 207 Dunstan Hall,Auburn University, Auburn, AL, 36849-5346, United States, elodree@auburn.edu

Mathematical programming and induction are used to prove that the well known EOQ formula is an optimal stationary policy. However, for integer order quantities, it is shown that a stationary policy for the discrete case is not necessarily optimal or even feasible. A heuristic method that generates discrete ordering policies is developed, and its performance with respect to objective function value and computational time is compared to the performance of mathematical programming software.

2 - Greedy Simulation-Based Scheduling to Increase Throughput at a Parcel Consolidation Terminal

Douglas McWilliams, Assistant Professor, Purdue University, 401 N. Grant Street, West Lafayette, IN, 47906-2021, United States, dmcwilli@purdue.edu

A discrete-event simulation model with an embedded greedy algorithm is presented to generate unload schedules to the parcel hub scheduling problem. This problem involves processing batches of parcels through a consolidation terminal in the least time possible.

3 - Key Factors in Successful Timber Procurement Auctions

Kendra Taylor, Ph.D. Candidate, GaTech, Industrial and Systems Engineering, Atlanta, GA, United States, kendra12@bellsouth.net

We analyzed data from reverse auctions for timber procurement on the spot market and found less than half of the auctions that were initiated attracted one or more bidders. Because aggregating volume is a primary goal of auctioneers for using the auction, we look for plausible explanations of low bidder participation using factors that tend to affect supply. We discuss our findings in this presentation.

4 - Optimization Techniques for Road Rehabilitation and Bridge Replacement

Alberto Garcia-Diaz, Industrial and Information Engineering, University of Tennessee, Knoxville, TN, 37996-2011, agarcia2@utk.edu, Illya Hicks

A road-bridge rehabilitation model is formulated as a mixed non-linear programming problem with linear constraints. Since the problem is related to the traffic assignment problem and the road rehabilitation budget allocation problem, we utilize these problems to construct near-optimal solutions for the original problem. We present computational results displaying the effectiveness of our approach.

■ MD36

H - 6th Floor, Taylor

Simulation Methods for Selecting the Best System

Sponsor: Simulation
Sponsored Session

Chair: Michael Fu, Professor, University of Maryland, Van Munching Hall, College Park, MD, 20742, United States, mfu@umd5.umd.edu

1 - Ranking and Selection with Control Variates

Barry Nelson, Professor, Northwestern University, Dept. of Industrial Engr. & Mgmt. Sci., 2145 Sheridan Road, Evanston, IL, 60208-3119, United States, nelsonb@northwestern.edu, Vadim Lesnevski, Shing Chih Tsai, Jeremy Staum

Ranking-and-selection procedures based on sample means (or generalized sample means) are well established in the stochastic simulation community. We introduce a companion theory, and evaluate the merits, of ranking and selection based on control-variate estimators.

2 - OCBA Simulation Selection Procedures for Opportunity Cost

Chun-Hung Chen, Associate Professor, George Mason University, 4400 University Drive, MS 4A6, Fairfax, VA, 22030, United States, cchen9@gmu.edu, Donghai He, Stephen Chick

We present an efficient procedure for ranking-and-selection problems, where the objective is to minimize the expected opportunity cost of a potentially incorrect selection. The new approach is a greedy OCBA (optimal computing budget allocation) procedure, which allocates samples sequentially in order to minimize an approximation to the expected opportunity cost.

3 - Fully Sequential Procedures for Bernoulli Selection
David Goldsman, Professor, Georgia Tech, School of ISyE, Georgia Tech, Atlanta, GA, 30332, United States, sman@isye.gatech.edu, Gwendolyn Malone, Seong-Hee Kim, Demet Batur

In Bernoulli selection problems, the basic output from each simulated system on each replication takes either the value one (success) or zero (failure), and the goal is to find the system with the largest probability of success. To solve this problem, we adapt a fully sequential procedure due to Kim and Nelson (2004), employing the use of common random numbers. We also compare the performance of the proposed procedure with those of two competitive procedures.

4 - Multi-Objective Optimization Approach for Simulation Model
Loo Hay Lee, Professor, National University of Singapore, Department of Industrial & Systems Engin, Singapore, —, Singapore, iseleelh@nus.edu.sg

We consider a multi-objective computing budget allocation problem, where the system designs are evaluated by more than one performance measure. The concept of Pareto optimality is introduced and the ultimate goal is to identify the Pareto set. To measure the quality of the Pareto set, two types of errors are identified. A sequential solution method that uses the asymptotic simulation replication allocation rule is developed to minimize these errors. Computational results are promising.

5 - Simulation Allocation with Correlated Non-Gaussian Sampling
Xiaoping Xiong,Freddie Mac, Fixed Income Research, 1551 Park Run Drive, McLean VA 22042, United States, xxiong@rhsmith.umd.edu, Michael Fu, Sandeep Juneja

We consider the problem of efficiently allocating simulation replications to maximize the probability of selecting the best design under the scenario in which system performance estimates are drawn from correlated samples, under both Gaussian and non-Gaussian sampling distributions. We propose an approximate problem as well as a solution procedure to that problem. We show that the solution is asymptotically exact and provide an analysis of the convergence rate.

■ MD37

H - 6th Floor, Van Ness

Joint Session AP/Minority/Workforce: Call Centers

Sponsor: Applied Probability, Minority Issues, Workforce Flexibility
Sponsored Session

Chair: Mark E. Lewis, Associate Professor, Cornell University, School of ORIE, 206 Rhodes Hall, Ithaca, NY, 14853, United States, melewis@orie.cornell.edu

1 - Approximate Dynamic Programming in Multi-skill Call Centers
Ger Koole, Professor, Vrije Universiteit, Department of Mathematics, De Boelelaan 1081a, Amsterdam, 1081HV, Netherlands, koole@few.vu.nl, Auke Pot

We consider skill-based routing in multi-skill call centers. The standard framework for finding the optimal dynamic routing policy is Markov decision theory. However, the curse of dimensionality makes it computationally infeasable to find this optimal policy. Therefore we use an approximation technique called approximate dynamic programming. It gives very good results for the call centers we analyzed.

2 - Service System Planning in the Presence of a Random Arrival Rate
Samuel Steckley, Ph.D. Student, Cornell University, School of ORIE, 292 Rhodes Hall, Ithaca, NY, 14853, United States, steckley@orie.cornell.edu, Shane Henderson, Vijay Mehrotra

Several authors have proposed modeling arrivals to a call center in a given period with a Poisson process with an uncertain arrival rate. We address the questions of what performance measures to use and how to estimate these measures in order to support staffing decisions given uncertainty in the arrival rate. We clarify when the analytical approximations can be expected to be accurate and describe when and how simulation should be used to provide better estimates.

3 - An Intelligent Intra-Day and Intra-Week Updating Model for Call Center Scheduling
Vijay Mehrotra, Professor, San Francisco State University, Department of Decision Sciences, 1600 Holloway Avenue, San Francisco, CA, 94132, United States, drvijay@sfsu.edu, Ozgur Ozluk

Agent schedules are typically made days or even weeks prior to the beginning of the scheduling period. It is known that actual call arrival volumes early in the week can provide valuable information about volumes later in the week. The challenge is to effectively make use of this information. We examine the impact of updated call forecasts on agent requirements, and propose linear programming models to determine optimal assignments for Voluntary Time Off and Overtime.

4 - Admission Policies for Finite-Capacity Queues with Multiple QoS Constraints
Eugene Feinberg, Professor, SUNY Stony Brook, Dept of Applied Math and Statistics, Stony Brook, NY, 11794-3775, United States, efeinberg@notes.cc.sunysb.edu, Xiaofei Fan-Orzechowski

We study optimal admission of customers to a Markovian finite-capacity queue with several customer types. The system managers are paid for serving customers and are penalized for rejecting them. The rewards and penalties depend on customer types. We discuss the structure of a policy that maximizes average rewards per unit time subject to the inequality constraints on the average costs.

■ MD38

R - 2nd Floor, Corintia

LP and SDP Approaches to Global Optimization

Sponsor: Optimization/ Global Optimization
Sponsored Session

Chair: Nikolaos Sahinidis, University of Illinois, Dept. of Chemical and Biomolecular Eng., Urbana, IL, 61801, United States, nikos@uiuc.edu

1 - Global Optimization of Quadratic Programs with Fixed Cost Variables
Dieter Vandenbussche, University of Illinois, 1206 West Green Street, Urbana, IL, 61801, United States, dieterv@uiuc.edu

Recent work has demonstrated the potential for globally optimizing nonconvex QPs using a reformulation based on the first order KKT conditions. We show how this reformulation may be generalized to account for fixed cost variables. We then extend some of the polyhedral work that has been done for bound constrained QPs to handle such fixed cost variables. We show how to lift known classes of inequalities for the case without fixed cost variables and propose several new classes.

2 - Semidefinite Programming Relaxations for Polynomial Optimization Problems with Structured Sparsity
Hayato Waki, Tokyo Institute of Technology, 2-12-1 Oh-Okayama, Miguro-ku, Tokyo, Meguro-ku, To, 182-8552, Japan, Hayato.Waki@is.titech.ac.jp, Masakazu Muramatsu, Masakazu Kojima, Sonyoung Kim

Sparse polynomial optimization problems (POP) are considered. A correlative sparsity pattern graph is defined to find a certain sparse structure in the objective and constraint polynomials of a POP. Based on this graph, sets of supports for sums of squares (SOS) polynomials that lead to efficient SOS and semidefinite programming (SDP) relaxations are obtained. Numerical results from various test problems are included to show the improved performance of the SOS and SDP relaxations.

■ MD39

R - 3rd Floor, Aragon

New Algorithmic Development for Linear Programming

Contributed Session

Chair: Roberto Lopez, RA, ITESM Campus Toluca, Eduardo Monroy Cardenas 2000, San Antonio Buenavista, Toluca, Mx, 50110, Mexico, roberto.lopez@itesm.mx

1 - An Elementary Algorithm and Interior Point Methods for Linear Programming
Joao Goncalves, IBM T.J. Watson Research Center, 1101 Kitchawan Road, Yorktown Heights, NY, 10598, United States, jpgoncal@us.ibm.com, Robert Storer, Jacek Gondzio

We present an elementary algorithm for linear programming extending one proposed by von Neumann. Computational results show significant improvement over von Neumann's algorithm. While not a viable stand alone LP algorithm, we show that it can improve the performance of an interior point algorithm when the two are combined.

2 - Cosine Network Simplex: A New Approach to Find the Initial Solution for Network Simplex
Federico Trigos, LSOG Chairman, ITESM Campus Toluca, Eduardo Monroy Cardenas 2000, San Antonio Buenavista, Toluca, MX, 50110, Mexico, ftrigos@itesm.mx, Alma Nieto, Francisco Zaragoza, Irma Hernandez

This paper presents the Cosine Network Simplex Method, which is a combination of the Cosine Simplex with Network Simplex. This method uses the Theta Heuristic (Cosine Simplex) for obtaining the initial spanning tree, this heuristic is based on the analysis of the angles between the gradient of the objective function and the gradients of the constraints and then uses regular Network Simplex to achieve Optimality.

2 - Practical Decision Tools to Evaluate Ecological Impact of Management Decisions

Donald Adolphson, Professor, Romney Institute of Public Management, 760 TNRB, Brigham Young University, Provo, UT, 84602, United States, donald_adolphson@byu.edu, Eldon Franz

The ecological impacts of management decisions are often ignored or underestimated because the impacts are often indirect, subtle, distant in time and space, and not easily quantifiable in monetary terms. This paper illustrates the effective use of probabilistic payoff matrices, and the Taguchi loss function, combined with Monte Carlo Simulation. Implemented in Excel, these methods provide simple and effective tools to assist managers in assessing the ecological impacts of management decisions.

3 - Using Decision Analysis to Facilitate the Artist Selection Capability in the Music Industry

Matthias Seifert, PhD Candidate, University of Cambridge, St. Edmund's College, Cambridge, CB3 0BN, United Kingdom, ms607@cam.ac.uk

The paper integrates decision analysis & resource-based view creating a methodology for core capability development in music companies. Only 5-10% of a firm's artists make profit & there are no objective criteria for evaluating success potential. The paper leads to 3 debates:1) How can resource-based theory be empirically tested for core capabilities;2) How can strategy & decision theory be combined to provide a holistic management view;3) What does such a management tool look like in practice?

4 - Energy, Productivity, and Waste Management in Small and Medium Size Manufacturing Plants

Farouq Alhourani, Assistant Professor, Morehead State University, 313-4 Lois Lane, Morehead, KY, 40351, United States, f.alhourani@moreheadstate.edu, Umesh Saxena

The possible factors affecting the implementation rates of energy, productivity, and waste recommendations made to small and medium size companies were investigated. Using Logistic Regression, five factors were investigated, saving, implementation cost, payback period, amount of sales, and number of employees in the company. It was determined that implementation cost is the main factor. A probability model for determining implementation rate of a recommendation is also developed.

5 - Integrated Policy Analysis for Managing Polio

Kimberly Thompson, Associate Professor, Harvard School of Public Health, 677 Huntington Ave., 3rd Floor, Boston, MA, 02115, United States, kimt@hsph.harvard.edu

This overview of a collaborative process to use risk and decision analytic tools to help inform decisions and evaluate the trade-offs associated with policies to ensure maintenance of a polio-free world after global eradication discusses different perspectives and conditions that apply to various decision makers about to enter global negotiations and demonstrates the need to rigorously model variability, uncertainty, and time in the context of analyses to inform global health policy decisions.

■ MD50

R - 4th Floor, Cervantes

DAS 2005 Awards Session

Sponsor: Decision Analysis
Sponsored Session

Chair: Greg Parnell, United States Military Academy, Department of Systems Engineering, West Point, NY, 10996, United States, Gregory.Parnell@usma.edu

Decision Analysis Society Awards

The Decision Analysis Society of INFORMs will announce the recipients of the 2005 Ramsey Medal for lifetime contributions to decision analysis, the 2005 publications award for best publication in the year 2003, and the 2005 Student Paper Award. Each winner will speak briefly. The winner of the Decision Analysis Practice Award will also be announced. The practice award finalists will make their presentations in an earlier session.

1 - Ramsey Medal

Jim Dyer, The Fondren Centennial Chair in Business, Graduate School of Business, The University of Texas at Austin, Austin, TX, 78712, United States, Jim.Dyer@mccombs.utexas.edu

The Frank P. Ramsey Medal is the highest award of the DAS. It was created to recognize distinguished contributions to the field of decision analysis. The Ramsey Medalists are recognized for having made substantial further contributions to that theory and its application to important classes of real decision problems.

2 - Student Paper Award

Jeff Stonebraker, GlaxoSmithKline, Five Moore Drive, Research Triangle Park, NC, United States, jeffrey.s.stonebraker@gsk.com, Eva Regnier

The Student Paper Competition Award is given annually to the best decision analysis paper by a student author, as judged by a panel of the Decision Analysis Society of INFORMS. Students who did not complete their Ph.D. prior to May 1, 2004 are eligible for this year's competition.

3 - Practice Award

Kazuo Ezawa, Senior Director, Daiichi Medical Research Inc, One Maynard Drive, Park Ridge, NJ, 07656-0712, KazuoEzawa@DMR.DaiichiUS.com

The Decision Analysis Society (DAS) of INFORMS is seeking entries for the seventh annual DAS Practice Award competition. The intent of this award is to recognize, promote, and publicize good decision analysis practice.

4 - Publication Award

George Wu, george.wu@gsb.uchicago.edu, Jim Dyer, James E. Smith

The Decision Analysis Publication Award is given annually to the best decision analysis journal article or book published in the second calendar year prior to the year in which the award is given. For consideration for this year's award, a work should have been published during CALENDAR YEAR 2003.

This talk will present an overview of recent advances in solving railroad planning and scheduling problems, encompassing blocking, train scheduling, yard location, locomotive and crew scheduling. It will next summarize the new frontiers that need to be fathomed. Finally, it will give our vision of how railroad should go about implementing models in their decision-making processes.

2 - Robust Optimization of Investments in Freight Network Capacity
Yao Sun, Cornell University, Ithaca, NY, 14853, United States, ys238@cornell.edu, Mark Turnquist, Linda Nozick

We describe a model for robust optimization of investments in freight network capacity under uncertainty in future demand patterns. Specific attention is paid to network resilience under temporary losses of facility capacity. The double-stack container network in the western U.S. rail system is used as a case study.

3 - The Little Stretch from Airline Tail Assignment to Rail Fleet Routing
Sami Gabteni, Ph.D. Senior Consultant, Carmen Systems, 11bis rue de Maubeuge, Paris, 75009, France, samig@carmen.se

Recently, Carmen Systems has extended its Airline Tail Assignment system to a Fleet Routing application. Using RAVE, a proprietary business modeling tool, and relying on a powerful column generation based optimizer, there was no need to modify the core. By presenting how we stretched the business modeling, we will illustrate the potential of a generic product platform.

■ MD47

R - 4th Floor, Michelangelo

Economic Incentives and Mechanisms for Air Traffic Management

Sponsor: Transportation Science & Logistics
Sponsored Session

Chair: Michael Ball, Professor, U of Maryland, R H Smith School of Business, College Park, MD, 20742, United States, Mball@rhsmith.umd.edu

1 - Impact of Infrastructure-Related Taxes and Fees on the Cost of Air Travel
Amedeo Odoni, MIT, Room 33-219, MIT, Cambridge, MA, 02139, United States, arodoni@mit.edu, Shiro Yamanaka, Joakim Karlsson

Various add-on taxes and fees for the development, operations and security of the airport and air traffic management systems consume ever-increasing portions of an air traveler's budget. This paper summarizes the findings of an extensive statistical analysis of tickets for domestic United States and for domestic and intra-EU travel in Europe.

2 - Auctions for Airport Landing Slots
Pavithra Harsha, Student, MIT, 77 Massachusetts Ave., Bldg E40-130, Cambridge, MA, 02139, United States, pavithra@mit.edu, David Parkes, Rui Dong, Cynthia Barnhart

In this paper, we model airline behavior in response to the airport slot auctions being considered by the Federal Aviation Administration for LaGuardia Airport. We develop and present a network-based model to determine the slots on which an airline should bid, given the current prices of each landing slot. We describe how to integrate our model, which is efficient and highly tractable, with an auction mechanism. We conduct experiments on different network structures and present results.

3 - An Airline Industry Slot Auction Exercise to Affect Public Policy: A Case Study
Karla Hoffman, Professor, George Mason University, Mail Stop 4A6, 4400 University Drive, Fairfax, VA, 22030, United States, khoffman@gmu.edu, Michael Ball, Peter Cramton, Lawrence Ausubel, David Parkes

The FAA asked NEXTOR, a consortium of universities, to research and make recommendations regarding demand management at LaGuardia airport. One proposed solution is to determine the number of arrival and departure slots that cap congestion and then make such slots available through an auction mechanism. This talk describes the combinatorial clock auction mechanism proposed for slot allocation and also presents details of the February mock auction in which airline representatives participated.

4 - Airport Congestion Prices based on Deterministic Queueing Effects
David Lovell, Associate Professor, University of Maryland, Dept. of Civil Engineering, College Park, MD, 20742, United States, lovell@eng.umd.edu, Michael Ball, Avijit Mukherjee

Congested airports are considering congestion pricing to shift or reduce demand. Airport congestion prices cannot be adjusted quickly, hampering efforts to find an equilibrium solution quickly. We propose a set of iterations for finding equilibrium congestion prices with controls on queueing delays. The scheme focuses on periods where the marginal impact of congested flights is the greatest. We consider technical issues related to convergence and stability, and some policy implications.

■ MD48

R - 4th Floor, Dante

Pierskalla Award - 2

Sponsor: Health Applications
Sponsored Session

Chair: Allen Holder, Trinity University Mathematics, One Trinity Place, San Antonio, TX, United States, aholder@trinity.edu

1 - Feature Selection for Consistent Biclustering via Fractional 0-1 Programming
Stanislav Busygin, University of Florida, busygin@ufl.edu, Oleg Prokopyev, Panos Pardalos

Biclustering is a simultaneous partition of given samples and their features into classes. Samples and features classified together are supposed to have a high relevance to each other. We define the notion of consistency for biclustering and prove that it implies separability of the classes by convex cones. A fractional 0-1 model for supervised biclustering whose consistency is achieved by feature selection is proposed. Computational results on microarray data mining problems are reported.

2- Cost Effectiveness of Highly Active Antiretroviral Therapy for Injection Drug Users in Russia
Magaret Brandeau, Professor, Stanford University, MS&E Dept., Stanford, CA, United States, Brandeau@stanford.edu, Swati Tole, Elisa Long, Douglas Owens, Cristina Galvin, Tatyana Vinichenko

Injection drug users (IDUs) are key drivers of the HIV epidemic in Russia. Using a dynamic model, we evaluate the cost effectiveness of highly active antiretroviral therapy (HAART) in Russia. We find that providing HAART only to IDUs prevents more HIV infections among non-IDUs, at less total cost, than providing HAART exclusively to non-IDUs. However, treatment of both groups is very cost-effective. Our findings highlight the urgency of initiating HAART for both IDUs and non-IDUs in Russia.

3 - Real-Time Emergency Treatment Planning for Bioterrorism and Infectious Disease Outbreaks
Eva Lee,Associate Professor & Director, Center for Operations Research in Medicine, Georgia Institute of Technology, Industrial & Systems Engineering, Atlanta GA 30332-0205, United States, evakylee@isye.gatech.edu, Siddhartha Maheshwary, Jacquelyn Mason

We present a real-time simulator and decision support system that allows the study, training and enhancement of emergency response and planning for treating biologic threats from terrorism and infectious disease outbreaks. The system will enable public health agencies to investigate numerous design and staffing scenarios quickly, efficiently, and cost-effectively, and to determine the resources needed to provide for basic medication needs for a specific population during an emergency response.

■ MD49

R - 4th Floor, Medici

Some Representative Applications of Decision Analysis

Contributed Session

Chair: Kimberly Thompson, Associate Professor, Harvard School of Public Health, 677 Huntington Ave., 3rd Floor, Boston, MA, 02115, United States, kimt@hsph.harvard.edu

1 - The Analytical Process to Develop Military Utility-Based Architectures for the USAF Space Command
John Tindle, Senior Decision Analyst, Northrop Grumman/TASC, 1795 Jet Wing Drive, Suite 200, Colorado Springs, CO, 80916, United States, john.tindle@ngc.com, Danny Mellott, Joyce Stivers

Prior to the FY06 budget, the Air Force Space Command relied on one specialized software tool to generate integrated architectures. However, military utility was not evaluated. A pathfinder effort was initiated to explore new analytical methods and a new ground-breaking analytical process and suite of tools was developed to create Military Utility-Based Architectures. The new process created architectures that were feasible, provided the greatest cost/benefit, and maximized military utility.

2 - Probability Bounds Supporting Stochastic Programming Techniques

Jozsef Bukszar, Postdoctoral fellow, Virginia Institute for Psychiatric and Behavioral Genetics, Virginia Commonwealth University, P.O.Box 980126, Richmond, VA, 23298-0126, United States, bukszar@mail.eecis.udel.edu

Tight lower and upper bounds for the probability of the union of finite number of events are presented. Our bounds turned out to be a powerful tool in a number of applications such as computing the values of multivariate distribution functions and solving stochastic programming problems due to their following features. They rely on only a few intersection probabilities. To each bound a tighter one can be given algorithmically at low computational cost.

3 - On Strong Unimodality of n-Dimensional Discrete Distributions

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

The sufficient conditions are given that a discrete function is strongly unimodal. Six sufficient conditions are given for the case of n = 3 and one for the general case. A three-dimensional example shows that the logconcavity of a discrete function does not imply strong unimodality, in general. A dual type linear programming algorithm is presented to find the maximum of a strongly unimodal discrete function.

4 - Discrete Moment Problem with the Given Shape of the Distribution

Ersoy Subasi, RUTCOR, Rutgers University, 640 Bartholomew Rd, Piscataway, NJ, 08854, United States, esub@rutcor.rutgers.edu, Andras Prekopa, Mine Subasi

Discrete moment problem with finite, preassigned support and with the given shape of the distribution are formulated and used to obtain sharp bounds for expectations of convex functions of discrete random variables and unknown probabilities that at least one out of n events occurs, based on the knowledge of some of the binomial moments of the number of events which occur. The derivations are presented for the dual feasible basis structure theorems in case of power and binomial moment problems.

■ MD43

R - 4th Floor, Parc Ballroom II

Global Constraints in Constraint Programming

Sponsor: INFORMS Computing Society/ Constraint and Integer Programming
Sponsored Session

Chair: Jean-Charles Regin, Cornell University, 5133 Upson Hall, ITHACA, NY, 14853, United States, jcregin@cs.cornell.edu

1 - An Efficient Propagation Algorithm for the Soft-all Different Constraint

Willem-Jan van Hoeve, Cornell University, Dept. of Computer Science, 4130 Upson Hall, ITHACA, NY, 14853, United States, vanhoeve@cs.cornell.edu

When a problem is over-constrained, the traditional hard constraints are replaced by soft constraints. We present an efficient propagation algorithm for the soft-alldifferent constraint, based on the minimum-cost flow in a particular graph. The cost-structure of this graph allows us to check the consistency of the constraint in O(nm) time and to achieve hyper-arc consistency in O(m) time, for a graph with n vertices and m edges.

2 - Regular Language Membership Constraints

Gilles Pesant, CRT, University of Montreal, Montreal, Qc, Canada, pesant@crt.umontreal.ca

This talk describes a constraint on a fixed-length sequence of finite-domain variables requiring that the corresponding sequence of values taken by these variables belong to a given regular language, thereby generalizing some other known constraints. We describe and analyze a filtering algorithm achieving domain consistency for this constraint. We also discuss a soft version of this constraint, in which some amount of violation can be tolerated, and an optimization version.

3 - Approximated Consistency for the Automatic Recording Constraint

Meinolf Sellmann, Assistant Professor, Brown University, P.O. Box 1910, Providence, RI, 02912, United States, sello@cs.brown.edu

We introduce the automatic recording constraint that can be used for scheduling problems where tasks may not overlap in time and the tasks linearly exhaust some resource. Since achieving arc-consistency for the ARC is NP-hard, we develop an algorithm that achieves approximated consistency only. Numerical results on the automatic recording problem show the benefits of the new constraint that achieves runtimes orders of magnitude better than those of the best previous CP approach.

■ MD44

R - 4th Floor, Parc Ballroom III

Recent Advances in Metaheuristics

Sponsor: INFORMS Computing Society/ Heuristic Search
Sponsored Session

Chair: Stefan Voss, Professor, University of Hamburg, Von-Melle-Park 5, Institute of Information Systems, Hamburg, D, 20146, Germany, stefan.voss@uni-hamburg.de

1 - Sequential Versus Simultaneous Generation of High Variety Solutions

Peter Greistorfer, Karl-Franzens-University Graz, Universitatsstrafle 15, ReSoWi-Zentrum G2, Graz, 8010, Austria, peter.greistorfer@kfunigraz.ac.at, David Woodruff, Stefan Voss, Arne Lokketangen

Many decision support systems as well as population based metaheuristics need solution vectors that have good objective function values but are distant from each other. The question is: should they be generated sequentially or simultaneously. In this talk we describe research that addresses this question. Computational results are presented.

2 - Heuristics and Metaheuristics for Aligning 2D NMR Spectra

David Woodruff, Professor, UC Davis, Graduate School of Management, UC Davis, Davis, CA, 95616, United States, dlwoodruff@ucdavis.edu

The problem of aligning 2 dimensional NMR Spectra is important for identification of metabolites that may be biomarkers. The problem has high dimension, but by taking advantage of chemical structure, the search space can be reduced dramatically. In this talk I will review formulations and progress to date on solving them. The results of physical and computational experiments will be described.

3 - Virtual Experiments within Metaheuristics Courses

Torsten Reiners, University Hamburg, Von-Melle-Park 5, Institute of Information Systems, Hamburg, D, 20146, Germany, reiners@econ.uni-hamburg.de, Stefan Voss

In addition to courses on metaheuristics basics, virtual learning environments should provide virtual rooms to conduct and analyze experiments step-by-step. We present a concept and preliminary prototype for a web-based interface to configure, execute, and debug metaheuristics on (submitted) datasets. Results include further (debuging) information for understanding the solution processes.

■ MD45

R - 4th Floor, Raphael

Facility Logistics

Sponsor: Transportation Science & Logistics
Sponsored Session

Chair: Kevin Gue, Associate Professor, Auburn University, Dept of Industrial & Systems Engineering, Auburn, AL, 36849, United States, kevin.gue@auburn.edu

1 - A New Facility Layout Formulation

Russell Meller, Professor, Virginia Tech, 250 Durham Hall (0118), Blacksburg, VA, 24060, United States, rmeller@vt.edu

The facility layout problem may well be the toughest optimization problem faced in the area of facility logistics. We will present the latest installment in quest for solvability to the well-known block layout problem.

2 - Aisle and Puzzle-based Storage Systems

Kevin Gue, Associate Professor, Auburn University, Dept of Industrial & Systems Engineering, Auburn, AL, 36849, United States, kevin.gue@auburn.edu

We describe models of storage systems in which products move freely and autonomously in the plane. Such systems can assume storage densities that approach one, but at the cost of reduced throughput.

■ MD46

R - 4th Floor, Rubens

TSL/RASIG: Emerging Trends in Rail Optimization

Sponsor: Transportation Science & Logistics
Sponsored Session

Chair: David Hunt, Senior Associate, Cambridge Systematics, P.O. Box 816, Pennington, NJ, 08534, United States, dhunt@camsys.com

1 - New Frontiers in Railroad Optimization

Ravindra Ahuja, Professor, University of Florida, Dept. of Industrial and Systems Eng., 303 Weil Hall P.O. Box 116595, Gainesville, FL, 32611, United States, ahuja@ufl.edu

3 - A Complete Cosine Simplex Method with New Experimental Results

Irma Hernandez, RA, ITESM Campus Toluca, Eduardo Monroy Cardenas 2000, San Antonio Buenavista, Toluca, Mx, 50110, Mexico, irma.hernandez@itesm.mx, Federico Trigos

This paper presents new Theoretical and Experimental results for the Cosine Simplex Method. This method finds an efficient starting point based on the vertex with minimum angles between the gradient of the objective function and the gradient of each constraint. This paper introduces a new algorithm called Big M Parametric Phase I which guarantees convergence to the solution of the problem under unfeasible and not optimal initial solution. Significant computational savings are achieved.

4 - Primal-dual Type Linear Programming Algorithm using QR-factorization

Seunghyun Kong, Ph. D student, School of Industrial and Systems Engineering, Georgia Institute of Technology, 765 Ferst Drive NW, Atlanta, GA, 30332-0205, United States, konggas@isye.gatech.edu, Ellis Johnson

We present a primal-dual type linear programming algorithm, devoid of degeneracy. The algorithm uses non-negative least-squares problems as a sub-problems and the sub-problem is solved by QR-factorization. Some methods for updating the basis in factorization and maintaining sparser upper triangular matrix are designed. For the large scale linear programming, primal-dual sub-problem approach is employed. Crew paring optimization problems and some other instances are tested.

5 - Numerical Experimentation on the Cosine Cutting Plane Method for Linear Programming

Roberto Lopez, RA, ITESM Campus Toluca, Eduardo Monroy Cardenas 2000, San Antonio Buenavista, Toluca, Mx, 50110, Mexico, roberto.lopez@itesm.mx, Federico Trigos

Professor H.W. Corley from UT at Arlington has proposed a new method for solving the LP problem based on a sequence of relaxed LP problems using the cosine of the angles between the gradient of the OF and each constraint. This paper presents numerical experimentation based on the Net Lib set of problems and compared this method with current state of the art algorithms.

■ MD40

R - 3rd Floor, Barcelona I

Network Discovery, Routing, and Caching

Sponsor: Optimization/ Network Optimization
Sponsored Session

Chair: Ana Radovanovic, IBM, 1101 Kitchawan Rd., Route 134, P.O. Box 218, Yorktown, Heights, NY, 10598, aradovan@us.ibm.com

1 - Nearly Optimal Cache Replacement Policies

Ana Radovanovic, IBM, 1101 Kitchawan Rd., Route 134, P.O. Box 218, Yorktown, Heights, NY, 10598, aradovan@us.ibm.com, Predrag Jelenkovic

Renewed interest in caching techniques stems from their application in improving the performance of the World Wide Web, where storing popular documents in proxy caches closer to end users can significantly reduce the document download latency and overall network congestion. Rules used to update the collection of frequently accessed documents inside a cache are referred to as cache replacement algorithms (policies). Our design and analysis concentrates on replacement policies for a cache in isolation, given that most of the existing solutions for a single cache do not unify desirable characteristics of a replacement policy in the Web environment, such as: adaptability to fluctuations in information demands, implementation, excellent (nearly optimal) performance.

2 - Network Discovery

Alexander Hall, Institut für Theoretische Informatik, ETH Zentrum, CLW A1/2, CH - 8092 Zürich, alex.hall@inf.ethz.ch

Consider the problem of discovering a network using a minimum number of queries. A query at node v discovers all edges and non-edges whose endpoints have different distance from v. We discuss an experimental study of several discovery strategies and investigate the setting where we are interested in discovering a large constant fraction of both the edges and non-edges in various graph classes. This is joint work with several members of ETH Zurich and University of Leicester.

3 - Oblivious Routing in Directed Graphs with Random Demands

Mohammad Hajiaghayi, MIT, CSAIL, Room 32-G596, 32 Vassar St., Cambridge, MA, 02139, United States, hajiagha@mit.edu

Oblivious routing algorithms for general undirected networks were introduced by R\"acke, and this work has led to many subsequent improvements and applications. Comparatively little positive results are known about oblivious routing in general {\em directed} networks. Using a novel approach, we present the first oblivious routing algorithm which is $O(\log^2 n)$-competitive with high probability in directed graphs given that the demands are chosen randomly from a known demand-distribution. On the other hand, we show that no oblivious routing algorithm can be $o(\frac{\log n}{\log \log n})$ competitive even with constant probability in general directed graphs.

■ MD41

R - 3rd Floor, Barcelona II

Advances in Mixed Integer Programming

Sponsor: Optimization/ Integer Programming
Sponsored Session

Chair: Ahmet Keha, Assistant Professor, Arizona State University, P.O. Box 875906, Tempe, AZ, 85287, United States, ahmet.keha@asu.edu

1 - Sequential Pairing of Mixed Integer Inequalities-tree Case

Yongpei Guan, Assistant Professor, School of Industrial Engineering, University of Oklahoma, Norman, OK, United States, guanyp@isye.gatech.edu, Shabbir Ahmed, George Nemhauser

In this talk, we present the result of the sequential pairing scheme for the general stochastic tree case. We provide the closed form expression of the new generated inequalities and analyze the non-dominant sequence for generating new inequalities. Facet-defining condition and convex hull results are provided. Finally, we did experiments on stochastic dynamic knapsack problems as well as its extensions to stochastic lot-sizing problems.

2 - Integrating Column Generation and Nested Partitions

Andrew Miller, University of Wisconsin, Industrial and Systems Engineering, Madison, WI, United States, amiller@engr.wisc.edu

We present a framework for generating lower bounds that takes advantage of solutions produced by nested partitions (a metaheuristic method) within a column generation algorithm. We demonstrate that our framework is capable of efficiently generating high quality bounds by applying it to multicommodity distribution system design problems. The use of a primal metaheuristic to generate lower bounds (and not just feasible solutions) is a novel aspect of this research.

3 - A Mixed-Integer Programming Model and Algorithm for Determining the Branchwidth of a Graph

Cole Smith, Associate Professor, University of Florida, United States, cole@ise.ufl.edu, Illya Hicks, Elif Kolotoglu

Branch decomposition techniques have recently been proposed for addressing difficult problems in combinatorial optimization problems on graphs. The efficacy of these algorithms depends on obtaining a branch decomposition of the input graph with the smallest width possible. However, determining the smallest width (i.e., the branchwidth) of a graph is strongly NP-hard. We discuss an integer programming methodology for establishing the branchwidth of a graph in this talk.

4 - A Polyhedral Study of Cardinality Constrained 0-1 Knapsack Problems

Bo Zeng, Graduate Student, Purdue University, 315 North Grant Street, West Lafayette, IN, 47907, United States, bzeng@purdue.edu, Jean-Philippe Richard

We study the convex hull of 0-1 integer solutions to a knapsack and a cardinality constraint. We derive strong inequalities for this set through sequence independent lifting for the case where all the coefficients are nonnegative. For the more difficult case where some coefficients are negative, we develop an approximate lifting scheme that is tractable and strong. We show how this scheme can be applied to other multi-constraint MIPs and how it improves on single-constraint cut generation.

■ MD42

R - 4th Floor, Parc Ballroom I

Probabilistic Programming

Sponsor: Optimization/ Stochastic Programming
Sponsored Session

Chair: Andras Prekopa, Professor, RUTCOR, Rutgers University, 640 Bartholomew Rd., Piscataway, NJ, 08854-8003, United States, prekopa@rutcor.rutgers.edu

1 - Properties of Linear Probabilistic Constraints

Rene Henrion, Weierstrass Institute, Berlin, Mohrenstr. 39, Berlin, 10117, Germany, henrion@wias-berlin.de

We consider probabilistic constraints with random coefficients. An existence theorem for problems with joint constraints is provided. We extend the convexity result of Van de Panne/Popp and Kataoka. The convexity, compactness and non-triviality ranges of the probability level are exactly identified.

Tuesday, 8:00am - 9:30am

■ TA01

H - Lobby Level, Plaza A

Tutorial: Active Learning in the OR Classroom

Cluster: Tutorials
Invited Session

1 - Tutorial: Active Learning in the OR Classroom
James Cochran, Department of Marketing and Analysis, College of Administration and Business, Louisiana Tech University, Ruston, LA, 71272, jcochran@cab.latech.edu

This tutorial provides an overview of active learning for quantitative courses such as operations research, management science, production and operations management, probability, and statistics. The potential risks and benefits of active learning exercises are discussed, types of active learning exercises are reviewed, and several interesting and creative active learning exercises are described and demonstrated.

■ TA02

H - Lobby Level, Plaza B

New Developments in DEA

Cluster: Data Envelopment Analysis
Invited Session

Chair: Hiroshi Morita, Professor, Osaka University, 2-1 Yamadaoka, Suita, Japan, morita@ist.osaka-u.ac.jp

1 - Dual Role Factors in DEA
Joe Zhu, Worcester Polytechnic Institute, 100 Institute Road, Worcester, MA, 01609, United States, jzhu@wpi.edu, Wade Cook

This paper presents a methodology for dealing with performance evaluation settings where factors can simultaneously play both input and output roles. Models and applications are provided.

2 - How to Measure Supply Chain Performance Using DEA
Yao Chen, College of Management, University of Massachusetts, Lowell, MA, United States, Yao_Chen@uml.edu, Joe Zhu

This presentation discusses alternative ways in measuring supply chain efficiency using DEA. A non-linear model is proposed to fully characterize the supply chain performance.

3 - Evaluation of Performance under Competitive Environment
Hiroshi Morita, Professor, Osaka University, 2-1 Yamadaoka, Suita, Japan, morita@ist.osaka-u.ac.jp, Koichiro Hirokawa

It is important to analyze the efficiency of performance relative to the competitor in the market. We consider the performance evaluation under competitive environment from DEA efficiency and frontier shift incorporating game theory. The proposed method enables to determine the position of each company quantitatively in the market.

4 - The Inefficient Frontier and Its Use for Outlier Detection
Andrew Johnson, Graduate Student, Georgia Institute of Technology, 765 Ferst Drive NW, Atlanta, GA, 30332, United States, ajohnson@isye.gatech.edu, Paul Griffin, Leon McGinnis

This presentation introduces the inefficient frontier and explains its value in outlier detection. Two iterative outlier detection methods for both the efficient frontier and the inefficient frontier are demonstrated. A two-stage semi-parametric bootstrapping method is used to show results of the second stage can differ if the inefficient frontier is not considered.

■ TA03

H - Ballroom Level, Continental Ballroom 1

Recent Innovations in Teaching OR/MS

Sponsor: Education (INFORM-ED)
Sponsored Session

Chair: Pelin Pekgun, Georgia Institute of Technology, 765 Ferst Drive, Atlanta, GA, United States, ppekgun@isye.gatech.edu

1 - Hands-On Teaching of the Optimization Process
Amy Cohn, University of Michigan, 1205 Beal Avenue, Ann Arbor, MI, 48109-2117, United States, amycohn@engin.umich.edu

We have incorporated a broader problem solving process in optimization. Students work in teams during the semester to solve an optimization problem of personal interest such as, budgeting for their sorority or developing their class schedule. Over the course of the semester, they encounter many real-world challenges that add to the complexity. We discuss the format and process of these projects, provide examples, and discuss the educational pros and cons we've experienced.

2 - Team-Based Problem Solving in a Six Sigma Course
Sandra Furterer, furterer@mail.ucf.edu

This presentation discusses an approach to implementing team-based problem solving in Six Sigma courses. The courses enable undergraduate and graduate students to work together on teams to solve real-world problems applying statistical problem solving principles and tools. Six Sigma project examples will be presented.

3 - Operations Research: A Link Connecting Engineering Faculty with High School Teachers and Students
Donna Llewellyn, donna.llewellyn@cetl.gatech.edu, David Goldsman

Due to Georgia Tech's GK-12 program, many HS teachers/students wish to work with GT faculty. In the sciences, this partnering comes naturally, but it is harder to find placements for math teachers. OR can be a bridge between these teachers and engineering faculty. Lessons learned and ideas will be discussed.

4 - Creating and Teaching Courses that Integrate Manufacturing and Mathematics
Elmira Popova, Associate Professor, University of Texas at Austin, 1 University Station C2200, Austin, TX, 78712, United States, elmira@mail.utexas.edu, Wei Yu, Philip Schmidt

We create educational modules for the core engineering undergraduate program to enhance the teaching of probability and statistics. Each module consists of: manufacturing problem description, mathematical methodology to be studied, detailed steps to implement the methodology, and numerical example to be solved using Excel. The manufacturing problem is defined by Ford. Each module is self-contained.

■ TA04

H - Ballroom Level, Continental Ballroom 2

Daniel H. Wagner Prize Competition Awards

Cluster: The Daniel H. Wagner Prize for Excellence in Operations Research
Invited Session

Chair: Joseph H. Discenza, SmartCrane, LLC, 2 Eaton Street Suite 500, Hampton, VA, 23669, United States, jhdiscenza@smartcrane.com

1 - The Daniel H. Wagner Prize for Excellence in Operations Research Practice
Joseph H. Discenza, SmartCrane, LLC, 2 Eaton Street Suite 500, Hampton, VA, 23669, United States, jhdiscenza@smartcrane.com

CPMS's practice prize, the Daniel H. Wagner Prize for Excellence in Operations Research Practice, is now underway for its sixth competition. Four finalist teams have been selected for 2005 and these four will be presented in two sessions. The prize began in 1998 and winning teams have represented work done at Merrill Lynch, IBM, GM, Qwest, and Bank One. The prize was established by CPMS in honor of the late Daniel H. Wagner and the prize money is provided by an endowment with contributions from Metron, Inc., Daniel H. Wagner Associates, Inc., and Applied Mathematics, Inc.

■ TA05

H - Ballroom Level, Continental Ballroom 3

Dynamic and Game Theoretic Models for Service Operations Management I

Cluster: Service Sector Operations
Invited Session

Chair: Terry Friesz, Marcus Professor of Industrial Engineering, Pennsylvania State University, 305 Leonhard Building, Industrial & Manufacturing Eng Dept, University Park, PA, 16802, United States, tfriesz@psu.edu

1 - Value Added of Learning in the Pricing of Perishable Products
Soulaymane Kachani, Professor, IEOR Department, Columbia University, 500 West 120th Street, NYC, NY, 10027, United States, kachani@ieor.columbia.edu, Georgia Perakis, Carine Simon

In this talk, we present alternate models of pricing and demand learning of perishable products in presence of competition. We first focus on the single product case, and show how learning contributes to the performance of both simulataneous and sequential pricing processes. We extend our analysis to the multi-product case. We present a solution algorithm and report on computational results.

2 - Computational Methods for Game-Theoretic Service Operations Management Models with Explicit Time Lag

Terry Friesz, Marcus Professor of Industrial Engineering, Pennsylvania State University, 305 Leonhard Building, Industrial & Manufacturing Eng Dept, University Park, PA, 16802, United States, tfriesz@psu.edu, Reetabrata Mookherjee, Changhyun Kwon

In a series of papers, Friesz et al (2004, 2005) have shown that certain dynamic problems of revenue optimization and service operations management in oligopolistic competition with explicit time lags may be stated as differential variational inequalities and as nonlinear complementarity problems in Hilbert space. This paper gives an overview of such formulations then concentrates on solution methods involving implicit fixed point and gradient projection calculations in Hilbert space.

3 - The Evolution and Emergence of Integrated Social and Financial Networks

Anna Nagurney, Professor, University of Massachusetts Amherst, Department of Finance and Operations Man, Isenberg School of Management, Amherst, MA, 01003, United States, nagurney@gbfin.umass.edu, Tina Wakolbinger, Li Zhao

In this paper, we propose a theory for the integration of social networks with financial networks with intermediation in the presence of electronic transactions. We explore the dynamic evolution of the financial flows, product prices, and relationship levels until the equilibrium is attained. Qualitative properties and an algorithm with numerical examples are given.

■ TA06

H - Ballroom Level, Continental Ballroom 7

Closed-Loop Supply Chain Design

Cluster: Reverse Supply Chains
Invited Session

Chair: Vedat Verter, Associate Professor, McGill University, 1001 Sherbrooke St. W., Montreal, PQ, H3A 1G5, Canada, vedat.verter@mcgill.ca

1 - Modeling Approaches for the Design of Logistics Network Integrating Reverse Logistics

Marc Chouinard, PhD student, Université Laval, Cité Universitaire, Pav. Adrien-Pouliot, Département de génie mécanique, Québec, Qc, G1K7P4, Canada, Marc.Chouinard@centor.ulaval.ca, Daoud Aït-Kadi, Sophie D'Amours

The integration of reverse logistics within the supply chain generates additional stochastic flows. To consider these flows, traditional modeling methods must be revised. Product families, bill of materials, user zones as well as demand (for new and used) and return (under different conditions) forecasts must be modeled to represent opportunities and constraints related to recovery, processing and redistribution. This presentation proposes a modeling framework suitable in medical services.

2 - Empirical Research Opportunities in Reverse Supply Chains

Carol Prahinski, Assistant Professor, Richard Ivey School of Business, University of Western Ontario, London, ON, N6A 3K7, Canada, cprahinski@ivey.uwo.ca, Canan Kocabasoglu

This study reviews the literature in reverse supply chains (RSCs) and develops 10 research propositions to be studied using empirical research methods. Businesses increasingly have to cope with environmental regulations and product disposal costs. Through effective management of the RSC, managers can improve customer service, after-market product sales and after-sales service. Opportunities exist to use survey-based research methods to explain predominant and critical issues in the RSC.

3 - Reverse Logistics Network Design with Stochstic Lead Times

Kris Lieckens, University of Antwerp, Prinsstraat 13, Antwerp, BE, 2000, Belgium, kris.lieckens@ua.ac.be, Nico Vandaele

From a competitive point of view, product returns with a high value decay rate should re-enter the market as soon as possible. To this end, we developed a queueing network design model with stochastic lead times that allows for the responsive organization of collecting and restoring activities. Results from industry are shown.

4 - Designing Distribution Systems with Reverse Flows

Vedat Verter, Associate Professor, McGill University, 1001 Sherbrooke St. W., Montreal, PQ, H3A 1G5, Canada, vedat.verter@mcgill.ca, Tamer Boyaci, Necati Aras

We provide a MIP formulation to identify the optimal number and location of distribution centers and return centers so as to minimize the total cost of satisfying customer demand and processing the returns. We present a two-level Lagrangean relaxation method that proved effective in taking advantage of the problem structure.

■ TA07

H - Ballroom Level, California

Queuing and Congestion in Service Competition

Sponsor: Manufacturing & Service Oper Mgmt
Sponsored Session

Chair: Senthil Veeraraghavan, Asst. Professor, Wharton School, University of Pennsylvania, 3730 Walnut St, OPIM Department, Philadelphia, PA, 19104, United States, senthilv@wharton.upenn.edu

Co-Chair: Cuihong Li, Assistant Professor, University of Connecticut, School of Business, 2100 Hillside Road, Storrs, C, 06269, United States, Cuihong.Li@business.uconn.edu

1 - The Benefits of Capacity Pooling in Decentralized Service Industries

Gad Allon, Columbia, GSB, Uris Hall, 4D, New York, NY, 10027, United States, ga2003@columbia.edu, Awi Federgruen

Competing service providers often outsource the service process to a common supplier so as to benefit from pooling efficiencies. We show how the service supply chain can be optimally coordinated, when the providers compete in terms of prices, waiting time standards or both. The single server supplier chooses a service rate to accommodate the providers' promised waiting times under their demand volumes. These in turn depend on the price and waiting time standard offered by all providers.

2 - To Join the Longest Queue or the Shortest Queue: Inferring Quality Through Congestion

Senthil Veeraraghavan, Asst. Professor, Wharton School, University of Pennsylvania, 3730 Walnut St, OPIM Department, Philadelphia, PA, 19104, United States, senthilv@wharton.upenn.edu, Laurens Debo

When choosing between service providers whose quality is common knowledge, customers trade off waiting times with service values. Rational customers also examine queue lengths at two competing service providers to make a decision. Customers may ignore their private information and "herd". We introduce herding behavior of customers, in a two-server queuing model. We find that it may be rational in equilibrium to ignore private information and choose the service provider with the longer queue.

3 - Queuing and Herding

Laurens Debo, Carnegie Mellon University, Tepper School of Business, 5000, Forbes Avenue, Pittsburgh, PA, 15213, United States, laurdebo@andrew.cmu.edu

We consider a firm that sells a service which can either be of high or low quality. While the firm knows the quality of its good, it cannot credibly communicate the quality to its customer base. Instead, prospective customers have some private information about the quality of the service. We enrich the herding models by introducing a Poisson customer arrival process and exponentially distributed customer processing.

4 - Call Center Outsourcing: Coordinating Staffing Level and Service Quality

Justin Ren, Boston University School of Management, 595 Commonwealth Ave., Boston, MA, United States, ren@bu.edu, Yongpin Zhou

In this paper we study the contracting issues in an outsourcing supply chain consisting of a user company and a call center that does outsourcing work for the user company. We model the call center as a G/G/s queue with customer abandonment. Our results suggest that managers pay close attention to service quality and its contractibility in seeking call center outsourcing.

■ TA08

H - Ballroom Level, Imperial A

Empirical Research in Operations Management using Secondary Data

Sponsor: Manufacturing & Service Oper Mgmt
Sponsored Session

Chair: Serguei Netessine, Assistant Professor, University of Pennsylvania, 3730 Walnut St. Suite 500, Philadelphia, PA, 19104, United States, netessin@wharton.upenn.edu

Co-Chair: Gerard Cachon, University of Pennsylvania, The Wharton School, 500 JMHH, Philadelphia, PA, 19104, United States, cachon@wharton.upenn.edu

1 - Drivers of Finished Goods Inventory Performance in the U.S. Automobile Industry

Gerard Cachon, University of Pennsylvania, The Wharton School, 500 JMHH, Philadelphia, PA, 19104, United States, cachon@wharton.upenn.edu, Marcelo Olivares

This paper explores variation in finished goods inventory performance in the U.S. automobile industry. Time series of inventory to sales ratios show striking differences in inventory performance across auto makes. We conjecture this variation can be partially explained by product line breadth, distribution network concentration, demand variability, gross margins and capacity utilization measures.

2 - Drivers of Manufacturing Flexibility Adoption: An Empirical Analysis of the Automotive industry.

Manu Goyal, Assisant Professor, R.H. Smith School of Business, University of Maryland, College Park, MD, United States, goyalm@wharton.upenn.edu, Serguei Netessine, Taylor Randall

It has been argued that firms in many different industries are increasingly resorting to the use of flexible manufacturing systems, in part to mitigate uncertainty in demand and to better respond to competition. The purpose of this paper is to empirically validate the propagation of manufacturing flexibility over time for the automotive industry and to tease out the drivers for the same.

3 - Operational Performance, Buyer Supplier Relations and Shareholder Value

Taylor Randall, University of Utah, David Eccles School of Business, Salt Lake City, UT, United States, acttr@business.utah.edu, Michael Lemmon, Mi Luo

Shareholders of Dell Computers and Walmart reaped huge rewards from supply chain strategies that increase operational performance. However, anecdotal evidence suggests the gains of shareholders come at the expense of shareholders of supplier firms. To generalize this debate, we use a sample of public companies, to test the hypothesis that increased operational performance leads to higher shareholder value. We then examine whether shareholder wealth is transferred between buyers and suppliers.

4 - The "Earns Versus Turns" Strategic Choice in Retailing and its Effect on Performance

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

We apply an inventory productivity benchmarking model to study the "earns versus turns" strategic choice in retailing. Using public financial data for US retailers, we investigate the reasons for the choice between high-turns-low-earns and low-turns-high-earns strategies at different stages of the lifecycle of a firm, and examine whether one of these strategies leads to superior performance.

■ TA09

H - Ballroom Level, Yosemite A

Information and Forecasting

Cluster: Supply Chain Management
Invited Session

Chair: Kaijie Zhu, Assistant Professor, IELM Department, HKUST, Kowloon, KL, Hong Kong, kzhu@ust.hk

1 - Decentralized Inventory Sharing with Asymmetric Information

Xinghao Yan, PhD Student, Department of Management, Purdue University, 135-01 Nimitz Dr., West Lafayette, IN, 47906, United States, yan1@mgmt.purdue.edu, Hui Zhao

Previous work has always assumed full demand information sharing in an inventory sharing network. Such assumptions are far from reality for decentralized supply chains. In this paper, we study a system with one manufacturer supplying two retailers who privately hold demand information and share inventory with each other. We study the impact of information in the inventory sharing game. To the best of our knowledge, this is the first paper to incorporate inventory sharing and information sharing.

2 - Secure Collaborative Planning, Forecasting and Replenishment (SCPFR)

Vinayak Deshpande, vinayak@exchange.purdue.edu, Mikhail Atallah, Leroy Schwarz, Keith Frikken, Marina Bykova, Jiangtao Li

We introduce the use of secure multiparty-computation protocols to facilitate collaborative forecasting and inventory-replenishment decisions between a supplier and a retailer. In a collaborative framework, a joint forecast is created by incorporating past observations of demand as well the retailer's and supplier's signals about future demand. The goal of our research is to provide protocols such that this forecasting and inventory planning can be conducted in a "privacy-preserving" fashion.

3 - Dynamic Inventory Management with Learning about Demand Distribution and Substitution Probability

Li Chen, Stanford University, Stanford University, Stanford, CA, 94306, United States, skychen@stanford.edu, Erica Plambeck

When a product is out-of-stock, a customer may accept a substitute or choose not to purchase. The optimal inventory level for the product depends upon both the demand distribution and substitution probability. Furthermore, the choice of inventory level influences the customer behavior we observe, and hence our learning about the demand distribution and substitution probability. This paper provides qualitative insights about how this potential for learning influences the optimal inventory level.

4 - Inventory Control with Unobservable Lost Sales and Bayesian Updates

Xiangwen Lu, Institute of Transportation Studies, University of California, Irvine, CA, United States, xlu@translab.its.uci.edu, Jing-Sheng Song, Kaijie Zhu

We study a finite-horizon inventory model in which lost sales are unobservable. Departing from the relevant literature, we assume the product is nonperishable. We derive a sample-path expression of the first derivative function of the optimality equation to characterize the tradeoff in the decision making. We find that, unlike in the perishable-product case, the myopic solution is no longer a lower bound on the optimal inventory level. We also develop and evaluate heuristics.

■ TA10

H - Ballroom Level, Yosemite B

Stochastic Models for Manufacturing Systems and Supply Chains

Cluster: Supply Chain Management
Invited Session

Chair: Ananth Krishnamurthy, Rensseaer Polytechnic Institute, CII 5225, Dept of DSES,, 110 8th Street,, Troy, NY, 12180, United States, krisha@rpi.edu

1 - Analysis of Multi-stage Blocking Systems with Zero Buffers

Nico Vandaele, Professor, UA-UFSIA, Prinsstraat 13, Antwerp, Belgium, Nico.Vandaele@ufsia.ac.be, Nico Goossens

Blocking systems with zero buffers are typical of (semi-) process industries. Methodologically, these systems can be modeled as multi-stage kanban systems. To analyse queuing models of these systems, we first analyze two specialized fork/join stations in isolation. Results from this analysis are then incorporated into an algorithm to analyze the original blocking systems. We compare the results obtained proposed algorithm with simulation results.

2 - Capacitated Multi-item Inventory Systems with Markov Modulated Demands

Aykut Atali, Stanford University, Management Science & Eng'g, 377 Terman, Stanford, CA, 94305, United States, aykut@stanford.edu, Ozalp Ozer

We consider a capacity constrained, periodic-review, multi-item production system with Markov modulated demands and minimum production requirements. We propose lower bounds and close-to-optimal heuristics to manage a two level production system. We investigate the effect of production system design strategies, such as delayed differentiation, on system's performance and the inventory at risk.

3 - Design and Performance Tradeoffs in Multi-product Pull Systems

Ananth Krishnamurthy, Rensseaer Polytechnic Institute, CII 5225, Dept of DSES,, 110 8th Street,, Troy, NY, 12180, United States, krisha@rpi.edu, Kumar Satyam

This paper proposes a new parametric decomposition approach for queuing models of multi-product systems operating under pull control. The approach is used to obtain insights with respect to design parameters such as loop length, card counts, and production batch sizes on performance measures such as throughput, work-in-process inventories and service levels.

4 - On the Use of Fractional Number of Customers to Achieve Target Throughputs in Queueing Networks

Rajan Suri, Professor, Dept. of Industrial and Systems Engineering, University of Wisconsin-Madison, 1513 University Ave, Madison, WI, 53706, United States, suri@engr.wisc.edu, Rahul Shinde, Mary Vernon

Closed queueing networks are used for performance prediction in many applications. It has been assumed that Ni (the number of customers of class i) must be integer, but this will usually not achieve the target throughputs for multiple classes. We use Mean Value Analysis with the Schweitzer-Bard approximation and allow Ni to be fractional. We show how these fractional values can be used in an actual system and verify with simulations that this method achieves target throughputs accurately.

■ TA11

H - Ballroom Level, Yosemite C

Supply Chain Systems with Service Level Requirement

Contributed Session

Chair: Jing Zhou, University of Texas at Dallas, 2600 Waterview Pkwy., #3623, Richardson, TX, 75080, United States, jingzh@utdallas.edu

1 - Exogenous or Endogenous Service Quality in Setting Delivery Guarantee

Weixin Shang, Ph.D., Department of IEEM, HKUST, Clear Water Bay, Kowloon, Hong Kong, Hong Kong, shangwx@ust.hk, Liming Liu

Nowadays many suppliers offer delivery time guarantees to compete for customers, and they need to consider both the attraction of quoting short delivery times and their capabilities to maintain high service reliability. We demonstrate how the arrivals to the whole marketplace are split to individual suppliers. We further explicitly derive the optimal time decision for a small supplier, and prove the existence and uniqueness of Nash equilibrium for a game setting.

2- Safety Stock Placement in a Serial Supply Chain

Gangaraju Vanteddu,PhD Candidate, Wayne State University, 4815 Fourth Street, Room # 1073, Detroit MI 48202, United States, vgraju@wayne.edu, Ratna Babu Chinnam, Kai Yang

This research investigates the issue of safety stock placement in a serial supply chain.We compare & contrast our model with some of the existing models with respect to criteria such as cost & responsiveness and also offer some insights into the positioning of the bottleneck player.

3 - Cooperation between Multiple Newsvendors with Service Constraints

Ulas Ozen, Ph.D. Student, Technische Universiteit Eindhoven, Department of Technology Management, P.O. Box 513, Paviljoen E13, Eindhoven, NL-5600 MB, Netherlands, u.ozen@tm.tue.nl, Marco Slikker, Nesim Erkip

This study considers a supply chain that consists of n retailers, each of them facing a newsvendor problem, and a supplier. Groups of retailers might increase their expected joint profit by joint ordering and inventory centralization. Furthermore, we assume that each retailer has to satisfy a certain condition, e.g., service level. For these situations, we focus first on balancedness of associated cooperative games. Subsequently, we deal with several monotonicity properties.

4 - Optimizing Service Level Management Feedback Measurement Loops in Multi-Provider Environments

James Fogal, MarketAnswer, 4891 Mattos Drive, Fremont, CA, 94536, United States, jfogal@MarketAnswer.com

Establishing a service level management framework requires having feedback loop(s) from both internal processes and external deliverables. To achieve optimal efficiencies requires adaptation and regulation of internal processes to balance exterior demands and conditions. In this paper consideration is given to SLM frameworks focusing on managing the value derived from feedback. Investigated in this work is how service-levels cab be architected to provide corrective information.

5 - A Supply Chain with a Service Requirement for Each Market Signal

Jing Zhou, University of Texas at dallas, 2600 Waterview PKWY #3623, Richardson, TX, 75080, United States, jingzh@utdallas.edu, Hanqin Zhang, Suresh P. Sethi, Houmin Yan

We study a single-period two-stage service-constrained supply chain with an information update. The buyer has two procurement (buying/canceling) opportunities before the demand realization. He also commits to a service level after observing the market signal. We derive his optimal ordering decisions, and analyze the monotonicity properties with respect to the target service level. We discuss the impact of the forecast quality and compare the results of cancellation and no-cancellation models.

■ TA12

H - 4th Floor, Union Square 1

Game Theoretic Methods in Computer Science and Engineering I

Cluster: Applications of Auction and Game Theory

Invited Session

Chair: Ramesh Johari, Assistant Professor, Stanford University, Mgmt. Sci. and Eng., Terman Eng. Ctr., Room 319, Stanford, CA, 94305, United States, ramesh.johari@stanford.edu

Co-Chair: Amin Saberi, Assistant Professor, Stanford University, 317 Terman Eng. Ctr, Stanford, CA, United States, saberi@stanford.edu

1 - Competition and Efficiency in Congested Markets

Asu Ozdaglar, MIT, 77 Massachusetts Avenue, 32-D630, Cambridge, MA, 02446, United States, asuman@MIT.EDU, Daron Acemoglu

We study the efficiency of oligopoly equilibria in congested markets. The motivating examples are the allocation of network flows in a communication network or of traffic in a transportation network. We show that increasing competition among oligopolists can reduce efficiency, measured as the difference between users' willingness to pay and delay costs. We characterize a tight bound of 5/6 on efficiency in pure strategy equilibria.

2 - Resource Allocation and Pricing in Wireless Networks

R. Srikant, University of Illinois, Coordinated Science Lab, 1308 W. Main Street, Urbana, IL, 61801, United States, rsrikant@uiuc.edu, Atilla Eryilmaz, Xinzhou Wu

We consider the problem of allocating resources to many competing flows in a wireless network. In a wireline network, pricing mechanisms can be designed such that the aggregate utility obtained by price-taking users playing a noncooperative game is equal to the maximum aggregate utility that can be obtained when they cooperate. For wireless networks, we will show that scheduling algorithms, implemented at the network nodes, play an important role in achieving efficient resource allocation.

3 - Finding Equilibria in Large Sequential Games of Incomplete Information

Tuomas Sandholm, Carnegie Mellon University, Computer Science Department, 5000 Forbes Avenue, Pittsburgh, PA, 15213, United States, sandholm@cs.cmu.edu, Andrew Gilpin

We introduce an automated (lossless) abstraction technique for general sequential games of incomplete information and observable actions by the players. It enabled us to exactly solve Rhode Island Hold'Em, a known challenge problem poker game with 3.1 billion nodes in the game tree (the largest poker game solved previously had 140,000). To address even larger games, we introduce approximation methods that do not preserve equilibrium, but yield (ex post) provably close-to-optimal strategies.

4 - The Price of Anarchy for the Serial and the Avaerage Cost Sharing Method

Herve Moulin, Rice University, Economics Department, moulin@rice.edu

Users share an increasing marginal cost technology. Cost shares are nonnegative and cover costs: shares are nontransferable, e.g., waiting time. With quadratic costs and n users, the price of anarchy for serial goes to 1 as 1-1/n, versus 1-1/log(n) for average cost. Both mechanisms outperform marginal cost pricing. The more convex the marginal cost, the higher (resp. the lower) the price of the serial (resp. average cost) method. Yet the asymptotic superiority of the serial method is preserved.

■ TA13

H - 4th Floor, Union Square 5

Software Demonstration

Cluster: Software Demo

Invited Session

1 - Syncopation Software- From Project to Portfolio Analysis

Chris Dalton, Syncopation Software, 1623 Main Street, Concord, MA, 01742, cdalton@syncopationsoftware.com

See how easy it is to use DPL to develop a full decision analysis from a cash flow spreadsheet. The demonstration covers decision trees, influence diagrams and sensitivity analyses. A preview of DPL's portfolio capabilities will also be demonstrated from defining a portfolio in DPL to risk/reward and productivity ratio charts.

2 - Dash Optimization - Building Optimization Applications Using Mosel and XAD

Nitin Verma, Dash Optimization Inc, 560 Sylvan Ave, Englewood Cliffs, NJ, 07632, United States, nitin.verma@dashoptimization.com, Horia Tipi

This tutorial focuses on building optimization models using simple and advanced features available in Mosel, our modeling and programming language, and integrating them seamlessly with Xpress-Application Developer for visualization, analysis and deployment purposes. For updated information about Dash Optimization's activities at the 2005 INFORMS Annual Meeting, please visit: http://dashoptimization.com/home/services/news/informs_sanfrancisco.html.

■ TA14

H - 4th Floor, Union Square 6

Modeling and Assessment of Stabilization

Sponsor: Military Applications
Sponsored Session

Chair: Maj Victor Wiley, Chief, Deployability Analysis Branch, USAF, AFSAA/SAPP, 1570 Air Force Pentagon, Washington, DC, 20330, United States, victor.wiley@pentagon.af.mil

1 - A Pound Of Stability Or Five Feet Of Reconstruction?

Dave Davis, Director, Peace Operations Policy Program, George Mason University, 3401 N Fairfax Dr., Original Bldg, MS3B1, Arlington, VA, 22201, United States, ddavis@gmu.edu

Measuring the effectiveness of activities in stability operations is problematic. Even when we can measure our progress in electrical grids or in town councils, how do we know how much of either is needed? The Conceptual Model of Peace Operations provides a complete cover of the functions in a Peace Operation as well as a task inventory. There is a new data base that contains information on the relative frequency and importance of these tasks. The methodology will use this information to propose trade offs between the functions of the CMPO and to identify the parameters that must be used.

2 - A Systems Dynamic Approach to Stabilization and Reconstruction

Matthew Robbins, Captain, USAF, 6 Sherman Oaks Dr, New Hartford, NY, 13413, United States, Matthew.Robbins@rl.af.mil, Richard Deckro, Maj Victor Wiley

The complexities of nation-building involve many different but interrelated systems, infrastructures, institutions, and dynamic relationships. In this presentation a system dynamics model is outlined as a support tool allowing decision-makers and analysts to investigate different sets of decision approaches at a sub-national, regional level.

3 - Effects Based Assessment Support Systems (EBASS) Implementation

Michael Kwinn, Lieutenant Colonel, DSE, USMA, Department of Systems Engineering, US Military Academy, West Point, NY, 10996, United States, michael.kwinn@usma.edu, Thomas Morel, Gregory Boylan, LTC Simon Goerger

The Effects Based Assessment Support System (EBASS) was developed through collaboration between the Operations Research Center of Excellence and the Information and Technology Operations Center, both at the US Military Academy. Initially developed in Afghanistan, it is a dynamic system which allows distributed inputs and links metrics with effects assessment. This system has been used in three combatant commands and is now being implemented at the US Cabinet level in the GWOT.

■ TA15

H - 4th Floor, Union Square 9

Real-world Production Scheduling Systems

Cluster: Scheduling
Invited Session

Chair: Jeffrey Herrmann, Associate Professor, University of Maryland, Dept. of Mechanical Engineering, Institute for Systems Research, College Park, MD, 20742, United States, jwh2@umd.edu

1 - A New Shop Floor Scheduling System for a Food Company

Guilherme Vieira, Associate Professor, Catholic University of Parana, Imaculada Conceicao 1155, Curitiba, PR, 80215901, Brazil, gui.vieira@pucpr.br

This paper presents a proposal for the development of a new scheduling system for a large international food company in Brazil. The company currently schedules production based on one or two people's experience, using regular spreadsheet. Therefore, neither optimization nor meta-heuristics has been applied. The author believes that if the company uses an advanced scheduling system, the total schedule flow time can be decreased, saving thousands of dollars by better utilizing the resources.

2 - Integrated Long- and Short-term Underground Mine Scheduling

Alexandra Newman, Colorado School of Mines, Division of Economics and Business, Golden, CO, United States, anewman@mines.edu, Michael Martinez, Mark Kuchta

We present an optimization model that plans both long and short-term ore extraction sequences in an underground mine in Kiruna, Sweden. We introduce several procedures, both exact and heuristic, to expedite solution times for our integer program. We provide numerical results and implementation details.

3 - Plate Design in the Steel Industry

Jayant Kalagnanam, jayant@us.ibm.com, Chandra Reddy, Sanjeeb Dash

Heavy plates in the steel industry refer to products that are about 10mm or thicker. The manufacturing of heavy plates consists of designing "mother plates" based on an order book and is a 2D packing problem. The casting of mother plates is done as slabs that have a different geometry and this transformation adds a degree of freedom that needs to be exploited in designing a casting sequence. In this talk we provide an overview of plate design problem some approaches for solving this problem.

4 - Decision-making Systems in Production Scheduling

Jeffrey Herrmann, Associate Professor, University of Maryland, Dept. of Mechanical Engineering, Institute for Systems Research, College Park, MD, 20742, United States, jwh2@umd.edu

Production scheduling is part of the complex flow of information and decision-making that forms the manufacturing planning and control system. Improving scheduling requires understanding the context in which the scheduling decision occurs and the information available for that decision. This talk discusses an approach to obtaining that understanding, presents a tool for representing the information flow and decision-making system, and discusses several examples.

■ TA16

H - 4th Floor, Union Square 10

Scheduling Methods and Applications

Cluster: Scheduling
Invited Session

Chair: Jorge Leon, Professor, Texas A&M University, 106 Fermier, MS 3367, College Station, TX, 77843-3367, United States, leon@entc.tamu.edu

1 - VLSN Techniques for the Tool Loading Problem

Skylab Gupta, Ph.D. Student, Auburn University, 207 Dunstan Hall, Auburn University, AL, 36849, United States, guptasr@auburn.edu, Jeffrey Smith

We consider the Tool Loading Problem for an FMS. We are given a set of jobs, each requiring a set of tools to be loaded onto the tool magazine. The tool magazine can hold at most c tools. The problem is to find a processing sequence and a tool loading schedule so as to minimize the total number of tool switches. We present new heuristics for this problem based on Very Large Scale Neighborhood search techniques. We investigate the performance of our heuristics on standard problem instances.

2 - Optimization-based Semiconductor Manufacturing Scheduling

Erhan Kutanoglu, Assistant Professor, The University of Texas at Austin, 1 University Station C2200, Austin, TX, 78712, United States, erhank@mail.utexas.edu, John Hasenbein, Yiwei Cai

We present our initial modeling efforts on hierarchical, decomposition-based scheduling as applied to high-volume, low-mix semiconductor manufacturing. We also present the preliminary results based on real-life data.

3 - Bias in Certain Forward Approximate Stochastic DP's

Robert Storer, Professor, Lehigh University, Industrial & Systems Engineering, Bethlehem, PA, 18015, United States, rhs2@lehigh.edu, David Drake

We show how bias can enter into value function estimates in certain forward approximate dynamic programming heuristics. In particular we illustrate the effect using the "nomadic trucker" problem in which loads are assigned to a truck in a stochastic DP framework. Simple solutions to overcome the bias problem are presented.

4 - Extensions of Genetic Algorithms Demonstrated in Scheduling Problems

Mary Beth Kurz, Assistant Professor, Clemson University, 110 Freeman Hall, Clemson, SC, 29631, United States, mkurz@clemson.edu, Srinivasan Anandan, Sarah Canterbury

We demonstrate two extensions in the use of genetic algorithms, applied to scheduling problems. In scheduling flexible flow lines, we utilize the concept of gene expression to allow all feasible sequences to be realizable, while avoiding the computational burden imposed by always decoding the entire chromosome. In bi-criteria scheduling of a single machine, we utilize multiple measures of schedule quality in an effort to discover the set of all efficient sequences.

■ TA17

H - 4th Floor, Union Square 11

Managing the R&D Pipeline

Cluster: New Product Development
Invited Session

Chair: Stylianos Kavadias, Georgia Institute of Technology, 800 West Peachtree Street, Atlanta, GA, United States, stylianos.kavadias@mgt.gatech.edu

1 - Drug Development: Portfolio Selection and Capacity Investments

Karan Girotra, The Wharton School, 3730 Walnut St. STE 500 JMHH, Philadelphia, PA, 19104, United States, karang@wharton.upenn.edu, Christian Terwiesch, Karl Ulrich

New drug development presents some unique challenges with respect to selection of development portfolios, investments in R&D capacity and prioritization of competing development projects. We investigate alternate strategies along these dimensions that consider the competing benefits from focused versus diversified portfolios, high versus low utilization, high versus low selectivity.

2 - Strategic NPD Pipeline Management with an Endogenous Budget

Raul Chao, Georgia Institute of Technology, 800 West Peachtree Street, Atlanta, GA, United States, raul.chao@mgt.gatech.edu, Stylianos Kavadias, Cheryl Gaimon

We develop an analytical model to explore how a firm dynamically allocates resources between product development projects in the presence of an endogenous budget. Our results indicate that the optimal balance depends on the cost of capital as well as the managerial control structure employed by the firm.

3 - R&D Performance Volatility: A Behavioral Model

Gary Pisano, Professor, Harvard Business School, Morgan Hall T86, Soldiers Field, Boston, MA, 02163, United States, gpisano@hbs.edu, Fransesca Gino

We explore the underlying causes of R&D performance volatility over time at the firm level. R&D performance volatility has not been deeply examined in the literature despite its critical role in various industries. We use a simulation model to explore such phenomena, building on insights from behavioral theories of the firm: we argue that the performance swings, while rooted in uncertainty, are exacerbated by the behavioral influences in how decision makers deal with risk and uncertainty in R&D.

4 - Product Positioning in a Two-Dimensional Market Space

Chengxin Qu, INSEAD, BD CONSTANCE, FONTAINEBLEAU, 77305, France, chengxin.qu@insead.edu, Christoph Loch, Stylianos Kavadias

We examine the optimal composition of a firm's product portfolio to optimize the number of products, their features, prices, and qualities in multi-attribute markets. The end-products are development intensive. If customers are uniformly distributed in this market, products are differentiated only through their features. When the distribution of customers is non-uniform or the deviation costs differ, we show numerically that in optimal positioning products differ in price and quality.

■ TA18

H - 4th Floor, Union Square 12

Some Issues in Aviation Security

Sponsor: Aviation Applications
Sponsored Session

Chair: Arnold Barnett, George Eastman Professor, MIT Sloan School, E53-379 MIT, Cambridge, MA, 02139, United States, abarnett@MIT.EDU

1 - Who's Responsible for Aviation Security?

John Heimlich, Vice President and Chief Economist, Air Transport Association of America, 1301 Pennslyvania Ave., NW, Suite 1100, Washington, DC, 20004-1707, United States, JHeimlich@airlines.org

It is the airlines' view, as recognized by Congress, that aviation security is a component of national security and ought to be executed and funded accordingly. The incorporation of TSA into the Department of Homeland Security implicitly acknowledges the federal role in securing our transportation systems. The next phase of transportation security must include both organizational reform and increasing emphasis on risk assessment so that precious resources are used as effectively as possible.

2 - Intelligence versus Technology: A Tale of Two Approaches in Aviation Security Baggage Screening

Sheldon Jacobson, Professor, University of Illinois, 1206 West Green Street, mc244, Urbana, IL, 61801, United States, shj@uiuc.edu, Laura McLay, John Kobza

The Transportation Security Administration (TSA) supports selective screening of passengers to achieve improved airport security. A cost-benefit analysis of a selective baggage screening system is used to establish the tradeoffs between selective screening system accuracy in assessing risk versus the effectiveness of the baggage screening devices when few passengers are classified as higher-risk.

3 - Airline Security: Have We Won?

Arnold Barnett, George Eastman Professor, MIT Sloan School, E53-379 MIT, Cambridge, MA, 02139, United States, abarnett@MIT.EDU

Virtually no successful attacks on US aviation have occurred since 9/11 (as of this writing) which some see as evidence that our response to the crisis has been effective. Then again, there have been no other terrorist attacks since last 2001 in the US. We discuss recent developments in aviation security policy, some encouraging but others less so.

4 - Discussion

Alfred Blumstein, Professor, Carnegie-Mellon University Heinz School, Heinz School, Pittsburgh, PA, United States, ab0q@andrew.cmu.edu

Professor Blumstein will serve as discussant about the session.

■ TA19

H - 4th Floor, Union Square 13

Engineering and Technology Management

Sponsor: Technology Management
Sponsored Session

Chair: Pedro Ferreira, Post-Doctoral Fellow, University of California at Berkeley, 770 California #206, San Francisco, CA, 94108, United States, pedro@sims.berkeley.edu

Co-Chair: Pedro Oliveira, Assistant Professor, School of Economics and Management, Universidade Catòlica Portuguesa, Palma de Cima, Lisboa, 1649-023, Portugal, poliveira@fcee.ucp.pt

1 - Transaction Cost, Capabilities, and Innovation in Value Chains

Claudio Wolter, PhD Student, Carnegie Mellon University, cwolter@andrew.cmu.edu, Francisco Veloso

Different types of innovations have been described in the literature: architectural, modular, etc. Yet, both transaction cost economics and the capabilities view of the firm fail to consider this when discussing the performance of an industry's vertical structure. We discuss how distinct innovations affect how TCE and capabilities shape the optimal level of vertical integration. We also distinguish between optimality in adressing exogenous technical change and in generating endogenous change.

2 - Customer Technology Receptivity and the B2B e-Service Chain

Pedro Oliveira, Assistant Professor, School of Economics and Management, Universidade Catòlica Portuguesa, Palma de Cima, Lisboa, 1649-023, Portugal, poliveira@fcee.ucp.pt, Aleda Roth

This research investigates the role of customer technology receptivity, defined as the level of a business' receptivity and readiness to engage in electronic interactions and transactions, as an operational antecedent of B2B e-service capability. Using data gathered from 181 companies we find that a company's level of orientation towards service will have an impact on the customer technology receptivity, which on its turn has a positive impact of a company's B2B e-service capability.

3 - Outsourcing: The Impact of Learning-by-Doing and Strategic Behavior

John Gray, University of North Carolina—Chapel Hill, Campus Box 3490, McColl Building, Chapel Hill, NC, 27599-3490, United States, john_gray@unc.edu, Brian Tomlin, Aleda Roth

We investigate the impact of learning-by-doing and strategic behavior on manufacturing outsourcing decisions. We study a two-period game in which an original equipment manufacturer (OEM) can, if it chooses to, source production from a contract manufacturer. We show how firm characteristics (learning rates, costs, etc.) and market characteristics influence the optimal outsourcing strategy.

4 - Efficiency and Fairness in the Core of the Internet Backbone

Pedro Ferreira, Post-Doctoral Fellow, University of California at Berkeley, 770 California #206, San Francisco, CA, 94108, United States, pedro@sims.berkeley.edu

Connectivity in the Internet backbone is provided by agreements among ISPs, but existing transit and peering agreements are highly inefficient and unfair. Smaller ISPs in less developed regions pay extremely high transit fees to access eye-balls in the ISPs based in more developed countries while the latter ISPs peer without cash settlements. A more efficient interconnection mechanism is proposed in this paper, which associates a different forwarding price to each destination.

■ TA20

H - 4th Floor, Union Square 14

Agent-based and Complementarity Programming Modelling of Energy Markets

Sponsor: Energy, Natural Resources & the Environment / Energy Sponsored Session

Chair: Augusto Rupérez Micola, Research Fellow, IMD Lausanne, Chemin de Bellerive, 23, Lausanne, CH - 1001, Switzerland, augusto.ruperezmicola@imd.ch

1 - Designing Electricity Markets using Simulation
Robert Marks, Professor, AGSM, Australian Graduate School of Management, UNSW, Sydney, NS, 2052, Australia, bobm@agsm.edu.au

Over the past 20 years, how to design market-based electricity generation and distribution systems has become pressing. Engineers, economists, and computer scientists have been using computer simulations to help design these markets. We compare and contrast several simulation platforms, to explore our learning about simulating electricity markets. Issues of modelling actors' learning, and how to validate simulation models will be canvassed.

2 - A Decision Support Model for Genco Strategic Actions: A Complementarity Programming Approach
Scott Rogers, Professor, University of Toronto, Dept Of Mech & Ind Eng, 5 Kings College Rd., Toronto, on, M5S3G8, Canada, scott.rogers@utoronto.ca

This paper describes a decision support model for genco strategic actions such as maintenance scheduling, hydro scheduling, emissions planning etc. in the context of an oligopolistic market structure. The model uses Complementarity Programming to compute the results and is illustrated with examples from the recently revised Ontario system.

3 - Artificial Life Techniques For Market Simulation
Gerald Sheble, Professor, Department of Electrical Engineering, Iowa State University, 1115 Coover Hall, Ames, IA, 50011, United States, gsheble@iastate.edu, Feng Gao

Electric operation works as a competitive market environment. Generation companies apply novel technologies to produce electricity as other commodities. Market simulation is of extreme interest for each supply chain and for each future period of time. The research objective is to compare various artificial life techniques to solve the complex large-scale multiple-market, multiple time-frame problems that extend over the period of operation including risk management by various contracts.

4 - Vertical Incentives and Coordination in Energy Markets via Agent-Based Simulations
Augusto Rupérez Micola, Research Fellow, IMD Lausanne, Chemin de Bellerive, 23, Lausanne, CH - 1001, Switzerland, augusto.ruperezmicola@imd.ch, Albert Banal-Estanol, Derek W. Bunn

We present an agent-based model of a multi-tier energy market including gas shippers, electricity generators and retailers, with multiple non-Pareto ranked equilibria. Reward interdependences between strategic business units within a firm increase profits. This effect is distinct from the "raising rivals' costs" normally found in the literature. Higher prices relate to the sequential nature of energy markets, which facilitate the emergence of coordination across natural gas and electricity.

■ TA21

H - 4th Floor, Union Square 15

Joint Session DM Appl/ DM: Industrial and Applied Data Mining

Cluster: Data Mining Applications, Data Mining
Invited Session

Chair: Kas Kasravi, Kas.Kasravi@eds.com

1 - Data and Text Mining Technologies
James Mentele, Senior Research Fellow, CMU Research Corporation, 2625 Denison Dr., Mount Pleasant, MI, United States, james_mentele@chartermi.net

This speaker will outline various text and data mining technology developments and how they have been related to various business processes. Considerations and examples of text, data, and geographic integration to enable more comprehensive analysis and modeling will be presented. In particular, tools to address 'location, location, location' and 'timing is everything' aspects of decision making will be discussed. Data and deployment considerations required for analysis, prediction, and real-time decision-making environments will be outlined.

2 - A Data Analysis Framework for Early Warning of Critical Business Events
Maria Risov, maria.risov@eds.com

A data analysis framework for early detection of critical business events is introduced. Early detection of events such as adverse drug reactions, component failures, fraud, automotive recalls, or competitive activities can be of great importance to organizations and industries. Information technology solutions, such as text mining and data mining, can be used to maximize opportunities or minimize losses. Optimization of exiting processes, early detection of events, and prediction of future events are the elements of the proposed framework.

3 - Text Mining Enables the Agile Enterprise
Joe Barkai, Manufacturing Insights, jbarkai@manufacturing-insights.com

Challenged by a fragmented network of users, suppliers and partners that spans geographies and systems, the manufacturing industry continues to invest in text mining technologies to improve operational visibility. Yet, the success of text mining has been limited to individual projects and no clear leaders, standards or best practices have emerged. Using examples from failed and successful implementations, this presentation will address the roadblocks to adoption of text mining and propose an enterprise model that utilizes text mining to address the industry's needs.

4 - Text Mining Employee and Customer Survey Data
Sergei Ananyan, Megaputer Intelligence Inc., 120 West 7th Street, Suite 310, Bloomington, IN, 47404, United States, s.ananyan@megaputer.com

Employee and customer survey data represents a mixture of structured data and natural language narratives. While the structured portion of survey data can be efficiently analyzed with the help of powerful statistical and data mining techniques, the analysis of the corresponding natural language narratives still represents a major challenge and frequently is performed manually. At the same time, in many cases textual narratives contain up to 80% of most valuable information. Text mining is a collection of linguistic and semantic techniques for extracting and structuring useful information from text narratives. This business case illustrates the synergy of joint application of data and text mining techniques for solving employee survey analysis tasks. The customer is a Fortune 100 technological company. The results of the analysis of ALL available data provide valuable insights in employee needs, concerns, and loyalty factors. These results are available to key decision makers and business analysts across the organization in a visual and interactive form.

■ TA22

H - 4th Floor, Union Square 16

Information and Pricing Issues in Supply Chains

Sponsor: Information Systems
Sponsored Session

Chair: Shankar Sundaresan, Rutgers University at Camden, School of Business, Camden, NJ, United States, sxs87@psu.edu

1 - Information and Knowledge Effects in Multi-tier Supply Chains
Moti Levi, Penn State University, 509D, University Park, PA, 16802, United States, mlevi@psu.edu

Managing multi-tiers in supply chains is becoming increasingly important due to outsourcing and globalization. We analyze a multi-tier supply chain when quality and effort by lower tiers determine final product quality and revenues. We examine how both knowledge and information affect contracts and supply chain structure and determines which tier would be the locus of control and able to extract rents. The framework establishes a combined Knowledge and Information View of the Firm.

2 - Knowledge Market Signalling in Firms
Zuopeng Zhang, Penn State University, 324 Beam, University Park, PA, 16802, United States, zzhang@psu.edu, Shankar Sundaresan

This research studies the design of reward structures as well as its necessary support of information systems for participants of an internal knowledge market. The internal knowledge market is modeled as a marketplace where knowledge providers can signal their knowledge and learners acquire the knowledge from providers. Based on the characteristics of knowledge recipients, we study knowledge providers' best signaling strategy and the firm's optimal decisions on incentives and IT support.

3 - Inventory Availability Disclosure in Online Retailing
Michael Pangburn, University of Oregon, pangburn@lcbmail.uoregon.edu, Alex Talalayevsky

Online retailers sometimes choose to disclose inventory information to browsing customers. Product availability can influence consumers' decisions because of the risk of deferring purchase when stock levels are low. Using a two-period model, we analyze the inventory-disclosure decision and show that the firm's optimal policy follows a simple threshold structure.

■ TA23

H - 4th Floor, Union Square 17

Design Issues in Optical Network Design

Sponsor: Telecommunications
Sponsored Session

Chair: Hui Lui, Verizon Laboratories, 40 Sylvan Road, Waltham, MA, United States, hui.lui@verizon.com

1 - Traffic Grooming in Optical Networks
Hui Liu, hui.liu@verizon.com, Amr Farahat, Cynthia Barnhart, Rina Schneur, Roger Tobin

We address the traffic grooming problem in optical communication networks with general mesh topologies. We formulate the problem as a mixed-integer program, propose a Lagrangian-based decomposition scheme, and use cuts to strengthen the underlying network loading problem. Computational results on test instances drawn from a major network provider are reported that suggest the tractability of the solution procedure proposed.

2 - Network Design with Multiple Hop-Constrained Node Disjoint Routing
Pedro Patrìcio, pmendes@noe.ubi.pt, Luis Gouveia, Amaro de Sousa

We address the multi-commodity capacitated network design problem with maximum delay survivable routing, i.e., each demand is splitted by multiple hop-constrained node disjoint commodities. We propose an ILP model based on a hop-index model and study the tradeoffs between design cost and degree of survivability for different number of splitting commodities.

3 - Integrated Traffic Grooming and Lightpath Routing in WDM Networks
S. Raghavan, Smith School of Business, University of Maryland, 4345 Van Munching Hall, College Park, MD, 20742, United States, raghavan@umd.edu, Daliborka Stanojevic

Due to their complexity, traffic grooming and lightpath routing have traditionally been tackled separately in WDM network design. We consider these two problems jointly. We discuss several variants of the problem, and present our experience applying a branch and price algorithm on some of these variants.

■ TA24

H - 4th Floor, Union Square 18

Financial Strategies

Cluster: Financial Engineering
Invited Session

Chair: Farid AitSahlia, Industrial and Systems Engineering, University of Florida, Gainesville, FL, United States, farid@ise.ufl.edu

1 - A Continuous Model for Optimizing Taxable Portfolio of Many Assets
Song Yang, Northwestern University, Industrial Engineering and, Management Sciences, Evanston, IL, United States, yangsong@northwestern.edu, John Birge

To deal with taxable portfolios, we proposed a model including a continuum of risky assets. Under this model, the optimal consumption and trading strategy is formulated as a stochastic program. A proof of the trading strategy's optimality is given. Difficult, if not impossible, to get analytic forms, we use dynamically chosen intervals to get bounds and approximation; the convergence rate is discussed. Under different market and consumption conditions, computational results are given.

2 - Quantile Approximations for Asian Options
Farid AitSahlia, Industrial and Systems Engineering, University of Florida, Gainesville, FL, United States, farid@ise.ufl.edu

This talk presents efficient and accurate pricing and hedging approximations for Asian options based on closed-form expressions derived for quantile options. Both Wiener and Levy processes will be addressed.

3 - Quasi-Monte Carlo Simulation in a LIBOR Market Model
Jennifer Jiang, Northwestern University, 2145 Sheridan Rd, C210, Evanston, IL, 60208, United States, xfjiang@northwestern.edu, Song Yang

We apply quasi-Monte Carlo simulation to LIBOR market models based on the Brace-Gatarek-Musiela/Jamshidian framework. We price exotic interest-rate derivatives and compare the results using pseudo random sequences and different quasi-Monte Carlo sequences.

4 - How Inefficient is the 1/N Asset-Allocation Strategy?
Victor DeMiguel, Assistant Professor, London Business School, Regents Park, London, UK, NW14SA, United Kingdom, AVMiguel@london.edu, Lorenzo Garlappi, Raman Uppal

We compare the out-of-sample performance of the 1/N rule, which allocates 1/N to each of the N assets available, to about ten models of optimal asset-allocation for ten data sets. We find that the 1/N rule typically has higher out-of-sample Sharpe ratio and lower turnover than the optimal policies. Thus the loss from naive rather than optimal diversification is smaller than the loss arising from the use of estimated rather than true parameter values to compute optimal policies.

■ TA25

H - Ballroom Level, Franciscan D

A View from Abroad I

Sponsor: OR in SpORts
Sponsored Session

Chair: Mike Wright, Senior Lecturer, Lancaster University, Management Science Department, Lancaster University, Lancaster, La, LA1 5AG, United Kingdom, m.wright@lancaster.ac.uk

1 - Naismith's Rule and its Variants
John Norman, Emeritus Professor, Sheffield University Management School, 9 Mappin Street, Sheffield, S1 4DT, United Kingdom, j.norman@sheffield.ac.uk

Naismith's Rule, a guide for people walking in mountainous country, suggests allowing 8 times as much time for 1000 feet of ascent as for 1000 feet on the level. Some results of mountain road and trail races suggest allowances of 4 and 6 times. Possible reasons for the differences are suggested.

2 - Are Football Referees Really Biased and Inconsistent? Evidence from the English Premier League
Stephen Dobson, University of Otago, P.O. Box 56, Dunedin, Ot, New Zealand, sdobson@business.otago.ac.nz, Peter Dawson, John Wilson, John Goddard

This paper analyses patterns in the incidence of disciplinary sanction (yellow and red cards) taken against players in English football, using bivariate negative binomial and bivariate Poisson regressions. Several questions concerning sources of inconsistency and bias in refereeing standards are examined. The incidence of disciplinary sanction is found to be stable over time but varies between referees. There is also evidence to suggest a refereeing bias favouring the home team.

3 - Decision Problems in Cricket, Football and Mountain Marathons
Phil Scarf, Dr, University of Salford, Centre for OR and Applied Statistics, University of Salford, Salford, M5 4WT, United Kingdom, philscarf@hotmail.com

We consider some very English sports, namely Cricket and Football (Soccer). Cricket has some similarities to Baseball, but not many. In international "test" cricket, each side has two innings and draws are possible. An early termination, or declaration, of an innings can increase the win probability for a team; we look at optimum timing of the third innings declaration. In football, we will look at player ranking on the basis of performance. Also in mountain marathons, we look at route choice.

4 - Computer Support for Coaching and Scouting
Gerard Sierksma, Prof.dr., University of Groningen, P.O. Box 800, Groningen, 9700AV, Netherlands, g.sierksma@rug.nl

Scouting players and measuring the effectivity of individuals is the subject of this paper. With the systems C&SAssistant and EffInAction it is possible to support the design of optimal teams. Indications on player's salaries are given. The systems are tested for soccer/football, hockey, volleyball, rowers-8. For all field positions graphs are shown that depict the development of the players. www.rug.nl/economics/sierksmaG

■ TA26

H - Ballroom Level, Continental Ballroom 4

Studies in Maintenance

Contributed Session

Chair: Xiaoyue Jiang, Assistant Professor, Louisiana State University, Industrial Engineering, Baton Rouge, LA, 70803, United States, jiang@lsu.edu

1 - Approaches in Accelerated Life Testing
Chenhua Li, graduate Student, Northeastern University, 334 Snell Engineering Center, Boston, MA, 02115, United States, chenhual@coe.neu.edu, Nasser Fard

Accelerated life testing (ALT) is usually performed to obtain information concerning failures, in order to quantify reliability. Units are tested at accelerated stress conditions, which cause the products to fail more quickly. There are different approaches in ALT, by increasing the stress levels for hastening the product degradation and accelerating their failures. ALT can be classified as constant stress, step stress, etc. Data analysis and design problems in ALT are discussed.

2 - Equipment Replacement under Continuous and Uncertain Discontinuous Technological Change

Jennifer Rogers, graduate student, Lehigh University, 450 F Mickley Run, Whitehall, PA, 18052, United States, jer4@lehigh.edu

Equipment replacement problems generally consider only continuous or discontinuous technological change. In this model, continuous technological change occurs at a known rate and breakthroughs may arrive with some probability each period. We present a model in which the level of improvement associated with technological breakthroughs is uncertain. By solving the model, we hope to gain insight into the decisions made when the timing and quality of available replacements is uncertain.

3 - Fuzzy Optimal Replacement Policy in a Condition-Based Maintenance Model

Hongye Wang, Louisiana State University, Department of Industrial Engineering, Baton Rouge, LA, 70803, United States, hwang9@lsu.edu, Xiaoyue Jiang

Condition monitoring techniques offer a potential for advanced maintenance decisions based on a rich set of information. However, decision-makers are challenged with complexity of the system dynamics including randomness, imprecision and non-monotonicity. We develop a condition-based maintenance model under a fuzzy and probabilistic setting. By applying a fuzzy optimal stopping approach, we derive an optimal policy that maximizes the total expected profit.

4 - Optimal Preventive Maintenance Policies for Stochastically Deteriorating Two-State Processes

Sofia Panagiotidou, PhD Candidate, Aristotle University, University Campus P.O. Box 461, Thessaloniki, 54124, Greece, span@auth.gr, George Tagaras

We develop models for suitable age-based preventive maintenance policies that are applicable to production processes with two operating states. The equipment starts its operation in the good quality state but it may shift to the inferior quality state before failure or scheduled preventive maintenance, resulting in decreased production revenues and increased failure rate of the process. The objective is to study the effect of the process quality shift on the optimal maintenance time.

5 - Optimal Repair-Replacement Strategy for a Warranted Product

Xiaoyue Jiang, Assistant Professor, Louisiana State University, Industrial Engineering, Baton Rouge, LA, 70803, United States, jiang@lsu.edu

Under a free replacement warranty policy, the manufacturer has the option of repairing the failed item or replacing it. In Jack and Van der Duyn Schouten [2000], a conjecture is made on the optimality of an age-limit replacement policy. We prove that this conjecture is correct. Moreover, we show that for a generalized model where the repair cost is random, a repair-cost-limit policy is optimal, and the age-limit policy becomes its special case.

■ TA27

H - 4th Floor, Union Square 21

Joint Session Practice/ CPMS: Edelman - Reprise of 2005 Edelman Award Finalists

Sponsor: CPMS, The Practice Section of INFORMS, OR Practice
Sponsored Session

Chair: R. John Milne, Senior Technical Staff Member, IBM, 43 Skunk Hollow Road, Jericho, VT, 05465, United States, jmilne@us.ibm.com

1 - A Scheduling and Capable-to-Promise Application for Swift & Co.

Brian Downs, Supply Chain Advisor, Aspen Technology, Inc., 5731 Deseret Trail, Dallas, TX, 75252, United States, brian.downs@aspentech.com, Ann Bixby

An integrated system of 45 linear programming models using three separate model formulations allows Swift & Company to dynamically schedule its beef fabrication operations at five plants in real time as orders are received. This unique scheduling and capable-to-promise application resulted in documented improvements in key metrics such as order fulfillment, on-time delivery and a 22% increase in weekly inventory-sold position, while providing a 200% ROI in its first year of production.

2 - An OR/MS Approach to the Management of Nanzan Gakuen

Toshiharu Hasegawa, Professor, Nanzan University, 27, Seirei-cho, Seto, A, 489-0853, Japan, thasegaw@it.nanzan-u.ac.jp, Atsuo Suzuki, Katsushige Sawaki, Mihiro Sasaki

OR/MS methodology was applied to the management of the Nanzan School complex. The administration recognized OR/MS as a strong effective management tool, This report delas with how the school complex change so that it can survive the increasing competition among institutions of higher education.

■ TA28

H - 4th Floor, Union Square 22

Robust Revenue Management

Sponsor: Revenue Management & Pricing
Sponsored Session

Chair: Aurelie Thiele, Assistant Professor, Lehigh University, Dept of Industrial Engineering, 200 West Packer Ave, Bethlehem, PA, 18015, United States, aurelie.thiele@Lehigh.EDU

1 - Robust Models for Routing and Staffing Call Centers

Garud Iyengar, Associate Professor, Columbia University, garud@ieor.columbia.edu, Anuj Manuja

In this talk we will explore various robust models for staffing and routing in call centers. The intent of these models is to systematically correct for statistical variations in the arrival rate vector and service rate matrix. We will specifically focus on robust models that are able to work with asymmetric distributions; allow for decisions to be made over multiple time periods; and, work with general convex loss functions.

2 - Retailer-Supplier Flexible Commitments Contracts via Robust Optimization

Arkadi Nemirovski, Professor, School of Industrial and Systems Engineering, Georgia Institute of Technology, 765 Ferst Drive NW, Atlanta, GA, 30332-0205, United States, nemirovs@isye.gatech.edu, Boaz Golany, Jean-Philippe Vial, Aharon Ben-Tal

We consider a Multi-Stage Inventory affected by uncertain demand, where we seek for (a) commitments - initial estimates of future orders, and (b) rules specifying actual orders as affine functions of demands observed so far. The objective includes usual expense components and penalties for deviations of the actual orders from the commitments. We demonstrate that the Robust Counterpart of the problem is tractable, and report on numerical results.

3 - Robust Airline Revenue Management

Fernando Ordonez, Assistant Professor, University of Southern California, 3715 McClintock Ave, GER-247, Los Angeles, CA, 90089, United States, fordon@usc.edu, Rene Caldentey

We consider the problem of deciding capacities for fare classes subject to uncertainty in demands. We investigate the relative merits for this problem of a robust optimization solution, which maximizes revenue for the worst possible demand realization. We study the conditions in which a robust solution is preferable and when it can be determined efficiently. We use the robust solution to propose booking practices via hybrid policies and bid prices.

4 - Robust Dynamic Pricing

Aurelie Thiele, Assistant Professor, Lehigh University, Dept of Industrial Engineering, 200 West Packer Ave, Bethlehem, PA, 18015, United States, aurelie.thiele@Lehigh.EDU

We present a robust approach to dynamic pricing, where we model the demands as uncertain parameters belonging to uncertainty sets rather than random variables with probability distributions. Unlike stochastic dynamic programming, robust optimization does not suffer from the curse of dimensionality and leads to a tractable solution even in large dimensions. We develop theoretical insights into the impact of uncertainty on optimal prices and present computational results.

■ TA29

H - 4th Floor, Union Square 23

Analysis of Customer Behavior for E-Commerce

Contributed Session

Chair: Fen Wang, University of Maryland Baltimore County, 4706 Gateway Terrace, Apt. C, Baltimore, MD, 21227, United States, fenwang1@umbc.edu

1 - Analysis of a Bucket Brigade System for Order Picking

Scott Webster, Professor, Syracuse University, Whitman School of Management, Syracuse, NY, 13244, United States, stwebste@syr.edu, Kum-Khiong Yang, Robert Ruben

Bucket brigade order picking is a method for retrieving orders from a storage rack where workers follow a fixed sequence and dynamically adjust to variability in work content along the rack. The method is simple and has been shown to provide superior performance in many applications. This research is motivated by small-order environments that are common in e-commerce and mail order applications. We offer insights for increasing bucket brigade productivity in such an environment.

2 - E-SELFQUAL: A Measure for Assessing Perceived Quality of Electronic Technology-Based Self-Service

Xin Ding, Ph.D. candidate, University of Utah, 1645 E Campus Center Drive, Salt Lake City, UT, 84112, United States, pmgtxd@business.utah.edu, Paul Hu, Olivia Sheng

This study proposes E-SELFQUAL as an innovative approach for measuring e-service quality. The conceptual model of E-SELFQUAL is composed by incorporating theories of service quality, technology acceptance model, and personal control. A survey of web-based self-service users is conducted to validate the conceptual model and to assess its impacts on satisfaction, and loyalty. We believe the model has both managerial and research implications for effectively measuring e-service performance.

3 - DTS to Facilitate E-business Strategy

Fen Wang, University of Maryland Baltimore County, 4706 Gateway Terrace, Apt. C, Baltimore, MD, 21227, United States, fenwang1@umbc.edu, Guisseppi Forgionne

E-business strategy can be facilitated through analytical and technological tools. Unfortunately, limited research has been done on such comprehensive support. In an ongoing project, we focus on DTS (decision technology system) development and its role in support of e-business strategy. We expect this research to be the first time theoretical implications from management science, intelligent technology and decision theory have been integrated in a DTS and investigated in the real business world.

■ TA30

H - 4th Floor, Union Square 24

Statistical and Optimization Modeling at Wastewater Treatments Plants

Cluster: Sustainable Development and OR
Invited Session

Chair: Steven Gabriel, Assistant Professor, University of Maryland, 1143 Martin Hall, College Park, MD, 20742, United States, sgabriel@umd.edu

1 - Statistical Modeling to Forecast Odor Levels of Biosolids Applied to Reuse Sites

Sirapong Vilalai, Ph.D. Candidate, University of Maryland, Department of Civil& Env. Engineering, College Park, MD, 20742, United States, vilalais@umd.edu, Chris Peot, Steven Gabriel, Mark Ramirez

Proper utilization or disposal of wastewater solids is an important responsibility of wastewater treatment plants. Land application of biosolids products is beneficial as part of recycling efforts on local farms. Coupled with these beneficial aspects are odors which must be managed relative to the receiving populations. In this paper we present several statistical models that predict biosolids odor levels based on processing and management variables as well as ambient conditions.

2 - Multiobjective Optimization Modeling of Biosolids Odors and Costs at a Wastewater Treatment Plant

Prawat Sahakij, University of Maryland, 173 Glenn L. Martin Hall, University of Maryland, College Park, MD, 20742-3021, United States, psahakij@umd.edu, Chris Peot, Mark Ramirez, Steven Gabriel

Advanced wastewater treatment plants remove deleterious chemicals and microorganisms from wastewater and produce biosolids products to be reused at farms and other sites. These biosolids are carefully regulated by environmental restrictions but still may be malodorous to the local populations. In this paper, we develop a multiobjective optimization model to simultaneously minimize the biosolids odors as well as processing and distribution costs.

3 - Prediction of Dimethyl Disulfide Levels from Biosolids Using Statistical Modeling

Hyunook Kim, Assistant Professor, University of Seoul/Department of Environmental Engineering, 90 Jeonnong-dong, Dongdaemun-gu, Seoul, 130-743, South Korea, h_kim@uos.ac.kr, Sirapong Vilalai, Susana Arispe, Steven Gabriel, Laura McConnell, Alba Torrents, Mark Ramirez, Chris Peot

Two models were used to predict the concentration of dimethyl disulfide (DMDS) released from biosolids of a wastewater treatment (WWTP). In general, both models explained observed DMDS levels in sludge samples. The adjusted R2 value of the regression models 1 and 2 were 0.79 and 0.77, respectively. Using the developed models, plant operators can proactively decrease this odorant. Therefore, these models are a useful tool in biosolids management at WWTPs.

■ TA31

H - 4th Floor, Union Square 25

Joint Session Practice/ Roundtable: Applying OR in the INFORMS Roundtable Companies

Cluster: OR Practice, Roundtable
Invited Session

Chair: Srinivas Bollapragada, Senior Operations Researcher, General Electric Global Research Center, 1 Research Circle, Niskayuna, NY, 12309, United States, bollapragada@research.ge.com

1 - Applying O.R. at Carmen Systems: Experiences from the Transportation Industry

Stefan Karisch, VP Operations Research, Carmen Systems, 1800 McGill College Avenue, Suite 2800, Montreal, QC, Canada, stefank@carmensystems.com

Carmen Systems develops and implements resource management and optimization solutions for demanding transportation operations. Clients include five of the ten largest airlines in the world, and with Deutsche Bahn (German Railways) one of the largest passenger transportation companies in the world. In this presentation, I will give an overview how O.R. is applied at Carmen and provide perspective on the value O.R. generates as part of our products.

2 - Operations Research Powers RCI Business

Sandeep Govil, Cendant/RCI, 7 Sylvan Way, Parsippany, NJ, 07054, United States, Sandeep.govil@cendant.com, Sri Raghavan

RCI runs a timeshare exchange as its core business. RCI has 4 million members and 4000 business affiliates worldwide. The core principle is to run a fair and profitable exchange. Business innovation and growth have been key to long term viability and market leadership for 30 years. RCI has established OR as a formal competency. OR has gained visibility as a strategic lever that drives business value. OR is delivering central capability to address decision needs of the business units worldwide.

3 - Making the Optimal Better. Emptoris' Strategic Sourcing Solutions

Olga Raskina, Emptoris, 200 Wheeler Road, Burlington, MA, 01803, United States, ORaskina@emptoris.com, Rina Schneur, Avner Schneur

Emptoris is a leading provider of enterprise supply management solutions for Global 5000 companies. It helps companies tackle one of the hardest problems in strategic sourcing: deciding the best allocation of sourcing awards based on supplier pricing and performance while complying with corporate purchasing policies. We study real-world obstacles that come in the way of practical benefits of optimization science for sourcing solutions and propose solution strategies.

4 - An OR Modeling Partnership between WSU and Ford and Visteon

Kenneth Chelst, Chair of Industrial and Manufacturing Engineering, Wayne State University, 4815 Fourth St., Detroit, MI, 48201, United States, kchelst@wayne.edu

Wayne State University (WSU) delivers an engineering management masters program to the next generation of technical leaders at Ford and Visteon. Students in their final year, carry out a leadership project that tackles a major corporate challenge. We describe the role that OR models have played and explore the factors contributing to the success of the projects.

5 - Operations Research Projects at GE Global Research

Srinivas Bollapragada, Senior Operations Researcher, General Electric Global Research Center, 1 Research Circle, Niskayuna, NY, 12309, United States, bollapragada@research.ge.com

GE Global Research Center is one of the world's most diversified industrial research labs, employing over 2500 researchers and providing innovative technology for all of GE's businesses. We will briefly present the recent OR projects that we had executed to improve operations at several GE businesses including NBC, GE Financial businesses, GE Energy and Plastics.

■ TA32

H - 6th Floor, Lombard

Network Location

Sponsor: Location Analysis
Sponsored Session

Chair: Zvi Drezner, Professor, California State University, College of Business and Economics, Fullerton, CA, 92834, United States, zdrezner@fullerton.edu

1 - Reliability vs. Travel Distance Trade-offs in Facility Location Problems

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

We consider a continuous p-Median Problem where some of the facilities may not be operational due to disruption. We consider two cases: (i) customers know which facilities are disrupted; (ii) no such information is available. We analyze the trade-offs between reliability and travel distance on a line and a plane.

2 - Positioning Employees in Workspace

H.A. Eiselt, haeiselt@unb.ca, Vladimir Marianov

The employee positioning and workload allocation model presented here allocates work to existing and potential new employees by minimizing the gap between an employee's ability and the work allocated to him, minimizing various cost components, and providing an equitable work allocation. Computational evidence is provided for a real application.

3 - On the Interplay Between Facility Location and Demand Uncertainty

Elif Tokar Erde, et5@buffalo.edu

This talk addresses the interplay between facility location and demand uncertainty. Both an explicit and an implicit model are introduced for this problem. Based on computational experiences and two case studies we conclude that a significant number of additional facilities are needed to achieve the same coverage with demand uncertainty.

4 - Facility Location Problems for Medical Services of Large-scale Emergencies

Hongzhong Jia, Research Assistant, University of Southern Calif., 2113 Oak ST, Los Angeles, CA, 90007, United States, hjia@usc.edu

We investigate the problem of locating facilities of medical supplies to address large-scale emergencies, as opposed to regular emergencies that can be serviced by hospitals or fire stations. We propose a general facility location model, which can be cast as a covering, P-median, or P-center problem. The requirement of multiple facility quantity and quality coverage is incorporated. Illustrative examples are given to show the applicability of the location models to different emergency scenarios.

■ TA33

H - 6th Floor, Mason

Data Mining and Statistics in Supply-Chain Management and Logistics

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: Jye-Chyi Lu, Professor, Georgia Institute of Technology, Industrial and Systems Engineering, 765 Ferst Drive NW, Atlanta, GA, 30332, United States, jclu@isye.gatech.edu

1 - Game-Theory Based Acceptance Sampling Plans for Supply-Chain Networks

Sashidhar Dandamudi, Ph.D. student, Georgia Institute of Technology, The School of Industrial and Systems Eng, 765 Ferst Drive, Atlanta, GA, 30332, United States, sashi@isye.gatech.edu, KwangSup Shin, Jye-Chyi Lu, Sukho Kang

This paper decomposes a complex supply-chain network to three basic relationships and develops game-theory based acceptance sampling plans between suppliers and retailers in each relationship. Analytic derivations show the existence of a global optimum. Numerical examples explore properties of the proposed method in realistic situations.

2 - Modeling and Decision-Making in Spatially Distributed Service Systems

Ni Wang, Ph.D. Student, Georgia Institute of Technology, Industrial and Systems Engineering, 765 Ferst Drive NW, Atlanta, GA, 30332, United States, gtg586c@mail.gatech.edu, Jye-Chyi Lu, Paul Kvam

A multi-level spatial framework is proposed to model the spatially distributed service systems. It can support various decisions at different levels, e.g. allocating distribution centers at the strategic level covering large regions, exploring regional demand-functions at the tactic level covering mid-size regions and demand-forecasting at new store locations in the local-level. Real-life examples demonstrate the importance of the research and illustrate the potential of the models.

3 - Managing Supply Chain Inventory Given Risk of Border Disruptions

Alan Erera, Assistant Professor, Georgia Institute of Technology, Industrial and Systems Engineering, 765 Ferst Drive NW, Atlanta, GA, 30332, United States, alan.erera@isye.gatech.edu

Motivated by the possibility of port-of-entry closures in the event of a security incident, we develop a supply chain inventory model that captures border closure risk via stochastic leadtimes. We model potential port congestion delays via a simple deterministic queueing mechanism. Optimal inventory policy and long-run average cost are analyzed. Finally, we present results from a computational study and provide managerial and policy insights.

4 - Multi-Echelon Inventory Coordination with Logistic Cost Approximations

Divya Mangotra, Ph.D. Student, Georgia Institute of Technology, Industrial and Systems Engineering, 765 Ferst Drive NW, Atlanta, GA, 30332, United States, gtg686i@mail.gatech.edu, Jye-Chyi Lu

This research explores various designs of a network with national distribution centers (DCs) serving regional DCs that serve stores. The optimal design will minimize the total logistic cost with minimum possible inventory held at the various echelons and meeting the desired customer service level. Novelty of this research is the use of multi-level spatial approximations models in deciding inventory levels coordinated between national and regional level DCs.

■ TA34

H - 6th Floor, Powell

Multiscale Wavelet Analysis and Applications

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: Judy Jin, Associate Professor, Department of Industrial and Operations Engineering, The University of Michigan, 1205 Beal Ave, Ann Arbor, MI, 48109-2117, United States, jhjin@umich.edu

1 - Performance Improvement of Run-by-Run (RbR) Control Through Multiresolution Analysis

Rajesh Ganesan, Assistant Professor, George Mason University, Fairfax, VA, 22030, United States, rganesan@gmu.edu, Tapas K. Das

Increased complexities of manufacturing together with higher demands on quality and throughput as in semiconductor manufacturing processes have created the need for superior performance of process control strategies. RbR controllers are one such type of controllers that is most commonly used in semiconductor manufacturing. In this talk we present some of the advantages in using wavelet based multiresolution analysis in RbR control.

2 - Wavelet Application for Helicopter Engine Prognostics

David He, davidhe@uic.edu

In this paper, a helicopter engine prognostic case study using wavelet analysis is presented. The objective of the case study is to demonstrate the feasibility of integrating wavelet analysis with probabilistic models to predict the remaining operating time before the next fault occurs in the engine. Real prognostic results will be presented.

3 - Multiscale Feature Extraction for Authocorelated Processes Monitoring

Judy Jin, Associate Professor, Department of Industrial and Operations Engineering, The University of Michigan, 1205 Beal Ave, Ann Arbor, MI, 48109-2117, United States, jhjin@umich.edu

The conventional control charts for autocorrelated process monitoring generally requires ARMA modeling efforts or the trial and errors on the parameter selection in the MA and EWMA charts. This research will show how the wavelet transfer can effectively reflect the dynamic system characteristics through multiscale decomposition. The systematic method to select optimal wavelet coefficients for the process monitoring will be presented.

4 - Customized Wavelet Representations of Grinding Wheel Profiles

Satish Bukkapatnam, Associate Professor, Oklahoma State University, School of IE&M, Stillwater, OK, 74078, satish.t.bukkapatnam@okstate.edu

A new approach, based on lifting (or 2nd generation wavelet) schemes, for grinding wheel profile representation is described. The resulting representation allows compact description of wheel condition, which is a chief cause for surface quality deterioration in many abrasive finishing operations, and can lead to effective real-time condition monitoring schemes.

■ TA35

H - 6th Floor, Sutter

OR/MS Modeling and Algorithms in Marketing II

Contributed Session

Chair: Ujwal Kayande, Penn State University, 707B, BAB, University Park, PA, 16802, United States, uak1@psu.edu

1 - A Column Generation Approach to the Product Line Design Problem

Xinfang Jocelyn Wang, University of Cincinnati, 523 Carl H. Lindner Hall, P.O. Box 210130, Cincinnati, 45221, United States, wangfx@email.uc.edu

Column generation (CG) is proposed to solve the product line design problem. The product line design problem is defined as determining the product attributes of a set of products for a firm to offer so as to maximize its market share provided by the set of products in the line. Our empirical results suggest that an LP-based heuristic using column generation performs quite well.

2 - Vaporware: Wisdom or Wasteland?
Kevin Yongchuan Bao, Assistant Professor, California State University Fullerton, 800 North State College Boulevard, Marketing Department, Fullerton, CA, 92834, United States, kbao@exchange.fulleron.edu

This study examines the phenomenon of vaporware, a preannouncement strategy by which a firm intentionally misses the product delivery date as promised in the preannouncement. The game-theoretic analysis shows that a firm's vaporware incentive depends on its market share and time sensitivity of the announced new product. The findings refute the established view that vaporware is used to deter entry. The study also shows that price can be used to signal a firm's product delivery speed.

3 - Customer Segmentation and Marketing Policy Optimization: A Field Experiment
Dirk Van den Poel, Associate Professor of Marketing, Ghent University, Hoveniersberg 24, Gent, B-9000, Belgium, dirk.vandenpoel@ugent.be

We present a field experiment of a joint optimization approach addressing two issues: (1) the segmentation of customers into homogeneous groups of customers, (2) determining the optimal policy (i.e., what action to take from a set of available actions) towards each segment. Our contribution lies in the combination of both steps into one optimization framework to obtain an optimal allocation of marketing expenditures.

4 - Learning to Navigate the DSS Maze: Type of Feedback Matters
Ujwal Kayande, Penn State University, 707B, BAB, University Park, PA, 16802, United States, uak1@psu.edu, Gary Lilien, Arnaud De Bruyn, Arvind Rangaswamy, Gerrit van Bruggen

A well designed decision support system (DSS) typically improves the objective quality of marketing decision making. Yet users do not appear to fully recognize the value of DSSs. We propose that the gap can be reduced if DSSs are designed to change users' mental models. We show that incorporating feedback in the form of upside potential and corrective cues can change users' mental models, leading to greater learning and adoption likelihood.

■ TA36

H - 6th Floor, Taylor

Simulation Output Analysis

Sponsor: Simulation
Sponsored Session

Chair: Seong-Hee Kim, Assistant Professor, Georgia Tech, School of ISyE, Georgia Tech, Atlanta, GA, 30332, United States, skim@isye.gatech.edu

1 - A Decentralized Approach to Discrete Optimization: Application to Network Flow
Kaushik Sinha, PhD Candidate, University of Virginia, 151 Engineer's Way, Charlottesville, VA, 22903, United States, ks7r@virginia.edu, Steve Patek, Alfredo Garcia

We study a new class of decentralized algorithms for discrete optimization via simulation, which is inspired by the fictitious play algorithm applied to games with identical interests. We first establish convergence under finite sampling to equilibrium solutions. In addition, in the context of discrete network flow models, we prove that if the underlying link cost functions are convex then our algorithms converge almost surely to an optimal solution.

2 - Performance Evaluation of ASAP3 for Steady-state Simulation Analysis
James Wilson, Professor, North Carolina State University, Dept. of Industrial Engineering, Raleigh, NC, 27695, United States, jwilson@ncsu.edu, Emily K. Lada, Natalie M. Steiger

An experimental performance evaluation of ASAP3 is presented, including several queueing systems with characteristics typically encountered in practical applications of steady-state simulation analysis procedures. Regarding conformance to prespecified precision and coverage-probability requirements, ASAP3 compared favorably with its predecessor, ASAP, and the batch-means procedure of Law and Carson. ASAP3's efficiency is also shown to be reasonable for the given test problems.

3 - Finding Feasible Systems When the Number of Systems or Constraints is Large
Demet Batur, Grad Student, Georgia Tech, School of ISyE, Georgia Tech, Atlanta, GA, 30332, United States, dbatur@isye.gatech.edu, Seong-Hee Kim

When one tries to find the best with the largest or smallest performance measure among a finite number of simulated systems that satisfy a number of stochastic constraints, it is necessary to identify the set of feasible systems. In this talk, we only focus on identifying the set of feasible systems when either the number of systems or the number of constraints is large.

4 - Convergence of Simulated Annealing for Noisy Objective Functions
Andrei Prudius, Georgia Institute of Technology, School of ISyE, Atlanta, GA, 30332, United States, aprudius@isye.gatech.edu, Sigrun Andradottir

We prove the almost sure convergence of a simulated annealing algorithm (with a decreasing cooling schedule) for simulation optimization. We discuss the implications of this result for both transient and steady-state simulations and provide some numerical results.

■ TA37

H - 6th Floor, Van Ness

Stochastic Networks

Sponsor: Applied Probability
Sponsored Session

Chair: Assaf Zeevi, Graduate School of Business, Columbia University, NY, NY, United States, assaf@gsb.columbia.edu

1 - Optimization and the Price of Anarchy in a Dynamic Newsboy Model
Sean Meyn, Professor, University of Illinois, Coordinated Science Laboratory, 1308 W. Main St., Urbana, IL, 61801, United States, meyn@uiuc.edu, Sebastian Neumayer, In-Koo Cho, Mike Chen

This talk concerns resource allocation, pricing, and performance evaluation in production systems with uncertain demand, with special consideration to electric power markets. A multi-dimensional dynamic flow model is constructed in analogy with a standard stochastic queueing model, and an explicit socially-optimal policy is constructed. It is shown moreover that the socially-optimal policy cannot be sustained as a decentralized market outcome.

2 - Greedy Primal-Dual Algorithm for Convex Optimization Problems in Dynamic Resource Allocation
Alexander Stolyar, Bell Labs, Lucent, 600 Mountain Ave, 2C-322, Murray Hill, NJ, United States, stolyar@research.bell-labs.com

Recently, a dynamic control strategy, called greedy primal-dual (GPD) algorithm, was introduced and proved to be optimal for the problem of maximizing queueing network utility subject to stability of the queues. (Network utility is a concave function of the average rates at which network generates several "commodities.") We introduce a generalized GPD algorithm, which applies to the problem with additional convex (possibly non-linear) constraints on the average commodity rates.

3 - Performance Bounds for Open Queueing Networks
David Gamarnik, MIT, daveg@us.ibm.com, Assaf Zeevi

We derive bounds on the steady-state queue length distribution in certain classes of open queueing networks. The analysis hinges on a combination of a fluid-analysis, a workload-based Lyapunov function, and martingale methods.

4 - Asymptotically Optimal Control of a Time-Inhomogeneous Queueing Network
Kavita Ramanan, CMU, Department of Mathematical Sciences, Pittsburgh, PA, United States, kramanan@math.cmu.edu

In this talk, we introduce a framework for the asymptotic analysis of control problems for time-inhomogeneous queueing networks. We then apply this methodology to identify asymptotically optimal controls for concrete problems arising in computer and telecommunication systems. The analysis involves a characterization of second-order or functional central limit approximations to time-inhomogeneous queueing networks, which may be of independent interest.

■ TA38

R - 2nd Floor, Corintia

Convexification Techniques

Sponsor: Optimization/ Global Optimization
Sponsored Session

Chair: Mohit Tawarmalani, Assistant Professor, Purdue University, 4028 Rawls Hall, West Lafayette, IN, 47907, United States, mtawarma@mgmt.purdue.edu

1 - Convex Quasi-Relaxations for Global Optimization Problems
John Hooker, T. Jerome Holleran Professor of Business Ethics and Social Responsibility, Professor of Operations Research, Carnegie Mellon University, Tepper School of Business, Pittsburgh, PA, 15213, United States, john@hooker.tepper.cmu.edu

Nonconvex global optimization problems frequently become convex when some variables x1, ..., xk are fixed. We state conditions under which such problems have a convex quasi-relaxation, which is not a true relaxation but provides a valid bound on the optimal value. This generalizes work on structural design by Bollapragada, Ghattas and Hooker, in which the quasi-relaxations permit brnach-and-bound solution of much larger problems than before, by branching on x1, ..., xk.

2 - Convexification-based Global Optimization Algorithms in Emergency Response Allocation Problems

Jitamitra Desai, Postdoctoral Research Associate, University of Arizona, 1127 E North Campus Dr., 111, University of Arizona, Tucson, AZ, 85721, United States, jdesai@email.arizona.edu, Hanif Sherali

This paper presents global optimization algorithms for two risk mitigation models, namely emergency response resource allocation and event risk management. The resulting formulations turn out to be nonconvex programs, for which tight LP relaxations are derived. Subsequently, we design specialized branch-and-bound procedures to obtain global optimal solutions. For both problems, we present results using data obtained from practical case studies to demonstrate the efficacy of the proposed methods.

3 - MIP Lifting Techniques for Mixed Integer Nonlinear Programs

Jean-Philippe Richard, Assistant Professor, Purdue University, 315 North Grant Street, West Lafayette, IN, 47907, United States, jprichar@ecn.purdue.edu, Mohit Tawarmalani

Lifting locally valid inequalities to make them globally valid is a successful methodology for obtaining cuts in general MIPs. We adapt lifting techniques to obtain cuts for mixed integer bilinear sets without adding any variables. A stronger reformulation than that obtained by using simple linearization techniques is derived. Finally, we extend the concept of a cover to generate facets that can not be obtained from any single-row relaxation of the IP reformulation of the nonlinear set.

4 - Convex Extensions and Convexification of Nonlinear Sets

Mohit Tawarmalani, Assistant Professor, Purdue University, 4028 Rawls Hall, West Lafayette, IN, 47907, United States, mtawarma@mgmt.purdue.edu

We develop a framework of convex extensions that allows us to construct convex envelopes of many nonlinear functions and sets. In particular, we construct relaxation schemes for fractional terms and for polynomial terms over a hypercube. We provide insights and relations to disjunctive programming. We develop polyhedral relaxations for nonconvex programs and automatically exploit convexity in constructing relaxations without explicitly identifying it.

■ TA39

R - 3rd Floor, Aragon

Special Topics in Theory and Applications of Linear Programming Modeling

Contributed Session

Chair: Said Bahi, Associate Professor, Southern Utah University, 351 Center Street, Cedar City, UT, 84720, United States, bahi@suu.edu

1 - Company Based Optimisation and Joint use of a Gas Pipeline Network

Thor Bjoerkvoll, SINTEF Aplied Economics, No-7465 Trondheim, Trondheim, Norway, thor.bjorkvoll@sintef.no, Matthias Nowak

An export pipeline network with partly private and partly common ownership is utilized by owners and non-owners. Each company producing and transporting gas have to take into account both network ownership shares and field ownership shares. In a mathematical optimisation model also the other companies' production and transportation have to be modelled, and assumption made about their behaviour. We discuss problems and indicate some solutions.

2 - Optimizing Selections for Graduate Education Programs

William Wright, Operations Research Analyst, United States Marine Corps, 4240 Moot Dr, Dumfries, VA, 22026, United States, william.wright@usmc.mil

The presentation discusses the development of a specialized assignment model to select Marine Corps officers for graduate education, maximizing the quotas filled. Applicants request consideration for up to 20 academic disciplines for which the Service has specific quota requirements. Although the number of applicants exceeds the total available quotas, the ability to request specific disciplines and the academic prerequisites for the disciplines often make it impossible to fill every quota.

3 - Operational Planning in Natural Gas Markets

Kjetil Midthun, NTNU, Alfred Getz vei 3, Trondheim, Norway, Kjetil.Midthun@iot.ntnu.no, Asgeir Tomasgard

In this article a major gas producer with owner interests in the complete value-chain of natural gas will be considered. Delivery from gas fields can be supplemented with trading in the spot market, and the spot market can be used to create virtual routing of gas. Because of the long lead-time of gas transportation, the use of storages is an important part of the planning process.

4 - Data Fitting in the Presence of Bounded Modeling Uncertainties

Said Bahi, Associate Professor, Southern Utah University, 351 Center Street, Cedar City, UT, 84720, United States, bahi@suu.edu

We consider the problem of parameter estimation of overdetermined linear systems Ax = b, where A is an m x n matrix, b an m-real vector and x an n-real vector. We present a characterization of the robust solution when the data involve the presence of bounded uncertainties in the matrix A. The norms considered for the minimization problem are general strictly convex norms with straightforward application to the classical lp type problems, when p is between 1 and infinity.

■ TA40

R - 3rd Floor, Barcelona I

Network Coding

Sponsor: Optimization/ Network Optimization
Sponsored Session

Chair: Kamal Jain, Microsoft Research Center, Redmond, WA, 98052, kamalj@microsoft.com

1 - On the Capacity of Information Networks

Robert Kleinberg, Cornell / UC Berkeley, Soda Hall, Berkeley, CA, 94720, United States, rdk@csail.mit.edu, April Rasala Lehman, Micah Adler, Nick Harvey, Kamal Jain

The emerging theory of network coding studies information transmission in networks whose nodes can perform non-trivial operations to combine the data received on two or more channels, e.g. taking the XOR of two bits. We introduce techniques for proving upper bounds on the rate of transmission in network coding problems, by combining information-theoretic constraints (e.g. submodularity of entropy functions) with combinatorial constraints (generalizations of cut conditions).

2 - The Encoding Complexity of Network Coding

Michael Langberg, Caltech, mikel@caltech.edu, Jehoshua Bruck, Alexander Sprintson

In the multicast network coding problem, a source needs to deliver packets to a set of k terminals over an underlying network. The nodes of the coding network can be broadly categorized into two groups, 'encoding' nodes and 'forwarding' nodes. Encoding nodes incur delay and increase the overall complexity of the network. In this work we present network codes, that achieve capacity, in which the total number of encoding nodes is independent of the size of the network and is bounded by h^3k^2.

3 - Building Scalable and Robust Peer-to-Peer Overlay Networks for Broadcasting using Network Coding

Kamal Jain, Microsoft Research Center, Redmond, WA, 98052, kamalj@microsoft.com, Philip A. Chou, Laszlo Lovasz

We propose a scheme for building peer-to-peer overlay networks for broadcasting using network coding. The scheme addresses many practical issues such as scalability, robustness, constraints on bandwidth, and locality of decisions. We analyze the system theoretically and prove near optimal bounds on the parameters defining robustness and scalability. As a result we show that the effects of failures are contained locally, allowing the network to grow exponentially with server load. We also argue that adversarial failures are no more harmful than random failures.

■ TA41

R - 3rd Floor, Barcelona II

Integer Programming

Sponsor: Optimization/ Integer Programming
Sponsored Session

Chair: Gabor Pataki, Dept. of Statistics and Operations Research, University of North Carolina, Chapel Hill, NC, United States, gabor@unc.edu

1 - The Polyhedron of a Simple MIP

Ismael de Farias, Assistant Professor, University at Buffalo, SUNY, 403 Bell Hall, United States, defarias@buffalo.edu, Ming Zhao

We study the polyhedron of a simple MIP that appears as a substructure in several problems. We obtain the complete inequality description of the polar of the polyhedron and we show how it can be used to derive strong inequalities valid for the polydron. We also generalize results of Gunluk and Pochet, Miller and Wolsey, and van Vyve.

2 - Efficient Exact Algorithms via the Max-min Transportation Lower Bound for Machine Scheduling Problem

Yunpeng Pan, Computer Scientist, TomoTherapy Inc., 1240 Deming Way, Madison, WI, 53717, United States, ypan@tomotherapy.com, Leyuan Shi

Recently, we have shown that the time-indexed formulation of single-machine scheduling problems has a primal-dual relationship with a max-min problem whose minimization stage problem is the classical transportation problem. We present new results that enable us to approximate the time-indexed lower bound at a node by solving a transportation problem with appropriately computed shipping costs during branch & bound search.

3 - Decomposable Knapsack Problems (DKPs) and Column Basis Reduction

Gabor Pataki, Dept. of Statistics and Operations Research, University of North Carolina, Chapel Hill, NC, United States, gabor@unc.edu, Bala Krishnamoorthy

DKPs generalize hard IP instances proposed by Jeroslow, Chvatal and Todd, Avis, Aardal and Lenstra, and Cornuejols et al. We prove that the "majority" of such problems is hard for BB, but also easy, if we branch on a certain constraint. We give a recipe for constructing such instances with a prescribed degree of difficulty, and show that a preconditioning method called column basis reduction makes these instances easy even for BB branching on individual variables.

4 - Branching on General Disjunctions

Miroslav Karamanov, Carnegie Mellon University, Tepper School of Business, 5000 Forbes Ave, Pittsburgh, PA, 15213, United States, miroslav@andrew.cmu.edu, Gerard Cornuejols

This talk considers a modification of the branch-and-cut algorithm for MILP where branching is performed on general disjunctions rather than on variables. Our procedure exploits the relation between branching disjunctions and intersection cuts. Experiments with instances from the literature show that branching on general disjunctions leads to smaller branching trees and faster solutions, and closes more integrality gap than branching on variables for a majority of the instances.

■ TA42

R - 4th Floor, Parc Ballroom I

Stochastic Programming for Operations Issues

Sponsor: Optimization/ Stochastic Programming
Sponsored Session

Chair: Suvrajeet Sen, ssen@nsf.gov

1 - Stochastic Programming Models for Sea Cargo Contract Pricing

Anton Kleywegt, Georgia Institute of Technology, School of Industrial and Systems Enginee, Atlanta, GA, United States, anton.kleywegt@isye.gatech.edu, Yi He

Most ocean containers are shipped under contracts that are negotiated once per year. Ocean carriers desire a portfolio of contracts with favorable prices, and that will lead to a desirable set of shipments, taking into account operational considerations such as capacity constraints and the repositioning of empty containers. We formulate and solve a variety of models that carriers can use during the planning phase preceding annual contract negotiations.

2 - Column Generation for Solving Multi-Stage Stochastic Capacity-Expansion Problems

Andy Philpott, Professor, The University of Auckland, Department of Engineering Science, Private Bag 92019, Auckland, AU, New Zealand, a.philpott@auckland.ac.nz, Kevin Wood, Kavinesh Singh

We describe a general multi-stage stochastic integer-programming model for planning the capacity expansion of production facilities, where a scenario tree represents uncertainty. A split-variable reformulation of the basic model leads to a strong Dantzig-Wolfe decomposition, whose efficiency we demonstrate on a capacity-expansion model for electric power distribution. If a facility can expand at most once over the time horizon, a specialised model yields substantial computational savings.

3 - Production Planning Under Supply and Demand Uncertainty: A Stochastic Programming Approach

Julia Higle, University of Arizona, Dept of Systems/Industrial Engineering, Tucson, AZ, 85721, United States, julie@sie.arizona.edu, Karl Kempf

Motivated by problems that arise in semi-conductor manufacturing, we consider the problem of producing lots to satisfy demand under conditions leading to supply uncertainty (e.g., throughput times and yields) as well as demand uncertainty (e.g., quantities and due dates). Using data inspired by actual operating conditions, we will discuss preliminary computational results and insights obtained.

4 - Optimal Operation of Dispersed Generation using Stochastic Mixed-Integer Linear Programming

Frederike Neise, University of Duisburg-Essen, Lotharstraße 65, Duisburg, 47057, Germany, neise@math.uni-duisburg.de, Rüdiger Schultz

We consider the optimal operation of an energy system under uncertainty with dispersed generation of power and heat. Mixed-integer linear stochastic programming models addressing different aspects of risk aversion are presented for the optimization problem. The talk concludes with preliminary computational results when using decomposition methods for problem solution.

■ TA43

R - 4th Floor, Parc Ballroom II

Applications of Constraint Programming

Sponsor: INFORMS Computing Society/ Constraint and Integer Programming
Sponsored Session

Chair: Andrew Davenport, Research Staff Member, IBM T.J.Watson Research Center, 1101 Kitchawan Road, Rte 134/P.O. Box 218, Yorktown Heights, NY, 10598, United States, davenport@us.ibm.com

1 - Using Constraint Programming for the Functional Verification of Hardware Design

Yehuda Naveh, IBM Haifa Research Lab, Haifa University Campus, Haifa, 31905, Israel, naveh@il.ibm.com

Automatic stimuli generation plays a central role in the functional verification of complex hardware design. Modern stimuli generation technologies use constraints to enforce the validity of the stimuli and to bias it towards prone-to-bugs areas. I will review the unique aspects of applying constraint programming in this domain, present state-of-the-art methods, show some problems and solutions encountered in the verification of IBM's high-end processors and systems, and discuss open issues.

2 - Applications of Constraint Programming in the Steel Industry

Andrew Davenport, Research Staff Member, IBM T.J.Watson Research Center, 1101 Kitchawan Road, Rte 134/P.O. Box 218, Yorktown Heights, NY, 10598, United States, davenport@us.ibm.com

In order to remain competitive, steel companies are increasingly making use of optimization technology to solve complex production planning, design and operations scheduling problems. In this talk we will discuss an application of constraint programming to schedule steel making operations in a large, integrated steel mill.

3 - Interactive Optimization and What-if Analysis using ILOG ODM

Greg Glockner, Gregory Glockner, Technical Account Manager ILOG, Inc., 1080 Linda Vista Ave, Mountain View, CA, 94043, glockner@ilog.com, Greger Ottosson

ILOG Optimization Decision Manager (ODM) is an application development tool for optimization providing support for interactive what-if analysis, soft constraints and solution comparison for business people. We will present a planning application built with ODM and demonstrate how it makes optimization more accessible to business users and domain experts.

■ TA44

R - 4th Floor, Parc Ballroom III

Feasibility and Infeasibility Analysis in Optimization

Sponsor: INFORMS Computing Society
Sponsored Session

Chair: Jian Yang, Rapt Inc., 625 Second Street, San Francisco, CA, 94107, United States, jimmy.yang@rapt.com

1 - A Reformulation-linearization Technique for the Correction of Systems

Paula Amaral, Dep. Mathematics FCT UNL, D.Mathematics FCT Quinta da Torre, Caparica, ST, 2829-516, Portugal, paca@fct.unl.pt, Joaquim Judice, Hanif Sherali

Modelling real and complex problems by using linear or constraint programming often leads to inconsistent linear systems. In these cases it is important to find the best perturbation of the constraint coefficients in order to attain feasibility which can be formulated as a nonlinear nonconvex program in the objective function and in the constraints. In this talk an algorithm is described for finding a global optimum exploiting Reformulation-Linearization (RLT) techniques.

2 - Infeasibility and Classification Problems: Applications to Protein Structure Prediction

Jarek Meller, Biomedical Informatics, Children's Hospital Research Foundation, 3333 Burnet Avenue, Cincinnati, OH, 45229, United States, jmeller@chmcc.org

A LP-based classification relies on imposing the correct class label in terms of linear constraints. One strategy to deal with infeasibility of such defined problem involves identifying a subset of constraints that are feasible. While finding a maximum subset of feasible constraints is NP-hard, efficient heuristics may be designed to find approximate solutions. We used this strategy to design improved protein folding potentials and to define ensemble classifiers.

3 - Multi-Objective Programming for Infeasibility Resolution

Jian Yang, Rapt Inc., 625 Second Street, San Francisco, CA, 94107, United States, jimmy.yang@rapt.com

The goal of infeasibility resolution is to repair an infeasible mathematical programming model to make it feasible. It is modeled as multi-objective programming in this presentation. Various methods are used to solve the problem. Their

solutions are compared in terms of efficiency to the multi-objective programming. Linear and nonlinear examples are presented to show the advantages and disadvantages of the methods.

■ TA45

R - 4th Floor, Raphael

Marine Transportation & Logistics I

Sponsor: Transportation Science & Logistics
Sponsored Session

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

1 - Developing a Decision Support System for Ship Scheduling: Challenges and Opportunities

Kjetil Fagerholt, Norwegian University of Science and Technology, Otto Nielsensv. 10, Trondheim, NO, 7491, Norway, k-fagerh@online.no, Arent Arntzen

We present the challenges and opportunities faced when developing and implementing a decision support system for ship scheduling in a shipping company engaged in transport of oil products. More than 50 % of the business is long-term contracts, while the rest are spot. Scheduling includes both to decide which spot cargoes to carry in addition to the contracted, and to optimally assign all cargoes to vessels in the fleet. Tests indicate that our work improved the scheduling significantly.

2 - Ship Routing and Network Design for the Sea Cargo Industry

Richa Agarwal, Student, Georgia Institute of Technology, 1542 Woodlake Dr NE, Apt # F, Atlanta, GA, 30329, United States, ragarwal@isye.gatech.edu, Ozlem Ergun

A common problem faced by carriers in Sea-Cargo industry is the design of their service routes. Carriers want to satisfy as much demand as possible, thereby maximizing their revenue, using the available fleet of ships. We formulate the problem as a mixed integer linear program and propose an algorithm based on the Bender's decomposition approach, that exploits the separability of the problem.

3 - Tramp Ship Scheduling with Flexible Cargo Sizes

Marielle Christiansen, Professor, Norwegian University of Science and Technology, Alfred Getz vei 3, Trondheim, NO, N-7491, Norway, marielle.christiansen@iot.ntnu.no, Geir Bronmo, Bjorn Nygreen

We present a tramp ship scheduling problem involving the design of a set of maximum profit schedules for a ship fleet lifting bulk cargoes from given loading ports to corresponding unloading ports. A tramp shipping company normally takes both contracted and optional cargoes. For the long term contracts, the size of the cargoes is given in an interval. We give a mathematical formulation, present the solution approach and give computational results for real instances of the problem.

■ TA46

R - 4th Floor, Rubens

Transportation Network Modeling I

Sponsor: Transportation Science & Logistics
Sponsored Session

Chair: Satish Ukkusuri, Assistant Professor, Rensselaer Polytechnic Institute, 4036 Jonnson Engineering Center, Department of Civil & Environmental Engg, Troy, NY, 12180, United States, satish.ukkusuri@gmail.com

1 - Accounting for Demand Correlations in the Traffic Assignment Problem

Jennifer Duthie, University of Texas, ECJ 6.202, Austiin, TX, 78712, United States, jduthie@mail.utexas.edu, Avinash Unnikrishnan, Travis Waller

Previous work in this area has treated O-D demand as uncertain and explored the impact of considering both second and first order moments in evaluating network designs. In reality, these demands are likely correlated. This work gives insight into how accounting for these correlations can lead to improved models of traffic systems and may cause planners to design networks differently. Sampling techniques are compared for performance and efficiency.

2 - Robust Optimization for Bilevel DTA-Based Continuous Network Design Problem

Ampol Karoonsoontawong, Ph.D. Candidate, University of Texas at Austin, ECJ 6.202, Austin, TX, 78712, United States, ampolk@mail.utexas.edu, Travis Waller

We present the single-destination formulation and exact solution algorithms for the robust bi-level network design problem where the user optimal dynamic traffic assignment is a constraint and the long-term demand is stochastic with known probability. A comparison between the deterministic, stochastic and robust formulations is made using an illustrative example. Further, Simulated Annealing and Genetic Algorithm are presented to solve the multi-destination problem.

3 - A Spatial Computable General Equilibrium Approach to Study Interdependent Infrastructure Networks

Srinivas Peeta, Associate Professor, Purdue University, School of Civil Engineering, 550 Stadium Mall Drive, West Lafayette, IN, 47907-2051, United States, peeta@ecn.purdue.edu, Pengcheng Zhang

Using a system of systems framework, a spatial computable general equilibrium model and the corresponding mathematical programming formulation are proposed to study interdependencies in infrastructure networks. The various interactions among the infrastructure sub-systems are analyzed at the market layer and flow layer. The mathematical properties of the models are discussed.

4 - Development and Calibration of the Anisotropic Mesoscopic Traffic Simulation Model

Yi-Chang Chiu, Assistant Professor, University of Texas at El Paso, Engrg Bldg E201P, 500 W University Ave, El Paso, TX, 79968, United States, chiu@utep.edu, Liang Zhou

We present the theoretical developments and calibration of the Anisotropic Mesoscopic Traffic Simulation (AMTS) model. The proposed model has shown to reasonably simulate regular traffic and flow discontinuity under various traffic and facility conditions.

■ TA47

R - 4th Floor, Michelangelo

Transportation Infrastructure Management I

Sponsor: Transportation Science & Logistics
Sponsored Session

Chair: Pablo Durango-Cohen, Assistant Professor, Northwestern University, 2145 Sheridan Road, A335, Evanston, IL, 60208, United States, pdc@northwestern.edu

1 - A Poverty Impact Road Planning Model

Edward Petersen, petersen@post.queensu.ca, A. J. Hamish Taylor

A road planning tool that balances the objectives of an efficient transportation system with the needs of the poor communities is presented. Road projects that present complementary and conflicting objectives between the impact on local poverty and economic return are considered. The key contribution of this paper is the measurement of the impact that road projects have on the poor and very poor.

2 - A New Approach for Investment Problems in a Stochastic Network

Kannan Viswanath, Krannert School of Management, Purdue University, West Lafayette, United States, viswanak@purdue.edu

Consider a stochastic network, in which a decision-maker seeks to invest in order to improve its performance, viz. a criterion relating to an O-D pair. This talk proposes a new approach through reformulation of the traditional two-stage stochastic program, which offers an interpretation for the investment decisions.

3 - Robust Maintenance and Rehabilitation Policies for a System of Infrastructure Facilities

Kenneth Kuhn, Graduate Student Researcher, UC Berkeley, kdkuhn@uclink.berkeley.edu, Samer Madanat

This paper introduces the use of robust optimization to deal with epistemic uncertainty in network-level infrastructure management. It is found that epistemic uncertainty is significant in pavement deterioration modeling. A robust approach may reduce maintenance expenditures. The methods and results can be used to identify the cost of modeling uncertainty.

4 - Incorporating Functional Interdependencies in Maintenance Optimization

Pattharin Sarutipand, Graduate Student Researcher, Northwestern University, p-sarutipand@northwestern.edu, Pablo Durango-Cohen

We formulate a maintenance optimization problem for functionally interdependent components as a quadratic program. We describe conditions under which it is optimal to synchronize maintenance schedules for groups of components and present a case study where we applied our model to address maintenance planning for a transportation system.

■ TA48

R - 4th Floor, Dante

Simulation Applications in Health Services Research - 1

Sponsor: Health Applications
Sponsored Session

Chair: John Blake, john.blake@dal.ca

1 - Multiobjective Simulation-Based Methodologies for Disease/Injury Treatment

Ahmed Youssefagha, R.A., The School of Public Health and Information Sciences, The University of Louisville, MS06-06 4026 K BUILDING, Louisville, KY, 40292, United States, ahyous01@louisville.edu, Gerald Evans, Steven McCabe

A variety of methodologies have been employed for decision making related to the treatment of diseases/injury. This presentation (considering patient's profile/preferences and health states survival/quality/cost, QALY) presents an investigation of the use of simulation on the stochastic tree, with associated techniques related to ranking and selection, and multiobjectives decision analysis.

2 - Orthopaedic Clinic Re-design Through Simulation Modelling

Craig O'Neill, Operations Research Analyst, B.C. Children's Hospital, 4500 Oak St., Vancouver, BC, V6J4Y6, Canada, craigoneill23@hotmail.com, Andrew Gray, Geoff Blair, Stephen Tredwell

We present two models to improve patient flow at an orthopaedic clinic. The first model uses integer optimization and simulation to determine optimal clinic schedules. The second assesses the relationship between the clinic and multi-disciplinary support services as well as the effects of resource allocation, patient scheduling, and process policies on throughput and resource utilization with emphasis placed on the planned transition to enterprise-based scheduling.

3 - How Should Liver Transplants be Allocated? Modelled Using Simulation

Suchi Patel, Doctoral Researcher, Warwick Business School, University of Warwick, Coventry, CV4 7AL, United Kingdom, Suchi.Patel03@phd.wbs.ac.uk, Ruth Davies

A shortage exists between the number of livers donated in the UK (the supply) and the number of patients in need of a liver transplant (the demand). This gap makes it important to assess and understand the way in which liver transplants are allocated and how changing the allocation rules affect the overall benefits gained. This work uses discrete event simulation to consider various allocation policies and compares them to the one that is currently implemented.

4 - Planning Service Redesign in Social Services

Sally Brailsford, University of Southampton, School of Management, Southampton, SO, United Kingdom, scb@socsci.soton.ac.uk, Peter Knight, Grit Straube

In 2004 Hampshire Social Services in the UK were considering a new specialist service to all new home care clients, to 'right-size' the care offered to ensure clients achieved optimum independence. A discrete event simulation model was used to see if the new service was feasible within the current staff capacity. The model results indicated that it was, for a wide range of assumptions about the unknown factors, and on the strength of the results, HSS are going ahead with the new service.

■ TA49

R - 4th Floor, Medici

Optimization in Healthcare Applications

Cluster: Health Care
Invited Session

Chair: Gino Lim, Assistant Professor, University of Houston, Department of Industrial Engineering, E206 Engineering Bldg 2, Houston, TX, 77204, United States, ginolim@uh.edu

1 - A Framework for Evaluating the Cost Effectiveness of the India AIDS Initiative

Magaret Brandeau, Professor, Stanford University, MS&E Dept., Stanford, CA, United States, Brandeau@stanford.edu, Elisa Long, Douglas Owens, Joseph Chaudry

Between 2004 and 2009, the Gates Foundation will donate $200 million to support HIV prevention programs in India through its India AIDS Initiative (also known as the Avahan Project). We present a conceptual framework for evaluating the cost-effectiveness of programs in the Avahan Project. We illustrate our ideas using a simplified model of HIV transmission in India. We discuss how such a model might be tailored to evaluate specific interventions, and we discuss the types of data likely to be required to implement such a model.

2 - Robust Intensity-Modulated Radiation Therapy Treatment Planning

Shane Henderson, Cornell University, School of ORIE, 230 Rhodes Hall, Cornell University, Ithaca, NY, 14853, United States, sgh9@cornell.edu, Millie Chu, Yuriy Zinchenko, Michael Sharpe

Traditional treatment planning models handle uncertainties arising from organ motion etc. by inflating the target region. We instead use a probabilistic model and show that it is equivalent to using robust linear programming. For a sample prostate case, our results show that the method is computationally feasible, and finds plans that are more adept at sparing healthy tissue while maintaining the prescribed dose. We discuss the method, and our efforts to reduce the computational requirements.

3 - What Objective are Liver Surgeons Optimizing?

Tugba Ozkasap, tuo2@pitt.edu, Matthew Bailey, Mark Roberts, Andrew Schaefer

We seek the objective function of surgeons who schedule living-donor liver transplantations. There is evidence that these decisions are not optimal with respect to patient life expectancy. We introduce inverse Markov decision processes, and apply them to this problem. This model provides an objective function for which the observed timing decisions are optimal. We discuss an extensions in which the surgeons' policy is randomized and how this affects the inverse MDP formulation.

4 - Emergency Treatment Response and Real-Time Staff Allocation for Bioterrorism & Infectious Disease

Eva Lee, Associate Professor & Director, Center for Operations Research in Medicine, Georgia Institute of Technology, Industrial & Systems Engineering, Atlanta, GA, 30332-0205, United States, evakylee@isye.gatech.edu, Siddhartha Maheshwary, Jacquelyn Mason

We present the design and development of a large-scale simulation and decision support system for emergency dispensing clinics for biological threats or infectious disease outbreak. The system incorporates fast optimization technology seamlessly interfaced with a simulation module. It can be used as a training/planning tool for setting up dispensing centers, assessing/estimating resources, and coordinating efforts among administrators from multiple sites over large geographic regions.

■ TA50

R - 4th Floor, Cervantes

Normative Target-Based Decision Making

Sponsor: Decision Analysis
Sponsored Session

Chair: Ali Abbas, Assistant Professor, University of Illinois, Urbana-Champaign, 104 S Mathews Ave, Urbana, IL, 61801, United States, aliabbas@uiuc.edu

1 - Normative Utility Functions from Target-Based Incentives

Ali Abbas, Assistant Professor, University of Illinois, Urbana-Champaign, 104 S Mathews Ave, Urbana, IL, 61801, United States, aliabbas@uiuc.edu, Jim Matheson, Robert Bordley

Target-based incentives within an organization induce divisions to choose the projects that provide them with the highest probability of meeting their target and achieving success. We discuss the effects of independent, cooperative, and winner-take-all target-based incentives on the decision making process, and the effective utility functions they induce on the individual divisions. We also discuss the effects of compound and stretch targets on the decision making process.

2 - Applying Target-Oriented Utility to Product Design

Robert Bordley, Technical Fellow, General Motors Corporation, 525 Choice Court, Troy, Mi, 48085, United States, robert.bordley@gm.com, Jeffrey Keisler

Product design typically involves planning (setting program targets) and design (specifying how those targets will be met.) Multiattribute utility has been applied to the planning stage but PERT/CPM and other non-utility heuristics are typically applied to the design stage. This paper uses target-oriented utility to modify conventional heuristics to be consistent with utility optimization. This facilitates using multiattribute utility for both product planning and product design.

3 - Aspirations and Probabilities of Winning and Losing

Enrico Diecidue, Assistant Professor, INSEAD, Dd de constance, Fontainebleau, 77305, France, enrico.diecidue@insead.edu, Jeroen van de Ven

We propose a model that takes into consideration a finite number of aspiration levels in decision under risk. We include the probabilities of success, failure, and break even into expected utility. This turns out to be equivalent to expected utility with a discontinuous utility function. We give a behavioral foundation to the proposed model.

Tuesday, 10:00am - 11:30am

■ TB01

H - Lobby Level, Plaza A

Tutorial: Integrated Production and Demand Planning Models

Cluster: Tutorials
Invited Session

1 - Tutorial: Integrated Production and Demand Planning Models
Joseph Geunes, Associate Professor, University of Florida, 303 Weil Hall, Gainesville, FL, 32611, United States, geunes@ise.ufl.edu, Yasemin Merzifonluoglu, Kevin Taaffe, Edwin Romeijn

Effective demand planning has recently become recognized as an important source of competitive advantage from an operations perspective. A variety of planning and design contexts involve a supply chain stage selecting a subset of demands (either through pricing or explicit order acceptance/rejection) from a collection of potential downstream demands. This tutorial discusses optimization models for addressing degrees of demand selection flexibility in integrated production and demand planning.

■ TB02

H - Lobby Level, Plaza B

Geometry and Computations in DEA.

Cluster: Data Envelopment Analysis
Invited Session

Chair: Jose Dula, Associate Professor, Virginia Commonwealth University, Richmond, VA, 23284, United States, jdula@vcu.edu

1 - A Dimensional Decomposition Approach to Identifying Efficient Units in Large-scale DEA Models
Pekka Korhonen, Professor of Statistics, Helsinki School of Economics, P.O.Box 1210, 00101, Helsinki, Finland, pekka.korhonen@hkkk.fi, Pyry Siitari

We propose a dimensional decomposition procedure to reduce computational burden when identifying the efficient DMUs in Data Envelopment Analysis. The use of lexicographic parametric programming makes it possible to develop an efficient algorithm for the problems with few inputs and outputs. Our procedure first partitions the original problem dimensionally into sub-problems and use this information for solving the original problem. The approach is illustrated by numerical results.

2 - Returns to Scale in DEA with Non-Discretionary Inputs and Outputs
Ole Olesen, Associate professor, Odense University, Campusvej 55, Odense, 5230, Denmark, ole@sam.sdu.dk, Niels Christian Petersen

Methods for determining returns to scale (RTS) in DEA when non-discretionary inputs and/or outputs are presented. Banker and Thrall (1992) derive a measure of RTS based upon the standard definition. This approach can not be applied when non-discretionary categories are present because radial expansions involving such categories are not allowed. The procedure suggested in this paper involves directional derivatives keeping the level of the non-discretionary categories fixed.

3 - Role of Anchor Points in the Geometry of DEA.
Marie-Laure Bougnol, Assistant Professor, Western Michigan University, Haworth College of Business, Kalamazoo, MI, 49008, United States, ml.bougnol-potter@wmich.edu, Jose Dula

Anchor points play a role in DEA theory and application. They define the transition from the efficient frontier to the "free-disposability" portion of the boundary. Our algorithms efficiently identify anchor points. Tests on real and synthetic data lead to surprising result about the role of these points in DEA.

■ TB03

H - Ballroom Level, Continental Ballroom 1

Workforce Communication for Undergraduate IE Schools and for Analytical Work in Business Schools

Sponsor: Education (INFORM-ED)
Sponsored Session

Chair: Judith Norback, Ph.D., Dir. of Workforce & Academic Communication, Georgia Tech Industrial & Systems Engineering, 765 Ferst Drive, Atlanta, GA, 30305, United States, jnorback@isye.gatech.edu

1 - How to Bring Workforce Communication Skills into Undergraduate Industrial Engineering Curricula
Judith Norback, Ph.D., Dir. of Workforce & Academic Communication, Georgia Tech Industrial & Systems Engineering, 765 Ferst Drive, Atlanta, GA, 30305, United States, jnorback@isye.gatech.edu, Peter McGuire, Ph.D., Lisa McNair, Ph.D.

Georgia Tech's School of Industrial and Systems Engineering has integrated workforce communication instruction into Capstone Design and Technical Communication, through funding from the National Science Foundation and other sources. The instruction builds on interviews with IEs, supervisors, and CEOs; its purpose is helping graduates get better jobs and quickly ascend the career ladder. We will describe how the approach can be applied in other Schools.

2 - How Should Business Students Give Managerial Presentations of Analytical Work?
Thomas Grossman, Ph.D., Associate Professor, School of Business & Management, University of San Francisco, 2130 Fulton St., San Francisco, CA, 94117-1045, United States, tagrossman@usfca.edu, Judith Norback, Ph.D., Jill Hardin

Business students tend to give techical rather than managerial presentations of analytical work. Based on interviews of business leaders in a variety of settings, we have identified the workforce communication skills important for MBA students to effectively communicate analytical results. We will describe the skills and explore how they can be taught in the business school quantitative analysis course.

3 - An Industry Perspective on Workforce Communication Skills
Brenda Dietrich, Dir., Mathematical Sciences, IBM T.J. Watson Research Center, P.O. Box 218, Yorktown Heights, NY, 10598, United States, dietric@us.ibm.com

A Director from the IBM T.J. Watson Research Center will discuss her experience regarding important communication skills needed by industrial engineers and managers. She will also describe IBM's program on communication skills.

■ TB04

H - Ballroom Level, Continental Ballroom 2

Air Force Academy Undergraduate OR Initiatives

Sponsor: Military Applications
Sponsored Session

Chair: Jim Lowe, Associate Professor, US Air Force Academy, Dept of Management, US Air Force Academy, CO, 80840, United States, Jim.Lowe@usafa.af.mil

1 - Tools for OR: Implementing OR using MicroSoft Excel & VBA
Len Cabrera, Major, University of Florida, FL, lencab@ufl.edu

For years, implementing OR techniques was limited to obscure academic software packages. Recent advances bring OR power to every office desktop. Based on real examples using MS Excel and Visual Basic for Applications, a course was developed to teach students to apply their newly found OR skills. Students merged, visualized and presented data with the class time spent providing feedback versus lectures.

2 - Ops Research for All
John Dulin, Instructor, US Air Force, Dept of Management, 2354 Fairchild Dr, Suite 6H228, US Air Force Academy, CO, 80840, United States, john.dulin@usafa.af.mil

At USAFA, we have transformed the initial OR course from a technical introduction to the OR major to a core option taken by 40% of all students across both technical and non-technical majors. This presentation discusses how the course has evolved, how we have integrated it into the core curriculum, and how we've successfully introduced OR to non-OR majors.

■ TB05

H - Ballroom Level, Continental Ballroom 3

Dynamic and Game Theoretic Models for Service Operations Management II

Cluster: Service Sector Operations
Invited Session

Chair: Terry Friesz, Marcus Professor of Industrial Engineering, Pennsylvania State University, 305 Leonhard Building, Industrial & Manufacturing Eng Dept, University Park, PA, 16802, United States, tfriesz@psu.edu

1 - Dynamic Game Theoretic Model of Joint Network Pricing and Resource Allocation

Reetabrata Mookherjee, Doctoral student, Industrial Engineering, Pennsylvania State University, 244 Leonhard Building, University Park, PA, 16802, United States, reeto@psu.edu, Terry Friesz

We study a problem of joint pricing and resource allocation in a network for the service providers with finite supply of resources and who are involved in oligopolistic competition. We show existence of the pure-strategy Nash equilibrium and demonstrate that the competition leads to under-pricing. We outline an efficient algorithm using the framework of differential variational inequality. We provide some additional insights through a numerical example and outline some extensions of the model.

2 - Optimal Polices for Sizing and Timing Software Maintenance Projects

Qi Feng, Ph.D. Student, The University of Texas at Dallas, Mail Station SM30., 2601 N Floyd Rd., Richardson, TX, 75083, United States, qxf011100@utdallas.edu, Vijay Mookerjee, Suresh P. Sethi

We examine the optimal points for maintaining a software application. Two types of policies are analyzed: a work-based policy and a time-based policy. In the work-based policy, a fixed amount of work needs to be completed, and the time taken to accomplish the work is random. In the time-based policy, a fixed amount of time is allocated to maintenance, but a random amount of work is completed. We discuss similarities and differences between the two types policies.

3 - Web-hosting Services: Pricing and Performance

Natarajan Gautam, Professor, Industrial Engineering Texas A&M University, 235A Zachry, College Station, TX, 77843-3131, United States, gautam@tamu.edu, Piyush Goel, Yiyu Chen

In this research we consider a web-hosting service where there are a farm of web servers that are used to process requests from various client applications. The system can be modeled as several parallel multi-server queues. Our objective is to control such a system so that the revenue is maximized subject to being able to provide performance guarantees in terms of quality of service for the clients.

4 - Simple Models and Decision Support Systems For Short-Term and Long-Term Distribution Operations

Tan Miller, Director of Logistics, Pfizer, 201 Tabor Road, Morris Plains, NJ, 07950, United States, Tan.Miller@pfizer.com, Emmanuel Peters, Vijay Gupta, Josh Cheatham, Oduntan Bode

This presentation will review some simple modeling and decision support techniques used in daily practice to meet external customer service requirements and internal service commitments. The authors describe some basic data sets and models that facilitate effective distribution operations in private industry.

■ TB06

H - Ballroom Level, Continental Ballroom 7

Closed-Loop Supply Chains

Cluster: Reverse Supply Chains
Invited Session

Chair: Beril Toktay, Associate Professor, Georgia Institute of Technology, beril.toktay@insead.edu

1 - Managing a Distribution System with Product Returns

Gregory DeCroix, Associate Professor, Duke University, 1 Towerview Dr., Durham, NC, 27708, United States, decroix@mail.duke.edu

This paper considers a distribution system consisting of a single warehouse and N retailers. Stochastic demands and customer returns arrive at the retailers, and the system is controlled by a base-stock policy. We explore the impact of returns on the system under both local and centralized control.

2 - Life Cycle Dynamics for Portfolios with Remanufactured Products

Laurens Debo, Carnegie Mellon University, Tepper School of Business, 5000, Forbes Avenue, Pittsburgh, PA, 15213, United States, laurdebo@andrew.cmu.edu, Beril Toktay, Luk Van Wassenhove

We discuss the integrated dynamic management of a portfolio of new and remanufactured products that progressively penetrate a potential market over the product life cycle. We extend the Bass diffusion model in a way that maintains the two essential features of remanufacturing settings: (a) substitution between new and remanufactured products and (b) a constraint on the diffusion of remanufactured products due to the limited supply of used products that can be remanufactured.

3 - Managing the Reverse Channel with RFID-Enabled Negative Demand Information

Ozgen Karaer, PhD Candidate, Management Science & Engineering, Stanford University, Stanford, CA, 94305, United States, okaraer@stanford.edu, Hau Lee

We analyze inventory decisions of a manufacturer who has ample production capacity and also uses returned items to satisfy the end demand. All returned items get through an evaluation process, at the end of which the decision of disposal, direct reselling or rework is given for each unit. We quantify the benefit of RFID technology (full visibility) by comparing it with different approaches (no information, no visibility, and partial visibility) in terms of average holding and backorder costs.

4 - A Switching Rule for Plastics Identification in Electronics Recycling

Xiuli Qu, Ph.D. Candidate, Purdue University, 315 N. Grant Street, West Lafayette, IN, 47907, United States, qu@ecn.purdue.edu, Julie Ann Williams, Pedro Rios, Ed Grant, Jamie Wieland

To economically and environmentally recover engineering thermoplastics from end-of-life electronics, a switching rule is needed to rapidly identify plastics for sortation by color and type to increase plastics-to-plastics recycling value. A heuristic rule is developed to determine the thresholds for a switching rule that reduces setup time and queue space. Results indicate that laser identification probe utilization, setups, and queue space are sensitive to the switching rule.

■ TB07

H - Ballroom Level, California

RFID and Supply Chain Management

Sponsor: Manufacturing & Service Oper Mgmt
Sponsored Session

Chair: Warren Hausman, Management Science and Engineering, Stanford University, Stanford, CA, United States, hausman@stanford.edu

1 - The True Value of RFID in Reducing Out of Stock Through Inventory Visibility

Aykut Atali, Stanford University, Management Science & Eng'g, 377 Terman, Stanford, CA, 94305, United States, aykut@stanford.edu, Hau Lee, Ozalp Ozer

Inventory shrinkage, misplacement and process errors, have shown empirically to cause significant discrepancy between inventory records and physical inventories, leading to expensive stockouts. Based on our earlier theoretical work that explicitly models distinct error sources, extensive numerical analyses of the true value of RFID in reducing stockouts can be conducted.

2 - In-Store One-to-One Marketing with RFID

Diego Klabjan, Professor, University of Illinois at Urbana-Champaign, 1206 West Green Street, Urbana, IL, 61801, United States, klabjan@uiuc.edu, Emily Io

RFID offers numerous benefits in various areas of supply chain management: warehousing, marketing, etc. In marketing, the importance of one-to-one marketing has long been acknowledged by retailers. RFID brings a new perspective with the possibility of direct one-to-one marketing during a shopping experience. In this project we develop models for in-store one-to-one marketing. We consider routing the consumer in the store and offering coupons.

3 - Order Progress Information: Better Inventory Control using Emergency Ordering Options

Gary Gaukler, Stanford University, Management Science & Eng'g, MC 4026, Stanford, CA, 94305, United States, gaukler@stanford.edu, Warren Hausman, Ozalp Ozer

This talk focuses on an inventory control policy that makes use of additional information available in an RFID-enabled supply chain. We show how visibility of order progress can be used to improve replenishment decision-making. We identify an optimal replenishment policy that is based on the (Q,R) policy, but which in addition allows for releasing emergency orders in response to order progress information. In a numerical study we analyze the performance of this policy.

4 - Controlling the Supply Chain with RFID

Sanjay Sarma, MIT/Oat Systems, 67 Hurd Road, Belmont, MA, 02478, United States, sesarma@MIT.EDU

It is obvious that RFID enables unprecedented visibility into the supply chain. The implications seem to be at three levels: reducing execution errors, making day-to-day operations more efficient, and improving medium-to-long-term planning. I will present the view that while RFID does enable a new level of "sensing" within the supply chain, that it does not by itself enable "actuation" — "actuation" will need new business processes, of which I will present a couple of examples.

■ TB08

H - Ballroom Level, Imperial A

Empirical Supply Chain Research

Sponsor: Manufacturing & Service Oper Mgmt
Sponsored Session

Chair: Aleda Roth, W. P. Carey Chair of Supply Chain Management, Arizona State University, W. P. Carey School of Business, Tempe, AZ, 85287-4106, United States, aleda.roth@asu.edu

1 - Inventory Record Inaccuracy and Execution Problems in Retail Distribution Centers

Nicole DeHoratius, Asssistant Professor, University of Chicago, Graduate School of Business, 5807 S. Woodlawn Ave., Chicago, IL, 60637, United States, ndehorat@chicagogsb.edu, Laura Kornish

Inventory record inaccuracy in retail stores is a major obstacle to the successful application of automated decision tools designed to support firm operations. We attribute the existence of inventory record inaccuracy in retail stores in part to specific distribution processes that fail to be executed correctly. More specifically, we observe the distribution of products from two distribution centers to numerous stores of a single retail chain. We identify numerous errors that occur within the distribution center and demonstrate how such errors create a mis-match between actual and recorded store inventory.

2 - Product and Process Characteristics, Advanced Manufacturing Initiatives, and Supply Chain Management Initiatives: Complementarities and Fit-Performance Consequences

Johnny Rungtusanatham, Associate Professor, Arizona State University, W. P. Carey School of Business, Tempe, AZ, 85287, United States, j.rungtusanatham@asu.edu, Yuhchang Hwang, Ker-Wei Pei

We ask two related questions about the behavior of profit-maximizing manufacturing firms. First, do manufacturing firms adopt advanced manufacturing initiatives and supply chain management initiatives in a complementary manner, consistent with their product and process characteristics? Second, their adoptions represent complementary choices, what performance consequences can be expected? Empirical results based on secondary data analyses are reported to answer these two questions.

3 - Product Variety, Inventory Management and Firm Performance

Gerard Cachon, University of Pennsylvania, The Wharton School, 500 JMHH, Philadelphia, PA, 19104, United States, cachon@wharton.upenn.edu, Lorin Hitt, Guodong Gao

For the past two decades a salient trend in US manufacturing is a dramatic increase in product variety (PV). However, large-scale empirical evidence of PV's impact on inventory management and firm performance has been scarce. Based on a sample of Fortune 1000 manufacturing firms over 1980-2000, this paper examines the relationship between product variety and different inventory levels (raw materials, work-in-process, and finished goods), sales, and profit margin.

4 - An Empirical Study of Manufacturing Outsourcing

John Gray, University of North Carolina—Chapel Hill, Campus Box 3490, McColl Building, Chapel Hill, NC, 27599-3490, United States, john_gray@unc.edu, Aleda Roth, Brian Tomlin

Outsourcing of manufacturing carries risks, some of which are hard to contract. One of the more difficult risks to deal with is quality. We present progress on research to understand the drivers of quality performance in outsourcing relationships. We utilize theory from economics, strategy, and operations management to develop hypotheses. We also present plans for data collection.

■ TB09

H - Ballroom Level, Yosemite A

Designing Competitive Procurement Events

Cluster: Supply Chain Management
Invited Session

Chair: Tunay Tunca, Graduate School of Business, Stanford University, Stanford, CA, 94305, United States, tunca_tunay@gsb.stanford.edu

Co-Chair: Wedad Elmaghraby, University of Maryland, Wedad_Elmaghraby@rhsmith.umd.edu

1 - Outsourcing via Service Competition

Saif Benjaafar, Professor, University of Minnesota, Department of Mechanical Engineering, Graduate Program in Industrial Eng., Minneapolis, MN, 55455, United States, saif@umn.edu, Ehsan Elahi, Karen Donohue

We examine how a buyer should allocate demand across competing suppliers in order to maximize the service level received. We compare two possible competitive schemes: (1) market augmenting, where suppliers compete for a proportion of the buyer's demand, and (2) market seeking, where suppliers compete for the possibility of winning the entire market.

2 - Risk, Financing and the Optimal Number of Suppliers

Volodymyr Babich, Assistant Professor, University of Michigan, 1205 Beal Ave., IOE 2783, Ann Arbor, MI, 48105, United States, babich@umich.edu, Goker Aydin, Pierre-Yves Brunet, Jussi Keppo, Romesh Saigal

We study how financial constraints, trade credit and bank loan terms, wholesale and retail prices, supplier yield risk, and fixed costs affect supplier selection. Our analysis suggests that the firms use more suppliers if the bank financing is not available. We find that the limit on the supplier loans and the wholesale price affect the optimal number of suppliers in a non-monotone way and the shareholder's value may increase or decrease in yield variance depending on the level of yield mean.

3 - Procurement Auctions: An Experimental Study

Wedad Elmaghraby, University of Maryland, Wedad_Elmaghraby@rhsmith.umd.edu, Nathan Larson

Auctions (and other market mechanisms) are increasingly becoming standard instruments for procurement. However, the behavior/performance of procurement auctions when suppliers have non-convex costs are poorly understood. Because many industries are characterized by some variant of a fixed + variable cost structure, improving our understanding of how auctions perform in this context is of practical importance. We present results from a series of experiments we ran with human subjects.

4 - Multiple Sourcing and Procurement Process Selection with Bidding Events

Tunay Tunca, Graduate School of Business, Stanford University, Stanford, CA, 94305, United States, tunca_tunay@gsb.stanford.edu, Qiong Wu

We examine the procurement process selection problem of a large industrial buyer who purchases an intermediate good from a group of suppliers through bidding events. We derive the optimal quantity and contract strategies for a standard single-stage reverse auction process and a two-stage process. We then derive the optimal number of suppliers to be sourced from for both processes and characterize the conditions under which each procurement mode will be optimal.

■ TB10

H - Ballroom Level, Yosemite B

Newsboy Characterizations, Bounds, and Heuristics for Multi-Echelon Inventory Systems

Cluster: Supply Chain Management
Invited Session

Chair: Geert-Jan van Houtum, Associate Professor in Operations Management, Technische Universiteit Eindhoven, P.O. Box 513, Eindhoven, NL, 5600 MB, Netherlands, G.J.v.Houtum@tm.tue.nl

1 - Coordination Mechanisms for Decentralized Serial Inventory Systems with Batch Ordering

Kevin Shang, Fuqua School of Business, Duke University, Durham, NC, United States, khshang@duke.edu, Jing-Sheng Song, Paul Zipkin

We investigate coordination mechanisms that can make a decentralized serial inventory systems with batch ordering act as a centralized system. Both echelon- and local-based schemes are considered, depending on the level of information available. Under either scheme, divisions are measured as cost centers according to metrics based on the centralized solutions. We also develop close-to-optimal mechanisms whose contract terms can be determined without knowing the centralized solutions.

2 - Asymptotically Optimal Supply Chain Stock Allocation

Johan Marklund, Lund University, Box 118, Lund, SE-22100, Sweden, Johan.Marklund@im.lth.se, Kaj Rosling

We consider a stochastic one-warehouse-N-retailer inventory system subject to periodic review. Assuming that m time-periods remain until the next shipment arrives at the warehouse, we show that the asymptotically optimal allocation policy when N goes to infinity is to use period and retailer specific ship-up-to levels that are decreasing through the m periods. Based on the asymptotic analysis, heuristics and lower bounds are developed for systems with a finite number of retailers.

3 - Stock Positioning in a Distribution System with Service Constraints

Ozalp Ozer, Management Science and Engineering, Stanford University, Stanford, CA, United States, ozalp@stanford.edu, Hongxia Xiong

We developed simple heuristics and bounds to analyze a two-echelon distribution system consisting of one warehouse and multiple retailers, which are subject to service constraints. We will provide a discussion on the use of these heuristics to allocate inventory for a multi(>2)-echelon parts distribution network.

4 - Newsboy Characterizations for Multi-echelon Inventory Systems

Geert-Jan van Houtum, Associate Professor in Operations Management, Technische Universiteit Eindhoven, P.O. Box 513, Eindhoven, NL, 5600 MB, Netherlands, G.J.v.Houtum@tm.tue.nl

For several multi-echelon inventory systems, such as the Clark-and-Scarf model, the structure of the optimal policy is known. Optimal policies are pure or generalized basestock policies in many cases. Optimal basestock/reorder levels may satisfy Newsboy equations. We show how these Newsboy equations can be derived, and under which conditions they are obtained.

■ TB11

H - Ballroom Level, Yosemite C

Optimization Models in Supply Chain Management

Contributed Session

Chair: Lusine Baghdasaryan, University of Illinois at Chicago, 842 West Taylor st., 2039 ERF, MC 251, MC 251, Chicago, IL, 60607, United States, lbaghd1@uic.edu

1 - Resource Reservation in ATO Order Promising Systems

Richard Pibernik, Professor, MIT-Zaragoza Intl. Logistics Program, Zaragoza Logistics Center, Avda. Gomez Laguna 25, Zaragoza, Spain, rpibernik@zaragozalogistics.com, Prashant Yadav

We propose an approach to the reservation of resources in an ATO system that enhances the capability of an order promising system to fulfill uncertain future demand from high priority customers. Our model disaggregates demand forecasts into reservation policies based on a service level measure. We depict how reservation policies can be utilized to determine due dates and order acceptance/rejection decisions and quantify the value of reservation through numerical analysis.

2 - Optimizing the Natural Gas Value Chain

Marte Fodstad, SINTEF Technology and Society, S.P.Andersensv. 5, Trondheim, Norway, marte.fodstad@sintef.no, Matthias Nowak, Frode Romo, Asgeir Tomasgard

We will present a model for tactical planning of a natural gas value chain. The model coordinates production, transportation, transportation booking, deliveries in contracts and spot trading. Volume nominations and prices in contracts, as well as spot prices are treated as stochastic parameters described in a scenario tree. The tree is generated by an independent scenario generator. Results from tests on Statoil's operations on the Norwegian continental shelf will be presented.

3 - Design of Mass Customized Supply Chains

Hans-Dietrich Haasis, Prof. Dr., ISL, University of Bremen, Universitatsallee GW 1A, Bremen, 28359, Germany, haasis@isl.org

In this paper the design of mass customized supply chains is described. By this, the product related mass customization approach is transfered to services and supply chains. Related decision problems are analysed. Especially topics of intermodality and freight integrators are outlined. The approach is based on the linkage of variants in transportation. Modelling the design options helps 4PLs to decide on the appropriate supply chain for their clients.

4 - A Graph Based Method for Handling Model Flexibility of Supply Chains

Houshang Darabi, Assistant Professor, University of Illinois at Chicago, 842 W Taylor St. ERF 2039, MC 251, Chicago, IL, 60607, United States, hdarabi@uic.edu, Andreas Schaller, Francesca Schuler, Lusine Baghdasaryan

This paper proposes a new modeling and optimization management environment for large-scale supply chain (SC) networks. A graph-based method is used to automatically generate and update optimization models for large-scale SC networks. Graph's nodes and arcs, that define the optimization model constraints and variables, are generated according to SC requirements. The proposed tool increases accuracy and flexibility of modeling and information processing in large-scale SC models.

5 - Challenges in the Optimization Model Management of Large Scale Supply Chains

Lusine Baghdasaryan, University of Illinois at Chicago, 842 West Taylor st., 2039 ERF, MC 251, MC 251, Chicago, IL, 60607, United States, lbaghd1@uic.edu, Andreas Schaller, Francesca Schuler, Houshang Darabi

This paper discusses major challenges that large-scale manufacturers may face for solving supply chain optimization problems. First, a large optimization state space that results in an unsolvable model may be created. Second, significantly large amount of information that cannot be generated by traditional information systems may be necessary. Third, speed and accuracy of modeling and data handling may become impediments for correct model creation, solution and output interpretation.

■ TB12

H - 4th Floor, Union Square 1

Game Theoretic Methods in Computer Science and Engineering II

Cluster: Applications of Auction and Game Theory

Invited Session

Chair: Ramesh Johari, Assistant Professor, Stanford University, Mgmt. Sci. and Eng., Terman Eng. Ctr., Room 319, Stanford, CA, 94305, United States, ramesh.johari@stanford.edu

Co-Chair: Amin Saberi, Assistant Professor, Stanford University, 317 Terman Eng. Ctr, Stanford, CA, United States, saberi@stanford.edu

1 - A Network Pricing Game for Selfish Traffic

Eva Tardos, Cornell University, Department of Computer Science, Ithaca, NY, 14850, United States, eva@cs.cornell.edu, Tom Wexler, Ara Hayrapetyan

We suggest and analise a network design game that models agents that compete for users via prices and the quality of service provided. We propose a simple game to explore how is the quality of service affected when the service providers set prices so as to extract maximum profit? We consider the special case of scheduling parallel machines, where the quality of the service is modeled as delay.

2 - Tatonnement for the Market Equilibrium Problem

Lisa K. Fleischer, IBM, T J Watson Research, Yorktown Heights, NY, 10598, United States, lkf@watson.ibm.com, Richard Cole

For a market consisting of a set of infinitely divisible goods, and a set of agents with an initial allocation of goods and a utility function over combinations of goods, trade is driven by the prices of the goods. Each agent can buy at most the worth of their initial allocation. Prices are at equilibrium if the demand for each good is at most the supply. We propose a dynamic, discrete time, distributed mechanism that may indicate how a market arrives at an equilibrium.

3 - Temporally Strategyproof Online Mechanism Design

Robert Kleinberg, Cornell / UC Berkeley, Soda Hall, Berkeley, CA, 94720, United States, rdk@csail.mit.edu, Mohammad Hajiaghayi, Mohammad Mahdian, David Parkes

We study mechanisms for online markets in which agents arrive and depart over time. A mechanism is "temporally strategyproof" (time-SP) if each agent's dominant strategy is to truthfully reveal its arrival, departure, and value information. We present characterization theorems for time-SP mechanisms as well as competitive auctions for natural special cases of the time-SP mechanism design problem. This work has interesting connections to secretary problems from optimal stopping theory.

4 - On the Computation of Equilibria

Amin Saberi, Assistant Professor, Stanford University, 317 Terman Eng. Ctr, Stanford, CA, United States, saberi@stanford.edu

I will briefly survey some of the most recent results on the algorithmic aspects of Market and Nash equilibria. I will also talk about solution concepts in cooperative game theory such as core or Shapley value and their computational complexity.

■ TB13

H - 4th Floor, Union Square 5

Software Demonstration

Cluster: Software Demo

Invited Session

1 - Responsive Learning Technologies, Inc.- An Award-Winning Online Game to Teach Operations

Sam Wood, President, Responsive Learning Technologies, Inc., 10181 Parlett Pl., Cupertino, CA, 95014, United States, wood@responsive.net

Littlefield Technologies is a competitive factory simulator developed at Stanford University. It has been successfully used at dozens of universities to improve student enthusiasm and understanding of traditional operations topics like capacity management, lead time management and inventory control. It is very easy to learn and displaces minimal lecture time.

2 - MINITAB, Inc.- MINITAB 14

David McClelland, Minitab, Inc., 1829 Pine Hall Road, State College, PA, 16801, United States, dmcclelland@minitab.com

MINITAB® Release 14 is the leading statistical software package used in education. More than 4,000 colleges, universities and high schools worldwide choose MINITAB because it: —Contains all the methods students need and is easy to learn and use, —Parallels the approach used in virtually all the leading textbooks, making it compatible with any curriculum, —Produces stunning graphs that are simple to make, edit and update, —Is used by thousands of distinguished companies students will want to work for, including GE, 3M, Toshiba, Bank of America and the Ford Motor Company. See for yourself. Free demo: www.minitab.com/minitab14.

■ TB14

H - 4th Floor, Union Square 6

Munition Applications

Sponsor: Military Applications
Sponsored Session

Chair: Eduardo Pasiliao, Engineer, Munitions Directorate AFRL, 101 W Eglin Blvd, Eglin AFB, FL, 32542, United States, pasiliao@eglin.af.mil

1 - Optimal Target Selection under Uncertainty for Cooperative Autonomous Munitions
Paul Krokhmal, krokhmal@gerc.eng.ufl.edu

We present a decision-making strategy for autonomous munitions with advanced target recognition capabilities, which enables the munition to optimally select a target in the presence of uncertainty. In the context of multiple munitions, the corresponding cooperative strategy is formulated as an optimal stopping problem with multiple stopping opportunities, etc. Several numerical solution algorithms are proposed.

2 - Cooperative Motion Planning for a Collection of Reed-Shepp Vehicles
Swaroop Darbha, Associate Professor, Department of Mechanical Engineering, Texas A&M University, College Station, TX, 77843, United States, dswaroop@mengr.tamu.edu, David Jeffcoat, Sivakumar Rathinam

In this paper, we consider a collection of vehicles, whose motion is constrained by the maximum yaw rate, to visit a set of targets at a specified heading. The problem is to minimize the total distance traveled by the collection of vehicles while each target is visited exactly by one vehicle in the collection. The vehicles may not have the same origin and we do require each vehicle to come back to its origin after visiting the set of assigned targets.

3 - On the Cooperative Communication Problem in Mobile Ad Hoc Networks
Clayton Commander, Computer Scientist, Air Force Research Lab, 4831 Young Road, Crestview, FL, 32539, United States, commandc@eglin.af.mil, Panos Pardalos, Carlos Oliviera, Mauricio Resende

Given a set of wireless units each having a start point and a destination point, our goal is to determine a set of routes for the units which maximizes the overall connection time between them. This problem is known as the cooperative communication problem in mobile ad hoc networks and has several military applications. The problem is NP-hard, therefore efficient heuristics are needed to provide good solutions for real world instances. In this work, we propose a metaheuristic based on GRASP.

■ TB15

H - 4th Floor, Union Square 9

Production Planning, Booking, and Pricing

Cluster: Scheduling
Invited Session

Chair: Xiaoqiang Ca, Professor, The Chinese University of Hong Kong, Department of Systems Eng. & Eng. Mgmt, Hong Kong, China, xqcai@se.cuhk.edu.hk

Co-Chair: George Vairaktarakis, Case Western Reserve University, Department of Operations, Cleveland, OH, 44106, United States, gxv5@case.edu

1 - Production Planning Coordination with Booking and WIP Costs
Tolga Aydinliyim, Case Western Reserve University, Department of Operations, Cleveland, OH, 44106, United States, tolga.aydinliyim@case.edu, George Vairaktarakis

Manufacturers book capacity from a third party to process their operations. Each manufacturer books windows in FCFS so as to optimize his booking and total weighted flowtime cost. The third-party coordinates the various schedules and splits the savings amongst them so that the associated cooperative game is balanced.

2 - Production Planning Coordination with Booking and Tardiness Penalties I
Xiaoqiang Cai, Professor, The Chinese University of Hong Kong, Department of Systems Eng. & Eng. Mgmt, Hong Kong, China, xqcai@se.cuhk.edu.hk, George Vairaktarakis

The operational setting is similar to the previous article except that each manufacturer optimizes the total booking cost plus a fixed penalty for each tardy job. The cost of the manufacturing windows that may be released after coordination is returned to the manufacturers subject to a fee and the third-party can resell them.

3 - Production Planning Coordination with Booking and Tardiness Penalties II
George Vairaktarakis, Case Western Reserve University, Department of Operations, Cleveland, OH, 44106, United States, gxv5@case.edu, Xiaoqiang Cai

The previous articles assume that operations of various manufacturers are similar in nature e.g., finishing operations and can be processed in any sequence. Here we consider the case where the various operations are different and setup considerations force the third-party to utilize each booked day entirely for jobs of the same manufacturer.

4 - Retailers' Cooperative Strategies in a Supply Chain with a Group-Buying Price Mechanism
Xiping Song, Chinese University of Hong Kong, Systems Engg and Engg Mgmt Department, Shatin, Hong Kong, United States, xpsong@se.cuhk.edu.hk, Xiaoqiang Cai, Yunhui Liu, Jian Chen

We investigate a supply chain where the supplier offers a group-buying pricing mechanism, under which the actual price depends on the number of buyers (retailers) bidding for the same product. We analyze the optimal strategies of the retailers when they are cooperative to form a coalition.

■ TB16

H - 4th Floor, Union Square 10

Game-Theoretic Issues in Scheduling

Cluster: Scheduling
Invited Session

Chair: Jay Sethuraman, Columbia University, IEOR Department, New York, NY, United States, jay@ieor.columbia.edu

1 - Minimizing the Worst Slowdown: Off-Line and On-Line
Herve Moulin, Rice University, Economics Department, moulin@rice.edu

We look for protocols capping the worst slowdown (called here liability) a job may face no matter how large (or small) the other jobs are. In a scheduling problem, allowing the server to randomize the order of service cuts almost in half the liability profiles feasible under deterministic protocols. Ditto if cash transfers are feasible and users have linear waiting costs. In a queuing problem, a deterministic on-line protocol guaranteeing the liability theta_r to job i ...

2 - Cooperation in Queues
Jay Sethuraman, Columbia University, IEOR Department, New York, NY, United States, jay@ieor.columbia.edu, Akshay Katta

A set of agents arrive simultaneously to a service facility. Attached to each agent is an index (the ratio of waiting cost rate to processing time). Efficiency dictates that the agents be served in decreasing order of indices. If no monetary compensation is allowed, fairness suggests that agents be served in a random order. The efficient ordering is unfair to agents with low indices; the random service order is inefficient. Assuming quasi-linear preferences, we design fair compensation schemes.

3 - On the Coincidence of Prenucleolus and the Shapley Value
Manipushpak Mitra, Indian Statistical Institute, Calcutta, India, mmitra@isical.ac.in, Anirban Kar, Suresh Mutuswami

In this paper we identify a sufficient class of coalitional form games with transferable utility for which the Shapley value coincides with prenucleolus. We then apply our result to simple games and to generalized queueing games. In particular, for queueing games we identify a class of TU games for which we have this coincidence.

4 - Stochastic Scheduling subject to Multiple Stochastic Breakdowns: Discounted Reward Criteria
Xian Zhou, The Hong Kong Polytechnic University, Department of Applied Mathematics, Hong Kong, China, maxzhou@polyu.edu.hk, Xiaoqiang Cai, Xianyi Wu

Models for stochastic machine breakdowns have largely been classified into two types: preemptive-resume and preemptive-repeat. In the real world, however, it often happens that a breakdown may have multiple and mixed types of effects to the job being processed, and preemptive-resume/repeat models are only two extreme cases. In this work we examine such a problem, under the expected weighted discounted rewards criterion. Optimal policies will be presented.

■ TB17

H - 4th Floor, Union Square 11

Product Design and Supply Chain Issues

Cluster: New Product Development
Invited Session

Chair: H. Sebastian Heese, Assistant Professor of Operations and Decision Technologies, Kelley School of Business - Indiana University, 1309 E 10th St, Bloomington, IN, 47405, United States, hheese@indiana.edu

1 - Integration of Marketing, Product Development and Supply Chain Decisions
Nitin Joglekar, BU School of Management, 595 Commonwealth Avenue, Boston, MA, United States, joglekar@bu.edu

We present evidence from global development practices to illustrate the inherent tensions in the integration of distributed marketing, product development and supply chain decisions. Our analysis suggests that, shared supply chains and postponement practices are not viewed as mechanisms that promote integration and responsiveness, and dedicated supply chains coupled with mandated stretch goals for rapid reductions in costs and time to market are the drivers of integration.

2 - Coordination of Supply Chain under Misplaced Inventory
Almula Z. Camdereli, UNC - Chapel Hill, Kenan-Flagler Business School, McColl Building, Campus Box 3490, Chapel Hill, NC, 27599, United States, Zeynep_Camdereli@unc.edu, Jay Swaminathan

We consider an environment where although the items are physically in the store, a proportion of the items become unavailable for sale due to misplaced stock keeping units. We study both centralized and decentralized cases. We give conditions for coordinating the channel under buyback and revenue sharing contracts. We investigate the effects of investing in information technology to increase in the proportion of availability on retailer and manufacturer profits under different settings.

3 - Linking Production Technology and Product Line Design
Serguei Netessine, Assistant Professor, University of Pennsylvania, 3730 Walnut St. Suite 500, Philadelphia, PA, 19104, United States, netessin@wharton.upenn.edu, Terry Taylor

In this paper we characterize the impact of production technology on the optimal product line design. We analyze a problem in which a manufacturer segments the market on quality attributes and offers products that are partial substitutes. Because consumers self-select from the product line, product cannibalization is an issue. In addition, the manufacturer sets a production schedule in order to balance production setups with accumulation of inventories in the presence of economies of scale.

4 - Optimal Stocking Level of Products with Substitutable Demand
Wendell Gilland, Assistant Professor, University of North Carolina, CB#3490, McColl Bldg, Kenan-Flagler Busi School, UNC, Chapel Hill, NC, 27599, United States, Wendell_Gilland@unc.edu, H. Sebastian Heese

Customers that face a stockout situation often decide to purchase a different product in the same category. We analyze the resulting stocking problem in a retail environment with dynamic substitution, where customers serve themselves from the store shelves, such that the sequence of customer arrivals affects how scarce products are allocated to customers.

■ TB18

H - 4th Floor, Union Square 12

From Ground to Air: Capacity Planning

Sponsor: Aviation Applications
Sponsored Session

Chair: Mark Hansen, Professor, University of California at Berkeley, 107 McLauughlin Hall, Berkeley, CA, 94720, United States, mhansen@ce.berkeley.edu

1 - Scheduling Aircraft Landings using Airlines' Preferences
Maarten Soomer, mjsoomer@few.vu.nl

Airlines currently have little influence on tactical airport arrival planning. However airline operations and cost heavily depend on these decisions. A method will be presented to schedule aircraft landings, taking airlines' cost for each flight into account. The method also provides a safe and efficient arrival schedule. Experiments, using data from a week at Amsterdam Airport Schedule, show especially under low-visibility conditions, all airlines obtain considerable savings.

2 - Designing a Real-Time Intermodal System for Airline Use
Yu Zhang, UC Berkeley, 107A MaLaughlin Hall, UC Berkeley, Berkeley, CA, 94720, United States, zhangyu@berkeley.edu, Mark Hansen

In the national airspace system, most of the delay is caused by adverse weather. To address the problem of a hub airport facing capacity reduction due to adverse weather, we propose a real-time intermodal system by embedding surface transportation modes into solutions for schedule recovery problems. Passenger-related information communication and market issues involved in gaining consumer acceptance of the system are also discussed.

3 - Block.buster — A Mathematical Model, Heuristic and DSS for Planning of Road Feeder Services
Ulrich Derigs, derigs@informatik.uni-koeln.de

All major cargo airlines operate a multi-modal hub and spoke network with transportation from and to the hubs performed on the ground using specifically equipped trucks. Within Europe the majority of air cargo is transported via trucks due to time and cost reasons. In this paper we present a model and an associated heuristic which has been implemented in a decision support system called block.buster for supporting planning as well as operations of these road feeder services.

4 - Econometric Analysis of Aircraft Size and Service Type: The Case of LaGuardia Airport
Chieh-Yu Hsiao, University of California at Berkeley, 107 McLaughlin Hall, University of California at Berkeley, Berkeley, CA, 94720, United States, cyhsiao@berkeley.edu, Mark Hansen

A given level of air traffic can be served with more flights on small aircraft or fewer flights on large ones. There are many factors, such as slot controls, that influence this tradeoff. This research compares LGA markets with other markets to investigate if there are systematic differences in the service type and the size of aircraft used, or in the influence of factors such as stage length and market density on aircraft size.

■ TB19

H - 4th Floor, Union Square 13

Technology Strategy and Global Competition

Sponsor: Technology Management
Sponsored Session

Chair: Francisco Veloso, Assistant Professor, Carnegie Mellon University, Engineering and Public Policy, 5000 Forbes Av, Pitts, PA, 15213, United States, fveloso@cmu.edu

1 - Manaing Risk and Uncertainty in Technology Industries: Comparing Software, Biotech and Materials
Elicia Maine, Assistant Professor, Simon Fraser University, Management of Technology MBA, Vancouver, BC, Canada, emaine@sfu.ca

The combination of technical and market risks and uncertainties in the emerging technology industries of software, biotech, and advanced materials result in valuation and resource allocation challenges for investors and managers. A comparison is drawn between investment risk faced by ventures in these technology industries through data at the industry level and through an analysis of case studies.

2 - Dominant Design and Population Dynamics for Complex Technological Systems
Jaegul Lee, PhD Candidate, Carnegie Mellon University, Pittsburgh, PA, 15213, United States, jaegull@andrew.cmu.edu

This work examines sources of innovation and population dynamics of innovating firms during the entire technology cycle for a complex technological system: vehicle emission control. Contrary to expectations, analysis shows increasing entry of innovative firms during the era of incremental innovation, following the emergence of a dominant design. This result is used to provide new insights into our understanding of technological change in complex systems that embed core and peripheral subsystems.

3 - Changing Paths: The Impact of Manufacturing Off-Shore on Technology Development Incentives
Erica Fuchs, PhD Candidate, Massachusetts Institute of Technology, Materials Systems Laboratory, Cambridge, MS, 02141, United States, erhf@mit.edu, Randolph Kirchain

Firm decisions to manufacture offshore may be changing their long-term technology development path. Data shows manufacturing offshore significantly changes production characteristics - wage, yield, cycle times, downtimes, materials costs. Resulting cost structure differences between the U.S. and developing East Asia change the relative economic competitiveness of the technology alternatives facing industry.

4 - Innovation for Industry Dominance: How an Integral Product Architecture changed the Structure of the Bicycle Component Industry
Jin-Kyu Park, University of Michigan, Industrial and Operations Engineering, Ann Arbor, MI, United States, jinkp@umich.edu, Sebastian Fixson

Recent work has mostly highlighted the advantages of higher degrees of modularity in product architecture. In contrast, this paper investigates: (1) if there are incidences in which an integral and not the modular product architecture wins? and (2) what are the circumstances that contribute to this outcome? Studying the U.S. bicycle component industry we explore how a non-dominating foreign firm changes its product architecture from modular to integral and, as a consequence, corners the market.

■ TB20

H - 4th Floor, Union Square 14

Estimation and Optimization Issues in Electric Power and LNG

Sponsor: Energy, Natural Resources & the Environment / Energy
Sponsored Session

Chair: Johannes Enders, Ph.D. Student, Princeton University, Dept. of OR & Financial Engineering, Engineering Quadrangle, Princeton, NJ, 08544, United States, jenders@princeton.edu

1 - A Unit Commitment-based Electricity Price Model

Chung-Li Tseng, Associate Professor, Department of Engineering Management and Systems Engineering, University of Missouri-Rolla, Rolla, MO, 65409, United States, chungli@umr.edu

Electricity prices have been observed to be highly volatile with "jumps". The price jumps are commonly modeled by artificial discrete probability distributions such as Poisson processes, without considering system issues that produce the effects. A unit commitment-based electricity price model is proposed, which can naturally reveal occurrence of price jumps.

2 - Estimating the Failure Behavior of Transmission Assets

Dave Egan, Sr. Engineer, PJM, 955 Jefferson Avenue, Norristown, PA, 19403, United States, egand@pjm.com, Qiming Chen

We present our efforts to develop a Bayesian method with Perks' formula to model the failure behavior of high-voltage transformers over time. The problem is of paramount importance in efforts to ensure reliable long-term operations of power systems. Results and implications of our approach are presented.

3 - Stochastic Optimization for an Aging Electric Power Infrastructure

Johannes Enders, Ph.D. Student, Princeton University, Dept. of OR & Financial Engineering, Engineering Quadrangle, Princeton, NJ, 08544, United States, jenders@princeton.edu

As a large part of the high voltage transformer fleet in the U.S. approaches the end of its useful life, transmission owners and operators are increasingly concerned with the risk of transformer failures. How to acquire new transformers and how to allocate spare transformers that can be used in case of a failure are very relevant questions. We present models addressing these issues and explain the approximate dynamic programming techniques that we use to solve them.

4 - A Comparison of Two Optimization Models for the World Liquefied Natural Gas Market

Yris Olaya, Ph.D. Student, Division of Economics and Business, Colorado School of Mines, 1500 Illinois Street, Golden, CO, 80401, United States, yolaya@mines.edu

We capture the world liquefied natural gas market behavior with two different optimization models - one designed to mimic a competitive market, and one designed to mimic oligopolistic competition. We hypothesize that these models may reflect future integrated market behavior, and demonstrate through case studies, the economic implications of each market structure.

■ TB21

H - 4th Floor, Union Square 15

Data Mining in the Auto Industry

Cluster: Data Mining Applications
Invited Session

Chair: Thomas Montgomery, Ford Motor Company, 11298 Maple Valley Dr, Plymouth, MI, 48170, United States, tmontgo1@ford.com

1 - Starting Point for Early Warning: the Automotive Warranty Process

Brett Smith, Assistant Director, M.E.&T., Center for Automotive Research, 1000 Victors Way, Suite 200, Ann Arbor, MI, 48018, United States, bsmith@CARGROUP.ORG, Ray Miller

An effective early warning warranty system that is able to identify systemic part failures presents opportunity for cost advantage. In order to study how automotive warranty data flows through an organization, CAR interviewed representatives from automakers (OEMs), suppliers and one dealer. This report details the flow from dealer to OEM then to the supplier. This apparently simple flow is compounded by each company's internal data access requirements which were varied and complex.

2 - Text Analysis on Warranty and Quatlity Data

Michael Cavaretta, United States, mcavaret@ford.com

Every day, hundreds of engineers pour over the hundreds of thousands of warranty and quality records that come into Ford Motor Company each day. Each record contains textual fields which are then coded into structured data. Unfortunately, no coding scheme is perfect, leading many of the engineers to read thousands of records. This presentation will describe methods for combining unstructured and structured data mining for the analysis of textual and numeric data.

3 - Data Fusion for Consumer Insight

Thomas Montgomery, Ford Motor Company, 11298 Maple Valley Dr, Plymouth, MI, 48170, United States, tmontgo1@ford.com

When designing and marketing consumer products, the ideal is to have insight on all customers in the market. However, running a comprehensive survey of all customers is impossible (the expense is prohibitive, and the majority will not respond). This problem can be addressed with data fusion: performing a statistical match between a deep but narrow database of customers, with a shallow but broad database of survey responses. We present our experience applying data fusion in the auto industry.

4 - A Time Series Approach to Forecasting Patterns in the Automotive Industry

Nihat Altintas, Carnegie Mellon University, Tepper School of Business, Pittsburgh, PA, United States, nihat@andrew.cmu.edu, Alan Montgomery, Michael Trick

We consider a time-series model in which forecasts of orders at some future date are used as input to a series of inventory planning decisions of a supplier who supplies parts for the auto industry. Multiple customers (auto manufacturers), requesting multiple parts, submit forecasts starting from six months before the due date. Our goal is to improve the supplier's operations through a better understanding of his customers' ordering behavior.

■ TB22

H - 4th Floor, Union Square 16

Managing the Adoption and Usage of Radio Frequency Identification (RFID)

Sponsor: Information Systems
Sponsored Session

Chair: Fred Riggins, University of Minnesota, Carlson School of Management, 321 19th Avenue South, Minneapolis, MN, 55455, United States, friggins@csom.umn.edu

1 - A Model of Factors Leading to Supplier Adoption of RFID

Fred Riggins, University of Minnesota, Carlson School of Management, 321 19th Avenue South, Minneapolis, MN, 55455, United States, friggins@csom.umn.edu

Several major retailers and government agencies are seeking to implement RFID with their suppliers. We develop a model of factors that impact these suppliers' intention to adopt RFID within a supply chain context. Factors can be grouped into a number of categories including: relationship specific factors, supplier idiosyncratic factors, technology specific factors, and information requirements factors. The model is based on prior research on relationship factors leading to the adoption of EDI.

2 - From Meat to Criminalist: Case Studies on the Role of RFID in Data Management and Process Design

Brian Mennecke, Associate Professor of Management Information Systems, Iowa State University, College of Business, Gerdin Business Building, Room 3313, Ames, IA, 50011, United States, mennecke@iastate.edu, Anthony Townsend

RFID uses tags affixed to assets to transmit accurate, real-time information to compatible information systems. We report on two case studies that focus on the feasibility of RFID tagging to determine product provenance in the meat industry and managing evidentiary materials in forensic lab environments. We offer insights about impediments to RFID adoption with an emphasis on constraints associated with adoption, organizational inertia, economic and competitive forces, and technical limitations.

3 - Utilizing RFID as a Facilitating Technology to Reduce Out of Stocks

Bill Hardgrave, BHardgrave@walton.uark.edu

Passive RFID is used to tag pallets and cases as they move through an abbreviated retail consumer packaged goods supply chain that emphasizes movement from the distribution center to the sales floor. In this context, perhaps the biggest opportunity for payback for suppliers and retailers is in the reduction of out of stocks. We report preliminary results and insights on a major study examining RFID-facilitated process changes in a large retailer that examines how RFID can reduce out of stocks.

■ TB23

H - 4th Floor, Union Square 17

Telecommunications Network Design

Sponsor: Telecommunications
Sponsored Session

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

1 - On a Diameter Constrained Steiner Tree Problem
Luis Gouveia, University Lisbon-CIO, Campo Grande, Lisbon, Portugal, legouveia@fc.ul.pt, Thomas Magnanti, Cristina Requejo

We derive and study models for the following version of the Minimum Steiner Tree Problem: find a minimal Steiner tree spanning a set of required nodes R such that the maximum number of intermediate nodes in R in any tree path does not exceed a specified value.

2 - Telecommunications Access Network Design: A Review of Models and Algorithms
Hanan Luss, Senior Scientist, Telcordia Technologies, RRC-1D254, 444 Hoes Lane, Piscataway, NJ, 08854, United States, hluss@telcordia.com, Tamra Carpenter

We review representative concentrator location models and algorithms that are applicable to telecommunications access network design. We also describe possible adaptation of these models to diverse broadband access network technologies such as Digital Subscriber Line (DSL), Fiber-to-the-Premise (FTTP), cable TV, and Video-on-Demand.

3 - Design of Survivable Multicommodity Flow Networks with General Failure Scenarios
Manish Garg, PhD Student, University of Arizona, P.O. Box 210020, Tucson, AZ, 85715, United States, manish@email.arizona.edu, Cole Smith

We consider a survivable multicommodity flow network design problem, in which a network must be constructed that survives any of a given set of failure scenarios. Each failure scenario represents a possible case in which a given set of arcs can fail, and thus need not be restricted to "any one arc" types of scenarios. We present a Benders'-based algorithm for an arc-based formulation, and a branch-and-price-and-cut formulation for a path-based formulation.

4 - Combinatorial Optimization Techniques for Filter Placement in Networks
Chisonge Mofya, Postdoctoral Student, University of Florida, Gainesville, FL, United States, mofya@email.arizona.edu, Cole Smith

We consider forged address attacks in networks, wherein an attacker forges the address of communication requests sent to a victim node. The victim must cease to respond to requests until the attack subsides, unless it can determine the attacking node. We identify a minimum cardinality subset of nodes on a network, such that placing "filters" on these nodes provides a prescribed level of security. This problem is NP-hard in general, but can be solved in polynomial time...

■ TB24

H - 4th Floor, Union Square 18

Optimal Exercise and Hedging

Cluster: Financial Engineering
Invited Session

Chair: Tim Maull, PhD Student, University of Michigan, Department of IOE, 1205 Beal Avenue, Ann Arbor, MI, 48109-2117, United States, timmaull@umich.edu

1 - Additive and Multiplicative Duals for American Option Pricing
Nan Chen, Columbia University, 500 W120th Street, Rm.325, New York, NY, 10027, United States, nc2005@columbia.edu, Paul Glasserman

We study two duality approaches based on two different versions of Doob's decompositions of supermartingales: additive and multiplicative decompositions. We show how to improve an upper bound through repeated application of Doob's decomposition. The optimality is attained when further improvement is not possible. These iterative improvements establish a connection with the classical dynamic programming algorithm.

2 - When is it Best not to Hedge Risk?
John Birge, Professor, University of Chicago, Graduate School of Business, Chicago, 60637, United States, john.birge@gsb.uchicago.edu

Standard practice often favors risk reduction over strategies that might maintain or even increase risk. Hedging with financial derivatives provides a mechanism for this process by reducing the risk of uncertain future prices or rates. Hedging may, however, have negative consequences on overall revenue when prices and demand are positively correlated. In this talk, we will characterize conditions under which hedging may reduce overall value and make it best not to hedge.

3 - Optimization Based Polynomial Pricing Bounds for Options
James Primbs, Assistant Professor, Stanford Unversity, 444 Terman Engr. Ctr., Mail Code 4026, Stanford, CA, 94305, United States, japrimbs@stanford.edu

We formulate upper and lower bounds on option prices through trading strategies involving polynomial "securities". These bounds may be optimized using a semi-definite programming formulation. We also present the dual formulation of the problem which involves optimizing over moment matrices associated with the risk neutral pricing probabilities. Examples are used to demonstrate the accuracy of the bounds.

4 - Optimal Electoral Timing in a Parliamentary Democracy
Jussi Keppo, University of Michigan, IOE Department, 1205 Beal Avenue, Ann Arbor, MI, 48109, United States, keppo@umich.edu, Dmitry Davydov, Lones Smith

We model when a parliamentary governmnet calls an election as an optimal stopping time problem. The ruling party maximizes its time in power and, therefore, calls election when its poll support is high enough. We calibrate the model to British election and polling data and show that the model explains a significant variation in election times.

■ TB25

H - Ballroom Level, Franciscan D

A View from Abroad II

Sponsor: OR in SpORts
Sponsored Session

Chair: Mike Wright, Senior Lecturer, Lancaster University, Management Science Department, Lancaster University, Lancaster, La, LA1 5AG, United Kingdom, m.wright@lancaster.ac.u

1 - Do Skin Suits Increase Average Skating Speed?
Elmer Sterken, University of Groningen, P.O. Box 800, Groningen, Gr, 9700 AV, Netherlands, e.sterken@eco.rug.nl, Gerard Kuper

We analyze the effectiveness of speed skating (skin) suits to increase average skating speed at the 2002 Olympic Winter Games of Salt Lake City at distances from 500 to 10000 meters. We find that one specific suit, the so-called Swift Skin suit, significantly increases average skating speed, especially in long-distance events. This suits increase speed by up to 0.2-0.3 seconds per 400 meters lap. The effects are more pronounced for men than for women and show up in the first part of the race.

2 - Multi-Event Training Optimization; a Decathlete Preparing for the Olympic Games
Yori Zwols, Brown University, Box B, Providence, RI, 02912, United States, yori@brown.edu, Gerard Sierksma

A problem in designing training schedules for multi-event athletes is the fact that the athlete has limited time for a broad range of training exercises. Moreover, the effects of exercises on the athlete's performance in the events are interrelated. This paper presents an optimization model for decathletes, which can be used as a support system for composing efficient one-year training schedules. As an example, we calculate and show the schedule of a decathlete who is preparing for the Olympics.

3 - Strategic Decision Making under Conditions of Risk and Uncertainty in Test Match Cricket
John Goddard, School of Business and Regional Development, University of Wales, Bangor, LL57 2DG, United Kingdom, j.goddard@bangor.ac.uk, Stephen Dobson

In test match cricket, the rates at which runs are scored and wickets are taken depend on the teams' strategies and attitudes towards risk; the innate abilities of individual players; and external playing conditions such as the weather and type of wicket. Using data transcribed from ball-by-ball test match commentaries, we model the rates of run-scoring and wicket-taking conditional on the teams' strategies and skills, and on external playing conditions.

4 - Sports Scheduling - Don't Just Give Them What They Ask for, Give Them What They Really Want
Mike Wright, Senior Lecturer, Lancaster University, Management Science Department, Lancaster University, Lancaster, La, LA1 5AG, United Kingdom, m.wright@lancaster.ac.uk

There may be a temptation for sports schedulers to take a customer's requests at face value and even treat their problem as a "standard" sports scheduling case. The customer may be reasonably happy with the resulting outcomes, but this may be because he doesn't realise that we could do much better. We can, and should, do better. This argument will be illustrated using a cricket umpire scheduling problem.

■ TB26

H - Ballroom Level, Continental Ballroom 4

New Models and Algorithms in Reliability

Contributed Session

Chair: Wai F. Chiu, Los Alamos National Laboratory, Statistical Sciences Group, D-1, P.O. Box 1663, MS F600, Los Alamos, NM, 87545, United States, chiu@lanl.gov

1 - An Analytical Approach for the Lifetime Distribution in a Thin Homogeneous System

Kanoktip Nimitkiatklai, Clemson University, O-106 Martin Hall, Box 340975, Clemson, SC, 29634-0975, United States, kanoktn@clemson.edu, Peter Kiessler

The lifetime distribution in a thin homogeneous system is modeled as a Markov process on a thin lattice. The system evolves by adding edges at random times. When there is a path connecting the top and the bottom layers, the system fails. The lifetime is then the first passage time to a particular subset of the state space. For large systems, calculation of the lifetime is intractable. We show via extreme value theory that the lifetime is approximately Weibull distributed.

2 - Optimal Test Design for Two Step Stress Accelerated Life Testing

Nasser Fard, Associate Professor, Northeastern University, 317 Snell Engineering Center, Boston, MA, 02115, United States, n.fard@neu.edu, Chenhua Li

A specific type of accelerated life testing (ALT), known as step-stress accelerated life testing (SSALT), where the stresses are subject to change at some points during the test interval is presented. Analysis of test data and the test design in SSALT is presented by assuming failure time density and life-stress relationship. The test design problem deals with the optimal stress change times for achieving certain objectives, such as getting the most precise estimation of the unknown parameters.

3 - Detection Strategies for Systems Subjected to Random Shocks

Bahadir Aral, Graduate Student, Texas A&M University, Department of Industrial Engineering, Texas A\&M University, College Station, TX, 77843-3131, United States, aralbaha@tamu.edu, Georgia-Ann Klutke

In this study, we consider detection strategies for systems with non-self-announcing failures. System failures occur according to a non-homogeneous Poisson process with known local intensity. We consider the class of intensity based renewal inspections and develop expressions for systems performance in terms of limiting time-average availability and limiting number of inspections per unit time.

4 - A Study of Economic Efficiency for an n-Unit Parallel System Using a Stackelberg Game Formulation

Takeshi Koide, University Marketing and Distribution Sciences, 3-1, Gakuen-Nishimachi, Nishi-ku, Kobe, 6512188, Japan, koide@umds.ac.jp, Hiroaki Sandoh

The present study makes a comparison between an n-unit parallel redundant system and a single-unit system to analyze their economic efficiency. The study is formulated as a Stackelberg game which includes both viewpoints of a manufacturer and a consumer. We discuss optimal strategy for the manufacturer to produce the parallel systems considering consumerÅfs optimal reaction.

5 - A Dempster-Shafer Approach to System Reliability

Wai F. Chiu, Los Alamos National Laboratory, Statistical Sciences Group, D-1, P.O. Box 1663, MS F600, Los Alamos, NM, 87545, United States, chiu@lanl.gov, Arthur P. Dempster

Our approach to system reliability extends Bayesian methods to include Dempster-Shafer (D-S) logic. Numerical examples illustrate D-S inferences for simple AND-gate and OR-gate systems. We demonstrate a theorem asserting that system predictions can be obtained in two equivalent ways: either by inferring population properties for the system and deducing predictions for a new system, or by predicting the success/failure of each component and using logic to predict for the full system.

■ TB27

H - 4th Floor, Union Square 21

Sense and Respond Logistics

Cluster: OR Practice

Invited Session

Chair: Grace Lin, Global Sense and Respond Solution Leader, IBM Business Consulting Services, 9 Garey Drive, Chappaqua, NY, 10514, United States, gracelin@us.ibm.com

1 - Strategic Planning of Distribution Networks for Letter and Parcel Mail using Optimization Models

Hans- Jürgen Sebastian, Professor, Sebasti@or.rwth-aachen.de

The paper starts with a description of the strategic/tactical design phase of distribution networks for letter and parcel mail.If focuses on three classes of problems: facility location - , service network design- ,and location routing problems. Optimization models for such problems , which have been recently developed and implemented within our collaboration with Deutsche Post World Net will be presented.

2 - Sense & Respond: New Approaches and Technologies for Military Transformation

Grace Lin, Global Sense and Respond Solution Leader, IBM Business Consulting Services, 9 Garey Drive, Chappaqua, NY, 10514, United States, gracelin@us.ibm.com

The sense-and-respond (S&R) managerial framework enables organizations to rapidly adapt to changes. The S&R value net extends the managerial framework into an integrated planning, operations, intelligent decision making and logistics support for value net to collaboration. In this talk, we will present the use of S&R approaches o address new military challenges of the 21 century. S&R Network Centric Operations and Military Logistics scenarios and the solution framework will also be discussed

3 - Value-Driven Services and Delivery

Grace Lin, Global Sense and Respond Leader, IBM Business Consulting Services, 9 Garey Drive, Chappaqua, NY, 10514, gylin10@aol.com, Qingying Lu

In this talk, we will present a new value-centric model that focuses on demonstrating measurable values in selling and delivering services and solutions. This model provides a means to bridge the gap between business and IT and can be used to tune business operations and IT investments to optimize the ROI. An unified framework and use scenarios for assessing, delivering, and tracking business values based on key performance drivers and the componentized business and IT models will be discussed.

■ TB28

H - 4th Floor, Union Square 22

Revenue Management for Queueing Systems

Sponsor: Revenue Management & Pricing

Sponsored Session

Chair: Costis Maglaras, Columbia Business School, 3022 Broadway, New York, NY, 10027, United States, c.maglaras@gsb.columbia.edu

1 - On Bid-Price Controls in Network Revenue Management

Mustafa Akan, Ph.D. Student, Northwestern University, 2001 Sheridan Road, Evanston, IL, United States, m-akan@kellogg.northwestern.edu, Baris Ata

We consider a network model of revenue management and propose a generalized bid-price control mechanism. Under mild assumptions, we prove several desirable properties of the proposed bid-price control mechanism.

2 - Optimal & Incentive-compatible Revenue Management and Service Discrimination in Queuing Systems

Philipp Afeche, Asst. Prof., University of Chicago, 5807 South Woodlawn Avenue, Chicago, IL, 60637, United States, pafeche@gsb.uchicago.edu

How many service classes should a capacity-constrained provider offer to maximize revenues from heterogeneous time-sensitive customers with private information about their preferences? We propose a solution algorithm for this problem and discuss how the optimal number of service classes depends on customer attributes and operational characteristics.

3 - Designing and Pricing Grades of Service for Subscribers with Private Information

Tomer Yahalom, Stanford Graduate School of Business, 518 Memorial way, Stanford, CA, 94305, United States, yahalom_tomer@gsb.stanford.edu, Sunil Kumar, Michael Harrison

A profit-maximizing service provider may offer several grades of service at different prices. There are several classes of potential subscribers, differing in their price sensitivity and valuation of service quality. The provider does not know the class of a potential subscriber. We characterize the provider's optimal, incentive compatible menu of products and associated prices.

4 - Revenue Optimization for a Make-to-order Queue in an Uncertain Market Environment

Omar Besbes, Columbia Business School, 3022 Broadway, New York, NY, 10027, United States, ob2105@columbia.edu, Costis Maglaras

We study a revenue maximizing make-to-order manufacturer that serves a market of price and delay sensitive customers and operates in an environment in which the market size fluctuates stochastically over time. Focusing on an appropriate asymptotic regime, we compute optimal pricing policies and evaluate the benefits of incorporating model uncertainty.

■ TB29

H - 4th Floor, Union Square 23

Decision Support Issues for E-Commerce

Contributed Session

Chair: Abhay Mishra, Assistant Professor, University of Maryland, Robert H. Smith School of Business, 4325 Van Munching Hall, College Park, MD, 20910, United States, amishra@rhsmith.umd.edu

1 - A Study on Predicting Purchase Points Toward Web Stores

Jinhwa Kim, Sogang University, 1 Shinsoo-Dong, Mapo-Ku, Seoul, 121-742, South Korea, jinhwakim@sogang.ac.kr, Hyunsoo Byun, Seunghoon Lee

Predicting customer's purchase intention or purchase point is the important subject for both offline stores and web stores. In this study, we propose CFM(connection frequency matrix) based on adjacency matrix which is able to predict customer's purchase. The first result is that web customers are divided in two groups: the general search group and the specific search group. The second result is that all customers in two groups have the same pattern at the point of purchase intention.

2 - Building IT-enabled Strategic Flexibility in Net-enabled Retail Organizations

Lih-Bin Oh, Doctoral Student, National University of Singapore, Department of Information Systems, 3 Science Drive 2, Singapore, 117543, Singapore, ohlb@comp.nus.edu.sg, Hock-Hai Teo

In order to survive in this dynamic Internet era, retail organizations need to develop strategic flexibility - the capacity to offer a variety of new products and services rapidly. Strategic flexibility has received wide attention in manufacturing but is rarely studied in the context of integrated retail operations management. This research explores the role of information technology in building strategic flexibility and examines its implications on firm performance under turbulent environments.

3 - The Impact of the Internet on Housing Prices and Its Implications on Real Estate Brokerage Industry

Xiao-Bai Li, Assistant Professor, University of Massachusetts Lowell, College of Management, Lowell, MA, 01854, United States, bob_li@uml.edu, Luvai Motiwalla

The Internet has reshaped many industries such as security trading, retail banking and travel agency industry. It had been widely predicted that the Internet would present a serious threat to the real estate agent as a market intermediary. However, it is evidenced that the real estate brokerage industry has experienced steady growth recently. We investigate the impact of the Internet on housing prices and its implications on this industry through an economic analysis and an empirical study.

4 - Electronic Procurement from Internet-based Business-to-business Markets: A Multi-Perspective Study

Abhay Mishra, Assistant Professor, University of Maryland, Robert H. Smith School of Business, 4325 Van Munching Hall, College Park, MD, 20910, United States, amishra@rhsmith.umd.edu

Drawing upon rational efficiency, legitimacy and political perspectives, this paper examines the extent to which organizations anticipate to procure from Business-to-business (B2B) markets in the future. The procurement of direct and indirect goods is investigated from both short-term and long-term perspectives. The research model is tested with survey data from 292 manufacturing firms. Results largely support the proposed model. Theoretical and practical implications of findings are discussed.

■ TB30

H - 4th Floor, Union Square 24

Public Sectors and OR

Cluster: Sustainable Development and OR

Invited Session

Chair: Tatsuo Oyama, Professor, National Graduate Institute for Policy Studies, 7-22-1 Roppongi, Minato-ku, JAPAN, Tokyo, 106-8677, Japan, oyamat@grips.ac.jp

1 - Optimization Model Analyses for Measuring the Effects of Introducing Diversified Power Generating Plants

Tatsuo Oyama, Professor, National Graduate Institute for Policy Studies, 7-22-1 Roppongi, Minato-ku, JAPAN, Tokyo, 106-8677, Japan, oyamat@grips.ac.jp, Hozumi Morohosi, Tomonori Satoh

We build a mathematical programming model in order to obtain an optimal introduction of diversified power generating facilities (DPGF) such as diesel engine, gas turbine, fuel cell, MGT (micro gas turbine) and so on into the market. Our optimization model aims at maximizing the total "saving" obtained from introducing new DPGFs at large demand customers such as hotels, schools, hospitals and so on. Numerical results obtained from applying the model to a Japanese power company are shown.

2 - Applying Path Counting Methods for Evaluating Edge and Node Deletion Connectivity Functions for the Water Supply Network System

Tatsuo Oyama, Professor, National Graduate Institute for Policy Studies, 7-22-1 Roppongi, Minato-ku, JAPAN, Tokyo, 106-8677, Japan, oyamat@grips.ac.jp, Hiroshi Ashida, Hozumi Morohosi

We try to evaluate quantitatively the strength of connectivity of the network-structured systems such as electric power network, city gas network, water pipeline network and so on. We show stable connectivity functions for many different types of graphs and actual lifeline networks. Some theoretical results are shown for special types of graphs. We apply the path counting techniques in order to measure the strength of the connectivity of actual water supply network system in Japan.

3 - Developing Academic Activity Indices for Evaluating Policy-Related Graduate Education Program in Japan

Anwar Sanusi, PhD Student, National Graduate Institute for Policy Studies (GRIPS), Japan, 7-22-11 Roppongi, Minato-ku,, Tokyo, Japan, anwaru@rocketmail.com, Tatsuo Oyama

This paper defines several indices for quantitatively evaluating the academic performance for education programs in the graduate school - then apply these indices to actual policy-related graduate programs in Japan, and show numerical results applied to three different types of Japanese universities of national, public and private at the present. We try to obtain the comprehensive evaluation measure with respect to general academic activities in policy-related graduate education programs in Japan

4 - Applying Mathematical Modeling Approaches for Investigating Japan's Food Supply Security System

Tatsuo Oyama, Professor, National Graduate Institute for Policy Studies, 7-22-1 Roppongi, Minato-ku, JAPAN, Tokyo, 106-8677, Japan, oyamat@grips.ac.jp, Kunihisa Yoshii, Nguyen Huu Trung

We investigate the past decreasing trend of the food self-sufficient ratio (SSR) in Japan, then try to decompose the changes into two main factors (i) the change in calorie supplies, and (ii) the change in the SSR itself. Then we show a Japanese food supply and demand network in order to build a mathematical model representing Japanese food supply system. Optimization model analyses can be applied, thus numerical results for improving Japanese SSR are shown with our strategic policy analysis.

■ TB31

H - 4th Floor, Union Square 25

Joint Session Practice/ Roundtable: Improving Consumer's Lives Through Applied OR

Cluster: OR Practice, Roundtable

Invited Session

Chair: Glenn Wegryn, Associate Director, Global Analytics, The Procter & Gamble Co, Two Procter & Gamble Plaza, Cincinnati, OH, 45202, United States, wegryn.gw@pg.com

1 - Sustainable Mobility from an OR Perspective

Irv Salmeen, Manager, Systems Analytics Dept. Research & Adv. Engineering, 2101 Village Road, Dearborn, MI, 48124, United States, isalmeen@ford.com, John Sullivan

Sustainable Mobility is a fractal-like problem. The fractal metaphor implies that at all scales, the questions are: what is sustainable and to whom, and subject to what constraints? The challenge to the OR perspective is that economic, political, social, and behavioral dynamics vie for shaping the question of "what is sustainable?" An OR perspective helps to define the problems. We will illustrate these points with a discussion of issues arising around a future hydrogen-economy.

2 - OR at Procter & Gamble: Raising Decision-Making to a Science

Glenn Wegryn, Associate Director, Global Analytics, The Procter & Gamble Co, Two Procter & Gamble Plaza, Cincinnati, OH, 45202, United States, wegryn.gw@pg.com

The leader of the 2004 Informs Prize-winning organization at P&G talks about winning strategies for OR in practice at a large consumer products corporation. Topics will include an historical survey of various OR groups in the company, recent project work, the group's current structure, focus areas and future opportunities to continue to provide a sustained competitive advantage for P&G.

3 - Return on Strategic Innovation in Pharmaceutical Industry

Wonjoon Kim, Yale University, Yale School of Business, 135 Prospect St., New Haven, CT, 06511, United States, wonjoon.kim@yale.edu

This paper measures the effect of firms' strategic decision to innovate on consumer welfare and the expected rate of return from innovation. The considerable difference between innovation and imitation activities in inducing consumer welfare and expected rate of returns on innovation proves that pharmaceutical firms' strategic innovation decision has more extensive impact than imitation, such as generics and me-too drugs.

■ TB32

H - 6th Floor, Lombard

Location Models

Sponsor: Location Analysis
Sponsored Session

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

1 - An Integrated Solution Framework for Large-Scale Supply Chain
Alper Murat, McGill University, 1001 Sherbrooke Street West, Montreal, PQ, H3G 1A5, Canada, alper.murat@mail.mcgill.ca, Vedat Verter

The use of IP models prioritizes the location decisions in supply chain design. In contrast, we first determine service regions (each served by a single facility) given a predetermined market area. We show that this approach accelerates the exact solution procedure for large scale problems

2 - Location with Acceleration-Deceleration Distance
Zvi Drezner, Professor, California State University, College of Business and Economics, Fullerton, CA, 92834, United States, zdrezner@fullerton.edu, Tammy Drezner, George O. Wesolowsky

The time of a trip is calculated by starting at speed zero, accelerating to a cruising speed, staying at the cruising speed for a while, and decelerating to a stop. We prove that every demand point is a local minimum for the Weber problem defined by travel time rather than distance. We propose heuristic and optimal algorithms. Problems of 10,000 demand points are solved optimally in one minute.

3 - Facility Location with Stochastic Demand and Constraints on Waiting Time on the Plane
Opher Baron, Rotman School of Management, University of Toronto, 105 St. George Street, Toronto, ON, M5S 3E6, Canada, Opher.Baron@rotman.utoronto.ca, Oded Berman, Qian Wang, Dmitry Krass

We consider a location problem with stochastic demand and congestion on the unit square. We choose number of facilities, their capacity, and locations to minimize total costs subject to coverage and service level constraints. Using bounds on the number of facilities and a Voronoi diagram we develop an efficient heuristic.

4 - Special Classes of Competitive Facility Location and Design Problem
Robert Aboolian, raboolia@csusm.edu, Oded Berman, Dmitry Krass

We present a general framework for simultaneous decision making on the location and design of the competitive facilities. We also present special classes of this problem and develop efficient exact and approximate solution approaches for each class.

■ TB33

H - 6th Floor, Mason

Journal of Quality Technology Invited Session

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: Joe H. Sullivan, Professor of Quantitative Analysis, Mississippi State University, Box 9582, MSU, MS, 39762, United States, J.Sullivan@msstate.edu

1 - Multivariate Monitoring of the Process Mean Vector With Sequential Sampling
Marion R. Reynolds, Jr., Professor of Statistics and Forestry, Virginia Tech, Department of Statistics, Blacksburg, VA, 24061-0439, United States, mrr@vt.edu, Keunpyo Kim

Multivariate control charts based on sequential sampling are investigated. When sequential sampling is used, the observations at a sampling point are taken in groups of one or more observations, and the number of groups actually taken is a random variable that depends on the process data. It is shown that using sequential sampling is much more efficient in detecting changes in the process mean vector than standard control charts based on non-sequential sampling.

2 - Gauge R & R Studies for Destructive Measurements
Jeroen de Mast, Senior Consultant, Institute for Business and Industrial Statistics,University of Amsterdam (IBIS UvA), Plantage Muidergracht 24, Amsterdam, 1018 TV, Netherlands, jdemast@science.uva.nl

The standard method for assessing a measurement system's precision — the gauge R & R study — cannot be used when objects are affected by the measurement or when the true value of objects is variable (so-called destructive measurements). We study alternative set-ups, which can be applied to destructive measurements if certain conditions hold. Even if required conditions are not completely met, the proposed approaches will at least lead to a smaller overestimation of measurement spread.

3 - Confidence Intervals in a Gauge R&R Study with Fixed Operators
Rick Burdick, Quality Engineer, Amgen Inc., MS AC-22A, 4000 Nelson Road, Longmont, CO, 80503, United States, rburdick@amgen.com, Lorraine Daniels, Jorge Quiroz

The objective of this presentation is to develop a method for constructing confidence intervals in a two-factor gauge repeatability and reproducibility (R&R) study with fixed operators. A previously proposed method is compared with a generalized confidence interval method using computer simulation. Simulation results suggest that, although the two methods are comparable in most cases, there are situations where the generalized confidence interval is a better choice.

■ TB34

H - 6th Floor, Powell

Wavelet and Statistical Modeling of Multiple Curves and Spatial Data

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: Jye-Chyi Lu, Professor, Georgia Institute of Technology, Industrial and Systems Engineering, 765 Ferst Drive NW, Atlanta, GA, 30332, United States, jclu@isye.gatech.edu

1 - A Wavelet-Based Variance Thresholding Procedure for Multiple Curves
Myong K. Jeong, Assistant Professor, Univesity of Tennessee, Industrial and Information Engineering, 311 East Stadium Hall, Knoxville, TN, 37996-0700, United States, mjeong@utk.edu, Jye-Chyi Lu, Ming Yuan

Multiple sets of complicated functional data appeared in many engineering studies. We propose a wavelet-based mean and variance thresholding model. Results from real-life examples show that our proposed model performs better than several ad hoc techniques extended from single-curve based data modeling and vertical-energy-thresholding procedure.

2 - CATS: Clustering After Transformation and Smoothing
Nicoleta Serban, Assistant Professor, Georgia Institute of Technology, Industrial and Systems Engineering, 765 Ferst Drive NW, Atlanta, GA, 30332, United States, nserban@stat.cmu.edu

CATS — Clustering After Transformation and Smoothing — is a technique for nonparametrically estimating and clustering a large number of curves (or profiles). The basic idea is to first remove the curves which are nearly flat, smooth the remaining curves, and then cluster the smoothed curves with similar shape. A novel feature of our method is that we estimate the error due to the fact that we are clustering the estimated rather than the true curves.

3 - A Bayesian Multiresolution Approach to Process Monitoring
Tapas K. Das, Professor, University of South Florida, United States, das@eng.usf.edu, Rajesh Ganesan, A. N. V. Rao, Chaitra Gopalappa

This talk presents a process monitoring approach that applies Bayesian sequential probability ratio test on a wavelet decomposed sensor data. The method is then tested to detect the end point of a nanoscale Chemical Mechanical Planarization (CMP) process of wafer polishing.

4 - Robust Estimates for Spatial Random Field Models
S.-C. Lin, Ph.D. Student, Georgia Institute of Technology, Industrial and Systems Engineering, 765 Ferst Drive NW, Atlanta, GA, 30332, United States, slin@isye.gatech.edu, Jye-Chyi Lu

Spatial random field models are useful in describing data in spatial lattice formats. Our research is motivated from semiconductor device fabrication and printed-circuits-board manufacturing processes, where outliers can make modeling of treatment effects difficult. This paper presents a few robust estimation methods and studies its finite and large sample properties.

■ TB35

H - 6th Floor, Sutter

Stochastic Programming

Sponsor: Minority Issues
Sponsored Session

Chair: Lewis Ntaimo, Assistant Professor, Texas A&M University, 3131 TAMU, College Station, TX, 77843, United States, ntaimo@iemail.tamu.edu

1 - Solving a Stochastic Game in the Electricity Market with SMPEC
Lizhi Wang, University of Pittsburgh, 1048 Benedum Hall, Pittsburgh, Pa, 15261, United States, liw18@pitt.edu, Nan Kong

A stochastic game arising from the electricity market is formulated as a Stochastic Mathematic Program with Equilibrium Constraints (SMPEC). Sensitivity analysis for quadratic programming with both objective and right hand side parameters is applied to obtain the best response of each player. This solution technique is also generalized to a class of two stage stochastic programs with quadratic recourse functions.

2 - Bound-based Solution Evaluation in Multistage Stochastic Programs
Lei Zhao, Ph.D. Candidate, University of Arizona, Tucson, AZ, 85721, United States, leiz@email.arizona.edu, Julia Higle

In this computational research, we focus on bound-based solution evaluation techniques in multistage stochastic linear programs. Different representations of nonanticipativity constraints are studied. Lower and upper bounds are explored and established through manipulations of the nonanticipativity constraints.

3 - A Comparative Study of Decomposition Algorithms for Stochastic Mixed-Integer Programming
Lewis Ntaimo, Assistant Professor, Texas A&M University, 3131 TAMU, College Station, TX, 77843, United States, ntaimo@iemail.tamu.edu, Suvrajeet Sen

In this talk a comparative study of disjunctive decomposition (D2) algorithms for Stochastic Mixed-Integer Programming (SMIP) is presented. We give details of a computer implementation of the algorithms and report on a promising computational experience on solving several large-scale problem instances under uncertainty arising in server location, strategic supply chain planning and stochastic bipartite matching.

■ TB36

H - 6th Floor, Taylor

Simulation Analysis in Supply Chain and Resource Management

Sponsor: Simulation
Sponsored Session

Chair: Young Lee, IBM Research, 1101 Kitchawan Road, Yorktown Heights, NY, United States, ymlee@us.ibm.com

1 - Using Simulation to Analyze the Service Supply Chain
Feng Cheng, IBM Research, 1101 Kitchawan Road, Yorktown Heights, NY, 10598, United States, fcheng@us.ibm.com, Ally Lu

We describe a business process model for developing and analyzing the business value of outsourcing opportunities in the service-after-sales (SAS) business. Simulation is used to provide a cost-benefit analysis for outsourcing decisions and to identify the resource bottlenecks in the SAS operations. What-if analyses are performed for testing different configurations of the SAS chain and how various factors will impact the customer service performance measures.

2 - Effect of Component-Based Order Scheduling on Supply Chain Performance: Simulation Study
Young Lee, IBM Research, 1101 Kitchawan Road, Yorktown Heights, NY, United States, ymlee@us.ibm.com, Soumyadip Ghosh, Feng Cheng, Tom Ervolina, Barun Gupta

We have developed and used a supply chain simulation model to evaluate the benefits of scheduling customer orders based on the availability of components vs. finished goods for an IBM's hardware business. We have quantified the improvement of supply chain performance with respect to order fulfillment rate, lost sales and inventory.

3 - A Simulation to Teach Students How to Win the Beer Game
Leslie Gardner, Professor, University of Indianapolis, 1400 East Hanna Avenue, Indianapolis, IN, 46227, United States, lgardner@uindy.edu, Jerry Flatto, Jeff Adams

The Beer Game is a popular classroom exercise for demonstrating material and information flows in a supply chain. At the University of Indianapolis, spreadsheet and discrete event simulations are used to supplement the classroom exercise to illustrate the results of a variety of ordering strategies and whether or not they produce the bullwhip effect. This paper describes the results of the simulation and how it is used in the classroom.

4 - A Hybrid Approach to Minimize the Cost of Staffing a Call Center
Robert Saltzman, Professor, San Francisco State University, 1600 Holloway Ave., College of Business, San Francisco, CA, 94132, United States, saltzman@sfsu.edu

This paper describes a hybrid approach to staffing agents at an inbound call center. The costs of labor, customer abandonment and waiting time are explicitly represented and their sum is minimized. The minimization routine combines the use of Excel's Solver, an Arena simulation model and a Visual Basic tabu search heuristic.

■ TB37

H - 6th Floor, Van Ness

Special APS Session: QED Queues: Empirically-Based Theory of Queues in Call Centers

Sponsor: Applied Probability
Sponsored Session

Chair: Avi Mandelbaum, Technion, Faculty of IE&M, Haifa, 32000, Israel, avim@ie.technion.ac.il

1 - Special APS Presentation: QED Queues: Empirically-Based Theory of Queues in Call Centers
Avi Mandelbaum, Technion, Faculty of IE&M, Haifa, 32000, Israel, avim@ie.technion.ac.il

QED Queues arise in large service systems that are both Quality- and Efficiency-Driven (QED), for examples best-practice telephone call centers. The design and analysis of call center operations has traditionally relied on classical queueing models. However, the modern call center, being large, complex and data-intensive, is challenging the relevance of this conservative approach. My goal is to survey current research that addresses some of these challenges. Formally, our queuing models are analyzed as the number of servers increases indefinitely and their utilization levels approach 100%. In the limit, the fraction of customers that are served immediately, without wait, could be 0 (Quality-Driven) or 1 (Efficiency-Driven); but the goal is to strike a careful balance that leads to a limit strictly between 0 and 1 (QED). The latter (0,1)-limit is achieved by following a square-root staffing rule. Historically, the advantages of the QED operational regime were already clear to Erlang. But its rigorous mathematical articulation awaited the seminal paper by Halfin and Whitt (1981), which will be our theoretical starting point.

■ TB38

R - 2nd Floor, Corintia

Stochastic Search Methods for Global Optimization

Sponsor: Optimization/ Global Optimization
Sponsored Session

Chair: Dushyant Sharma, Assistant Professor, University of Michigan, IOE Department, Ann Arbor, MI, 48109, United States, dushyant@umich.edu

1 - A Fictitious Play Approach to Complex Systems Optimization
Archis V Ghate, University of Michigan, 1205 Beal Ave., Ann Arbor, MI, 48109, United States, archis@umich.edu

Complex systems are increasingly modeled through computer simulations rather than via traditional equation based approaches. The resulting model typically allows for little or no structural assumptions. We explore a novel optimization paradigm inherited from game theory that animates the components of the system within a game of identical interest.

2 - An Analysis of Cyclical Simulated Annealing Algorithms
Sheldon Jacobson, Professor, University of Illinois, 1206 West Green Street, mc244, Urbana, IL, 61801, United States, shj@uiuc.edu, Shane Hall, Laura McLay

Cyclical simulated annealing uses a cooling schedule that cycles through different temperature values, rather than cooling to zero. This paper provides an estimator for the expected number of iterations to visit a predetermined objective function value level for cyclical simulated annealing. Computational results are reported to illustrate the results presented.

3 - Multi-Particle Simulated Annealing
Zelda Zabinsky, Professor, zelda@u.washington.edu

We developed a multi-particle version of simulated annealing, where we move the current points using hit-and-run with a Metropolis filter. The set of current points is updated each iteration, and the set ends up with a single point. Numerical results are provided exploring temperature, number of points, and update procedure.

4 - Asymptotic Convergence Guarantees for General Annealing Algorithms
Dushyant Sharma, Assistant Professor, University of Michigan, IOE Department, Ann Arbor, MI, 48109, United States, dushyant@umich.edu, Sanphet Sukhapesna

In this talk, we present the necessary and sufficient conditions for a general annealing algorithm to converge to the set of optimal solutions for a discrete optimization problem. Our necessary and sufficient conditions are easy to verify. We show that the class of convergent algorithms is broader than the well-known Simulated Annealing algorithm, and in fact contains many other algorithms proposed in the literature.

■ TB39

R - 3rd Floor, Aragon

Special Session- History of OR/MS

Cluster: History of OR/MS
Invited Session

Chair: Ernest Koenigsberg, W A Haas School of Business, University of California at Berkeley, ekoenigsb@aol.co

1 - Reflections on An Annotated Timeline of Operations Research
Saul I. Gass, Professor emeritus, University of Maryland, R. H. Smith School of Business, College Park, MD, 20854, United States, sgass@rhsmith.umd.edu, Arjang A. Assad

The authors compiled an annotated timeline presentation of the events and people that combined to form the science of operations research. This talk will review the genesis of the timeline and recount some little known facts about specific entries. The compilation has been published as "An Annotated Timeline of Operations Research: An Informal History" by Springer Scientific (2005).

2 - The 'Invisible Science': British Military OR after 1945
Maurice Kirby, Professor, Lancaster University, Management School, Lancaster, LA1 4YX, United Kingdom, m.kirby@lancaster.ac.uk

This paper will analyse the impact of the Cold War on British military OR in the period 1945-70. It will focus on the fact that this was a war of intelligence and calculation. OR's contribution was to calculate possible effects in order to inform strategy and weapons procurement.

3 - The Case of OR in Germany (1955-2005): From Animosity Toward Partial Integration
Heiner Muller-Merbach, Prof Emer, Technische Universitat Kaiserlautern, Postfach 30 49, Erwin Schroedinger-Strasse,Geb.42-43, Kaiserlautern, D-67653, Germany, hmm@bior.de

The first reports about OR were received by German Business Administration (GBA) with a mixture of hostility and fascination. Nevertheless OR Societies AKOR (1957) and DGU (1961) were founded (and later merged into GOR) and journals and books were published. Since the 1960s OR has flourished In Germany without recognition in academic circles as an independent discipline.It remains in the shadow of GBA which continues to "swallow" the new techniques and approaches and integrates them into the mathematical curriculum of GBA.

4 - The Dawn of Production Control in the Early 19th Century
Kenneth McKay, Professor, Dept. Management Science, University of Waterloo, 200 University Ave. W., Waterloo, ON, N2L 3G1, Canada, kmckay@uwaterloo.ca, Ernest Koenigsberg

Early manufacturing enterprises organized their resources and conducted their affairs according to delivery dates and quality expectations; even in the absence of severe competition. We have found and compiled a number of early reports and descriptions of production control at early factories in Britain and the US. In some cases, the paths are parallel, in others different. We use examples such as the Springfield Armory to illustrate the production control concepts.

■ TB40

R - 3rd Floor, Barcelona I

Travelling Saleman and Related Problems

Sponsor: Optimization/ Network Optimization
Sponsored Session

Chair: James B. Orlin, MIT, E40-147, Cambridge, MA, 02139, United States, jorlin@mit.edu

1 - Algorithms for Path-Planning
Shuchi Chawla, Computer Science Department, Carnegie Mellon University, Wean Hall 4212, 5000 Forbes Avenue, Pittsburgh, PA, 15213, shuchi@cs.cmu.edu

Consider a FedEx delivery man who has to deliver packages to various addresses in the city. Each package has a value and a time-window within which it must be delivered. The goal is to maximize the total value of packages delivered within their time-windows. Path-planning problems such as the above arise in a variety of applications such as supply chain management. We revisit classical path-planning problems such as Orienteering and planning with time-windows, and present the first approximations for them.

2 - A Linear-time Approximation Scheme for TSP in Weighted Planar Graphs
Philip N. Klein, Department of Computer Science, Brown University, Providence, RI, klein@cs.brown.edu

For any positive epsilon, there is an O(f(epsilon) n) algorithm that finds an epsilon-optimal traveling-salesman tour in the metric defined by a connected planar graph with nonnegative edge-lengths. The algorithm thus takes linear time for constant epsilon. We will also discuss the application of the technique to the approximate solution of other optimization problems in such graphs.

3 - Grammars for Representing Very Large Neighborhoods for Sequencing Problems
James B. Orlin, MIT, E40-147, Cambridge, MA, 02139, United States, jorlin@mit.edu, Agustin Bompadre

We develop "sequence grammars," a method for generating exponentially large neighborhoods for sequencing problems using a polynomial number of production rules. We can optimally search these neighborhoods using dynamic programming in polynomial time for the Traveling Salesman Problem, the Linear Ordering Problem, and several other sequencing problems. This framework unifies a variety of previous results on exponentially large neighborhood for the Traveling Salesman Problem.

■ TB41

R - 3rd Floor, Barcelona II

Integer Programming Techniques

Sponsor: Optimization/ Integer Programming
Sponsored Session

Chair: Dieter Vandenbussche, University of Illinois, 1206 West Green Street, Urbana, IL, 61801, United States, dieterv@uiuc.edu

1 - Deriving Strong Inequalities for Group Polyhedra through Approximate Lifting
Jean-Philippe Richard, Assistant Professor, Purdue University, 315 North Grant Street, West Lafayette, IN, 47907, United States, jprichar@ecn.purdue.edu, Yanjun Li, Lisa Miller

Since the early work of Gomory and Johnson, it is well-known how facets of the group problem can be used to generate cuts for general MIPs. However, deriving facets of the group problem is often difficult. In this talk, we describe a lifting procedure to derive families of strong inequalities for the group problem. We use this procedure to derive new families of facets for the group problem, as well as some known families. Finally, we discuss the computational possibilities of this approach.

2 - Semidefinite-Based Branch-and-Bound for Nonconvex Quadratic Programming
Samuel Burer, Assistant Professor, University of Iowa, Department of Management Scienes, S346 Pappajohn Business Building, Iowa City, IA, 52242-1000, United States, samuel-burer@uiowa.edu, Dieter Vandenbussche

We present semidefinite relaxations of the first-order KKT conditions of nonconvex quadratic programs and show how to incorporate them in a finite branch-and-bound algorithm. Computational results show that only a small number of nodes are required. Specialization to box constraints yields a state-of-the-art method for globally solving this class of problems.

3 - Integer Programming Models and Analysis for a Multilevel Passenger Prescreening Problem
Laura McLay, University of Illinois, 1206 West Green Street, mc244, Urbana, IL, 61801, United States, lalbert@uiuc.edu, Sheldon Jacobson, John Kobza

Passenger prescreening is an important aspect of aviation security. The Multilevel Passenger Prescreening Problem (MP^3) is formulated as a discrete optimization model and integer programming model. The objective of MP^3 is to find passenger assignments subject to device capacity and assignment constraints. The model is illustrated with several examples.

4 - Improved Formulation for the Separation of Rank 1 CG Inequalities
Mustafa Baz, University of Pittsburgh, 1068 Benedum Hall, Pittsburgh, PA, 15261, United States, mub3@pitt.edu, Brady Hunsaker, Craig A. Tovey

We present an improved formulation for the separation of rank 1 Chvatal-Gomory inequalities for pure integer programs. We show how this also can be used in the identification of inequalities of rank 2. We provide open source implementations of these algorithms and discuss how researchers can use them to study families of integer programming models.

■ TB42

R - 4th Floor, Parc Ballroom I

Stochastic Programming: Theory to Computation

Sponsor: Optimization/ Stochastic Programming
Sponsored Session

Chair: David Morton, The University of Texas at Austin, 1 University Station, C2200, Graduate Program in Operations Research, Austin, TX, 78712-0292, United States, morton@mail.utexas.edu

1 - Dynamic Stochastic Programming with Decision Policies (DSPDP)

Michael Casey, 407 N. Broadway, Apt 14, Redondo Beach, CA, 90277, United States, msc.sedcontra@gmail.com, Suvrajeet Sen

Unlike traditional multi-stage stochastic programming, a DSPDP allows a model in which distinction is made between control and state. A solution to such a model is a decision policy which is a function of the sample space of the underlying stochastic process. We present A finite-element algorithm that generates decision policies by adaptively producing a sequence of scenario trees.

2 - Sequential Sampling for Stochastic Programming

Guzin Bayraksan, guzinb@mail.utexas.edu, David Morton

We present sequential sampling procedures to solve stochastic programs with recourse. We draw samples of increasing size until a stopping criterion is satisfied. We provide stopping rules and rules to increase the sample size such that when we stop, we have a solution that is close to an optimum solution with desired probability. Computational results are presented.

3 - Reformulation and Sampling to Solve a Stochastic Network Interdiction Problem

Jeff Linderoth, Lehigh University, 200 W Packer Ave, Bethlehem, PA, 18015, United States, jtl3@Lehigh.EDU, Udom Janjarassuk

We discuss a stochastic version of the network interdiction problem, in which the successful destruction of an arc of the network is random, and the objective is to minimize the maximum expected flow. Using duality and linearization, an equivalent deterministic mixed integer program is formulated. With a parallel, decomposition-based algorithm running on a computational grid, we give computational results showing the efficacy of a sample average approach to solving the problem.

4 - Adaptive Generalized Jackknife Estimators for Stochastic Programs

Amit Partani, Doctoral Student, The University of Texas at Austin, 1 University Station C2200, 5.116 ETC, Austin, TX, 78712, United States, partani@mail.utexas.edu, David Morton

We present a generalized jackknife estimator to reduce bias. The order of the bias is not required as input but is instead estimated in our procedure. This statistic is applied to optimality gap estimator in simulation-based methods in stochastic programming. It is easy to calculate and produces tighter confidence intervals on solution quality.

■ TB43

R - 4th Floor, Parc Ballroom II

Structure and Randomization

Sponsor: INFORMS Computing Society/ Constraint and Integer Programming
Sponsored Session

Chair: Carla Gomes, gomes@cs.cornell.edu

1 - The Backbone of the Travelling Salesperson

Toby Walsh, National ICT Australia and UNSW, Kensington, Sydney, 20, Australia, Toby.Walsh@nicta.com.au

I discuss the backbone of the travelling salesperson problem, that is edges in all optimal tours. I look at the cost of computing and approximating the backbone, and the relationship with other measures of problem hardness like backdoors.

2 - Postponing Branching Decisions

Willem-Jan van Hoeve, Cornell University, Dept. of Computer Science, 4130 Upson Hall, ITHACA, NY, 14853, United States, vanhoeve@cs.cornell.edu, Michela Milano

The efficiency of backtrack search methods for constraint satisfaction and optimization problems highly depends on the variable and value ordering heuristics. We propose a simple method to apply in case the value ordering heuristic produces ties: postponing the branching decision. To this end, we group together values in a tie and we branch on this subdomain. We show theoretically and experimentally that this simple modification can dramatically improve the efficiency of the search strategy.

3 - Empirical Hardness Models for Structured SAT Problems

Kevin Leyton-Brown, Assistant Professor, University of British Columbia, 185-2366 Main Mall, Vancouver, BC, V6T 1Z4, Canada, kevinlb@cs.ubc.ca, Eugene Nudelman, Holger Hoos, Yoav Shoham

We investigate the empirical behavior of several DPLL SAT solvers on a variety of structured SAT distributions. Using machine learning, we build models that predict each algorithm's runtime given a problem instance. We address the following questions: 1. How effectively can empirical performance be predicted for each solver-distribution pair? 2. What problem instance characteristics are relevant to these predictions? 3. Can our algorithms be effectively combined into an algorithm portfolio?

4 - Identifying Structure in Combinatorial Problems

Bart Selman, Cornell University, Upson Hall, Ithaca, NY, United States, selman@cs.cornell.edu

I will discuss different notions of structure in combinatorial problems, as studied in computer science, operations research, mathematics, and statistical physics.

■ TB44

R - 4th Floor, Parc Ballroom III

Economic Mechanisms in Information Search

Sponsor: INFORMS Computing Society
Sponsored Session

Chair: Kartik Hosanagar, The Wharton School, Penn, 3730 walnut st, Suite 500, philadelphia, pa, 19104, United States, kartikh@wharton.upenn.edu

1 - Price Cycles in Online Advertising Auctions

Jane Feng, Assistant Professor, University of Florida, Warrington School of Business, Gainesville, FL, United States, jane.feng@cba.ufl.edu, Michael Zhang

We use a Markov process to model the dynamic updating of bids and ranking in the online advertising auctions. We found the Markov Perfect Equilibrium bidding strategy following a clear cyclical pattern. We confirm the theory using an empirical framework based on maximum likelihood estimation of latent Markov state switching.

2 - Sponsored Search Auction Design

Hemant Bhargava, Professor, University of California Davis, Graduate School of Management, AOB IV (Room 135), Davis, CA, 95616, United States, bhargava@computer.org, Jane Feng

In Internet sponsored searches, the top slots are typically sold via auctions, with payment contingent on user action such as a click. Theauctionee, however, has inaccurate estimate of future click-rate. We discuss how to combine revenue maximization using current information with generation of click-through information to increase future revenues.

3 - Impact of Ranking Policies and Keyword Generality on Bidding Strategies in Search Engines

Kartik Hosanagar, The Wharton School, Penn, 3730 Walnut St, Suite 500, philadelphia, pa, 19104, United States, kartikh@wharton.upenn.edu

A number of different policies are used by search engines to rank order ads for any keyword. These include ranking ads based on the advertiser bid, ranking ads based on teh product of the bid and clickthrough rate of the ad, etc. In this paper, we determine how the ad ranking policy influences the optimal bidding strategy of advertisers. We further explore the impact of keyword generality or specificity on bidding behavior.

■ TB45

R - 4th Floor, Raphael

Marine Transportation & Logistics II

Sponsor: Transportation Science & Logistics
Sponsored Session

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

1 - An Operating Strategy to Improve Port Efficiency

Anne Goodchild, University of California at Berkeley, 945 Ohlone Ave #964, Albany, CA, United States, anne_g@berkeley.edu

Loading ships as they are unloaded (double-cycling) can improve the efficiency of a port by improving crane and landside vehicle utilization. This research describes the nature of the problem, and presents several solution algorithms to estimate benefits. Results from a standard numerical solver are compared to simulation, and analytical techniques. Implications for port operations are addressed. Results are provided for both short, and long-term planning horizons.

2 - Great Lakes Short Sea Shipping: Opportunities for OR and OM
James K. Higginson, Assistant Professor, Odette School of Business, University of Windsor, Windsor, ON, N9B 3P4, Canada, jhiggin@uwindsor.ca, Sofia Stepanenko

Short sea shipping refers to the movement of cargo and passengers by water over short distances, typically without crossing an ocean. This presentation outlines the requirements for viable short sea shipping on the Great Lakes / St. Lawrence Seaway, and discusses opportunities for OR and OM research and application in this endeavour.

3 - A Hybrid Continuous Time Model for Marine Transportation of Multiple Bulk Products
Kevin Furman, ExxonMobil, 1545 Route 22 East, Annandale, NJ, 08801, United States, kevin.c.furman@exxonmobil.com

In the routing, scheduling and inventory management of bulk products, continuous time models can reduce the combinatorial complexity at the expense of additional constraints. We propose a hybrid approach that incorporates the strengths of both continuous and discrete time models by differentiating on a port specific basis. An MILP formulation is developed and illustrated through example cases.

■ TB46

R - 4th Floor, Rubens

Transportation Network Modeling II

Sponsor: Transportation Science & Logistics
Sponsored Session

Chair: Srinivas Peeta, Associate Professor, Purdue University, School of Civil Engineering, 550 Stadium Mall Drive, West Lafayette, IN, 47907-2051, United States, peeta@ecn.purdue.edu

1 - Sampling Based Algorithms for the Robust Transport Network Assignment Problems
Avinash Unnikrishnan, University of Texas, ECJ, Austin, TX, 78712, United States, avinash@mail.utexas.edu, Travis Waller, Jennifer Duthie, Satish Ukkusuri

Existing methodologies for solving the traffic assignment in a network do not "adequately" account for demand uncertainty. Considering only the expected value of demand can result in underestimation of the total system travel time. Different sampling techniques will be compared for the problem and insights will be provided. The focus will be on techniques which reduce the variance of the system.

2 - Strategic Planning for Evacuation under Deliberate Disasters
Georgios Kalafatas, Purdue University, 518 N. River Rd Apt. 16, W. Lafayette, IN, 47906, United States, gkalafat@purdue.edu, Srinivas Peeta

We formulate the planning problem of identifying the links in a network for capacity enhancements under a limited budget so as to minimize the total evacuation time from the affected region under a deliberate disaster. We further seek redundancy and consider contra-flow operations in identifying the associated sub-network of critical paths.

3 - Single Freight Carrier Collaboration Problem
Salvador Hernandez, Purdue University, School of Civil Engineering, West Lafayette, IN, 47907-2051, United States, shhernan@purdue.edu, Srinivas Peeta

Due to the advances in e-commerce and information technologies, medium to small freight companies (e.g. trucking) have begun to collaborate to compete with larger firms for loads. This study models this collaboration over a freight transportation network from the perspective a single carrier. The problem is formulated, issues are identified, and solution directions are discussed.

■ TB47

R - 4th Floor, Michelangelo

Transportation Infrastructure Management II

Sponsor: Transportation Science & Logistics
Sponsored Session

Chair: Jasenka Rakas, jrakas@berkeley.edu

1 - Simulation of Imperfect Information in Vulnerability Modeling for Infrastructure Facilities
Mark Turnquist, Cornell University, Ithaca, NY, 14853, United States, mat14@cornell.edu, Dean Jones, Linda Nozick

A Markov model of malicious intrusions in infrastructure facilities is combined with simulation to analyze varying levels of imperfect intruder information in planning their attacks. This provides an explicit mechanism to estimate the probability of successful breaches of physical security, and to evaluate potential means to reduce that probability.

2 - Optimal Sequencing of Un-staffed Facility Inspection Sites in the National Airspace System
Juaida Norrell, juaida.norrell@faa.gov, Gautam Gupta, Jasenka Rakas

The evaluation of the Facility Condition Index (FCI) for 9,000 structural towers and 5,000 un-staffed facilities in the National Airspace System requires proper sampling methodology. This research focuses on developing an appropriate sequence of facility inspection sites with the objective to minimize sample variance. The proposed sequencing technique is supported by data analysis, including comparisons to highlight the relative benefits of such a technique.

3 - Balancing Service Components of the National Airspace System: Quality, Value, and Cost
Jady Handal, jady.handal@faa.gov, Jasenka Rakas

This research explores questions of balance among three components of service of the National Airspace System (NAS): quality, value and cost. We also explore how value and willingness to pay, either consciously or unconsciously, ultimately drives quality of NAS service. Service Level Agreements are discussed identifying how risk tolerance, as a new quality measure, influences cost. Deterministic and stochastic models are presented to illustrate the decision process.

4 - Infrastructure Maintenance Decisions Optimization using a History-dependent Markov Decision Process
Charles-Antoine Robelin, Graduate Student Researcher, UC Berkeley, robelin@ce.berkeley.edu, Samer Madanat

A reliability-based model of deterioration is developed and used in a facility level optimization model of bridge maintenance decisions, using A Markov chain whose state includes part of the history of deterioration and maintenance. This formulation allows the use of standard optimization techniques, while using realistic, history-dependent deterioration models. The framework to formulate a continuous deterioration model as a Markov model with limited loss of information is presented.

■ TB48

R - 4th Floor, Dante

Simulation Applications in Health Services Research - 2

Sponsor: Health Applications
Sponsored Session

Chair: Michael Carter, Professor, University of Toronto, Mech & Ind Engineering, 5 King's College Rd, Toronto, ON, M5S 3G8, Canada, carter@mie.utoronto.ca

1 - An Application of Queuing Theory for Analysis of Emergency In-patient Flow
Arnoud de Bruin, M. Sc., VU University Medical Centre, de Boelelaan 1117 (room 2B.120), 1007MB, Amsterdam, Netherlands, debruin@few.vu.nl, Ger Koole, Marieke Visser

Capacity decisions in Dutch hospitals are generally made without the help of OR model-based analyses. This study applies a queuing system with blocking to analyse congestion in the emergency cardiac in-patient flow in a university medical centre. Around Amsterdam, the number of refused admissions is significant. This is unacceptable an puts a great pressure on the required service level. Results are presented as the required number of beds to realise a given service level at minimum costs.

2 - A Patient Flow Model for Re-direction of Patients in Emergency Departments
Gilles Reinhardt, Asst. Professor, DePaul University, 1, E. Jackson Blvd., Suite 7000, Chicago, IL, 60604, United States, greinhar@condor.depaul.edu, Rahul Khare

We test the hypotheses that both strategic and operational ED quality measures improve when patients are re-directed from general emergency (ED1) to a focused care unit (ED2) whenever the sentinel diagnosis at Triage is determined with minimum uncertainty in terms of symptoms and condition, expected number of resources required and time to discharge. We assume an appropriate redeployment of responsive resources and analyze the resulting process measures.

3 - Implementation of Priority Wait Lists
Sherry Oh, Instructor, University of Calgary, 2500 University Dr. NW, Calgary, AB, T2N1N4, Canada, sherry.oh@haskayne.ucalgary.ca

The prioritization of wait lists in the Canadian healthcare system can be approached with a variety of OR methods and tools. The use of a prioritized queue that incorporates both priorities and maximum allowable wait times can provide estimates of appropriate performance measures For more complex scenarios, simulation techniques may be appropriate. Recommendations regarding scheduling best practices will be made based upon queueing and simulation results.

4 - Waitlist Management — Issues, Models, and Applications
John Blake, john.blake@dal.ca

Ensuring access to medical care is an issue in every industrialized nation. In environments without private markets, queues are used to ration health care. Queue based rationing has a number of problems, and is a perpetual "hot button" issue. In this paper we present a macro model for wait list management. We describe the function of wait lists and postulate a model for wait list management and draw high level conclusions about mechanisms to deal with excessive waiting times.

■ TB49

R - 4th Floor, Medici

Mathematical Biology and Bioinformatics

Cluster: Health Care
Invited Session

Chair: Joseph Wu, Assistant Professor, Georgia Tech, School of Industrial and Systems Engineering, Atlanta, GA, 30332, United States, joseph.wu@isye.gatech.edu

1 - Set Covering Approach for Sibling Relationship Reconstruction
Wanpracha Art Chaovalitwongse, Assistant Professor, Department of Industrial and Systems Engineering, Rutgers University, CoRE Building, 96 Frelinghuysen Rd., Piscataway, NJ, 08854, United States, wchaoval@rci.rutgers.edu, Mary V. Ashley, Tanya Berger-Wolf, Bhaskar DasGupta

A novel set covering approach for modeling and reconstructing sibling relationships in single-generation individuals without parental information is proposed. Simple genetic constraints on the full-sibling groups, imposed by the Mendelian inheritance rules, are employed to investigate data from codominant DNA markers. The results of this simulation study suggest that the proposed algorithm is efficient and will pave our way to a new approach in computational population genetics.

2 - Analyzing a Generic Attack on the Food Supply
Yifan Liu, Stanford University, 518 Memorial Way, Stanford, CA, United States, liuyifan@stanford.edu, Lawrence Wein

We derive the number of casualties resulting from an attack on a food supply chain with a biological or chemical agent, in terms of the key characteristics of the agent, the food processing facility, and the downstream portion of the food supply chain.

3 - Large-Scale Genomic Pattern Recognition and Classification of CpG Loci in Human Cancer
Eva Lee, Associate Professor & Director, Center for Operations Research in Medicine, Georgia Institute of Technology, Industrial & Systems Engineering, Atlanta, GA, 30332-0205, United States, evakylee@isye.gatech.edu, Lan Jiang

A pattern recognition/discriminant analysis approach is described for genomic classification in human cancer. The algorithm first identifies hidden patterns in DNA sequences. These patterns are used as attributes for an optimization-based predictive model. The model maximizes the total number of correct classifications while constraining the rate of misclassifications. It also allows a reserved judgement region. Prediction of DNA sequences related to human breast cancer will be presented.

4 - Detecting Differential Expression for Microarray Time Course Data
Ming Yuan, Assistant Professor, Georgia Institute of Technology, Industrial and Systems Engineering, 765 Ferst Drive NW, Atlanta, GA, 30332, United States, myuan@isye.gatech.edu

Among the first microarray experiments were those measuring expression over time, and time course experiments remain common. Most methods to analyze time course data attempt to group genes sharing similar temporal profiles within a single biological condition. However, with time course data in multiple conditions, a main goal is to identify differential expression patterns over time. I will present a Hidden Markov modeling approach designed specifically to address this question.

■ TB50

R - 4th Floor, Cervantes

Portfolio Decision Analysis

Sponsor: Decision Analysis
Sponsored Session

Chair: Jeffrey Keisler, Assistant Professor, University of Massachusetts Boston, College of Management, Boston, MA, 02125, United States, jeff.keisler@umb.edu

1 - An Approach to Climate Change R&D Portfolio Decision Analysis
Erin Baker, Asst. Prof., University of Mass. Amherst, 220 Elab, Amherst, MA, 01003, United States, edbaker@ecs.umass.edu, Jeffrey Keisler

We model a two-period environmental R&D portfolio problem. In period 1, funds are allocated across R&D projects intended to lead to a reduction of greenhouse gases. In period 2, successful projects and climate damages are revealed, and the socially optimal level of abatement is selected. The optimal portfolio is driven by the effect of each technology on the marginal abatement cost curve as it interacts with the eventual damage curve.

2 - The Research and Development Portfolio Problem
Roger Burk, Associate Professor, Dept of Systems Engineering, US Military Academy, West Point, NY, 10996, United States, roger.burk@usma.edu

We consider how to select the best portfolio of R&D projects from a given set under a budget limit. The problem is complicated by multiple criteria and nonadditive interactions among the projects. We review the literature on various approaches and our experience, and recommend value modeling and good graphics.

3 - R&D Project Valuation and Licensing Negotiations at Phytopharm plc
Zeger Degraeve, London Business School, Regent's Park, London, UK, NW1 4SA, United Kingdom, zdegraeve@london.edu, Pascale Crama, Bert De Reyck, Wang Chong

We present an R&D project valuation model built for a UK biotech company to assist licensing negotiations. We combine known valuation methods, Net Present Value, Decision Analysis and Monte Carlo Simulation, and include a novel method using the project's innate risk. The model offers contract terms based on typical licensing contract structures, break-even analyses, trade-offs and bargaining zones. The model was used to license a product to Unilever and will be deployed for the entire portfolio.

4 - Interaction Between R&D Portfolio Strategy and Abatement Policy for Climate Change
Geoffrey Blanford, Department of Management Science and Engineering, Stanford University, 491 Terman Engineering Center, Stanford, CA, 94305-4026, United States, blanford@stanford.edu

Optimal selection of an R&D portfolio for climate change technologies depends on the policy-maker's response to both future developments and current research investments. Similarly, a dynamically optimal abatement policy depends on the concurrent R&D strategy. The R&D and policy decisions are modeled simultaneously, allowing a classification of technology programs based on their interaction with the optimal internalization level. This classification leads to normative portfolio guidelines.

Interactive Sessions – Tuesday 12:30pm -1:30pm

Grand Ballroom

Chair: George Polak, Wright State University, george.polak@wright.edu

1- Coordination of Marketing and Production for Price and Leadtime Decisions
Pelin Pekgun,Georgia Institute of Technology, 765 Ferst Drive, Atlanta GA, United States, ppekgun@isye.gatech.edu, Paul Griffin, Pinar Keskinocak

We study a firm which serves customers that are sensitive to quoted price and leadtime, where pricing and leadtime decisions are made by marketing and production departments, respectively. We analyze the ineffciencies that are due to the decentralization of these two decisions under different organizational structures and explore coordination mechanisms.

2- Identifying Leading Indicators for Workers' Injury Rate
Mingming Lu,lengm@mcmaster.ca, Zhong Liu, Shanshan Wang, Anming Zhang

The Workers' Compensation Board (WCB) of British Columbia faces a number of risks regarding the occupational health insurances that it provides. These risks include increase in compensation expenses and inadequacy of premiums charged presently to cover future compensation. In order to mitigate these risks at an early stage and help the WCB with designing preventative actions, this study investigated potential leading indicators for the number of injuries in selected industry sub-sectors and those for injury types based on the analysis of historical injury data. Having measured the changes of identified leading indicators over time, we detected areas of high risk for injuries. A model for forecasting the number of injuries in these areas was developed.

3- The Missing Piece in Multimedia Tutorials for Spreadsheet Modeling
Linda Leon,Loyola Marymount University, College of Business Administration, One LMU Drive, Los Angeles CA, lleon@lmumail.lmu.edu, Kala C. Seal

We propose a four step pedagogy to maximize learning of spreadsheet skills outside of class: 1. Demonstrate (multimedia tutorials), 2. Practice (use interactive tools), 3. Evaluate (test the skills), and 4. Apply (build models using spreadsheets). We use Macromedia Captivate to create tutorials that include interactive simulations for step 2.

4- Using Simulation as Decision Tool for Capacity Planning at a Heart Investigations Unit

Lei Wang,University of Minnesota, 111 Church Street SE, Minneapolis MN, United States, wang0620@me.umn.edu, Amiram Gafni, Diwakar Gupta, Madhu Natarajan, Salim Yusuf

We develop a computer simulation model of patients' flow through the Heart Investigation Unit at the Hamilton General Hospital. This model is used to determine capacity requirements for keeping waiting times within desired targets, compare different assignment rules and study the impact of stressful events on patient waiting times.

5- Optimal Income Taxation with Multidimensional Taxpayer Types

Che-Lin Su,Northwestern University, CMS-EMS, Kellogg School of Management, Evanston IL 60208, United States, clsu@stanford.edu, Kenneth Judd

Beginning with Mirrlees, the optimal taxation literature has generally focused on economies where individuals are differentiated by only their productivity. We examine models where individuals differ in two or more characteristics. We find that the extra dimensionality produces substantively different results, such as negative MTR for some high productivity taxpayers.

6- Allocating Funds to HIV Interventions in Sub-Saharan Africa: How Many Lives Could You Save?

Arielle Lasry,Student, University of Toronto, 5 King's College Road, Dept. of Mech. & Industrial Engineering, Toronto ON M5S 3G8, Canada, arielle@mie.utoronto.ca, Michael Carter, Hui Zhang

In this session participants can allocate a (fictitious!) budget towards HIV programs within a population, witness the impact on the number of new infections, and compare with the optimal solution. This session also presents an audio interview describing the model, a photo exhibit of recent fieldwork, and handouts summarizing this work.

7- Djinni: A C++ Framework for Heuristic Optimization

Jeffrey Ohlmann,Assistant Professor, Department of Management Sciences, University of Iowa, Iowa City IA 52242, United States, jeffrey-ohlmann@uiowa.edu, Robert Hansen, Barrett Thomas

We present a prototype C++ framework to support the implementation of heuristic search methods for combinatorial optimization problems. Through object-oriented techniques such as inheritance, data encapsulation, and polymorphism, we create a modular structure possessing the necessary degree of abstraction to support extensibility.

8- Employment Protection and Labour Market Demand

Jussi Keppo,University of Michigan, IOE Department, 1205 Beal Avenue, Ann Arbor MI 48109, United States, keppo@umich.edu, Tim Maull

We analyze how firing costs as well as firing delays affect the labour market demand. We solve companies' optimal hiring and firing policies by using stochastic control. Then we study the effect of the labour market frictions by using estimated model parameters for different OECD countries.

9- A Parallel Algorithm for Coordinated Traffic Signal Control and Dynamic Route Guidance

Shih-Fen Cheng,University of Michigan, 1205 Beal Avenue, Ann Arbor MI 48109, United States, chengsf@umich.edu, Marina Epelman, Robert Smith

In this paper, the challenging problem of finding coordinated signal timing plans and dynamic routes at the same time is investigated. We employ the game-theoretic paradigm of fictitious play to iteratively converge to a locally optimal solution. Through parallelization, the algorithm is robustly scalable to realistic size networks modelled with high-fidelity simulations such as city of Troy, Michigan. Significant savings can be achieved by this combined approach.

10- Experiments with the RAMP Approach on Solving the Capacitated Minimum Spanning Tree Problem

Frank Mathew,Student (Doctoral Candidate), University of Mississippi, PO Box 4999, University MS 38677, United States, fmathew@bus.olemiss.edu, Fred Glover, Cesar Rego

Fundamental to the design of communication networks, the Capacitated Minimum Spanning Tree (CMST) problem has been extensively studied. Relaxation Adaptive Memory Programming (RAMP) is a relatively new metaheuristic approach that capitalizes on primal-dual relationships coupled with the adaptive memory programming structure of approaches like tabu search. We exploit variants of the RAMP approach to the CMST problem and present comparative results with state-of-the-art algorithms.

11- A General Queuing Network Model to Optimize Refurbishing Policies for Returned Products

Jumpol Vorasayan, PhD Candidate, Iowa State University, 2019 Black Engineering, Ames IA 50011-2164, United States, jumpolv@iastate.edu, Sarah Ryan

Many retail product returns can be refurbished and resold, typically at a reduced price. Although the perceived quality of refurbished products is not as high as that of new products, the refurbished products may attract significant demand at the appropriate price. However, in markets where consumers consider buying either new or refurbished products, cannibalization is a concern: the increase in demand for refurbished products could possibly cause a decline in the demand for new products and vice versa. While the price affects demand, the total production and inventory costs increase with the quantity of product returns refurbished. We focus on an original equipment manufacturer who sells both new and refurbished products directly to consumers, such as a computer maker who sells products online. New products are produced in a make-to-order policy while returned products will be refurbished and ready to ship to consumers immediately in a make-to-stock policy. We model the sale, return, refurbishment and resale processes in a general open queueing network and formulate a mathematical program to find the optimal price and proportion to refurbish. The general queueing model allows us to account for how the variability of each process affects other parts of the system. The numerical study shows the optimal policy's sensitivity to different refurbishing policies and the perceived quality of refurbished products. We identify scenarios where differentiating among returned products by their condition can reduce inventory cost and increase overall total profits.

12- Optimization of Production Allocation and Transshipment for a Leading Canadian Forest Products Company

Mehmet Aydinel,Centre for Operations Excellence, Sauder School of Business, University of British Columbia, 2053 Main Mall, Vancouver BC V6T 1Z2, Canada, mehmet.aydinel@coe.ubc.ca, Eric Cope, Mats Gerschman, Ximena Cerda Salzmann, Taraneh Sowlati, Qing Wu

The transshipment of final products is a significant cost factor for a company with geographically distributed production facilities and customer destinations. In collaboration with a leading Canadian forest products company, we developed a mathematical model to minimize the total cost of production and transshipment of different products while customer orders were satisfied; production capacity, transportation modes, sizes and availability were also considered in the model.

13- Heuristic and Exact Techniques for Solving a Temperature Estimation Model

COL Darrall Henderson, Academy Professor, United States Military Academy, Department of Mathematical Sciences, 626 Swift Road, West Point NY 10996, United States, Darrall.Henderson@usma.edu, Al Ortega, Cole Smith

This presentation demonstrates several techniques for solving a temperature estimation model. This model arises in the thermal analysis of electronic chip packages. First a heuristic technique that exploits the problem's structure is demonstrated. An exact method based on reformulation linearization is also presented along with extensions to improve performance.

14- Integrated Reconfiguration and Age-Based Preventive Maintenance Policy

Jing Zhou,Ph.D. Candidate, Mechanical Engineering Dept., the University of Michigan, Ann Arbor, 2125 Hayward Street, 1210 HH Dow, Ann Arbor MI 48105, United States, zhoujz@umich.edu, Jing Zhou, Dragan Djurdjanovic, Julie Ivy, Jun Ni

The decision makings on maintenance and reconfiguration in Reconfigurable Manufacturing Systems (RMS) are always disjoint in the literature. An integrated reconfiguration and age-based maintenance policy is proposed to a parallel-serial system for improved system-level cost and responsiveness. Numerical examples demonstrate that the system has a higher probability of fulfilling production requirements at a lower cost under the integrated policy compared to the purely age-based PM policy.

15- Simulation of Healthcare Facilities

Christos Alexopoulos,Professor, Georgia Tech, School of ISyE, Georgia Tech, Atlanta GA 30332, United States, christos@isye.gatech.edu, John Fontanesi, David Goldsman

We simulate a variety of healthcare facilities: a clinic serving inner-city poor, a large cancer treatment center, and a pediatric unit of a major hospital. We discuss characteristics that are common among these projects, leading to possible opportunities to develop templates for generic healthcare facility modeling.

Tuesday, 1:30pm - 3:00pm

■ TC01

H - Lobby Level, Plaza A

Tutorial: Solving Difficult Optimization and Counting Problems via the Cross-Entropy Method

Cluster: Tutorials
Invited Session

1 - Tutorial: Solving Difficult Optimization and Counting Problems via the Cross-Entropy Method

Dirk Kroese, The University of Queensland, Australia, kroese@maths.uq.edu.au

In this tutorial talk we give a gentle introduction to the cross-entropy method, emphasizing its simplicity and effectiveness in solving difficult combinatorial optimization and counting problems. Examples are #P-complete problems such as counting the total number of Hamilton cycles, determining the permanent of a matrix, and computing the number of self-avoiding random walks. We demonstrate that the CE method provides an important advancement in these types of problems.

■ TC02

H - Lobby Level, Plaza B

Data Evelopment Analysis: Methodololgy and Applications

Contributed Session

Chair: Alexander Vaninsky, Assistant Professor, Hostos CC, CUNY, Math Dept, Room 409 B, 500 Grand Concourse Ave., Bronx, NY, 10451, United States, avaninsky@hostos.cuny.edu

1 - Application of Data Envelopment Analysis to Textile Industry in India

Ranjan Ghosh, Professor, Indian Institute of Management, Joka, Diamond Harbor Road, Kolkata, WB, 700104, India, ranjan@iimcal.ac.in

This paper describes the application of DEA for analyzing the efficiency of firms in the Indian textile industry. The results obtained from the application of DEA were examined and conclusions arrived at in regard to the processes, and the managerial and operating practices of the firms identified as relatively efficient.

2 - Technical Efficiency of the Thai Cattle Farms

Wirat Krasachat, Assistant Professor, King Mingkut's Institute of Technology Ladkrabang, Department of Agribusiness, Ladkrabang, Bangkok, 10520, Thailand, kkwirat@kmitl.ac.th

The primary purpose of this study is to measure technical efficiency in Thai cattle farms. The data envelopment analysis (DEA) approach and farm-level cross-sectional survey data of Thai cattle farms in 2005 are used. The empirical results provide valuable information on efficiency levels, and also suggest that there are significant possibilities to increase efficiency levels in the Thai cattle farms. In addition, scale inefficiency makes a greater contribution to overall inefficiency.

3 - Data Envelopment Analysis: Cases in Polymer Processing

Mauricio Cabrera R"os, Associate Professor, Universidad Autònoma de Nuevo Leòn, Pedro de Alba S-N, FIME Edificio de Posgrado, San Nicolàs de los Garza, NL, 66450, Mexico, mcabrera@uanl.mx, José Castro

There is a large potential in the application of Data Envelopment Analysis in manufacturing. Several case studies in this paper show how effectively combining DEA with several other techniques such as finite element analysis and neural networks, it is possible to solve important design and variable setting problems in this area. Widespread use of DEA in the industry depends, however, on ease of use and an inexpensive implementation. A discussion on how to address these issues is presented here.

4 - Operational Performance Efficiency Measurements of Railway Transportation Systems: A DEA Approach

N. K. Kwak, Professor of Decision Sciences, St. Louis University, 3674 Lindell Blvd., St. Louis, MO, 63108, United States, kwakn@slu.edu, Chang W. Lee

This paper presents a model of operational performance efficiency measurements of railway transportation systems among the 23 UIC member countries. The model considers financial and non-financial variables in transportation business settings using as multiple inputs and outputs. It identifies and compares the best practice group among the peer group of countries. The proposed model facilitates managerial decision-making by providing valuable information.

5 - Concept of DEA-Neuron and its Application to Analysis of Economic Behavior

Alexander Vaninsky, Assistant Professor, Hostos CC, CUNY, Math Dept, Room 409 B, 500 Grand Concourse Ave., Bronx, NY, 10451, United States, avaninsky@hostos.cuny.edu

It is shown that Data Envelopment Analysis algorithm may be considered as a neuron with memory, that is a signal processor receiving DEA inputs and outputs and producing a normalized output signal, an efficiency index. This approach allows inclusion of DEA-processor into a neural network thus obtaining a new promising tool for analysis and forecasting of economic behavior. Suggested approach has advantage over conventional DEA in problems where variety of multi-faceted information is involved.

■ TC03

H - Ballroom Level, Continental Ballroom 1

Use of OR/MS Techniques for Designing Better Education Strategies

Contributed Session

Chair: Kristin Tolstad Uggen, Research Scientist, SINTEF Technology & Society, S.P.Andersens veg 5, Trondheim, 7465, Norway, ktu@sintef.no

1 - Modeling a Scheduling Problem for a Faculty Teaching Load

Maria Cristina Villalobos, Assistant Professor, University of Texas-Pan American, 1201 W. University Drive, Edinburg, TX, 78539, United States, mcvilla@utpa.edu, Kanadpriya Basu, Teena Sircar

We present a scheduling problem that distributes classes among the faculty in a math department. Currently, a faculty member assigns 192 classes to 48 instructors through trial and error by considering an instructor's teaching workload, the availability of classes, and instructor class preferences, as well as, other criteria. We model the problem as a linear program, having approximately 8000 binary variables and 450 equality and inequality constraints. Numerical results are presented.

2 - Multi-lingual Scientific Content Design with Focus on Integrated Support of Machine Translation

Torsten Reiners, University Hamburg, Von-Melle-Park 5, Institute of Information Systems, Hamburg, D, 20146, Germany, reiners@econ.uni-hamburg.de, Imke Sassen, Stefan Voss

Scientific learning modules imply certain requirements in terms of, e.g., multilingual (virtual) target groups, degree of interactivity or appliance to real-world scenarios. In particular, we focus in multinational education and research communities by demonstrating a preliminary prototype for an integrated support of machine translation during the authoring process, i.e., virtual (learning) environments.

3 - A Study on Patterns Followed by Team Members in Assorted Learning Environments

Tuba Pinar Yildirim, Ph.D. candidate, University of Pittsburgh, 1048 Benedum hall, Pittsburgh, PA, 15261, United States, tpy1@pitt.edu, Harvey Wolfe, Larry Shuman, Mary Besterfield-Sacre

In a related study, we showed that probability theory applied to work sampling can replace 100% behavioral observation in assessing process-oriented outcomes with no information loss. In this study, we use work sampling to observe patterns followed by teams in assorted learning and work environments and identify the stages of the teamwork process. Results of the research will facilitate the allocation of time and resources to teams adequately in educational and industrial milieu.

4 - A Constraint-Based System For The Hiring and Management of Graduate Teaching Assistants

Ryan Lim, University of Nebraska-Lincoln, 256 Avery Hall, University of Nebraska-Lincoln, Lincoln, NE, 68588-0115, United States, rlim@cse.unl.edu, Berthe Choueiry

We designed a constraint-based system for assigning graduate teaching assistants to academic tasks given their qualifications, availability, and preferences. Our system provides both interactive and automated solving strategies. The former propagates the effects of the user's decisions and presents only allowable choices. The latter comprises a number of complete and stochastic algorithms. We present the system and compare the algorithms' relative benefits in the context of our application.

5 - Structure of Upper Secondary Schools/high Schools in Norwegian Counties

Kristin Tolstad Uggen, Research Scientist, SINTEF Technology & Society, S.P.Andersens veg 5, Trondheim, 7465, Norway, ktu@sintef.no, Frode Romo, Lars Hellemo

The counties have economic responsibility for the structure of high schools and transportation and intake of pupils. SINTEF has made a model to be used by bureaucrats for calculating consequences of political proposals. Algorithms have been made to make a correct intake of pupils to the different schools and courses based on grades. We will present cost-analyses, algorithms, optimizations models and results.

■ TC04

H - Ballroom Level, Continental Ballroom 2

Using Excel to Solve Real World Problems

Sponsor: Military Applications
Sponsored Session

Chair: LtCol Jeffery Weir, Assistant Professor, Air Force Institute of Technology, AFIT/ENS Bldg 641, 2950 Hobson Way, Wright-Patterson AFB, OH, 45433, United States, jeffery.weir@afit.edu

1 - Minimizing Security Forces Response Times Through the Use of Facility Location Methodologies

SMSgt Michael Dawson, Air Force Logistics Management Agency, 501 Ward Street, Maxwell AFB, AL, 36114-3236, United States, Michael.Dawson@MAXWELL.AF.MIL

The problem of finding the optimal placement for security forces Fire Teams in support of ICBM maintenance operations is modeled as a facility location problem using Excel. Three approaches, maximum covering, p-center and p-median were modeled to give decision makers alternate methods to solve the problem based on their objectives. In this research, a penetrated Launch Facility represents a demand site and a Fire Team represents a servicing facility.

2 - Optimization Model for Base-level Delivery Routes and Crew Scheduling

LtCol Jeffery Weir, Assistant Professor, Air Force Institute of Technology, AFIT/ENS Bldg 641, 2950 Hobson Way, Wright-Patterson AFB, OH, 45433, United States, jeffery.weir@afit.edu, CPT Young-ho Cha

A new scheduling model and algorithm are provided as an approach to crew scheduling for a base-level delivery system with a single depot. A Microsoft Excel® application, the Daily Squadron Scheduler (DSS), was built to implement the algorithm. DSS combines generated duties with the concept of a set covering problem. It utilizes a Linear Programming pricing algorithm and Excel Solver as the primary engine to solve the problem.

3 - Supporting Interventions: Phase 0 - Phase 7

Dean Hartley, Hartley Consulting, 106 Windsong Ln, Oak Ridge, TN, 37830, United States, DSHartley3@comcast.net

Interventions range from peacetime engagement, thru stability operations, to self-sustaining peace. Civilian agencies and the military provide interventions in all phases, of varying absolute and relative levels and type. The Interim Semi-static Stability Model (ISSM) is a political, military, economic, societal, information, & infrastructure (PMESII) model that supports measuring, tracking, projecting and understanding the status of interventions in any phase and transition.

■ TC05

H - Ballroom Level, Continental Ballroom 3

Demand Modeling and Cost Reduction in Service Industry

Cluster: Service Sector Operations
Invited Session

Chair: Zuo-Jun Max Shen, University of California, IEOR, Berkeley, CA, 94720, United States, shen@ieor.berkeley.edu

1 - Inter-temporal Pricing with Strategic Customer Behavior

Xuanming Su, University of California, Berkeley, 545 Student Services Bldg # 1900, Berkeley, CA, 94720, United States, xuanming@haas.berkeley.edu

There is a firm who sells a finite inventory over a finite time horizon. The firm faces two types of customers: strategic customers are inter-temporal utility maximizers who may wait for sales, and myopic customers are one-time shoppers who either buy immediately or leave forever. We characterize: (i) the seller's optimal pricing, rationing, and capacity decisions, and (ii) customers' optimal purchasing decisions. The equilibrium depends critically on the composition of the customer pool.

2 - Optimal Location and Service Selection for Community Health Centers

Christina Scherrer, Southern Polytechnic State University, Industrial Engineering Technology, Marietta, GA, 30360, United States, cscherre@spsu.edu, Paul Griffin, Julie Swann

Community Health Centers (CHCs) are an important part of the government's plan to make health care more affordable. We analyze the impact of existing CHCs in the state of Georgia and determine the best location and medical service offerings of new CHCs using a network-based facility location approach. Competing objectives are modeled, including financial sustainability, medical need, and societal benefit of service.

3 - Real-Time Staffing of Virtual Call Centers

Matthew Keblis, Assistant Professor, Mays Business School, Texas A&M, Keblis@tamu.edu, Ying Li, William Stein

Although the adoption of the virtual call center (VCC) model has allowed call center operators to reduce housing and equipment costs, staffing costs have remained relatively unchanged. We present an auction based approach to the call center staffing and scheduling problem that enables call center operators to simultaneously decrease labor costs and increase service levels while also increasing measures of worker satisfaction.

4 - Product Availabity and Customer Demand Modeling in an Inventory Model

Zuo-Jun Max Shen, University of California, IEOR, Berkeley, CA, 94720, United States, shen@ieor.berkeley.edu, Xiaoyan Liu, J. George Shanthikumar

We study an inventory model of a retailer who considers the impact of product availability on customer purchasing behavior. There are two types of customers, "happy customers" and "unhappy customers", and the probability of an unhappy customer purchasing again in the next period is less than that of a happy customer. A customer's status may change depending on her last shopping experience. We present properties of the optimal inventory ordering policy.

■ TC06

H - Ballroom Level, Continental Ballroom 7

Closed-Loop Supply Chain Models

Cluster: Reverse Supply Chains
Invited Session

Chair: Geraldo Ferrer, Associate Professor of Operations Management, Naval Postgraduate School, Grad Sch of Business and Public Policy, IN-234 555 Dyer Rd, Monterey, CA, 93943, United States, gferrer@nps.edu

1 - Supplier Proactive Environmental Performance: Construct and First Results

Markus Biehl, York University, Schulich School of Business, 4700 Keele St, Toronto, ON, M3J 1P3, Canada, mbiehl@schulich.yorku.ca, Olga Kaminer, Ashwin Joshi

The effective management of the environment has to be viewed in the context of supply networks. We present the initial results of a study that investigates the impact of customer incentives on the environmental performance of suppliers. We discuss the mechanisms and their effectiveness, as well as the results of the manufacturer's actions. Initial evidence shows that using such incentives can result in benefits to both the manufacturer and the supplier.

2 - Framework for Integrated Decoupling of Closed-loop Supply Chains

Ou Tang, Associate Professor, Linköping Institute of Technology, SE 581 83, Linköping, Sweden, ou.tang@ipe.liu.se, Joakim Wikner

The customer order decoupling point (CODP) can be used in a number of situations and applications. In this paper, we make a first attempt to investigate how to position decoupling point in closed loop supply chains. After the CODP framework has been established, we can then classify the planning and control focus on the upstream and downstream of the supply chains. Case studies are used to demonstrate this approach.

3 - Controlling Product Returns from Pre-Sale Demonstrations

V. Daniel R. Guide, Jr., Assistant Professor, The Pennsylvania State University, Smeal College of Business, University Park, PA, 16802-3005, United States, drg16@psu.edu, Luc Muyldermans, Luk Van Wassenhove

For companies with substantial product returns from demos it is imperative to carefully integrate pre-sale and demo provision operations with reverse supply chain activities and to align incentives. In order to analyze the impact of an integrated approach as well as to uncover the major profitability drivers, we evaluate a simple network flow model.

■ TC07

H - Ballroom Level, California

Computational and Modeling Issues in Manufacturing Systems

Contributed Session

Chair: Anshu Jalora, Texas A&M University, 1100 Hensel Drive W3L, College Station, TX, 77840, United States, anshu@tamu.edu

1 - An Order Releasing Strategy for a Semiconductor Final Test Facility

Hsiao-Min Chuang, Doctoral Student, National Dong-Hwa University, #61, Chieh-lin 7th Street, Hualien City, 970, Taiwan, d9232003@em92.ndhu.edu.tw, Kung-Jeng Wang, Chun-chih Chiu

This study discussed the input model of the assembly and final test combined facility. Based on the test capacity constrained, we used genetic algorithms for finding device input optimization solutions. Experiments revealed that the proposed genetic algorithm efficiently can find better solutions than the conventional ones.

2 - Capacitated Part-Routing in the Presence of Process and Routing Flexibilities and Setup Costs

Aaron L. Nsakanda, Carleton University, 1125 Colonel by Drive, Ottawa, Canada, aaron_nsakanda@carleton.ca

We develop a lagrangean relaxation-based heuristic procedure to generate a near-optimal solution to large-scale capacitated part-routing problems through a cellular manufacturing system with both routing flexibilities and setup times. Several alternate process plans exist for each product. Any given operation can be performed on alternate machines at different costs. The part demands can be satisfied from internal production or through outsourcing. Numerical results are reported.

3 - Loss of Pooling Synergy in Cellular Manufacturing: The Labor Dimension

Nallan Suresh, Professor, SUNY at Buffalo, 326 F Jacobs Management Center, Buffalo, NY, 14260, United States, ncsuresh@buffalo.edu

This paper addresses the issue of overcoming pooling losses when designing cellular manufacturing systems. Much work has been done on pooling losses due to partitioning of machine pools to create cells. However, the labor pools also get partitioned, which again lead to pooling losses that need to be overcome by labor-related actions such as cross-training, labor flexibility chaining, labor assignment rules, etc. These investigated analytically and through simulation models in this paper.

4 - Multiple-point Product Differentiation Models under Stochastic Demand and Revenue

Bashar Al-salim, University of Nebraska-Lincoln, 175 Nebraska Hall, Lincoln, NE, 68588, United States, bashar2002@yahoo.com, Fred Choobineh

Product differentiation is a methodology for managing product variety and reducing cost. In this paper, a multi-point product differentiation model is developed for a multi-product system. We formulate a profit maximization mathematical programming model to determine the optimal points of differentiation. We assume the product revue follows a Geometric Brownian Motion. Finally, a parametric analysis is conducted to develop model insights.

5 - Order Acceptance at a Make-to-Order Manufacturing Facility

Anshu Jalora, Texas A&M University, 1100 Hensel Drive W3L, College Station, TX, 77840, United States, anshu@tamu.edu, Brett A. Peters

The current work looks at order acceptance and scheduling at a make-to-order manufacturing facility that delivers on exact due-dates. Efficient scheduling allows processing more orders and improving capacity utilization. However, when any order is processed in advance of its due-date warehousing costs are incurred. A stochastic approximation method has been developed that simultaneously determines in-house warehousing capacity, order acceptance and scheduling policy.

■ TC08

H - Ballroom Level, Imperial A

Inventory Models and Industry Equilibrium

Sponsor: Manufacturing & Service Oper Mgmt

Sponsored Session

Chair: Hong Chen, Professor, University of British Columbia, Sauder School of Business, 2053 Main Mall, Vancouver, BC, V6T1Z2, Canada, hong.chen@sauder.ubc.ca

1 - Provably Near-Optimal Sample-Based Policies for Stochastic Inventory Control Models

Retsef Levi, Postdoctoral Fellow, IBM Watson Research Center, P.O. Box 218, Yorktown Heights, NY, 10598, United States, retsef@us.ibm.com, David Shmoys, Robin Roundy

In this work we consider stochastic inventory control models under the assumption that the demand distributions are not known (no parametric assumption is taken). Instead there is a black-box that can generate independent samples from the demand distributions (this may correspond to available historical data or to a simulation setting). Using finite many samples, we compute provably near-optimal policies. The number of samples required does not depend on the demand distributions.

2 - Inventory and Substitution Decisions for Perishables

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

We compare four substitution policies and two replenishment policies in a model for perishables with separate demand streams for items of different ages. For each replenishment policy we provide conditions ensuring that one substitution option is better than the others, for an item with a two-period lifetime, making no restrictive assumptions on demand processes. We then compare our replenishment policies with the optimal state dependent replenishment policy in numerical experiments.

3 - Optimal Control and Competitive Equilibrium of Production-Inventory Systems

Owen Wu, Ph.D. Candidate, University of British Columbia, Sauder School of Business, 2053 Main Mall, Vancouver, BC, V6T1Z2, Canada, owen.wu@sauder.ubc.ca, Hong Chen

We study a competitive equilibrium production-inventory model with application to the petroleum refining industry. We first consider an individual firm's production and inventory control problem under uncertain input and output prices. We then model an economy with many identical production firms, and many price-taking suppliers and consumers. The competitive rational expectations equilibrium is established and characterized. We simulate the equilibrium behavior and fit it with actual data.

4 - Bricks-and-Mortar vs. Clicks-and-Mortar - An Equilibrium Analysis

Xiaona Zheng, Duke University, The Fuqua School of Business, 1 Towerview Drive, Durham, NC, 27708, United States, xiaona.zheng@duke.edu, Jing-Sheng Song, Fernando Bernstein

The Internet has provided traditional retailers with a new avenue to serve the customers. We consider an oligopoly model in which retailers may decide to launch an Internet channel (or, to align with a pure e-tailer). We find that the clicks-and-mortar model arises as the equilibrium structure. However, we show that this equilibrium may not imply higher profits for the firms - rather, in some cases, it emerges as a strategic necessity. We relate this result to the existence of barriers to entry.

■ TC09

H - Ballroom Level, Yosemite A

Coordinating Competitive and Dynamic Supply Chains

Cluster: Supply Chain Management

Invited Session

Chair: Xuan Zhao, Assistant professor, Wilfrid Laurier University, 75 University Ave. West, Waterloo, ON, N2L3C5, Canada, xzhao@wlu.ca

1 - Random Yield and Uncertain Demand in Decentralized Supply Chains

Charles Wang, Assistant professor, State University of New York at Buffalo, 352 Jacobs Management Center, University at Buffalo, Buffalo, NY, 14260-4000, United States, cxwang@buffalo.edu

We consider a supply chain comprised of a manufacturer and a retailer selling short life cycle products with random yield and uncertain demand. We identify some implications of random yield for the decentralized supply chain under RMI and VMI partnerships. We also compare the channel performance of the RMI and VMI supply chains and the integrated system.

2 - Consumer Surplus and the Price-setting Newsvendor: An Application to Influenza Vaccine Distribution
Harish Krishnan, Assistant Professor, University of British Columbia, 2053 Main Mall, Vancouver, BC, V6T 1Z2, Canada, harish.krishnan@sauder.ubc.ca

Influenza vaccine shortages frequently affect the U.S. market. Demand is uncertain and periodic, the vaccine is perishable, and manufacturing lead times are long; so manufacturers can be modeled as price setting newsvendors. Taking a social planner's perspective, consumer surplus under different market structures is analyzed. If manufacturers supply an identical product, competition can reduce surplus. This counter-intuitive result may be mitigated if manufacturers offer differentiated products.

3 - Coordinating Supply Chains under Multi-period Competition
Derek Atkins, Professor, University of British Columbia, Vancouver, BC, Canada, derek.atkins@sauder.ubc.ca, Xuan Zhao

We consider the coordination of competitive supply chains over multiple periods. We reflect on and combine two well-known results: 1. The set of equilibria achievable in repeated games is greater than available in the single period 'stage' game. 2. The decentralized supply chains can outperform integrated supply chains under conditions of fierce competition. We look at the equilibrium channel structure of competing supply chains in a repeated setting and offer some new results.

4 - Coordinating Supply Chains under Competition
Xuan Zhao, Assistant professor, Wilfrid Laurier University, 75 University Ave. West, Waterloo, ON, N2L3C5, Canada, xzhao@wlu.ca

This research studies contract design for supply chains under horizontal competition. We consider duopoly supply chains competing for the same uncertain market, and each includes an upstream supplier and a downstream retailer. We investigate a variety of contracts, and we find that different contract have different impact on the strategic behavior of the supply chains and hence influence the market equilibrium.

■ TC10

H - Ballroom Level, Yosemite B

Managing Supply Risk and Uncertainty

Cluster: Supply Chain Management
Invited Session

Chair: Sila Cetinkaya, Texas A&M University, Department of Industrial Engineering, College Station, TX, United States, sila@tamu.edu

1 - Effects of Sharing Demand Information for a Three-Level Supply Chain
Nesim Erkip, Professor, Bilkent University, Department of Industrial Engineering, Ankara, 06800, Turkey, nesim@bilkent.edu.tr, Sila Cetinkaya

Consider a buyer facing random demand, a first tier supplier (OEM manufacturer) and a second tier supplier (supplier of the OEM). We investigate the effect of buyer sharing her demand information with the supply chain under arbitrary contract structures all enforcing total satisfaction of the random demand. We are especially interested in depicting situations where buyer benefits sharing demand information with the second-tier supplier.

2 - Procurement Risk Management using Options: Random Spot Price and the Portfolio Effect
Qi Fu, HK University of Science and Technology, Clear Water Bay, Hong Kong, China, fuqi@ust.hk, Chung-Yee Lee, Chung-Piaw Teo

This paper examines the single-period optimal portfolio contract procurement problem when both the demand and spot market price mechanism are random. We study the optimal procurement strategy. More importantly, we show that the resulting optimal cost function has a simple geometric interpretation, which allows us to analyze the extent of the benefit of protfolio procurement and address the risk pooling effect of multiple buyers in portfolio procurement environment.

3 - Capacity Dynamics of Feed-Forward Flow Matching Networks Exposed to Random Disruptions
Martin Wortman, Professor, Texas A&M University, Industrial and Systems Engineering, College Station, TX, 77841-3131, United States, wortman@mwx.tamu.edu, Alex Savachkin

Capacity loss is the most profound influence on risk, within the commerce infrastructure. We offer a modeling paradigm suitable for capturing the stochastic dynamics of capacity in feed-forward flow-matching networks exposed to distuption. Particular emphasis is given to constructing the stochastic process characterizing capacity dynamics at point of delivery, which in conjuction with demand dynamics, provides the analytical foundation necessary to model network risk.

4 - Managing Supply Uncertainty under a Consignment Contract
Xingchu Liu, Consultant, Zilliant, Inc., 3815 South Capital of Texas HWY, Suite 300, Austin, TX, 78704, United States, liuxch@neo.tamu.edu, Sila Cetinkaya

We investigate the impact of supply uncertainty on a two-stage manufacturer-retailer channel and present a consignment contract under which the retailer sets the maximal stock level and shares the revenue and cost with the manufacturer to improve the system efficiency. The advantage of this contract is that the buyer does not need to know the distribution of supply uncertainty to design the contract.

■ TC11

H - Ballroom Level, Yosemite C

Bullwhip Effect in Supply Chain Management

Contributed Session

Chair: Tin-chung Huang, National Dong Hwa University, Institute of Business Administration, 1. Sec. 2. Da-hsueh Rd. Shou-Feng, Hualien, 974, Taiwan, d9232001@em92.ndhu.edu.tw

1 - The Impact of Order Variance Amplification/dampening on Lead Times and Safety Stock
Robert Boute, KULeuven, Naamsestraat 69, Leuven, 3000, Belgium, robert.boute@econ.kuleuven.ac.be, Steve Disney, Marc Lambrecht, Benny Van Houdt

We consider a two echelon supply chain (retailer/manufacturer). Inventory control policies at the retailer often transmit customer demand variability to the manufacturer, sometimes even amplified. When the manufacturer produces in a make-to-order fashion though, he prefers a smooth order pattern. But dampening the order variability inflates the retailer's safety stock due to increased inventory variance. We resolve these conflicting objectives by including endogenous lead times in the analysis.

2 - Reducing Supply Chain Bullwhip Effect via Information Market: Dynamic Implications
Yiling Chen, The Pennsylvania State University, School of IST, University Park, PA, 16802, United States, yxc194@psu.edu, Anthony Kwasnica, Tracy Mullen, Chao-Hsien Chu

It has been empirically proved that information markets can provide very accurate forecasts of future events. Combining information markets with supply chains may reduce the supply chain bullwhip effect. We use simulation to understand the dynamics of these markets and their impact on supply chain efficiency.

3 - Extending the Echelon-Stock Policy to Reduce Supply Chain Variability
Kai Hoberg, Muenster University, Universitaetsstrasse 14-16, Muenster, 48143, Germany, Kai.Hoberg@uni-muenster.de, Ulrich Thonemann, James Bradley

Our objective is to extend the echelon-stock policy to reduce the variability induced into the supply chain and to simultaneously consider the responsiveness to a step change in demand. We apply linear control theory to represent the inventory policy in a two-echelon supply chain by discrete transfer functions and to derive closed-form analytical expressions for different performance measures. Additionally, we show several properties and compare it to the original echelon stock policy.

4 - An Empirical Study of Main Board Industry on the Bullwhip Effect in Taiwan
Tin-chung Huang, National Dong Hwa University, Institute of Business Administration, 1. Sec. 2. Da-hsueh Rd. Shou-Feng, Hualien, 974, Taiwan, d9232001@em92.ndhu.edu.tw, Shao-ju Lee

Today, the market share of PC main board (MB) made in Taiwan is very amazing, so this research investigates the bottlenecks of MB manufacturers in Taiwan, and analyzes strategies as well as factors they may take into consideration. Besides, it also develops an ordering model to include lower-stream retailers and upper-stream suppliers in MB industry. From the viewpoint of minimizing inventory related costs, inventory strategies in each supply chain layer within the industry shall be considered.

■ TC12

H - 4th Floor, Union Square 1

Auctions in Supply Chains

Contributed Session

Chair: Farooq Sheikh, Bloomsburg University, 400 East Second Street, Bloomsburg, PA, 17815, United States, fsheikh@bloomu.edu

1 - Mechanism Design for Single-Value Domains

Moshe Babaioff, SIMS at UC Berkeley, 2 South Hall, Berkeley, CA, 94720, United States, moshe@sims.berkeley.edu, Ron Lavi, Elan Pavlov

In ``Single-Value domains", each agent has the same private value for all desired outcomes. We formalize this notion, and we study two informational models: where the set of desired outcomes is public ("known") or private ("unknown"). Under the "known" assumption, we present several truthful approximation mechanisms. We give a characterization of truthfulness for the "unknown" case, demonstrating that the difference from the "known" case is subtle and surprising.

2 - Iterative Multiattribute Auctions for Procuring Multi-unit Homogeneous Items

Zhuoxiu Zhang, Mississippi State University, P.O. Box 9542, Mississippi State, MS, 39762, United States, zz52@msstate.edu, Mingzhou Jin

This study is to develop iterative multi-attribute auctions for multi-unit homogeneous item procurement. A multi-unit allocation problem allowing order split among suppliers improves efficiency. This paper assumes additive structure of buyer value and supplier costs. Suppliers' bids are decomposed into separate prices for each attribute level. The supplier can provide discriminative price over unit based on their marginal costs. Numerical experiments show the effectiveness of the mechanism.

3 - Bidding For Partial Load In Multi-round Auctions for Transportation Services

Samik Raychaudhuri, University Of Wisconsin, Madison, 1513 University Avenue, Dept of ISyE, Madison, WI, 53706, United States, samik@freeshell.org, Raj Veeramani

In the context of transportation service procurement auctions, truckload carriers are often awarded partial quantity of truckloads of a lane or a lane bundle in spite of bidding on full load. In this research work, we consider different bidding scenarios for truckload carriers participating in auctions. We develop strategies for carriers for these scenarios when there is a possibility of partial award.

4 - Airline Ticket Pricing Explained

Farooq Sheikh, Bloomsburg University, 400 East Second Street, Bloomsburg, PA, 17815, United States, fsheikh@bloomu.edu

We use a variant of the second price auction of identical multiple units of a good to explain the common practise of airline ticket pricing based on revenue managment techniques.

■ TC13

H - 4th Floor, Union Square 5

Software Demonstration

Cluster: Software Demo

Invited Session

1 - ILOG Direct - See the NEW ILOG OPL Development Studio 4 and get a SPECIAL INSIDE PREVIEW of the Next CPLEX

Irv Lustig, Manager, Technical Services, ILOG Direct, 25 Sylvan Way, Short Hills, NJ, 07078, United States, ilustig@ilog.com

Join Irv Lustig, and members of the R&D team, to see the new ILOG OPL Development Studio 4 - the fastest way to develop, tune and deploy CPLEX-based optimization models. This session will also include a special inside preview of the upcoming new CPLEX. Simply incomparable. Come see why.

2 - Decisioneering, Inc.-Crystal Ball Software

Larry Goldman, Decisioneering, Inc., 1515 Arapahoe St., Ste. 1311, Denver, CO, 80202, United States, lgoldman@crystalball.com

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

■ TC14

H - 4th Floor, Union Square 6

Multicriteria Decision Making Analysis: Modeling and Applications II

Contributed Session

Chair: Christopher D. Geiger, Assistant Professor, University of Central Florida, Indus Engr & Mgmt Sys, 4000 Central Florida Blvd, Orlando, FL, 32816, United States, cdgeiger@mail.ucf.edu

1 - Reorganizing a Belgian Police District Using a Hypercube Approach

Mark Moonen, Research Assistant, Katholieke Universiteit Leuven, 4141 Etcheverry Hall #1177, Berkeley, CA, 94720, United States, mark.moonen@cib.kuleuven.ac.be, Dirk Cattrysse

We present how a Belgian police district uses queueing models to reorganize the operational functioning of their patrol units in line with guiding policing philosophies. Using a Hypercube queueing model we evaluate redrawing sector boundaries, changing dispatch procedures, capacity allocations and specific policy aspects, weighing different performance measures. Data is provided by a standardized national computer system, extending the potential market for the presented methodology.

2 - In Search for the Best Alliance Structure Between Banks and Insurance Companies

Raimo Voutilainen, Senior consultant, WM-data plc, Karvaamokuja 2, 00380 Helsinki, Finland, raimo.voutilainen@wmdata.fi

We study the problem of finding the best alliance structure between banks and insurance companies as a multi-criteria decision problem. We consider the points of view of management, supervisors and customers. We also study possible compromises for several decision maker groups. We use the Analytic Hierarchy Process and group expert panels to solve the problem. The optimal solution depends on the decision maker group, but financial conglomerate could be a compromise if certain conditions are met.

3 - Organizational Decision Making with Multiple Experts and Criteria

Ozlem Arisoy, PHD Candidate, University of Pittsburgh, 1048 Benedum Hall,, School of Engineering, Pittsburgh, PA, 15261, United States, oza1@pitt.edu, Bopaya Bidanda

Organizational decisions encompass problems with both tangible and intangible values, necessitating integration either by quantifying the intangible variables or by embedding the quantities in qualitative reasoning. In this study, we develop a novel method that provides a comprehensive and systematic approach to improve the foresight of current decision making theory by providing tools that integrate qualitative factors into mathematical modeling and ensuring the consensus of multiple experts.

4 - A Fast Multiobjective Evolutionary Algorithm Approach for Stochastic Problem Environments

Christopher D. Geiger, Assistant Professor, University of Central Florida, Indus Engr & Mgmt Sys, 4000 Central Florida Blvd, Orlando, FL, 32816, United States, cdgeiger@mail.ucf.edu, Hamidreza Eskandari, Mansooreh Mollaghasemi, Luis Rabelo

We present a new evolutionary algorithm for multiobjective optimization in stochastic environments. The algorithm, called stochastic Pareto genetic algorithm, uses new concepts of stochastic and significant dominance that we introduce for stochastic multiobjective problem domains. New search operators are also introduced to enhance the algorithm's performance in terms of convergence velocity. Computational results on a number of test problems are presented.

■ TC15

H - 4th Floor, Union Square 9

Order Scheduling and Scheduling in Robotic Cells

Cluster: Scheduling

Invited Session

Chair: Joseph Leung, Professor, New Jersey Institute of Technology, Department of Computer Science, Newark, NJ, 07102, United States, leung@cis.njit.edu

1 - Production-Distribution Scheduling with Unequal Order Weights

Zhi-Long Chen, Associate Professor, Robert H. Smith School of Business, University of Maryland, College Park, MD, 20742, United States, zchen@rhsmith.umd.edu, Guruprasad Pundoor

Most existing models on integrated production-distribution scheduling problems assume that each order has the same weight and hence the capacity of a delivery shipment is measured by the number of orders that can be carried by the shipment. We study several problems where orders have unequal weights and hence order batching alone becomes difficult. Complexity results and heuristics will be presented.

2 - Sequencing and Scheduling in Robotic Cells: Recent Developments

Milind Dawande, Associate Professor, University of Texas at Dallas, School of Management, P.O. Box 830688, Richardson, TX, 75083-0688, United States, milind@utdallas.edu, Chelliah Sriskandarajah, H. Neil Geismar, Suresh P. Sethi

We examine the recent results for robot move-sequencing and part-scheduling problems in robotic flowshop cells. In addition to reporting results on classical robotic cell scheduling problems, we include results on cells with advanced features such as dual gripper robots, parallel machines and multiple robots.

3 - Scheduling Orders in a Dedicated Machine Environment to Minimize the Total Weighted Completion Time

Joseph Leung, Professor, New Jersey Institute of Technology, Department of Computer Science, Newark, NJ, 07102, United States, leung@cis.njit.edu, Haibing Li, Michael Pinedo

We consider the problem of minimizing the total weighted completion time in a dedicated machine environment. We first show that the problem is strongly NP-hard for three or more machines. We then consider five heuristics and show that they are all m-approximation algorithms. Constant bounds are derived for special cases. Finally, the heuristics are evaluated empirically. It is shown that one of the heuristics has extremely good performance.

4 - Approximation Algorithms for Minimizing the Total Weighted Completion Time of Orders on Identical Machines

Michael Pinedo, Professor, New York University, Stern School of Business, New York, NY, 10012, United States, mpinedo@stern.nyu.edu, Joseph Leung, Haibing Li

We consider the problem of minimizing the total weighted completion time in a flexible machine environment. Because the problem is strongly NP-hard, we focus on the design and analysis of fast heuristics. We consider static sequential heuristics and dynamic sequential heuristics. It is shown that one class of heuristics have a worst-case bound of 2-1/m, while all others have a worst-case bound of m. Finally, one heuristic is shown to have superior performance in an empirical study.

■ TC16

H - 4th Floor, Union Square 10

Special Topics in Production & Scheduling

Contributed Session

Chair: Zichao Li, National University of Singapore, #08-216, Blk 289A, Bukit Batok Street 25, Singapore, 650289, Singapore, g0308089@nus.edu.sg

1 - A Comparative Analysis of Scheduling Rules for SCM

Katariina Kemppainen, Helsinki School of Economics, Department of Business Technology, Runeberginkatu 22-24, Helsinki, 00100, Finland, katariina.kemppainen@hse.fi, Ari P.J. Vepsalainen

Tightening of service level and lead time goals, limited visibility, and misaligned incentives force companies to search for simple and efficient scheduling rules, especially in the context of supply chains. We test the performance of scheduling rules that have been selected based on a new classification system in various production environments. Findings about the commonalities and applicability of the policies into inter-organizational scheduling are discussed.

2 - Philosophies and Systems for Production Planning, Scheduling, and Control: A Brief Overview

Guilherme Vieira, Associate Professor, Catholic University of Parana, Imaculada Conceicao 1155, Curitiba, PR, 80215901, Brazil, gui.vieira@pucpr.br, Fàbio Favaretto, Osvaldo Corrêa Netto

The paper presents an overview about main concepts of philosophies and systems for production planning, scheduling and control. Its objective is to refresh the reader's mind with the most recent concepts in operations management that can and must be applied in most companies. The paper quickly reviews some common terms, like production scheduling and control, just-in-time and optimal production technologies, and production information systems in general, such as MRP, MRPII and ERP systems.

3 - Solving a Production Scheduling Challenge with Project Scheduling - Genetic Algorithms Heuristic

Ekundayo Shittu, Research Assistant, University of Massachusetts, Mechanical & Industrial Engineering Dept, Amherst, MA, 01003, United States, eashittu@engin.umass.edu

A Genetic Algorithms (GA) procedure for finding a feasible, near-optimal schedule is presented. The GA approach employs special chromosomes which differ from conventional type by their 3-D characteristic. The Selection process is elitist with single-point crossover and sequence-defined mutation on low probability. Constraints are handled with a penalty that negates the chromosome fitness. The performance of this GA heuristic is compared to an optimal solution procedure running GAMS/CPLEX.

4 - Alternative Mobile Device Schedule Prediction by Using the Compliance Information

Song-Kyoo Kim, Senior Engineer, Samsung Electronics, 94-1 Imsoo-Dong, Gumi, South Korea, amang@paran.com

This paper deals with the statistical forecasting method that is based on congruent random distributions of two different subjects. The estimation of a target approval date is one of most important part for schedule the development procedure. This research shows the relationship between the compliance rate and TA (Target Approval) date based on statistical congruent feature.

5 - Dynamic Maintenance Scheduling for Critical Oil Production Equipment

Zichao Li, Georgia Institute of Technology, School of Industrial and System Engineering, Room 615B, 301 10th Street, NW, Atlanta, United States, zli@isye.gatech.edu

Regular and irregular breakdown of oil pumps have largely affected the global oil production. This paper presents a solution using two level multi-objective co-evolutionary algorithms (EA) to solve both static and dynamic scheduling pumps. The job/flow shop scheduling based strategy introduced by author consists of two parts - a Genetic Algorithm(GA)for the schedule optimization and a second EA for the parameter co-evolution.

■ TC17

H - 4th Floor, Union Square 11

Issues in Information & Knowledge

Contributed Session

Chair: Hsiu-Yueh Sonya Hsu, Doctoral Candidate, Southern Illinois University, Management Department, Carbondale, IL, 62901, United States, sonyah@siu.edu

1 - The Metric Foundation of Information Economics

John Lundin, Assistant Professor, SJSU, One Washington Sq 0244, San Jose, CA, 95192, United States, lundin_j@cob.sjsu.edu

Information Economics supplements Materials and Process Economics (the traditional Economics) and complements financial models of the enterprise. This paper proposes a framework for Information Economics as a foundation for both assessment of current and future information technology alternatives, and creation of more robust enterprise performance metrics to capture the information component of today's products and services.

2 - Examining Institutional Choices and Scientific Process: Patent Policy in the Human Genome Project

Kenneth G Huang, Ph.D. Candidate in Technology, Management and Policy, Massachusetts Institute of Technology, 64 Frost Street #2, Cambridge, MA, 02140, United States, ghuang@mit.edu, Fiona Murray

This paper examines a central question in diffusion and accumulation of scientific knowledge — impact of strategic institutional patenting choices on that process. The Human Genome Project, a 13 year, $3.8 billion and a most significant life science research is the setting. The seven matched genome centers are critical in knowledge diffusion and an institutional pro-patenting policy does not stifle its use and dissemination. It contributes to technological innovation and commercialization.

3 - Early Warning Signals for Outsourced IT Projects - A management Perspective

ramamurti sridar, Adjunct Faculty, San Jose State University, one washington sqaure, san jose, ca, 95192, United States, rsridar@aol.com

The growth of outsourcing in Information Techncology industry is unabated. While it is legitimate to focus on the true intent of outsourcing - share global resource pool, labor cost savings, one needs to pay attention to what can go wrong in the outsourcing venture. There are four key early warning signals one can observe that includes service degradation, resource turnover, security breach, and incompetent project management.

4 - Robust Stochastic Games

Erim Kardes, Ph.D.Student, USC, 7120 Hollywood Blvd, Apt 5, Los Angeles, CA, 90046, United States, kardes@usc.edu

This paper focuses on incomplete information stochastic games, and presents a robust approach to account for uncertainty in the data of the game. Uncertain transition probabilities and payoffs that belong to convex hull sets are considered. We prove existence of equilibrium points and present a new formulation to solve robust stochastic games. Comparison of robust and nominal solutions for a small example is presented subsequently.

5 - Knowledge Management and Intellectual Capital
Hsiu-Yueh Sonya Hsu, Doctoral Candidate, Southern Illinois University, Management Department, Carbondale, IL, 62901, United States, sonyah@siu.edu

Neoclassical economics brings up the importance of knowledge and "capital" to the business processes. This research attempts to divide intellectual capital (IC) from knowledge management (KM) before integrating these two concepts. To establish an integral framework is an ultimate goal. Drawn from resource-based view, the focus is to examine the effects of human/innovation capital on organizational effectiveness in the mediation of knowledge process capabilities and structural capital.

■ TC18

H - 4th Floor, Union Square 12

Predicting Air Transportation System Performance I

Sponsor: Aviation Applications
Sponsored Session

Octavio Richetta, Associate Professor of Management Science, U. Mass. - Boston, 100 Morrissey Blvd., MSIS Department, Boston MA 02125, octavio.richetta@umb.edu

1 - Impact of Variations in the Terminal Area Forecasts on Modeled National Airspace System Performance
Glenn Foster, Senior Staff, The MITRE Corporation, 7515 Colshire Drive, McLean, 22102, United States, glennf@mitre.org, David Millner, Jerry Freedman, William Baden, Lorrie Smith, Michael Callaham

We examine the impact of variations in the FAA's Terminal Area Forecasts (TAF) on the results of simulation runs of the National Airspace System (NAS). We consider the variations in the TAF forecasts from 1998 to 2004 and evaluate their impact on delays at individual airports and in the NAS.

2 - Goal-Oriented Performance Metrics for Air Traffic Flow Management
Robert Hoffman, Metron Aviation, Herndon, VA, Hoffman@metronaviation.com, Bert Hackney

With the FAA's move toward a performance-based organization, there is a need to demonstrate the value of present and proposed investments in traffic flow management. TFM metrics comprise such things as diversions, arrival delays, and unused ground delay program slots. However, it can be difficult to extract meaningful statistics that do not simply scale with weather or traffic volume. We present novel metrics focused on the need to track progress in TFM programmatic improvements.

3 - Estimating Flight Delay Distributions for Multiple Airports and Airlines
Yufeng Tu, Ph.D. Candidate, University of Maryland, The Robert H. Smith School of Business, University of Maryland, College Park, MD, 20742-181, United States, ytu@rhsmith.umd.edu, Michael Ball, Wolfgang Jank

In this paper we present an extension of our previous approach for estimating flight departure delay distributions. Such distributions are required for air traffic congestion prediction models. The previous approach analyzed a case study of United Airlines and Denver International Airport and demonstrated reasonable goodness of fit and robustness. We extend this work to multiple airlines and airports by employing nonparametric methods (Functional Data Analysis).

4 - Optimal Algorithms for the Ground-Holding Problem with Nonlinear Delay Costs
Octavio Richetta, Associate Professor of Management Science, U. Mass. - Boston, 100 Morrissey Blvd., MSIS Department, Boston MA 02125, octavio.richetta@umb.edu

We present stochastic programming models for the ground-holding problem with nonlinear ground and air delay cost functions. We explore the computational complexity of the models and conditions under which the linear programming relaxation yields integer solutions that are compatible with the Collaborative Decision Making - Enhanced Ground Delay Program.

■ TC19

H - 4th Floor, Union Square 13

Entrepreneurship

Sponsor: Technology Management
Sponsored Session

Chair: Moren Levesque, Assistant Professor of Entrepreneurship and of Operations, Case Western Reserve University, 10900 Euclid Avenue, Cleveland, OH, 44106, United States, mxl101@cwru.edu

1 - Market Share and Market Demand in Nascent Industries
John Angelis, Case Western Reserve University, 10900 Euclid Avenue, Cleveland, OH, 44106, United States, john.angelis@case.edu

Entrepreneurs strive to maximize their profits by increasing market share. However, unlike oligopolists in mature industries, they also can maximize their profits by convincing new customers to enter the market. This paper will investigate financial investment strategies and tradeoffs between increasing market share and stimulating primary demand. We also look at how contractual spillover profits from the new customers can affect the optimal solution.

2 - Putting the Choice Between Exploration and Exploitation in Context
David Deeds, Associate Professor, University of Texas at Dallas, P.O. Box 830688, Richardson, TX, 75083, United States, dxd52@po.cwru.edu, Joseph Coombs

We study the impact of explorative and exploitative search on a technology venture's ability to develop new products in different geographic regions of varying levels of munificence. We develop a model of search strategies whose benefits are contingent upon the characteristics of the local region and test it on a sample of 174 US-based pharmaceutical biotechnology firms.

3 - Entrepreneurship and Aggregate Economic Activity
Moren Levesque, Assistant Professor of Entrepreneurship and of Operations, Case Western Reserve University, 10900 Euclid Avenue, Cleveland, OH, 44106, United States, mxl101@cwru.edu, Maria Minniti

Endogenous growth theory provides many occasions to appreciate the role played by entrepreneurship in the growth process. And yet, entrepreneurs have remained surprisingly neglected. Smaller and entrepreneurial firms, however, are crucial for the long run competitiveness of a country. The purpose of this paper is to point out the macroeconomic implications of entrepreneurial behavior.

■ TC20

H - 4th Floor, Union Square 14

Economic Models of Distributed Energy Resources

Sponsor: Energy, Natural Resources & the Environment / Energy
Sponsored Session

Chair: Afzal Siddiqui, Lecturer, University College London, Dept. of Statistical Science, Gower Street, London, WC1E 6BT, United Kingdom, afzal@stats.ucl.ac.uk

1 - Optimal Real-Time Dispatch for Integrated Building Energy Systems
Ryan Firestone, Graduate Student Research Assistant, Lawrence Berkeley National Laboratory, 1 Cyclotron Road, MS 90-4000, Berkeley, CA, 94720-8061, United States, RMFirestone@lbl.gov

Distributed generation - the practice of on-site electricity generation - can offer economic and energy savings over the conventional consumption of utility electricity. Economically optimal operation will depend on site-specific details regarding energy loads, tariffs, and policy, equipment performance, and load curtailment options and costs. Hedging behavior is required to address uncertainty. This paper proposes a generic approach to optimal dispatch for integrated building energy systems.

2 - A Stochastic Model for Customer Adoption of Distributed Generation
Karl Magnus Maribu, Ph.D. Student, Norwegian University of Science and Technology, NO-7034, Trondheim, Norway, karl.maribu@elkraft.ntnu.no

Using a stochastic model the effect of long-term uncertainty in natural gas and electricity prices on optimal distributed generation system and profitability is studied. Natural gas fueled technologies are exposed to volatile natural gas prices but have operational flexibility. Photovoltaic units have no operational flexibility but their value can be less exposed to natural gas price volatility. The optimal solution can be a combination of technologies and is robust to the different scenarios.

3 - Operation of Distributed Generation Under Stochastic Prices
Afzal Siddiqui, Lecturer, University College London, Dept. of Statistical Science, Gower Street, London, WC1E 6BT, United Kingdom, afzal@stats.ucl.ac.uk

We model the operating decisions of a commercial enterprise that needs to satisfy its periodic electricity demand with either on-site distributed generation (DG) or purchases from the wholesale market. While the former option involves electricity generation at a deterministic cost from a set of capacity-constrained DG technologies, the latter implies unlimited open-market transactions at stochastic prices. A stochastic dynamic programme is used to solve the resulting optimisation problem.

4 - A Stochastic Programming Approach for Electricity Generation Scheduling with Wind Power Generation
François Bouffard, McGill University, 3480 University St., Room 633, Montreal, QC, H3A 2A7, Canada, francois.bouffard@mcgill.ca, Francisco D. Galiana

Short-term electric power systems operation planning is evolving in response to the increasing integration of intermittent generation resources, wind power being the prime example. In this paper, we formulate a stochastic unit commitment problem as a means to incorporate the randomness of the wind into day-ahead scheduling. This approach permits optimizing the benefits of wind power while ensuring reliable system operation.

■ TC21

H - 4th Floor, Union Square 15

Data Mining in Manufacturing and Logistics

Sponsor: Data Mining
Sponsored Session

Chair: Myong K. Jeong, Assistant Professor, Univesity of Tennessee, Industrial and Information Engineering, 311 East Stadium Hall, Knoxville, TN, 37996-0700, United States, mjeong@utk.edu

Co-Chair: George Runger, Arizona State University, Arizona State University, Tempe, AZ, 85287-5906, United States, runger@asu.edu

1 - Supervised Rule Discovery to Explain Rare Events in Process Data
Abdelaziz Berrado, PhD Candidate, Arizona State University, Department of Industrial Engineering, Arizona State University, P.O. Box 875906, Tempe, AZ, 85287-5906, United States, berrado@asu.edu, George Runger

Learning predictive models is not always an efficient approach to explain rare events in massive, high dimensional and heterogeneous process data. As an alternative, we discretize continuous data and integrate classification and association rules mining to associate operating conditions with process performance measures. Once organized, the discovered rules form a Glass Box model that is more actionable and less complex than traditional predictive models.

2 - Using the Power of Data Mining to Explain Employee Retention
Bradley Utz, Schneider National, Inc., 3101 S. Packerland Drive, P.O. Box 2545, Green Bay, WI, 54306-2545, United States, utzb@schneider.com

For any business to prosper, skilled and motivated employees are an essential resource of the enterprise. Retaining employees is a critical concern, for experience is difficult to replace. Data mining enables a business to use historical operational data to analyze those factors that cause an employee to stay. This paper examines an ongoing application of clustering, classification, and regression techniques to explain retention in experienced employees.

3 - Ensemble Methods to Model a Fermentation Process
Stina W. Andersen, Arizona State University/Novo Nordisk, Denmark, Department of Industrial Engineering,, Tempe, AZ, 85287, stina@asu.edu, George Runger

Fermentation processes are often modeled and monitored using methods based on projection to latent structures. However, the interpretation of the latent variables can be difficult. Here we present an alternative method to modeling fermentation processes using novel data mining techniques based on ensembles of decision trees. The performance of the proposed method is compared to the popular latent variable techniques.

4 - Motor Shaft Misalignment Prediction Using On-line Support Vector Regression
Olufemi A. Omitaomu, Ph.D. Candidate, University of Tennessee, Industrial and Information Engineering, Knoxville, TN, 37996, United States, omitaomu@utk.edu, Myong K. Jeong, Adedeji B. Badiru, J. Wesley Hines

We present an on-line support vector regression approach for shaft misalignment prediction. This approach has the capability of enhancing rotating machinery maintenance design through timely and accurate information about incipient faults. The approach is demonstrated with a case study using high-dimensional power spectrum data. The results show that the approach is effective for predicting motor shaft alignment state that is defined by a shaft misalignment monitoring index.

■ TC22

H - 4th Floor, Union Square 16

Joint Session DMA/DM: Data Mining Applications in Developing Countries

Cluster: Data Mining Applications, Data Mining
Invited Session

Chair: Kweku-Muata Osei-Bryson, Professor, Virginia Commonwealth University, 1015 Floyd Avenue, Richmond, VA, 23284, United States, kmuata@isy.vcu.edu

1 - Transforming Mineral Processing through Data Mining
Francis Kofi Andoh-Baidoo, Virginia Commonwealth University, 1015 Floyd Avenue, P.O. Box 844000, Richmond, VA, 23284, United States, andohbaidoof@vcu.edu

Data mining is a proven approach for analyzing the vast amount of data that is presented to the mineral processing engineer. We discuss how various data mining techniques can be employed to analyze data from a typical gold processing plant to enhance the production and recovery of gold.

2 - Determining the Factors that Affect Adult Literacy in Jamaica
Lila Rao, Lecturer, University of the West Indies, Mona, Kingston, 7, Jamaica, lila.rao@uwimona.edu.jm, Gunjan Mansingh

The level of adult literacy is an ongoing concern for national and business leaders for many countries, including developing countries such as Jamaica. In this study data mining techniques will be applied to explore the relationships between various socio-economic and demographic factors and adult literacy.

3 - Telecommunications Infrastructure and Economic Growth in Developing Countries: A Data Mining Approach
Muhammadou Kah, Rutgers University, School of Business-Camden, 227 Penn Street, Camden, NJ, 08026, United States, mkah@camden.rutgers.edu, Jainaba Kah, Kweku-Muata Osei-Bryson

In this paper, we apply data mining techniques to investigate how telecommunication infrastructure affects economic growth in developing countries. We use evidence from selected developing countries over the past twenty five years to examine the impacts that telecommunications developments may have had.

4 - Providing Guidance for Bauxite Treatment Operations in Jamaica
Kweku-Muata Osei-Bryson, Professor, Virginia Commonwealth University, 1015 Floyd Avenue, Richmond, VA, 23284, United States, kmuata@isy.vcu.edu, Maurice Bryson

Many countries that have bauxite mines export the ore to other countries for further processing. Typically before shipping, some water content is removed so as to reduce shipping cost. In this study data mining is used to identify relationships that can be used by operators to meet shipping cost goals.

■ TC23

H - 4th Floor, Union Square 17

Optimization Problems in Wireless Networks

Sponsor: Telecommunications
Sponsored Session

Chair: Eli Olinick, SMU, P.O. Box 750123, Dallas, TX, 75275, United States, olinick@engr.smu.edu

1 - A Virtual SONET Model for Ad Hoc Network Management
Michael Bartolacci, Associate Professor of IST, Penn State University, P.O. Box 7009, Tulpehocken Rd., Reading, PA, 19610, United States, mrb24@psu.edu, Vassiliki Cossiavelou

The authors propose a model for clustering ad hoc network nodes into virtual clustered "rings" in order to facilitate traffic routing and network management. The logical ring structure has advantages similar to the rings of a SONET network in that some fault tolerance is gained through bi-directional routing and linking of rings.

2 - Branch-and-Price-and-Cut for the Multi-Period Traffic Routing Problem in Satellite Networks
Ioannis Gamvros, Smith School of Business, University of Maryland, igamvros@rhsmith.umd.edu, S. Raghavan

Satellite networks consist of a set of geostationary satellites at specific longitudes. Each satellite has a specific set of channels that can connect particular pairs of regions. We consider a complex multi-period traffic routing problem that arises in satellite networks and presents new challenges compared to routing problems in terrestrial networks. We develop a (multi-period) path-based multi-commodity integer programming formulation and develop a branch-and-price-and-cut solution procedure.

3 - Reliable W-CDMA Network Design
Qibin Cai, Southern Methodist University, 6425 Ownby Drive, Room 321, Dallas, TX, 75206, United States, qcai@smu.edu, Jeffery Kennington, Joakim Kalvenes, Eli Olinick

We present a W-CDMA network design model that maximizes revenue net the cost of building and maintaining a network infrastructure to provide reliable communication subject to capacity and quality of service constraints is developed. We present empirical results for several IP-based heuristic solution procedures.

4 - Base Station Deployment in Tiered CDMA Cellular Networks
Rosemary Berger, Lehigh University, Industrial and Systems Engineering, 200 W. Packer Ave., Bethlehem, PA, 18015, United States, rtb3@lehigh.edu, Shalinee Kishore

We study the problem of where to locate a new base station within an overloaded single macrocell system. We present an integer programming model to determine an optimal location for a new base station so as to maximize the number of users supported subject to quality of service constraints on the uplink. We present an approach for solving the model and provide computational results.

■ TC24

H - 4th Floor, Union Square 18

Financial Engineering Models

Contributed Session

Chair: Joel Polanco, Arizona State University, Electronics Assembly Laboratory, Department of Industrial Engineering, Tempe, AZ, 85287, United States, jpolanco@asu.edu

1 - Pricing and Hedging Bond Options under Transaction Costs
Jaemyoung Kim, Ph.D.Candidate, Stanford University, P.O.Box 11596, Stanford, CA, 94309, United States, jmkim21@stanford.edu

We consider a bond option as a claim to exchange two bonds at maturity and formulate the hedging problem as a singular stochastic control problem. For the sake of computation, we transform the problem to an optimal stopping problem. This results in optimal trading boundaries of the underlying asset from which we can derive bounds on the value of a bond option using self-financing argument. Our work also gives us an optimal hedging strategy and rebalancing timings.

2 - License Valuation in the Aerospace Industry: A Real Options Approach
Luke Miller, Assistant Professor, Fort Lewis College, 1000 Rim Drive, Durango, CO, 81301, United States, lukemiller@sandiego.edu

This paper discusses a practical case application of real options applied to license valuation in the aerospace maintenance, repair, and overhaul industry. After categorizing the available licensing opportunities of the firm, four distinct licensing classes are identified: traditional delay licenses, contingent investment licenses, licenses with cost uncertainties, and indefinite delay licenses.

3 - Capacity Management through Real Options
Joel Polanco, Arizona State University, Electronics Assembly Laboratory, Department of Industrial Engineering, Tempe, AZ, 85287, United States, jpolanco@asu.edu, Rene Villalobos, George Runger, Karl Kempf

The incorporation of financial and real options theory as a means to coordinate channels has become a hot topic in operations research. Options create ordering flexibility between the buyers and sellers of different goods as they allow all firms to schedule their production or service activities much more efficiently. In this talk, the authors will present some results of a revenue maximization methodology that applies real options to fixed capacity systems.

4 - Optimal Dynamic Allocation Between Taxable and Nontaxable Assets
Zhidong Wang, Columbia University, Graduate School of Business, Uris Hall 4F, 3022 Broadway, New York, NY, 10027, United States, zw35@columbia.edu, Mark Broadie

We study the optimal policy for dynamic allocation between taxable and nontaxable assets. The optimal policy can be simply described with "target lines". We also derive the analytical solution for the optimal policy just prior to the terminal date. Computational results are presented to illustrate characteristics of the optimal policy and the performance of the optimal policy and some heuristic policies.

■ TC25

H - Ballroom Levell, Franciscan D

Innovations in Education

Contributed Session

Chair: Thomas Groleau, Associate Professor, Carthage College, 2001 Alford Park Drive, Kenosha, WI, 53140, United States, tgroleau@carthage.edu

1 - Teaching Introductory Quantitative Courses Via Distance Learning
John Lawrence, Professor, California State University, Fullerton, Dept. of ISDS, Fullerton, CA, 92834, United States, jlawrence@fullerton.edu, Nicholas Farnum

An increasing number of introductory statistics and management science courses are being taught by distance learning. What factors should one consider in designing such courses? What time commitments are required? What can one reasonably expect from distance learning courses? These and other questions are addressed based on results from over five years of distance learning teaching experience.

2 - Teaching Enterprise Decision-Making using ERP-Based Modules
Sharon Johnson, Associate Professor, Worcester Polytechnic Institute, Department of Management, Worcester, MA, 01609, United States, sharon@wpi.edu, Diane Strong, Jamshed Mistry

We describe a framework for teaching enterprise decision-making using ERP-based modules linked through a common case scenario. Each module is situated in an organizational process, e.g., the supply chain and order fulfillment process, and involves students in hands-on exercises that explore the integrated, process-oriented, data-rich environment typical of modern organizations. We report results from our pilot study testing the feasibility of this approach with two decision-making modules.

3 - Marketing OR/MS on College Campuses
Dawn Strickland, Assistant Professor, Winthrop University, 156 Bancroft, Rock Hill, SC, 29733, United States, stricklandd@winthrop.edu

Many gifted students graduate and pursue other careers because they simply never know about the field of OR/MS. We discuss why and where this happens, and what can be done to fix it in order to grow the profession.

4 - The Bread/Flour/Grain Trading Game —Bidding In and Designing Auction Events
Hannele Wallenius, Professor, Helsinki University of Technology, Otaniementie 17, Espoo, 02015 HUT, Finland, hannele.wallenius@tkk.fi, Jyrki Wallenius, Jeffrey Teich

Strategic sourcing and more specifically, e-procurement have become part of standard industry practice in recent years with the use of forward and reverse auction events. Training materials and games to teach participants to bid in and design such events, however, has been limited. We have developed a Bread/Flour/Grain trading game for instructors to use. This game imparts design and bidding experience, which students can then apply to real world auction events.

5 - Using Mock Debates in the Classroom to Explore Ethics and Intellectual Property Rights
Thomas Groleau, Associate Professor, Carthage College, 2001 Alford Park Drive, Kenosha, WI, 53140, United States, tgroleau@carthage.edu

This paper reports on using mock debates in a unit on ethics in a junior-level Information Systems course. The unit utilized verbal debates between student groups were students were randomly assigned to defend specific stances. The unit also required students to respond to an instructor's presentation that opposed continued efforts to protect intellectual property. Students were given a pre-unit and post-unit survey to gauge any change in attitudes toward intellectual property rights.

■ TC26

H - Ballroom Level, Continental Ballroom 4

Some Applications and Modeling Issues in Statistics/Quality Control

Contributed Session

Chair: Jianming Ma, The University of Texas at Austin, Department of Civil Engineering, 1 University Station C1761, Austin, TX, 78712-0278, United States, mjming@mail.utexas.edu

1 - Statistical Analysis of Residential Duct Leakage Methods
Jinson Erinjeri, Graduate Research Assistant, Louisiana Tech University, P.O Box 3178, Ruston, 71272, United States, jinson_je@yahoo.com, Raja Nassar, Norman Witriol, Myron Katz

The three most commonly used test methods (Manual, APT, and Combined) to determine residential duct-leakage-to-outside are compared using parametric and non-parametric statistical techniques. The objective is to determine how well one method predicts the results of the other methods.

2 - Economic Development of Specifications for 100% Inspection
Qianmei Feng, Assistant Professor, University of Houston, Department of Industrial Engineering, E206 Engineering Bldg 2, Houston, TX, 77204, United States, qmfeng@uh.edu, Kailash Kapur

100% inspection plays an important role when the consequences of excessive deviations from target values are very high, such as airport security screening. Motivated by Deming's "all or none rule" and associated philosophy for quality improvement, we develop optimal specifications for inspection strategy with consideration of the total cost to both producers and customers using asymmetric quality loss functions and inspection errors.

3 - Advanced Process Control in the Semiconductor Industry — Real World Challenges
Ramkumar Rajagopal, Advanced Process Control Engineer, Intel Corportation, 5000 W. Chandler Blvd., Chandler, AZ, United States, ramkumar.rajagopal@intel.com

The problem of run-to-run (R2R) advanced process control (APC) continues to be a popular area for academic research. A lot of the proposed models and algorithms in the R2R literature use applications from the semiconductor industry for illustration. However, not many get implemented in practice because of the complexities of the semiconductor fabrication processes. This presentation will address some of the real-world challenges in implementing APC applications in the semiconductor industry.

4 - Optimization of Multiple Response Surfaces with Secondary Constraints
Szu Hui Ng, Assistant Professor, National University of Singapore, 10 Kent Ridge Crescent, Singapore, Singapore, isensh@nus.edu.sg, Kai Xu

Quality measures of products and processes are frequently multidimensional, and the goal of many statistical studies is to find settings of process variables that optimize such products or processes. Often, not only are these measures of interest conflicting, they are also restricted by some physical secondary constraints of the process. The operability region imposed by the constraints is often unknown a priori. We present a sequential approach to tackle this constraint optimization problem.

5 - Simultaneously Modeling Crash Frequencies by Severity using Bayesian Multivariate Poisson Models
Jianming Ma, The University of Texas at Austin, Department of Civil Engineering, 1 University Station C1761, Austin, TX, 78712-0278, United States, mjming@mail.utexas.edu, Kara Kockelman

In studying traffic crashes, statistical analyses are usually performed to model crash frequencies separately from the multivariate severity measures. This paper presents a new approach of simultaneously modeling crash frequencies by severity with multivariate Poisson models. It can address some questions that may not be able to be answered otherwise. The parameters are estimated using a Gibbs sampler. The methodology is applied to studying crashes that occurred on Washington State highways.

■ TC27

H - 4th Floor, Union Square 21

Analyzing Populations for Business Applications

Contributed Session

Chair: Martin Jetton, Senior Analytic Consultant, Unicru, Inc, 9525 SW Gemini Dr, Beaverton, OR, 97008, United States, mjetton@unicru.com

1 - Needs-Based Segmentation: An Emerging Attractive Marketing Tool
Amey Raut, Rajesh Srivastava, srivastava@usnl.net

Segmentation of customers becomes critical. Characteristics-based segmentation includes Geographic, Behavioral, Psychographic and Demographic segmentation approaches. Needs-Based Segmentation is a unique process that identifies existing and potential clusters of customers with similar Needs Profiles. Needs -based segmentation is different from the other forms of segmentation because it is capable of adapting to changing environment and changing consumer needs. This segment migration is easily traceable through needs-based segmentation but not so much by characteristic-based segmentation. This article supports a segmentation approach to targeting customer groups based on both, the needs underlying the purchase and descriptive buyer data. Segmentation views that all the customers are not same. Thus, segmentation consists of homogenous customers. Some customers have needs of which they are not fully conscious, or they cannot articulate these needs, or they use words that require some interpretation. Needs-Based segmentation is the clustering of customers according to common sets of needs and purchasing behavior. Need-based segmentation systematically defines all relevant, unarticulated and future customer needs and thereby ensures innovative clustering of customer-groups based on shared needs to focus efforts.

2 - How Popular is Radio amongst Youth
Avni Tolia, Rajesh Srivastava, srivastava@usnl.net

Radio has turned to be quite effective as a new advertising media. It is the most local of all forms of media having a wide coverage and covering 97% of the country's population. It ensures a captive audience due to its low cast and ability to capture them on the move thereby ensuring greater interactivity. Radio offers tremendous opportunities for advertisers and media planners need to explore various options by which they can effectively use radio in their media mix. Therefore, to aid them in understanding the listening habits of the youth, this research was carried out.

3 - Sensitivity Analysis for the Mathematical Model as a Guide for the Manager to Rationalize the Production Plans
Mahmood Ridha, Assis Professor, Philadelphia University, Jordan Amman P.O. Box 1, Amman, 19392, Jordan, mahbedir@hotmail.com

The aim of this research is to view and analyze linear programming model as a tool to support the decision maker. As a result of this research we conclude that this model can be used as a framework for the production plan, and utilize the results of the sensitivity analysis as a knowledge base to support the decision maker to achieve the best production plan

4 - Valuation of a Firm: Some Cases
Anibal Irarrazabal, Professor, Universidad Catolica de Chile, Vicuna Makenna 4860, Santiago, Chile, airarraz@ing.puc.cl

Choosing the right model to use in valuation is as critical to arriving at a reasonable value as understanding how to use the model. The valuation framework and some valuation models are applied to a selected group o firms.

5 - Replacement Rate of Population Traits using a semi-Markov Renewal Process
Martin Jetton, Senior Analytic Consultant, Unicru, Inc, 9525 SW Gemini Dr, Beaverton, OR, 97008, United States, mjetton@unicru.com, Dr Robert Yerex

Population dynamics can be used in decision support and workforce optimization issues. A closed form estimator of the replacement of headcount is developed using a semi-Markov alternative renewal process. A combination of probabilistic survival and compliance in hiring target traits is used to build a transition matrix for a position within a headcount population. The transition matrix is used to estimate the rate of replacement of personality behavior traits into a population of employees.

■ TC28

H - 4th Floor, Union Square 22

Dynamic Pricing and Revenue Management

Sponsor: Revenue Management & Pricing
Sponsored Session

Chair: Jeff McGill, Associate Professor, Queen's University, School of Business, 143 Union Street, Kingston, ON, K7L3N6, Canada, McGillJ@post.queensu.ca

1 - A Linear Programming Approach to Dynamic Bid-Prices in Revenue Management
Dan Adelman, Professor, University of Chicago, Graduate School of Business, 5807 South Woodlawn Ave., Chicago, IL, 60637, United States, dan.adelman@gsb.uchicago.edu

We formally derive the standard deterministic linear program (LP) for bid-price control by making a linear functional approximation to the optimal dynamic programming value function. This linear functional approximation gives rise to a new LP that yields tighter bounds than the standard LP, and computes a time trajectory of bid-prices.

2 - Transactional Pricing in a Competitive Multi-Product Multi-Attribute Environment
Soulaymane Kachani, Professor, IEOR Department, Columbia University, 500 West 120th Street, NYC, NY, 10027, United States, kachani@ieor.columbia.edu, Kyrylo Shmatov

We consider the problem of simultaneous pricing of a line of complementary and/or substitute products with distinct price differentiation classes for each product (e.g. volume discounts, different distribution channels). An extension to the case where product demand is sensitive to prices of competitors is also considered. An iterative relaxation algorithm is proposed, and sufficient conditions for convergence are shown. A case study with numerical results is presented.

3 - Dynamic Pricing with Online Learning and Strategic Consumers
Jeff McGill, Associate Professor, Queen's University, School of Business, 143 Union Street, Kingston, ON, K7L 3N6, Canada, jmcgill@business.queensu.ca, Jeff McGill, Mikhail Nediak, Tanya Levin

We study the problem of dynamic pricing when consumers are rational (strategic) and consumer preferences are unknown. The company learns consumer demand through successive observations (i.e. online) and incorporates it in pricing decisions. We formulate the model as a stochastic dynamic game with learning integrated via an aggregating algorithm. We study the effects of strategic nature of consumers on the pricing policy of the company, and report numerical experience.

■ TC29

H - 4th Floor, Union Square 23

Revenue Management in Non-Passenger Streams

Cluster: Pricing and Revenue Management for Non-Travel Industries
Invited Session

Chair: Abhijit Gosavi, Assistant Professor, University at Buffalo, SUNY, 317 Bell Hall, Buffalo, NY, 14260, United States, agosavi@buffalo.edu

1 - Wavelets for Estimating the Cargo Show-up rate Distribution
Andreea Popescu, Ph.D. candidate, Georgia Institute of Technology, School of Industrial and Systems Engineering, 765 Ferst Drive NW, Atlanta, GA, 30332-0205, United States, andreeap@isye.gatech.edu, Ellis Johnson, Pinar Keskinocak

Given the increasing importance of cargo within their business, most major airlines now take a closer look at the estimation of the show-up rates for cargo bookings, a key element of overbooking. We demonstrate the benefits of a discrete estimator for cargo overbooking and propose a wavelet based estimator. Tested on real world data from a major airline and simulated data, the study shows that improved estimation of the show-up rate can have a significant impact on profits and customer service.

2 - Air Cargo Revenue Management: Industry Practices and Challenges
Raja Kasilingam, Vice-President Cargo Products, Sabre Airline SOLUTIONS, 3150 Sabre Drive, Southlake, TX, 76092, United States, raja.kasilingam@sabre.com

Revenue management in the air cargo industry has been around for more than a decade now. However, the adoption rate of revenue management by the air cargo industry has been very slow. This presentation provides an overview of cargo revenue management, current status of industry practices in this area, challenges in selling/implementing cargo revenue management to/at airlines, and some of the key research areas that could advance the state of cargo revenue management.

3 - A Strategic Capacity-management Problem in Cargo Revenue Management
Aykut Kahraman, Research Assistant, University at Buffalo, SUNY, afk3@buffalo.edu, Abhijit Gosavi

A queuing model is developed for the performance analysis and optimization of aircraft capacity in air-cargo revenue management. We will show that the semi-Markov kernel underlying the queuing model has some pleasant structural properties that can be exploited for optimization.

4 - Risk-sensitive and Risk-neutral Models for Clearance-markdown Pricing
Abhijit Gosavi, Assistant Professor, University at Buffalo, SUNY, 317 Bell Hall, Buffalo, NY, 14260, United States, agosavi@buffalo.edu, Jay Neelakantan, Rajan Batta

We develop risk-neutral and risk-sensitive strategies for dynamic pricing in the clearance period of fashion goods. Our models integrate the Cobb-Douglas function within dynamic-programming and integer-programming methods.

■ TC30

H - 4th Floor, Union Square 24

Applications to Land Development

Cluster: Sustainable Development and OR
Invited Session

Chair: Jose A. Faria, Faculty Research Assistant, University of Maryland, 1173 Glenn L. Martin Hall, College Park, MD, 20742, United States, josefaria@compuserve.com

1 - Decomposition Methods Applied to a Land Development Problem
Jose A. Faria, Faculty Research Assistant, University of Maryland, 1173 Glenn L. Martin Hall, College Park, MD, 20742, United States, josefaria@compuserve.com, Steven Gabriel

The authors present a mixed integer programming formulation for land development along with decomposition methods to effectively find solutions.

2 - Bi Level Optimization of a Land Development Problem with Minimum Spanning Trees
Jose A. Faria, Faculty Research Assistant, University of Maryland, 1173 Glenn L. Martin Hall, College Park, MD, 20742, United States, josefaria@compuserve.com, Steven Gabriel

The authors have embedded the minimum spanning tree within a multiobjective formulation to a land development problem, a hybrid algorithm including the shortest path algorithm, cutset inequalities and packing constraints is proposed to efficiently solve the problem.

3 - Land Use Optimization Questions: Could they be Resolved?
Ardeshir (Ard) Anjomani, Professor, University of Texas at Arlington, P.O. Box 19588, Arlington, TX, 76019, United States, anjomani@uta.edu

Land-use/transportation planning process is not in line with sustainable development considerations. This paper introduces a planning process which utilizes programming models and GIS to develop alternative solutions to overcome this problem. The model seeks to minimize the negative effects of development and/or maximize the positive or net effects. However, complexity of land development considerations raises questions that need to be resolved. The problems and possible solutions are discussed.

4 - A Two Level Spatial Decision Support System Case Study in Water Conservation of West Macedonia Greece
Odysseus Manoliadis, Assoc Professor, Technological Education Institute of Western Macedonia, Koila, Ath Filiou 10, Kzani, 50100, Greece, omano@tee.gr, Konstantinos Vatalis

Recent public awareness of the scarcity of water and its conflicting use prompted increasing needs that has led to uncontrolled wells and overpumping. There is a rising need for water conservation by eliminating undesired wells. A two-stage, multicriteria evaluation is presented. In the first stage, GIS digital map overlay techniques are used. In the second stage, the criteria used are economic efficiency, and environmental. The alternatives are evaluated using multicriteria evaluation models.

5 - GIS Application in Landfill Site Selection using Multicriteria Decision Analysis
Konstantinos Vatalis, Assistant Professor, TEI of West Macedonia, koila, Kozani, 50100, Greece, kvatalis@teikoz.gr, Odysseus Manoliadis

In this paper a two-stage, multicriteria evaluation is presented for selection of temporary construction facilities. In the first stage, GIS digital map overlay techniques are used to eliminate not suitable alternatives according to environmental criteria. In the second stage, criteria that represent technical economic efficiency goals are used for evaluation of the alternatives.

■ TC31

H - 4th Floor, Union Square 25

Joint Session Practice/ Health Applications: Healthcare Practical Applications

Cluster: OR Practice, Health Applications
Invited Session

Chair: Michael Carter, Professor, University of Toronto, Mech & Ind Engineering, 5 King's College Rd, Toronto, ON, M5S 3G8, Canada, carter@mie.utoronto.ca

1 - Pruning Radiotherapy Treatment Plans
Allen Holder, Trinity University Mathematics, One Trinity Place, San Antonio, TX, United States, aholder@trinity.edu

Radiotherapy is the treatment of cancerous tissues with external beams of radiation, and treatment planning is the process of selecting how to focus these beams onto the cancerous regions so that damage to surrounding organs is limited. We address the "holy grail" of problem in this area called the Beam Selection Problem. We will show how vector quantization and the p-median problem effectively solve this problem.

2 - Risk Analysis in Radiation Oncology: A Taxonomic and Causal Structure
Edidiong Ekaette, Research Associate, Faculty of Medicine - University of Calgary, Foothills Med. Centre, SouthTower 602, 1403 - 29 Street NW, Calgary, AB, T2N 2T9, Canada, eekaette@ucalgary.ca, Robert Lee, Peter Dunscombe

Radiation oncology for cancer is a process that involves numerous health professions and complex equipment. To manage patient risks while ensuring quality care, a systematic approach to collecting, processing and learning from incidents is required. Probabilistic risk analysis provides a means of defining and modeling the system in a qualitative and quantitative manner. This paper proposes a taxonomic and causal structure for adverse events that supports risk analysis in radiation oncology.

3 - Planning Resources for Renal Replacement Therapy - National and Local Models

Ruth Davies, Professor of Operational Research, Warwick Business School, University of Warwick, Coventry, CV4 7AL, United Kingdom, Ruth.Davies@wbs.ac.uk

The costs of renal replacement therapy in England are around $1 billion a year. A discrete event simulation model for national use takes account of rising admission rates and differential survival rates by risk group. Requirements are local level are more variable and are affected by historical supply together with age and racial mix of the local population. Models need to be simpler than the national DES model but must show the confidence intervals of the results and the assumptions made.

■ TC32

H - 6th Floor, Lombard

Variants of Traditional Location Problems

Sponsor: Location Analysis
Sponsored Session

Chair: Rajan Batta, Professor, University at Buffalo (SUNY), 438 Bell Hall, Department of Industrial Engineering, Buffalo, NY, 14260, United States, batta@eng.buffalo.edu

1 - The Multiple Server Location-Allocation Problem with Fixed Cost

Robert Aboolian, raboolia@csusm.edu, Zvi Drezner, Oded Berman

We introduce the multiple server location problem with fixed costs on a network. Each node generates demand. We need to select a subset of nodes to locate one or more servers in each. The number of servers at each node is unbounded. Each customer selects the closest server. We wish to minimize the overall cost: fixed installation cost, variable server cost, and the cost of travel time plus the average waiting time at the server. Results for approximate and exact solution approaches are reported.

2 - Constraint Minisum Location Problem with l_p Distances, Convex Programming Approach

Yu Xia, The Institute of Statistical Mathematics, 4-6-7 Minami-Azabu, Minato-Ku, Tokyo, 106-8569, Japan, yuxia@ism.ac.jp

Minisum facility location problem. The distance is measured by l_p norm with extension, since it is more suitable to real-world practice. There are extra constraints on locations. The problem is reformulated as a convex program. The algorithm proposed has advantages over existing methods.

3 - Alleviate Congestion in a Facility Layout: Reroute Flows, Relocate Departments or a Combination of Both?

Min Zhang, Dept. of Indutrial Engineering, Univeristy at Buffalo(SUNY), 342 Bell Hall, Buffalo, NY, 14260, United States, minzhang@buffalo.edu, Rajan Batta, Rakesh Nagi

To alleviate congestion in a facility layout one can relocate departments, reroute flows between departments without department relocation, or a combination of the two strategies. We formalize modeling of workflow congestion and develop models on alleviating workflow congestion in a facility layout. Computational results, examples, and a case study will be presented.

■ TC33

H - 6th Floor, Mason

Joint Session QSR/ Health Applications: Quality and Statistical Decision Making in Healthcare Applications I

Sponsor: Quality, Statistics and Reliability, Health Applications
Sponsored Session

Chair: Jing Li, Industrial and Operations Engineering Department, University of Michigan, Ann Arbor, MI, United States, jinglz@engin.umich.edu

1 - The Use of Control Charts in Health Care Monitoring and Public Health Surveillance

Bill Woodall, Professor of Statistics, Virginia Tech, Department of Statistics, Blacksburg, VA, 24061-0439, United States, bwoodall@vt.edu

There are many application and research opportunities in the use of control charts in health care monitoring and in public health surveillance. We introduce these applications and discuss the relationships to industrial monitoring. The advantages and disadvantages of proposed health-related charting methods are considered.

2 - Statistical Process Analysis used to Improve Healthcare Decision Making

Jose Zayas-Castro, Professor & Chair, University of South Florida, 4202 East Fowler Ave, ENB 118, IMSE, Tampa, FL, 33620, United States, josezaya@eng.usf.edu, Jana Iezzi, Abhik Bhattacharya

System complexity and process variability in healthcare benefit from statistical process improvement. Statistical data analysis is being used in pilot studies at two major hospitals. The objective is to improve operational decision-making through process mapping, controlling variation, and modeling. Expected results are to enhance patient flow and resource utilization.

3 - Structure Learning of Probabilistic Networks with the Consideration of Data Uncertainties

Jing Li, Industrial and Operations Engineering Department, University of Michigan, Ann Arbor, MI, United States, jinglz@engin.umich.edu, Jan Shi

Learning the structure of a probabilistic network has been traditionally studied assuming that there are no uncertainties (errors and noise) in the data. This paper investigates the constraint-based algorithm and studies how the data uncertainties impact the learning. The analytical results are also demonstrated through a healthcare application.

■ TC34

H - 6th Floor, Powell

Sensor IV

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: Qiang Huang, Assistant Professor, University of South Florida, 4202 E. Fowler Ave., ENB118, Tampa, FL, 33620, huangq@eng.usf.edu

1 - Fault Region Localization: Product/Process Improvement Based on Field Data and Distributed Sensing

Kamal Mannar, Research Assistant, University of Wisconsin-Madison, 1513 University Ave., 266E ME Building, Madison, WI, 53706, United States, darek@engr.wisc.edu, Darek Ceglarek

Customer feedback in the form of warranty performance is an important and direct indicator of quality and robustness of a product. Linking warranty information to manufacturing measurements can identify key design parameters and process variables that are related to warranty failures. This paper proposes a novel Fault Region Localization (FRL) methodology to map warranty failures to manufacturing measurements to diagnose warranty failures and perform tolerance revaluation

2 - Boosted Classification Methods for Multi-sensor-based Grinding Wheel Condition Monitoring

Fengming Tang, Industrial Engineering, LSU, Industrial Engineering, 3128 CEBA, Louisiana State University, Baton Rouge, LA, 70802, United States, ftang1@lsu.edu, Warren Liao

Multi-sensor signals in grinding process under different cutting conditions are studied. Regression models with auto correlated errors are used to extract features. The model coefficients from each signal are fused and serve as the features for classification. Several boosting methods capable of multi-class classification are employed. Results are discussed.

3 - Monitoring Global and Local Variations in Multichannel Functional Data

Qiang Huang, Assistant Professor, University of South Florida, 4202 E. Fowler Ave., ENB118, Tampa, FL, 33620, huangq@eng.usf.edu, Hani Kababji, Hui Wang

We develop a new approach for faulty condition detection and discrimination based on the analysis of the global and local variations in the multichannel functional data. Each channel of functional data was decomposed into global and local variations components. Global variation was extracted using weighted spline smoothing technique, whereas, local variation was obtained by subtracting the global variation from the original data. Principal Curve Regression test was used for process monitoring.

4 - Sensor-based Modeling Applications to Surface Quality Estimation in Abrasive Finishing Processes

Satish Bukkapatnam, Associate Professor, Oklahoma State University, School of IE&M, Stillwater, OK, 74078, satish.t.bukkapatnam@okstate.edu, P. Rao, R. Komanduri

We present a low-order nonlinear dynamic model that relates material removal in grinding and lapping processes with the signals from vibration sensor arrays, and the application of the resulting models for real-time monitoring of surface quality. Experiments show that the approach can accurately estimate surface roughness for Ra ≥ 20nm.

■ TC35

H - 6th Floor, Sutter

OR/MS Modeling and Algorithms in Marketing I

Contributed Session

Chair: Zhong Wen, Stern Business School, New York University, 44 West 4th St., KMC 8-80, New York, NY, 10012, United States, zwen@stern.nyu.edu

1 - A Comparison of Compositional Models for Evaluation of a College Career Center

Chaim Ehrman, Associate Prof, Loyola University, 820 N. Michigan Ave., Chicago, IL, 60611, United States, cehrman@luc.edu

Compositional Models have been introduced in the Consumer Behavior literature over time. Prof. Amos Tversky is famous for his Lexicographic Model; Dr. Martin Fishbein introduced the Linear Compensatory Model; and the Conjunctive Model is essentially a screening technique that eliminates brands whose scores are below par. In this paper, scoring results are compared across students from 30 Universities and 10 majors. The objective is to determine if there is convergence across these models or not.

2 - Brand Strategy and Customer Equity of Electric Power Suppliers in the US

Toshio Ariu, Seinor Researcher, CRIEPI, 1-6-1 Ohtemachi, Chiyoda-ku, Tokyo, 100-8126, Japan, ariu@criepi.denken.or.jp

Customer equity is critical to a long-term success of not only private firms but electric power suppliers. We confirmed that high reliability were important for brand value of power suppliers. This paper pointed out that customers attached great importance to information of stable power and bill. We estimated that 9.3% of customers would change suppliers if they were given a $5 reduction per month. We could calculate customer equity based on price reduction and the duration for switching.

3 - Pricing of Add-On Products Online

Hejun Zhuang, PhD Candidate, The Chinese U. of Hong Kong, G23, KKL, the Chinese U. of Hong Kong, Hong Kong, Hong Kong, hejun@baf.msmail.cuhk.edu.hk

This paper analyzes optimal pricing for the multiple products in the electronic market under incomplete information, where retailers usually quote one good for a low price and sell additional products with high prices by applying add-one strategies. It is shown that the competition is softened and higher equilibrium profits are achieved by the retailers.

4 - On the Profitability of Firms in a Differentiated Industry

Bing Jing, Assistant Professor of Information Systems, Stern School of Business, New York University, 44 West 4th Street, KMC 8-80, New York City, NY, 10012, United States, bjing@stern.nyu.edu

In a model of vertical differentiation, I identify sufficient conditions for a firm selling a higher quality good to be more (or less) profitable. There are three key results: (1) I develop the notion of relative cost efficiency, whose monotonicity in quality indicates that of the firms' profitability; (2) A firm with a higher-quality good is more profitable if it has a higher absolute cost efficiency; and (3) A set of lower and upper bounds is provided on each firm's profitability.

5 - Finite Brand Loyalty and Equilibrium Price Promotions

Zhong Wen, Stern Business School, New York University, 44 West 4th st., KMC 8-80, New York, NY, 10012, United States, zwen@stern.nyu.edu, Bing Jing

The literature on price promotions typically assumes that consumers loyal to a brand never switch. In contrast, this paper allows finite brand loyalty. For high brand loyalty, our equilibrium reduces to the one in Narasimhan (1988). For intermediate and low brand loyalty, (1) the strong brand has a higher price range and a higher regular price; (2) both brands may promote equally frequently; (3) the strong brand has a higher (lower) promotional depth for small (large) switcher population.

■ TC36

H - 6th Floor, Taylor

Aviation Applications in Simulation

Sponsor: Simulation

Sponsored Session

Chair: John Shortle, Assistant Professor, George Mason University, Dept. of Syst. Eng. & O.R., Mail Stop 4A6, Fairfax, VA, 22030, United States, jshortle@gmu.edu

1 - Reduction of Queueing Networks for Efficient Simulation of the National Airspace System

Donald Gross, Professor, George Mason University, Dept. of Syst. Eng. & O.R., Mail Stop 4A6, Fairfax, VA, 22030, United States, dgross1@gmu.edu, John Shortle, Brian Mark

Detailed models of the National Airspace System (NAS) can be computationally expensive to simulate. In this talk, we consider modeling the NAS as a network of queues. Then, we consider various heuristics for reducing these networks. The goal is to obtain a smaller network whose performance approximates that of the original network, but whose simulation time is considerably reduced. We discuss trade-offs between simulation time and accuracy for various reduction methods.

2 - SimAir: A Simulation of Airline Optimization

David Goldsman, Professor, Georgia Tech, School of ISyE, Georgia Tech, Atlanta, GA, 30332, United States, sman@isye.gatech.edu, Loo Hay Lee, Christos Alexopoulos, Ellis Johnson

We discuss SimAir, a software package that simulates various robust recovery strategies for airlines in the presence of stochastic disturbances such as unexpected aircraft maintenance or weather problems. SimAir has been developed and is administered jointly by personnel at Georgia Tech and the National University of Singapore. We report on recent progress and future goals in SimAir capabilities.

3 - Combining Analytic and Numeric Techniques to Solve Challenging Queueing Problems

Fred Wieland, Senior Simulation Scientist, AEgis Technologies Group, 1901 N. Beauregard St., Suite 101, Alexandria, VA, 22311, United States, FWieland@aegistg.com

With the rapid increase in speed and concurrent drop in price of desktop computers, it is possible to combine both analysitcal and simulation techniques to gain insight into challenging queueing problems. In this paper we will examine the dual queue/single server with priority for the longer queue system. We show how modeling this system with simulation can be combined with known analytical results to yield further insights that neither technique alone could produce.

4 - Airport Design Using Simulation

Cenk Tunasar, Director, TransSolutions, 1632 Hunting Creek Drive, Alexandria, VA, 22314, United States, ctunasar@transsolutions.com, Rahmi Evlioglu

We demonstrate a detailed discrete-event passenger and baggage simulation model developed for JFK International Airport. Working together with architects and planners, we show that simulation can become part of the design process by evaluation multiple design options quickly. The design team altered plans based on input from the simulation process and achieved a balanced design early in the planning phase. Animation helped to convey the performance of the planned terminal to decision makers.

■ TC37

H - 6th Floor, Van Ness

Economic Analysis and Control of Stochastic Service Systems

Sponsor: Applied Probability

Sponsored Session

Chair: Costis Maglaras, Columbia Business School, 3022 Broadway, New York, NY, 10027, United States, c.maglaras@gsb.columbia.edu

1 - Should a Service Network be Integrated or Product-Focused? Option Value of Dynamic Substitution

Baris Ata, Northwestern University, 2001 Sheridan Road, Evanston, IL, United States, b-ata@kellogg.northwestern.edu, Jan Van Mieghem

Inspired by contrasting approaches of FedEx and UPS, we study how network design impacts capacity requirements and responsiveness. We derive analytic expressions for delay distributions and the network integration value, showing how network integration value depends on QoS guarantees and demand characteristics: Operating dedicated networks is a fine strategy only if a firm primarily serves express requests with high reliability and the correlation with regular requests is not strongly negative.

2 - Effects of Substitution and Customer Choice on Heavy-traffic

Assaf Zeevi, Graduate School of Business, Columbia University, NY, NY, United States, assaf@gsb.columbia.edu, Costis Maglaras

We study a service system in which customers select the level of service upon arrival based on price and congestion level in each class. System performance is studied in an asymptotic regime where the volume of demand grows to infinity and the utilization level approaches one. We demonstrate that real-time choice of service level has profound effects on the heavy-traffic behavior of such systems, and discuss some of the economic implications and insights that emerge.

3 - Cross-selling in Service Focused Call Centers: Staffing, Control and Performance Analysis

Mor Armony, NYU, 44 West Fourth Street, New York, NY, 10012, United States, marmony@stern.nyu.edu, Itay Gurvich

We study large inbound call-centers with cross-selling opportunities and operational considerations. We examine the question of how many servers are needed (staffing) and when to cross-sell (control) to maximize cross-selling revenues minus staffing costs, subject to waiting time constraints. We emphasize the importance of considering staffing and control jointly; when these issues are tackled together, cross-selling does not necessarily damage quality, but might even dramatically improve it.

4 - Operations with Subscribers and Reusable Products

Ramandeep Randhawa, Stanford University, 518 Memorial Way, Stanford, CA, 94305, United States, randhawa_ramandeep@gsb.stanford.edu, Sunil Kumar

We study a firm that offers reusable products to price and quality sensitive subscribers; an equipment rental firm is a typical example. The system manager sets prices and capacity levels in order to maximize the firm's long run average profit. In the natural asymptotic regime of a large number of potential subscribers, we explicitly derive the optimal price and capacity level, and obtain structural insights on the relative importance of these two decisions.

■ TC38

R - 2nd Floor, Corintia

Advances in Large-Scale Nonlinear Optimization

Sponsor: Optimization/ Nonlinear Programming
Sponsored Session

Chair: Richard Waltz, Research Assistant Professor, Northwestern University, ECE Department, 2145 Sheridan Road, Evanston, IL, 60208, United States, rwaltz@ece.northwestern.edu

1 - Acceleration Techniques for Interior Point Methods

Long Hei, lhei@ece.northwestern.edu, Jorge Nocedal

Interior point methods have become a popular approach for solving nonlinear programming problems. In this talk we will present some techniques that help to accelerate the standard interior point approaches, including preconditioning and system decomposition, and corresponding numerical results. We also consider the use of interior point algorithms on nonlinear problems with special structures.

2 - Optimizing Shape Quality

Todd Munson, Argonne National Laboratory, Mathematics & Computer Science Division, Argonne, IL, 60439-4844, United States, tmunson@mcs.anl.gov

Meshes containing elements with bad quality can result in poorly conditioned systems of equations that must be solved when using the finite-element method to solve a partial differential equation. In this talk, a nonlinear fractional program is presented that relocates the vertices of a given mesh to optimize the average element shape quality. Numerical results on several test meshes are presented.

3 - Interpretation of Nonlinear Interior Methods as Damped Newton Methods

Paul Armand, Universite de Limoges, Faculte des Sciences et Techniques,Laboratoire LACO, 123, Avenue Albert Thomas, 87060 Limoges, France, Paul.Armand@unilim.fr, Joel Benoist, Dominique Orban

We propose an interpretation of the primal-dual interior point method as a Newton method applied on an augmented system that incorporates an explicit updating function for the barrier parameter. We propose some updating strategies of the barrier parameter and analyse their convergence properties. We report numerical experiments on nonlinear problems.

4 - Using State-of-the-art NLP Solvers in System Identification and Beyond

Hans Mittelmann, mittelmann@asu.edu

In our interdiscplinary research effort to optimally design certain input signals for the purpose of "plant-friendly" identification of process systems various challenging nonlinear optimization problems arise. After sketching these formulations we will report on our experiences with several of the latest NLP codes. We will then extend the comparison to more general large-scale problems.

■ TC39

R - 3rd Floor, Aragon

Special Topics in Operations Management I

Contributed Session

Chair: Biying Shou, Northwestern University, 2145 Sheridan Road, Evanston, IL, 60208, United States, biying@iems.northwestern.edu

1 - Rethinking Service Recovery: A Systematic Approach

Chao Wang, London Business School, OTM Department, Regent's Park, London, NW1 4SA, United Kingdom, cwang.phd2004@london.edu

Previous service recovery research only focuses on providing solutions based on individual service failure and ignores the importance of organizational service recovery capability establishment. I propose a systematic approach to integrate the organizational recovery processes and specific recovery activities via organizational learning mechanisms. Furthermore, I enrich the literature by providing the service recovery taxonomy, which facilitates the determinants of appropriate recovery actions.

2 - Outsourcing Decision Models: A Comparison of Techniques

Kevin Watson, Assistant Professor, University of New Orleans, 185 Business Building, Lakefront Campus, 2000 Lakeshore Drive, New Orleans, LA, 70148, United States, KWatson@UNO.edu, Gregory Smtih, Andrey Pavlov

Companies increasingly turn to outsourcing to reduce cost and improve ROI. Assumptions underlying breakeven analysis and application of antiquated cost accounting methods may produce poor corporate performance. This study compares optimal product mix results obtained from Cost Accounting, Linear Programming, Genetic Algorithms, and the Theory of Constraints. This identifies how traditional analysis may result in inferior corporate performance relative to in-house production.

3 - Bargaining Power, Signaling Cost, and Service Outsourcing Contracts

Qiang Zeng, University of California, Irvine, 2513 Verano Place, Irvine, United States, qzeng04@gsm.uci.edu

While the failure of the relationships between service providers and their outsourcing partners occurs more and more often, the following issue does not attract much attention as it should: how can a service provider communicate better with its potential outsourcing partner about the stochastic demand on which the service provider owns private information? We provide an alternative answer by modeling this situation using a signaling game in a queuing system to study the dynamics.

4 - A Model for Store Handling; Potential for Efficiency Improvement

Karel van Donselaar, Asst Prof, Technische Universiteit Eindhoven, PO Box 513, Pav. E3, Eindhoven, 5600 MB, Netherlands, k.h.v.donselaar@tm.tue.nl, Tom van Woensel, Rob Broekmeulen, Jan Fransoo, Susan van Zelst

In this paper a conceptual model for store handling is derived using the analogy based on order picking models for warehouses. Then, via a time and motion study empirical data was collected in retail stores. Regression models revealed the impact of the most important drivers for handling efficiency: case pack size, number of case packs stacked simultaneously, and the stacking regime. Furthermore it is shown that handling costs are non-linear with the number of consumer units stacked.

5 - Agile Automated Production Systems: to Push or to Pull?

Biying Shou, Northwestern University, 2145 Sheridan Road, Evanston, IL, 60208, United States, biying@iems.northwestern.edu, Wallace Hopp, Seyed Iravani

We study Agile Automated Production (AAP) systems, which consist of automated and manual equipment staffed by a single cross-trained operator. We address questions: Where is automation most effective? How to allocate operator over time? How does automation affect the relative effectiveness of push and pull protocols? In addition to deriving design principles for AAP systems, we show pull AAP systems are more efficient, flexible and robust than their pull counterparts.

■ TC40

R - 3rd Floor, Barcelona I

Combinatorial Quadratic Optimization

Sponsor: Optimization/ Network Optimization
Sponsored Session

Chair: Garud Iyengar, Associate Professor, Columbia University, garud@ieor.columbia.edu

1 - Approximation Algorithms for Semidefinite Packing Problems
Garud Iyengar, Associate Professor, Columbia University, garud@ieor.columbia.edu, Cliff Stein, David J. Phillips

We define the semidefinite packing problem and show that a number of combinatorial optimization problems can be approximated by such packing problems. We show that any algorithm that the solves the semidefinite packing problem by solving a sequence of maximum eigenvalue problems will require at least O(1/epsilon^2) iterations to compute a solution within relative error 1/epsilon. We then describe an algorithm that is able to compute an epsilon-approximate solution in O(1/epsilon) iterations.

2 - Fast Algorithms for Approximate Semidefinite Programming using the Multiplicative Weights Update Method
Sayten Kale, Elad Hazan, Sanjeev Arora

This work is about using the Multiplicative Weights Update Method developed by many authors for designing custom solvers for semidefinite programs in applications. We get faster algorithms for solving SDPs for a number of problems than the currently known interior point methods.

3 - On Non-approximability of Quadratic Programs
Elad Hazan, Eli Berger, Guy Kindler, Muli Safra, Sanjeev Arora

This work is about getting near optimal hardness of approximation results and integrality gaps for certain maximization quadratic programs, commonly occurring in applications such as MAX-CUT, Correlation Clustering, Grothendieck constant of a graph, etc.

4 - On Approximating Complex Quadratic Optimization Problems via Semidefinite Programming Relaxations
Jiawei Zhang, Assistant Professor, New York University, IOMS-Operations Management, Stern School of Business, New York City, NY, 10012, United States, jzhang@stern.nyu.edu, Anthony So, Yinyu Ye

We consider SDP relaxations for a class of discrete and continuous quadratic optimization problems in the complex Hermitian form, which includes the Max-3-Cut problem as a special case. We present constant factor approximation algorithms for this class of problems.

■ TC41

R - 3rd Floor, Barcelona II

Integer Programming: Theory and Algorithms

Contributed Session

Chair: Paul Krokhmal, Assistant Professor, University of Iowa, 3131 Seamans Center, Iowa City, IA, 52242, United States, krokhmal@engineering.uiowa.edu

1 - A Fast Algorithm for Cover Inequality Separation
Osman Oguz, Assoc. Prof., Bilkent University, 06800 Ankara, Ankara, Turkey, ooguz@bilkent.edu.tr

Deciding whether there exists a cover inequality that separates a given noninteger solution from the convex hull of the set of solutions is NP-Complete. There exists a polynomial algorithm for the special case described by an extreme point noninteger solution with respect to a fixed set of linear constraints. We present a polynomial algorithm for the same problem that works for any solutions and for any number of constraints but requires a fixed degree of numerical input precision.

2 - Results of the Implementation of Flow Cover Cuts for the MOPS MIP Solver
Philipp Christophel, University of Paderborn - DSOR Lab, Warburger Str. 100, Paderborn, Germany, pmc@dsor.de, Leena Suhl, Uwe Suhl

In current mixed-integer programming solvers various kinds of cuts are generated either before the branch-and-bound (cut-and-branch) algorithm or within the nodes of it (branch-and-cut). Flow cover cuts are a well known class of cuts for which a good separation algorithm exists. This talk reports on the implementation of flow cover cuts for the MOPS MIP solver and discusses several implementational details and algorithm variants.

3 - Solving the Precedence Constrained ATSP with an Extended Formulation
Pierre Pesneau, Faculdade de Cifncias, Universidade de Lisboa, Bloco 6, Piso 4, Campo Grande, Lisboa, Portugal, ppesneau@fc.ul.pt, Luis Gouveia

We present formulations for the Precedence Constrained Assymetric Travelling Salesman (PCATS) problem obtained by relating formulations of the ATS problem with formulations of the so-called linear ordering problem. We introduce several exponential sized sets of cut-like inequalities to link formulations of these two problems. We discuss polynomial routines to separate these inequalities and provide computational results in the context of a branch and cut approach.

4 - Asymptotic Behavior of the Expected Optimal Value of the Multidimensional Assignment Problem
Paul Krokhmal, Assistant Professor, University of Iowa, 3131 Seamans Center, Iowa City, IA, 52242, United States, krokhmal@engineering.uiowa.edu, Don Grundel, Panos Pardalos

We consider asymptotical behavior of the expected optimal value of very-large-scale Multidimensional Assignment Problem (a higher-dimensional version of the Linear Assignment Problem) whose assignment costs are iid random variables. We derive the limiting value of the expected optimal cost of the MAP for a broad class of probability distributions, estimate the rate of convergence, and construct asymptotical bounds for the expected optimal cost.

■ TC42

R - 4th Floor, Parc Ballroom I

Topics in Stochastic Programming

Sponsor: Optimization/ Stochastic Programming
Sponsored Session

Chair: Alexander Shapiro, Professor, Georgia Institute of Technology, ISyE, Atlanta, GA, 30332, United States, ashapiro@isye.gatech.edu

1 - Quasi-Monte Carlo Methods in Stochastic Programming
Tito Homem-de-Mello, tito@northwestern.edu

We discuss the use of Quasi-Monte Carlo methods when solving stochastic programming problems by means of sample average approximations. It is known that convergence (with probability one) of approximating solutions and values in ensured under mild assumptions; here, we focus on rates of convergence. We show that, for some classes of functions, Quasi-Monte Carlo methods can be much more efficient than standard Monte Carlo. Some numerical results are presented to illustrate the ideas.

2 - Stochastic Programming Approaches for Capacity Planning
Shabbir Ahmed, Georgia Tech, 765 Ferst Dr, Atlanta, GA, 30068, United States, sahmed@isye.gatech.edu

Deciding the optimal timing and level of capacity acquisition and allocation, plays a crucial role in strategic level planning in a wide array of applications. We describe a number of stochastic programming approaches for capacity planning under uncertainty. We present structural results, and exploit these to develop efficient solution strategies.

3 - Optimization of Risk Measures
Alexander Shapiro, Professor, Georgia Institute of Technology, ISyE, Atlanta, GA, 30332, United States, ashapiro@isye.gatech.edu, Andrzej Ruszczynski

In this talk we discuss some recent advances in the theory of risk measures with a particular emphasis on applications to optimization of two and multi-stage stochastic programs.

■ TC43

R - 4th Floor, Parc Ballroom II

Integrated Methods for Optimization II

Sponsor: INFORMS Computing Society/ Constraint and Integer Programming
Sponsored Session

Chair: John Hooker, T. Jerome Holleran Professor of Business Ethics and Social Responsibility, Professor of Operations Research, Carnegie Mellon University, Tepper School of Business, Pittsburgh, PA, 15213, United States, john@hooker.tepper.cmu.edu

1 - Nondeterministic Control for Hybrid Search
Pascal Van Hentenryck, Brown University, Box 1910, Providence, RI, United States, pvh@cs.brown.edu

Hybrid algorithms combining local and systematic search often use nondeterminism in different ways. This paper presents nondeterministic control structures to express hybrid search algorithms concisely and elegantly. These abstractions describe the search tree, are compiled into first-class continuations, are parameterized by search controllers specifying the exploration strategy. Experimental results on scheduling algorithms are presented.

2 - Domain Reduction for the Circuit Constraint
Latife Genc, Carnegie Mellon University, Tepper School of Business, 5000 Forbes Avenue, Pittsburgh, PA, 15213, United States, lgenc@andrew.cmu.edu, John Hooker

We present an incomplete filtering algorithm for the circuit constraint. The filter removes redundant values by eliminating non-Hamiltonian edges from the associated graph (i.e., edges that are part of no Hamiltonian cycle). We prove a necessary condition for an edge to be Hamiltonian, which provides the basis for eliminating edges of a smaller graph defined on a separator of the original graph.

3 - An Integrated Solver for Optimization Problems

Tallys Yunes, University of Miami, School of Business Administration, Coral Gables, FL, 33124, United States, thyunes@gmail.com, Ionut Aron, John Hooker

Recently, both the OR and Constraint Programming (CP) communities have acknowledged the benefits of combining OR and CP techniques to solve optimization problems. We introduce a modeling language and solver that uses the paradigm of search-infer-and-relax to allow for a clean and generic integration of CP and OR. We illustrate the usage of our solver with a few examples.

4 - A Benders Approach for the Minimum Break Scheduling Problem

Michael Trick, Carnegie Mellon University, Tepper School of Business, Pittsburgh, PA, United States, trick@cmu.edu, Rasmus Rasmussen

The minimum break scheduling problem is a sports scheduling problem where the goal is to create a schedule that minimizes the number of consecutive home (or away) games for a team. We design an approach for this that integrates integer programming and constraint programming through a bender's decomposition method.

■ TC44

R - 4th Floor, Parc Ballroom III

Optimization Tools and Modeling Languages

Sponsor: INFORMS Computing Society/ Optimization Services and Open Source Software
Sponsored Session

Chair: Kipp Martin, Professor, University of Chicago, Graduate School of Business, 5807 South Woodlawn Avenue, Chicago, IL, 60637, United States, kmartin@gsb.uchicago.edu

1 - Impact Solver for Optimization Services

Huanyuan(Wayne) Sheng, student, Northwestern University, 2145 Sheridan Road, Room C210, Evanston, IL, 60201, United States, h-sheng@northwestern.edu, Sanjay Mehrotra, Jun Ma

IMPACT is a new Integrated Math Programming Advanced Computational Tool. It is the first optimization solver that natively supports the Optimization Services (OS) protocols. It integrates state-of-the-art optimization algorithms with the OS framework to provide a robust solver service.

2 - A Problem Instance Analyzer for Optimization Services

Robert Fourer, Professor, Northwestern University, Dept of Industrial Eng & Mgmnt Sciences, 2145 Sheridan Road, Evanston, IL, 60208-3119, United States, 4er@iems.northwestern.edu, Dominique Orban

We describe new developments in the design and testing of Dr. AMPL, a collection of utilities for determining properties of optimization problem instances generated from the AMPL modeling language. Dr. AMPL's 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. This information can then be fed to optimization services such as NEOS and OSxL.

3 - POAMS and Web Services

Victor Foulk, University of Arizona, Systems and Industrial Engineering, 1127 E North Campus Dr. Room 111, Tucson, AZ, 85721, United States, vfoulk@email.arizona.edu, Leonardo Lopes

POAMS is an object-algebraic modeling system designed to serve as a test bed for several modularization ideas proposed by Fourer and Lopes. Like PULP, POAMS is implemented within the versatile Python scripting language. In this talk, we will demonstrate several web services and systems integration features of the POAMS system.

4 - OSmL: Optimization Services Modeling Language

Kipp Martin, Professor, University of Chicago, Graduate School of Business, 5807 South Woodlawn Avenue, Chicago, IL, 60637, United States, kmartin@gsb.uchicago.edu, Jun Ma

We describe Optimization Services modeling Language (OSmL), an open source algebraic modeling language for mathematical optimization. OSmL is designed to convert raw data in XML format into problem instances that conform to the Optimization Services instance language (OSiL) standard. There is support for sets, indexing, and loops. An optimization model represented in OSiL can be solved with any solver that is Optimization Services compatible.

■ TC45

R - 4th Floor, Raphael

Integrated Inventory Distribution Systems

Sponsor: Transportation Science & Logistics
Sponsored Session

Chair: Maher Lahmar, Univeristy of Houston, Department of Industrial Engineering, Houston, TX, 77204, United States, mlahmar@uh.edu

1 - Coordination of a Multi-Retailer Inventory/Distribution System with Limited Supplier Capacity

Sylvana Saudale, University of Houston, ssaudale@uh.edu, Maher Lahmar

We consider a distribution system made of a single vendor with a limited capacity and a set of retailers with stochastic demand where the vendor has complete inventory information of the currently visited retailer only. The vendor decides sequentially on how much stock to allocate to each retailer. We formulate the problem as an MDP, discuss optimal replenishment policies and compare the performance of myopic heuristics to the optimal solution.

2 - An Analytical Model for Computing the Parameters of an Optimal Hybrid Policy for Shipment Consolidation

Fatih Mutlu, Texas A&M University, fmutlu@tamu.edu, James H. Bookbinder, Sila Cetinkaya

In this paper, we study the stochastic shipment consolidation problem. We develop a renewal theoretic model for computing the parameters of an optimal hybrid policy which is also known as time-and-quantity policy in the literature. We also present results for a comparison of hybrid policies with other well-known policies for shipment consolidation.

3 - Impact of Coordinated Replenishment and Shipping Strategies in Inventory/Distribution Systems

Mustafa Gurbuz, PhD Student, University of Washington, Business School, University of Washington, Business Schoo, Mazkenzie Hall, P.O. Box 353200, Seattle, WA, 98195, United States, mgurbuz@u.washington.edu, Yongpin Zhou, Kamran Moinzadeh

We study the impact of coordinated replenishment in a multi-item distribution system with multiple identical retailers, one warehouse, and multiple suppliers with positive lead times. We propose a new centralized ordering policy that would achieve coordination across retailers/items to synchronize shipments of different items. We aim to quantify the benefits of coordination via comparing the results of the proposed policy to that of the traditional independent inventory control policy.

■ TC46

R - 4th Floor, Rubens

Vehicle Routing Problems

Contributed Session

Chair: Shankara Kuppa, PhD Candidate, University of Michigan - Ann Arbor, Industrial and Operations Eng. Dept., 1205 Beal Avenue, Ann Arbor, MI, 48109, United States, skuppa@umich.edu

1 - A New Solution Approach for an Inventory Routing Problem

Wikrom Jaruphongsa, National University of Singapore, 10 Kent Ridge Crescent, Singapore, Singapore, isejw@nus.edu.sg, Henri Thierry Toutounji, Ek Peng Chew

This paper studies an inventory routing problem (IRP) where a warehouse replenishes several customers using a finite fleet of capacitated vehicles. Each customer faces a deterministic demand over a finite planning horizon, and has a finite capacity to keep local inventory. Our main contribution lies in transforming this problem into an equivalent rich vehicle routing problem (VRP). The transformation allows us to design a constructive heuristic inspired by the VRP literature.

2 - Routing in Sensor Networks

Hari Prasad Thadakamalla, Student, The Pennsylvania State University, 310 Leonhard Blgd., University Park, PA, 16802, United States, hpt102@psu.edu, Usha Nandini Raghavan, Soundar Kumara

Sensor networks consist of large number of tiny sensors that coordinate amongst themselves to achieve a larger sensing task. The sheer number of these sensors would present unique challenges in the design of unattended autonomous sensor networks. In this presentation we represent these sensor networks as weighted complex networks and discuss some routing techniques on them. In specific, we define a local parameter called local betweenness centrality and discuss how it affects the search process.

3 - Routing Co-operating Vehicles to Perform Precedence-Linked Tasks

Andrew Vakhutinsky, Lead Research Analyst, BAE SYSTEMS/AIT, 6 New England Executive Park, Burlington, MA, 02453, United States, andrew.vakhutinsky@baesystems.com, Cynara Wu

The problem of scheduling cooperating vehicles is a generalization of the classical vehicle routing problem where certain tasks are linked by precedence constraints and vehicles have varying constrained resources. We describe a type of roll-out algorithm that finds an approximate solution to the problem in real-time and demonstrate the results of the computational experiments.

4 - Integrated Package and Trailer Routing in Freight Transportation

Shankara Kuppa, PhD Candidate, University of Michigan - Ann Arbor, Industrial and Operations Eng. Dept., 1205 Beal Avenue, Ann Arbor, MI, 48109, United States, skuppa@umich.edu, Dushyant Sharma

The freight transportation industry faces two major planning problems - package-routing and trailer-routing, while satisfying a number of operational and quality-of-service constraints. Further, the costs of the package or trailer flow on a link are usually non-linear in the flow values. We present an integrated integer linear programming formulation for the two problems along with exact and heuristic approaches for solving it. We also present computational results on some realistic scenarios.

■ TC47

R - 4th Floor, Michelangelo

Dynamic Traffic Assignment: Theory, Algorithms, and Models (I)

Sponsor: Transportation Science & Logistics
Sponsored Session

Chair: Henry Liu, Assistant Professor, University of Minnesota, Department of Civil Engineering, 500 Pillsbury Drive SE, Minneapolis, MN, 55455, United States, henryliu@umn.edu

1 - A Link Based Quasi-VI Formulation and Solution Algorithm for Dynamic User Equilibria

Jeff Ban, xban@cc.usu.edu, Henry Liu, Michael Ferris, Bin Ran

We propose a link-node based quasi-variational inequality formulation for the basic deterministic dynamic user equilibrium problem with single-user-class and fixed demands. The solution existence and boundedness condition for the proposed model is established using a newly developed theory for a group of quasi-variational inequality problems.

2 - Discrete-Time Models for Dynamic Traffic Assignment with Periodic Planning Horizon

Siriphong Lawphongpanich, Lawphong@ise.ufl.edu

In this talk, we discuss discrete-time models for dynamic traffic assignment in which the planning horizon is a circular interval. This class of models includes those with linear planning horizon and does not require the network to be empty at the beginning or at the end of the horizon.

3 - Applications of a Simulation Based Dynamic Traffic Assignment Model

Michael Florian, Professor, University of Montreal, Montreal, QC, H3C 3J7, Canada, mike@crt.umontreal.ca

We present five applications of a dynmaic traffic assignment model with data originating from cities in Canada, the USA , Australia and Europe. The network sizes vary from 700 to over 5,000 linkes. The issues analyzed and the resulting scenario comparisons are analyzed in detail.

4 - Solving the OD Demand and Traffic Assignment Calibration Problem for Dynamic Traffic Assignment

Yi-Chang Chiu, Assistant Professor, University of Texas at El Paso, Engrg Bldg E201P, 500 W University Ave, El Paso, TX, 79968, United States, chiu@utep.edu, Jorge Villalobos

We present a methodology and a case study for calibrating the OD information for the Dynamic Traffic Assignment models for urban transportation long term planning applications. The matrix formulation of the proposed quadratic program with equilibrium constraints enables the proposed approach to be quickly implemented on a large metropolitan network.

■ TC48

R - 4th Floor, Dante

Healthcare Resource Planning and Flow Management - 1

Sponsor: Health Applications
Sponsored Session

Chair: Keith Willoughby, Operations Research Consultant, Health Quality Council, 241-111 Research Drive, Saskatoon, SK, S7N 3R2, Canada, kwilloughby@hqc.sk.ca

1 - Planning for the Right Number of Doctors in the Future

Ben Chan, Chief Executive Officer, Health Quality Council, 241-111 Research Drive, Saskatoon, SK, S7N 3R2, Canada, bchan@hqc.sk.ca

Physician supply is always a hot topic in the news. We describe how simulation techniques were used to predict future supply and demand for physician services. Our planning model has forged a consensus between the medical profession and government on future medical school enrolment size, allocation of residency positions and training programs for foreign physicians.

2 - Classify Patient Flow Data in Emergency Departments

Yong Li, Operations Research Consultant, Health Quality Council, 241-111 Research Drive, Saskatoon, SK, S7N 3R2, Canada, yli@hqc.sk.ca, Ben Chan, Keith Willoughby

A classification tool is designed to recognize patient flow patterns in EDs. It automatically classifies patient flow data into distinctive patterns. Given the complexity of an ED system, which encompasses a huge variety of diseases and complications thus patient pathways, the proposed method can simplify simulation model development enormously. The model helps to identify bottlenecks and reduce patient wait time in EDs. This tool can also be used to process data of other complicated systems.

3 - Breast Cancer Patient Flow Analysis

Keith Willoughby, Operations Research Consultant, Health Quality Council, 241-111 Research Drive, Saskatoon, SK, S7N 3R2, Canada, kwilloughby@hqc.sk.ca, Yong Li, Ben Chan

Cancer care is a complex variable pathway combining several system entry points, various transfer points, and a range of providers. There appears to be a natural delay for transfer between services, as well as passage of information. We have recently begun an OR study to map the pathway of activities for breast cancer patients and to build a simulation model to investigate system bottlenecks. Our objective is to help reduce the time from cancer suspicion to definitive diagnosis.

■ TC49

R - 4th Floor, Medici

Recent Innovations in Health Care Modeling

Cluster: Health Care
Invited Session

Chair: Andrew Schaefer, Assistant Professor, University of Pittsburgh, Department of Industrial Engineering, Pittsburgh, PA, United States, schaefer@ie.pitt.edu

1 - The Optimal Time to Initiate HIV Therapy

Steven Shechter, University of Pittsburgh, 1048 Benedum Hall, Pittsburgh, PA, 15232, United States, sms13@pitt.edu, Andrew Schaefer, Scott Braithwaite, Matthew Bailey, Mark Roberts

This is perhaps the most important and unresolved issue in HIV therapy today. We present a Markov Decision Process framework for addressing this topic and discuss theoretical and practical considerations. We will present some results based on a large dataset of HIV patients.

2 - Optimal Nursing Workforce Planning

Mariel Lavieri, PhD Student, Sauder School of Business, 2053 Main Mall, Vancouver, BC, Canada, lavieri@exchange.commerce.ubc.ca, Martin Puterman

This talk describes the development of a planning tool to determine the optimal number of nurses to train, promote and import over a finite horizon to achieve nursing staff level targets. The model is based on the age dynamics of the nursing workforce. The tool is being developed to model the Registered Nurses workforce in British Columbia.

3 - Do Profit Incentives Affect Outcomes of Dialysis Patients?

Donald Lee, Stanford University, 344 Olmsted Road, #423, Stanford, CA, 94305, United States, dkklee@stanford.edu, Stefanos Zenios

We examine End Stage Renal Disease Medicare beneficiaries from nonrural areas who were on dialysis during any part of the period from 1999 to 2001. Using instrumental-variables to control for hidden bias we establish that there is a marked increase in expenditures associated with for-profit clinics. On the other hand, propensity score methods conclude in the opposite direction indicating the presence of hidden biases. Implications on strategies for reimbursing health providers will be discussed.

■ TC50

R - 4th Floor, Cervantes

Joint Session DA/ Research: Research Clinic- The Future of Decision Analysis Research

Sponsor: Decision Analysis, Research Clinics
Sponsored Session

Chair: Jason Merrick, Associate Professor, Virginia Commonwealth University, P.O. Box 843083, 1001 W. Main St., Richmond, VA, 23284, United States, jrmerric@vcu.edu

1 - The Future of Decision Analysis Research
Jason Merrick, Associate Professor, Virginia Commonwealth University, P.O. Box 843083, 1001 W. Main St., Richmond, VA, 23284, United States, jrmerric@vcu.edu, Larry Phillips, Jacqueline Maszaros, Howard Kunreuther, L. Robin Keller, Bob Clemen

What is the future of decision analysis? Has the field developed to maturity? Are we just about to hit another major break through? What areas should young researchers be concentrating on? A panel of the top researchers in the field will discuss these are another questions critical to the future direction of research in the field.

Tuesday, 4:30pm - 6:00pm

■ TD01

H - Lobby Level, Plaza A

Tutorial: Branch and Tree Decomposition Techniques for Discrete Optimization(Joint)

Cluster: Tutorials, Minority Issues
Invited Session

1 - Tutorial: Branch and Tree Decomposition Techniques for Discrete Optimization
Illya Hicks, Assistant Professor, Texas A&M University, 237K Zachry Engineering Center, 3131 TAMU, College Station, TX, 77843-3131, United States, ivhicks@tamu.edu, Arie Koster

This tutorial gives a general overview of two emerging techniques for discrete optimization: branch decompositions and tree decompositions. We will discuss basic definitions, the Graph Minors Theorem, algorithms for constructing the decompositions and how to utilize branch decompositions and tree decompositions in a practical setting for solving NP-hard problems such as domination, the travelling salesman problem, general minor containment, and frequency assignment problems.

■ TD02

H - Lobby Level, Plaza B

Data Envelopment Analysis: Advances in Environmental Performance, Productivity, and Portfolio Efficiency Analysis

Cluster: Data Envelopment Analysis
Invited Session

Chair: Timo Kuosmanen, Assistant Professor, Wageningen University, ENR Group, POB 8130, Wageningen, 6700EW, Netherlands, Timo.Kuosmanen@wur.nl

1 - GMM Tests for the SD Efficiency of a Given Portfolio
Thierry Post, Professor, Erasmus University Rotterdam, P.O. Box 1738, Rotterdam, 3000 DR, Netherlands, gtpost@few.eur.nl, Philippe Versijp

We develop empirical tests for Stochastic Dominance (SD) efficiency of a given investment portfolio relative to all possible portfolios formed from a set of assets. Contrary to existing Linear Programming tests, our tests are embedded in the Generalized Method of Moments (GMM) framework, which results in superior statistical power properties and increases the comparability with existing mean-variance tests.

2 - On the Anatomy of Productivity Growth: A Decomposition of the Fisher Ideal TFP Index
Timo Sipilainen, Senior researcher, MTT Economic Research, Luutnantintie 13, Helsinki, 00410, Finland, timo.sipilainen@mtt.fi, Timo Kuosmanen

This paper presents the most comprehensive decomposition of Fisher ideal total factor productivity index to date. We systematically isolate the productivity effects of changes in production technology, technical efficiency, scale efficiency, allocative efficiency, and the market strength. The three efficiency components further decompose into input- and output-side effects. The proposed decomposition is illustrated with an empirical application to a sample of Finnish farms.

3 - Environmental Cost-Benefit Analysis Using DEA
Mika Kortelainen, University of Joensuu, Department of Business and Economics, P.O. Box 111, Joensuu, FI-80101, Finland, mika.kortelainen@joensuu.fi, Timo Kuosmanen

DEA is an extensively applied method for evaluating performance of comparable production units. Despite its popularity, its use in environmental applications remains limited. In this paper we show how DEA approach can be applied in the context of the environmental Cost-Benefit Analysis. Our purpose is to illustrate how the valuation principles of DEA can offer useful insights for the valuation of the environmental services, and thus complement the conventional toolbox of environmental modelers.

4 - Weak Disposability of Undesirable Outputs in DEA
Timo Kuosmanen, Assistant Professor, Wageningen University, ENR Group, POB 8130, Wageningen, 6700EW, Netherlands, Timo.Kuosmanen@wur.nl

Weak disposability means emission abatement by decreasing activity level. Appropriate way of modeling weak disposability in DEA has caused confusion. We identify a dilemma in these approaches: conventional formulations assume all firms apply uniform abatement factors. However, it is often cost efficient to abate emissions in firms where marginal abatement costs are lowest. We re-formulate weak disposability such abatement factors are non-uniform and the linear structure of DEA is preserved.

■ TD03

H - Ballroom Level, Continental Ballroom 1

New Horizons for Higher Education

Sponsor: Education (INFORM-ED)
Sponsored Session

Chair: Don Phillips, drdon@tamu.edu

1 - Homeland Security- New Horizons for Higher Education
Don Phillips, drdon@tamu.edu, David McIntyre

The events of 9-11 have permanently changed the face of Homeland Security forever. Concomitantly, the scope of higher education will change also. We will discuss the new challenge to higher education and the paths to follow in integrated coursework, training and certification / certificate programs. Challenges and opportunities will be presented within a unifying framework.

2 - Integration and Synthesis of Operations Research Concepts Throughout the Industrial Engr Curriculum
Bryan Norman, Associate Professor, University of Pittsburgh, 1033 Benedum Hall, Pittsburgh, PA, 15261, United States, banorman@engrng.pitt.edu, Kim LaScola Needy, Mary Besterfield-Sacre, Jayant Rajgopal

In this talk we discuss the innovative approach to curriculum reform by the Department of Industrial Engineering at the University of Pittsburgh containing several overarching objectives, including: integration of operations research and other concepts across the curriculum; teaching students to synthesize different concepts to solve unstructured problems; and providing problem solving methods and strategies within a societal framework.

3 - The University of Alabama MBA Business Intelligence Track: A New Initiative
J. Michael Hardin, mhardin@cba.ua.edu, Michael Conerly, Charles Sox

Recently the University of Alabama Culverhouse College of Commerce undertook a revision of its MBA program. Outcomes of this process included the development of several new MBA tracks, and the introduction of several new courses specifically related to emerging technologies in the contemporary business environment. This presentation will discuss the development and details of the business intelligence (BI)/data mining curriculum into new MBA. A key feature of this curriculmn is the partnership between management science and statistics faculty in the new BI course required of all MBA students.

■ TD04

H - Ballroom Level, Continental Ballroom 2

Army Analysis Shaping the Future

Sponsor: Military Applications
Sponsored Session

Chair: Clark Heidelbaugh, Operations Research Analyst, Center for Army Analysis, 6001 Goethals Rd, Fort Belvoir, VA, 22060, United States, clark.heidelbaugh@us.army.mil

1 - Modeling Army Force Generation Using Simulation

Steven Stoddard, Operations Research Analyst, Center for Army Analysis, 6001 Goethals Rd, Fort Belvoir, VA, 22060, United States, steven.stoddard@us.army.mil, Mark Brantley

The Army developed the AFGM simulation to determine the best size for the force. We simulate the flow of units through lifecycles. AFGM allows us to examine force structure by illustrating gaps or redundancies, and associated deployment tempos. It also allows us to examine force generation options, such as how long rotations should last and when to mobilize reserves. The Army has adopted AFGM to analyze its force structure for the Quadrennial Defense Review and other analytical efforts.

2 - The Army's Analytical Support to the Quadrennial Defense Review, 2005

Clark Heidelbaugh, Operations Research Analyst, Center for Army Analysis, 6001 Goethals Rd, Fort Belvoir, VA, 22060, United States, clark.heidelbaugh@us.army.mil

The Center for Army Analysis (CAA) is providing key support to the Army's Quadrennial Defense Review (QDR) Office, the Army Staff, and senior Army leadership to shape Army positions, inform senior leaders, and assist in key decisions they face under the QDR 2005. This work will demonstrate applications of operations research methodologies to address the nature of strategic Army challenges for and application of forces to future challenges.

3 - An Analytic Approach For Monitoring, Shaping, and Evaluating Responses to State Fragility

Sean O'Brien, Operations Research Analyst, Center for Army Analysis, 6001 Goethals Rd, Fort Belvoir, VA, 22060, United States, Sean.P.OBrien@us.army.mil

CAA's Near-term Forecasts of Crisis and Instability using Text-Based Events is a system for monitoring, assessing and forecasting (in near-real time) the character and intensity of interactions between individuals and organizations operating within each country of interest. The ACTOR model provides an assessment of the environmental conditions that enable and constrain people, FORECITE provides an assessment of who is doing what to whom, when where and how in each country.

4 - Analytical Support to the Headquarters and Support Activities Joint Cross Service Group, BRAC 2005

Christopher Hill, Operations Research Analyst, Center for Army Analysis, 6001 Goethals Road, Fort Belvoir, VA, 22060, United States, Christopher-Hill@us.army.mil, Joseph McGill, Russell Pritchard, Doris Futrell, Elisa Turner, John Bott, Linda La Barbera, Patrick Chapin, Michael Bowes, Andrew Layman, Donald Duckro, James Harris

Joint Cross Service Groups (JCSG) played a pivotal role in the realignment and transformation of the Department of Defense through BRAC 2005. This brief details the analytical support given to the Headquarters and Support (HSA) JCSG. Analytical techniques employed include data and statistical analysis, decision analysis, optimization and econometric analysis. These efforts were a key to the success of BRAC, even though it was first time many of the functions were studied in a joint context.

■ TD05

H - Ballroom Level, Continental Ballroom 3

Service Capacity Planning and Scheduling

Cluster: Service Sector Operations
Invited Session

Chair: John Goodale, University of Oregon, Lundquist College of Business, Eugene, OR, United States, jgoodale@lcbmail.uoregon.edu

1 - Two-Dimensional Cargo Overbooking Models

Metin Cakanyildirim, Assistant Professor of Operations Management, The University of Texas at Dallas, 2601 N Floyd Rd., SM 30, School of Management, Richardson, TX, 75083, United States, metin@utdallas.edu, Sirong Luo, Raja Kasilingam

This paper introduces 2-dimensional overbooking models and compares them with a 1-dimensional model. For 1-dimensional model, it shows that the optimal overbooking limit does not change with the magnitude of the booking requests. In 2-dimensional models, the overbooking limit is replaced by a curve. We present Curve (Cab) and Rectangular (Rab) models. The boundary of the acceptance region in the Cab (Rab) model is a curve (rectangular).

2 - Service Performance Analysis and Improvement for a Ticket Queue with Balking Customers

Susan H. Xu, Penn State, shx@psu.edu, Long Gao, Jihong Ou

We study a ticket queue in which each customer is issued a ticket and the number being served is broadcast on a display panel. A customer would balk if his ticket position exceeds a critical number. We develop a Markov model and propose exact and approximate solution procedures. We also propose a service improvement which is shown to raise the performance of the ticket queue on par with the physical queue.

3 - Improving the Efficiency of Porter Operations in Two Vancouver Hospitals

Martin L. Puterman, Professor, Centre for Health Care Management, Sauder School of Business, University of British Columbia, Vancouver, BC, V6T 1Z2, Canada, martin.puterman@sauder.ubc.ca, Fredrik Odegaard, Li Chen, David Puterman, Ryan Quee, Mats Gerschman

This paper reports the results of a study of porter operations for two Vancouver area hospitals. It describes the importance of efficient portering, how the systems operated at the time of the study, the challenges faced in carrying out the study, our analysis approach, the performance measures developed, our models, recommendations and outcomes. The study used simulation to measure the impact of system changes and linear programming to develop enhanced staff schedules.

4 - Economics of Priority Queues in Theme Parks

Fred Easton, Syracuse University, Whitman School of Management, Syracuse University, Syracuse, NY, 13244-2130, United States, ffeaston@syr.edu, Heather Lutz

In theme parks guests routinely face hour-long waits for attractions. To address this key satisfaction issue, some parks sell priority passes that let guests bypass alll lines. However, queueing theory, prospect theory and organizational justice theories suggest that priority queues may increase dissatisfaction among non-participants, jeopardizing future visits, favorable recommendations, and discretionary spending. This paper models the impact of a priority pass system on expected profit.

■ TD06

H - Ballroom Level, Continental Ballroom 7

Closed-Loop Supply Chain Economics

Cluster: Reverse Supply Chains
Invited Session

Chair: Geraldo Ferrer, Associate Professor of Operations Management, Naval Postgraduate School, Grad Sch of Business and Public Policy, IN-234 555 Dyer Rd, Monterey, CA, 93943, United States, gferrer@nps.edu

1 - Optimal Price and Quantity of Refurbished Products

Sarah Ryan, Associate Professor, Iowa State University, Industrial & Mfg Sys Engg, 2019 Black Engineering, Ames, IA, 50011-2164, United States, smryan@iastate.edu, Jumpol Vorasayan

New and refurbished products compete for consumers by price and perceived quality. For new products made to order and returns refurbished to stock, we optimize the proportion of returns to refurbish and their sale price in a general open queueing network. Optimality conditions show when refurbishing none, some, or all of the returns will maximize total profit.

2 - Value of Creating a Recollection and Redistribution System for Influenza Vaccine

Prashant Yadav, Assistant Professor of Supply Chain Management, MIT-Zaragoza International Logistics Program, Zaragoza Logistics Center, Zaragoza, AR, 50009, Spain, pyadav@mit.edu, David Williams

The supply chain for flu vaccine in the US has seen marked shortages and wastage in the last few years.This supply chain is characterized by a high degree of uncertainty in both supply and demand, resulting in order gaming and sub-optimal ordering by the healthcare providers.We characterize the value of establishing a redistribution mechanism and its impact on initial ordering and demand fulfillment.

3 - An Analysis of Decentralized Collection and Processing Operations for end-of-life Products

Ibrahim Karakayali, Research Assistant, University of Florida, 303 Weil Hall P.O. Box 116595, Gainesville, FL, 32611, United States, ibrahimk@ufl.edu, Elif Akcali, Hulya Emir-Farinas

We analyze decentralized system for end-of-life products where both the supply of end-of-life products and demand for remanufactured parts are price-sensitive. We develop models to determine the optimal acquisition price for the used product and sales price for the remanufactured part in a decentralized setting, where either the collector or the remanufacturer is the leader. We discuss how the decentralized systems can be coordinated to achieve centralized system collection volume and profits.

4 - Managing Distinguishable New and Remanufactured Products
Geraldo Ferrer, Associate Professor of Operations Management, Naval Postgraduate School, Grad Sch of Business and Public Policy, IN-234 555 Dyer Rd, Monterey, CA, 93943, United States, gferrer@nps.edu, Jay Swaminathan

We study a monopolist that makes new and remanufactured products as a market segmentation mechanism. We characterize the production quantities associated with self-selection, and explore the effect of various parameters in the Nash equilibrium.

■ TD07

H - Ballroom Level, California

OR/MS Modeling in Some Key Manufacturing Problems

Contributed Session

Chair: Douglas Morrice, Professor, The University of Texas at Austin, Red McCombs School of Business, 1 University Station B6300, Austin, TX, 78712-0210, United States, morrice@mail.utexas.edu

1 - Minimizing Setup Time for a Complex Crew Setup
A. Dale Flowers, Faculty of Operations Management, Case Western Reserve University, Weatherhead School of Management, 10900 Euclid Avenue, Cleveland, OH, 44106, United States, dale.flowers@case.edu, Amit Garg, Kevin Linderman

We consider a production line operated by a crew of people. While changing production from one product to another, multiple tasks have to be completed by the crew members, but not all crew members are capable of performing all tasks. Our research objectives are to assign the tasks to available crew members so as to minimize the time until all tasks are completed, and to explore the impact of worker flexibility on the solution.

2 - Control of Manufacturing Systems using State Feedback and Linear Programming
Joost van Eekelen, M.Sc., Technische Universiteit Eindhoven, P.O.Box 513, W-Hoog 0.125, Eindhoven, 5600 MB, Netherlands, j.a.w.m.v.eekelen@tue.nl, Erjen Lefeber, Koos Rooda

Most studies on control of discrete event manufacturing systems focus on control in the event domain. However, in production environments, events occur while time elapses. We develop an explicit state feedback controller in MPC setting for a specific class of manufacturing systems. The state of the system is specified as a function of time. For larger systems, where explicit feedback control is too difficult, we present an MPC framework based on repeatedly solving linear programming problems.

3 - Multi-Level Batch Production Smoothing Problem
Mesut Yavuz, Visiting Assistant Professor, University of Florida, 1350 N. Poquito Road, Shalimar, FL, 32579, United States, yavuzm@ufl.edu

The production smoothing problem (PSP) aims to find smooth schedules for mixed-model production lines. In a smooth schedule, models are evenly dispersed over the schedule. The batch production smoothing problem (BPSP) is an extension of the PSP which allows the models to be produced in batches. This paper addresses the multi-level version of the BPSP. The problem is modeled as an optimization problem, its computational complexity is shown and heuristic solution methods are proposed.

5 - Designing and Operating a High-Volume, Make-to-Order Assembly Line under Uncertain Demand
Douglas Morrice, Professor, The University of Texas at Austin, Red McCombs School of Business, 1 University Station B6300, Austin, TX, 78712-0210, United States, morrice@mail.utexas.edu, Fehmi Tanrisever

We address the problem of designing and operating a flexible assembly line for a make-to-order electronics assembly firm to minimize the costs of setups and lost demand. During the design of the assembly line the firm must also determine the number of lanes per line by incurring a fixed cost which reduces the setup requirements during the operations. We formulate this problem as a stochastic assignment problem and characterize the optimal level of flexibility under stochastic demand.

■ TD08

H - Ballroom Level, Imperial A

Human Aspects in Operations Management

Sponsor: Manufacturing & Service Oper Mgmt
Sponsored Session

Chair: Jay Swaminathan, UNC - Chapel Hill, McColl building, 4717, Chapel Hill, NC, United States, msj@unc.edu

1 - Impact of Sales Force and Effective Incentive Structure on Supply Chain Performance
Gigi Yuen, Northwestern University, 2145 Sheridan Road, C229, Evanston, IL, 60208, United States, gigiyuen@northwestern.edu, Wallace Hopp, Seyed Iravani

In many supply chains, it is common practice for manufacturers to use a sales force to promote sales and improve coordination with retailers. In this paper, we investigate the impact of a salesperson on the profit of the manufacturer and the overall supply chain. We show how a proper compensation plan for salesperson can serve as a mechanism for improving supply chain efficiency.

2 - An Experimental Investigation of Supply Chain Contracting Mechanisms
Elena Katok, Associate Professor, Penn State University, 5F BAB, State College, PA, United States, ekatok@psu.edu, Yan (Diana) Wu

The topic of supply chain coordination is a much studied one. While theoretical properties of various contracting mechanisms have been studied extensively, much less is known about their practical performance. We compare several contracting mechanisms in the controlled setting of an experimental laboratory to investigate their performance.

3 - Is Timely Information Always Better? The Effect of Feedback Frequency on Performance and Knowledge Acquisition
Jay Swaminathan, UNC - Chapel Hill, McColl building, 4717, Chapel Hill, NC, United States, msj@unc.edu, Nicholas H. Lurie

The effect of frequent information updates on human decision making has not been studied in the past. In this research, using two experimental studies in a newsvendor setting and a management simulation, we show that in an environment characterized by random noise, more frequent feedback can potentially lead to declines in performance. This effect does not change significantly for cases where there is a cost associated with making a change and is amplified in environments that have a higher degree of randomness.

4 - Managing Organizational Structure to Promote Creativity and Cooperation
Fang Liu, PhD student, Northwestern University, 2145 Sheridan Rd. C210, Evanston, IL, 60208, United States, f-liu@northwestern.edu, Seyed Iravani, Wallace Hopp

Cooperation in a knowledge work environment is greatly affected by the social connections among agents. In this paper, we develop models to investigate teaming strategies aiming at maximizing group performances. We also study various agent-based search heuristics and compare these to the organizationally "optimal" strategy. From these comparisons we draw insights into organizational structure in creative environments and managerial policies for promoting improvement.

■ TD09

H - Ballroom Level, Yosemite A

Issues in Supply Chain Management

Cluster: Supply Chain Management
Invited Session

Chair: Asoo Vakharia, Professor, University of Florida, Department of DIS, POB 117169, Gainesville, FL, 32611, United States, asoo.vakharia@cba.ufl.edu

1 - Aggregate Planning with Pricing and Capacity Flexibility
Joseph Geunes, Associate Professor, University of Florida, 303 Weil Hall, Gainesville, FL, 32611, United States, geunes@ise.ufl.edu, Edwin Romeijn, Yasemin Merzifonluoglu

We develop a new set of profit-maximizing aggregate planning models for determining demand and internal capacity levels under price-sensitive deterministic demands and outsourcing options. The models determine optimal price, production, inventory, and capacity levels, while accounting for production economies of scale and inventory holding costs. We use polyhedral results and dynamic programming techniques to provide polynomial-time solution approaches when internal capacity is time-invariant.

2 - The Value of Stable Production Cycles and Advanced Demand Information In Multi-Echelon Supply Chains
James Rappold, Assistant Professor, University of Wisconsin, School of Business, 975 University Avenue, Madison, WI, 53706, United States, jrappold@bus.wisc.edu, Keenan Yoho

We analyze stabilizing production cycles in manufacturing environments where there is a single, capacitated resource producing multiple products in a predetermined sequence, setup times are significant and customer demand is highly uncertain. We construct a set of integrated models to stabilize production cycle lengths to assess strategic changes in capacity, demand volume and uncertainty, and the availability of information.

3 - Strategic Interactions between Channel Structure and Durability
Sreekumar Bhaskaran, Doctoral Student, University of Texas-Austin, McCombs School of Business, Austin, TX, United States, Sreekumar.Bhaskaran-Nair@phd.mccombs.utexas.edu, Stephen Gilbert

We investigate how the use of intermediaries in the channel of distribution affects a manufacturer's investment in the durability of a product. We show that the use of intermediaries can increase the incentive for a manufacturer to invest in durability. This contrasts with existing results that indicate that the use of intermediaries generally discourages manufacturers from increasing other dimensions of product quality.

4 - Optimal Strategy of Offering Single-function vs. Fusion Products
Yuwen Chen, Doctoral Student, University of Florida, Department of DIS, POB 117169, Gainesville, FL, 32611, United States, yuwen@ufl.edu, Asoo Vakharia, Aydin Alptekinoglu

This paper investigates the optimal product strategy for a monopolist who may potentially offer two single-function products and two fusion products with double functionality. We characterize six optimal strategies, all of which include at most two products, and five include at least one fusion product. A single-function product with small profit margin is likely succumbed to a fusion product. Surprisingly, a fusion product with high substitution does not always stay in the optimal offering.

■ TD10

H - Ballroom Level, Yosemite B

Pricing and Coordination Issues in Supply Chains

Cluster: Supply Chain Management
Invited Session

Chair: Haresh Gurnani, University of Miami, 417B Jenkins Building, Dept of Management, Coral Gables, FL, 33156, United States, hgurnani@exchange.sba.miami.edu

Co-Chair: Yunzeng Wang, Professor, Case Western Reserve University, Weatherhead School of Management, Cleveland, OH, United States, yxw36@case.edu

1 - The Role of Bundling Strategies in a Two-product, Two-firm Competitive Environment
Srinagesh Gavirneni, Cornell University, Johnson Graduate School of Management, Ithaca, NY, 14853, United States, sg337@johnson.cornell.edu, Vickii Zhou

We analyze a two-firm scenario where each company sells two complementary products with their competition focused primarily on price. If one firm decides to bundle its products, we wish to determine (i) whether it (or its competitor) is better off? (ii) what happens to the market size? (iii) whether the competitor will follow? We determine conditions under which the market behavior can be easily predicted.

2 - Value of Decision Flexibilities and Information Updating in a Two-Echelon Supply Chain
Saibal Ray, McGill University, 1001 sherbrooke street west, Montreal, QC, Canada, saibal.ray@mcgill.ca, Yuyue Song, Tamer Boyaci

We analyze a decentralized two period, two-echelon supply chain with price-sensitive stochastic demand. Any unsatisfied demand is lost, and any leftover inventory from the first period is carried over to the second period. Moreover, the demands for the two periods are correlated. We study this setting to shed light on the effects of decision flexibilities and information updating on the decisions and profit performance of the channel partners.

3 - Pricing-Production Strategies in Decentralized Assembly System with Component Delivery Leadtimes
Xiang Fang, Ph.D. Candidate, Case Western Reserve University, 10900 Euclid Ave., Weatherhead School of Management, Cleveland, OH, 44106, United States, xxf6@case.edu, Kut So, Yunzeng Wang

Consider an assembler who procures components from multiple suppliers. We explore how the assembler relies on contractual arrangements to coordinate the quantity and timing of components production of suppliers, when facing uncertainty, production leadtimes and delivery-delay-sensitive demand in the supply chain. A resulting game problem is formulated and analyzed.

4 - A Comparison of Supply Contracts with Provision for Special Orders
Haresh Gurnani, University of Miami, 417B Jenkins Building, Dept of Management, Coral Gables, FL, 33156, United States, hgurnani@exchange.sba.miami.edu, Diwakar Gupta

Many retailers offer to special order items that stock out at no additional cost to customers. Some even provide incentives for customers to prevent a loss of sale. We compare and contrast several common contract mechanisms and show that this strategy can increase retailer power in typical supplieróretailer interactions.

■ TD11

H - Ballroom Level, Yosemite C

Supply Chain Management Planning and Integration

Contributed Session

Chair: Tomoaki Shimada, PhD Candidate, INSEAD, Boulevard de Constance, Fontainebleau, 77305, France, shimada@iuj.ac.jp

1 - Locating Service Centers under Performance Guarantees
Prahalad Venkateshan, Doctoral Candidate, Case Western Reserve University, Room 320-10, Dept. of Operations, 11119 Bellflower Road,Peter B Lewis Bldg, Cleveland, OH, 44106, United States, Prahalad.Venkateshan@case.edu, Kamlesh Mathur, Ronald Ballou

Service firms facing demand from customers need to decide where to locate their service centers,which customer sites to assign to the centers and the staffing level at each center so that customers experience guaranteed service at minimum cost.To determine adequate staffing levels,we approximate a service center and customers assigned to it as an M/G/s queueing system.Using this as a sub-problem we formulate the location problem as a set-covering problem and solve it using column-generation.

2 - Multi-Objective Supplier Selection Problem
Vijay Wadhwa, PhD. Student, Penn State University, 310 Leonhard Building, State College, PA, 16802, United States, vuw100@psu.edu, A. Ravi Ravindran

The supplier selection problem is modeled as a multi-objective optimization problem where one or more buyers order multiple products from different suppliers in a multiple sourcing network. Lead-time, quality and price under quantity discounts are the conflicting criteria that have to be minimized simultaneously. We present several techniques for solving the multi-objective problem with numerical examples.

3 - Supply Chain Management for the LNG Business
Roar Gronhaug, PhD-student, Norwegian University of Science and Technology, Alfred Getz veg 3, Trondheim, N-7491, Norway, roar.gronhaug@iot.ntnu.no, Marielle Christiansen

We consider an LNG (liquefied natural gas) actor's supply chain, consisting of liquefaction plants, sea transportation, and regasification terminals. To achieve the greatest possible profit from this supply chain, the LNG actor gets support from an optimization model and associated solution approach. The model is integrating the inventory management at both liquefaction plants and regasification terminal as well as the as the ship routing and scheduling.

4 - Intelligent Planning and Control System to Support Enhanced Supply Chain Operations
Radu Babiceanu, Virginia Polytechnic Institute and State University, Dept. of Industrial and Systems Eng., Blacksburg, VA, 24061, United States, rbabicea@vt.edu, Frank Chen

The decentralized architecture of multi-agent systems seems appropriate for modeling supply chain systems, since the constituent organizations cannot make individual decisions without collaborating with upstream or downstream members. The proposed intelligent planning and control system aims at integrating production planning, inventory control and transportation strategies to effectively improve operations across the supply chain.

5 - Empirical Study on Data Accuracy and Possible Data Manipulation in a Supply Chain
Tomoaki Shimada, PhD Candidate, INSEAD, Boulevard de Constance, Fontainebleau, 77305, France, shimada@iuj.ac.jp

We empirically study data accuracy issues entailed by e-procurement systems, and explore possibility for opportunistic behavior that causes data inaccuracy in a supply chain. We investigate factors that cause suppliers to doubt buyers' intentional overstatement of their demand forecasts using partial least squares models. The data were collected from a questionnaire survey of component or raw material suppliers in the electrical and electronics industry of Southeast Asia.

■ TD12

H - 4th Floor, Union Square 1

Auction and Game Theory

Cluster: Applications of Auction and Game Theory
Invited Session

Chair: Leon Chu, UF, Weil Hall 303 PO 116595, Gainesville, FL, United States, zhuyang@ufl.edu

1 - Approximating Revenue-Maximizing Combinatorial Auctions
Tuomas Sandholm, Carnegie Mellon University, Computer Science Department, 5000 Forbes Avenue, Pittsburgh, PA, 15213, United States, sandholm@cs.cmu.edu, Anton Likhodedov

Designing revenue-maximizing combinatorial auctions is a recognized open problem. Our approximations belong to Virtual Valuations Combinatorial Auctions (VVCAs), which we introduced in AAAI-04. We construct VVCAs with logarith-

mic approximations for 1) additive valuations, and 2) unlimited supply. Then, for the general case, our algorithms search the VVCA parameter space, guided by economic insights. Experimentally they yield near-optimal VVCAs and substantial revenue increase over VCG.

2 - An Incentive Engineering Approach to RFID Data Sharing
Jun Shu, junshu@psu.edu

Data collected by RFID belongs to different agents. It is beneficial to share the data for some system-wide goal of the supply chain, but there is risk in exposing data. We presents a game theoretical framework in which different supply chain integration strategies are in alignment with different data sharing schemes in an effort to achieve incentive compatibility.

3 - Optimal Procurement Auction with Capacitated Suppliers
Anuj Kumar, PhD Student, IEOR Department, Columbia University, 321 Mudd Building, 120th Street, New York, NY, 10027, United States, ak2108@columbia.edu, Garud Iyengar

We consider a procurement auction model where production capacities are also privately known to the supplier firms, in addition to the privately known marginal cost. We derive the optimal direct mechanism which maximizes the retailers expected profits. We also construct an implementation of the optimal direct mechanism. We also discuss some applications in supply chain management.

4 - A Double Auction Mechanism for e-Marketplaces
Leon Chu, UF, Weil Hall 303 PO 116595, Gainesville, FL, United States, zhuyang@ufl.edu, Zuo-Jun Max Shen

We study the problem of designing truthful double auction mechanisms for e-marketplaces with many buyers and sellers, and propose a double auction mechanism under which truthful bidding is a dominant strategy for all buyers and sellers. Furthermore, this mechanism achieves asymptotic efficiency by just solving two linear programs. This is significant considering the fact that the efficiency maximization problem with complete information is NP-hard.

■ TD13

H - 4th Floor, Union Square 5

Software Demonstration

Cluster: Software Demo
Invited Session

1 - AdapChain, Inc.- Using AdapLink to Connect Supply Chain Data to Supply Chain Optimization
Svenne Juul, President, AdapChain, Inc., 275 Firethorne Dr., West Chester, PA, 19382, United States, sjuul@adapchain.com

Commerce is full of supply chain problems and the marketplace offers a wide variety of software designed to solve these problems. Unfortunately, many implementation projects suffer under the burden of integrating the application with the data. AdapLink is designed to provide a cost effective solution for that specific problem.

■ TD14

H - 4th Floor, Union Square 6

OR Supporting Force Protection

Sponsor: Military Applications
Sponsored Session

Chair: Greg Graves, Lieutenant Colonel, U.S. Army / Texas A&M University, Department of Industrial Engineering, TAMU 3131, College Station, TX, 77843-3131, United States, greg.graves@tamu.edu

1 - A Risk Theoretic Approach to Force Protection Decisions
Greg Graves, Lieutenant Colonel, U.S. Army / Texas A&M University, Department of Industrial Engineering, TAMU 3131, College Station, TX, 77843-3131, United States, greg.graves@tamu.edu, Martin Wortman

Arrangement of forces and resources in force protection roles can be modeled as a stochastic network. Under this framework, force and resource allocation decisions become network design exercises. We provide an overview of a risk theoretic approach to force protection network design decisions. We propose an approach to determine the effect of a partial or inexact delineation of event probabilities on a clear preference among design alternatives.

2 - Enhancing Force Protection with Modeling and Simulation
Gregory Rau, Lieutenant Colonel, U.S. Air Force (FP Battlelab), 1517 Billy Mitchell Blvd, Lackland AFB, TX, 78236-0119, United States, Gregory.Rau@lackland.af.mil, Tom Scrivener, Bob Jordan, Daniel Ledermann

We use Joint Conflict and Tactical Simulation for comparative analysis of alternatives, producing valuable insights for force protection decision makers. The efficacy of these results is a product of the methodology, including picking the correct gamers, placing gamers on familiar terrain with known physical features, and requiring them to follow their standing orders. Attacking with a worst-case postulated threat ensures results will compare favorably with the real world.

3 - R&D Support for Forward Operating Base Protection
Eddie Chesnut, Senior Engineer Analyst, U.S. Army Engineer Research and Development Center, 3903 Halls Ferry Road, Vicksburg, MS, 39180, United States, Eddie.Chesnut.LTC@erdc.usace.army.mil

This presentation will cover current efforts by the U.S. Army Engineer Research and Development Center to support Forward Operating Base protection in Iraq. Efforts include structural materials and methods, technologies, tactics, techniques and procedures to counter rockets, artillery, mortars, and vehicle borne improvised explosive devices. Integrated solutions and Department of Defense sponsored programs will be highlighted along with a description of the requirements generation process.

■ TD15

H - 4th Floor, Union Square 9

Recent Developments in Scheduling Theory

Cluster: Scheduling
Invited Session

Chair: Yunpeng Pan, Computer Scientist, TomoTherapy Inc., 1240 Deming Way, Madison, WI, 53717, United States, pany@cae.wisc.edu

1 - Hybrid Dynamic Programming & Branch-and-Bound Approach to Single Machine Earliness-Tardiness Problem
Leyuan Shi, University of Wisconsin-Madison, Department of Industrial and System Engi, 1513 University Avenue, Madison, WI, 53706, United States, leyuan@engr.wisc.edu, Yunpeng Pan, Hoksung Yau

We address the single machine earliness-tardiness scheduling problem with linear objective function and distinct due date, release time and unit penalty. Hybrid approaches of dynamic programming and branch-and-bound are proposed for the problem. The approaches either apply branch-and-bound on the problem's dynamic programming tree or the way reverse.

2 - Sequencing Games with Work-In-Progress and Third-Party Booking Costs
Tolga Aydinliyim, Case Western Reserve University, Department of Operations, Cleveland, OH, 44106, United States, tolga.aydinliyim@case.edu, George Vairaktarakis

We investigate the relation between manufacturers (M) and a single third party (3P) by applying cooperative game theory to scheduling situations. Each M, who aims to minimize booking costs plus the total weighted flow time, books 3P's limited capacity. As soon as bookings are completed, 3P offers a new schedule which minimizes the total outsourcing costs of all M's.

3 - On the Equivalence of Max-min Transportation Lower Bound and Time-indexed Lower Bound
Yunpeng Pan, Computer Scientist, TomoTherapy Inc., 1240 Deming Way, Madison, WI, 53717, United States, ypan@tomotherapy.com, Leyuan Shi

We consider scheduling problems with min-sum objectives and general costs. We show that the optimal adjustment of transportation costs to obtain the tightest possible lower bounds can be computed as a linear program. We also prove that the "optimal" lower bound is in fact equal to the time-indexed lower bound.

4 - Pareto Optima for Total Weighted Completion Time and Maximum Lateness on a Single Machine
George Steiner, McMaster University, Management Science and Information Syste, Hamilton, Ontario, L8S 4M4, Canada, steiner@mcmaster.ca, Paul Stephenson

We consider the single-machine problem of enumerating all Pareto-optimal sequences with respect to the total weighted completion time and the maximum lateness objectives. We show that the master sequence concept originally introduced by Dauzère-Pérès and Sevaux, implies the existence of global dominance orders for a large number of scheduling problems.

■ TD16

H - 4th Floor, Union Square 10

Project Scheduling

Cluster: Scheduling
Invited Session

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

1 - Alternative Formulations of the Rough-Cut Capacity Planning (RCCP) Problem

Jade Herbots, K.U.Leuven, Research Center for Operations Managemen, Naamsestraat 69, Leuven, BR, B-3000, Belgium, Jade.Herbots@econ.kuleuven.be, Willy Herroelen, Erik Demeulemeester

The objective of Rough-Cut Capacity Planning (RCCP) is to provide information which supports tactical decisions such as bidding and order acceptance of new projects. We study the underlying mathematical structure of the problem and explore alternative formulations and objective functions which enhance the usefulness of the provided information.

2 - Algorithms for Stable Resource Allocation in Project Scheduling

Kristof Braeckmans, K.U.Leuven, Dept. Appl. Econ., Naamsestraat 69, Leuven, BR, B-3000, Belgium, Kristof.Braeckmans@econ.kuleuven.ac.be, Erik Demeulemeester, Willy Herroelen, Roel Leus

Uncertainty in the duration of project activities may cause the baseline schedule to be disrupted during project execution. We present algorithms that determine the flow of renewable resources through the activities in a given baseline schedule under the objective of maximizing schedule stability.

3 - An Exact Procedure for Generating Stable Time-Buffered Project Baseline Schedules

Stijn Van de Vonder, K.U.Leuven, Dept. Appl. Econ., Naamsestraat 69, Leuven, BR, B-3000, Belgium, Stijn.VandeVonder@econ.kuleuven.ac.be, Erik Demeulemeester, Willy Herroelen

Proactive project scheduling aims at protecting the baseline schedule against future disruptions. This paper introduces an exact algorithm that aims at maximizing schedule stability by inserting time buffers in an initial non-buffered baseline schedule. The impact of initial schedule alternatives on the maximum stability is examined through extensive simulation.

4 - A Meta-heuristic for Generating Robust Project Baseline Schedules under Uncertain Renewable Resource

Olivier Lambrechts, K.U.Leuven, Dept. of Appl. Econ., Naamsestraat 69, Leuven, BR, B-3000, Belgium, Olivier.Lambrechts@econ.kuleuven.ac.be, Erik Demeulemeester, Willy Herroelen

One possible measure for a schedule's ability to cope with unexpected disturbances is its robustness, defined as the total sum of free slacks over all activities. We introduce a meta-heuristic to create buffered schedules that combine good makespan performance with a high robustness.

■ TD17

H - 4th Floor, Union Square 11

Special Topics in Inventory Management

Contributed Session

Chair: Y. Levent Kocaga, Ph.D. student, USC, IOM Department Marshall School of, Business, Bridge Hall 401, USC, Los Angeles, CA, 90089-0809, United States, kocaga@usc.edu

1 - Ordering Policies for Products with Bi-Level Demand

Parag Dhumal, Ph.D. student, The College of Business Administration, The University of Toledo, Mail Stop #103, 2801 West Bancroft St., Toledo, OH, 43606, United States, pdhumal@utnet.utoledo.edu, Udayan Nanadkeolyar, P Sundararaghavan

The demand pattern common in many situations generated by periodical promotions such as coupons; special discounts followed by regular sales may be termed as bi-level demand. In this study, we develop optimal policy as well as heuristics for such demands faced by retailers. Performance of heuristics is compared against bounds and optimal solution.

2 - Inventory Models with Transportation and Deterioration Costs

Arash Dadvand, Student, Auburn University, 507 W.glenn Ave. Apt 6, Auburn, AL, 36832, United States, dadvaar@auburn.edu, Andrew Phelps, Emmett Lodree

The purpose of this research is to investigate the effects of transportation decisions and in transit product deterioration of inventory models within a global transshipment environment. Mathematical models and sensitivity analysis are formulated for basic inventory systems with these additional characteristics

3 - Inventory Modeling with Auction Procurement Method

Pooya Farahvash, Graduate Student, Rutgers University, 96 Frelinghuysen Road, Room 201, Piscataway, NJ, 08854, United States, pooya@eden.rutgers.edu, Tayfur Altiok

Auction mechanism can be a successful method for selecting the most appropriate supplier in the different stages of a supply chain. In this work we considered a cost based inventory model when the selection of the supplier is done through a reverse auction method. We developed an inventory model that incorporates the uncertainty of the unit price due to auction procurement method. Effects of the number of suppliers and correlation between unit cost and order quantity is also studied.

4 - Excess Shelf Space in Grocery Retailing: New Insights into an Onipresent Resource

Jan Fransoo, Professor, Technische Universiteit Eindhoven, P.O. Box 513, Pav F12, Eindhoven, ND, NL-5600 MB, Netherlands, j.c.fransoo@tm.tue.nl, Rob Broekmeulen, Karel van Donselaar, Tom van Woensel

Shelf space and non-linear handling cost are the main operational drivers in grocery retail operations. We model these into a single model, and conduct an empirical analysis, and find that significant amounts of excess shelf space exist for a large part of the assortment at retailers. Excess shelf space is retail space that is not required to carry out the replenishment policy, and offers interesting opportunities for the development of new supply chain coordination mechanisms.

5 - Inventory Models for Substitutable Products

Y. Levent Kocaga, Ph.D. student, USC, IOM Department Marshall School of, Business, Bridge Hall 401, USC, Los Angeles, CA, 90089-0809, United States, kocaga@usc.edu, Sampath Rajagopalan

In this study, we examine the optimal inventory policy in a system where there are two substitutable products. Both the total demand and the proportion of each product's demand are random. Also, a fixed proportion of the unsatisfied customers for one product will purchase the other, if available in inventory. We build on the work in Nagarjan and Rajagopalan (2004) and show that the optimal policy exhibits a "partially decoupled" structure in certain regions.

■ TD18

H - 4th Floor, Union Square 12

Predicting Air Transportation System Performance II

Sponsor: Aviation Applications
Sponsored Session

Chair: Andrew Lacher, Research Strategist, The MITRE Corporation, 7515 Colshire Drive, McLean, 22102, United States, alacher@mitre.org

1 - Using the FAA NAS Strategy Simulator to Measure Impacts of Internal and External Change

Anne Yablonski, Federal Aviation Administration, Washington, DC, Anne.Yablonski@faa.gov, Daniel Goldner, David Knorr, Lance Sherry

The FAA NAS Strategy Simulator (NSS) is a dynamic simulation model that examines interactions between Passengers/Shippers, Airlines, and the NAS. It reveals and explains NAS system behavior and provides a platform to test hypotheses. The paper shows results of applying the NSS to potential system changes such as fuel prices or government fees to evaluate expected system impacts. By better understanding what drives our customer's decisions, we can better plan for the future.

2 - Initial Parametric Analysis of JPDO NGATS Concept

Shahab Hasan, Program Manager, Logistics Management Institute, 2000 Corporate Ridge, McLean, VA, 22102, United States, SHASAN@lmi.org, Sherry Borener, Matt Blake

In the spring of 2005, the Joint Planning and Development Office (JPDO) for the Next Generation Air Transportation System (NGATS) developed a top-level operational concept. This paper presents the results of an initial parametric analysis of the capacity benefits. This quick-turnaround analysis was performed by the JPDO Evaluations and Analysis Division using fast-time simulations.

3 - A Parametric Model of National Airspace System Delay

Joseph Post, Principal Analyst, Congressional Budget Office, Ford House Office Building, 2nd and D Streets, SW, Washington, DC, 20515, United States, joseph.post@cbo.gov, Daniel Murphy

While airspace system models can generally account for time-varying airport weather, current models cannot account for en route convective weather. Further, most fast-time models require lengthy set-up, and so cannot be used to simulate a broad range of weather conditions. In order to overcome these difficulties, we develop a parametric model of system-wide delay which explicitly accounts for surface and en route weather using multinomial regression techniques.

4 - Future Airport Capacity Analysis (FACT)
William Swedish, Principal Staff, The MITRE Corporation, McLean, VA, 22102, swedish@mitre.org, George Solomos, Steve Urlass, Jackie Kee

The FAA wanted to assure that the long-term capacity of the aviation system matched forecasts of demand and initiated the FACT study. The FACT analysis looked across multiple studies to identify airports and metropolitan areas that did not have sufficient capacity to meet future demand. There were nearly 300 commercial service airports evaluated in this study. The results underscore the importance of continuing the current investment plans in order to meet future airport capacity demands.

■ TD19

H - 4th Floor, Union Square 13

Theoretical, Experimental, and Econometric Approaches to Entrepreneurship and Innovation

Sponsor: Technology Management
Sponsored Session

Chair: Christian Schade, Professor, Institute for Entrepreneurial Studies and Innovation Management, Humboldt University Berlin, Spandauer Str. 1, Berlin, DE, 10178, Germany, schade@wiwi.hu-berlin.de

1 - When Should New Products be Preannounced?
Joachim Büschken, Prof. Dr., Catholic University Eichstaett, Institute for Marketing, Auf der Schanz 49, Ingolfstadt, DE, 85049, Germany, joachim.bueschken@ku-eichstaett.de

In industries like computer game software or commercial aircraft, new product preannoucement (NPP) is the norm. Research focuses on NPP's effects on consumer behavior, but we know little about NPP timing. The paper builds upon Lilly and Walters (1997, 2000) to develop a system dynamics model of optimal NPP timing. The model incorporates the influence of competitive action, which often is retaliatory in nature. The model is used to develop testable hypotheses on optimal NPP timing.

2 - Predicting New-product Adoption Time with a Spatial Model
Christian Schade, Professor, Institute for Entrepreneurial Studies and Innovation Management, Humboldt University Berlin, Spandauer Str. 1, Berlin, DE, 10178, Germany, schade@wiwi.hu-berlin.de, Yasemin Boztug

Development of new product sales can be predicted via adoption time of individuals. One might also want to incorporate spatial dependence, geographical and social, between consumers. We present a model based on these premises and analyze data for the diffusion of digital cameras in Germany. We start with a linear regression analysis with adoption time as the dependent variable and introduce, in a stepwise manner, different spatial extensions. The predictive power of the models is compared.

3 - German and Russian entrepreneurs — A Quasi-Experimental Study on Differences in Traits and Behavior
Katrin Burmeister, Research Associate, Institute for Entrepreneurial Studies and Innovation Management, Humboldt University Berlin, Spandauer Str. 1, Berlin, DE, 10178, Germany, burmeister@wiwi.hu-berlin.de, Ulrik Schˆneberg, Christian Schade

Entrepreneurs' traits have been investigated to forecast the propensity to start a business or the success of an existing venture. In this study, quasi-experimental and experimental in nature, we compare traits such as openness for experience and manipulate decision behavior of entrepreneurs from Russia and Germany. We examine, e.g., whether different tendencies to fall prey to a status quo bias or to be affected by extremeness aversion result from country differences or from traits.

4 - Innovation and Coordination in the Experimental Economics Laboratory
Claudia Keser, IBM T.J. Watson Research Center, P.O. Box 218, Yorktown Heights, NY, 10598, United States, ckeser@us.ibm.com

We examine innovation coordination in simple games with multiple equilibria. These coordination games involve the choice between payoff- and risk-dominant equilibria. Game theory makes no clear-cut prediction as to which equilibrium to choose. We present some results on how interaction structures and other aspects can influence participants' coordination on either of the equilibria in the experimental economics laboratory and discuss potential implications for innovation.

■ TD20

H - 4th Floor, Union Square 14

Forestry I: Fire Applications

Sponsor: Energy, Natural Resources & the Environment / Forestry
Sponsored Session

Chair: David Martell, Faculty of Forestry, University of Toronto, 33 Willcocks Street, Toronto, ON, M5S 3B3, Canada, martell@smokey.forestry.utoronto.ca

1 - Strategic Budgeting for Initial Response of Wildfire Management in the U.S.
Gyana Parija, Research Staff Member, IBM T.J. Watson Research Center, Yorktown Heights, NY, 10598, United States, parija@us.ibm.com, Brian Booher, Dan Keller, Samer Takriti

We will present a MIP model, and an algorithm for optimizing the initial response (IR) organization needed to maximize the effectiveness of various fire containment activities. An initial response organization could consist of a set of hand crews, engines, bull-dozers, helicopters, water-tenders and the like. We will then discuss our computational results for a set of large MIP instances arising from a collection of prototype planning units from Mississippi, Oregon, California and Alaska.

2 - Evaluating Financial Incentives for Fuel Treatment in Private Forests
Robert Haight, Research Forester, USDA Forest Service, North Central Research Station, 1992 Folwell Avenue, St. Paul, MN, 55108, rhaight@fs.fed.us, Gregory Amacher, Arun Malik

Forest fires damage or destroy trees and homes. Losses can be reduced if landowners treat fuels before wildfire strikes. We evaluated two kinds of financial incentives for fuel treatment: compensating landowners for the cost of fuel treatment and requiring landowners to share the cost of fire suppression. Using a stand-level model with stochastic fire occurrence, we found that cost-sharing of fire suppression is more effective at reducing total social cost.

3 - Spatially Explicit Closed Loop Inter-temporal Decision Making under the Risk of Fire
Masashi Konoshima, Oregon state university, Oregon state university, 280 Peavy Hall, Corvallis, OR, 97331, United States, Masashi.Konoshima@oregonstate.edu, Claire A. Montgomery, Jeffrey L. Arthur, Heidi Albers

Previous studies of forest management under the risk of fire simulate fire behavior using spatially explicit fire models and optimize for a particular realization of a fire on a landscape. This paper models a spatially explicit closed loop dynamic decision making process. The model is specified as a stochastic dynamic programming problem. General implications regarding optimal fuel treatment and timber harvest are drawn from a series of scenario analyses on a hypothetical seven-unit landscape.

4 - Adaptive Management of Flammable Forests
David Martell, Faculty of Forestry, University of Toronto, 33 Willcocks Street, Toronto, ON, M5S 3B3, Canada, martell@smokey.forestry.utoronto.ca

Forest managers have developed and used a broad array of strategies for dealing with uncertain fire losses when they develop harvest schedules for flammable forest landscapes. In this paper we explore the extent to which adaptive ecosystem management strategies can be used to help manage such landscapes.

■ TD21

H - 4th Floor, Union Square 15

Advances in Data Mining Techniques for Industrial Applications

Sponsor: Data Mining
Sponsored Session

Chair: Wei Jiang, Assistant Professor, Stevens Institute of Technology, Castle Point of Hudson, Hoboken, NJ, 07030, United States, wjiang@stevens.edu

Co-Chair: Zhiguang Qian, Georgia Institute of Technology, 755 Ferst Ave, Atlanta, GA, 30332, United States, zqian@isye.gatech.edu

1 - Improving Hidden Markov Model for Information Extraction
Jinlin Chen, Assistant Prof., The City University of New York, 65-30 Kissena Blvd., Computer Science, Flushing, NY, 11367, United States, jchen@cs.qc.edu

This paper studies the major problems existing in today HMM based Info. Extraction, which include 1) Training data sparseness, 2) Single HMM for all, and 3) One dimension state transition. To solve these problems, several different approaches have been proposed, which include, 1) Using Boosted Wrapper Induction algorithm to automatically create training data for HMM, 2) Creating multiple HMM for a specific domain instead of single HMM, and 3) Considering surrounding state transition for HMM.

2 - A New Multiclass Generalization of AdaBoost
Ji Zhu, Assistant Professor, University of Michgan, 439 West Hall, 1085 South University, Ann Arbor, MI, 48109-1107, United States, jizhu@umich.edu

We propose a new algorithm that directly extends the original AdaBoost algorithm to the multi-class case without reducing it to multiple two-class problems. This algorithm differs from AdaBoost.M1 in that it only requires the performance of each weak classifier be better than random guessing rather than 1/2. We further show that the new algorithm fits a forward stagewise additive model using a multi-class exponential loss function.

3 - A Data-mining Approach to Study the Significance of Nonlinearity in Multi-Station Assembly Processes

Yuan Ren, Ph.D. Candidate, Research Assistant, Industrial Engineering, Texas A&M University, Texas A&M University, MS3131, College Station, TX, 77843, United States, renyuan@tamu.edu, Shiyu Zhou, Yu Ding

This paper presents a data-mining method to study the significance of nonlinearity in a multi-station manufacturing process, including (1) a factor-covering design, which helps assess the significance of nonlinearity in a multi-station process with hundreds of variables; (2) a MART-based predictive model, identifying the critical factors and partial dependence relationship among factors and the response. Decision guidelines are generalized to help decide when a nonlinear model must be used.

4 - Functional Mixed-effect Models for Curve Clustering

Zhiguang Qian, Georgia Institute of Technology, 755 Ferst Ave, Atlanta, GA, 30332, United States, zqian@isye.gatech.edu, Fangyi He, Wei Jiang

Gaussian process is a flexible means for modeling complex functions. By using Gaussian process models, this paper extends the mixture Gaussian model (for finite-dimensional data) to some functional mixed-effect models for curve clustering. The advantages of the proposed method are illustreated with some real examples.

■ TD22

H - 4th Floor, Union Square 16

Enumeration Problems (in memory of Leo Khachiyan)

Sponsor: Optimization/ Optimization and Data Mining
Sponsored Session

Chair: Endre Boros, Professor, Rutgers University, RUTCOR, 640 Bartholomew Road,, Piscataway, NJ, 08854, United States, boros@rutcor.rutgers.edu

1 - Generating Horn Cores of Horn Disjunctions

Thomas Eiter, Institute for Information Systems, Technical University of Vienna, Favoritenstrasse 9-11, Vienna, A-1040, Austria, eiter@kr.tuwien.ac.at, Kazuhisa Makino

Horn formulas are an important knowledge representation tool. Since the disjunction of such formulas, may violate the Horn property, Horn cores are considered as approximations in terms of semantically largest Horn functions included in the disjunction. We report about previous and recent results on generating such Horn cores.

2 - Generating all k-connected Spanning Subnetworks

Khaled Elbassioni, Professor, Max-Planck Institute for Informatics, Saarbrucken, 66123, Germany, elbassio@mpi-sb.mpg.de

We show that all connected and spanning subsets of a graph or in a matroid can be generated efficiently. We also extend these results for k-connected and spanning subsets.

3 - Generating Vertices of a Polyhedron is Hard

Vladimir Gurvich, Professor, Rutgers University, RUTCOR, 640 Bartholomew Road, Piscataway, NJ, 08854, United States, gurvich@rutcor.rutgers.edu, Leonid Khachiyan, Endre Boros, Khaled Elbassioni, Konrad Borys

We prove that generating negative cycles in a digraph is hard, that is, given a digraph with weighted arcs and a family of its negative cycles, it is an NP-hard to decide whether this family is complete or it can be extended. As a consequence, we solve in negative two open problem from linear programming. Given a system of linear inequalities, generating all minimal infeasible subsystems, as well as all vertices of the corresponding polyhedron, is hard.

4 - A Faster Algorithm for Enumerating All Maximal Cliques

Kazuhisa Makino, Division of Mathematical Science for Social Systems, Graduate School of Engineering Science, Osaka University, Toyonaka, Osaka, 560-8531, Japan, makino@sys.es.osaka-u.ac.jp, Takeaki Uno

We consider the problems of generating all maximal (bipartite) cliques in a given (bipartite) graph. We show that all maximal cliques can be generated with O(M(n)) time delay and in O(n^2) space, where n denotes the number of vertices and M(n) denotes the time needed to multiply two nxn matrices.

■ TD23

H - 4th Floor, Union Square 17

Robustness and Reliability in Networks

Sponsor: Telecommunications
Sponsored Session

Chair: Cole Smith, Associate Professor, University of Florida, United States, cole@ise.ufl.edu

1 - Multicommodity Flow Network Interdiction Problems Under Varying Attacker Strategies

Churlzu Lim, Postdoctoral Student, University of Florida, Gainesville, FL, United States, clim@email.arizona.edu, Cole Smith, Neil Bearden

Consider a network interdiction problem in which an attacker disables a set of network arcs in order to minimize the maximum profit that can be obtained from shipping commodities across the network. The attacker is limited by some interdiction budget. We examine algorithms for protecting a network against an optimal attacker, and against an attacker acting according to two heuristic schemes. We then discuss empirical tests with human subjects that illustrate the effectiveness of each approach.

2 - Algorithms for Reliable k-Path Routing Problems

April Andreas, PhD Student, University of Arizona, P O Box 210020, Tucson, AZ, 85715, United States, april@email.arizona.edu, Cole Smith

Most routing problems assume perfect operability of all arcs. However, when arc failure probabilities exist, we may wish to stipulate that two paths shall exist, such that the probability that at least one path survives is sufficiently large. This consideration requires the presence of a nonconvex constraint within an integer program. We provide a globally optimal algorithm for finding minimum-cost k paths between a source and destination, with and without arc-disjointness restrictions.

3 - A Two Stage Transportation Problem Under Uncertainty

Richard Wollmer, California State University, Long Beach, CA, rwollmer@csulb.edu

This problem differs from the classical transportation problem in that demands are random variables. Supplies at the origin points must be ordered before the actual values of the random demands are known. This is to be done in a way that minimizes total expected cost, which consists of transportation costs and penalty costs for unsatisfied demand and excess supply.

■ TD24

H - 4th Floor, Union Square 18

Special Topics in Financial Engineering

Contributed Session

Chair: Hongman Gao, Ph. D. Candidate, University of Mississippi, School of Business Administration, University, MS, 38677, United States, hgao@bus.olemiss.edu

1 - Portfolio Construction using Adaptive Optimization

Eli Faulkner, Software Scientist/Mathematician, Quantum Leap Innovations, 3 Innovation Way, Suite 100, Newark, DE, 19711, United States, etf@quantumleap.us

We describe a novel optimization approach to the index tracking problem from financial engineering. We describe our in-house technology, the Adaptive Optimization Engine(AOE), and show its ability to solve portfolio construction and balancing problems in one pass using index tracking as an evaluation criteria. We show that the AOE is a good tool for solving this problem since it applies a variety of optimization methods as well as transparently handling both discrete and continuous variables.

2 - A Dual Markowitz Approach to Evaluation of the Warsaw Stock Exchange

Bartosz Sawik, M.Sc., AGH University of Science & Technology/Department of Systems Analysis and Computer Modelling, al. Mickiewicza 30, Krakow, 30-059, Poland, B_Sawik@yahoo.com, Piotr Lebkowski

This paper presents a method for constructing a set of alternative constraints for the Markowitz model. Various structures of stock portfolio with different coefficients of extreme risk aversion are considered. The investment space of each portfolio depends on the shape of utility function for the selected investments and the ratio of shares in the portfolio to shares in the stock exchange. Dataset for the analysis are based on a 55 month horizon of the WSE.

3 - Pricing Weather (Precipitation) Derivatives

Tomoaki Tabata, Tokyo Fuji University, Takadanobaba 3-8-1,Shinjuku, Tokyo, 1690075, Japan, tabata@fuji.ac.jp, Takashi Namatame

Although weather derivatives are offered for a hedge tool of the risk by rain, they are not marketed in the present condition because the index and the pricing method have not been constructed sufficiently. We suggest a pricing model for precipitation derivatives and propose an approach to make a precipitation derivatives market.

4 - Alternative Formulations of the Robust Portfolio Selection Problem

Andrew Lim, University of California, 4135 Etcheverry Hall, IEOR Dept, University of California, Berkeley, CA, 94720-1777, United States, lim@ieor.berkeley.edu, J. George Shanthikumar, Thaisiri Watewai

We present an alternative to the typical 'max-min' (worst case) formulation of the robust portfolio selection problem which has a number of interesting features: (i) the optimal portfolio can be obtained fairly explicitly (ii) it lies in the interior of the uncertainty set and hence is less conservative than the solution of the typical robust portfolio selection problem (iii) the optimal portfolio for continuous price processes is the same for all concave increasing utility functions!

5 - A Framework to Develop a Composite Model in Financial Rating System

Hongman Gao, Ph. D. Candidate, University of Mississippi, School of Business Administration, University, MS, 38677, United States, hgao@bus.olemiss.edu, Fred Glover, Haibo Wang, Yaquan Xu

We survey recent development in credit-risk evaluation and propose a framework to develop a flexible credit rating system combining the rule-based expert system and machine learning techniques to improve both performance and accuracy. This rating system is designed for finding outliers in the data set. The outliers often give important information to the financial analyst and can be used as a trig in the fraud detection system.

■ TD25

H - Ballroom Level, Franciscan D

ICS Prize

Sponsor: INFORMS Computing Society
Sponsored Session

Chair: John Chinneck, Professor, Carleton University, Systems & Computer Engineering, Ottawa, K1S 5B6, Canada, chinneck@sce.carleton.ca

1 - Global Optimization with Branch-and-reduce

Nikolaos Sahinidis, University of Illinois, Dept. of Chemical and Biomolecular Eng., Urbana, IL, 61801, United States, nikos@uiuc.edu, Mohit Tawarmalani

We present the main theoretical and algorithmic components of the branch-and-reduce approach to the global optimization of continuous, integer, and mixed-integer nonlinear programs. Central to this approach are convexification and polyhedral cutting plane approaches and their computational implementation in BARON.

■ TD26

H - Ballroom Level, Continental Ballroom 4

OR and Radiation Therapy

Sponsor: Optimization/OR and Medicine
Sponsored Session

Chair: Eva Lee, Associate Professor & Director, Center for Operations Research in Medicine, Georgia Institute of Technology, Industrial & Systems Engineering, Atlanta, GA, 30332-0205, United States, evakylee@isye.gatech.edu

1 - Optimization and Decision Support in IMRT Cancer Treatment

Eva Lee, Associate Professor & Director, Center for Operations Research in Medicine, Georgia Institute of Technology, Industrial & Systems Engineering, Atlanta, GA, 30332-0205, United States, evakylee@isye.gatech.edu, KyungDuck Cha, Jin Shi

In this talk, we present an optimization decision support system for designing treatment plans in intensity-modulated radiation therapy (IMRT). Plan designs involve optimization of beam geometries, radiation energies and beam intensity. Several MIP-based optimization models and computational strategies will be presented. Clinical qualities of resulting plans on real cancer patient cases will be discussed.

2 - Quadratic Programming for Intensity-Modulated Radiation Therapy Treatment Planning

KyungDuck Cha, Georgia Institute of Technology, 765 Ferst Drive NW, Atlanta, GA, 30332, United States, chacha2000@isye.gatech.edu, Eva Lee

In this talk, we introduce constrained quadratic programming for inverse planning in intensity-modulated radiation therapy. The model employs dose-volume based objective while explicitly constrains the solution space to include coverage, homogeneity, and conformity for tumor target, and dose volume restrictions for critical structures and normal tissues. Several methods to solve the quadratic programs will be discussed. Computational results on real patient cases will be presented.

3 - Including Fractination in Planning IMRT Radiation Treatment for Cancer

Ronald L Rardin, Professor, Industrial Engineering, Potter Engineering Center, Purdue University, West Lafayette, IN, 47907-2022, United States, rardin@purdue.edu, Mark Langer, Delal Dink, Joseph Pekny

Tools for planning IMRT choose beam angles and fluence patterns for an entire treatment program actually delivered in 25-50 daily fractions. Fractions should meet minimum target and maximum normal tissue doses, but these limits are usually handled by ad hoc post processing. We present new models and computational results that compute treatment plans including the fractionation constraints. Incremental computational costs prove modest, and the stage is set for dynamically adjusting plans.

4 - A Continuous Tabu Search Method for Catheter Placement Optimization in HDR Brachytherapy

François Galea, PRiSM - Université de Versailles, 45 Avenue des Etats-Unis, Versailles CEDEX, 78035, France, francois.galea@prism.uvsq.fr, Catherine Roucairol

The current catheter placement determination schemes in high dose rate (HDR) brachytherapy still do not take into account the use of modern techniques, and particularly the use of HDR remote afterloaders. In this talk, we present a methodology for determining a suitable placement of the catheters, making use of a tabu search method with continuous variables.

■ TD27

H - 4th Floor, Union Square 21

Some Planning Problems in Business Environment

Contributed Session

Chair: Zhong-Xian Wang, Professor, Montclair State University, 234 McCosh Rd., Montclair, NJ, 07043, United States, wangj@mail.montclair.edu

1 - Forecasting GDP using Neural Networks

Mahdi Nasereddin, Pennsylvania State University, P.O.Box 7009, Reading, PA, 19610, United States, mxn16@psu.edu, Farooq Malik

Recent evidence suggests that oil prices affect output of the economy in a non-linear complex fashion. However, there is no clear agreement on the unknown functional form. An application of artificial neural network for short-term forecasting of GDP using oil prices and utilizing cascaded learning is proposed. We find that the mean absolute forecasting error is reduced by applying cascaded neural network relative to conventional artificial neural networks and popular linear models.

2 - The Effect of Offshore Business Services Outsourcing Announcements on the Market Value of the Firm

James Kroes, Georgia Institute of Technology, 800 West Peachtree Street NW, Atlanta, GA, 30332-0520, United States, james.kroes@mgt.gatech.edu

We empirically estimate the effect that announcements to outsource business services (information technology services and business processes) to offshore locations have on the shareholder wealth of a firm. The stock market reaction to offshore outsourcing announcements is positive and significantly different from zero. We do not find a significant difference between the market's reaction to offshore and onshore outsourcing announcements.

3 - Dynamic R&D Project Selection

Tao Yao, Stanford University, Terman 464, Stanford, CA, 94305, United States, taoyao@stanford.edu

We formulate a stochastic differential equation model for project selection under technical and market uncertainty where a firm may make ongoing decisions for an incremental and a radical innovation. We examine how features of R&D projects such as relative efficiencies and benefits affect investment policy, valuation and risk premia. Illustrate our model with a Hybrid Electric Cars vs. Hydrogen Fuel Cell Vehicles example as pursued by GM and note managerial implications of our analysis.

4 - Critical Success Factors for Implementing ERP in UAE: An Empirical Study

Faisal Al-khateeb, Dr., United Arab Emirates University, P.O.Box 17555, Al-ain, United Arab Emirates, faisal.alkhateeb@uaeu.ac.ae

Enterprise Resource Planning (ERP) system is one of the most widely accepted choices to obtain competitive advantages in the market. However, despite such strategic importance, the successful rate is low and many firms didn't achieve the intended goal in the United Arab Emirates (UAE). This study explores the root of such high failure from an "organization fit of ERP" prospective.

5 - An ERP Implementation through a SAP Installation
Zhong-Xian Wang, Professor, Montclair State University, 234 McCosh Rd., Montclair, NJ, 07043, United States, wangj@mail.montclair.edu, Zu-Hsu Lee, Qiyang Chen

The survival guide to competitiveness is to be closer to the customer and deliver value added product and services in the shortest possible time. We implemented SAP for Quote-to-Cash process. Four modules of SAP, blueprint, realization, final preparation and go-live and support, were planned to implement as a part of QTC project. These four categories are controlled and monitored by program management group.

■ TD28

H - 4th Floor, Union Square 22

New Approaches to Revenue Management and Pricing

Sponsor: Revenue Management & Pricing
Sponsored Session

Chair: Georgia Perakis, Associate Professor of Operations Research, MIT, Cambridge, MA, 02478, United States, georgiap@mit.edu

1 - Inter-temporal Valuations, Product Design and Revenue Management
Guillermo Gallego, Professor, Columbia University, 326 S.W. Mudd Building, New York, NY, 10027, United States, ggallego@ieor.columbia.edu, Ozge Sahin

We study inter-temporal choice models where customer valuations evolve over time. This requires discounts to induce people to book early and leads to a low-to-high pricing scheme in expectation. We show that for a wide range of capacity levels, selling call options on capacity can result in significantly higher expected revenues than those obtained using traditional low-to-high revenue management. The use of options allows customers to self-select products without the need of imposing fences.

2 - Joint Pricing and Revenue Management with Stochastic Demand
Ioana Popescu, INSEAD, Blvd de Constance, Fontainebleau, 77300, France, ioana.POPESCU@insead.edu, Ayse Kocabiyikoglu

We extend standard revenue management models to simultaneously optimize price and allocation decisions. Simple conditions on elasticity of demand, as a stochastic function of price, guarantee uniqueness of the optimal price-allocation solution and monotonicity of the optimal allocation in price. Analogue results are obtained for newsboy models with lost sales and flexible manufacturing. Numerical results show that the added value of price optimization can be very high.

3 - A Bilevel Model for Pricing Telecommunication Services
Patrice Marcotte, DIRO,, Université de Montréal, CP 6128, Succursale Centre-Ville, Montréal, QC, H3C 3J7, Canada, marcotte@iro.umontreal.ca, Gilles Savard, Mervat Chouman

Competition in telecommunication should be based not only on prices, but also on quality of service. In this presentation, we propose two models for maximizing the revenue of a firm operating over a network, taking into account market segmentation.

4 - Pricing and Demand Learning for a Perishable Product in a Competitive Transient Setting
Soulaymane Kachani, Professor, IEOR Department, Columbia University, 500 West 120th Street, NYC, NY, 10027, United States, kachani@ieor.columbia.edu, Georgia Perakis, Carine Simon

We consider the closed-loop problem of joint pricing and demand learning for a perishable product in an oligopolistic setting. We analyze the properties of the MPEC formulation of this problem. We propose a efficient Gauss-Newton algorithm, and provide sufficient conditions for convergence of the algorithm. We illustrate our approach with numerical results.

■ TD29

H - 4th Floor, Union Square 23

Pricing and Revenue Management in Manufacturing and Retail

Cluster: Pricing and Revenue Management for Non-Travel Industries
Invited Session

Chair: Itir Karaesmen, Assistant Professor, University of Maryland, 3457 Van Munching Hall, College Park, MD, 20742, United States, ikaraes@rhsmith.umd.edu

1 - Revenue Management Policies for Simultaneous Order Promising and Delivery Commitment
Michael Ball, Professor, U of Maryland, R H Smith School of Business, College Park, MD, 20742, United States, Mball@rhsmith.umd.edu, Yingjie Lan

In this paper we study the revenue management problem in a make-to-order setting where sellers/producers must commit to a delivery date at the time an order is accepted. Under the business scenario, the order promising system must not only simultaneously optimize production and shipping activities, but also disable or enable the delivery choices offered. We formulate a Markov decision process (MDP) model for this problem and discuss specialized iterative methods for solving it.

2 - Quoting Customer Lead Times When The Demand Depends on Service Performance
Serhan Duran, Georgia Tech, gtg865i@mail.gatech.edu, Julie Swann, Pinar Keskinocak, Altan Gulcu

We investigate a manufacturer's lead time quotetion problem when the recent performance of the manufacturer in meeting quoted lead times effects the future orders from the customers. We model the problem as an M/M/1 queue where the probability of a customer placing an order depends on the quoted lead time. We analyze the manufacturer's optimal lead time quote decision both finite and infinite capacity queues and compare with the case where the arrival rate does not depend on service performance.

3 - Blueprints of a Retail Laboratory
Sean Warnick, Assistant Prof., Brigham Young University, 2222 TMCB, Provo, UT, 84604, United States, sean@cs.byu.edu, Christophe Giraud-Carrier, Kevin Seppi, Nghia Tran

We report our efforts to develop a retail laboratory using the e-channel of the on-campus retailer as the experimental testbed. We point out specific challenges related to measuring the ROI of a particular pricing policy in the retail environment, and demonstrate how some approaches to policy verification can be misleading. Considering retail explicitly as a feedback process, we then show how the small gain theorem may play an important role in developing practical pricing strategies.

4 - Markdown Pricing at Multiple Stores
Zhi-Long Chen, Associate Professor, Robert H. Smith School of Business, University of Maryland, College Park, MD, 20742, United States, zchen@rhsmith.umd.edu, Guruprasad Pundoor, Suresh Acharya

We consider a markdown pricing problem involving multiple retail stores. We will talk about a number of business constraints in the problem, and two different approaches to formulate and solve the problem. Computational results and insights will also be presented.

■ TD30

H - 4th Floor, Union Square 24

Two-Stage Inventory Models

Contributed Session

Chair: Qi Feng, Ph.D. Student, The University of Texas at Dallas, Mail Station SM30., 2601 N Floyd Rd., Richardson, TX, 75083, United States, qxf011100@utdallas.edu

1 - Analysis of Replenishment Decisions in Material Requirements Planning System with Demand Uncertainty
Keli Feng, Assistant Professor, St. Cloud State University, Department of Management, 720 4th Ave. S., St. Cloud, MN, 56301, United States, kfeng@stcloudstate.edu, Amitabh Raturi, Uday Rao

We examine a single end product, discrete time inventory replenishment problem in material requirements planning (MRP) system with demand uncertainty and supply capacity limits. We develop a simulation-based optimization approach and a novel two moment approximation heuristic. We also evaluate traditional MRP and safety stock approaches. To evaluate the four approaches, we conduct computational experiments. We also provide managerial insights on the effects of different input factors.

2 - A Two-Stage Newsvendor Problem with a Service Constraint
Qi Feng, Ph.D. Student, The University of Texas at Dallas, Mail Station SM30., 2601 N Floyd Rd., Richardson, TX, 75083, United States, qxf011100@utdallas.edu, Alain Bensoussan, Suresh P. Sethi

We extend the classical newsvendor problem by introducing a service constraint and a demand forecast update. The newsvendor orders an initial amount and has the possibility to adjust the initial order after she observes a demand updating signal. She also commits to a target service level before any forecast update is available. We use the method of Lagrange multipliers to solve the problem, and we derive an analytical expression for the optimal ordering decisions.

3 - Demand Variability Impact in an Inventory System with Transshipments
Claudia Rosales, University of Cincinnati, 3253 Morrison Ave. Apt.303, Cincinnati, United States, rosalecr@email.uc.edu, David Rogers, Uday Rao

Transshipment is commonly employed among retailers to respond to temporary shortages. An analysis of demand's variability impact on the effectiveness of the system will be discussed.

4 - Lot-Sizing with Nonstationary Cumulative Capacities
Fatma Zeynep Sargut, PhD student, University of Florida, University of Florida, Industrial and Systems Eng. Dept, Gainesville, FL, 32611-6595, United States, zeynep@ufl.edu, Edwin Romeijn

We consider a two-level supply chain with non-stationary production capacities but with no production and holding costs at the first level. We show that this problem is equivalent to a single-level lot-sizing problem with cumulative capacities: for each period the cumulative production quantities should not exceed the cumulative capacities up to that time. We show that the problem is NP-hard for general cost functions and present a polynomial-time algorithm when the cost functions are concave.

5 - Shelf Space Allocation in a Two-Stage Supply Chain System
Veysel Dalkilic, Graduate Student, Auburn University, 207 Dunstan Hall, Auburn University, Auburn, AL, 36849, United States, dalkivu@auburn.edu, Emmett Lodree, Jeffrey Smith

The growing intensity of retail competition is forcing stores to strive for excellence in operations. In this environment, retailers have to balance the interconnected operations, such as transportation from warehouse, in-store replenishment and shelf space allocation in a way that the overall profit is maximized. This study introduces a shelf space allocation model for multiple items with stochastic demands in which both shelf and back-stock replenishment processes are considered.

■ TD31

H - 4th Floor, Union Square 25

Optimization in Radiation Treatment Planning

Cluster: OR Practice
Invited Session

Chair: Gino Lim, Assistant Professor, University of Houston, Department of Industrial Engineering, E206 Engineering Bldg 2, Houston, TX, 77204, United States, ginolim@uh.edu

1 - A Greedy, Least-Squares Approach for IMRT Fluence Map Optimization
Yin Zhang, Professor, Rice University, Computational and Applied Mathematics, 6100 Main Street, Houston, TX, 77005, United States, zhang@caam.rice.edu, Michael Merritt

The combinatorial nature of dose-volume constraints in IMRT poses significant challenges to fluence map optimization. We introduce a greedy approach based on a least-squares formulation which treats dose distributions as primary independent variables and beamlet intensities as secondary. We will present theoretical and computational results for the proposed approach.

2 - Morphological-based Multiobjective Planner for IMRT Fluence Map Optimization
Vira Chankong, Associate Professor, Case Western Reserve University, Electrical Engineering and Computer Sci, 10900 Euclid Avenue, Cleveland, Oh, 44106, United States, vira@case.edu, Boonyanit Mathayomchan, Qing-Rong Wu

We describe a goal programming based planner to generate IMRT treatment plans that are robust against patient movement during treatment. The medial line (core) of an object is used to capture morphological information of each target and OAR. Each voxel weight is calculated using its distance from the core and is included into the dose-volume objective functions to steer the local dose distribution. We demonstrate the clinical benefits of the planner in dealing with difficult clinical cases.

3 - A Risk Management Approach to IMRT Treatment Planning
Edwin Romeijn, Associate Professor, University of Florida, 303 Weil Hall, P.O. Box 116595, Gainesville, FL, 32611-6595, United States, romeijn@ise.ufl.edu, James Dempsey

We view the problem of determining a high quality radiation therapy treatment plan as the problem of shaping the dose distributions in a set of targets and critical structures in a patient. Through this interpretation, we show that most frequently employed criteria can be viewed as (a monotone function of) the expected utility with respect to a dose distribution. This provides insight into the suitability of different types of criteria for individual structures.

4 - An Optimization Approach for Intensity Modulated Radiation Therapy
Gino Lim, Assistant Professor, University of Houston, Department of Industrial Engineering, E206 Engineering Bldg 2, Houston, TX, 77204, United States, ginolim@uh.edu

We present an optimized treatment planning system for Intensity Modulated Radiation Therapy. We optimize for beam angles, beam segmentation, and the sequence. Our treatment planning system is not only easy to use, but delivers high quality treatment solutions within a clinically acceptable time window.

■ TD32

H - 6th Floor, Lombard

Location Modeling

Sponsor: Location Analysis
Sponsored Session

Chair: Richard Francis, Professor Emeritus, Dept. Industrial & Systems Engineering, University of Florida, 303 Weil Hall, Gainesville, FL, 32611, United States, francis@ise.ufl.edu

1 - An Empirical Investigation of the Robustness of Several Aggregation Methods for the p-median Problem
M. John Hodgson, Professor Emeritus, Department of Earth and Atmospheric Sciences, The University of Alberta, Edmonton, AL, T6G 2E3, Canada, john.hodgson@ualberta.ca, Niko Yiannakoulias, Weiping Zeng, Vladimir Lassenovski, Iain Getty

We present the results of a large empirical comparison of several aggregation methods for the p-median problem, for several different study areas, for reducing problems of roughly 100,000 demand points to roughly 3000 aggregated demand points. Aggregation methods reflecting the underlying spatial patterns of the original points result in the least aggregation error.

2 - A Multi-product Network Design with Lead Time and Safety Stock
Leyla Ozsen, Assistant Professor, Purdue University, 315 N. Grant Street, West Lafayette, IN, 47907, United States, lozsen@ecn.purdue.edu

We introduce a multi-product network design problem with lead time and safety stock considerations. The network distribution centers (DCs) carry safety stock to maintain prescribed service levels at the retailers. Service times at the DCs are modeled explicitly. We develop a Lagrangian heuristic, and present preliminary results.

3 - Approximation Algorithms for Dynamic Facility Location
Jiawei Zhang, Assistant Professor, New York University, IOMS-Operations Management, Stern School of Business, New York City, NY, 10012, United States, jzhang@stern.nyu.edu, Yinyu Ye

We present approximation algorithms for a dynamic facility location problem where demands of the clients vary between time periods, and we need to decide when and where to locate facilities such that all the demands can be served with minimum cost.

4 - Locating k Facilities that Serve Cycles, Not Nodes
Richard Larson, Professor, MIT Operations Research Center, 1 Amherst Street, MIT E40-149, Cambridge, MA, 02139Q, United States, rclarson@mit.edu, Michael Metzger

Consider a variant of the k-median/k-center problems, with capacities, where "customers" are cycles on the graph. 'k-Servers' travel to the tours and serve each tour customer following the tour path. We present methods, both optimal and heuristic, for locating servers. Computational results illustrate the applications and intricacies of the methods.

■ TD33

H - 6th Floor, Mason

Statistical Issues in Networking

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: George Michailidis, University of Michigan, gmichail@umich.edu

1 - The Characteristics of Voice Traffic Over the Internet
Bowei Xi, Purdue University, xbw@stat.purdue.edu

The characteristics and performance of voice traffic over the Internet (VoIP) are studied and modeled through the analysis of VoIP data. VoIP packet traces, which include timestamps and IP/UDP/RTP headers, are collected from two Internet links, each carrying both direction of VoIP calls. Call detail records are available for one of the two links. The accuracy and consistency of the data available are verified by the comparison of call detail records and the packet trace measurements.

2 - Flexicast Network Tomography
Earl Lawrence, University of Michigan, earl@umich.edu, Vijay Nair, George Michailidis

Characterizing network performance has become an important problem. In this talk, I will discuss link delay assessment based on active network tomography: characterizing internal link delay distributions based on path delays of injected traffic. We consider a new class of probing experiments, flexicast, that allows selective investigation of the network. We examine several estimation schemes and the associated identifiability issues. The methods will be applied to a VoIP readiness study.

3 - Improving Localization and Connectivity: Design Issues in Sensor Networks

George Michailidis, University of Michigan, gmichail@umich.edu

In this paper we examine new design mechanisms that allow one to achieve better connectivity and localization with the same number of sensors by using such strategies as sequential deployment of sensors, partitioning the region and deploying sensors within each subregion, judiciously placing anchors, or any flexible combination of these that would be feasible in practice.

■ TD34

H - 6th Floor, Powell

Process Monitoring and Diagnosis(3)

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: Amit Mitra, Associate Dean, Auburn University, College of Business, Suite 516, Auburn, AL, 36849-5240, United States, mitra@business.auburn.edu

1 - Monitoring Performance across Plants with a Cross-Sectional and Times-Series Function

Rodrigo Duran, rodduran@rutgers.edu, Susan Albin

A corporation manufactures a product across different plants worldwide. We propose to monitor corporate and individual plant performance through a multivariate profile model. Performance, for example yield or costs, is modeled by a cross-sectional and times-series function of explanatory variables such us quality, inventories, labor, breakdowns and fixed plant effects.

2 - Detection and Analysis of Causes in Multivariate Processes

Amit Mitra, Associate Dean, Auburn University, College of Business, Suite 516, Auburn, AL, 36849-5240, United States, mitra@business.auburn.edu

In multivariate processes, traditional approaches for monitoring do not identify the specific causal factors that lead a process astray. Here, we consider the impact of the process adjustment variables as well as that of uncontrollable factors. Performance measures such as the time to first detection of out-of-control conditions are utilized.

3 - An Adaptive T2 Chart for Monitoring Multivariate Dynamic Systems

Kaibo Wang, PhD Candidate, Hong Kong University of Science and Technology, IELM Department, HKUST, Clear Water Bay, Kowloon, HK, Hong Kong, kbwang@ust.hk, Fugee Tsung

This paper proposes an adaptive T2 scheme, which can successfully capture the time-varying shift patterns of a dynamic system via an EWMA forecasting procedure. The adaptive scheme preserves the optimality of a directionally variant chart, while provides a scalable extension to the Hotelling's T2 procedure. The smoothing parameter of the proposed scheme can be tuned for desired shift sizes. Significant improvement of sensitivity over an intended range is demonstrated by Monte Carlo simulation.

4 - A Distribution-Free Tabular CUSUM Chart for Autocorrelated Data

Seong-Hee Kim, Assistant Professor, Georgia Tech, School of ISyE, Georgia Tech, Atlanta, GA, 30332, United States, skim@isye.gatech.edu, James Wilson, Christos Alexopoulos, Kwok Tsui

A distribution-free tabular CUSUM chart is designed to detect shifts in the mean of an autocorrelated process. The chart's average run length (ARL) is approximated by generalizing Siegmund's ARL approximation for the conventional tabular CUSUM chart based on independent and identically distributed normal observations. Also discussed are the choice of reference value and the use of batch means to handle highly correlated processes.

■ TD35

H - 6th Floor, Sutter

Marketing and Operations Interfaces

Sponsor: Marketing
Sponsored Session

Chair: Yi Xu, University of Miami, 5250 University Dr., Coral Gables, FL, 33146, United States, yxu@miami.edu

Co-Chair: Jun Zhang, Tulane University, 7 McAlister Dr, New Orleans, LA, United States, jzhang4@tulane.edu

1 - Resale Price Maintenance Contract in Decentralized Channel Interactions with Retailer Sales Effort

Yi Xu, University of Miami, 5250 University Dr., Coral Gables, FL, 33146, United States, yxu@miami.edu, Haresh Gurnani

This paper studies Resale Price maintenance (RPM) contracts in a decentralized channel where demand is influenced by retailer sales effort. First, we discuss the value of flexibility of RPM in the presence of demand uncertainty. We then investigate how the use of RPM affects competition in the retail market.

2 - Pricing Models for an Internet Travel Site

Hari Natarajan, Assistant Professor, University of Miami, 412-D Jenkins Building, Department of Management, Coral Gables, FL, 33124, United States, hari@miami.edu, Yalcin Akcay

We study a pricing problem facing an Internet travel site that sells opaque products, and propose a model for managing revenues assuming a multinomial logit choice model for consumer behavior. In this talk, we discuss some preliminary findings and outline directions for future work.

3 - Supply Chain Structure in E-commerce and its Impact on Supply Chain Efficiency

Jun Zhang, Tulane University, 7 McAlister Dr, New Orleans, LA, United States, jzhang4@tulane.edu, Gove Allen, Mei Xue, Jianan Wu

When a retailer sells through two online channels with different supply chain structures, how should it price its products? In particular, how do the supply chain structure and the power structure in a supply chain affect a retailer's pricing behavior which in turns affects the supply chain efficiency? To answer these questions, we develop a simple model that shows the optimal pricing policy for a firm who sells in two online channels and test our findings using a unique data set.

■ TD36

H - 6th Floor, Taylor

Advances in Simulation Methodology

Sponsor: Simulation
Sponsored Session

Chair: Roberto Szechtman, Assistant Professor, Naval Postgraduate School, Operations Research Dept., Glasgow Hall, Monterey, CA, 93943, United States, rszechtm@nps.edu

1 - Pricing Basket Default Swaps

Zhiyong Chen, Student, Columbia University, 419 West 119th Street, Apt 2H, New York, NY, 10027, United States, zc2012@columbia.edu, Paul Glasserman

In an nth-to-default swap, the seller pays the buyer upon the occurrence of the nth default in a basket of bonds. Generally, pricing the swap is a rare-event simulation problem. In the Gaussian copula model of credit risk, we apply importance sampling by changing the default probabilities and combine this with stratified sampling applied to the factors in the copula. The method leads to substantial variance reduction and is applicable to other credit derivatives as well.

2 - Exploiting Dependencies in Data Collection and Simulation

Mike Freimer, Assistant Professor, Pennsylvania State University, 509N Business Administration Bldg., State College, PA, 16803, United States, mbf10@psu.edu

Simulation studies are often viewed as three independent stages: data collection, model simulation, and analysis and decision making. The inherent dependencies between these stages can often be exploited to improve the efficiency of decisions based on the output of the simulation.

3 - Adaptive Control Variates Methods in Monte Carlo Simulation

Sujin Kim, Student, Cornell University, skim@orie.cornell.edu, Shane Henderson

Adaptive Monte Carlo techniques are designed to adaptively tune variance reduction methods to improve performance of simulation experiments. We introduce adaptive simulation schemes based on the method of control variates. We focus on the case where the control variates are nonlinearly parameterized, developing algorithms and the asymptotic properties of the resulting estimators. We also present the results from numerical experiments.

4 - Estimation of a Censored Nonhomogeneous Poisson Process from Aggregated Data

Roberto Szechtman, Assistant Professor, Naval Postgraduate School, Operations Research Dept., Glasgow Hall, Monterey, CA, 93943, United States, rszechtm@nps.edu, Kyle Lin

We are concerned with the estimation of the (cumulative) rate function of a nonhomogeneous Poisson process in the presence of censoring that arises in, for example, bufferless queueing systems that do not record arrivals when all servers are busy. A characterization of the asymptotic properties of our proposed estimator is presented.

■ TD37

H - 6th Floor, Van Ness

Simulation and Financial Engineering

Sponsor: Applied Probability
Sponsored Session

Chair: Steven Kou, Columbia University, 312 Mudd Building, Dept. of IEOR, New York, NY, United States, sk75@columbia.edu

1 - Importance Sampling for Portfolio Credit Risk with Extremal Dependence

Achal Bassamboo, Stanford University, 518 Memorial Way, Stanford, 94305, United States, achalb@stanford.edu, Assaf Zeevi, Sandeep Juneja

We consider the problem of estimating the credit risk in a portfolio of defaultable instruments which exhibit strong dependence. For portfolios with highly rated obligor's significant losses resulting from a large number of defaults is a rare event. We develop tail asymptotes of the large loss probability and 'three stage' (asymptotically optimal) importance sampling algorithms to estimate this probability via simulation as the number of obligor's grow large.

2 - Analyzing the Theory of Self-fulfilling Prophecy via Birth-Death

Nan Chen, Columbia University, 500 W120th Street, Rm.325, New York, NY, 10027, United States, nc2005@columbia.edu, Steven Kou

In the case of self-fulfilling prophecy, a system can have a fast transition from one state to another closely related state, which has been well studied and has a great impact in sociology and finance (e.g. the financial market crashes). In this paper, we show that the system may also have a slow transition to an totally opposite state. The analysis is based on a model using birth-death processes.

3 - Fast Simulation of Multifactor Portfolio Credit Risk

Perwez Shahabuddin, Professor, Columbia University, 116th Street and Broadway, New York, NY, 10027, United States, ps147@columbia.edu, Wanmo Kang, Paul Glasserman

We investigate fast simulation methods, using importance sampling, for the estimation of portfolio credit risk in multifactor copula models, where the events of significant portfolio losses are rare. Earlier importance sampling methods have been shown to be provably efficient only for the single factor case. We present a different importance sampling approach that is provably efficient in the multifactor case.

4 - Modeling Growth Stocks

Steven Kou, Columbia University, 312 Mudd Building, Dept. of IEOR, New York, NY, United States, sk75@columbia.edu

In this talk we will give a survey of some recent development of modeling biotech and Internet stock. Particular issues to be discussed include what the cross-sectional distributions of growth stocks are, and what the long-term real return of growth stocks should be.

■ TD38

R - 2nd Floor, Corintia

Large-Scale Nonlinear Programming

Sponsor: Optimization/ Nonlinear Programming
Sponsored Session

Chair: Zhaosong Lu, Zeev Nehari Visiting Assistant Professor, Carnegie Mellon University, Department of Mathematical Sciences, Pittsburgh, PA, 15213-3890, United States, zhaolu@andrew.cmu.edu

1 - A Conic Interior Point Decomposition Approach for Large Scale Semidefinite Programming

Kartik Krishnan Sivaramakrishnan, Assistant Professor, Department of Mathematics, North Carolina State University, Raleigh, NC, 27695, United States, kartik@optserv.cas.mcmaster.ca, Gema Plaza, Tamas Terlaky

We present a conic interior point decomposition approach to solve large scale semidefinite programs (SDP) in practice. The idea is to solve an SDP in an iterative fashion between a master problem which is a mixed conic problem over LP-second order-smaller SDP blocks, and a set of subproblems. In this talk, we motivate and develop our decomposition approach, discuss issues required in an efficient implementation, and also present our computational experiences with the algorithm.

2 - Convex Optimization Models for VLSI Floorplanning

Chaomin Luo, Ph.D. candidate, University of Waterloo, 200 University Avenue West, Waterloo, ON, N2L 3G1, Canada, c2luo@engmail.uwaterloo.ca, Anthony Vannelli, Miguel Anjos

The VLSI floorplanning problem is an NP-hard global optimization problem for wirelength minimization. We use a two-stage methodology for this problem. The first stage relaxes it to a convex optimization problem that globally minimizes the wirelength. Based on the optimal relative locations of the modules in the first stage, the second stage fixes the dimensions of the modules subject to given aspect ratios. Experiments on MCNC benchmarks show that this methodology is effective and competitive.

3 - On Self-dual Embeddings in Conic Optimization

Kees Roos, Professor, TU Delft, Mekelweg 4, Delft, NL, Netherlands, C.Roos@ewi.tudelft.nl

Any linear optimization problem can be embedded naturally in a self-dual problem, whose solution gives all the desired information about the original problem. An important feature of the self-dual problem is that it has a natural strictly feasible solution that can be used as a starting point when using an interior-point method for solving the problem. Similar results exist for optimization over the second order and the semidefinite cone. We discuss possible extensions to other cones.

4 - Approximations of Nash Equilibria

Jong-Shi Pang, Renssealer Ploytechnic Institute, Dept of Math Sciences, Troy, NY, 12180-3590, United States, pangj@rpi.edu, Gul Gurkan

We investigate approximating Nash equilibria and clarify conditions for convergence of approximate equilibria via a direct, a variational, and an optimization approach. Besides directly addressing the issue of convergence of Nash equilibria via approximation, our investigation leads to a deeper understanding of various notions of functional convergence and their interconnections. An illustrative application in a competitive capacity expansion model under uncertainty is presented.

■ TD39

R - 3rd Floor, Aragon

Operations Management in Supply Chains

Contributed Session

Pamela Murray-Tuite,Assistant Professor, Virginia Tech, Northern Virginia Center, 7054 Haycock Road, Falls Chuch VA 22043, United States, murraytu@vt.edu

1 - Inventory Policies with Cross-Docking in a One-Supplier Multi-Distribution-Center System

Juhwen Hwang, Associate Professor, Institute of Business Administritation, National Dong Hwa University, 1, Sec. 2, Da-Hsueh Rd., Shou-Feng, Hualien, 974, Taiwan, hjw@mail.ndhu.edu.tw

This paper studies a model of planning inventory levels for a supplier and several distribution centers in order to satisfy demand and minimize the total cost of the model. The model in this study will consider the gross amount requirements and formulate the relative demand characteristics as independent random variables. The cost structure of the model considers shortage costs, inventory holding costs, and cross-docking costs among distribution centers.

2 - Integrated Inventory and Flexible Capacity Management under Stochastic Demand and Set-up Costs

Tarkan Tan, Assistant Professor, Eindhoven University of Technology, Paviljoen F-07, P.O. Box 513, Eindhoven, 5600MB, Netherlands, t.tan@tm.tue.nl, Osman Alp

We discuss a model for inventory and flexible capacity management under under non-stationary stochastic demand and positive set-up costs for initiating production and ordering contingent capacity. We analyze the characteristics of the optimal policies for the integrated problem and evaluate the value of utilizing flexible capacity under different settings to develop managerial insights.

3 - Forecasting Methods and ARMA Demand Filtering in Serial Supply Chains

Xiaolong Zhang, Assistant Professor, Georgia Southern University, Dept. of Finance and Quant. Analysis, P O BOX 8151, Statsboro, GA, 30460, United States, xzhang@georgiasouthern.edu

This paper examines the filtering effect of forecasting methods in serial supply chains when demand is modeled with an ARMA process. The MMSE, moving average, and exponential smoothing forecasting methods are considerd. We characterize the time-series structure of the order process for each method and apply it to study the bullwhip effect and the coordination of forecasting methods.

4 - The Strategic Effects of a Merger upon Supplier Interactions

Yusen Xia, Assistant Professor, Georgia State University, Robinson College of Business, Atlanta, GA, 30303, United States, ysxia@gsu.edu, Stephen Gilbert

We consider how a merger between two naturally differentiated dealers affects their interactions with a common supplier, and identify conditions under which the merger can increase or decrease the combined net worth of the two firms. In this research, we find that the attractiveness of merging depends critically upon which level of the supply chain has greater potential to influence demand.

■ TD40

R - 3rd Floor, Barcelona I

Optimal Paths and Orderings

Sponsor: Optimization/ Network Optimization
Sponsored Session

Chair: Brian C. Dean, Department of Computer Science, Clemson University, Clemson, SC, 29634-1906, brian.dean@cs.clemson.edu

1 - Ordering by Weighted Number of Wins Gives a Good Ranking for Weighted Tournaments

Atri Rudra, Department of Computer Science and Engineering, University of Washington, Seattle, WA, 98105, atri@cs.washington.edu, Lisa K. Fleischer, Don Coppersmith

In the feedback arc set problem in tournaments, given a tournament, we want to order the vertices such that the number of back edges is minimized. This is a NP-hard problem. We consider the following simple algorithm: arrange the vertices by their indegrees (breaking ties arbitrarily). We show that this algorithm has an approximation guarantee of 5. We also show a family of tournaments such that the above algorithm is a factor 5 away from the optimal irrespective of how the ties are broken.

2 - Optimal Paths under Uncertainty: The Case of Non-linear Objective

Eddie Nikolova, MIT Stata Center, Office 32-G596, Cambridge, MA, 02139, enikolova@csail.mit.edu, Matthew Brand, David R. Karger

We seek a path of lowest expected cost between a pair of vertices in a graph, where the edge travel times are independent random variables and the cost is a function of total travel time. We obtain hardness results for given start time and cost functions with a global minimum. For discretizations of the travel times we give pseudopolynomial algorithms via dynamic programming. In contrast, joint optimization for the optimal path and start time can sometimes be solved exactly and efficiently.

3 - Faster Dynamic Programming Algorithms for Shortest Path Problems in time-expanded Networks

Brian C. Dean, Department of Computer Science, Clemson University, Clemson, SC, 29634-1906, brian.dean@cs.clemson.edu

Many shortest path problems can be solved by dynamic programming in a time-expanded network. We discuss improved algorithms for two such problems in this talk, the first being the time-dependent shortest path (TDSP) problem. By applying techniques originally developed for sequence alignment in computational biology, we show how to speed up dynamic programming solutions to TDSP problems with various waiting constraints at nodes. We also consider the stochastic shortest path (SSP) problem, where we can improve dynamic programming running times by employing a technique from the signal processing literature known as zero-delay convolution.

■ TD41

R - 3rd Floor, Barcelona II

Integer Programming: Applications and Implementations

Contributed Session

Chair: Kai Huang, Dr., Georgia Institute of Technology, 765 Ferst Drive NW, Atlanta, GA, 30332, United States, kaih@isye.gatech.edu

1 - On Hop-Indexed Reformulations for the Unit Demand Vehicle Routing Problem

Teresa Godinho, ESTIG - IPBeja, R. Afonso III, nº 1 e 3, Beja, Portugal, mtgodinho@estig.ipbeja.pt, Luis Gouveia, Thomas Magnanti

We discuss two strategies for designing hop-indexed reformulations for the vehicle routing problem: one considers the "hop constrained shortest path from the depot to a given node" as the subproblem and the other considers the "hop constrained shortest circuit passing through the depot and a given node" as the suproblem.

2 - Timetabling Process using Optimization to Maximize Expected Academic Performance in Mexican University

Francisco Zaragoza, PhD Student, ITESM, Eduardo Monroy Cardenas 2000, San Antonio Buenavista, Toluca, mx, 50110, Mexico, francisco.zaragoza@itesm.mx, Federico Trigos

This paper presents an Optimal Timetabling Implementation at ITESM Campus Morelia, a 1000 student institution in Mexico. Based on parsimonious binary programming model trying maximizing expected academic performance. This implementation offers a 50% increment in the expected academic performance of the institution, and a full range on qualitative improvements will be presented also.

3 - Sorting Via Mixed Integer Programming, with an Application to Ranking MBA Programs

Jyrki Wallenius, Professor, Helsinki School of Economics, POB 1210, Helsinki, 00101, Finland, walleniu@hkkk.fi, Tayyar Buyukbasaran, Murat Köksalan, Ozgur Ozpeynirci

We present a mixed IP model for sorting alternatives under multiple criteria. Our model selects criterion weights for each alternative from a feasible weight space to maximize the number of alternatives outperformed. We apply the model to ranking/sorting MBA Programs using the Financial Times data and discuss problems with such rankings.

4 - Improvement of the Efficiency of the B&B Algorithm via Flatness Information

Ivan Derpich, Doctor, University of Santiago, Av. Ecuador 3769, Volcan lanin 205, Santiago, 12, Chile, iderpich@usach.cl

A new rule to branch in the Branch and Bound algorithm is presented, this is based in the flatness information. The rule is derived of the geometric information of the polyhedron, and branch first in this directions where the polyhedron has minimum width. This rule allow reduce aproach 50% the time solution, decreasing the number of nodes generatde and the iterations simplex did too.

5 - The Planning Horizon of the Infinite Horizon Stochastic Lot-Sizing Problem

Kai Huang, Dr., Georgia Institute of Technology, 765 Ferst Drive NW, Atlanta, GA, 30332, United States, kaih@isye.gatech.edu, Shabbir Ahmed

We study the infinite horizon stochastic lot-sizing problem in the context of stochastic programming. By using a shifting up procedure, we show a monotone property of the optimal solutions of finite approximation problems, which leads to the solution and objective value convergence of the finite approximation problems to the original problem as the planning horizon goes to infinity. Then we show the existence of planning horizon. We also develop formula to calculate the planning horizon.

■ TD42

R - 4th Floor, Parc Ballroom I

Robust Optimization

Sponsor: Optimization/ Stochastic Programming
Sponsored Session

Chair: Aurelie Thiele, Assistant Professor, Lehigh University, Dept of Industrial Engineering, 200 West Packer Ave, Bethlehem, PA, 18015, United States, aurelie.thiele@Lehigh.EDU

1 - Two-Stage Robust Network Flow and Design under Demand Uncertainty

Alper Atamturk, University of California, Berkeley, Department of IEOR, Berkeley, CA, United States, atamturk@ieor.berkeley.edu, Muhong Zhang

For two-stage robust network flow and design with demand uncertainty, we give an explicit characterization of the first-stage decisions and prove that the corresponding separation problem is NP-hard. We describe tractable special cases. By using a ``budget of uncertainty" we give an upper bound on the probability of infeasibility of the robust solution for a random demand vector. We give applications to production lot-sizing and facility location problems.

2 - Ambiguous Chance Constraints, Learning and Robust Optimization

Garud Iyengar, Associate Professor, Columbia University, garud@ieor.columbia.edu, Emre Erdogan

An "ambiguous" chance constraint is a chance constraint where the measure defining the constraint is itself uncertain. Thus, there are two levels of uncertainty — first, the measure is uncertain; and second, given the measure, the particular realization is uncertain. In this talk we will discuss sampling based methods for solving optimization problems with ambiguous chance constraints.

3 - On Bernstein Approximation of Chance Constraints

Arkadi Nemirovski, Professor, School of Industrial and Systems Engineering, Georgia Institute of Technology, 765 Ferst Drive NW, Atlanta, GA, 30332-0205, United States, nemirovs@isye.gatech.edu, Alexander Shapiro

Opimizing convex objectives under chance constraints "Prob(Fi(x,s) positive) does not exceed a given epsilon" (x is decision vector, s is random data) typically is a computationally intractable task. Assuming Fi affine in s, we develop efficiently computable "safe" convex approximations of chance constraints, thus arriving at an explicit convex program with the feasible set contained in the one of the chance constrained problem.

4 - Robust Linear Optimization With Recourse

Aurelie Thiele, Assistant Professor, Lehigh University, Dept of Industrial Engineering, 200 West Packer Ave, Bethlehem, PA, 18015, United States, aurelie.thiele@Lehigh.EDU

We propose an approach to linear optimization with recourse that does not involve a probabilistic description of the uncertainty, and instead models random variables as uncertain parameters in a polyhedral set. The objective is to minimize the worst-case cost over that set. We show that the robust problem can be reformulated as a linear problem with potentially a large number of constraints and present an algorithm based on Benders decomposition. Computational results are encouraging.

■ TD43

R - 4th Floor, Parc Ballroom II

Distributed Optimization Systems

Sponsor: INFORMS Computing Society/ Optimization Services and Open Source Software
Sponsored Session

Chair: Jun Ma, Northwestern University, Tech. C231, Sheridan Road, Evanston, IL, 60208, United States, maj@northwestern.edu

1 - Optimization Services (OS) Framework

Kipp Martin, Professor, University of Chicago, Graduate School of Business, 5807 South Woodlawn Avenue, Chicago, IL, 60637, United States, kmartin@gsb.uchicago.edu, Robert Fourer, Jun Ma

Optimization Services is an XML-based, service-oriented decentralized optimization architecture. It is a unified framework for the next generation distributed optimization systems. The corresponding Optimization Services Protocol (OSP) is intended to be a standard. Through standardization of representation and communication, OS provides an open infrastructure for all system components including modeling languages, servers, registries, agents, interfaces, analyzers, solvers and simulations.

2 - Web Enabled Optimisation Tools and Models

Gautam Mitra, Professor, Brunel University, Middlesex, Uxbridge, UB8 3PH, United Kingdom, Gautam.Mitra@brunel.ac.uk, Sachin Patkar, Chandra Poojari

We have developed a webservice frame-work called "Web enabled optimisation tools and models for research, professional training and industrial deployment"(WEBOPT). We discuss the use of session based approach wherein the information are re-used and advanced features such as warm-restart of the solver. SOAP is used as message protocol as it firewall friendly and supports complex datatypes for remote procedure calls.

3 - Advances in Version 5 of the NEOS Server for Optimization

Robert Fourer, Professor, Northwestern University, Dept of Industrial Eng & Mgmnt Sciences, 2145 Sheridan Road, Evanston, IL, 60208-3119, United States, 4er@iems.northwestern.edu, Jorge Moré, Todd Munson, Jason Sarich

The NEOS Server makes over 40 optimization packages freely available for experimentation and evaluation over the Internet. The recently released version 5 has been rewritten using the XML-RPC, an XML-based remote procedure call protocol, to greatly simplify the work of submitting and managing requests from local client programs. Other improvements to be described include an express queue for short jobs and improved procedures for installing new solvers.

4 - Simulation Embedding Optimization Web Services

Leonardo Lopes, Assistant Professor, University of Arizona, Tucson, AZ, 85721, United States, leo@sie.arizona.edu, Young-Jun Son

Simulation embedding optimization uses mathematical programming to describe decisions taken within a simulation model, such as rerouting of jobs in response to a resource failure event. This research describes the web services framework to enable efficient integration of optimization within simulation. Operational control for manufacturing systems is used for illustration.

■ TD44

R - 4th Floor, Parc Ballroom III

Heuristic Search

Sponsor: INFORMS Computing Society/ Heuristic Search
Sponsored Session

Chair: Jeffrey Ohlmann, Assistant Professor, Department of Management Sciences, University of Iowa, Iowa City, IA, 52242, United States, jeffrey-ohlmann@uiowa.edu

1 - VLS Neighborhood Search for Balancing Problems

Robert Storer, Professor, Lehigh University, Industrial & Systems Engineering, Bethlehem, PA, 18015, United States, rhs2@lehigh.edu

We present a Very Large Scale Neighborhood Search algorithm for general balancing problems. N fixed weights must be assigned to N fixed locations in M-dimensional space so that the system center of gravity is close to some target. A "multi-dimensional" number partitioning algorithm accomplishes the neighborhood search at each iteration.

2 - Incorporating Learning Techniques in Functional Annealing

Dushyant Sharma, Assistant Professor, University of Michigan, IOE Department, Ann Arbor, MI, 48109, United States, dushyant@umich.edu

Functional Annealing is a stochastic search algorithm that guarantees asymptotic convergence to the set of global optima for a combinatorial optimization problem. It escapes local optima by perturbing the objective function of the optimization problem. In this talk we discuss a generic learning approach based on function approximation to improve the performance of the Functional Annealing algorithm. Computational results are presented, showing the effectiveness of the approach.

3 - A Very Large Scale Neighborhood Search Algorithm for the q-mode Problem

Yahya Fathi, Professor & Co-Director of Operations Research Program, NC State university, 430 Daniels, NC State University, Raleigh, NC, 27695, United States, fathi@ncsu.edu, Girish Kulkarni

The q-mode problem is a combinatorial optimization problem that requires partitioning of objects into clusters. We propose a local improvement algorithm for this problem based on a very large scale neighborhood that is implicitly searched using network flow techniques. The algorithm is empirically evaluated through a computational experiment. We observe that the algorithm obtains optimal or near optimal solutions in instances that have strong natural clusters.

■ TD45

R - 4th Floor, Raphael

Intermodal Transportation

Sponsor: Transportation Science & Logistics
Sponsored Session

Chair: Teodor Gabriel Crainic, Professor, Ecole des sciences de la gestion, UQAM and, Centre for Research on Transportation, Montreal, QC, Canada, theo@crt.umontreal.ca

1 - Planning Advanced Rail Intermodal Systems

Teodor Gabriel Crainic, Professor, Ecole des sciences de la gestion, UQAM and, Centre for Research on Transportation, Montreal, QC, Canada, theo@crt.umontreal.ca, Ioana Bilegan, Michel Gendreau, GeneviËve Hernu, Michael B. Pedersen

Railroads move toward full-asset-utilization operating policies by introducing regular, scheduled services and booking systems. This requires new approaches in building plans and handling uncertainties. We discuss issues and O.R. challenges and present some of the optimization and simulation developments we undertook to address them.

2 - Optimizing Intermodal Train Schedules with a Design Balanced Network Design Model

Michael B. Pedersen, Center for Trafic and Transportation, DTU bygning 115, Kgs. Lyngby, 2800, Denmark, mbp@ctt.dtu.dk, Teodor Gabriel Crainic

We present a modeling approach for optimizing intermodal trains schedules based on an infrastructure divided into time-dependent train paths. The formulation can be generalized to a capacitated multi commodity network design model with additional design balance constraints. We present a Tabu Search based metaheuristic to solve large instances of the generalized problem and compare its results on standard network design problems to those obtained using the solver XpressMP.

3 - Neural Networks for Demand Estimation in Intermodal Transportation

Ioana Bilegan, Dr., Centre for Research on Transportation, Université de Montréal, Montreal, QC, H3C 3J7, Canada, bilegan@crt.umontreal.ca, Michel Gendreau, Teodor Gabriel Crainic

We examine the issue of forecasting demand for freight rail intermodal services with schedules and advance bookings. We present a neural network based demand forecasting methodology and discuss data processing and model design and development issues. Results based on a North American rail carrier will be presented as well.

■ TD46

R - 4th Floor, Rubens

User Behavior Analysis in Transportation

Contributed Session

Chair: Dimitris Poulakidas, Assistant Professor, CAL POLY, POMONA, 1528 11TH Street, Apt. #F, Santa Monica, CA, 90401, United States, dpoulakidas@csupomona.edu

1 - Coping with Time Variability in Routing Problems

Christophe Lecluyse, Research Assistant, UA, Prinssstraat 13, Antwerp, Belgium, christophe.lecluyse@ua.ac.be, Tom van Woensel, Herbert Peremans, Nico Vandaele

In routing problems, the variability on travel times can not be ignored in order to carry out a realistic optimization. The approach proposed introduces a travel time distribution based on queueing theory resulting in a stochastic dynamic routing problem. The approach allows for evaluating routes on the travel time risk involved. The models are validated using numerical results based on standard datasets.

2 - Influence of Providing Parking Space Information to the Parking Behavior of Drivers

Yoshihiro Asano, Graduate Student, Nanzan University, 27, seirei-cho, Seto, 489-0853, Japan, m05mm001@it.nanzan-u.ac.jp, Toshiharu Hasegawa

Parking space problems play important roles in urban road traffic systems. As various systems for ITS have been proposed and implemented, such as DSRC, parking space information provision systems for drivers on the road are expected to make remarkable progress. This paper deals with simulation models to estimate the behaviors of drivers on the road trying to use a parking place when various information concerning the available parking place are given to them, using SD.

3 - Behavior-Consistent Within-Day Traffic Routing under Information Provision

Alexander Paz, Student, Purdue University, 270 Littleton St, Apt 440, West Lafayette, IN, 47906, United States, apaz@purdue.edu, Srinivas Peeta

A fuzzy control approach is proposed to determine en-route information-based traffic routing strategies. It uses an H-infinity filtering procedure to systematically and continuously update membership function parameters to minimize the error between the predicted and ideal traffic flow rates. The system optimal dynamic traffic assignment solutions are used as the ideal target states, but driver behavior and network dynamics define actual system conditions.

4 - A Conditional Mixed Logit Model of Microbehavioral Residential Choice

Dimitris Poulakidas, Assistant Professor, CAL POLY, POMONA, 1528 11TH Street, Apt. #F, Santa Monica, CA, 90401, United States, dpoulakidas@csupomona.edu

This research develops, calibrates, and validates a Mixed-Logit model of Residential Choice that accounts for travel micro-behavior and explicit locational quality variables in order to measure the effect of neighborhood quality on the choice of residence. The research employs GIS for validating micro-data and generating residential location choice sets. The findings have profound implications for policy making, and improvement of residential and transportation modeling.

■ TD47

R - 4th Floor, Michelangelo

Dynamic Traffic Assignment: Theory, Algorithms, and Models (II)

Sponsor: Transportation Science & Logistics
Sponsored Session

Chair: Henry Liu, Assistant Professor, University of Minnesota, Department of Civil Engineering, 500 Pillsbury Drive SE, Minneapolis, MN, 55455, United States, henryliu@umn.edu

1 - Solving the Dynamic User Optimal Assignment Problem Considering Link Interactions

Yu Nie, Graduate Student, University of California, Department of Civil Engineering, Engr. III, Room 2001, Davis, CA, 95616, United States, ynie@ucdavis.edu, Michael Zhang

This paper studies the dynamic user optimal assignment problem considering simultaneous route and departure time choice. The DUO problem is formulated as a VI, and a mesoscopic dynamic network loading model consistent with the LWR theory is developed to encapsulate traffic dynamics. Various VI solution algorithms, particularly those based on feasible directions and line search, are applied to solve the DUO problem.

2 - Sensitivity Analysis of Traffic Network Flows under Dynamic User Equilibrium

Jiangang Lu, University of Wisconsin at Madison, 1241 Engineering Hall, 1415 Engineering Drive, Madison, WI, 53705, United States, jiangang@cae.wisc.edu, Bin Ran, Shu Lu

A method is proposed for sensitivity analysis of network flows under DUE. The major difficulty in applying standard sensitivity techniques is that the incidence matrixes used to relate different flow variables are themselves functions of the network flows and these functions can not be expressed in a closed form. This difficulty is overcome by formulating an equivalent problem of the original problem under small perturbations and then conducting sensitivity analysis for the equivalent problem.

3 - Dynamic Equilibrium Assignment with Calibrated Flow-Delay Relationships Using Microscopic Simulation

Henry Liu, Assistant Professor, University of Minnesota, Department of Civil Engineering, 500 Pillsbury Drive SE, Minneapolis, MN, 55455, United States, henryliu@umn.edu, Jeff Ban, Wenteng Ma, Pitu Mirchandani

Analytical dynamic equilibrium assignment model are generally based on aggregate link performance functions. These functions need to be calibrated using the dynamic field measurements. In this paper, we develop a scheme to calibrate flow-delay relationship using microscopic simulation as a representation of the real world traffic.

■ TD48

R - 4th Floor, Dante

Healthcare Resource Planning and Flow Management - 2

Sponsor: Health Applications
Sponsored Session

Chair: Murray Côté, Assistant Professor, University of Florida, Health Serv. Res., Mgmt. and Policy, Gainesville, FL, 32610-0195, United States, mjcote@phhp.ufl.edu

1 - A Network-Based Optimization Model for Hospital Bed Planning

Elif Akcali, Assistant Professor, University of Florida, 303 Weil Hall, P.O. Box 116595, Gainesville, FL, 32611-6595, United States, akcali@ise.ufl.edu, Murray Côté, Cindy Lin

The combination of fewer hospital beds and increasing inpatient admissions has created a challenge for the delivery of inpatient care. We model the demand for hospital beds as a network to capture the effects of: 1) demand over time, 2) resource availability, and 3) system performance to determine the optimal number of beds.

2 - Establishing OR Skills in Health Care Organizations

Keith Willoughby, Operations Research Consultant, Health Quality Council, 241-111 Research Drive, Saskatoon, SK, S7N 3R2, Canada, kwilloughby@hqc.sk.ca, Ben Chan, Shauna Hickey

The Health Quality Council is an independent agency that measures and reports on quality of care in Saskatchewan, promotes improvement, and engages its partners in building a better health system. As part of our efforts with external constituencies, we have recently begun to work directly with our 13 regional health authorities on particular OR problems of importance to them. We report on our experiences thus far in helping these authorities to formulate and solve specific OR problems.

3 - Reducing Nosocomial Infection Through a Community Collaborative

Sandra Potthoff, Potth001@umn.edu

Over the past year, hospitals in the Twin Cities area of Minnesota have been engaged in a collaborative to reduce ventilator-associated pneumonias and central line associated blood stream infections. This research provides a case study of 4 hospitals engaged in the change effort and the challenges they faced in implementing changes to reduce these infections.

4 - A Stochastic Mathematical Appointment Overbooking Model for Healthcare Providers to Improve Profits

Seongmoon Kim, Assistant Professor, Florida International University, 10555 W. Flagler Street / EC 3100, Miami, FL, 33174, United States, Seongmoon.Kim@FIU.edu, Ronald Giachetti

This paper develops a stochastic mathematical overbooking model (SMOM) for determining the optimal number of patient appointments to accept to maximize expected total profits. SMOM is unique since it considers the probability distributions of no-shows and walk-ins. We provide a method to extrapolate the conditional probability to estimate what happens when overbooking occurs. SMOM is then compared with the base case of no overbooking and the naive statistical overbooking approach.

■ TD49

R - 4th Floor, Medici

Stochastic Models in Health Care

Cluster: Health Care
Invited Session

Chair: Oguzhan Alagoz, University of Wisconsin-Madison, Department of Industrial and Systems Engineering, 3162 Engineering Centers Building, 1550 Engineering Drive, Madison, WI, 53706, United States, alagoz@engr.wisc.edu

1 - A Dynamic Programming Approach for Triage in the Aftermath of a Major Emergency

Nilay Argon, University of Wisconsin-Madison, 1513 University Avenue, Dept. of Industrial and Systems Engr., Madison, WI, 53706, United States, nilay@engr.wisc.edu, Serhan Ziya

We consider a major emergency after which the hospitals in close proximity are overwhelmed by the number of casualties. Our objective is to identify properties of effective triage decisions that maximize the expected number of lives saved based on the lifetime and treatment time distributions for patients. We use stochastic dynamic programming to characterize the structure of the optimal policy, and study the sensitivity of the optimal policy to the system parameters by a numerical study.

2 - Determining the Optimal Set of Regions for Multiply Listing Patients with End-Stage Liver Disease

Oguzhan Alagoz, University of Wisconsin-Madison, Department of Industrial and Systems Engineering, 3162 Engineering Centers Building, 1550 Engineering Drive, Madison, WI, 53706, United States, alagoz@engr.wisc.edu, Andrew Schaefer, Mark Roberts, Lisa Maillart

According to the current liver allocation policy, a patient with end-stage liver disease may join the organ waiting list in more than one geographical region. We consider the problem of determining the optimal set of regions that maximizes a patient's total expected quality-adjusted life expectancy. We formulate this problem using a continuous-time Markov decision process model with a constraint on the total number of regions that a patient can be listed in.

■ TD50

R - 4th Floor, Cervantes

Behavioral Decision Theory

Sponsor: Decision Analysis
Sponsored Session

Chair: Manel Baucells, IESE Business School, Ave. Pearson, 21, Barcelona, 08034, Spain, MBaucells@iese.edu

1 - Time and Uncertainty Integrated

Franz Heukamp, IESE Business School, Avenida Pearson 21, Barcelona, 08034, Spain, fHeukamp@iese.edu, Manel Baucells, Antonio Villasis

Taking the proverb "The future is uncertain" serious, we study the psychological parallels between decisions under risk and intertemporal choice. We propose a model that integrates Cumulative Prospect Theory and Hyperbolic Discounting. In that framework, discounting of future events corresponds to assigning a weighted probability to their actual occurrence. In a series of experiments we test the validity of the model.

2 - Econophysics and the Psychology of Individual Choice

Robert Bordley, Technical Fellow, General Motors Corporation, 525 Choice Court, Troy, Mi, 48085, United States, robert.bordley@gm.com

Research in probability assessment highlights how individual probability assessments vary depending upon how the individual partitioned the space of possible events (i.e. depending upon the individual's 'small world' representation of the universe.) This paper shows that von Neumann's solution to a similar problem in quantum physics is applicable to human choice.

3 - Recent Results in the Psychology of Probability Judgment and Implications for Practice

Bob Clemen, Associate Professor of Decision Sciences, Fuqua School of Business, Duke University, Box 90120, Durham, NC, 27708, United States, clemen@mail.duke.edu, Canan Ulu

We present experimental results on the psychological support function that underlies an individual's probability judgments. In contrast to psychology's support theory, we show that the support function is additive for probability assessments for continuous variables, which in turn leads to a simple procedure for debiasing probability judgments. The paper serves as an example of how deep understanding of a psychological process can lead to a specific prescriptive procedure for decision analysis.

4 - Stability of Risk Preferences

Manel Baucells, IESE Business School, Ave. Pearson, 21, Barcelona, 08034, Spain, MBaucells@iese.edu, Antonio Villasis

We explore the stability of risk preferences. To explain the observed changes in elicited preferences, we propose a stochastic choice model in which the preference reversals of individuals facing two times the same decision are governed by some underlying preference, together with a random error in the decision process. This model finds a large percentage of the population agreeing with Prospect theory.

Wednesday, 8:00am - 9:30am

■ WA01

H - Lobby Level, Plaza A

Tutorial: Adaptive Memory Programming: A Key to Breakthroughs for Solving Hard Problems

Cluster: Tutorials
Invited Session

1 - Tutorial: Adaptive Memory Programming: A Key to Breakthroughs for Solving Hard Problems

Cesar Rego, Associate Professor, University of Mississippi, University, Oxford, MS, 38677, United States, crego@bus.olemiss.edu

The concept of Adaptive Memory coupled with advances in neighborhood structures derived from dynamic and adaptive search constructions have been the source of numerous important developments in metaheuristic optimization throughout the last decade. These innovations have been the key to the most successful results in a wide range of applications in business, industry and life sciences. This talk will review some of these major advances and discuss potential directions for future developments.

■ WA02

H - Lobby Level, Plaza B

DEA for Managerial Benchmarking

Cluster: Data Envelopment Analysis
Invited Session

Chair: Liam ONeill, Asst Prof, Cornell University, 105 MVR Hall, PAM Dept., Ithaca, NY, 14853, United States, lo22@cornell.edu

1 - Estimating 'Postmodern' Frontiers

James Storbeck, Professor, University of Texas at Brownsville, School of Business, 80 Fort Brown, Brownsville, TX, 78520, United States, james.storbeck@utb.edu

This work first defines its use of modernist-postmodernist frameworks and proposes a postmodern (or pomo) perspective for DEA that takes advantage of current cognitive linguistic frameworks. The paper discusses the nature of counterfactuals, the characterization of fictive movement, and the representation of 'goodness' within frontier frameworks, especially for non-economic contexts.

2 - Super-Efficiency as a Disruptive Innovation in DEA

Liam ONeill, Asst Prof, Cornell University, 105 MVR Hall, PAM Dept., Ithaca, NY, 14853, United States, lo22@cornell.edu

This research traces the recent history of super-efficiency as a disruptive innovation in DEA. Methods are given for normalizing the slack values from the super-efficient model. The purpose is to increase the face validity and versatility of DEA results and extend its use from its economic roots toward managerial benchmarking. An example of this technique is shown using empirical data for a single hospital.

3 - Resituating Performance Narratives in DEA

Lin Fitzgerald, Professor, Loughborough University, Leicestershire, LE11 3TU, United Kingdom, l.fitzgerald@lboro.ac.uk

Modeling organizational performance oftentimes entails the reduction of multiple stories to a single narrative. The paper demonstrates how we can give voice to the excluded within a performance modeling framework. This study describes a multi-storied context for UK water companies and demonstrates how 'good' performance is defined within each story.

■ WA03

R - 3rd Floor, Sienna II

Decision-Making in Supply Chains I

Contributed Session

Chair: Jill Hardin, Assistant Professor, Virginia Commonwealth U. Statistics and OR, 1001 W. Main St., P.O. Box 843083, Richmond, VA, 23284-3083, United States, jrhardin@vcu.edu

1 - Optimal Sourcing Under Price Uncertainty: A Risk Averse Buyer's Perspective

Santosh Mahapatra, PhD Candidate, Michigan State University, N 370, NBC, Eli Broad College of Business, East Lansing, MI, 48824, United States, mahapat1@msu.edu, Ram Narsimhan, Shlomo Levental

A buying firm's concern for magnitude and uncertainty of cost is dynamic and is governed by its relative significance vis-à-vis other attributes of a product. The dynamic nature of the concern implies the sourcing strategy should be appropriately adjusted over time. We analytically investigate this issue when a buying firm adopts "contractual" arrangements and "open market" arrangements. The problem is of increasing significance due to the recent emergence of electronic markets.

2 - Base Stock Policies for the Stochastic Inbound Inventory Routing Problem (SIIRoP)

Malini Natarajarathinam, University of Alabama, Tuscaloosa, 1303, 8th street Apt D, Tuscaloosa, AL, 35401, United States, mnataraj@cba.ua.edu

We propose a two phase heuristic solution procedure for SIIRoP. In the first phase, we calculate reorder intervals. In the second phase, we account for the stochastic nature of the problem and calculate the order up to level for each supplier corresponding to the reorder intervals from the first phase. This sequential approach adds value to the integrated supply chain by achieving a balance between inventory costs, transportation costs and stock-out costs.

3 - A Two-stage Algorithm with Valid Inequalities for the Split Delivery Vehicle Routing Problem

Mingzhou Jin, Assistant Professor, Mississippi State University, P.O. Box 9542, Mississippi State, MS, United States, mjin@ie.msstate.edu, Kai Liu

This study proposes a two-stage algorithm with valid inequalities (TSVI) to optimally solve the Split Delivery Vehicle Routing Problem (SDVRP). The first stage creates clusters and the second stage calculates the minimal travel distance of each cluster. The cluster costs are added into the first stage to have iterations. Seven valid inequalities are developed for the first stage to improve computational efficiency. The TSVI significantly outperforms other exact solution approaches to the SDVRP.

4 - Dynamic Supply Chains Competition

Fouad El Ouardighi, Associate professor, ESSEC Business School, BP105, Cergy Pontoise, 95021, France, elouardighi@essec.fr

A differential game model involving two independent two-stages coordinated supply chains competing for consumer demand is proposed. On the manufacturing side, each manufacturer controls its production rate, its quality improvement effort and its advertising effort. On the retailing side, each retailer decides on its purchasing rate and its sales price. The model is analyzed by qualitative as well as numerical means.

5 - Vehicle Minimization for Periodic Deliveries

Jill Hardin, Assistant Professor, Virginia Commonwealth U. Statistics and OR, 1001 W. Main St., P.O. Box 843083, Richmond, VA, 23284-3083, United States, jrhardin@vcu.edu, Ann Campbell

We consider the problem of minimizing the number of vehicles required to make strictly periodic, single destination deliveries to a set of customers, under the initial assumption that each delivery requires the use of a vehicle for a full day. This problem is motivated by inventory routing problems in which customers consume goods at a steady rate. We evaluate the complexity of the problem and discuss its general properties, including problem decomposition.

■ WA05

H - 6th Floor, Powell B

Service System Design: Probabilistic Models

Cluster: Service Sector Operations
Invited Session

Chair: Sriram Dasu, University of Southern California, Marshall School of Business, Los Angeles, CA, United States, sriram.dasu@marshall.usc.edu

1 - When to Come Back: A Queueing Control and Capacity Allocating Problem

Chunyang Tong, University of Southern California, Marshall School of Business, Los Angeles, CA, 90089, United States, chunyant@marshall.usc.edu, Sriram Dasu

We consider a queuing system design and control problem. The model consists of two service stations for inline and offline waiting respectively.Arriving customers choose to join one irrevokably so as to minimize waiting costs.We also assume that these two servers pool resource.We attempt to establish an optimal policy that minimizes the total waiting cost,by letting system manager indicate a returning time and simultaneously allocate capacity between the two stations.

2 - Staffing and Referral Rates in Gatekeeper Systems with Congestion

Robert Shumsky, University of Rochester, Simon School of Business, Rochester, NY, United States, shumsky@simon.rochester.edu, Sameer Hasija, Edieal Pinker

This paper studies service systems with gatekeepers who diagnose a customer problem and then either refer the customer to an expert or attempt treatment. We determine the optimal staffing levels and referral rates that minimize the system costs, where these costs include staffing, customer waiting, and mistreatment costs. We also compare the optimal gatekeeper system (a two-tier system) with a system staffed with only experts (a direct-access system).

3 - Robust Analysis of Variance: Process Design and Quality Improvement

Sridhar Seshadri, Stern School of Business NYU, 44 West Fourth St., New York, NY, United States, sseshadr@stern.nyu.edu, Jeffrey Simonoff, Avi Giloni

We discuss the use of robust ANOVA techniques as applied to process engineering. We demonstrate how it can be used as a diagnostic tool to find influential observations. We provide several examples where incorrect inferences occur when utilizing traditional ANOVA methods, but do not occur when utilizing robust methods.

4 - An Approximately Optimal Data-driven Call Center Staffing Method

Achal Bassamboo, Stanford University, 518 Memorial Way, Stanford, 94305, United States, achalb@stanford.edu, Assaf Zeevi, Michael Harrison

We consider a multi-class/multi-pool call center model; the instantaneous call arrival rates vary stochastically over time. We seek staffing levels that minimize personnel costs subject to a quality of service constraint. Using fluid model and convex duality we reduce the problem to an unconstrained optimization which is equivalent to a multi-dimensional newsvendor problem. We prove that a consistent estimator for optimal staffing levels can be obtained on the basis of historical data.

■ WA06

H - Ballroom Level, Imperial B

Reverse Supply Chains in Manufacturing

Contributed Session

Chair: Sasidhar Malladi, Graduate student, Iowa State University, Black Engineerin Bldg, Ames, IA, 50011, United States, sasi@iastate.edu

1 - Extended Producer Responsibility and Remanufacturable Product Design

Ravi Subramanian, Ross School of Business, University of Michigan, Ann Arbor, United States, rsubramz@bus.umich.edu, Brian Talbot, Sudheer Gupta

We model a single manufacturer supplying a remanufacturable, durable good to a single customer and analytically investigate how various attributes of EPR influence upstream design choices of performance and remanufacturability by the manufacturer, given that the customer makes equipment replacement decisions optimally. We also look at contracts that can help uncoordinated firms achieve the profitability as well as environmental design superiority of coordinated firms.

2 - Scoring Model for Disposition in Reverse Supply Chain

Santhanam Rajagopalan, Graduate Research Assistant, University of Texas at Arlington, 312, UTA Blvd, Apt 201, Arlington, TX, 76010, United States, sanmanisha@yahoo.com, Srikanth Yellepeddi

The process of capturing maximum value from products entering the reverse logistics (RL) network is gaining utmost importance across many industries. Yet little has been written on how an enterprise becomes adept at it. We develop a "Scoring model" that lists and prioritizes the available disposition options for products in the RL pipeline and evaluates them from different economical, legal and supply chain perspectives.

3 - A Reverse Logistics Channel with Remanufacturing

Jo Min, Associate Professor, IMSE/Iowa State University, 2019 Black Engineering, Ames, IA, 50011, United States, jomin@iastate.edu, Jie Li

In this paper, we formulate and analyze a closed-loop manufacturer-retailer supply chain model with product remanufacturing. We study the supply chain performance under different scenarios of leader/follower relationships and build mathematical models in single-period and multi-period settings. For both single and multi period models, we will examine and illustrate the implications of different supply chain scenarios on prices, profits, and the degrees of remanufacturing.

4 - A Producer-Service Provider Model with Variable Remanufacturability

Sasidhar Malladi, Graduate student, Iowa State University, Black Engineerin Bldg, Ames, IA, 50011, United States, sasi@iastate.edu, Jo Min

We consider a producer who sells both newly manufactured and remanufactured products to a service provider, who in turn utilizes them to meet his/her own customers' demand. The producer can vary the fraction of new products that can be remanufactured via investments in technology. We investigate the relationship between the producer and the service provider in terms of the price, quantity, and technology investment.

■ WA07

H - Ballroom Level, California

Assortment Planning under Operational Considerations

Sponsor: Manufacturing & Service Oper Mgmt
Sponsored Session

Chair: Goker Aydin, University of Michigan, Dept. of Industrial and Operations Engr., Ann Arbor, MI, 48109, United States, ayding@umich.edu

1 - Dynamic Assortment with Demand Learning for Seasonal Consumer Goods

Felipe Caro, UCLA Anderson School, 110 Westwood Plaza, Los Angeles, CA, 90095, United States, felipe.caro@anderson.ucla.edu, Jeremie Gallien

We consider a finite-horizon multiarmed bandit with several plays per stage and Bayesian learning. We derive a closed-form dynamic index policy capturing the key exploration vs. exploitation trade-off and also provide associated suboptimality bounds. We then use the index to derive heuristic policies for the dynamic assortment problem faced by a fast fashion retailer and show how to incorporate lead times, product substitution, and inventory decisions under different scenarios of available data.

2 - Convenience Tying of Complementary Retail Items

Ebru Bish, Assistant Professor, Virginia Tech, Dept. of Industrial and Systems Engg., Blacksburg, VA, 24061-0118, United States, ebru@vt.edu, Bacel Maddah

We study a selling practice that we refer to as "convenience tying," which is gaining popularity among retailers. Under convenience tying, the retailer "ties" two complementary items (such as berries and short cakes) together by physically displaying them in near proximity in order to stimulate the overall demand. We provide sufficient conditions for the profitability of this selling practice, and characterize properties of the optimal prices under this strategy.

3 - Optimal Retailer Assortment and Stocking Decisions

Maria Mayorga, Ph.D. Candidate, University of California, Berkeley, Dept. of Industrial Engineering, and Operations Research, Berkeley, CA, United States, mmayorga@bus.umich.edu, Goker Aydin, Hyun-soo Ahn

We consider optimal assortment and stocking decisions for a retailer. We characterize the optimal policy when products are differentiated both horizontally by variety and vertically by quality. Consumers are heterogeneous and differ in their preference for the two attributes. We present the results under static substitution and dynamic substitution, and show the effects of cannibalization on the optimal product mix.

4 - Pricing and Production Decisions in Supply Chains of Complementary Products

Yunzeng Wang, Professor, Case Western reserve University, Weatherhead School of Management, Cleveland, OH, United States, yxw36@case.edu, Xiang Fang

Consider n manufacturers each producing one of a set of complementary products and selling it to the market though a common retailer under a consignment-sales contract with revenue-sharing. We explore how different sequences of manufacturers' decisions on their individual retail prices and production quantities affect channel and individual firms' performance in equilibria.

■ WA08

H - Ballroom Level, Imperial A

Supply Chain Management

Sponsor: Manufacturing & Service Oper Mgmt
Sponsored Session

Chair: Alan Erera, Assistant Professor, Georgia Institute of Technology, Industrial and Systems Engineering, 765 Ferst Drive NW, Atlanta, GA, 30332, United States, alan.erera@isye.gatech.edu

1 - Production and Transportation Integration for a Make-to-Order Manufacturing Company

Xuying Zhao, The University of Texas at Dallas,School of Management, Richardson, TX, xuying.zhao@student.utdallas.edu, Kathryn E. Stecke

To reduce outbound shipping costs paid to a third party logistics company, a make-to-order manufacturer can take advantage of slow shipping modes through better scheduling. We analyze such an integration problem for eight distribution scenarios. Following NP-hard complexity and worst case analyses, efficient heuristic algorithms with numerical experiments are given.

2 - Revenue Maximizing Mixed-bundling Strategies
Prakash Mirchandani, pmirchan@katz.pitt.edu, Mihai Banciu, Srinivas Bollapragada

Mixed-bundling (MB) entails pricing and selling individual products as well as bundles of the individual products combined in any proportion. Investigating MB in a monopolistic, revenue maximization setting with limited product availability, we develop mathematical programming models for pricing the products and their bundles. We derive closed-form solutions for the two product, linear-demand case, develop structural insights, and design and implement an efficient algorithm for general case.

3 - Location/Distribution Decisions for Remnant Inventory Supply Chains
Jayant Rajgopal, University of Pittsburgh, Department of Industrial Engineering, University of Pittsburgh, Pittsburgh, PA, 15261, United States, rajgopal@pitt.edu, Andrew Schaefer, Joe Wang

We consider a remnant inventory distribution network where a set of facilities must meet stochastic & dynamic demand for a 1-dimensional product arising at other geographically dispersed demand locations. We address the problem of locating capacitated facilities in conjunction with developing a price-directed distribution policy. A mixed integer programming formulation is presented. The model considers fixed, cutting and transportation costs, as well as revenue generated from recovered scrap.

4 - Value of Demand Sensing for Inventory System Control
Olga L. Ortiz, Graduate Student, Georgia Institute of Technology, School of Industrial and Systems Engineering, 765 Ferst Drive NW, Atlanta, GA, 30332, United States, oortiz@isye.gatech.edu, Chelsea C. White, III, Lynn T Truss, Atul Saroop, Alan Erera

Consider an inventory system where the demand process is described by a Markov chain. When stockouts do not occur, demand can be inferred from sales; otherwise, demand is only partially observed. We present an approach to assess the potential improvement in inventory control that can be obtained from demand sensing.

■ WA09

H - Ballroom Level, Yosemite A

Risk, Financing and Supply Chains

Cluster: Supply Chain Management
Invited Session

Chair: Volodymyr Babich, Assistant Professor, University of Michigan, 1205 Beal Ave., IOE 2783, Ann Arbor, MI, 48105, United States, babich@umich.edu

1 - Coordinating Production and Dividends in a Growing Firm
Matthew Sobel, Professor, Case Weatherhead School of Management, Department of Operations, 10900 Euclid Ave., Cleveland, OH, 44106-7235, United States, matthew.sobel@case.edu, Danko Turcic

We optimize the expected present value of the time stream of dividends in a growing firm. The operational decisions are production and inventory levels, the financial decisions are dividends and short-term borrowing, and successive demands comprise an ARMA process. We focus on the manner in which decisions should depend on the changing volume of sales. Except for the tendency of demands to grow, the assumptions would imply that a base-stock level policy is optimal.

2 - Optimal Policies with Unreliable Suppliers and Currency Exchange Risk
John Birge, Professor, University of Chicago, Graduate School of Business, Chicago, 60637, United States, john.birge@gsb.uchicago.edu, Umut Aytekin

Multinational firms can take advantage of currency exchange fluctuations through the use of suppliers in multiple markets. Firms may also seek multiple sources to manage the risk associated with unreliable supply. In this talk, we consider both exchange and supply risk and show how the correlation between these risks can change the preference for multiple market sources.

3- The Interaction of Technology Choice and External Financing Costs
Beril Toktay,Associate Professor, Georgia Institute of Technology, beril.toktay@insead.edu, Onur Boyabatli

This paper analyzes the interaction between the technology choice and the external financing costs. We model a firm that decides on its technology (flexible or dedicated) and capacity level, that can use a collateralized short-term bank loan to finance its operations. We demonstrate the effect of external borrowing frictions on the firm's operating decisions. We also analyze the effect of technology choice on external financing costs through altering the collateral value and the default risk.

4 - Designing Resilient Supply Chains: Diversification vs. Dedicated Supplier Procurement Strategies
Volodymyr Babich, Assistant Professor, University of Michigan, 1205 Beal Ave., IOE 2783, Ann Arbor, MI, 48105, United States, babich@umich.edu

A bankruptcy of UPF-Thompson, the supplier of chassis for Land Rover, has exposed the automaker to a risk of either 45 mil. pounds loss or a production disruption. This paper examines the tradeoffs between two strategies for managing supplier bankruptcy risks: diversification of the supplier base vs. financial subsidies to a few dedicated suppliers. The analysis employs firm-value models for supplier defaults and characterizes the optimal dynamic procurement and financial-subsidy policies.

■ WA10

H - Ballroom Level, Yosemite B

Marketplace and its Impact on Supply Chain Management

Cluster: Supply Chain Management
Invited Session

Chair: Jun Zhang, Tulane University, 7 McAlister Dr, New Orleans, LA, United States, jzhang4@tulane.edu

1 - Designing an Online Marketplace for Supplier Aggregation and Integration
Geoffrey Parker, Tulane University, gparker@tulane.edu, Amiya Chakravarty

In this paper we focus on a public market that matches buyers and suppliers in order to study the subscription fee and the context-service investment that determine the viability of the marketplace. This paper is novel because it characterizes optimal exchange investments in the context of heterogeneous complementary externalities between sellers. When suppliers are heterogeneous, it can be optimal for the exchange operator to set fees such that not all suppliers are willing to join.

2 - Price Setting and Price Discovery Strategies with a Mix of Frequent and Infrequent Internet Users
Amiya Chakravarty, Tulane University, AB Freeman School of Business, 7 McAlister Drive, new orleans, LA, United States, akc@tulane.edu, Suman Banerjee

We study an e-marketplace with two buyer groups to establish pricing and search strategies. With group-specific search costs, we find that novice buyers choose from two possible search strategies and firms follow noncompetitive pricing strategies. We confirm Stigler's insight that search process causes price dispersion. Our results challenge the belief that price dispersion increases with search cost and highlight implications of search strategy on welfare, price and e-marketplace efficiency.

3 - Capacity Investment with Capacity Exchange
Jun Zhang, Tulane University, 7 McAlister Dr, New Orleans, LA, United States, jzhang4@tulane.edu

We study the problem of capacity investment decisions with exchange where the exchange price is determined endogenously by the supply and demand. We show that the capacity decision problem with exchange is equivalent to a capacity decision problem without exchange. Using this equivalence result, we demonstrate that capacity exchange effectively changes a firm's demand by reducing its variability. Further, exchange moves a firm's optimal capacity to certain indifference level.

4 - Core Products and their Auxiliaries: A Preliminary Look at Playstation - Xbox Competition
Ozgen Karaer, PhD Candidate, Management Science & Engineering, Stanford University, Stanford, CA, 94305, United States, okaraer@stanford.edu, Feryal Erhun

We study a duopolistic model where the players compete on the price of a core product as well as the variety of its auxiliaries. The revenues are generated by direct sales of the core and the future revenues of the auxiliary products. We study the market dynamics under a monopoly, a duopoly with simultaneous and sequential competition, and a duopoly with collaboration. We identify the market characteristics that would favor a duopoly and analyze the value of collaboration for the whole system.

■ WA11

H - Ballroom Level, Yosemite C

Value of Information in Supply Chain Management

Contributed Session

Chair: David Claudio, Dept of DSES, Rensselaer Polytechnic Institute, 110 8th Street,, Troy, NY, 12180, United States, claudd@rpi.edu

1 - Knowledge Integration to Support Complex Supply Network Management

Xiangyang Li, Assistant Professor, University of Michigan-Dearborn, 4901 Evergreen Road, 2260 Engineering Complex, Dearborn, MI, 48128, United States, xylum@umich.edu, Charu Chandra

With emerging techniques such as sensor networks and RFID, information integration becomes the key in efficiently managing modern supply networks. An adaptive framework is proposed here that consists of dependency modeling, active configuration, and integration quality assurance. We use risk management and service network to elaborate on the problem and the framework. Initial results of the proposed Bayesian approach are also presented. We conclude by the implication and future research issues.

2 - Upstream Information Sharing in a Serial Supply Chain with Supplier Random Yields

Hyun-cheol Choi, PhD Candidate, Indiana University, 1309 E. 10th St. BU570, Bloomington, IN, 47405, United States, hyunchoi@indiana.edu, James Blocher, Srinagesh Gavirneni

We look at the benefits of a supplier sharing its upstream production information with its customers in a two-stage supply chain where the supplier's processes have uncertain yields. Our computational study shows that information is more beneficial when the leadtime from the supplier to its customer is short, when the uncertainty in the supplier's yield is high, when customer demand variances are low, and when the stockout penalty to holding cost ratio is high.

3 - Supply Chain Management Under Advance Supply Information

Mehmet Sekip Altug, PhD Candidate, Columbia University, Graduate School of Business, 3022 Broadway Uris Hall 4J, New York, NY, 10027, United States, msa2104@columbia.edu, Alp Muharremoglu

We consider a manufacturer who gets "advance supply" information from its supplier in the form of capacity availability forecasts for the near future. The questions we study are: i) How does the manufacturer use this information when making replenishment decisions? ii) What is the value of information sharing under various scenarios? We show that state-dependent base stock policies are optimal for the manufacturer. We propose lower and upper bounds along with an easily implementable heuristic.

4 - Demand-Supply Interaction and Production Planning for Short Life Cycle Products

Deepak M. Agarwal, Graduate Student, University of Texas at El Paso, TX, 79968, dmagarwal@utep.edu, Rong Pan

Managing short life cycle products have become a challenge in today's business world. In this research we propose a set of mathematical models based on cumulative demands. Bass diffusion model is used to characterize the demand-sales interaction. The optimal production response to a particular demand pattern can be found after we build the cost models to analyze each demand-sales interaction circumstance.

■ WA13

H - 4th Floor, Union Square 5

MARA 2005

Sponsor: Decision Analysis
Sponsored Session

Chair: Martin Schilling, London School of Economics, M.Schilling@lse.ac.uk

1 - MARA 2005 - A Contribution to the Internationalisation of Decision Analysis

Martin Schilling, London School of Economics, M.Schilling@lse.ac.uk

The project MARA 2005 (Methodologìas para la Asignaciòn der Recursos: Argentina) was designed to transfer decision-analytic methodologies to allocate resources efficiently in organisational practice. MARA 2005 - organized by PhD students from the London School of Economics and assistant professors from the University of Buenos Aires - thereby built a bridge between academic methodologies and organisational needs, giving decision analysis a higher profile in Argentina. During the three-month project approx. 30 young academics and young professionals from five nations developed decision-analytic models to aid organisations in the private and NGO sector in Argentina to apply resources efficiently.

2 - Marketing Budgeting and the Commons Dilemma: A Marketing Budgeting Support System based on Multiple-Criteria Decision Analysis

Andrés Lartigue, Universidad de Buenos Aires

Within the framework of MARA two teams applied decision analysis in the marketing area. Based on this work, we present a new Marketing Decision Support System to create best value-for-money marketing activity portfolios. A socio-technical approach, combining multiple-criteria decision analysis and decision conferencing is introduced to aid groups of marketing managers to optimize the "marketing-mix" problem and resolve cross-department value trade-offs.

3 - Corporate Social Responsibility (CSR) and the Socio-technical Approach: The Contribution of Decision Analysis to Create CSR Activity Portfolios

Juan Manuel Duhalde, Universidad de Buenos Aires

Futher work of MARA 2005 resulted in a Group Decision Support System to develop efficient corporate social responsibility portfolios. Within the framework of MARA 2005 one of our team applied decision analysis in the CSR area to help decision-makers estimate the impact of different CSR activities in the areas of Economic Development, Environment and Education.

4 - Panel Discussion: MARA 2006 - Methodologìas para la Asignaciòn de Recursos: Alemania (Resource Allocation Methodologies: Germany)

Moderator: Martin Schilling, London School of Economics, M.Schilling@lse.ac.uk, Panelists: Cornelius Schaub

More scientifically focused, we are planning to organize MARA 2006 in Germany. As a preliminary idea, four MARA tracks shall be established, to create new knowledge about resource allocation methodologies in the areas: Marketing, R&D, Government and Negotiation. The objective of MARA 2006 will be to contribute to the advance of the area of decision analysis, giving it a higher public profile. Within the framework of MARA 2006 we intend to create a space for young academics from different international "Schools" of decision analysis to meet over the summer and together develop decision-analytic models, to exchange modelling ideas and to create new knowledge. In this session, we would like to discuss possible the contents of the project. In addition, we would like to invite senior academics from the field to train our participants, and (PhD) students to participate.

■ WA14

H - 4th Floor, Union Square 6

The Role of Search and Tracking in Domain Awareness

Sponsor: Military Applications
Sponsored Session

Chair: L. D. Servi, MIT Lincoln Laboratory, 244 Wood Street, Lexington, MA, 02420, United States, servi@ll.mit.edu

Co-Chair: Donald P. Gaver, Operations Research Dept, Naval PostGraduate School, Monterey, CA, United States, DGaver@nps.edu

1 - Role of Tracking in Domain Awareness

Sumedh Puranik, Elec. and Comp. Engin., Auburn University, Auburn, AL, United States, puransp@auburn.edu

Multi-target tracking systems are very sophisticated and require enormous data processing capability for track-formation (target-detection, classification), track-maintenance (estimation, data association, data-fusion, sensor-management), and decision-making (identification and hand-off control for weapon activation). In this talk, we will briefly overview issues and main approaches that have been investigated over the two decades.

2 - A Maritime Domain Awareness and Protection Problem

Donald P. Gaver, Operations Research Dept, Naval PostGraduate School, Monterey, CA, United States, DGaver@nps.edu, Hiro Sato, Patricia A. Jacobs

A littoral area of (Blue) interest is to be attacked by (Red/Hostile) forces. Blue overhead (OH) sensors monitor the area. When a possible Red attacker is identified amidst a large number of (White/Neutrals), possibly with error, the OH tracks the latter until an escort force arrives. Red leakage is evaluated.

3 - Non-linear Non-Gaussian Multi-target Tracking

L. D. Servi, MIT Lincoln Laboratory, 244 Wood Street, Lexington, MA, 02420, United States, servi@ll.mit.edu

A multi-target tracking problem is described which requires (i) handling non-linear non-Gaussian object dynamics, (ii) probabilistically associating noisy location measurements to establish the object's identity, and (iii) probabilistically initiating new tracks. The analytic approach will be presented along with numerical results which use a simulation, for which "truth" is known, to provide validation.

4 - Scheduling policies for a sensor to guard a perimeter

Kyle Lin, Assistant Professor, Naval Postgraduate School, Operations Research Dept., Monterey, CA, United States, kylin@nps.edu, Moshe Kress, Roberto Szechtman

There are two types of agents, friendly and malevolent, that attempt to cross a perimeter. A sensor can sequentially classify each agent as friendly or malevolent during the agent's crossing time. However, classification takes time and is prone to errors. We discuss different scheduling policies for the sensor.

■ WA15

H - 4th Floor, Union Square 9

Production and Scheduling

Contributed Session

Chair: Michael R. Wagner, MIT Operations Research Center, 77 Massachusetts Avenue, Bldg. E40-149, Cambridge, MA, 02139, United States, mikew@mit.edu

1 - Petri Nets and Improved Heuristic Search Methods for Manufacturing System Scheduling

Gonzalo Mejia, Universidad de los Andes, Calle 19 N1-37E, Oficina W263, Bogota, Colombia, gmejia@uniandes.edu.co

In this paper, we propose new Petri Net-based algorithm for manufacturing scheduling. This algorithm combines Heuristic Graph Search methods with both aggressive node pruning strategies and improved evaluation functions. Extensive computational tests were conducted a variety of problems ranging from classical jobs shop to complex FMS scheduling problems. The results obtained are very promising results in both solution quality and computing times.

2 - Using Boosting and Bagging Methods with Neural Networks to Improve Flow Time Prediction

Rahul Patil, doctoral student, Leeds School of Business, University of Colorado, campus box 419, Boulder, CO, 80309, United States, Rahul.Patil@colorado.edu, Stephen Lawrence

Basic neural network methodology proposed in the previous research showed significant improvement over the conventional regression models in predicting flow times. We augment the basic methodology by using evolutionary neural network architecture, boosting and bagging methods. Experiments results indicate that these methods generate better flow time predictions than the conventional neural network methodology .

3 - A Multi-Objective Customer Orders Assignment and Resource Leveling in Make-to-Order Manufacturing

Tadeusz Sawik, Professor, AGH University of Science & Technology/Department of Computer Integrated Manufacturing, Al.Mickiewicza 30, Krakow, 30-059, Poland, ghsawik@cyf-kr.edu.pl

This paper presents integer programming formulations and compares weighting with lexicographic approach to a multi-criteria production scheduling in make-to-order manufacturing. The objective is to determine an assignment of customer orders and machines over a horizon to minimize numbers of tardy and early orders and to level machine assignments over the horizon.

4 - Impact of Market Cannibalization and Substitution on Pricing and Inventory Control Problems

Mustafa Karakul, York University, 4700 Keele St, Toronto, ON, M3J 1P3, Canada, mkarakul@yorku.ca, Abdullah Dasci

There are mainly three implications of new product introductions on firm's profitability: first, the new product generates new demand, the usual market stealing effect. Second, the new product may steal from the firm's old product market, the well-known market cannibalization effect. Finally, the new version can be used to substitute the old one when it is out of stock. Here we study pricing and inventory decisions of a manufacturer that introduces a new version of a product.

5 - LP-Based Online Scheduling: From Single to Parallel Machines

Michael R. Wagner, MIT Operations Research Center, 77 Massachusetts Avenue, Bldg. E40-149, Cambridge, MA, 02139, United States, mikew@mit.edu, Jose R. Correa

We study machine sequencing problems in an online setting. We look at an algorithm for scheduling jobs with release dates on identical parallel machines, to minimize the sum of weighted completion times. Using linear programming techniques, borrowed from the single machine case, we are able to design a 2.62-competitive deterministic algorithm for the non-preemptive version of the problem, improving upon the 3.28-competitive algorithm of Megow and Schulz.

■ WA16

H - 4th Floor, Union Square 10

Production Scheduling Modeling in Manufacturing

Contributed Session

Chair: Jun Zhang, Ph.D. student, Purdue University, 315 N. Grant Street, West Lafayette, IN, 47907-2023, United States, zhang28@purdue.edu

1 - Modelling and Analysis of Production Systems with Multiple-Kanban Loops

Zhenyu Zhang, M.I.T, 77 Mass Ave, Cambridge, MA, 02139, United States, zhyzhang99@hotmail.com, Stanley B Gershwin

This paper describes the underlying system of multiple-Kanban system as assembly/disassembly network with multiple-loop structure. It presents a stochastic model integrating information flows into material flows. Graph theory is applied to analyze the behavior of multiple-loop structure. An efficient algorithm is developed for evaluating system performance. The accuracy of the algorithm is reported. The paper also suggests how this model can help improve the design of multiple-Kanban systems.

2 - Modeling and Exact Analysis of a Tandem Line with Two Unreliable Batch Machines and a Finite Buffer

Seok Ho Chang, Dr., Massachusetts Institute of Technology, 77 Massachusetts Avenue, Cambridge, MA, 02139-4307, United States, soccer9@mit.edu, Stanley B Gershwin

This paper considers a tandem line with two unreliable batch machines and a finite buffer. The main purpose of this paper is twofold: (i) to present analytical modeling and exact analysis of this system; (ii) to present new qualitative insights and interpretation of system behavior. We demonstrate new generalized conservation of flow, flow rate-idle time relationships, the equivalence property, and useful performance measures such as production rate and probabilities of blocking and starvation.

3 - A Genetic Algorithm to Solve Sequence Dependent Job Shop Scheduling Problems

Andrew Manikas, Georgia Institute of Technology, 800 West Peachtree Street, Atlanta, GA, 30332, United States, andrew.manikas@mgt.gatech.edu, Yih-Long Chang

We find the best parameter settings for a Genetic Algorithm to solve Sequence-dependent job shop scheduling problems with recirculation. The results of the genetic algorithm are compared to common heuristics such as SPT. Robustness tests demonstrate that the Genetic Algorithm significantly outperforms common heuristics for this class of complex problems.

4 - Analytical Models for Optimal Loading of Multi-Server Queues

Kumar Satyam, Dept of DSES, Rensselaer Polytechnic Institute, 110 8th Street, Troy, NY, 12180, United States, satyak@rpi.edu, Ananth Krishnamurthy

This paper considers the queuing model of a production system where multiple products are processed at a shared production center. The production center is modeled as a multi-server queue with non-identical servers having general processing characteristics. Individual products are assumed to have unique setup times, batch sizes, and processing times on different servers. Analytical models and approximations are derived to characterize the optimal loading of products at the production center.

5 - A Hierarchical Stochastic Planning Model for Biomedical Manufacturing

Jun Zhang, Ph.D. student, Purdue University, 315 N. Grant Street, West Lafayette, IN, 47907-2023, United States, zhang28@purdue.edu, Yuehwern Yih

We present a hierarchical stochastic planning model in a biomedical manufacturing setting, which is a multi-stage and multi-product manufacturing system. We incorporate demand and raw material supply uncertainty in our model. The objective is to minimize the expected cost of sum of inventory cost and shortage cost. The constraints consider the capacity limitation and demand and raw material supply uncertainty.

■ WA17

H - 4th Floor, Union Square 11

Newsvendor Model and Multiple Supplier Systems

Contributed Session

Chair: Gokhan Sarpkaya, Graduate Student, Auburn University, 207 Dunstan Hall, Auburn University, Auburn, AL, 36849, United States, sarpkgo@auburn.edu

1 - The Newsvendor Model with Risk Preference

Werner Jammernegg, Professor, Vienna University of Economics and Business Administration, Nordbergstrasse 15, Wien, Austria, werner.jammernegg@wu-wien.ac.at, Peter Kischka

Only recently, in inventory management risk-averse objective functions have been used for determining the optimal order quantity. We propose a newsvendor model where the objective function depends on two risk parameters, and we show that it is consistent with dual utility theory. We provide a managerial guideline to select the appropriate risk parameters and to determine the corresponding salvage price for given level of product availability and given probability of loss.

2 - Optimal Production and Price Decisions for Substitutable Products

Sang-Won Kim, PhD Candidate, Management Science, Richard Ivey School of Business, University of Western Ontario, 1151 Richmond Street North, London, ON, N6A3K7, Canada, swkim@ivey.ca, Peter Bell

We consider a single period inventory management problem where a company has flexibility of substitution. Specifically, a two product model with product and demand substitution is described. A variety of different rules of substitution is applied. We present analytical findings and numerical results.

3 - Risk-aware Newsboy
Toshikazu Aiyama, Professor, Tokyo Metropolitan University, Higashi-cho, Akishima, 196-8540, Japan, aiyama@tmca.ac.jp

Our research centers at the relationship of the forecast and utility function to the newsboy problem: replenishment size determination facing single period stochastic demand. We would like to know the possibility of different order quantity based on how confident he is to the forecast of the demand.

4 - A Single Product Outsourcing Policy with Multiple Capacitated Suppliers
Tinglong Dai, Graduate Student, HK University of Science and Technology, Room 206C, Tower A, HKUST, Clear Water Bay, Kowloon, Hong Kong, ieemdai@ust.hk, Xiangtong Qi

We consider a problem for a manufacture that outsources a single product from multiple capacitated suppliers. A decision has to be made as to which supplier(s) should be used, how much and often to purchase from each selected supplier. We build an EOQ-type model with a finite time horizon, which differs from an existing model with an infinite time horizon in the literature. We design a dynamic program and a heuristic method to solve this problem.

5 - Order Splitting in a Multiple Supplier, Multiple Product Healthcare Supply Chain
Gokhan Sarpkaya, Graduate Student, Auburn University, 207 Dunstan Hall, Auburn University, Auburn, AL, 36849, United States, sarpkgo@auburn.edu, Veysel Dalkilic, Abishek Ramesh, Emmett Lodree

The suppliers for health care providers perform their procurement process in a time, quality and cost sensitive setting. Although many inventory models assume items are replenished from a single supplier, this study analyzes the multiple-supplier multiple-item case with stochastic lead times from the perspective of a single first tier supplier of a health care provider. The mathematical model is solved using an improved evolutionary strategy.

■ WA18

H - 4th Floor, Union Square 12

Measuring the Impact of National Air Transportation System Changes

Sponsor: Aviation Applications
Sponsored Session

Chair: Andrew Lacher, Research Strategist, The MITRE Corporation, 7515 Colshire Drive, McLean, 22102, United States, alacher@mitre.org

1 - A Proposed New Safety Metric to Measure Air Transportation Safety System
Yue Xie, George Mason University, 4400, University Dr., Fairfax, VA, 22030, United States, yxie@gmu.edu, George Donohue, John Shortle

Aviation safety is usually measured by accident rates, calculated as the number of accidents divided by total operations in a time unit. Research in aviation safety area has indicated that safety is related with the internal and external factors of the system in a complex and nonlinear manner. We propose a safety metric in logarithmic scale based on the research in aviation safety. The new metric is expected to reflect the nonlinear characteristics of aviation safety more efficiently.

2 - Effect of Controller-pilot Data Link Communications on En-route Sector Routing Efficiency
Jasenka Rakas, jrakas@ce.berkeley.edu, David Knorr, Michael Bennett

We analyze effects of controller-pilot data link communications (CPDLC) on sector routing efficiency and hypothesize that reduced voice channel occupancy results in more timely vectoring of aircraft onto their original routes in cases where they previously have been vectored off-route to resolve conflicts. We test this hypothesis by studying the relationship between voice channel occupancy and the excess distance caused by conflict resolutions.

3 - En-Route Air Traffic Modeling and Strategic Flow Management using Mixed Integer Linear Programming
Charles-Antoine Robelin, Graduate Student Researcher, UC Berkeley, robelin@ce.berkeley.edu, Dengfeng Sun, Guoyuan Wu, Alexandre Bayen

An Eulerian model of air traffic flow is developed for the National Airspace System and validated against real data at the level of one Center. The model relies on an integer linear dynamical system framework. This is used to assess real-time controllability of user-defined metrics (sector counts, inbound flows). Empirical evidence of fast running time using Mixed Integer Linear Programming is provided, which makes the method applicable to online strategic traffic flow management for one Center.

■ WA19

R - 3rd Floor, Sienna I

Management Applications of DEA

Sponsor: Technology Management
Sponsored Session

Chair: Tim Anderson, Portland State University, P.O. Box 751, Mail Code ETM, Portland, OR, 97207-0751, United States, tima@etm.pdx.edu

1 - Improving Time to Market Forecasts: Technology Forecasts for Predicting Fighter Jets (1944-1982)
Tim Anderson, Portland State University, P.O. Box 751, Mail Code ETM, Portland, OR, 97207-0751, United States, tima@etm.pdx.edu, Lane Inman, Robert Harmon

We extend a classic study of U.S. fighter jets to compare technology forecasting using data envelopment analysis (TFDEA) to the classic regression-based forecast. We used aircraft introduced between 1944 and 1959 to predict the first flights of those introduced later, 1960-82. TFDEA better predicted first flight dates than the regression forecast. Results indicated TFDEA may be a powerful new technique for predicting complex technological trends and time to market for new products.

2 - Navigating Process Improvement: IDEF0 Maps with DEA Compasses
And Ozbay, Lead Operations Researcher, Wells Fargo, 18700 NW WALKER RD, MAC P6053-022, Beaverton, OR, 97006, United States, and.ozbay@wellsfargo.com, William Eisenhauer

Integration DEFinition Language 0 (IDEF0) provides a method to depict complex systems. An integral part of IDEF0 diagrams is inputs and outputs for a process. Measurable inputs and outputs associated with an IDEF0 mapped process provide a ripe opportunity to measure the process productivity. The illustrated integration of an IDEF0 mapped process into a DEA based process efficiency measurement system used at a major financial institution, will be presented.

3 - Labor Productivity in the Construction Industry
Gerald Williams, R. Brown Consulting Group LLC, 2300 SW First Avenue, Suite 102, Portland, OR, 97212-5047, United States, Gerry@CEMResearch.com, Evan Lenneberg

The commercial construction industry is over 10% of US GDP. Labor is the single largest variable cost in construction and impact to labor productivity is a major concern of construction contractors. This paper uses DEA to empirically evaluate the magnitude of certain types of labor impacts on productivity.

4 - Revisiting DEA as a Tool for Vendor Evaluation and Selection
Johannes Grefe, Portland State University, Bussardstr.6, Reichertshofen, Germany, johannes.grefe@t-online.de

Recently a variation of DEA was proposed as a tool for supply base optimization through vendor evaluation. This application is revisited and critiqued in terms of both methodology and interpretation of results.

■ WA20

H - 6th Floor, Mason B

Forestry II: Forest Product Applications

Sponsor: Energy, Natural Resources & the Environment / Forestry
Sponsored Session

Chair: Charles Brunner, Associate Professor, Dept. of Wood Science and Engineering, Oregon State University, 119 Richardson Hall, Corvallis, OR, 97331, United States, Charles.Brunner@oregonstate.edu

1 - Robust Optimization in Supply Chain Problems in the Forest Industry
Jorge Vera, Professor, Dept. of Industrial and System Engineering, Catholic University of Chile, Vicuna Mackenna 4860, Santiago, Chile, jvera@ing.puc.cl, Pamela Alvarez

This work considers some optimization problems which arise in the management of the supply chain of forest industries, namely sawmills and harvesting operations. Several operational parameters in this problem are not known exactly and vary within certain ranges. Hence, a robust optimization approach, following Ben-Tal and Nemirovsky formulations, is applied. We show results for several instances of problems with real industrial data and discuss the potential advantages of the approach.

2 - Logging Road Grader Scheduling Modeled as a RPP — Computational Heuristic Solutions

Matthew Thompson, Graduate Student, Department of Forest Engineering, 204 Peavy Hall, Oregon State University, Corvallis, OR, 97330, United States, matthew.thompson@oregonstate.edu, Kevin Boston, Jeffrey L. Arthur, John Sessions

Scheduling for logging road grading is approached as a Rural Postman Problem (RPP), and computational combinatorial heuristic techniques are utilized to generate solutions. Model amendments include capacitated arcs (in the form of operator time constraints), multiple vehicles and multiple depots. The purpose of the project is to create a decision-support tool that can be used to assist in cost-effective road maintenance.

3 - Simulating Lean Manufacturing Techniques to Assess Improvement in a Value-added Forest Products Mill

Jim Reeb, Director of Outreach Education, College of Forestry, Oregon State University, 232 Richardson Hall, Corvallis, OR, 97331, United States, Jim.Reeb@oregonstate.edu, Jim Funck, Charles Brunner

Discrete event simulation was used to assess the impact of switching from traditional manufacturing to cell manufacturing in a wood products firm that manufactures high value pianos and organs. Batch size, part travel time, and the ratio between value-added and non-value-added time were assessed as part of the study.

4 - The Computational Performance of Strengthened Cover Inequalities in Area-based Harvest Scheduling

Marc E. McDill, Associate Professor, Penn State School of Forest Resources, 214B Ferguson Bldg, University Park, PA, 16802, United States, mem14@psu.edu, Sandor F. Toth, Sonney George

The computational performance of applying strengthened cover inequalities to area-based adjacency formulations is evaluated on sixty hypothetical and four real forest planning instances. The proposed inequalities were found to perform the best when used in a combined branch-and-bound and cutting planes framework.

■ WA21

H - 4th Floor, Union Square 15

Optimization and Data Mining I

Sponsor: Optimization/ Optimization and Data Mining Sponsored Session

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

1 - Clustering via Clique Partitioning

Fred Glover, University of Colorado, Leeds School of Business, Boulder, CO, United States, Fred.Glover@colorado.edu, Gary Kochenberger

An important step in data mining is to apply clustering techniques to reveal structures in data. Clique partitioning models have been proposed for this but standard formulations limit their applicability to small to medium size applications. We report computational results for a new formulation that effectively handles much larger applications.

2 - An Alternative Approach to Designing Clinical Trials: Budgeted Learning of Probabilistic Classifiers

Russ Greiner, fiknedef.rgreiner@sfm.cs.ualberta.ca, Dan Lizotte, Aloak Kapoor

To produce an effective classifier, experimenters often spend their given budget purchasing and using the values of *every* feature for a limited set of instances. We show how to produce superior classifiers (within the budget) by sequentially purchasing only certain features, from a larger set of instances.

3 - Best Patterns in Machine Learning

Endre Boros, Professor, Rutgers University, RUTCOR, 640 Bartholomew Road,, Piscataway, NJ, 08854, United States, boros@rutcor.rutgers.edu

We provide an exhaustive approach to generate all patterns for a learning problem, the quality of which is above a given threshold. We deomonstrate on a number of datasets from the Irvine depository that using these patterns achieves very good precision.

4 - Data Similarity Imputation and Outliers

Peter L. Hammer, Director, RUTCOR, Rutgers University, 640 Bartholomew Road, Piscataway, NJ, 08854, United States, hammer@rutcor.rutgers.edu, Mine Subasi, Ersoy Subasi, Martin Anthony

We propose a measure of similarity of a Boolean vector to a given set of Boolean vectors motivated by data analysis problems, and relate it to a Hamming distance-based measure. Applications include data imputation and outlier detection.

■ WA22

H - 4th Floor, Union Square 16

Joint Session DA Appl/ DA/ Health Applications: Applications of Data Mining to Healthcare

Cluster: Data Mining Applications, Data Mining, Health Applications Invited Session

Chair: Victoria Chen, Associate Professor, University of Texas at Arlington, Dept. of Ind. & Manuf. Sys. Eng., Campus Box 19017, Arlington, TX, 76019-0017, United States, vchen@uta.edu

1 - Using Classification Trees to Develop a Nurse Activity Simulation

Duraikannan Sundaramoorthi, The University of Texas at Arlington, Industrial and Manufacturing Systems Eng, Arlington, TX, 76019, United States, dxs7400@omega.uta.edu, Jay Rosenberger, Victoria Chen

A methodology for identifying nurse movement probabilities using classification trees to develop a nurse activity simulation is presented. Data was collected from four different care units of Baylor Regional Medical Center for this analysis. We describe how the probabilities depend on previous locations, time and shift.

2 - Forecasting Future Inpatient Volumes From Recent Ambulatory and ED Data

Michael H. Kennedy, Director, Doctor of Health Administration Program, Central Michigan University, Health Professions Building 1218, Mount Pleasant, MI, United States, kenne1m@cmich.edu, Carl Lee, Lyubov Fishman, Mike Meitzner, James Mentele, Timothy Pletcher

Central Michigan University and Henry Ford Hospitals created a predictive model using SAS Enterprise Miner. The proof-of-concept employed traditional data mining techniques with the recent six months of encounters and patterns from the last five years of outpatient and emergency room data to predict future inpatient admits by specialty. These predictions were subsequently compared to actual and resulted in very accurate predictions for the future year.

3 - Readmission Risk Scoring System: A Data Mining Approach

Satheesh Ramachandran, Sr. Research Scientist, Knowledge Based Systems, Inc., One KBSI Place, 1408 E. University Dr., College Station, TX, 77840, United States, sramachandran@kbsi.com, Perakath Benjamin, Richard Mayer, Rosemary Chacko

This research involves the test and validation of a Readmission Risk Scoring System, which is currently being validated at Brook Army Medical Center. At the core of the Readmission Risk Scoring System lies a set of data mining models that capture the relationship between historical patient attributes and clinical outcome - namely, readmission behavior.

4 - Semi-supervised Learning in Real-Time fMRI

Rong Duan, AT&T Lab, P.O. Box 1923, 340 Mt. Kemble Ave., Morristown, NJ, United States, rongduan@ems.att.com, Hong Man, Wei Jiang, Jinlin Chen, Wen-Ching Liu

This study proposes a real time fMRI activity detection method using semi-supervised learning approach. The basic idea is to use labeled and unlabeled data together to obtain a more accurate reference sequence. The goal of the study is to assess the capability of using unlabeled data in real time brain activation detection when experiment paradigm is unavailable.

■ WA23

H - 4th Floor, Union Square 2

Optimization and Games in Communication Networks

Sponsor: Telecommunications Sponsored Session

Chair: Asu Ozdaglar, MIT, 77 Massachusetts Avenue, 32-D630, Cambridge, MA, 02446, United States, asuman@MIT.EDU

1 - A Game Theoretic Analysis of Distributed Spectrum Sharing

Randall Berry, Professor, Northwestern University, Dept. of ECE, 2145 Sheridan Rd., Evanston, IL, 60208, United States, rberry@ece.northwestern.edu, Jianwei Huang, Michael Honig

We consider techniques for controlling transmission power to share wireless spectrum among distributed users. A distributed and asynchronous algorithm is given where users share pricing signals to indicate the "cost" of interference to them. The convergence of this algorithm is studied by relating it to a "fictitious game," which in certain cases is supermodular. Extensions to multi-channel networks will also be discussed.

2 - Optimization and Games in Inter-domain Routing

Steven Low, Professor, Caltech, MC256-80, Caltech, Pasadena, CA, 91125, United States, slow@caltech.edu, Lun Li

Inter-domain routing protocol, BGP, is a means to implement economic relations among competing entities. To understand the global connectivity of the Internet, it is not enough to study the physical connectivity or protocol details. We will describe simple models to study the interplay between economics and routing and present results on behavior of BGP and peering structure.

3 - Layering as Optimization Decomposition
Mung Chiang, Professor, Princeton, B328, Engineering Quad, Olden Street, Princeton, NJ, 08544, United States, chiangm@princeton.edu

Layering structures for communication networking protocols are traditionally designed based only on engineering heuristics. A new methodology has recently emerged to analyze and design layering as optimization decomposition: the entire network solves a generalized Network Utility Maximization problem, which is decomposed into subproblems each of which corresponds to a layer. We survey several results of this rigorous and holistic approach to network design.

4 - Throughput and Fairness in Random Access Networks
Peter Marbach, Professor, University of Toronto, Bahen Center for Information Technology, BA5232, Toronto, Ontario, M5S 3G4, Canada, marbach@cs.toronto.edu

We study throughput and fairness in random access networks by jointly considering rate control and scheduling. We first present a simple mathematical model which allows to study and explain the performance of TCP over wireless networks. Using this model, we then consider alternative scheduling and rate control mechanisms which are based on recent results obtained by applying optimization theory to the resource allocation problem in wireline networks.

■ WA24

H - 4th Floor, Union Square 8

Optimization Approaches in Financial Engineering

Cluster: Financial Engineering
Invited Session

Chair: Sergey Sarykalin, University of Florida, 303 Weil Hall, Gainesville, FL, 32611, United States, saryk@ufl.edu

1 - Pricing a Book of Options
Sergey Sarykalin, University of Florida, 303 Weil Hall, Gainesville, FL, 32611, United States, saryk@ufl.edu, Valeriy Ryabchenko

The paper considers a regression approach to pricing options in incomplete markets. The algorithm replicates an option by a portfolio consisting of an underlying security and a risk-free bond. In the framework of linear regression we applied quadratic programming with linear constraints. Risk neutral processes or probabilities are not needed in this framework. Numerical tests with several real life datasets showed acceptable performance of the algorithm.

2 - Best Execution in Mortgage Secondary Markets
Jonathon Wang, University of Florida, 303 Weil Hall, Gainesville, FL, 32611, United States, cjwang@ufl.edu

A significant task faced by mortgage bankers attempting to profit from the mortgage secondary market is the best execution problem. This paper built a formal model to perform the best execution analysis. The model offers secondary marketing functionality including the loan-level best execution, guarantee fee buy-up/buy-down, and base/excess servicing fee. The model is formulated as a mixed integer programming problem.

3 - Generalized DEA Model of Fundamental Analysis and Its Application to Portfolio Optimization
Chanaka Edirisinghe, Professor, University of Tennessee, College of Business, Management Science, Knoxville, TN, 37996, United States, chanaka@utk.edu, Xin Zhang

A generalized data envelopment analysis (GDEA) model is developed to analyze a firm's financial statements over time to determine a relative financial strength indicator (RFSI) that is predictive of stock price returns. The model has flexible inputs and outputs to maximize the power of RFSI to predict RoR, via solving a binary nonlinear program that use a two-step heuristic algorithm. Tests with 230 public firms demonstrate the usefulness of the proposed scheme in portfolio optimization.

■ WA26

H - 6th Floor, Sutter B

Computational Approaches in Medical Research

Sponsor: Optimization/OR and Medicine
Sponsored Session

Chair: Wanpracha Art Chaovalitwongse, Assistant Professor, Department of Industrial and Systems Engineering, Rutgers University, CoRE Building, 96 Frelinghuysen Rd., Piscataway, NJ, 08854, United States, wchaoval@rci.rutgers.edu

1 - Balancing Transplant Efficiency and Equity: An Multiobjective Combinatorial Optimization Approach
Nan Kong, Assistant Professor, University of South Florida, 4202 E. Fowler Ave, ENB118, Tampa, FL, 33620, United States, kong@eng.usf.edu

A major concern in the organ transplantation and allocation system is the conflict between transplant efficiency and equity. We discuss various measures associated with either efficiency or equity and propose a multiobjective IP formulation to group organ procurement organizations into regions to maximize the weighted sum of the efficiency and equity measures. The formulation provides a tool to balance the two objectives. Solution techniques to the resulting large-scale IP are also discussed.

2 - An Algorithm for Maximum Likelihood on Phylogenetic Tree Analysis
Carlos Oliviera, Assistant Professor, School of Industrial Engineering and Management, Oklahoma State University, 322 Engineering North, Stillwater, OK, 74078, United States, coliv@okstate.edu

Maximum likelihood (ML) is a problem arising in the reconstruction of evolutionary trees, derived from the analysis of genomic data. We consider two restricted versions of the problem from ML: the ancestral maximum likelihood (AML) and the maximum parsimony (MP) problems. We propose a new approach for computing solutions for these problems, based on genetic algorithm programming.

3 - Change Detection of Synchrony in Oscillatory Neurophysiologic Signals
Qiang Huang, Assistant Professor, University of South Florida, 4202 E. Fowler Ave., ENB118, Tampa, FL, 33620, huangq@eng.usf.edu, Hui Wang, Kendall Morris, Bruce Lindsey

Synchronization, a phenomenon describing the adjustment of rhythms of interacting oscillatory objects like that of neurons, has been related to several central issues of neuroscience. In this study, we focus on detecting the changes of synchrony (rather than the synchrony itself) among oscillatory neurophysiologic signals.

4 - Quadratic Programming for Cluster Analysis in Epilepsy
Wanpracha Art Chaovalitwongse, Assistant Professor, Department of Industrial and Systems Engineering, Rutgers University, CoRE Building, 96 Frelinghuysen Rd., Piscataway, NJ, 08854, United States, wchaoval@rci.rutgers.edu

Although most of clustering problems are discrete in nature, we herein propose a novel technique for cluster analysis by solving continuous quadratic programming problems. The proposed technique has many potential applications, which will touch upon many disciplines including neuroscience, data mining, and computational biology. In this talk, we present the utility of the proposed technique to predict seizures in patients with in epilepsy.

■ WA27

H - 6th Floor, Taylor B

Multi-Agent System Applications

Sponsor: Artificial Intelligence
Sponsored Session

Chair: Riyaz Sikora, Associate Professor, University of Texas at Arlington, Dept. of Information Systems, P.O. Box 19437, Arlington, TX, 76019, United States, rsikora@uta.edu

1 - Foraging for Trust: Exploring Rationality and the Stag Hunt Game
Steven Kimbrough, Professor, University of Pennsylvania, Wharton School of Business, Philadelphia, PA, kimbrough@wharton.upenn.edu

Trust presents a number of problems and paradoxes, because existing theory is not fully adequate for understanding why there is so much of it, why it occurs, and so forth. This paper explores the generation of trust with two simple, but very different models, focusing on repeated play of the Stag Hunt game. A grid-scape model examines creation of trust among cognitively basic simple agents. A Markov model examines play between two somewhat more sophisticated agents.

2 - SAMAS: Scalable Architecture for Multiscale Agent-based Simulation
Alok Chaturvedi, Director, Purdue Homeland Security Institute, Purdue University, West Lafayette, IN, alok@purdue.edu, Jie Chi, Daniel Dolk

Large-scale agent-based simulation has been shown to be an effective tool for understanding a variety of complex systems, such as market economies, war games, and epidemic propagation models. We present a design for a highly scalable architecture for multi-resolution agent-based simulation. SAMAS is a dynamic data-driven application system that allows large numbers of heterogeneous agents to operate across a wide range of time scales without unnecessarily compromising simulation runtime.

3 - An Application for Discrimination with Strategic Behavior
Fidan Boylu, University of Florida, Decision and Information Sciences, The Warrington College of Business, Gainesville, FL, 32611, United States, fidan@ufl.edu, Gary Koehler, Haldun Aytug

Rational agents subject to classification by a principal might attempt to influence the classification as in loan decision situations where an agent might try to increase his chances of being accepted by altering his true attribute values. Exploring this strategic gaming, we apply our results to a credit-risk evaluation dataset.

4 - Learning Optimal Seller Policy: Application of Reinforcement and Evolutionary Learning
Riyaz Sikora, Associate Professor, University of Texas at Arlington, Dept. of Information Systems, P.O. Box 19437, Arlington, TX, 76019, United States, rsikora@uta.edu, Vishal Sachdev

We consider the problem, recently reported in the literature, of homogeneous sellers of a single raw material or component vying for business from a single large buyer. Standard game-theoretic analysis of the problem assumes completely rational and omniscient agents to derive equilibrium seller policy. We relax those assumptions and present simple reinforcement and evolutionary learning agents that learn near-optimal seller policies.

■ WA28

R - 4th Floor, DaVinci I

New Applications of Pricing and Revenue Optimization

Sponsor: Revenue Management & Pricing
Sponsored Session

Chair: Robert Phillips, Founder, Nomis Solutions, 1150 Bayhill Dr., Suite 305, San Bruno, CA, 94066, United States, robert.phillips@nomissolutions.com

1 - Pricing Optimization in Consumer Credit
Robert Phillips, Founder, Nomis Solutions, 1150 Bayhill Dr., Suite 305, San Bruno, CA, 94066, United States, robert.phillips@nomissolutions.com

This presentation describes a methodology for determing the profit-maximizing APR's to offer in consumer credit markets such as unconstrained consumer loans, mortgages, auto loans and home-equity loans. Complicating features in these markets are the need to include adverse selection and complex profit models. We present an overview of the methodology as well as results from several applications.

2 - Promotion Planning in Clothing Retail
Ozgur Ozluk, Professor, Department of Decision Sciences, San Francisco State University, 1600 Holloway Avenue, San Francisco, CA, 94132, United States, ozgur@sfsu.edu, Qing Wu

We search for the optimal promotion bundle for a set of SKUs through a specific season subject to various practical constraints. Typical constraints may limit the length of the promotion, the percentage of SKUs on promotion at any given time, and number of promotions that can be offered on a particular SKU. The promotion types can be price discounts or buy two get one free. The price elasticity, promotion type-related lifts and sales curves are derived from history.

3 - Pricing Mechanisms to Induce Forecast Effort in a Decentralized Supply Chain
Ozalp Ozer, Management Science and Engineering, Stanford University, Stanford, CA, United States, ozalp@stanford.edu, Onur Uncu

Consider a contract manufacturer (CM) who produces and sells through multiple original equipment manufacturers (OEMs). Each OEM is able to make a costly effort to obtain and share a forecast update. The CM is considering a capacity expansion based on the available forecasts. We design a pricing mechanism that induces OEM to obtain a forecast update. We characterize CM's optimal pricing and capacity decision.

4 - Revenue Management with Customer Search and Switching Costs
Garrett van Ryzin, Professor, Columbia University, gjv1@columbia.edu, Qian Liu

An important long-term effect that is not well captured in current RM methods is the impact short-term pricing has on customers' perceptions of "price image" and their willingness to search and switch (or not switch) to a different firm. We discuss perliminary work on incorporating this phenomenon into revenue management models and methods.

■ WA29

R- 4th Floor, DaVinci III

Modeling Customer Behavior for Offer Optimization

Cluster: Pricing and Revenue Management for Non-Travel Industries
Invited Session

Chair: Loren Williams, Vice President - Pricing Science, Zilliant, 221 Lamont Drive, Decatur, GA, 30030, United States, loren.williams@zilliant.com

1 - Revenue Management for Buy-up Models via Stochastic Programming
Utku Yildirim, University of Texas at Austin, 1 University Station C2200, Austin, Tx, 78712, United States, yildiriu@mail.utexas.edu, Harun Ahmet Kuyumcu, Burak Buke

We considered the capacity allocation problem of a firm that owns multiple resources. We will assume each product available for purchase is a combination of multiple resources and demand for each product is stochastic. We utilized stochastic programming to construct various models to solve this problem. Approximate solution methods are discussed when demand is a continuous random variable.

2 - Optimal Pricing Schedules Based on Price Sensitivity of Demand
Xiajun (Amy) Pan, PhD student, MSIS Department, University of Texas at Austin, 1 University Station, #B6500, Austin, TX, 78712-1175, United States, Xiajun.Pan@phd.mccombs.utexas.edu, Harun Ahmet Kuyumcu

It is common for companies to give pricing schedules (quantity discounts) in B2B and B2C environments. Most articles have focused on the cost minimization aspects of the quantity discounts. This presentation provides an approach for generating optimal pricing schedules using price sensitivity and reports results from a simulation study on the impacts of alternative pricing schedules.

3 - Revenue Management in an Interactive Environment
Vikas Sabnani, Hotwire.com, 333 Market Street, #100, San Francisco, CA, 94105, United States, vsabnani@hotwire.com

E-Commerce presents some very different and exciting opportunities for revenue management that are not typically possible in other industries. In this presentation, we will review a few advantages, challenges and methods for Revenue Management in an online environment.

4 - Exploiting Experimental Pricing
Loren Williams, Vice President - Pricing Science, Zilliant, 221 Lamont Drive, Decatur, GA, 30030, United States, loren.williams@zilliant.com

We describe two conditions under which price testing offers benefits: minimal price variability (catalog pricing), and non-random price variability (negotiated pricing). We simulate price and purchase data corresponding to these situations, and show how price testing regimes can improve outcomes of standard price sensitivity estimation methods. Finally, we examine how the net benefits from price testing vary with experiment design.

■ WA30

R- 4th Floor, DaVinci II

Studies in Risk Analysis

Contributed Session

Chair: George Birbilis, LSE, LSE, London, United Kingdom, gbirbilis@acm.org

1 - A Software Project Cost Risk Evaluation Model Based on Cyclic Bayesian Network
Yingwu Chen, Professor, School of Information System and Management,National University and Defense Technology, School of Information System and Manage, Nat'l Uni. of Defense Tech., Changsha, HN, 410073, China, ywchen@nudt.edu.cn, Yuejin Tan, Guoping Jiang

This paper builds a new software project cost risk evaluation model based on cyclic Bayesian network. Referencing an ideal project, the project cost overhead is modeled as a cyclic Bayesian network. Then project cost risk is evaluated according to the relation between cost overhead and productivity. Convergence of directed cycle is proved, and probability inference method for cyclic Bayesian network is also exploited.

2 - Operational Risk Management: Literature Review and Future Directions
Manpreet Hora, Ivey Business School, University of Western Ontario, 1151 Richmond Street North, London, ON, Canada, mhora@ivey.uwo.ca

Efficient management of operational risk is critical for survival of organizations. Hence, this phenomenon has been of interest for researchers in several business

sub-disciplines. This survey reviews a diverse body of research on management of operational risk and presents a conceptual framework that integrates current literature and identifies opportunities for future research.

3 - Optimizing over Joint Chance Constraints: A Robust Optimization Approach

Wenqing Chen, Ph.D. Candidate, National University of Singapore, PHD/MSC by Research Program, Vice Dean Office, NUS Business School, Singapore, 117592, Singapore, g0201946@nus.edu.sg, Melvyn Sim, Jie Sun

We focus on "joint chance constraint" problems where a system of linear inequalities with stochastic entries is required to remain feasible with high probability. Using recent development in robust optimization, we propose a framework and a conditional gradient approach that enhances the solution. We show experimentally that the proposed algorithm is computationally inexpensive and leads to significant improvement of the solution.

4 - Integrated Risk Management Techniques for Decision Making

George Birbilis, LSE, LSE, London, United Kingdom, gbirbilis@acm.org

This research lies within the intersection of three distinct domains. The first is simulation-optimization technology. The second domain is decision science, particularly the planning and decision-making process. The third domain is AI expert system technology and the concept of software agents. The principle contribution of this research is to provide a new methodology for the Enterprise Risk Management.

5 - How to Make Your Point Estimate Look Like a Cost-Risk Analysis

Gabriela Rohlck, OR Analyst, MCR, LLC, 600 Maryland Ave, SW, Suite 700, Washington, DC, 20024, United States, grohlck@mcri.com, Marc Rose

This paper will address a methodology for performing a "quick-risk" analysis given limited data. Given a simple point estimate, this methodology, when combined with some assumptions, allows the decision maker to estimate the high-confidence cost/benefits. The methodology is developed for three different assumed statistical distributions (Triangular, Normal & Log-Normal). Additionally a high-level discussion of cost/benefits risk analysis will be covered.

■ WA31

H - 4th Floor, Union Square 25

Applications in Transporatation, Inventory and Logistics

Cluster: OR Practice
Invited Session

Chair: Michael Gorman, Assistant Professor, University of Dayton, Dept. of MIS/OM/DSC, 300 College Park, Dayton, OH, 45469-2130, United States, michael.gorman@udayton.edu

1 - Origin and Destination Fleet Assignment with Demand Re-Mapping

Xiaoqing Sun, Sr. Enginerr, Schneider National, 3101 South Packerland Drive, Green Bay, WI, United States, SunP@schneider.com

Present the approaches that solve the disconnect between traditional airline leg-based fleet assignment model (FAM) and demand forecast in airline profitability model using Origin and Destination FAM (O&D FAM) framework, demand re-mapping, and linearizationg. O&D FAM models O&D effect by integrating revenue management into FAM. We will extend the framework to integrating demand forecast into FAM and overcoming inherent convergence problems in original O&D FAM with linearization.

2 - Getting Better Returns From Your Inventory

Tom Taylor, Consulting Engineer, Palladian Analysis, 5715 Navigation Blvd., Houston, TX, 77011, United States, ttaylor@computer.org

The inventory optimization system presented here is unique in that we are distributing inventory that we do not plan to replenish and we need a distribution of sizes while meeting each store's unique size needs. An example is a fashion sports coat. We will stock it this season, but maybe never again. We do this using a just-in-time inventory optimization system. This IP based system has positively impacted profits and lowered store inventory complaints.

3 - Rethinking Inventory Policies For Service Vehicles At A Major Appliance Manufacturer

Michael Gorman, Assistant Professor, University of Dayton, Dept. of MIS/OM/DSC, 300 College Park, Dayton, OH, 45469-2130, United States, michael.gorman@udayton.edu

A major consumer appliance manufacturer needed to effectively manage inventory levels in over 1300 warranty service vehicles. We applied a heuristic solution to find an appropriate inventory/service level blend. We found that over three million dollars per year could be trimmed from its warranty repair costs and its first-visit repair rate could be improved from 86% to 90%.

4 - Metrics for Optimizing Railroad Tank Car Safety Design

M. Rapik Saat, Graduate Research Assistant, Railroad Engineering Program, UIUC, 205 N Mathews, B 118, Urbana, IL, 61801, United States, mohdsaat@uiuc.edu

A generalized version of a model for optimizing tank car safety design is presented. Each of the four principal elements of a tank car are evaluated with regard to their effect on weight and two different objective functions, minimization of release probability and minimization of expected quantity lost. Use of the different objective functions leads to different solutions regarding the optimal safety design of railroad tank cars.

■ WA32

H - 6th Floor, Lombard

Joint Session Location Analysis/ PP & P/ Minority: Public-Sector Applications

Sponsor: Location Analysis, Public Programs & Processes, Minority Issues
Sponsored Session

Chair: Michael Johnson, Associate Professor, Carnegie Mellon University, Heinz School, 5000 Forbes Ave., Pittsburgh, PA, 15213, United States, johnson2@andrew.cmu.edu

1 - Policy Implications of a Planning Model for Home-Delivered Meals

Hakan Yildiz, Doctoral student, Carnegie Mellon University, Tepper School of Business, Pittsburgh, PA, 15213, United States, hakanyil@andrew.cmu.edu, Michael Johnson

Current research on the home-delivered meals problem has resulted in an efficient genetic algorithm to solve the underlying location-routing problem. Using actual HDM data, we solve the full multiobjective HDM-LRP, identify efficiency-equity tradeoffs and make policy recommendations for public managers.

2 - Virtual Renter: An Agent Based Model of Affordable Housing Search

Keith Hunter, Doctoral Student, Carnegie Mellon University, Heinz School of Public Policy and Mgmt, 5000 Forbes Ave., Pittsburgh, PA, 15213-3890, United States, keithoh@verizon.net, Michael Johnson

Housing mobility is not well understood. The Section 8 housing program in particular is characterized by the issuance of vouchers that ultimately are not used for relocation. We provide an agent based simulation that incorporates observed attributes of renters and neighborhoods. Using this model, we test simple hypotheses about patterns of movement for Section 8 vouchers. We propose a richer model for informing policy decisions about public housing resource deployment.

3 - Flexible Planning Models for Affordable Housing Provision

Michael Johnson, Associate Professor, Carnegie Mellon University, Heinz School, 5000 Forbes Ave., Pittsburgh, PA, 15213, United States, johnson2@andrew.cmu.edu, Changmi Jung

Research in affordable housing design has resulted in models for design of strategic models for affordable housing provision. In this paper we extend a multiobjective integer programming model for affordable housing projects to address scale economies in provision costs and more realistic formulations of stakeholder equity. Efficient solution algorithms are proposed as well as model validation based on characteristics of actual affordable housing providers.

4 - Locating a Service Facility with Some Unserviced Demand

Carlton Scott, Professor, University of California, Irvine, The Paul Merage School of Business, Irvine, CA, 92697, United States, chscott@uci.edu, Zvi Drezner

The location of a facility in the plane when service availability is a convex decreasing function of the distance is considered. The total cost of the system consists of three components: (i) the cost of waiting in line for service (ii) the cost of providing the service, and (iii) the cost of lost demand. A heuristic approach and a global optimization approach are constructed and tested on problems of up to 10,000 demand points. Both algorithms are very efficient.

■ WA33

H - 6th Floor, Mason A

Statistics and Reliability in Nano-Technology

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: Jye-Chyi Lu, Professor, Georgia Institute of Technology, Industrial and Systems Engineering, 765 Ferst Drive NW, Atlanta, GA, 30332, United States, jclu@isye.gatech.edu

1 - One-Dimensional Semiconducting and Piezoelectric Nanostructures

Puxian Gao, Ph.D. Student, Georgia Institute of Technology, Materials Science and Engineering, Atlanta, GA, 30332, United States, gtg642c@mail.gatech.edu, Zhong Lin Wang

Nanobelt based materials have been demonstrated as building blocks for nanocircuits, nanosystems and nano-optoelectronics. Field effect transistors and ultra-sensitive nano-size gas sensors, nanoresonators and nanocantilevers have been fabricated based on individual nanobelts. This presentation will focus on our recent progress in the controlled growth, nano-scale property measurements and nano-size device fabrication using oxide nanostructures that are semiconducting and piezoelectric.

2 - Process Control of CMP Using Multiresolution Analysis and Machine Learning

Rajesh Ganesan, Assistant Professor, George Mason University, Fairfax, VA, 22030, United States, rganesan@gmu.edu, Tapas K. Das

CMP process control has emerged to be a critical research topic owing to the nanoscale nature of the process, lack of accurate process control models, and the demands placed on the quality and throughput of the semiconductor manufacturing processes. In this talk we present a novel strategy to control a MIMO CMP process using Multiresolution Analysis and Machine Learning. Results indicate that this strategy is robust and is capable of controlling even processes without models.

3 - Statistics and Reliability Studies in Nano-Technology

Ni Wang, Ph.D. Student, Georgia Institute of Technology, Industrial and Systems Engineering, 765 Ferst Drive NW, Atlanta, GA, 30332, United States, gtg586c@mail.gatech.edu, Jye-Chyi Lu, Shuen-Lin Jeng, S.-C. Lin

Nano-technology has been recognized as a revolution that will impact virtually every sector of our economy and our daily lives. This presentation provides an overview of how statistics and reliability can be useful in nano-technology fields. Examples are taken from a comprehensive literature review covering various science and engineering fields.

4 - Engineering Physics-Based Degradation Models

Philip Papush, Graduate Student, Georgia Institute of Technology, School of Mathematics, Atlanta, GA, 30332, United States, ppapush@yahoo.com, Paul Kvam, Shuen-Lin Jeng, Jye-Chyi Lu

Engineering physical models provide underlying mechanisms on how materials or products degrade over time. This presentation explores possible uncertainties in manufacturing or experimentation processes and ways to structure these uncertainties in engineering models. By integrating the differential equations, we obtain degradation models for deriving failure time distributions. Numerical illustrations taken from examples in nano-technology research show the potential of this approach.

■ WA34

H - 6th Floor, Powell A

Stochastic Problems

Contributed Session

Chair: Ron Davis, Associate Professor, San Jose State University, College of Business, One Washington Square, San Jose, CA, 95192, United States, ron@mathproservices.com

1 - A Daily Simulation Model of the California Natural Gas Transportation and Storage Network

Rocio Uria, Ph.D. Candidate, University of California, Davis, 635 Adams Street #8, Davis, CA, 95616, United States, uria@primal.ucdavis.edu

Strong natural gas demand fluctuations complicate the management of fixed capacity pipelines and make crucial the role of storage as a buffer. A dynamic, spatial price equilibrium model of the California natural gas network allows simulation of optimal flow and inventory profiles under a variety of scenarios. The model acknowledges demand responsiveness to price changes as well as engineering and regulatory constraints.

2 - Dimensioning Call Centers with Abandonment: Constraint Satisfaction and Cost Minimization

Sergey Zeltyn, Technion, Faculty of IE&M, Haifa, 32000, Israel, zeltyn@ie.technion.ac.il, Sem Borst, Avi Mandelbaum, Marty Reiman

The subject of our research is optimal staffing in queueing systems with impatient customers. We start with the constraint satisfaction problem choosing the minimal staffing level that satisfies a constraint on waiting, abandonment or deadline costs. Two operational regimes that play a central role in this setting are established. We continue with the cost minimization approach. It turns out that our asymptotic staffing formulae are very accurate and often coincide with the exact optimum.

3 - Judgment and Decision Making under Uncertainty: Modeling Insider-Threat Risks in Organizations

Ignacio Martinez-Moyano, Postdoctoral Research Associate, Argonne National Laboratory, 9700 South Cass Avenue, Building 900, Argonne, IL, 60439, United States, imartinez@anl.gov, Eliot Rich, Stephen Conrad, David Andersen, Thomas Stewart

This paper presents an effort to integrate theory of judgment and decision making under uncertainty by modeling the dynamics of insider-threat risks in organizations. Drawing on signal detection and social judgment theories, and by focusing on cyber security risks, the authors present a system dynamics model that embodies a behavioral approach to understanding insider-threat risks. Several scenarios in which attention to events, better information, and training activities are simulated.

4 - Stochastic Project Duration Analysis using PERT-beta Distributions

Ron Davis, Associate Professor, San Jose State University, College of Business, One Washington Square, San Jose, CA, 95192, United States, ron@mathproservices.com

This three part paper presents formulas and algorithms for using the beta distribution in PERT-based stochastic project duration analysis. Beta shape parameter formulas for Monte Carlo simulation are shown first. The second part shows an approximate analytic stochastic forward pass method that develops the CDF for project duration without simulation. The third part shows how to formulate the Stochastic Project Crashing problem. Example computational results are presented.

■ WA35

H - 6th Floor, Sutter A

Issues in Supply Chain Management III

Contributed Session

Chair: Sammi Y. Tang, Doctoral Candidate, Washington University in St. Louis, Olin School of Business, One Brookings Drive, Box 1133, St. Louis, MO, 63130, United States, ytang@wustl.edu

1 - Extending Safety Approaches from Process Plants to Supply Chain

Arief Adhitya, Research Officer, Institute of Chemical and Engineering Sciences, 1 Pesek Road, Jurong Island, Singapore, 627833, Singapore, arief_adhitya@ices.a-star.edu.sg, Rajagopalan Srinivasan, I. A. Karimi

Risk and disruption management has become imperative for today's supply chains. The main proposition of this work is to adopt methods from chemical process risk management to supply chain operation, which in many ways is comparable to a chemical plant. Chemical process risk management is a well-developed area resulting from decades of research and by proper adjustments can be applied to supply chains.

2 - New Models for Dynamic Pricing

Michael Katehakis, Professor, Rutgers University, Dept. of MSIS, Rutgers Business School, 180 University Avenue, Newark, NJ, 07102, United States, mnk@andromeda.rutgers.edu, Bin Zhou

We present new MDP models for dynamically pricing products over a finite time horizon. The demand of each period has a discrete distribution that is a function of the selling price and of the period. We discuss conditions under which optimal pricing policies have a simple structure and they are monotone in inventory level and in "remaining periods" of the time horizon. Applications include selling perishable and seasonal products, airline pricing, etc.

3 - Optimal Control of Inventory Systems with Multiple Supply Sources

Mohsen Elhafsi, Associate Professor, University of California, Anderson Graduate School of Management, Riverside, CA, 92521, United States, mohsen.elhafsi@ucr.edu, Saif Benjaafar

We consider a system consisting of a single inventory location supplied by multiple production facilities. The production facilities vary in their production rates and production costs. The objective is to determine when each production facility should produce in order to minimize the sum of inventory and backorder costs.

We formulate the problem as a Markov decision process and characterize the structure of the optimal policy.

4 - The Study on Inventory Model of SCM of Water Resource

Huimin Wang, Hohai University, 1#XiKang Road, Nanjing,Jangsu Province, Nanjing, 210098, China, huiminwang63@hotmail.com

On the basis of the actual conditions of water resources collocation in China, the sub-chain of water resources supply chains of South-to-North Water Transfer is selected as the research object of the article and the water ordering quantity in the lower reaches nodes is taken as a decision-making variable. Finally, an inventory concentrated control decision-making model of water resources supply chains under the conditions of unsymmetrical information is proposed.

5 - On Benefits of Operational Flexibility in a Distribution Network with Transshipment

Sammi Y. Tang, Doctoral Candidate, Washington University in St. Louis, Olin School of Business, One Brookings Drive, Box 1133, St. Louis, MO, 63130, United States, ytang@wustl.edu, Dennis Z. Yu, Julie Niederhoff, Haojun Shen

We consider resource flexibility of a distribution network facing stochastic demands. The resource flexibility is specified as operational flexibility in the paper, which is exercised by transshipment between locations. We propose a general modeling framework to formulate and solve the transshipment problem in the network. A two-stage distribution network is chosen to show the actual modeling and solving procedures under various network configurations.

■ WA36

H - 6th Floor, Taylor A

Interesting Problems in Flexible Manufactuing

Contributed Session

Chair: Majid Aldaihani, Assistant Professor, Kuwait University, College of Engineering, Khaldia, Kuwait, aldaihani@kuc01.kuniv.edu.kw

1 - Management of Product Variety in Cellular Manufacturing Systems

Muge Yayla Kullu, PhD Candidate, UNC, McColl Building CB#3490, UNC Chapel Hill, Chapel Hill, NC, 27599, United States, muge_yayla@unc.edu, M. Selim Akturk

We propose a cellular manufacturing system design model to manage product variety by integrating technology selection decision. Proposed model determines product families/machine groups while deciding the technology of each cell individually. Market dynamics leads us to use flexible machining systems and dedicated manufacturing systems at the same facility. Our hybrid technology approach is presented via a multiobjective mathematical model, solved by filtered-beam based local search heuristic.

2 - Condition-Based Supervisory Control for Flexibly Automated Manufacturing Systems

Shengyong Wang, Purdue University, 148 Arnold Dr. Apt. 11, West Lafayette, IN, 47906, United States, wangs@purdue.edu, Song Chew, Mark Lawley

In an FAMS with unreliable resources, ensuring deadlock-free operation in the face of resource failures and repairs is challenging. In this work, we incorporate degradation signals of unreliable resources into the control of these systems. The objective is to set up a framework in which control states can be updated based upon resource degradation status. We formulate the problem as a Markov-chain model. A supervisory controller is developed and proved to be robust for such systems.

3 - Control of Production Systems with Resource Failures

Song Chew, Mathematics Lecturer, Purdue University, 120 Wiggins St. Apt. 4, West Lafayette, IN, 47906, United States, chew@ecn.purdue.edu, Shengyong Wang, Mark Lawley

We consider deadlock and blocking problems in systems with multiple unreliable workstations in this paper. The objective is to develop supervisory controllers that allocate workstations so that failure of the workstation server does not propagate through blocking to effectively stall other portions of the system. We illustrate several deadlock and blocking problems, identify properties that controllers must satisfy, and develop a polynomial control policy that satisfies these properties.

4 - Scheduling in a Combination of Make-to-Order and Make-to-Stock Environment

David Miller, Professor, The University of Alabama, 249 Bidgood Hall, P.O. Box 870318, Tuscaloosa, AL, 35487, United States, dmiller@proctr.cba.ua.edu, Rahul Upreti

We present a mathematical model and a rule-based approach to solve a detailed scheduling problem faced by a local manufacturer of wood products. Components are processed on the first four machines and then assembled into an item at the fifth machine of a flow shop. Moreover, some of the items generate off-falls that can be used in some other items. The objective is to first meet due dates of confirmed orders and then second to build stocks for some items in order to meet future demand.

5 - Modeling of a Flexible Manufacturing Cell with Two Unreliable Machines Served by Two Robots

Majid Aldaihani, Assistant Professor, Kuwait University, College of Engineering, Khaldia, Kuwait, aldaihani@kuc01.kuniv.edu.kw, Mehmet Savsar

This paper presents a stochastic model for a flexible manufacturing cell (FMC), which consists of two unreliable machines, each served by a robot for loading and unloading purposes, and a common pallet handling system. The pallet system delivers a set of parts, which require different processing times in the FMC system. The model is based on Markov processes and determines system performance measures based on state probabilities of the system under different operational conditions.

■ WA37

H - 6th Floor, Van Ness

Joint Session AP/ Workforce: Stochastic Models in Computer Science and Call Center Operations

Sponsor: Applied Probability, Workforce Flexibility
Sponsored Session

Chair: Alan Scheller-Wolf, Associate Professor, Tepper School of Business, Carnegie Mellon University, Pittsburgh, PA, 15213, United States, awolf@andrew.cmu.edu

1 - Dynamic Operator Staffing for Call Centers

Atul Bhandari, Doctoral Student, Tepper School of Business, 5000 Forbes Avenue, Carnegie Mellon University, Pittsburgh, PA, 15213, United States, atulb@cmu.edu, Mor Harchol-Balter, Alan Scheller-Wolf

We study the Dynamic Operator Staffing problem where temporary agents (possibly supervisors who answer calls when the center is busy) may be used in addition to permanent employees to provide service. Employing temporary agents provides flexibility in provision of service at a lower cost than using additional permanent employees. The goal is to minimize total opportunity and payroll costs. We develop the BIDP algorithm which gives an LP formulation. We also consider service level constraints.

2 - Understanding the Effects of SMART Prioritization

Adam Wierman, Carnegie Mellon University, Computer Science Department, CMU, 5000 Forbes Ave, Pitsburgh, PA, 15213, United States, acw@cmu.edu, Takayuki Osogami, Mor Harchol-Balter, Misya Nuyens

We introduce the class of SMART scheduling policies: policies that prioritize towards jobs with small original sizes, small remaining sizes, or both. The SMART class includes common policies such as Shortest Remaining Processing Time and Preemptive Shortest Job First, in addition to a variety of hybrid policies. In this work, we prove that all SMART policies have mean response time within a factor of two of optimal. Further, we analyze the tail behavior of response time under SMART policies.

3 - Capacity Allocation for Business Processes with QoS Requirements

Paul Huang, IBM, Watson Research Center, Yorktown Heights, NY, 10598, United States, puhuang@us.ibm.com

BPEL4WS provides a common standard for modeling and sharing business processes via Web services. Business applications within a business process usually share computational capacity. We provide a method to allocate capacity across business applications. Applying a heavy traffic bound, we formulate and solve the capacity allocation problem as a nonlinear optimization problem. Our method gives a pessimistic bound on the maximum sustainable request rate the system can accommodate.

4 - Dynamic Assignment of Dedicated and Flexible Servers in Tandem Lines

Hayriye Ayhan, Associate Professor, Georgia Institute of Technology, School of IsyE, Georgia Institute of Technology, Atlanta, GA, 30332-0205, United States, hayhan@isye.gatech.edu, Sigrun Andradottir, Douglas Down

Consider a tandem queueing network with two stations, M servers, and either a finite or infinite buffer between the two consecutive stations. We study the dynamic assignment of servers to stations with the goal of maximizing the long-run average throughput, assuming that only a subset of the servers are flexible in that they are able to work at both stations, with each remaining server being dedicated to one station.

■ WA38

R - 2nd Floor, Corintia

Manufacturing System Design and Control

Contributed Session

Chair: Timothy Urban, Professor, The University of Tulsa, Operations Management, 600 South College Avenue, Tulsa, OK, 74104, United States, urbantl@utulsa.edu

1 - Optimized Order Fulfillment and Execution System for an Asian Auto OEM Manufacturing Facility

Wei Tan, ProQuest Syncata, Inc., 2101 Rosecrans Avenue, Suite 5250, El Segundo, CA, 90245, United States, wtan@syncata.com, Vijay Ramaswamy

Picking and loading finished parts according to customer truck arrival schedules (just-in-time) is often a challenging process. We present a MIP-based system that smoothes the parts picking and loading process to minimize mis-ships, and minimize parts picking variations by cycle, region/route, and part number. Using this system, the manufacturing facility is gaining benefits from reduced inventory, improved service quality and resource utilization while adhering to business constraints.

2 - A Lagrangian-Based Heuristic for the Capacitated Lot Sizing

Franklina Toledo, Assistant Professor, Universidade de Sào Paulo, Av. Trabalhador Sào Carlense, 400, Sào Carlos, SP, 13560970, Brazil, fran@icmc.usp.br, Vinicius Armentano

We consider the capacitated lot-sizing problem for producing multiple items on parallel machines. The production plan should meet the demand and minimize the sum of production, inventory and setup costs. A Lagrangian heuristic is proposed and is first tested on the single machine problem, with results compared to a heuristic from the literature. For parallel machines and small instances, the heuristic performance is tested against optimal solutions and for larger instances with the lower bound.

3 - Dynamic Routing of Prioritized Warranty Repairs

Feng Chen, Department of Statistics and Operations Research, University of North Carolina at Chapel Hill, Smith Building, CB\#3260, Chapel Hill, NC, 27599-3260, chenf@email.unc.edu, Vidyadhar Kulkarni

This paper considers a manufacturer dynamically routing failed items covered by one of two prioritized warranties to one of several outside service vendors for repair. The manufacturer pays a fixed fee per repair and incurs a holding cost while an item is undergoing or waiting for repair. The objective is to minimize the manufacturer's long-run cost. The size of the state space prevents the problem from being exactly solved in practice. We develop an effective index-based heuristic algorithm using DP policy improvement and compare it with some other heuristics.

4 - Simulation Intelligence for Machine and Labor Uncertainty in Manufacturing Systems

Ahad Ali, Visiting Assistant Professor, University of Toledo, 2801 West Bancroft MS-312, Toledo, OH, 43606, United States, ahad.ali@utoledo.edu, Hong Sun

A combination of product mix and production volume of is analyzed using a simulation model for optimal designing. This research shows how simulation modeling can be used to evaluate alternative designs for flexible assembly line in a dynamic uncertain manufacturing environment. The best satisfaction of the production requirements under a dynamic production is validated with real life application.

5 - Balancing Unpaced Synchronous Production Lines

Timothy Urban, Professor, The University of Tulsa, Operations Management, 600 South College Avenue, Tulsa, OK, 74104, United States, urbantl@utulsa.edu, Wen-Chyuan Chiang

Very little research has addressed the line-balancing problem for unpaced synchronous production lines, despite its practical relevance. This research addresses this type of production line, with stochastic task completion times, by formulating an appropriate model and developing and evaluating a variety of solution methodologies utilizing extreme value theory as well as simulation. Computational results are presented to gain insight into the design and operation of unpaced synchronous systems.

■ WA39

R - 3rd Floor, Aragon

Operations Management in Healthcare and Other Service Industries

Contributed Session

Chair: Jason Niggley, PhD Student, USC-Marshall School of Business, 400C Bridge Hall, Expositions Blvd, Los Angeles, CA, 90089, United States, niggley@usc.edu

1 - A Revenue Management Model for Resource Allocation in Healthcare Service Delivery

George Konstantinow, Director, Research & Development, The ISERA Group, LLC, 135 East Ortega Street, Santa Barbara, CA, 93101, United States, george.konstantinow@iseragroup.com

Revenue management addresses dynamic control of resource availability for services to increase revenues. Healthcare services are delivered by multiple procedure classes, with different revenues and resource quantities consumed for each class. Highly specialized resources perish at the end of a finite time horizon if not used. We present a resource allocation model (medical staff, specialists, facilities and equipment) and schedule optimization to optimize projected revenue across services.

2 - Revenue Management in Optimal Appointment Allocation in Rehabilitation Outpatient Clinic

Raghunandan Yedehalli-V., Graduate Student, Dept. of Industrial & Manufacturing Engg, Wichita State Univirsity, 1845 Fairmount, Wichita, KS, 67260, United States, yvraghu@gmail.com, Mehmet Yildirim

Traditional approaches to the appointment allocation problems in healthcare involve scheduling patients such that patients' waiting time and doctors' idle time is at a minimum. In addition, it's also important to increase the total profit efficiently. This research facilitates the scheduling of patients in a rehabilitation outpatient clinic in such a way that the profit generated from a fixed capacity is maximized while providing the patients the required treatment effectively.

3 - A Stochastic Program for Nurse Assignment

Prattana Punnakitikashem, Department of Industrial and Manufacturing Systems Engineering, The University of Texas at Arlington, P.O. Box 19017, Arlington, TX, 76019, United States, prattana_p@yahoo.com, Jay Rosenberger

This research focuses on the assignment of nurses to patients. A stochastic integer programming model that minimizes excess workload on nurses is presented. To solve this problem, we use a Benders decomposition approach, in which a greedy algorithm is employed to solve the subproblem. Computational results are provided based upon data from Baylor Regional Medical Center in Grapevine, Texas, and we discuss topics of future research.

4 - Modeling the Impact of Emergency Department Overcrowding on Patients, Physicians and Hospitals

Xiaofang Wang, Carnegie Mellon University, Tepper School of Business, 5000 Forbes Avenue, Pittsburgh, PA, 15213, United States, xiaofanw@andrew.cmu.edu, Laurens Debo

Emergency Department (ED) overcrowding has been observed in many hospitals nationwide. It decreases the quality of patient care. The ED crowding problem is a result of uncoordinated interaction of different parties: physicians, hospitals, patients and insurers. In this talk, we present an analytical model that allows understanding better the ED overcrowding problem and possible solutions that make all parties better off.

5 - The Importance of an "Event" in Determining Sequence Effects in Service Operations Management

Jason Niggley, PhD Student, USC-Marshall School of Business, 400C Bridge Hall, Expositions Blvd, Los Angeles, CA, 90089, United States, niggley@usc.edu

Current literature has yet to differentiate an event in a sequence of events. In service operations the concept of an event is germane to research because without definitions it remains difficult to compare different experiments already preformed in order to see if their results agree. A possible definition advanced after researching the area is "anytime there is a change in possible service failures or service recovery techniques a new event has occurred".

■ WA40

R - 3rd Floor, Barcelona I

Mathematical Programming for Network Problems

Sponsor: Optimization/ Network Optimization
Sponsored Session

Chair: Francisco Barahona, barahon@us.ibm.com

1 - Distributed Optimization of Converged Data-Optical Networks

Debasis Mitra, Bell Labs, Lucent Technologies, 600 Mountain Avenue, Murray Hill, NJ, 07974, mitra@research.bell-labs.edu, Qiong Wang, Anwar Walid

We jointly optimize IP traffic engineering and optical wavelength provisioning in a framework where each of the IP access and the optical core networks have a limited view of the other network, and information exchange is also limited. The joint problem is nonlinear, integer programming. Our approach is based on a novel application of Generalized Bender's Decomposition. The iterative process of local optimizations and information exchange converges to the global optimum.

2 - Experimental Behavior of Algorithms for Semidefinite Relaxations
David J. Phillips, Columbia University, IEOR Dept., 500 W. 120th St., New York, NY, 10027, United States, djp80@columbia.edu, Garud Iyengar, Cliff Stein

Semidefinite programming relaxations have been used in algorithms for several combinatorial optimization problems. Although solvable in polynomial time, large instances of these relaxations require a considerable runtime. Because of this, various specialized algorithms have been proposed to solve these relaxations. We present experimental results which compare the performance of some of these algorithms.

3 - A Linear Programming Approach to Increasing the Weight of all Minimum Spanning trees
Francisco Barahona, barahon@us.ibm.com, Mourad Baiou

Given a graph where increasing the weight of an edge has a nondecreasing convex piecewise linear cost, we study the problem of finding a minimum cost increase of the weights so that the value of all minimum spanning trees is equal to some target value. We formulate this as a combinatorial linear program and give an algorithm.

4 - Lower Bounding Techniques for the Degree-Constrained Network Design Problem
Guvenc Sahin, PhD Student, University of Florida, Dept. of Industrial and Systems Eng., 303 Weil Hall P.O. Box 116595, Gainesville, FL, 32611, United States, guvencs@ufl.edu, Ravindra Ahuja

The degree-constrained network design problem is to select a spanning sub-network that honors an upper limit on the number of outgoing arcs for each node in the resulting network. We study lower bounding techniques for the objective function of this problem. Two algorithms in the case of directed networks are proposed. This problem has several real-life applications. In this study, we explore the railroads' blocking problem as a special case.

■ WA41

R - 3rd Floor, Barcelona II

Some Recent Developments in Global Optimization

Contributed Session

Chair: Jiawang Nie, Grad Student, UC Berkeley, 276 Wilson, Albany, CA, 94710, United States, njw@math.berkeley.edu

1 - ACCPM with Multiple Second-order Cone Cuts
Mohammad Oskoorouchi, Assistant Professor, California State University San Marcos, 333 Twin oaks Valley Rd., San Marcos, CA, 92096, United States, moskooro@csusm.edu, John Mitchell

We present an analytic center cutting surface algorithm that uses multiple second-order cone cuts. Theoretical issues and applications of this technique are discussed. We discuss the complexity of recovering the analytic center after adding multiple second-order cone cuts, and show that the overall algorithm is fully polynomial. Computational experience with eigenvalue optimization is reported.

2 - Tabu Search with a New Hybrid Local Search for UBQP Problems
Wei Liu, The University of Mississippi, 201 Weir Hall, Universtiy, MS, 38677, United States, wliu@olemiss.edu, Bahram Alidaee, Dawn Wilkins

This paper proposes a hybrid local search algorithm for the UBQP problem. A new algorithm which combines a simple tabu search and the hybrid local search is compared with an algorithm that uses the 1opt local search with the same simple tabu search and a multiple start tabu search proposed by Palubeckis. Computational results are provided for 88 problems with size up to 6000. The new tabu search algorithm using the hybrid local search performs well, as confirmed by the experimental results.

3 - Solution Techniques of an Integrated Location, Allocation and Inventory Model
Vishv Jeet, Doctoral Student, The University of Texas at Austin, 1 University Station,, C2200 Mechanical Engineering, Austin, TX, 78712, United States, vjeet_a@mail.utexas.edu, Erhan Kutanoglu, Amit Partani

We discuss modeling and solution techniques of a location-allocation problem for single commodity with integrated inventory stocking decisions time-based service level constraint and stochastic demand satisfied by facilities operating with one-for-one replenishment inventory policy.

4 - Global Optimization of Stochastic Nonconvex Mixed Integer Nonlinear Programming (MINLP) Problems
Jing Wei, ExxonMobil Research and Engineering, 1545 Route 22 East, Annandale, NJ, 08801, United States, jing.wei@exxonmobil.com, Kevin Furman, Marco Duran, Mohit Tawarmalani, Nikolaos Sahinidis

Sample average approximation methods (Shapiro, 2003) are used to represent the probability structure and domain of stochastic nonconvex MINLPs. The resulting deterministic problems are solved to global optimality with branch-and-bound (BB) and convexification techniques (Tawarmalani and Sahinidis, 2004) in the context of outer approximation methods (Duran and Grossmann, 1986). Influence of different global optimization techniques on the convergence and sample sizes is studied.

5 - Global Optimization for Polynomial Functions
Jiawang Nie, Grad Student, UC Berkeley, 276 Wilson, Albany, CA, 94710, United States, njw@math.berkeley.edu, James Demmel, Bernd Sturmfels

Consider the global optimization of polynomials. Sum of Squares (SOS) approximations can provide a lower bound f^*_{sos} of the infimum f^* of a polynomial $f(x)$ in polynomial time. But usually $f^*_{sos} <= f^*$. In this talk, a new method is proposed to find a better lower bound f^*_{grad} for f^* by using gradient info. And we show that $f^*_{grad}=f^*$ if the infimum f^* is attained. Under some mild assumption, we show that the new method converges in finite many steps.

■ WA42

R - 4th Floor, Parc Ballroom I

Robust Optimization

Sponsor: Optimization/ Stochastic Programming
Sponsored Session

Chair: Dimitris Bertsimas, MIT, Sloan School of Management, Rm E53-363, Cambridge, Ma, 02142, United States, dbertsim@mit.edu

1 - Robust Linear Optimization and Coherent Risk Measures
David Brown, MIT, L.I.D.S., 32-D560, Cambridge, MA, 02139, United States, dbbrown@mit.edu, Dimitris Bertsimas

We propose an axiomatic methodology for constructing uncertainty sets within the framework of robust optimization for linear optimization problems with uncertain data. We take as primitive for such problems a coherent risk measure, and utilize a duality theorem to construct corresponding uncertainty sets in the robust optimization framework.

2 - Adaptive Optimization
Constantine Caramanis, MIT, Laboratory for Information and Decision, Systems, 32-D560, Cambridge, MA, 02139, United States, cmcaram@mit.edu, Dimitris Bertsimas

We propose a framework for optimization under uncertainty in which the decision-maker has some limited adaptability. This framework naturally bridges the gap between the robust and re-optimization formulations. We examine the complexity, algorithms and added value of adaptive optimization and provide examples of its power.

■ WA43

R - 4th Floor, Parc Ballroom II

Parallel Metaheuristics

Sponsor: INFORMS Computing Society
Sponsored Session

Chair: Teodor Gabriel Crainic, Professor, Ecole des sciences de la gestion, UQAM and, Centre for Research on Transportation, Montreal, QC, Canada, theo@crt.umontreal.ca

1 - Parallelization Strategies for VNS Applied to Task Scheduling
Tatjana Davidovic, Researcher, Mathematical Institute, Serbian Academy of Sciences and Arts, Knez-Mihailova 35, Belgrade, YU, 11001, Serbia-Montenegro, tanjad@turing.mi.sanu.ac.yu, Teodor Gabriel Crainic

We analyze parallel strategies for Variable Neighborhood Search applied to Multiprocessor Scheduling Problem with Communication Delays: parallel exploration of neighborhoods, parallelization of the main steps of the algorithm, and cooperative multi-VNS. Experimental results show that most parallel strategies achieve good speedups and improved solution quality at the same time.

2 - Guided Cooperative Search for Vehicule Routing Problem
Alexandre Le Bouthillier, Centre for research on Transportation, Université de Montréal, C.P. 6128, Succursale Centre-ville, Montreal, QC, H3C 3J7, Canada, alexleb@crt.umontreal.ca, Teodor Gabriel Crainic, Peter Kropf

We present a framework for a guided parallel cooperative search that combines meta-heuristics to solve combinatorial problems with more robustness and efficiency. Based on the central memory concept, the proposed pattern identification mechanism sends information to meta-heuristics about un/promising patterns of the solution space. By fixing/prohibiting specific solution attribute values, we enforce a better coordination and control the diversification/intensification of the global search.

3 - Parallel Solution of the Vehicle Routing Problem
Ted Ralphs, Lehigh University, 200 West Packer Avenue, Easton, PA, 18015, United States, tkralphs@lehigh.edu, Ali Pilatin

We discuss parallel solution of the capacitated vehicle routing problem, focusing on generation of initial upper bounds using a parallel metaheuristic approach. Computational results on real-world instances from a delivery company will be presented.

4 - Parallelization and Diversification Strategies for the Quadratic Assignment Problem
Tabitha James, Virginia Tech, 1007 Pamplin Hall, Blacksburg, VA, 24060, United States, tajames@vt.edu, Cesar Rego, Fred Glover

The design of appropriate diversification strategies is essential to find the highest quality solutions in complex search spaces. We identify promising diversification strategies for sequential and parallel adaptive memory algorithms for the Quadratic Assignment Problem and demonstrate their merit.

■ WA44

R - 4th Floor, Parc Ballroom III

Joint Session Computing/ Health: OR Applications in Computational Biology

Sponsor: INFORMS Computing Society/ OR and Biomedicine, Health Applications
Sponsored Session

Chair: Bala Krishnamoorthy, Assistant Professor, Washington State University, 103 Neill Hall, PO Box 643113, Department of Mathematics, WSU, Pullman, WA, 99164-3113, United States, kbala@wsu.edu

1 - Gene Expression Patterns of Breast Cancer Phenotype Revealed by Molecular Profiling
Gabriela Alexe, T.J. Watson IBM Research Center, Yorktown Heights, NY, United States, galexe@us.ibm.com, Gustavo Stolovitzky, Jorge Lepre, Gyan Bhanot

We address the breast cancer outcome heterogeneity problem by re-investigating and validating the existence of various breast cancer phenotypes on independent microarray datasets. For this purpose we apply robust consensus clustering and meta-classification techniques and focus our attention in developing diagnosis models with increased specificity.

2 - Re-creation of Evolutionary History from Molecular Phylogenetic Trees
J. Scott Provan, Professor, Dept of Statistics and Operations Research, University of North Carolina, Chapel Hill, NC, United States, Scott_Provan@UNC.edu, Vaibhav Kolekar, Todd Vision

The methods which create phylogenetic trees from a family of genomes cannot always identify the precise evolutionary events that take place at each branch point of the tree. We present a method of labeling a constructed phylogenetic tree with a set of duplication events, chosen from three standard event types, in such a way as to maximize the transfer of genetic information down the tree. This allows one to create an evolutionary history as well as simply a measure of genome similarity.

3 - Statistical Pattern Recognition of Diurnal Variation in Human Plasma by 1H NMR Spectroscopy
Seoung Bum Kim, Assistant Professor, Manufacturing and Industrial Systems Engineering, University of Texas at Arlington, Arlington, TX, United States, sbkim@isye.gatech.edu

In this talk, we studied feasibility of using 1H NMR spectroscopy to address diurnal effects in human plasma obtained from 8 healthy subjects for 25 time points in a day. Statistical pattern recognition techniques were employed to detect metabolomic change in association with time of data and identify significant metabolites that discriminate among different time groups in a day. The results offer useful information to investigate physiological status of human.

4 - An Integer Programming Model for de novo Interpretation of Tandem Mass Spectra
Bala Krishnamoorthy, Assistant Professor, Washington State University, 103 Neill Hall, P.O. Box 643113, Department of Mathematics, WSU, Pullman, WA, 99164-3113, United States, kbala@wsu.edu

A tandem mass spectrum provides the masses of certain fragments of a protein. de novo interpretation is the identification of the peptide given the spectrum. An optimization model is presented in which the number of occurrences of each amino acid (20 in total) as well as the ion type of each fragment are modeled as integer variables. Errors in mass measurements are also modeled. An efficient scoring function for the identification of the sequences (from the compositions) is also provided.

■ WA45

R - 4th Floor, Raphael

Material Handling Systems

Sponsor: Transportation Science & Logistics
Sponsored Session

Spyros Reveliotis,Assoc. Prof., ISyE, Georgia Tech, 765 Ferst Dr., Atlanta GA 30332, United States, spyros@isye.isye.gatech.edu

1 - Enumeration and Heuristic Procedures for a Circular Flow Pattern
Ardavan Asef-Vaziri, California State Un., ardavan.asef-vaziri@csun.edu, Gilbert Laporte, Robert Ortiz

We develop optimization, decomposition, and heuristic procedures to design a unidirectional loop flow pattern along with the pickup and delivery station locations for unit load automated material handling vehicles. The objective is to minimize the total loaded and empty vehicle trip distances. The empty vehicle dispatching policy underlying the model is the shortest trip distance first.

2 - Analytical Models of Vehicle-based Automated Material Handling Systems in Semiconductor Fabs
Dima Nazzal, Georgia Institute of Technology, 765 Ferst Dr., Atlanta, GA, 30332, United States, dnazzal@isye.gatech.edu, Leon McGinnis

We explore queuing network models to approximate the performance of vehicle-based Automated Material Handling Systems (AMHS). Using analytic models, we rapidly evaluate the performance of the AMHS and its impact on key performance indicators. We use the model to analyze AMHSs in semiconductor fabs. We develop a methodology to evaluate the throughput capacity of AMHS in the fab, and we conduct experiments to evaluate AMHS parameters that significantly affect fab productivity and performance.

3 - Supporting Flexibility in AGV Systems
Spyros Reveliotis, Assoc. Prof., ISyE, Georgia Tech, 765 Ferst Dr., Atlanta, GA, 30332, United States, spyros@isye.isye.gatech.edu

While the current AGV system technology can support, in principle, very flexible and dynamic routing schemes, this potential is limited by the lack of a rigorous methodology able to provide the real-time control logic that will ensure conflict and congestion-free traffic. The work presented in this talk is seeking to enhance the flexibility of contemporary AGV systems, by taking advantage of recent results in Discrete Event Systems theory.

■ WA46

R - 4th Floor, Rubens

Information and Control in Transportation Networks

Sponsor: Transportation Science & Logistics
Sponsored Session

Chair: S. Travis Waller, University of Texas, 1 University Station C1761, Austin, TX, United States, S.Travis.Waller@engr.utexas.edu

1 - User Equilibrium with Recourse in Stochastic Transportation Networks
S. Travis Waller, University of Texas, 1 University Station C1761, Austin, TX, United States, S.Travis.Waller@engr.utexas.edu, Satish 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 problem examples, a formulation, and solution method.

2 - A Fictitious Play Algorithm for Coordinated Traffic Signal Control and Dynamic Route Guidance
Shih-Fen Cheng, University of Michigan, 1205 Beal Avenue, Ann Arbor, MI, 48109, United States, chengsf@umich.edu, Marina Epelman, Robert Smith

In this paper, the challenging problem of finding coordinated signal timing plans and dynamic routes at the same time is investigated. We employ the game-theoretic paradigm of fictitious play to iteratively converge to a locally optimal solution. Through parallelization, the algorithm is robustly scalable to realistic size networks modelled with high-fidelity simulations such as city of Troy, Michigan. Significant savings can be achieved by this combined approach.

3 - The Incident Management of a Transportation Network with Asymmetrical Severity
Jian Hu, Ph.D Student, University of Arkansas at Little Rock, 2801 S. University Ave., ETAS 303B, Little Rock, AR, 72204, United States, jxhu@ualr.edu, Yupo Chan

Current literature introduces Stochastic Programming into the analysis and optimization of traffic-incident management. However, there is an implicit premise that all incidents have the same importance, precluding distinguishing trunk

lines from minor branches in a network, where incidents on trunk lines can have far more damaging effects. Here, the authors provide a new concept, asymmetrical severity, including the status of each incident, the level of damage, and the effect on congestion.

4 - Combined Signal Setting Design and User Optimal Dynamic Traffic Assignment Problem
Ampol Karoonsoontawong, Ph.D. Candidate, University of Texas at Austin, ECJ 6.202, Austin, TX, 78712, United States, ampolk@mail.utexas.edu, Travis Waller

We show that this problem with single destination can be formulated as a mixed-integer linear bi-level program when employing the known LP DTA models based on Daganzo's CTM. Given signal phase sequencing, the upper level problem minimizes the total system travel time, and its decision variables are phase green times, cycle length and offsets. The lower level problem is the user optimal DTA. For the multi-destination problem, Simulated Annealing and Genetic algorithm are employed.

■ WA47

R - 4th Floor, Michelangelo

Transportation Infrastructure Problems

Contributed Session

Chair: Peter Kelle, Professor, Louisiana State University, Information Syst. and Decision Sc,, Baton Rouge, LA, 70803, United States, qmkell@lsu.edu

1 - Hybrid Tabu Search Strategies for Urban Transit Networks
David Fan, SAS Institute Inc., 100 SAS Campus Drive, Cary, NC, 27513, United States, Wei.fan@sas.com, Randy Machemehl

Systematic tabu search (TS)-based heuristic methods, for the first time, are designed and applied for the urban transit networks. A multi-objective nonlinear mixed integer model is formulated. Solution methodologies are proposed, comprehensive characteristics analyses are conducted and numerical results clearly indicate that the preferred tabu search method outperforms the genetic algorithm used as a benchmark. Future directions and extensions of this work to other topics are also identified.

2 - Empty Containers Interchange in the Los Angeles/Long Beach Port Area
Hossein Jula, Assist. Professor, Penn State - Harrisburg, 777 West Harrisburg Pike, Middletown, PA, 17057, United States, hjula@psu.edu, Anastasios Chassiakos, Hwan Chang, Petros Ioannou

A system, which facilitates the interchange of empties outside the ports, reduces the traffic congestion, noise and emissions around the ports. In this paper, the empty container interchange problem is investigated for both deterministic and stochastic networks. Simulation experiments are used to demonstrate the efficiency of the optimization techniques for the Los Angeles/Long Beach port area.

3 - Aguascalientes: Global Logistics Center
Juan Enrique Sandoval, Business Relations and Studies, Universidad Politecnica de Aguascalientes, Prol. Mahatma Gandhi Km 2, Col. San Francisco del Arenal, Aguascalientes, AG, 20280, Mexico, jsn@upa.edu.mx, Jaime Escalera, Guillermo Hernandez Duque

The State of Aguascalientes in Mexico is exploring the opportunity to become a consolidation and distribution hub between North America and the rest of the World. This paper presents the performance of volumes and relative size of all the goods that go through Aguascalientes (by roads or airways) in order to support the theoretical phase of the study and to discover the pertinence of establishing formal infrastructure to boost the logistic and supply capabilities of the region.

4 - Selecting Highway Improvement Projects Considering Benefit and Risk Objectives
Peter Kelle, Professor, Louisiana State University, Information Syst. and Decision Sc,, Baton Rouge, LA, 70803, United States, qmkell@lsu.edu, Helmut Schneider

Selecting highway improvement projects based on benefit/cost neglects sites with high number of accidents. Our decision support identifies abnormal crash locations based on thousands of crash data, provides a multi-criteria ranking based on DEA, and selects projects using knapsack algorithm with the DEA ranking scores to maximize under budget constraint.

■ WA48

R - 4th Floor, Dante

Joint Panel Discussion Health/ Education: Education in OR & Healthcare

Sponsor: Health Applications, Education (INFORM-ED)
Sponsored Session

Chair: Allen Holder, Trinity University Mathematics, One Trinity Place, San Antonio, TX, United States, aholder@trinity.edu

1 - A Panel Discussion: Education in OR & Health Care
Moderator: Michael Carter, Professor, University of Toronto, Mech & Ind Engineering, 5 King's College Rd, Toronto, ON, M5S 3G8, Canada, carter@mie.utoronto.ca, Panelists: Yasar Ozcan, Murray Côté

A large part of an academics responsibilities lies within the educational arena, and this session discusses the specific challenges of educating students about Operations Research applications in Health Care. A panel of three experts will discuss their views on this topic and will lead a discussion to assist us in becoming better educators.

■ WA49

R - 4th Floor, Medici

Healthcare System Modeling and Operations Management

Cluster: Health Care
Invited Session

Chair: Margarida Moz, Instituto Superior de Economia e Gestão, Universidade Técnica de Lisboa; Centro de Investigação Operacional, UL, Rua do Quelhas 6, 1200-781, Lisboa, Li, Portugal, mmoz@iseg.utl.pt

1 - Goal Programming for Nurse (re)rostering: A Case-study
Margarida Moz, Instituto Superior de Economia e Gestão, Universidade Técnica de Lisboa; Centro de Investigação Operacional, UL, Rua do Quelhas 6, 1200-781, Lisboa, Li, Portugal, mmoz@iseg.utl.pt, Margarida Vaz Pato

Efficient allocation of human resources in specialised medicine services has important impacts on labour costs, on patient care standards and on the health of the technicians working under rotating shift patterns. This case-study refers to nurse rostering and rerostering in a surgical hospital unit. Solutions for both problems, formulated within a preemptive goal programming network flow model, will be presented and discussed.

■ WA50

R - 4th Floor, Cervantes

Medical Decision Analysis

Sponsor: Decision Analysis
Sponsored Session

Chair: Elissa Ozanne, Harvard Medical School, 101 Merrimac St., 10th Fl., Institute for Technology Assessment, Boston, MA, 02114, United States, elissa@mgh-ita.org

1 - Markov Chain Population Models for Medical Decision Making
Min Huang, Northwestern University, 2145 Sheridan Rd., Evanston, IL, 60208, United States, huangmin@northwestern.edu, Gordon Hazen

Markov models are widely employed in cost-effectiveness analysis of healthcare interventions. Although such models are usually formulated at the individual level, it is also useful to examine outcomes at the population level. We examine population-level Markov models and derive equilibrium distributions using Jackson and Whittle networks. We present several measures of population health quality to evaluate healthcare interventions and illustrate how they may differ in applications.

2 - Methods for Measuring Decision Quality
Elissa Ozanne, Harvard Medical School, 101 Merrimac St., 10th Fl., Institute for Technology Assessment, Boston, MA, 02114, United States, elissa@mgh-ita.org, Albert Mulley, Karen Sepucha

Many problems in health care today arise from the poor quality of decisions made by patients and physicians. Formal methods of decision analysis and decision quality assessment are not feasible to implement in routine clinical settings. Here, we propose a framework for practical instruments to capture knowledge and value concordance as a measure of decision quality in medicine.

3 - Integrating Decision Support into Clinical Practice of Medicine
Jeff Belkora, Director, Decision Services, University of California, San Francisco, 2186 Geary Blvd, Suite 103, San Francisco, CA, 94115, United States, jeff.belkora@ucsfmedctr.org

I will present my variation of the decision dialogue process, FAST SCOPED, to support patients and providers as they navigate complex medical issues. At UCSF, we use FAST SCOPED to tailor care to patient preferences and biology, based on medical evidence and clinical performance. We are also expanding the use of FAST SCOPED to other settings with promising preliminary results.

Wednesday, 10:00am - 11:30am

■ WB01

H - Lobby Level, Plaza A

Tutorial: Stochastic Dynamic Optimization with Model Uncertainty and Learning

Cluster: Tutorials
Invited Session

1 - Tutorial: Stochastic Dynamic Optimization with Model Uncertainty and Learning

George Shanthikumar, Professor, IEOR Department, University of California, Berkeley, CA, United States, jgshant@ieor.berkeley.edu, Andrew Lim

In stochastic optimization, it is customary to assume that a full probabilistic characterization is known. In reality, only an estimate of the probabilistic characterization is known. We will demonstrate that this can lead to inefficient solution to the real problem. We will discuss the formulation of such problems by a collection of models and solve it to obtain robust solutions. We will develop robust formulations to inventory control, revenue management, and portfolio selection with and without benchmarked objectives. Notions of learning under model uncertainty will be discussed.

■ WB02

H - Lobby Level, Plaza B

Performance and Efficiency Analysis

Cluster: Data Envelopment Analysis
Invited Session

Chair: Camilla Mastromarco, University of Lecce, Dep. of Economics and Quant. Mehtods, Ecotekne, via per Monteroni, Lecce, 73100, Italy, C.Mastromarco@economia.unile.it

1 - Openness, Human Capital and Efficiency in Developing Countries

Camilla Mastromarco, University of Lecce, Dep. of Economics and Quant. Mehtods, Ecotekne, via per Monteroni, Lecce, 73100, Italy, C.Mastromarco@economia.unile.it

This article uses stochastic frontier method to analyse FDI and imported capital goods as channels for increased efficiency in less developed countries. Both contribute to greater efficiency. However, there is an important difference: the article demonstrates that the general and disembodied knowledge diffusion effects of FDI are more growth enhancing than the more localised, embodied knowledge impact of imported capital goods. The positive effect depends crucially on the level of human capital.

■ WB03

R - 3rd Floor, Sienna II

Performance Analysis of Supply Chains Systems II

Contributed Session

Chair: Philip Huang, Thornhill Professor, Virginia Tech, 1007 Pamplin Hall, Blacksburg, 24061, United States, phhuang@vt.edu

1 - The Bullwhip Effect in Decentralized Supply Chains

Yanfeng Ouyang, Assistant Professor, University of Illinois at Urbana-Champaign, 1210 Newmark Civil Engineering Lab, 205 N Mathews Ave, Urbana, IL, 61801, United States, yfouyang@uiuc.edu, Carlos Daganzo

This paper examines decentralized supply chains with general inventory replenishment policies. It presents: (i) demand-independent tests to determine if the bullwhip effect arises; (ii) exact formulae for the variance of the stage-n order stream under ergodic demand; and (iii) the variance-reduction benefits of advance demand information.

2 - Six Sigma in Supply Chain Environment

Mahour Parast, Ph.D. Candidate, University of Nebraska-Lincoln, 175 NE Hall, IMSE Department, Lincoln, NE, 68588, United States, mmellatparast3@unl.edu, Erick Jones

The objective of this paper is to introduce and define Six Sigma concept within a supply chain environment. Six Sigma has been traditionally applied and implemented within a firm. However, with the emergence of supply chain management and inter-firm networks new definition of Six Sigma needs to be developed. The paper introduces a conceptual model for Six Sigma in a supply chain environment.

3 - Holonic Supply Chain: A Simulation Study

Philip Huang, Thornhill Professor, Virginia Tech, 1007 Pamplin Hall, Blacksburg, 24061, United States, phhuang@vt.edu

Intense market competition has forced business organizations to rethink their competitive strategy. This research examines a new business model, holonic supply chain, which proposes a different business structure where a supplier of major component parts can interact and cooperate with other suppliers to accomplish the common goal of meeting customer requirements in terms of quality, cost, quantity, and due date. A simulation model will be built to study the performance of this new approach.

■ WB06

H - Ballroom Level, Imperial B

Special Topics in Reverse Supply Chains

Contributed Session

Santhanam Rajagopalan,Graduate Research Assistant, University of Texas at Arlington, 312, UTA Blvd, Apt 201, Arlington TX 76010, United States, sanmanisha@yahoo.com

1 - Quantitative Model for Product Development in Life-cycle Strategy

Yasutaka Kainuma, Associate Professor, Tokyo Metropolitan University, 3-6-33, Azumacho, Akishima, Tokyo, 196-8540, Japan, yass.kainuma@nifty.com

Design for Environment (DfE) method and quantitative evaluation method for social acceptability using Quality Function Deployment (QFD) have developed and recognized its efficiency. In this paper, we defined life-cycle model where attractive life-cycle factors, must-be life-cycle factors and one-dimensional life-cycle factors by application of Kano's quality model, respectively. Finally, we propose a quantitative model for associating life-cycle model using utility function method.

2 - Determinants of an Effective Reverse Supply Chain

Rajesh Tyagi, DePaul University, 1 E. Jackson Street, DPC 7032, Chicago, IL, 60604, United States, rtyagi@depaul.edu, Kanwalroop Kath Dhanda, Jose Nicolas Ramos

We describe managerial drivers to achieve an effective reverse supply chain. A survey instrument, consisting of series of questions aimed at the design / redesign of the new / existing facility, was developed. We have conducted the second phase of the study using the survey instrument. Data based on the second phase of the study will be presented at the conference. The analysis will point at the relevant drivers leading to the effectiveness of a Reverse Supply Chain.

3 - A Dynamic Programming Approach to Solving an Inventory Problem with Returns

Rahul Upreti, Ph.D. Candidate, The University of Alabama, 249 Bidgood Hall, P O Box 870318, Tuscaloosa, AL, 35487, United States, rupreti@cba.ua.edu, Charles Schmidt

We consider a situation where some of the sold units of an item may return in future periods with a probability distribution. Returned units are just like new units in terms of salability. As some of the issued units may never return, new units have to be acquired from time to time. In this presentation an ordering policy for these new units is determined using Dynamic Programming for a finite time horizon so as to minimize the total ordering and expected carrying and backordering costs.

4 - Reuse of Plastic Bottles

Pratik Goradia, Clemson University, 110 Freeman Hall, Clemson, SC, 29634, United States, pgoradi@clemson.edu, Mary Beth Kurz

Reducing waste has become a primary concern for many developed countries. Companies spend time and money fine-tuning their forward supply chains while ignoring their backward supply chains. However, in competitive business environments with internal and external pressures, companies can no longer ignore reverse supply chains. Recycling of plastic bottles has been a major issue all over the world. This research considers reusing plastic bottles rather than recycling/remanufacturing them.

5 - An Examination of Third Party Reverse Logistics Service Provider Capabilities

Srikanth Yellepeddi, Graduate Research Assistant, University of Texas at Arlington, 2001, E.Spring Creek Pkwy, Apt 9101, Plano, TX, 75074, United States, yellepeddi@gmail.com, Santhanam Rajagopalan, Jamie Rogers

Reverse Logistics (RL) is not a core-competency for most of the organizations. This paper gives an overview of the RL functions that are currently outsourced, and assesses the risks and benefits, a Third Party Logistics Service Providers (3PLSP) faces in its migration to a Third Party Reverse Logistics Service Provider (3PRLSP). Based on these studies we identify the logistics capabilities a 3PLSP requires to become a successful 3PRLSP, and develop critical performance metrics.

■ WB07

H - Ballroom Level, California

Information System Research and Practice

Contributed Session

Chair: Caroline Bergeron, Geobusiness Group, Faculte d'Administraton, Universite de Sherbrooke, Sherbrooke, PQ, J1K2R1, Canada, Caroline.Bergeron3@USherbrooke.ca

1 - Improving Performance in the Public Sector using e-government: The INA Lessons

Manuel Pereira, Vice-President, INA-NAtional Administration Institute, Palacio dos Marqueses de Pombal, Oeiras, Oeiras, LX, Portugal, mjp@ina.pt, Lu"s Tavares

INA is the portuguese training institute for portuguese civil servents.More than 16000 students per year have training courses at INA.During the last 2 years a new IST strategy improved several dimensions of the business. Involvement of users and software supplyers, integration of information, outsourcing, tight project control and difussion of the results to the other public services are some of the good practices used.This paper discusses the IST strategy used and the results achieved at INA.

2 - External Funding In IS Research

Natalie Campbell, Doctoral Student, Mississippi State University, P.O. Box 9581, Mississippi State, MS, 39762-9581, United States, ncc34@msstate.edu, Merrill Warkentin

External funding supports equipment purchase, travel, and graduate assistant stipends, thus impacting quality and quantity of research outcomes. Yet IS researchers rarely seek external funding because of perceptions of the role of funding regarding tenure and promotion reviews, time investment, and the misperception that business disciplines are not funded. We examine the role and impact of external funding on IS research by assessing its relationship to the scholarship of prolific IS authors.

3 - The Learning Curve of Knowledge Workers in a Computing Call Center

Youngsoo Kim, phd student, Carnegie Mellon University, 5000 Forbes Ave., Pittsburgh, United States, yskim@andrew.cmu.edu, Ramayya Krishnan, Linda Argote

This study examines the learning curves of IS knowledge workers, using data from a computing call center. We find that (a)learning rate of the group in charge of requests associated with application-level knowledge is faster than that of the group of technical level knowledge in terms of average resolution time, (b)variance of resolution times becomes smaller in only the generalist group and (c)knowledge transfers across IS problem types. Theoretical and practical implications are discussed.

4 - Addressing Privacy Concerns with Veiled Certificates

John Gerdes, Assistant Professor, University of California, Riverside, 209 Anderson Hall, Riverside, CA, 92521, United States, john.gerdes@ucr.edu, Joakim Kalvenes

Traditional credentials (i.e., SS No.) raise privacy concerns and can lead to identity theft. Extending blind certificates, veiled certificates mask the user's identity from non-authorized individuals and satisfy regulatory need of unique, explicit identification. Veiled certification incorporates means to prove ownership, provide for certification revocation, and limit others from compiling a detailed dossier on an individual from information stored in multiple information sources.

5 - Users' Emotions and IS Satisfaction: An Exploratory Study in an ERP Context

Caroline Bergeron, Geobusiness Group, Faculte d'administraton, Universite de Sherbrooke, Sherbrooke, PQ, J1K2R1, Canada, Caroline.Bergeron3@USherbrooke.ca, Michel Berthiaume, Lin Gingras

Several studies have shown that emotions and affective states often influence people's evaluation and satisfaction of their work environment, as well as goods and services they acquire and use. Few studies have analyzed the affective states of users in the information systems area. This paper presents the results of an exploratory field study of the relations between users' positive and negative emotions and their satisfaction with an information system.

■ WB08

H - Ballroom Level, Imperial A

Special Topics in Operations Management II

Contributed Session

Chair: Wenjing Shen, Ph.D. Candidate, Ross School of Business, the University of Michigan, 3080 Whisperwood Drive, APT 473, Ann Arbor, MI, 48105, United States, wenjings@bus.umich.edu

1 - Measuring the Alignment: Applied Euclidean Distance Method

Sabin Srivannaboon, Research Associate, Portland State University, Dept. of Eng. & Tech. Mgmt. P.O. Box 751, Portland, OR, 97207-0751, United States, sabin@etm.pdx.edu

This research proposed the measuring method of strategic alignment based on an assumption that the strategic alignment was inversely related to the difference between two elements (the Euclidean Distance method). The study hypothesized that an increasing level of communication between representatives of strategies positively impacted the alignment scores, which in turn improved strategic performances (and vice versa).

2 - A Robust Reservation Control on a Single-Leg Flight with an Internet Distribution

Youyi Feng, Professor, The Chinese University of Hong Kong, Dept. of SEEM, EB Phase II 606, Chinese University of Hong Kong, Hong Kong, HK, Hong Kong, yyfeng@se.cuhk.edu.hk, Pang Zhan

This paper considers a risk sensitive utility criterion for reservation control on a single-leg flight with online distribution channels. Online agencies often require that the rate of plane seats be notified much earlier, and the web-site visitors ordinarily are unwilling to reveal direct information. The reservation control is based on the inaccurate demand information. The traditional revenue management analysis is no longer workable.

3 - Cutting Costs or Enhancing Revenues? An Example Illustrates a Choice Facing Operations Researchers.

Jing Chen, Ph.D student, University of Western Ontario, Apt.G,279 Windermere Road, London, ON, N6G 2J7, Canada, jchen@ivey.uwo.ca, Peter Bell

A new dilemma facing the operations researcher is whether to work on improving the efficiency of the firm or to focus instead on improving revenues. In this article, we examine this decision using a model of a firm published in JORS (2004). We use this model to illustrate the dramatic revenue and profit gains potentially available by applying revenue management concepts in a manufacturing environment.

4 - Supply Chain Coordination for Risk-averse Firms with Cash Constraints and Return Contracts

Ulku Gurler, Professor, Bilkent University, Department of Industrial Engineering, Bilkent, Ankara, TR, 06800, Turkey, ulku@bilkent.edu.tr

We analyze the structure of optimal inventory policy and channel coordination conditions under return contracts for a retailer with a manufacturer in a single period with limited cash for both. Based on the optimal inventory policy for the firm to maximize its utility function, we establish conditions for channel coordination conditions through return contracts. The impact of system parameters on optimal inventory policy variables and channel coordination is investigated in a numerical study.

5 - Managing Delays and Material Expenses in Production with Yield Losses

Wenjing Shen, Ph.D. Candidate, Ross School of Business, the University of Michigan, 3080 Whisperwood Drive, APT 473, Ann Arbor, MI, 48105, United States, wenjings@bus.umich.edu, Roman Kapuscinski, Izak Duenyas

In the pharmaceutical industry, when testing new products the production process has significant yield losses . At the same time, raw materials are expensive and products need to be ready on time for clinical trials. We analyze this problem through joint consideration of rigid demand, random-yield production, and queueing of products waiting for tests. We characterize the optimal policy structure, and compare it with some heuristic policies widely used in industry.

■ WB09

H - Ballroom Level, Yosemite A

Risk Management and 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 - Long-Term Exploitation of a Non-Renewal Resource

Rene Caldentey, Assistant Professor, New York University, Stern School of Business, 44W 4th Street, KMC 8-77, New York, NY, 10012, United States, rcaldent@stern.nyu.edu, Rafael Epstein, Denis Saure

We develop a methodology for the optimal extraction of a non-renewal resource such as crude oil or a mineral. The resource is deposited over a collection of sites with varying quality and extraction costs. Output is sold on a spot market at a stochastically evolving price independent of the level of production. We also assume the existence of a futures market for the product. Using risk-neutral valuation, we determine the optimal extraction plan in terms of the sequencing and production rate.

2 - Promotions and Options

Arnd Huchzermeier, Professor, WHU, Otto-Beisheim GSM, Burgplatz 2, Vallendar, 56179, Germany, Arnd.Huchzermeier@whu.edu, Stefan Spinler

Options on capacity have been shown to be beneficial for capital-intensive industries in the presence of demand and spot price uncertainty. We extend the framework of contingency contracts to the consumer goods industry and show how residual forecast error can be hedged via options contracts.

3 - Pricing, Operational Recourse and Consumer Choice in Coproduction Systems

Brian Tomlin, University of North Carolina, McColl Building, CB3490, Chapel Hill, NC, 27599, United States, Brian_Tomlin@unc.edu, Yimin Wang

Coproduction systems, in which a simultaneous production run results in multiple vertically-differentiated products, are subject to significant supply and demand uncertainties. Using a consumer-choice model to directly link customer purchasing behavior with the firm's operating decisions, we consider the joint pricing-and-quantity problem for a firm with multiple classes of customers. Furthemore, we investigate the value of a number of operational recourses, such as downward conversion.

4 - Managing Demand Uncertainty with Dual Supply Option-Contracts

Ozgur Yazlali, oyazlali@stanford.edu, Feryal Erhun

A manufacturer first reserves capacity and then orders from a local and a global supplier offering complementary option-contracts. We prove that, given a contract pair, a two-level modified base-stock ordering policy is optimal. A reserve-up-to policy is shown to be optimal for the manufacturer's capacity reservation problem. Our methodology can be used to explain diverse sourcing strategies (such as in-house versus offshore production) practiced by many companies in various industries.

■ WB10

H - Ballroom Level, Yosemite B

Strategic Issues in Supply Chain Design

Cluster: Supply Chain Management
Invited Session

Chair: Mark Ferguson, Assistant Professor, Georgia Tech, College of Management, 800 West Peachtree St., NW, Atlanta, GA, 30307, United States, Mark.Ferguson@mgt.gatech.edu

1 - Simple Newsvendor Heuristics for Multiechelon Distribution Networks

Erik Lystad, PhD Candidate, Georgia Institute of Technology, 800 West Peachtree St, Atlanta, GA, United States, gt3737a@prism.gatech.edu, Mark Ferguson

We consider a multiechelon distribution network consisting of M echelons and N nonidentical terminal locations with an arborescent network topology. We bound the arborescent system by constructed serial systems, resulting in an average error of 0.66% across numeric examples. This simple heuristic outperforms both state of the art and frequently utilized policies. We provide parametric analysis and insight, and show a number of interesting extensions and applications of the approach.

2 - Partial Backlogging in an Inventory Duopoly

Rodney Parker, Yale University, P.O. Box 208200, New Haven, CT, 06520-8200, United States, rodney.parker@yale.edu

We consider two competing firms facing stochastic demand. We construct a very general framework for customers experiencing a stockout including partial backlogging, lost sales, competitor search, competitor backlog, competitor lost sales, and consumer return backlog. Under general conditions we can show the equilibrium policy and compare with the integrated model.

3 - Lead Time, Uncertainty, and Channel Decision Making

Oded Koenigsberg, Assistant Professor, Columbia University, 3022 Broadway, 505 Uris, New York, NY, 10027, United States, ok2018@columbia.edu, Eyal Biyalogorsky

Production lead time forces companies to make production decisions before the realization of demand. We considered which channel member, the retailer or the manufacturer, should keep ownership of the units in the channel and what are the optimal pricing and promotion decisions. We find that it depends on the type (market size or price sensitivity) and the amount of demand uncertainty. Further we show that there is a possibility of channel conflict erupting under some conditions.

■ WB11

H - Ballroom Level, Yosemite C

Game Theory in Supply Chain Management

Contributed Session

Chair: Suman Mallik, University of Illinois, 1206 South Sixth Street, 350 Wohlers Hall, Champaign, IL, 61820, United States, malik@uiuc.edu

1 - A Network Model for Supply Chain Formation and Inter Supply Chain Competition

Ding Zhang, Professor, State University of New York at Oswego, School of Business, State University of New York, Oswego, NY, 13126, United States, zhang@oswego.edu

We consider a supply chain economy that comprises firms of various functions who are potential supply chain participants. The model addresses the following questions. (1) What will be he winning supply chains in the competition? (2) How much market share will a winning supply chain obtain? (3) Which firms will successfully form a supply chain? We furnish qualitative properties such as existence and uniqueness of the equilibrium, and provide numerical examples for illustrative purposes.

2 - On the Convexity of Newsvendor Games

Marco Slikker, Assistant Professor, Technische Universiteit Eindhoven, Department of Technology Management, P.O. Box 513, Paviljoen F13, Eindhoven, NL-5600 MB, Netherlands, m.slikker@tm.tue.nl, Ulas Ozen, Henk Norde

We study a situation with n retailers, each of them facing a newsvendor problem. Groups of retailers might increase their expected joint profit by joint ordering and inventory centralization, which means that they give a joint order to satisfy total future demand. It is already known in the literature that the associated (cooperative) newsvendor game has a nonempty core. We focus on conditions on the underlying situation to guarantee convexity of the newsvendor game.

3 - Role of Decision Structures in Supply Chain Coordination with Stochastic Demand

Xinjie Shi, University of Tennessee, Knoxville, 1611 Laurel Ave Apt 807, Knoxville, TN, 37916, United States, xshi@utk.edu, Chanaka Edirisinghe

We study coordination for a single period supply chain with one supplier and one retailer. In contrast to previous literature where one powerful agent assumes both the roles of Stackelberg leader and supply chain captain, we analyze situations in which the supplier and the retailer can act as either Stackelberg leader or supply chain captain. Furthermore, the stocking decision and pricing decision(s) can be made by either agent. Coordination contracts are investigated under different situations.

4 - Where's the Beef? Issues in Supply Chain Coordination.

Brian Neureuther, Indiana State University, College of Business, Analytical Department, Terre Haute, IN, 47809, United States, sdbrian@isugw.indstate.edu

Issues in the beef industry's supply chain, such as asymmetric information between buyer and sellers coordination mechanisms that are not appropriately matched to the market structure, can create suboptimal supply chain performance. This research looks at the upstream participants to determine the degree to which information technologies are currently being utilized, and the degree to which these new technologies have driven improvements within the beef industry's supply chain.

5 - Inventory Competition & Capacity Allocation in a Multi-Channel Distribution System

Suman Mallik, University of Illinois, 1206 South Sixth Street, 350 Wohlers Hall, Champaign, IL, 61820, United States, malik@uiuc.edu, Qin Geng

Consider a manufacturer distributing her product to the end consumer through an independent retailer as well as through her direct channel. Each of the two channels faces a stochastic demand. If one channel is out of stock, a fraction of the unsatisfied customers visit the other channel. Under the scenario described above, what are the equilibriums of the game? How does a capacity constraint affect the equilibrium outcome? Using a game theoretic model we seek answers to the above questions.

■ WB12

H - 4th Floor, Union Square 1

New Topics in Online Auctions

Cluster: Applications of Auction and Game Theory
Invited Session

Chair: Damian Beil, Ross School of Business at the University of Michigan, 701 Tappan Street, D8204, Ann Arbor, MI, 48109, United States, dbeil@umich.edu

1 - Ranked Items Auctions and Online Advertisement
Lezhou (Roger) Zhan, ISE, University of Florida, Gainesville, FL, 32611, United States, zhan@ufl.edu, Zuo-Jun Max Shen, Jane Feng

We study auctions for a set of ranked items. An auction mechanism used in this environment is the simultaneous pooled auction (SPA). We study how to improve the seller's expected revenue by enforcing a reserve price in SPA. One severe problem inherent in SPA is that some bidders may incur ex post losses. We propose a tailored VCG mechanism that generates the same revenue as SPA does, while the bidders do not incur any ex post loss. The potential applications of this research is also discussed.

2 - A Real Options-Based Infrastructure for eBay's Sequential Auction Problem
Adam Juda, Ph.D. Candidate, Harvard University, Sherman Hall, Harvard Business School, Boston, MA, 02163, United States, ajuda@hbs.edu, David Parkes

Bidders have no dominant bidding strategy when acquiring goods across multiple auctions in an e-market such as eBay. This failure can lead to unnecessary complexity and mistakes. We present an options based modification that enables a simple, dominant bidding strategy. We collect four months of eBay bidding data on Dell LCD screens, confirm that a sequential bidding problem exists, and provide a revenue analysis to demonstrate that this scheme can be beneficial for sellers as well as buyers.

3 - Auctioning Supply Contracts with Uncertain Demand
Cuihong Li, Assistant Professor, University of Connecticut, School of Business, 2100 Hillside Road, Storrs, CT, 06269, United States, Cuihong.Li@business.uconn.edu, Alan Scheller-Wolf

Consider a company that sources the production of a component with uncertain demand via an auction. After a contract is awarded, the supplier capacity is invested. We study the supply contract auctions for a buyer in such a situation, analyzing and comparing the optimal mechanisms and simpler single-attribute mechanisms.

4 - Selling with Auctions and Fixed Price Channels
Damian Beil, Ross School of Business at the University of Michigan, 701 Tappan Street, D8204, Ann Arbor, MI, 48109, United States, dbeil@umich.edu, Matthew Potoff

We consider a manufacturer selling a short life-cycle product over a finite selling horizon. The manufacturer is uncertain about consumers' willingness to pay. We explore how the manufacturer can combine auctions and fixed price channels to mitigate this uncertainty.

■ WB13

H - 4th Floor, Union Square 5

Decision and Decision Making

Contributed Session

Chair: Shuning Wu, Dept. of Industrial and Manufacturing Systems Engineering, Iowa State University, Ames, IA, 50010, United States, nickwu@tsinghua.org.cn

1 - Multiple Dimensional Modeling of Individual Decision Maker
Hyun Kim, Graduate Student, Case Western Reserve University, 10900 Euclid Ave Olin 613, Cleveland, OH, 44106, United States, hsk5@case.edu, Behnam Malakooti

The traditional decision making research focuses on obtaining an optimal solution from a set of alternatives. We have shifted from this conventional approach and developed multi-dimensional models for representing various decision making behaviors. This modeling of the decision making behavior can be implemented in a variety of applications such as creating artificially intelligent agents with different problem solving attributes.

2 - Screening to Prevent Catastrophic Failures
Ludmila Zheltova, Doctoral Student, Weatherhead School of Management, Case Western Reserve University, 10900 Euclid Ave, Cleveland, 44106, United States, lvz@case.edu, Lisa Maillart

The main motivation of screening for chronic diseases is to diagnose disease early in the expectation that benefit from earlier treatment will reduce mortality and improve quality of life. Our basic model consists of three health states: disease-free, preclinical, and clinical. Two other states included in the model are death from disease and death from other causes. For this model we investigate the impact of changes in the disease incidence and/or aggression on mortality.

3 - Service Quality Judgment under Uncertainty
Jianmin Jia, Professor, Chinese University of Hong Kong, Dept. of Marketing, Shatin, NT, Hong Kong, chongyan@baf.msmail.cuhk.edu.hk, Jianmin Jia

This paper investigates service quality judgment under the distribution of customer satisfaction ratings. In the positive domain of customer satisfaction ratings, managers would be averse to uncertainty; and in the negative domain, they would prefer uncertainty. There is also an asymmetric effect such that the managers's evaluation of service quality is more sensitive to customer dissatisfaction than customer satisfaction. We propose a model to capture these empirical findings.

4 - Improved Instance Selection for Better Decision Trees
Shuning Wu, Dept. of Industrial and Manufacturing Systems Engineering, Iowa state university, Ames, IA, 50011, United States, wsn97@hotmail.com

In this paper we present an improved optimization-based approach for instance selection based on our former research by adding some random factors to the genetic algorithm to select a better subset of instances that result in a smaller decision tree with much less deviation in tree's size and even better accuracy. Also this paper analyzes the reason why instance selection is beneficial for decision tree by using a new criterion: average leaf ratio.

■ WB14

H - 4th Floor, Union Square 6

Optimization for Supply Chain Disruptions, Crew Composition, Spare Parts and Strategic Mobility

Sponsor: Military Applications
Sponsored Session

Chair: Fred Glover, University of Colorado, Leeds School of Business, Boulder, CO, United States, Fred.Glover@colorado.edu

1 - The Effects of Disruptions on the Performance of Supply Chains
Sanjay Kumar, PhD Student, University of Texas at Dallas, School of Management, Richardson, TX, United States, skumar@utdallas.edu, Kathryn E. Stecke, Thomas Schmitt

Supply chains that make and distribute military products are vulnerable to disruptions. Using simulation we study various disruption types and inventory management policies. This should contribute to the ability to prepare for possible disruptions in critical infrastructure and improve the effectiveness of responses.

2 - Determining Crew Composition for a New Technology
HaiTao Li, College of Business Administration, Troy University, hli@troy.edu, Keith Womer

This paper presents a procedure for determining crew composition for a new technology like the Navy's DD(X). Here we present a method for solving the manpower scheduling problem where multi-skilled sailors form teams to accomplish interrelated tasks. This is modeled as Project Scheduling with Multi-Purpose Resources (PSMPR). A hybrid Mixed Integer Linear Programming (MILP) and Constraint Programming (CP) decomposition algorithm is implemented for solving the proposed model.

3 - Integer Programming Alternatives to Marginal Analysis for Spare Parts Optimization
Jean-Paul Watson, Sandia National Laboratories, P.O. Box 5800, MS 1110, Albuquerque, NM, 87185-1110, jwatson@sandia.gov, William E. Hart, Michael J. Collins

Global optimization of spare-parts distribution systems at the enterprise level is an open challenge; point solutions exist only for specific aspects, e.g., marginal analysis for computing inventory levels. We introduce an integer programming formulation of the enterprise-level sparing problem that simultaneously considers inventory levels, repair locations, and resource levels. Computational results on a sparing distribution system for the Lockheed Martin Joint Strike Fighter are detailed.

4 - A Tabu Search Approach to Strategic Mobility Mode Selection
LTC Kaye McKinzie, The University of Texas at Austin, Austin, TX, 78712-1063, Kaye.McKinzie@csl.carlisle.army.mil, J. Wesley Barnes

Strategic mobility has received great interest lately. Shrinking budgets and force size emphasize the importance of efficient deployments of personnel and materiel. This presentation overviews a three stage adaptive tabu search (ATS) approach to improving the deployment process. The ATS model's results are markedly superior to current methods.

■ WB15

H - 4th Floor, Union Square 9

Multi-Machine Scheduling

Contributed Session

Chair: Yangkuei Lin, Ph. D. Candidate, Arizona State University, 1140 East Loyola Drive, Tempe, AZ, 85282, United States, Yangkuei.Lin@asu.edu

1 - Farsighted Data Collection Management for Air-to-Ground Tracking

Angelia Nedich, Senior Engineer, BAE Systems, AIT, 6 New England Executive Park, Burlington, MA, 01803, United States, angelia.nedich@baesystems.com, Robert Washburn, Michael Schneider

We consider the problem of managing data collection arising in air-to-ground tracking. The system to be managed includes a sensor collecting data and a tracker utilizing the data. The problem is to decide where and what data to collect to optimize the data utility. Finding the best data collection is a hard problem due to a large number of possible decisions and complex dynamics. We propose two, efficient, farsighted algorithms using dynamic programming, and we evaluate them in simulations.

2 - Decomposition Based Lower Bounds for the Three Machine Group Scheduling Problem in PCB Manufacturing

Rasaratnam Logendran, Associate Professor, Department of Industrial and Manufacturing Engineering, 118 Covell Hall, Oregon State University, Corvallis, OR, 97331, United States, logendrr@engr.orst.edu, Cumhur Gelogullari

We consider minimizing the makespan of the three machine group scheduling problem with carryover sequence dependency, typically encountered in printed circuit board (PCB) manufacturing. We develop a novel mixed integer linear programming formulation and propose an integer column generation approach based on Dantzig-Wolfe decomposition to identify tight lower bounds, and demonstrate the approach on an example problem.

3 - Minimizing Earliness and Tardiness in a Two-stage Flowshop with a Common Due Date

Débora Ronconi, USP, Av. Prof. Almeida Prado, 128, Sào Paulo, SP, 05508900, Brazil, dronconi@usp.br, Celso Sakuraba

In this paper, we present a heuristic for the two-stage flowshop scheduling problem for minimizing the sum of the absolute deviation from a common due date. Two parts form such heuristic: the NEH job insertion procedure is utilized to determine the job sequence through the construction of partial sequences and a new algorithm is presented to schedule these sequences. The proposed approaches are examined through a comparative study and better results were achieved in problems with up to 500 jobs.

4 - Minimizing the Absolute Deviation from a Common Due Date in a Two Machine Job Shop Scheduling

Leonardo Bedoya-Valencia, PhD Student, Old Dominion University, 1245 Westover Av. Apt b-10, Norfolk, VA, 23507, United States, lbedo001@odu.edu, Yaneth Cristina Correa-Martinez, Ghaith Rabadi

The problem addressed here is the two machines job shop scheduling problem when the objective is to minimize the total earliness and tardiness from a common due date for a set of jobs. This objective became very significant after the introduction of the Just-in-time manufacturing approach. Different cases of this problem are solved by using exact and heuristic algorithms. A numeric example illustrates the three cases and computational results show the performance of the algorithms.

5 - Processing Time Generation Schemes for Parallel Machine Scheduling Problems with Various Correlation

Yangkuei Lin, Ph. D. Candidate, Arizona State University, 1140 East Loyola Drive, Tempe, AZ, 85282, United States, Yangkuei.Lin@asu.edu, John Fowler, Michele Pfund

We consider the problem of generating processing time matrices for parallel machines scheduling problems. We present several processing time generation schemes that consider no correlation, and different levels of machine correlation, job correlation and mix-correlation corresponding to a variety of real-world manufacturing environments. Also, a method to evaluate the machine relatedness and job uniformity for the randomly generated processing times of a given problem instance is presented.

■ WB16

H - 4th Floor, Union Square 10

Optimization Modeling in Economics

Contributed Session

Chair: Talat Genc, University of Guelph, Dept. of Economics, Guelph, ON, N1G2W1, Canada, tgenc@uoguelph.ca

1 - OR and Labor Policy Analysis: Optimizing Labor Tax Credit Programs

Dr Robert Yerex, Unicru, Inc, 9525 SW Gemini Dr, Beaverton, OR, 97008, United States, ryerex@unicru.com

In the United States, a variety of federal, state and local tax incentive programs exist for the purpose of encouraging private sector corporations to employee certain targeted classes of disadvantaged workers. This study demonstrates the use of OR modeling and simulation approaches in the analysis of the federal Work Opportunity Tax Credit (WOTC) program in terms of its impact, and the potential for increased value to corporations seeking to optimize their participation in the program.

2 - Joint Capacity and Contract Design: An Application of the Principal-Agent Model

Yabing Jiang, Simon School, University of Rochester, Rochester, NY, United States, jiangya@simon.rochester.edu, Avi Seidmann

We study the issue of incentive contract in a stochastic environment where the firm has capacity constraints and incurs delay-related costs. By embedding a queuing model within a general principal-agent framework, we unite the firm's decision regarding incentive contract with its decision regarding operation capacity. We show that the principal can effectively manage capacity utilization with our optimal incentive contract and avoid a common pitfall in cost accounting known as the death spiral.

3 - Externalities in Groundwater Overexploitaion and Optimal Groundwater Extraction Program

Balasubramanian Rudrasamy, Associate Professor, Tamil Nadu Agricultural University, Department of Agricultural Economics, Lawley Road, Coimbatore, TN, 641003, India, rubalu@gmail.com

Groundwater overexploitation is serious ecological challenge. Econometric model is used to quantify externalities of overexploitation using time-series data on groundwater fluctuation, area irrigated, well density. Optimal control is used to develop intertemporal groundwater allocation which shows significant economic gains compared to competitive extraction. Results bring out issues for developing institutional alternatives for regulating groundwater overexploitation.

4 - Economic Interpretations for Resource Allocation Models in the Presence of Indivisible Goods

Talat Genc, University of Guelph, Dept. of Economics, Guelph, ON, N1G2W1, Canada, tgenc@uoguelph.ca, Suvrajeet Sen

In the presence of indivisible goods, resource allocation models often result in mixed-integer linear programs. Unlike LP duality however,MILP problems present duality gaps, and shadow prices (opportunity costs)are not as conveniently interpreted. We discuss an economic interpretation associated with certain disjunctive cuts, and identify appropriate properties for shadow prices for MILP problems.

■ WB17

H - 4th Floor, Union Square 11

Planning and Control in Inventory Systems

Contributed Session

Chair: Nan Yang, Graduate School of Business, Columbia University, 3022 Broadway, 311 Uris Hall, New York, NY, 10027, United States, ny118@columbia.edu

1 - Combined Pricing and Inventory Control for a Perishable Product with Two-Period Lifetime

Yanzhi Li, Dept. IELM, HongKong University of Science and Techn, Kowloon, Hong Kong, ieyanzhi@ust.hk, Andrew Lim

This work addresses the simultaneous determination of pricing and inventory replenishment strategies for perishable products in the face of demand uncertainty in multiple periods, either finite and infinite. We have proposed several models based on different practices and assumptions and explore their optimal solution structures. Extensive numerical experiments have been conducted to provide further managerial insights.

2 - Coordinated Inventory Planning for New and Old Products under Warranty

Wei Huang, SAS Institute, 100 SAS Campus Dr, Cary, NC, 27513-8617, United States, wehuan@wnt.sas.com, Vidyadhar Kulkarni, Jay Swaminathan

A seller faces new demand and demand to replace failed items under warranty. An age-dependent fraction of the items under warranty fail each period. We consider geometric and constant warranty duration distributions in backlogging and emergency supply cases. We prove the optimality of the w-dependent base stock policy, where the base stock level is a function of w, the number of items under warranty for finite, infinite horizon discounted cost, and long run average cost cases.

3 - Replenishment Strategy of a Quantity Flexibility Contract under a Rolling Horizon Environment

Xiang Zhu, PhD Candidate, Hong Kong University and Science and Technology, Tower B 508D, HKUST, Clear Water Bay,, Kowloon, Hong Kong, Hong Kong, zhuxiang@ust.hk, Liming Liu

In this paper we explore an important class of quantity flexibility (QF) contract under the Rolling Horizon Planning (RHP) for a single buyer with a single product. We analyze how a QF contract with three-period RHP provides flexibility for a buyer to respond to changes in an uncertain market.

4 - Managing Inventory Through The Synchronization Of Orders And Customers

Alejandro Lago, IESE Business School, Av. Pearson 21, Barcelona, 08034, Spain, alago@iese.edu, Victor Martinez de Albeniz

We consider an inventory problem where linear ordering costs and selling prices vary over time, and demand is generated by a stream of non-stationary Poisson arrivals. We provide conditions under which the myopic base-stock policy is optimal. This corresponds to synchronizing the arrival of a customer to the placement of an order. We specialize the results to the Bass demand model, with falling prices and costs

5 - Safeguarding Strategic Supplies: Planning for Disaster

Nan Yang, Graduate School of Business, Columbia University, 3022 Broadway, 311 Uris Hall, New York, NY, 10027, United States, ny118@columbia.edu, Awi Federgruen

We analyze a model for an organization which needs to satisfy uncertain demand for a given item, by procuring supplies from multiple sources. Each source is exposed to a random yield factor, the distribution of which may allow for the possibility of a complete shutdown. The problem amounts to selecting which of the given set of suppliers to retain, and how much to order from each, so as to minimize total procurement costs, while ensuring that demand is met with a given probability.

■ WB18

H - 4th Floor, Union Square 12

Measuring Air Transportation System Performance

Sponsor: Aviation Applications
Sponsored Session

Chair: Andrew Lacher, Research Strategist, The MITRE Corporation, 7515 Colshire Drive, McLean, VA 22102, United States, alacher@mitre.org

1 - Factors which Affect the NAS On-Time Percentage

David Knorr, Federal Aviation Administration, Washington, DC, Dave.Knorr@faa.gov

Poor NAS on-time performance is strongly correlated with adverse surface weather conditions in the winter and convective weather in the summer, while on-time percentages are high in the spring and fall. We show that most of the delay that leads to flights arriving late occurs on the ground. We compare departure delays with ground delays and ground stops imposed by the FAA, and find that they are highly correlated. We discuss the benefits of transferring delays from the air to the ground.

2 - Excess Airline Cost As a Composite Metric For Assessing Air Traffic System Performance

Alexander Klein, Research Professor, George Mason University, 4400 University Drive, Fairfax, VA, 22030, United States, aklein1@gmu.edu

We introduce Excess Airline Cost (EAC) as a NAS performance metric, calculated as a total direct airline operating cost of delays, extra distance, diversions and cancellations, normalized per-flight. EAC relationship with en-route and terminal weather, and its applicability to NAS performance assessment, is analyzed. Weather Impacted Traffic Index (WITI), first proposed by MITRE CAASD, is refined and tested vis-a-vis EAC. Results show good correlation between cost and weather-impact variables.

3 - Delay Normalization: an Econometric Analysis of US Airline Flight Delays

Chieh-Yu Hsiao, University of California at Berkeley, 107 McLaughlin Hall, University of California at Berkeley, Berkeley, CA, 94720, United States, cyhsiao@berkeley.edu, Mark Hansen

We normalize airline flight delay by estimating an econometric model of average daily delay. With this model we are able to quantify major causal factors of delays, such as flow, weather, and seasonal effects. The model is applied to analyzing the flight delays of US National Airspace System.

4 - Commercial Airlines' Flight Cancellation Analysis

Jing Hees, Research Fellow, Logistics Management Institute, 2000 Corporate Ridge, McLean, VA, 22102, United States, JHEES@lmi.org, Joseph Post

Commercial airlines sometimes must cancel flights due to factors such as severe weather, equipment failure, and excessive delay. This analysis focused on understanding the cancellation decision-making process, and to characterize and quantify the cancellations' relationship with weather, delay, and airlines' operational characteristics. We found that the cancellation decision-making criteria primarily differed due to the airlines' business model; i.e., hub-and-spoke or point-to point.

■ WB19

R - 3rd Floor, Sienna I

Analytic Hierarchy Process Applications and Decision Support

Contributed Session

Chair: Alvaro Mendoza, Instructor, University of Los Andes, Calle 19 A # 1-37 Este Of. W510, Cra. 11 # 119-69 Ap 204, Bogotà, DC, Colombia, a-mendoz@uniandes.edu.c

1 - Mode Choice Model for Long Distance Travel in the USA

Isaradatta Rasmidatta, PhD candidate, University of Texas at Arlington, Arlington, Arlington, TX, 76013, United States, ixr6048@exchange.uta.edu

Long distance travel (more than 50 miles) has been rapidly increasing every year due to economic growth and activity. Characteristics that influence long-distance trips in USA will be analyzed by logistic regression to specify mode choice models and develop better strategies for infrastructure investments. Isaradatta Rasmidatta, University of Texas at Arlington Stephen P. Mattingly, University of Texas at Arlington

2 - A Constraint Solving Scheduling Application by using Constraint Logic Programming

J. Joshua Thomas, Lecturer, KDU College Penang Campus, 32,Jalan Anson,, Penang, GT, 10400, Malaysia, joshopever@yahoo.com

This paper, concentrates on a typical scheduling problem which generates a timetable for the Cineplex. A solution for the problem is an assignment of value to each variable such all the constraints are handled through propagation methods which allows the reduction of the domains of variables and for the trimming of the search space. Another method named backtracking have invoked with the propagation to allow exploring the search space systematically. The solutions are in a weekly manner.

3 - Group Demand Forecasting in the Hospitality Industry

John Lancaster, Senior Consultant, Manugistics, 9715 Key West Avenue, Rockville, MD, 20850, United States, jlancaster@manu.com, Jon Higbie, Mehmet Gulsen

Group demand forecasting for groups presents major challenges for hotel revenue management. This presentation explores how group demand and associated resource utilization can be forecasted in the hospitality sector using a combination of forecasting and simulation techniques.

4 - ISESS: A Intelligent Prototype DSS to Enterprise System Selection.

Leopoldo Colmenares, Professor, Simon Bolivar University, USB. Valle de Sartenejas. EGE Building., Caracas, DC, 1080A, Venezuela, lcolmen@usb.ve

This paper presents a inteligent prototype Decision Support System (DSS) to Enterprise System Selection (ISESS), which embodies the Analityc Hierarchy Process (AHP) framework to decision making. ISESS allows construte the objective hierarchy and the appropiate attributes are specified to provide datailed guidance for ERP system selection. ISESS consists of three parts, the user interface, the evaluation model and a scenario manager. ISESS was developed using REALBasic software package.

5 - Methodology for Selecting the Best Strategy for Operating a Pipeline System in Ecopetrol

Alvaro Mendoza, Instructor, University of Los Andes, Calle 19 A # 1-37 Este Of. W510, Cra. 11 # 119-69 Ap 204, Bogotà, DC, Colombia, a-mendoz@uniandes.edu.co, Mario Castillo

The Colombian Petroleum Company ECOPETROL has finished the construction of a new pipeline and must select the best alternative to operate the pipeline system that transport and provide fuel to the capital of the country during the next 20 years. This paper presents a structured decision analysis methodology that considers quantitative and qualitative decision criteria to select the best alternative supported in simulation and risk analysis models, and Analytic Hierarchy Process (AHP).

■ WB20

H - 6th Floor, Mason B

Forestry III - Land Acquisition and Planning Applications

Sponsor: Energy, Natural Resources & the Environment / Forestry
Sponsored Session

Chair: Evelyn Richards, Faculty of Forestry, University of New Brunswick, P.O. Box 44555, Fredericton, NB, E3B 6C2, Canada, ewr@unb.ca

1 - Acquisition Strategies for Grassland Bird Habitat in an Urbanizing Landscape

Stephanie Snyder, Operations Research Analyst, USDA Forest Service, North Central Research Station, 1992 Folwell Ave, St. Paul, MN, 55108, United States, stephaniesnyder@fs.fed.us, Robert Haight, James Miller, Adam Skibbe

Open space protection in urban areas is one policy for regulating development. Planners in Kane County in suburban Chicago identified habitat protection for grassland birds as a critical objective of open space protection. We develop a site selection model to examine tradeoffs between goals of maximizing effective grassland habitat and minimizing distance from existing reserves. The model considers the influence of adjacent land uses on the quality of grassland habitat and restoration costs.

2 - Habitat Reserve Site Selection to Maximize Endangered Species Persistence

Laurel Travis, Department of Forestry, Virginia Tech University, Blacksburg, VA, ltravis@vt.edu, Robert Haight

We maximize the probability of persistence of species using discrete stochastic optimization to select reserve sites. The probability of persistence is estimated with a stochastic, individual-based, meta-population simulation. Tabu search and theoretical results are combined to identify a set of promising options. Statistical ranking and selection is used to select the most promising option from this set. We use commercial software (OptQuest) and comment on its applicability to larger problems.

3 - Working from the Chief's Agenda: An OR Based Approach to Managing Motorized Recreation

Ashton Hargrave, Forestry Technician, USDA Forest Service, P.O. Box 624, Leadville, CO, 80461, United States, skicoloradopowder@yahoo.com

The purpose of this paper is three-fold. First, the issues of unmanaged recreation will be introduced. Second, literature relevant to the problem will be reviewed. Finally, a preliminary model formulation will be discussed, along with its feasibility, data needs, and limitations. My approach to this issue is to perform a 0-1 integer variable, constraints-based analysis of the transportation network in order to derive management and planning decisions to be applied to specific land areas.

4 - Stand-Centred Constraints for Adjacency Problems in Forest Management

Eldon Gunn, Professor, Dalhousie University, 5269 Morris Street, Room 208, Halifax, NS, B3J 2X4, Canada, eldon.gunn@dal.ca, Evelyn Richards

In this talk, we present some computational results for ARM adjacency problems using the recently developed stand-centred constraints integer programming formulation. The results reported range from extremely simple problems where it is easy to see the consequences of the formulation to large scale problems of more than 6000 stands and with multi-period greenup.

■ WB21

H - 4th Floor, Union Square 15

Optimization and Data Mining II

Sponsor: Optimization/ Optimization and Data Mining
Sponsored Session

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

1 - Monotone Classification by Function Decomposition

Jan C Bioch, Assoc. prof, Erasmus University Rotterdam, P.O. Box 1738, Rotterdam, 3000dr, Netherlands, bioch@few.eur.nl

We propose a function decomposition method for discrete functions which can be appplied to generate a monotone classifier based on extracted concept hierarchies.

2 - Concept Analysis with Galicia

Petko Valtchev, Assistent Professor, DIRO, University of Montreal, Universite de Monteal, C.P. 128 succ Centre-Ville, Montreal, Qc, H3C 3J7, Canada, petko.valtchev@umontreal.ca, Robert Godin, Rokia Missaoui

Concept analysis is a knowledge discovery paradigm for binary datasets rooted in Galois connections and closures. The talk focuses on three remarkable set families, closed, pseudo-closed and min-generators, on the challenges their computation represents, on their impact on practical problem resolution, and on the way our Galicia platform deals with.

3 - Feature Selection with the Logical Analysis of Data

Pierre Lemaire, Rutgers University, RUTCOR, Piscataway, NJ, United States, lemaire@rutcor.rutgers.edu, Peter L. Hammer

We propose an iterative feature selection procedure within the framework of the Logical Analysis of Data. It is based on the potential of both the individual variables, and small subsets of interactive variables, to distinguish between positive and negative observations. Applicability and usefulness are demonstrated on large real-life datasets.

■ WB22

H - 4th Floor, Union Square 16

Joint Session DA/ Health: Data Mining in Medicine

Sponsor: Data Mining,Health Applications
Sponsored Session

Chair: Dursun Delen, Assistant Professor of MSIS, Oklahoma State University, 700 N. Greenwood Ave., Tulsa, OK, 74106, United States, delen@okstate.edu

1 - Potential and Issues of Evidence-Based Medicine

David L. Olson, James and H.K. Stuart Professor in MIS, University of Nebraska, Department of Management, Lincoln, NE, 68588-0491, United States, dolson3@unl.edu, Sergei Ananyan

Evidence-based medicine is a promising tool to improve the accuracy of the medical treatment system. It applies information technology to accurately record patient medical data and scientifically-based evaluation of alternative treatments. This session demonstrates the potential of data mining tools to support evidence-based medicine, with special consideration of text mining.

2 - Robust Data Mining in Biomedical Images

Y. Alp Aslandogan, University of Texas at Arlington, Dept. of Computer Science & Eng., Campus Box 19015, Arlington, TX, 76019-0015, United States, alp@cse.uta.edu

Theoretical and operational feature definitions, their accurate extraction and interpretation lie at the heart of successful data mining. We illustrate the types of features that can be considered for extraction in specific biomedical image domains, such as dermatology and magnetic brain imagining, and how their definition as well as extraction impacts the outcome of data mining. We will present some methods for robust mining of biomedical images in presence of uncertainty.

3 - Factor Analysis for Functional Genomics

Romy Shioda, University of Waterloo, 200 University Avenue West, Waterloo, ON, Canada, rshioda@math.uwaterloo.ca

In this work, we map approximately 4000 yeast genes to 369 functional categories using gene microarray expression data and gene ontology data. Instead of using traditional classification approaches, we model the problem using factor analysis and find the genes classification using variety of optimization approaches, including spectral decomposition, semi-definite relaxations, and mixed-integer nonlinear optimization.

4 - Data Mining in Cancer Research

Dursun Delen, Assistant Professor of MSIS, Oklahoma State University, 700 N. Greenwood Ave., Tulsa, OK, 74106, United States, delen@okstate.edu

The understanding and prediction of breast cancer survivability has been a challenging research problem for many researchers. In this presentation we repot on a research project where we developed prediction models for breast cancer survivability. We used popular data mining methods (e.g., artificial neural networks and decision trees) along with most commonly used statistical methods (e.g., logistic regression). We used a large dataset (more than 200,000 cases) to develop the prediction models.

■ WB23

H - 4th Floor, Union Square 2

Strategic Models in Telecommunications

Sponsor: Telecommunications
Sponsored Session

Chair: Pamela Murray-Tuite, Assistant Professor, Virginia Tech, Northern Virginia Center, 7054 Haycock Road, Falls Chuch, VA, 22043, United States, murraytu@vt.edu

1 - The Systems Approach and Telecommunications Strategic Management

Steven Powell, Professor, California State Polytechnic University, Pomona, CIS Department, 3801 West Temple Avenue, Pomona, CA, 91768, United States, srpowell@csupomona.edu

Systems thinking has been incorporated into many disciplines, and its development has produced a variety of approaches to solve problems. This paper addresses systems thinking in strategic management and investigates how the systems approach can be applied to the strategic management of telecommunications.

2 - Global Internetworking: The Economics of Voice and Data Convergence

Vijay Deokar, Professor, California State Polytechnic University, Pomona, 3801 W.Temple Ave, CLA98, Pomona, CA, 91768, United States, vdeokar@csupomona.edu

No one can argue the cost benefits of usng a common networks to transmit both voice and data. Convergence needs to have a strong corporate strategy based on business goals to take advantage of the benefits, keeping in mind the associated potential risks. The objective of this study is to analyze the current technology status of both the voice and the data, and suggest a phased approach that will capitalize on the past investments to build an integrated infrastructure.

3 - A Reference Model for RFID as an Overlay Network

Jun Shu, junshu@psu.edu

We give RFID a new definition with a very different emphasis: RFID is a set of technologies that provides network-delivered information services dependent on physical-object identities captured through the use of radio waves. We present a formal reference model in which the essence of RFID is an overlay network in the presentation layer. Through the reference model, we show how different network architectures: centralized, distributed, and P2P can be used to implement RFID.

■ WB24

H - 4th Floor, Union Square 8

Some Important Issues in Group Decisions & Negotiations

Contributed Session

Chair: David Ben-Arieh, Professor, Kansas State University, Dept. of IMSE, 216 Durland Hall, Manhattan, KS, 66506, United States, davidbe@ksu.edu

1 - Client-Contractor Bargaining on Net Present Value in the Context of a Project with Limited Resources

Gunduz Ulusoy, Professor, Sabanci University, Faculty of Engineering, Orhanli, Tuzla, Istanbul, 34956, Turkey, gunduz@sabanciuniv.edu, Funda Serifoglu, Ilker Birbil, Nursel Kavlak

The client-contractor bargaining problem aims at maximizing the bargaining function comprised of the objectives of both the client and the contractor. The objective of the client is to minimize the net present value of the payments to the contractor, whereas the objective of the contractor is to maximize the net return. Individual objectives of both the client and the contractor are in conflict most of the times, and the bargaining objective should consider the incentives of both parties.

2 - A Technique For Aggregating Incomplete Individual Ratings

Donald Stengel, Professor, California State University, Fresno, 5245 N. Backer Avenue, MS PB07, Fresno, CA, 93740-8001, United States, dons@csufresno.edu

This paper addresses the development of a robust technique for deriving aggregate ratings/allocations from a set of incomplete individual ratings/allocations (incomplete in the sense that not all candidate options are evaluated by each individual.) The technique applies to a variety of group decision problems like negotiating the division of resources or evaluating competing projects/candidates - situations where raters are often either unable or not allowed to make complete evaluations.

3 - A Classification of Inconsistency in the Process of Multicriteria Decision-Making

Juan C. Leyva-Lopez, Universidad de Occidente, Carr. a Culiacancito Km. 1.5, Culiacan, Mexico, jleyva@culiacan.udo.mx

In this paper, we defined a classification scheme for inconsistency in the process of multicriteria decision making and constructed a framework that integrates an evolutionary algorithm-based automatic inconsistency identification method. We demostrated the mechanism of the method in the multicriteria ranking problem.

4 - Multi Attribute Group Consensus Under Linear Cost Opinion Elasticity

David Ben-Arieh, Professor, Kansas State University, Dept. of IMSE, 216 Durland Hall, Manhattan, KS, 66506, United States, davidbe@ksu.edu, Todd Easton

This paper describes three problems where experts of unequal importance and with a linear cost of changing their opinion (Opinion Elasticity) consider a single and a multi-criterion decision consensus. These problems achieve a minimum cost consensus without a budget limit. It turns out that the optimal consensus point is at the median opinion for rectilinear cost function, and at the weighted average opinion for squared geometric distance calculations.

■ WB26

H - 6th Floor, Sutter B

Problems in Production & Scheduling

Contributed Session

Chair: Kevin Ross, Assistant Professor, University of California, Santa Cruz, UCSC School of Engineering, 1156 High St, SOE3, Santa Cruz, CA, 95064, United States, kross@soe.ucsc.edu

1 - The General Lot Sizing and Scheduling Problem with Sequence Dependent Changeovers

Ayse Koçlar, Research Assistant, Middle East Technical University, Inonu Bulvari, Ankara, 06531, Turkey, ayse@ie.metu.edu.tr, Haldun Süral

In the General Lot Sizing and Scheduling Problem with sequence dependent changeovers, capacity utilization and long changeovers necessitate the integration of decisions in the production plan. We present a mathematical model capturing essences of the generic problem setting. We represent the problem with an alternative formulation and attempt to enhance the formulations using additional inequalities. Finally, we develop a heuristic by restricting changeovers. Computational results are discussed.

2 - An Improved Short-term Scheduling Model for Multipurpose Batch Plants with Resource Constraints

I. A. Karimi, Associate Professor, National University of Singapore, Department of Chemical and Biomolecular Engineering, 4 Engineering Drive 4, Singapore, Sg, 117576, Singapore, cheiak@nus.edu.sg, Arul Sundaramoorthy, Rajagopalan Srinivasan, Liu Yu

Short-term scheduling is an important and routine problem in multipurpose batch plants. In this paper, we present a new, simpler and more efficient continuous-time mixed integer linear programming (MILP) formulation for short-term scheduling in multipurpose batch plants. Our model accounts for various resources in the plant (material, units, utilities and manpower), different storage policies, and several operational constraints, and yields optimal schedule.

3 - Resource Allocation and Scheduling in Service Networks

Kevin Ross, Assistant Professor, University of California, Santa Cruz, UCSC School of Engineering, 1156 High St, SOE3, Santa Cruz, CA, 95064, United States, kross@soe.ucsc.edu

This work considers scheduling in a general service network, where jobs from multiple classes arrive simultaneously and resources are allocated online. A combination of service rates to several queues is selected, reflecting the capacity of each server, forwarding between queues and buffer constraints. These networks describe call centers, flexible manufacturing and utility computing, and the results have implications for capacity planning, pricing and load balancing.

■ WB27

H - 6th Floor, Taylor B

Some Heuristic-based Applications

Sponsor: Artificial Intelligence
Sponsored Session

Chair: Selwyn Piramuthu, University of Florida, Decision and Info. Sci., 351 Stuzin Hall, Gainesville, FL, 32611-7169, United States, selwyn@nersp.nerdc.ufl.edu

1 - Web Advertisement Scheduling to Maximize Revenue under a Hybrid Pricing Model with Size Limitations

Anurag Agarwal, Assistant Professor, University of Florida, 347 Stuzin Hall, Gainesville, Fl, 32606, United States, anurag.agarwal@cba.ufl.edu, Jason Deane

On-line advertising revenue is groing rapidly and many companies are struggling to maximize their earning potential as a result of scheduling difficulties. Scheduling on-line ads is a very challenging and dynamic task. We present and test several heuristic and meta-heuristic solution techniques for the proposed web advertisement scheduling problem.

2 - Learning under Hierarchy and Competition

Kurian Tharakunnel, University of Illinois,Chicago, Information and Decision Sciences, 601 S. Morgan Street (MC 294), Chicago, IL, 60607, United States, kthara1@uic.edu, Siddhartha Bhattacharyya

We consider the problem of learning in the context of decision situations where both hierarchy and competition are present. A general theoretical framework for modeling such problems that can facilitate development of reinforcement learning schemes is presented. We also briefly discuss some interesting applications of this new framework.

3 - Inventory Control and Learning in Dynamic Supply Chain Networks

Jason Deane, Ph.D. Student, University of Florida, 361 B Stuzin Hall, Gainesville, FL, 32606, United States, jdeane@ufl.edu, Selwyn Piramuthu

Inventory control is of paramount importance for smooth operation of supply chains. A single inventory level may not necessarily be optimal across various scenarios of demand, supply, lead-time, penalty for excess inventory as well as loss of revenue when a sale is lost due to insufficient inventory, etc. We consider learning to control inventory levels in supply chains where the network configuration can be dynamically changed in real-time.

■ WB28

R - 4th Floor, DaVinci I

Pricing and Revenue Management with Endogenous Demand

Sponsor: Revenue Management & Pricing
Sponsored Session

Chair: Guillaume Roels, MIT, 1 Amherst Street, Cambridge, MA, 02139, United States, roels@mit.edu

1 - The Effects of Learning Behaviors on the Optimal Response to Consumer Wait-or-Buy

Anton Ovchinnikov, PhD Candidate in Operations Management, Joseph L. Rotman School of Management, University of Toronto, 105 St. George Street, Toronto, ON, M5S 3E6, Canada, Anton@Rotman.Utoronto.Ca, Joseph Milner

We consider the revenue management problem faced by a firm whose customers strategically wait for a last minute discount. The fraction of customers waiting depends on the pricing history. We derive the optimal policy when both demand and the fraction waiting are random. We consider restricted versions of the problem and present solutions in the closed form. We study how allowance for overbooking and different learning behaviors affect the structure of the optimal policy.

2 - The Price of Information: Robust Inventory and Revenue Management

Guillaume Roels, MIT, 1 Amherst Street, Cambridge, MA, 02139, United States, roels@mit.edu, Georgia Perakis

The newsvendor model is at the foundation of inventory theory and revenue management but relies on the assumption that the demand distribution is fully known. We assume partial information on the demand. We investigate order policies by minimizing the regret from not ordering optimally. This approach is less conservative than the traditional maximin approach. We derive tractable order policies and quantify the risk exposure from not having full information.

3 - Salesforce Motivation and Incentives

Ayse Kocabiyikoglu, INSEAD, Blvd de Constance, Fontainebleau, 77300, France, ayse.kocabiyikoglu@insead.edu, Ioana Popescu

Traditional revenue management models consider demand to be exogenous. Besides price, an important factor affecting demand, and hence profits, is the motivation of the salesforce. We provide comparative statics results that relate motivational patterns to the agent's preferences, firm's policies (pricing, inventory, HR) and market factors.

■ WB29

R- 4th Floor, DaVinci III

Evaluation of Pricing Policies

Cluster: Pricing and Revenue Management for Non-Travel Industries
Invited Session

Chair: Harun Ahmet Kuyumcu, Chief Scientist, Zilliant, Inc., 3815 South Capital of Texas Highway, Suite 300, Austin, TX, 78704, United States, ahmet.kuyumcu@zilliant.com

1 - Measuring the Impact of Pricing Policies in Wholesale Channels

Nachum Shacham, CTO, Metreo, Inc., 1146 Stanely Way, Palo Alto, CA, 94303, United States, nachum@Metreo.com

Methods will be presented for measuring the effectiveness of pricing policies in wholesale channels where sales are negotiated across a range of prices ("price band"). Metrics that capture the financial impact of policy changes will be defined. Approaches for collecting data for calculating these metrics, and statistical methods for ascertaining confidence levels, will be discussed. Finally, we present results of field measurements of the impact of changes in pricing strategies.

2 - Does Buyer Collusion Affect Market Outcomes?

Amy Taylor, University of New Hampshire, 217-F McConnell Hall, Durham, NH, 03824, United States, William Tunnercliffe

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.

3 - A Method for Estimating Willingness to Pay Using Distributions of Wins and Losses

Gurcan Bicken, Principal Scientist, Zilliant, Inc., 3815 South Capital of TX Hightway, Suite 300, Austin, TX, 78704, United States, gurcan.bicken@zilliant.com

When there is some correlation between offered prices and customer's willingness to pay, the conventional logistic regression may not be suitable for estimating customer response. This work presents a method for estimating willingness to pay distribution using distribution of wins and losses when such correlation exists. We assume that both willingness to pay and historical prices are normally distributed. The results of the present method and conventional logistic regression are compared.

4 - Lease Expiration Control in Multi-family Revenue Management

Jian Wang, Sr. Pricing Analyst, Archstone-Smith, Inc, 9200 E. Panorama Circle, Englewood, CO, 80112, United States, JWang@archstonesmith.com

Multi-family sector represents a new frontier for Revenue Management (RM). This industry shares many characteristics with traditional hotel RM industry, but presents new challenges, e.g. extremely long lengths of stay. The objective of this paper is to study how to entice demand to expire in the "good" periods. A set of numerical simulations with real business data is presented.

5 - Evaluation of Markdown Pricing Policies

LiWen Chen, PhD Student, University of Texas at Austin, liwen.chen@mail.utexas.edu, Leung Chun, Bansri Gandhi, Harun Ahmet Kuyumcu

In this article, simulation techniques are used to study performance of various markdown pricing policies. A set of managerial insights are drawn from the numerical results.

■ WB30

R- 4th Floor, DaVinci II

OR /MS Issues in Organization Theory

Contributed Session

Chair: Jamison Day, University of Houston, 4800 Calhoun Rd, Houston, TX, 77204, United States, jmday@uh.edu

1 - On Interdependence and Modularity: How to Divide a Team

William Millhiser, Visiting Assistant Professor of Operations, Weatherhead School of Management, Case Western Reserve University, 10900 Euclid Ave., Cleveland, OH, 44106, United States, william.millhiser@case.edu, Corinne Coen, Daniel Solow

How should firms disrupt complex worker interdependencies to modularize teams? Drawing upon the strategy and mathematical organization literatures, we develop a mathematical model (an extension of Kauffman's NK model) for determining how performance changes when a team is split. Computer simulations provide managerial insights on how to optimally assign workers to modules, and if low-performing teams should be improved (through worker replacements) prior to modularization.

2 - The Role of Irreversibilities in Organizational Change Management: A Case Study

Diego Ponte, University of Trento, Via Matteo del Ben, Rovereto, TN, 38068, Italy, ponte@form.unitn.it, Matteo Bonifacio

Using a case study, conflict between organizational communities is examined starting from the question of why the change of communities' perspectives is so hard to facilitate and support. Extending the concept of pragmatic view of knowledge our claim is that communities do not easily change their perspective since it is coherent with a set of irreversible investments (i.e. capabilities, ecc). Once the perspective is changed, these irreversibilities would be lost.

3 - A Practical Approach to Brand Architecture - A Case Study on Vilco-track-marketing

Rajesh Srivastava, emeritus prof, simsr, University of Bombay, 2/9/12, bluemoon, bhawaninagar, marol, mumbai, 400059, India, srivastava@vsnl.net

Powerful Brands reap profits. As an organisation works to unlock the potential of their brand portfolio they face a wide range of Brand Management issues- optimum number of brands the company requires, what strategy the company uses to manage the brands, does one brand synergies with the others within a portfolio, whether a brand has a potential to become a homogeneous global Brand in all countries. These issues arise in a multi brand company in today's scenario. These multiple brands have to be managed by building an organised structure that is clear, provides insightful identity and makes impact on the consumers' mind. This technique of building a structure is known as Brand Architecture. The author give a practical approach to brand architecture and validate the same in a one year study.

4 - Strategic Decisions Regarding the Vertical Integration of Human Resource Organizations

Lars Friedrich, Johann Wolfgang Goethe University Frankfurt, Breslauer Strasse 4b, Kelkheim, 65779, Germany, lars.friedrich@accenture.com, Tom Gellrich

The purpose of this paper is threefold: (1) Gain insights into the current status of HR-outsourcing in Financial Services and Industry. (2) Develop a theory-based framework (transaction-cost, resource-based, principal agent) and derive and test eight hypotheses using OLS-regression analyses. Thus, we examine determinants of vertical integration or outsourcing of HR-processes. (3) We analyze the impact of HR-outsourcing on company performance.

5 - A Conceptual Framework for Refining Intuition and Making Effective Decisions

Jamison Day, University of Houston, 4800 Calhoun Rd, Houston, TX, 77204, United States, jmday@uh.edu

We present a framework to guide managerial decision-making, focusing on the integration and continual improvement of knowledge and intuition through the use of information gathering, training, and implementation results feedback. Several common management science methods are categorized within the framework and an examination of known behavioral phenomenon are considered before discussing recommendations for continually improving managerial decision-making through intuition refinement.

■ WB31

H - 4th Floor, Union Square 25

Applications of OR to Demand Chain Management.

Cluster: OR Practice
Invited Session

Chair: Shailendra Jain, Dept Manager, Hewlett-Packard Labs, 1501 Page Mill Road, ms 1u, Palo Alto, CA, 94304, United States, sjain@hpl.hp.com

1 - An Experimental Study of Lease Contracts in Durable Goods Markets

Kay-Yut Chen, Principal Scientist, Hewlett-Packard Laboratories, 1501 Page Mill Road, MS 1u-2, Palo Alto, CA, 94304, United States, kay-yut.chen@hp.com, Suzhou Huang

Economics experiments, with human subjects playing as consumers, were used to study interactions between lease contracts and an underlying used-goods market, which have enormous revenue implications to manufacturers such as Ford. Results have confirmed qualitative features predicted by the theoretical model while biases in the quantitative predictions have been observed.

2 - Less Pain more Gain: Automated Learning of Response Models from Transaction Data

Dirk Beyer, HP Labs, 1501 Page Mill Road, MS1140, Palo Alto, CA, 94304, United States, dirk.beyer@hp.com, Hsui-Khuern Tang, Troy Shahoumian, Alex Zhang

There are many tools and solutions on the market that use customer response models to improve advertising effectiveness. Most of them require significant effort in setting up the infrastructure for training data preparation and are inflexible in their choice of model classes. In this talk, we are describing a platform for response model learning that allows for automated just-in-time training dataset creation based on transaction data as well as automated model type selection and calibration.

3 - Change Point Detection with Applications

Jerry Shan, Senior Scientist, Hewlett-Packard Labs, 1501 Page Mill Road, Palo Alto, CA, 94304, United States, jerry.shan@hp.com

Business conditions can change rapidly, and data quality issues can exist at varying levels. These two seemingly unrelated problems share one characteristic: there is a change in the data. If a change goes unnoticed, it could be very costly; if detected promptly, it can provide a critically needed time window for addressing the underlying issues and help reset the course for operation. This paper presents a new methodology for automatic change detection with applications in multiple areas.

■ WB32

H - 6th Floor, Lombard

Location Analysis

Sponsor: Location Analysis
Sponsored Session

Chair: Tammy Drezner, Professor, California State University, College of Business and Economics, Fullerton, CA, 92834, United States, tdrezner@fullerton.edu

1 - On a Stackelberg-Hotelling Game

Tal Raviv, tal.raviv@sauder.ubc.ca, Frieda Granot, Daniel Granot

We introduce and analyze a location game wherein players locate in a linear city as long as it is profitable for them to do so. We characterize the Stackelberg equilibrium of this game by providing a closed form expression for the number of players that would locate in the city and their equilibrium locations.

2 - Flow Interception Location-Allocation for Pickup

Weiping Zeng, zeng@ualberta.ca, M. John Hodgson, Ignacio Castillo

Flow interception models locate facilities to serve patrons who pick up some product on a pre-determined journey. For many products, (eg: videos), the consumer does not care where in the journey the product is picked up. For other products (eg: pizza on the way home from work, coffee to be enjoyed during the journey), the consumer does care. We adapt flow interception models to deal with pickups for which "where" in the journey, or on a deviation from the journey, is important.

3 - Strategic Location/Capacities of Hospitals in a Disaster Prone Area

Jomon Paul, jpaul3@buffalo.edu, Rajan Batta

This talk attempts to address the question of finding strategic locations for hospitals in a disaster prone area. It also aims at finding the capacities of these hospitals. The aim is to minimize ambulance travel time to deliver casualties to hospitals in a disaster situation, e.g., an earthquake.

4 - A Model for the Location of a Transit Line

Vladimir Marianov, Professor, Pontificia Universidad Catolica de Chile, Department of Electrical Engineering, Vicuna Mackenna 4860, Santiago, RM, 6904411, Chile, marianov@ing.puc.cl

We propose a model for the optimal construction of a transit line in a city. The transit line must be built in such a way as to minimize its length, while maximizing coverage (demand within a reasonable distance), or minimize its length and maintaining coverage above a minimum preset value.

■ WB33

H - 6th Floor, Mason A

Sensor III

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: Satish Bukkapatnam, Associate Professor, Oklahoma State University, School of IE&M, Stillwater, OK, 74078, satish.t.bukkapatnam@okstate.edu

1 - Towards Self-Sustainable Sensor Networks

Soundar kumara, Distinguished Professor, Penn State, Marcus Dept. of Ind. & Mfg. Eng., University Park, PA, 16803, United States, skumara@psu.edu, San-Gook Kim, Xiang Zhang, Satish Bukkapatnam

This presentation describes the authors' ongoing collaborative research in developing miniature wireless sensors equipped with piezoelectric elements that can harvest energy from the host environment, and in deriving methods to harness information on nonlinear stochastic dynamics of the underlying complex processes from a large network of such sensors.

2 - Sensing Data Analysis for Surface Quality Control of Hot Rolling Processes

Shiyu Zhou, Assistant Professor, University of Wisconsin - Madison, 1513 University Ave., Dept. of Industrial and Systems Engr., Madison, WI, 53706, United States, szhou@engr.wisc.edu

Surface quality is a long-term troubling issue in hot rolling processes due to the ineffectiveness of existing process control methods. This paper presents statistical analysis methods to integrate various sensing data from the hot rolling process to effectively detect the condition of poor surface quality and provide guidelines for optimal process control.

3 - Form Error Assessment Using Bayesian Spatial Model for Multiple Coordinate Sensor Data

Haifeng Xia, Research Assistant, Industrial Engineering, Texas A&M University, Industrial Engineering Department, Texas A&M University, 3131 TAMU, College Station, TX, 77843-3131, xiahf@neo.tamu.edu, Jyhwen Wang, Yu Ding

We present a Bayesian spatial model for assessing the errors of various geometry and free form features based on an array of coordinate sensor data. The ability to characterize systematic form errors would be essential for developing reliable conformance checking methods and meaningful feedback for manufacturing process improvement. The resulting Bayesian solution can integrate prior engineering knowledge and provide better estimate of form errors and their uncertainty than conventional methods.

4 - Designing Valid, Energy-Efficient Distributed Sensor Networks
Abhijit Deshmukh, National Science Foundation, University of Massachusetts, adeshmuk@nsf.gov, Robert Gao, Ruqiang Yan, Daniel Ball

This paper focuses on two issues related to the decomposition of sensor networks: overall energy efficiency and the ability to make valid inferences about the whole system. We present several decomposition schemes that lead to a reduction in the overall energy usage by the ensemble of sensors. We also present conditions for segmenting the network that guarantee the validity of inferences made by the decomposed network.

■ WB34

H - 6th Floor, Powell A

Joint Session QSR/ Health: Quality and Statistical Decision Making in Healthcare Applications III

Sponsor: Quality, Statistics and Reliability, Health Applications
Sponsored Session

Chair: Jing Li, Industrial and Operations Engineering Department, University of Michigan, Ann Arbor, MI, United States, jinglz@engin.umich.edu

1 - Schedule Reliability and Operating Room Capacity
Ying Li, Assistant Professor, Texas A&M University, 4217 TAMU, College Station, TX, 77845, YLi@mays.tamu.edu

We study how start time reliability, patient's wait to get on schedule and operating room capacity affect a hospital's cost. Different alternatives regarding operating room capacity expansion are examined. A participation-inducing contract is recommended.

2 - Small Denominators and Nursing Home Ranking Measures
David Zimmerman, David_Zimmerman@chsra.wisc.edu

Resident-based nursing home quality indicators (QIs) are affected by small denominators, which increase their variability. Mixed effects models were tested with facility ranking modeled as a function of QI value and size. Sensitivity analysis was performed to identify denominator thresholds to improve ranking efficiency.

3 - Modeling and Uncertainty in Breast Cancer Decision Making
Kim Barron, United States, kab386@psu.edu, Julie Simmons Ivy, Harriet Black Nembhard

We design a model that combines statistical process control (SPC) with a partially observable Markov decision process (POMDP) for breast cancer decision making. Using simulation we examine the impact of parameter uncertainty on key metrics with an emphasis on identifying those that significantly impact the care decision.

■ WB35

H - 6th Floor, Sutter A

Issues in Supply Chain Management IV

Contributed Session

Chair: Arul Sundaramoorthy, Research Engineer, Institute of Chemical and Engineering Sciences, 1, Pesek Road, Jurong Island, Singapore, SG, 627833, Singapore, Arul_Sundaramoorthy@ices.a-star.edu.sg

1 - Understanding Supply Chain Dynamics through Multi-Agent Modeling
Ramakrishna Govindu, Doctoral Candidate, Wayne State University, 4815 Fourth St. Room#1055, Industrial & Manufacturing Engineering, Detroit, MI, 48202, United States, ah0776@wayne.edu, Ratna Babu Chinnam

Understanding supply chain "dynamics" is essential for managing and improving its performance. Modeling and coordinating supply chains through multi-agent systems is gaining interest of researchers and industry alike. A framework for supply chain modeling, that utilizes the "Gaia" methodology for developing multi-agent systems and JADE (Java Agent DEvelopment Framework), will be presented. Experiences and implementation results from applying the framework on the "Tamagotchi" case will be shared.

2 - Location-Allocation-Production-Distribution in the Chemical Process Industries
Pavan Kumar Naraharisetti, Research Engineer, Institute of Chemical and Engineering Sciences, 1 Pesek Road, Jurong Island, Singapore, 627833, Singapore, pavan_kumar@ices.a-star.edu.sg, Rajagopalan Srinivasan, I. A. Karimi

The location allocation problem involves strategic decisions regarding the (dis)investment and tactical decisions regarding the production allocation. In this work, we present a new deterministic model that combines location allocation problem with production distribution problem. Capacity expansion and contraction, production allocation, distribution along different transportation routes and regulatory factors are considered.

3 - Exchange of Demand Informations across Retailers in a Supply Chain
Jianghua Wu, Assistant Professor, School of Business, Renmin University of China, Beijing, 100872, China, jianghuawu@alumni.purdue.edu, Paul V Preckel, Ananth Iyer

We study the impact of information sharing across decentralized retailers in a supply chain. We show that, under constant market conditions, the number of retailers may affect their incentives to share information. Specially, we show that there may exist stable coalition of partial retailers in 3-retailer game, in which the two first movers form a information exchange group while excluding the third one from joining the group.

4 - A Strategic Capacity Allocation Problem for a Stochastic Manufacturing and Marketing System
Liuxin Chen, Ph.D Student, Chinese University of Hong Kong, Dept. of SEEM, EB Phase II 615, Chinese University of Hong Kong, Hong Kong, Hong Kong, lxchen@se.cuhk.edu.hk, Youyi Feng

We study a stochastic make-to-stock manufacturing system which is able to market its products to the local customers. To fully utilize capacity the system seeks outsourcing orders from a global OEM. The system aims to maximize long-run discounted profit through dynamic capacity allocation and price adjustment.It is found that a threshold pricing and production control policy optimizes the system performance and the optimal allocation decision can be numerically determined effectively.

5 - An Efficient Model for Integrated Planning in Global Supply Chains with Transfer Pricing
Arul Sundaramoorthy, Research Engineer, Institute of Chemical and Engineering Sciences, 1, Pesek Road, Jurong Island, Singapore, SG, 627833, Singapore, Arul_Sundaramoorthy@ices.a-star.edu.sg, Rajagopalan Srinivasan, I. A. Karimi, Seah Xianming

In this paper, we present a unified framework with a generalized recipe representation to model disparate entities and their activities in a global supply chain in a seamless fashion with a granularity at the level of production lines. We use this framework to develop a powerful model to address the integrated supply chain planning problem involving internal transfer pricing with special focus on pharmaceutical and specialty chemical industries.

■ WB36

H - 6th Floor, Taylor A

Recent Developments in Stochastic Processes

Contributed Session

Chair: Wei Xiong, Mr., Rutgers University, Department of Industrial Engineering, Piscataway, NJ, 08854, United States, weixiong1@gmail.com

1 - On the Machine Repairmen Model with General Repair Times and Spares
Muhammad El-Taha, USM, Department of Mathematics and Statistics, Portland, United States, eltaha@usm.maine.edu, Bacel Maddah

Consider the repairmen model with spares, single repairman, and identical machines. Machine times to failure are iid exponential r.v.s, and repair times are iid with a general distribution. We derive an exact solution for the steady state system size probabilities using the imbedded Markov Chain approach. Numerical results will be presented.

2 - On the Stability Condition and the Performance Deterioration Due to Lead Time Syndrome
Baris Selcuk, TU/e, TU/e Pav.E12 5600MB, Eindhoven, Netherlands, b.selcuk@tm.tue.nl, Ivo Adan, Jan Fransoo, Ton De Kok

The increased variability in the system as a result of frequently updating lead times is known as lead time syndrome. Although it is conceptually well defined, analytical evaluation of the phenomenon has been omitted. In this paper, we model a single-stage production inventory situation controlled by a base-stock policy with updated lead times as a two-dimensional Markov process. We provide the stability conditions and the levels of performance deterioration under different update frequencies.

3 - The Asymptotic Dependence of Log-fractional Stable Motion
Joshua Levy, U.T. of the Permian Basin, 4901 E. University Blvd., Odessa, TX, 79762, United States, levy_j@utpb.edu

A "heavy-tailed" stochastic process has infinite variance, so there is no available covariance for quantifying its dependence. A plausible substitute is the covariation. Here we apply this measure to the stationary increments of the alpha-stable process, log-fractional stable motion (log-FSM), and then determine their exact rate of convergence over long time lags. The obtained rate, which is hypergeometric, gauges the asymptotic dependence of log-FSM.

4 - Stochastic Programming Applied to Project Risk Management
Manish Garg, PhD Student, University of Arizona, P.O. Box 210020, Tucson, AZ, 85715, United States, manish@email.arizona.edu, Karl Kempf, Cole Smith

Many organizations perform multiple projects in parallel that must coordinate to deliver products to the market. Our motivating example is product design, manufacturing process design, and manufacturing facilities design. We show a mixed integer programming formulation that includes tasks, risks, and mitigations from the standpoint of cost and time. The resulting decision tool can be used for meta-project design and execution.

5 - Queues with Deterministic Reneging Times Arising in Application Servers
Wei Xiong, Mr., Rutgers University, Department of Industrial Engineering, Piscataway, NJ, 08854, United States, weixiong1@gmail.com, Tayfur Altiok, David Jagerman

The study is motivated by the timeout mechanism in application servers. A Volterra integral equation is developed using the level crossing approach for the M/G/1 queue with reneging. Examples are shown for the M/H-k/1 queue with deterministic reneging times.

■ WB37

H - 6th Floor, Van Ness

Resource Allocation for Computer Systems

Sponsor: Applied Probability
Sponsored Session

Chair: Zhen Liu, IBM T.J. Watson Research Center, P.O. Box 704, Yorktown Heights, NY, 10598, United States, zhenl@us.ibm.com

1 - Resource Control in a Multiclass Network with Simultaneous Server Occupancy
David Yao, Professor, Columbia University, IEOR Dept, MC4704, New York, NY, 10027, United States, yao@columbia.edu

We study a stochastic network that consists of a set of links (servers /resources), serving multiple classes of jobs. To process each class of jobs requires the simultaneous occupancy of a distinct subset of links (i.e., a route). Each link has a given capacity (maximum service rate), which is shared among jobs from all the routes that involve the link. We study two types of input control mechanisms, via setting thresholds and via pricing, and discuss their relationship and asymptotics.

2 - Distributed Channel Allocation in Wireless Networks
Vishal Misra, Columbia University, 450 Mudd Building, MC 0401, 1214 Amsterdam Avenue, New York, NY, 10027, United States, misra@cs.columbia.edu, Dan Rubenstein, Hanhua Feng

We consider the problem that m users share n channels, for data transmission. The goal of a channel allocation scheme is to maximize the number of channels transmitting, with the constraint that users are autonomous and do not communicate with each other. We consider various distributed randomized schemes and study their convergence properties as a function of m and n. Further, we study the impact of observability on the convergence properties, from FDMA, Ad Hoc networks, to TDMA.

3 - Stochastic Search and Queueing Modeling Techniques for OnDemand Computing
Asser Tantawi, IBM T.J. Watson Research Center, P.O. Box 704, Yorktown Heights, NY, 10598, United States, tantawi@us.ibm.com

Managing an on-demand computing environment with service level objectives is challenging in the face of demand fluctuations. In such an environment, the goal is to maximize resource utilizations while maintaining the service level objectives. We will describe one such environment and present research problems for its management. We will focus on modeling and optimization problems using queueing and stochastic search techniques. We will present experimental results and discuss practical issues.

4 - A Multicommodity Model for Distributed Stream Data Processing
Li Zhang, Dr., IBM T.J. Watson Research Center, P.O. Box 704, Yorktown Heights, NY, 10598, United States, zhangli@us.ibm.com, Cathy H. Xia, James A Broberg, Zhen Liu

We consider a multicommodity model for streaming data processing applications. Data streams from multiple sources need to be processed and delivered to multiple destinations. It is a challenge to manage available resources in a distributed manner to optimize the network performance. We develop a distributed resource allocation algorithm that maximizes the overall system throughput. We prove the convergence of the algorithm and demonstrate the performance by experimental results.

■ WB38

R - 2nd Floor, Corintia

Algorithms for Mathematical Programs with Equilibrium Constraints

Sponsor: Optimization/ Nonlinear Programming
Sponsored Session

Chair: Mihai Anitescu, Argonne National Laboratory, Math and Computer Science Division, 9700 S Cass Avenue, Argonne, IL, 60439, United States, anitescu@mcs.anl.gov

1 - Global Convergence of Elastic Mode Approaches for Mathematical Programs with Equilibrium Constraints
Mihai Anitescu, Argonne National Laboratory, Math and Computer Science Division, 9700 S Cass Avenue, Argonne, IL, 60439, United States, anitescu@mcs.anl.gov

We study global convergence properties of elastic mode approaches to MPEC, which involve generating an (exact or inexact) first- or second-order point of the formulation. We establish conditional finite or asymptotic convergence to points having a certain stationarity property, such as strong stationarity. In particular, our analysis and the numerical evidence show that exact complementarity can be achieved finitely even when the elastic-mode formulation is solved inexactly.

2 - MPEC Approaches to Moral-Hazard Problems
Che-Lin Su, Northwestern University, CMS-EMS, Kellogg School of Management, Evanston, IL, 60208, United States, clsu@stanford.edu, Kenneth Judd

We introduce MPEC approaches to moral-hazard problems. To avoid local solutions for the MPEC formulation, we propose a hybrid procedure that combines the best features of the MPEC and the LP lottery approaches. The numerical results on an example show that the hybrid procedure outperforms the LP approach in both computational time and solution quality in terms of the optimal objective value.

3 - Practical Penalty Methods
Gabriel Lopez-Calva, Northwestern University, 2145 Sheridan Road C210, Evanston, IL, 60201, United States, g-lopez-calva@northwestern.edu, Jorge Nocedal

We study practical penalty methods as an effective tool for regularizing both active-set and interior methods. We propose a practical updating strategy to handle the penalty parameter that promotes feasibility at every iteration. The method improves on the infeasibility detection capabilities of practical algorithms and can be coordinated with a barrier scheme. We present numerical results.

■ WB39

R - 3rd Floor, Aragon

Benchmarking and Performance Evaluation in Operations Management

Contributed Session

Chair: Earl Lee, Research Associate, Rensselaer Polytechnic Institute, CII 5107, 110 Eighth St, Troy, NY, 12180, United States, leee7@rpi.edu

1 - Management Efficiency Index: A Benchmark for Comparing Airline's Management Efficiency
Barbara Wonseon Son, faculty, Pepperdine University, 6100 Center Dr., Los Angeles, CA, 90045, United States, Barbara.Son@pepperdine.edu, Thomas Wedel

This paper takes an innovative approach to develop a management efficiency index (MEI) to use as a standard for comparing airlines' management efficiency. Performance measures that combine key strategic dimensions are essential for managers to evaluate their whole strategy. The MEI index incorporates the following dimensions: operational efficiency, management effectiveness, service efficiency, turnaround efficiency, sales efficiency, and profitability.

2 - Methodology for Measuring Effectiveness
Richard Bullock, US Air Force / AFIT, 2950 Hobson Way, WPAFB, OH, 45433, United States, richard.bullock@afit.edu, Richard Deckro

Measurement provides feedback on the influence of deliberate actions and correlation with strategic direction. Thus, measurement significantly influences irrevocable decisions concerning allocation of scarce resources. When objectives are abstract and/or the system ill-defined, feedback is based on effectiveness measures. This study presents a domain independent approach to measuring effectiveness. The approach is derived from Measurement Theory, Measure Theory, and new effect paradigms.

3 - Benchmarking in Tourism Destination, Keeping in Mind the Sustainable Paradigm

Valentina Bosetti, Dr, Fondazione ENI Enrico Mattei, c.so Magenta 63, Milano, MI, 20123, Italy, valentina.bosetti@feem.it, Mariaester Cassinelli, Alessandro Lanza

Tourism destination benchmarking and the assessment of tourism management performances are a crucial and challenging task in the direction of controlling tourism sustainability and reshaping tourism activities. In this paper we assess and compare tourism destinations (the twenty Italian regions), not only in terms of tourism services supply, but also in terms of the performance of environmental management. The proposed efficiency assessment procedure is based on Data Envelopment Analysis (DEA)

4 - The Interdependent Layered Network Model for Protection of Critical Infrastructures

Earl Lee, Research Associate, Rensselaer Polytechnic Institute, CII 5107, 110 Eighth St, Troy, NY, 12180, United States, leee7@rpi.edu, William Wallace, David Mendonca, John Mitchell

The Interdependent Layered Network (ILN) mathematical model can be used to identify vulnerability, taking interdependency into account, and suggest alternative strategies for protection of infrastructure systems. The ILN model can support response and restoration following disruptions, facilitates analyses of threat scenarios and supports emergency preparation and training activities.

■ WB40

R - 3rd Floor, Barcelona I

Shortest Path and Maximum Flow Problems

Contributed Session

Chair: Douglas Shier, Professor, Clemson University, Dept. of Mathematical Sciences, Clemson, SC, 29634, United States, shierd@clemson.edu

1 - Lagrangian Relaxation and Enumeration for Solving Constrained Shortest-Path Problems

Johannes O. Royset, Research Assistant Professor, Naval Postgraduate School, Operations Research Department, 1411 Cunningham Rd, Monterey, CA, 93943, United States, joroyset@nps.edu, Matthew Carlyle, Kevin Wood

We solve the constrained shortest-path problem by Lagrangianizing the side constraints, optimizing the resulting Lagrangian function, and closing any duality gap by enumerating near-shortest paths. Empirically, the procedure proves to be significantly faster than the competition. With few exceptions, we solve problems with millions of vertices and edges, and up to ten side constraints, in seconds.

2 - On Distributed Shortest Path Algorithms

Kevin Hutson, Assistant Professor, Denison University, Box M, Dept. of Mathematics, Granville, OH, 43023, United States, hutsonk@denison.edu, Terri Buchanan, Douglas Shier

The Bellman-Ford algorithm for shortest paths can be adapted to a parallel environment, with computations performed locally at each node to avoid reliance on a central controller. This paper discusses the behavior of the distributed Bellman-Ford and alternative algorithms in a dynamic environment, where communication link costs can change.

3 - A Network Simplex Algorithm for a Class of Infinite-Dimensional Network Flow Problems

Thomas Sharkey, Ph.D. student, ISE Department, University of Florida, 303 Weil Hall, P.O. Box 116595, Gainesville, FL, 32611-6595, United States, sharkeyt@ufl.edu, Edwin Romeijn

We develop a network simplex algorithm for solving a class of infinite-dimensional minimum cost network flow problems. We characterize extreme points of the problem that guarantee that pivots can be made in finite time and develop an integrated Phase-I/II algorithm that ensures that this characterization is maintained or discovers that the problem is infeasible. We show that our algorithm possesses cost convergence and, if the optimal solution is unique, solution convergence.

4 - A Double Scaling Algorithm for the Constrained Maximum Flow Problem

Cenk Caliskan, Assistant Professor, University of Delaware, Department of Business Administration, 211 Alfred Lerner Hall, Newark, DE, 19716, United States, caliskanc@lerner.udel.edu

The constrained maximum flow problem is to send the maximum possible flow from a source node to a sink node in a directed network with arc capacities where a budget constraint limits the total flow. Each arc has an associated cost and total cost of the flow is constrained. In this research, we present two special algorithms for the constrained maximum flow problem: a successive admissible path algorithm which is pseudo-polynomial and a double scaling algorithm which is polynomial.

5 - Label-Correcting Shortest Path Algorithms Revisited

Douglas Shier, Professor, Clemson University, Dept. of Mathematical Sciences, Clemson, SC, 29634, United States, shierd@clemson.edu, Gisela Bardossy

Various computational studies have studied shortest path algorithms, with the most efficient approaches typically depending on network structure and sparsity. We propose an explanation for the empirical behavior of label-correcting algorithms based on their "sharpness" properties as well as the "maturity" of their node labels. A new algorithm emerges which appears to be fairly robust over a range of network structures and densities.

■ WB41

R - 3rd Floor, Barcelona II

Special Topics in Optimization I

Contributed Session

Chair: Jean-Louis Goffin, Prof, McGill University, 1001 Sherbrooke Ouest, Montreal, Qc, H3A1G5, Canada, jean-louis.goffin@mcgill.ca

1 - Trust Region Models for Derivate Free Optimization in Environmental Engineering

Stefan Wild, Cornell University, School of Operations Research and IE, Rhodes Hall 257, Ithaca, NY, 14853, United States, stefan@orie.cornell.edu, Christine Shoemaker

Computationally expensive functions whose derivates are unavailable are abundant in modern engineering applications. The high cost of a function evaluation renders standard derivative estimation techniques, and hence classical nonlinear programming methods, impractical. In the last decade, many researchers have independently proposed algorithms for solving local optimization of such problems using a trust region approach. We unify this theory and apply it to groundwater remediation problems.

2 - Mitigating the Detrimental Effects of E-mail Overload: A Stochastic Optimization Approach

Chetan Yadati, Graduate Research Assistant, Oklahoma State University, School of IE and Mgmt, 322, Engineering North, Stillwater, OK, 74078, United States, chetan.yadati@okstate.edu, Manjunath Kamath, Ramesh Sharda, Robert Greve, Ashish Gupta

The ubiquitous use of e-mail for both formal and informal communication has led to new challenges for knowledge workers who are expected to process them in a timely manner in addition to performing their regular tasks. We present an exploratory approach based on stochastic dynamic programming techniques for deriving optimal email processing policies to mitigate the detrimental effects of e-mail overload on the efficiency of knowledge workers.

3 - Process Flexibility Revisited: Graph Expander and Food-From-The-Heart

Huan Zheng, National University of Singapore, National University of Singapore, Singapore, Singapore, zhenghuan@nus.edu.sg, Mabel Chou, Chung-Piaw Teo

Process Flexibility is a widely used strategy to handle the uncertain environment. We study how a process flexibility structure should be designed. We show that flexibility structures are closely connected to graph expander theory and give a precise mathematical proof of the existence of sparse flexibility structures having good performances.

4 - Arrival Rate Approximation by Nonnegative Cubic Splines

Farid Alizadeh, MSIS & RUTCOR, Rutgers University, 640 Bartholomew Rd, Piscataway, NJ, 08854, United States, alizadeh@rutcor.rutgers.edu, Jonathan Eckstein, Gabor Rudolf, Nilay Noyan

We describe an optimization method to approximate the arrival rate ofnon-homogeneous Poisson process based on observed arrival data. We estimate the arrival function by cubic splines using the maximum likelihood principle. A critical feature of the model is that the splines are constrained to be everywhere non-negative. We formulate this constraint using a characterization of nonnegative polynomials by positive semidefinite matrices. Results from e-mail arrivals will be presented.

5 - Condition Numbers: Then and Now

Jean-Louis Goffin, Prof, McGill University, 1001 Sherbrooke Ouest, Montreal, Qc, H3A1G5, Canada, jean-louis.goffin@mcgill.ca

We will look at the history of condition numbers going back to Block and Levin, Rosenblatt, Minsky and Papert (and to some extent this author), and attempt to relate and possibly integrate it with the newer developments in this field.

■ WB42

R - 4th Floor, Parc Ballroom I

Panel Discussion: ETMERC - Engineering and Technology Management Education and

Sponsor: Technology Management
Sponsored Session

Chair: Dundar F. Kocaoglu, Portland State University, Department of Engineering and Technology, Portland, OR, 97207, kocaoglu@etm.pdx.edu

1 - Panel Discussion: ETMERC - Engineering and Technology Management Education and Research Council
Moderator: Dundar F. Kocaoglu, Portland State University, Department of Engineering and Technology, Portland, OR, 97207, kocaoglu@etm.pdx.edu, Panelists: William Flannery, Antonie de Klerk, Tinus Pretorius, Anthony Bailetti, John Aje

ETMERC (Engineering and Technology Management Education & Research Council) was established in 2003 to address educational and research issues common to all educational institutions in this field. The Council is made up of the educational department/program heads and their designees. The activities include conducting benchmark studies, developing curriculum guidelines, establishing quality criteria, defining research agenda among others. ETMERC will be explained; its activities will be described; and an open discussion will be held on strategic issues, future directions and members' pro-active roles in defining the field and bringing it to higher levels of recognition and visibility.

■ WB43

R - 4th Floor, Parc Ballroom II

Open Source, Open Data, and Open Standards

Sponsor: INFORMS Computing Society/ Optimization Services and Open Source Software
Sponsored Session

Chair: Robin Lougee-Heimer, IBM Research, TJ Watson Research Center, 1101 Kitchawan Road, Yorktown Heights, NY, 10598, United States, robinlh@us.ibm.com

1 - OSU's Open Source Lab: How We Got to Open Source
Scott Kveton, Associate Director, OSU Open Source Lab, Oregon State University, Kerr Administration A008, Corvallis, OR, 97331, United States, scott@osuosl.org

OSU's Open Source Lab (OSL) has leveraged open source like no other University to help solve its IT problems and attract talent. Come learn how OSU "got to open source" and how it is changing how we do business more and more everyday. The OSL is doing software development on projects such as Kuali (http://kuali.org) and also provides hosting for projects such as the Mozilla Foundation, Gentoo Linux and the Freenode IRC network.

2 - How to Publish your Code on COIN-OR
Robin Lougee-Heimer, IBM Research, TJ Watson Research Center, 1101 Kitchawan Road, Yorktown Heights, NY, 10598, United States, robinlh@us.ibm.com

We review the processes and decisions involved in contributing to a COIN-OR project or "publishing" your own open-source code, data, and models in the COIN-OR repository. Common misconceptions regarding licenses, code ownership, and open-source will be discussed and your questions discussed.

3 - CoinMP: Simple C-API Windows DLL implementation of CLP, CBC, and CGL
Bjarni Kristjansson, Maximal Software, Suite 700, 2111 Wilson Boulevard, Arlington, VA, 22201, United States, bjarni@maximalsoftware.com

The COIN Open Source Initiative has become very popular in the recent years. To make life easier for users that simply want to solve models and not compile C++ applications, we have developed standard C-API Windows DLL CoinMP.DLL that implements most of the functionality of CLP, CBC, and CGL.

■ WB45

R - 4th Floor, Raphael

Improving Warehouse Operations

Sponsor: Transportation Science & Logistics
Sponsored Session

Chair: John Bartholdi, Professor, Georgia Institute of Technology, 765 Ferst Drive, Atlanta, GA, 30332-0205, United States, john.bartholdi@isye.gatech.edu

1 - Stocking Quantities in a Forward Pick Area for Small Parts
John Bartholdi, Professor, Georgia Institute of Technology, 765 Ferst Drive, Atlanta, GA, 30332-0205, United States, john.bartholdi@isye.gatech.edu, Steve Hackman

Industry practice is to give each stockkeeping unit equal space in the forward pick area or else to give each sku equal time supplies (for example, 2 weeks supply). We show that neither strategy is labor efficient and, in fact, they are equally bad and can be much worse than optimum.

2 - Modeling the Pick-Face Blocking Phenomenon in a Batch Picking System
Pratik Parikh, PhD Candidate, Virginia Tech, 250 Durham Hall (0118), Blacksburg, VA, 24060, United States, pparikh@vt.edu, Russell Meller

In a batch picking system, when two or more pickers pick items simultaneously in an aisle, there is a possibility that atleast two pickers need to pick at a pick-face in that aisle. As a result, one picker might pick while the other picker(s) would be blocked. This is termed as pick-face blocking. We have developed analytical models to estimate pick-face blocking for the case when the aisles are wide enough to allow passing.

3 - Small Parts Order-Picking Systems Design
Margarit Khachatryan, Georgia Institute of Technology, 765 Ferst Drive NW, Atlanta, GA, 30332-0205, United States, maga@isye.gatech.edu, Leon McGinnis

Queuing network-based models are developed and used to analyze both manual and automated small parts order-picking systems. The systems analyzed used state-of-the-art technologies for decoupling the retrieval of parts from assembly of orders. Impacts of key system parameters are investigated.

■ WB46

R - 4th Floor, Rubens

General Transportation Dynamics

Sponsor: Transportation Science & Logistics
Sponsored Session

Chair: Fan Yang, Transportation Research Analyst, ESRI, Inc, 380 New York St, Redlands, CA, 92373, United States, fyang@esri.com

Co-Chair: Monica-Gabriela Cojocaru, Assist. Professor of Mathematics, University of Guelph, Dept. of Mathematics and Statistics, MacNaughton Bldg., 548, Guelph, ON, N1G 2W1, Canada, mcojocar@uoguelph.ca

1 - The Dynamic System of the Traffic Assignment Problem
Wenlong Jin, UC Irvine, 522 Social Science Tower, Irvine, CA, 92687, United States, wjin@uci.edu

Based on a definition of First-In-First-Out violation, we propose a dynamic model of changing path flows in a transportation network. We then prove that, for static, symmetric traffic assignment problem with fixed demand, the objective function in the mathematical programming formulation can be interpreted as the total energy of the dynamic system and user equilibria are its only globally stable equilibria. In this sense, we obtain the dynamic system of the traffic assignment problem.

2 - The Congestion Call Option
Reetabrata Mookherjee, Doctoral student, Industrial Engineering, Pennsylvania State University, 244 Leonhard Building, University Park, PA, 16802, United States, reeto@psu.edu, Terry Friesz

We introduce a European-type congestion call option to value commuting to work along a given path for a given departure time selected by automobile drivers who are Cournot-Nash non-cooperative agents competing for limited roadway capacity when telecommuting-alternative exists. We show how to compute flow patterns based on congestion call options and contrast these to user optimized flow patterns. Through numerical example we show that congestion options can lower social costs of congestion

3 - The Relationship between Traveler's Day-to-Day Stochastic Learning Process and Traffic Equilibria
Fan Yang, Transportation Research Analyst, ESRI, Inc, 380 New York St, Redlands, CA, 92373, United States, fyang@esri.com, Bin Ran

We present a general traveler's day-to-day stochastic learning process, which may converge to Wardrop user equilibrium or stochastic user equilibrium under certain choice rules. We establish the significant statement that traffic equilibria can be achieved by travelers' stochastic day-to-day learning process. The day-to-day dynamical system suggests a path-based solution algorithm to solve the general traffic equilibria and the corresponding asymmetric variational inequality.

4 - Double Layered Dynamics and Transportation
Monica-Gabriela Cojocaru, Assist. Professor of Mathematics, University of Guelph, Dept. of Mathematics and Statistics, MacNaughton Bldg., 548, Guelph, ON, N1G 2W1, Canada, mcojocar@uoguelph.ca

We present here a model of a two timescales dynamics and its application to transportation newtorks. The double layered dynamics theory (DLD) is the combination of the theory of evolutionary variational inequalities and that of inifinite-dimensional projected dynamical systems. Our timescales intrepretation will involve the concepts of persistence time of equilibrium versus adjustment time to equilibrium introduced for a certain class of DLD models.

■ WB47

R - 4th Floor, Michelangelo

Topics in Transportation Science and Logistics I

Sponsor: Transportation Science & Logistics
Sponsored Session

Chair: Pablo Durango-Cohen, Assistant Professor, Northwestern University, 2145 Sheridan Road, A335, Evanston, IL, 60208, United States, pdc@northwestern.edu

1 - Using Time Series Analysis to Model Infrastructure Performance
Chih-Yuan Chu, Graduate Student Researcher, Northwestern University, jameschu@northwestern.edu, Pablo Durango-Cohen

We propose time series analysis by state-space methods to develop incremental performance models for transportation infrastructure. The framework incorporates uncertainty of measuring and forecasting infrastructure condition, missing observations, multiple data collection technologies, intervention analysis, and unobserved heterogeneity. The framework is illustrated through analysis of empirical panel data of pavement sections.

2 - A Review of Multi-Objective Models for Closed-Loop Supply Chains
Aman Gupta, a0gupt07@louisville.edu, Suraj M. Alexander, Gerald Evans

Closed-Loop supply chains have been taken as beneficial both economically and ecologically. One of the biggest challenges in the development of closed-loop supply chains is the integration of forward supply chain and reverse supply chain. This paper will review some of the Multi-Objective Models that deal with the integration of forward and reverse supply chains.

3 - Integrated Planning for Small Package Carriers
Amy Cohn, University of Michigan, 1205 Beal Avenue, Ann Arbor, MI, 48109-2117, United States, amycohn@engin.umich.edu, Alex Wang, Sarah Root

Small package delivery is a multi-billion dollar industry with many complex, inter-related planning decisions. Planning is typically decomposed into sub-problems for tractability, impacting solution quality. We integrate two key sub-problems to improve solution quality. We present a novel modeling approach and computational results from a major U.S. package carrier.

4 - Probabilistic Programming Models for Vehicle Dispatching and Resource Allocation in TIM
Melike Baykal-Gursoy, Associate Prof., Rutgers, The State University of NJ, I&SE Dept., 96 Frelinghuysen Rd., Piscataway, NJ, 08855-8018, United States, gursoy@rci.rutgers.edu, Weihua Xiao, Kaan Ozbay, W. Iyigum

We propose mathematical programming (MP) models with probabilistic constraints in order to address incident response and resource allocation problems for traffic incident management. An IP model with probabilistic constraints is proposed to address the dispatching problem with consideration given to the stochastic resource requirements at incident sites. We introduce an MP model to determine the number of service vehicles allocated to each depot to meet the requirements of potential incidents.

■ WB48

R - 4th Floor, Dante

OR/MS Modeling of Healthcare Applications

Contributed Session

Chair: Xiuli Qu, Ph.D. Candidate, Purdue University, 315 N. Grant Street, West Lafayette, IN, 47907, United States, qu@ecn.purdue.edu

1 - A Robust Approach to Radiotherapy Planning with Uncertainty
Timothy Chan, MIT, 77 Massachusetts Ave., E40-130, Cambridge, MA, 02139, United States, tcychan@mit.edu, Thomas Bortfeld, David Craft, John Tsitsiklis

We consider the problem of radiotherapy treatment planning with uncertainties introduced by intra-fractional motion. We propose a robust optimization formulation for this problem and demonstrate computational results, comparing various approaches. We will also discuss the related issue of using clinical data to create a model of data uncertainty that is used in the optimization.

2 - Effects of Reservation Level for Urgent cases on Delay Measure of a Primary Health Care Practice
Sameer Hasija, Simon School, University of Rochester, University of Rochester, Rochester, NY, United States, hasijas1@simon.rochester.edu, Gregory Dobson, Edieal Pinker

We examine the effect of reserving slots for urgent cases in a primary health care practice on two service quality measures: the average number of urgent cases that are not handled during normal hours and on the average queue of non-urgent cases. We model two scenarios depicting the scheduling of a practice with a stochastic dam model. Our results suggest that the practice will perform better on our two measures if it schedules patients according to an approach known as Open-Access.

3 - Integrated Scheduling Model for Critical Care Facilities in Public Hospitals
Sam McHardy, Queenskland University of Technology, GPO BOx 2434, Brisbane, Ql, 4001, Australia, sr.mchardy@student.qut.edu.au, Erhan Kozan, David Cook

Waiting lists for elective surgery is one of the major issues for hospitals. A system would determine patient scheduling and sequencing for a specified period of time, taking into account weekly variations in bed numbers and also being able to handle emergency arrivals. We aim to accommodate emergency arrivals with minimal impact to the existing schedule by using robust scheduling techniques. At the same time the utilisation of the ICU beds needs to be kept at a consistently high level.

4 - Parallel Execution in IMRT Intensity Map Segmentation Leads to Improved Results and Execution Times
Kelly Sorensen, Graduate Research Assistant, UW-Madison Computer Sciences, 1210 W. Dayton Street, Madison, WI, 53706, United States, kjs@cs.wisc.edu, Robert Meyer, Laura Goadrich

Benefits of using parallel execution (via Condor) for IMRT Intensity Map segmentation include reduced execution and clinical treatment times. Two methods of parallelization were implemented: (1) Partition the Intensity Map and solve in parallel; the upper and lower apertures are matched in post-processing using a max-matching algorithm for bipartite graphs. (2) 100 good quality apertures are selected; the residual Intensity Maps are processed in parallel and the best segmentation is chosen.

5 - Matching Provider Capacity with Patient Demand in Advanced Access Scheduling Systems
Xiuli Qu, Ph.D. Candidate, Purdue University, 315 N. Grant Street, West Lafayette, IN, 47907, United States, qu@ecn.purdue.edu, Julie Ann Williams

Advanced access scheduling, was introduced in the early 1990s to improve appointment scheduling in the U.S healthcare practices. The successful implementation of open access scheduling in a clinic requires the match of healthcare demand and provider capacity over time. We present a new guideline to match healthcare provider capacity with patient demand at the operational level for an advanced access scheduling system.

■ WB49

R - 4th Floor, Medici

Optimization for Radiation Therapy Treatment Planning

Cluster: Health Care
Invited Session

Chair: Edwin Romeijn, Associate Professor, University of Florida, 303 Weil Hall, P.O. Box 116595, Gainesville, FL, 32611-6595, United States, romeijn@ise.ufl.edu

1 - Fluence Map Optimization via Interior Point Method
Gino Lim, Assistant Professor, University of Houston, Department of Industrial Engineering, E206 Engineering Bldg 2, Houston, TX, 77204, United States, ginolim@uh.edu

We present a primal-dual interior point algorithm for optimizing the fluence map for Intensity Modulated Radiation Therapy (IMRT). Numerical results show that this method is not only easy to use, but practical for planning treatments for cancer patients.

2 - High Throughput Computing for Radiation Treatment Planning Optimization
Robert Meyer, UW-Madison Computer Sciences, 1210 West Dayton St, Madison, WI, 53706, United States, rrm@cs.wisc.edu, Warren D'Souza, Leyuan Shi

High Throughput Computing (HTC) via the freely distributed Condor software developed at UW-Madison allows the efficient utilization of idle resources associated with multiple workstations within a local area network. We discuss how such resources may be employed in a clinical setting to facilitate a radiation treat-

ment planning paradigm shift from the current sequential plan/review/modify process to a faster and more effective parallel multi-plan/select framework.

3 - A Response Surface Approach to Integrated Beam Orientation and Fluence Map Optimization for IMRT

Dionne Aleman, University of Florida, 303 Weil Hall, Gainesville, FL, 32605, United States, daleman1@ufl.edu

We view the beam orientation optimization problem in IMRT treatment planning as a global optimization problem with expensive objective function evaluations (each of which involves solving a fluence map optimization problem). We propose a response surface method that, in contrast with other approaches, allows for the generation of problem data only for promising beam orientations as the algorithm progresses, enabling the consideration of non-coplanar in addition to coplanar beam orientations.

■ WB50

R - 4th Floor, Cervantes

Decision Analysis Arcade II

Sponsor: Decision Analysis
Sponsored Session

Chair: Eric Bickel, Assistant Professor, Department of Industrial and Systems Engineering, Texas A&M University, 236B Zachry Engineering Center, 3131 TAMU, College Station, TX, 77843-3131, United States, ebickel@tamu.edu

1 - Value of Information is Highest when You are Undecided

Philippe Delquié, INSEAD, Boulevard de Constance, Fontainebleau, 77305, France, philippe.delquie@insead.edu

Value of Information is shown to obey a simple, general principle: it is maximum whenever the decisionmaker is indifferent between the choice alternatives, and decreases as the utility difference between choice alternative increases. This result provides intuition about nonmonotonic relationships observed between VOI and decision setting parameters, particularly risk aversion.

2 - Disappointment without Prior Expectation

Alessandra Cillo, Ph.D. student, DS, INSEAD, Boulevard de Constance, Fontainebleau, 77305, France, alessandra.cillo@insead.edu, Philippe Delquié

By making more realistic assumptions about the psychology of disappointment, we obtain a richer model, shown to be equivalent to Rank Dependent Expected Utility in some cases, and to mean-variance in others.

3 - Problems with Utility Theory

Jonathan Barzilai, Dalhousie University, P.O. Box 1000, Halifax, NS, B3J 2X4, Canada, barzilai@scientificmetrics.com

We establish that the operations of addition and multiplication are not applicable to utility scales or to any scales based on the classical theory of measurement. We also demonstrate that the interpretation that is needed to construct utility scales leads to an intrinsic contradiction.

4 - Do Decision Analysis Students Adhere to the Rules?

Russ Garber, Doctoral Candidate, Stanford University, 736 escondido road apt 207, Stanford, CA, 94305, United States, rgarber@stanford.edu

Dominance and invariance are essential to the rules of rational decision making. Loss aversion, the sure thing principle, and the conjunction fallacy are all well known effects that cause deviations from 'the rules.' In a survey administered to an experienced group of decision analysis students, results surprisingly showed these same effects. The results are discussed here, as well as other survey items indicating that DA students suffer from projection bias in predicting risky choice behavior.

Wednesday, 1:30pm - 3:00pm

■ WC01

H - Lobby Level, Plaza A

Tutorial: The COIN-OR Branch and Cut Solver

Cluster: Tutorials
Invited Session

1 - Tutorial: The COIN-OR Branch and Cut Solver

Robin Lougee-Heimer, IBM Research, TJ Watson Research Center, 1101 Kitchawan Road, Yorktown Heights, NY, 10598, United States, robinlh@us.ibm.com

The Computational Infrastructure for Operations Research (COIN-OR) Branch and Cut solver (CBC) is an open-source mixed-integer program solver. CBC provides operations research professionals with a well-tested, robust, re-useable code base for experimenting with advanced customizations of branch-and-cut algorithms. This tutorial introduces CBC, and illustrates how to implement a variety of common branch-and-cut customizations in CBC.

■ WC02

H - Lobby Level, Plaza B

Business Applications I

Contributed Session

Chair: Narasimhan Ravichandran, Professor, Indian Institue of management, Vastrapur, Ahmedabad, Gu, #80015, India, nravi@iimahd.ernet.in

1 - Optimizing the Network of a Large Automotive Component Distributor

Brijesh Rao, Graduate Research Assistant, Texas A&M University, Department of Industrial Distribution, (Doctoral Student in Ind Eng Dept), College Station, TX, United States, brijtv@tamu.edu, Barry Lawrence, Senthil Gunasekaran, Praveen Kuttava

The distributor has branches across the USA, and our project with this distributor required us to find out if a hub-and-spoke system would lead to lower costs while maintaining effective service. We present a two-stage analysis, with a network model as the first stage, and a post-optimization inventory analysis as the second stage. We describe how sales retention issues, product stratification (ABC analysis), and safety stock and service level issues are factored into this analysis.

2 - A Neuro-Dynamic Programming Approach to Developing Decision Strategies in a Stochastic Environment

Jules Comeau, Student, Dalhousie University, 37 Braemar Dr., Moncton, NB, E1A 3S7, Canada, jcomeau5@dal.ca, Eldon Gunn

In forestry, most whole stand models use three dimensional state descriptors. The discretization of this state space becomes a major issue when using dynamic programming (DP) in developing optimal harvest policies. This paper shows the application of a modern dynamic programming approach using radial basis approximations to the cost-to-go function in developing single species, even-aged decision policies in a stochastic environment.

3 - Dynamic Open Access Scheduling for Outpatient Clinics: Simulation Study

Sangbok Lee, School of Industrial Engineering, Purdue University, West Lafayette, IN, 47907, United States, lee309@purdue.edu, Christopher Suelzer, Yuehwern Yih, Bradley Doebbeling, Debra Thayer

Open Access scheduling has been adapted to tackle problems of the traditional outpatient clinic scheduling approach, e.g., long delay for appointments, high rate of no-shows and cancellations. However, the strict Open Access won't perform well under high variance of patient demands. In this paper, we propose a dynamic Open Access approach to adjust best policies according to the system current status, and an indicator to track system stability.

4 - Applying Quality Improvement to Healthcare: Reducing Waiting Time and Variability in Patient Flow.

John Norris, Doctoral Student, Purdue University, 403 W. State Street, West Lafayette, IN, 47907-2056, United States, norrisjb@purdue.edu, Steve Shade, Suresh Chand, PhD, Deanna Willis, MD, Herbert Moskowitz, PhD

Manufacturing techniques for improving quality, such as Six Sigma and Lean have similar benefits in healthcare environments, as shown in a clinic in Indianapolis. A traditional scheduling system running under capacity and an open access system running near capacity are modeled and compared. Design of Experiment techniques show that the insights of various factory physics techniques from traditional manufacturing disciplines can be applied to healthcare with similar benefits.

5 - Excellence In Project Management: Lessons from Amalgamtion of Banks

Narasimhan Ravichandran, Professor, Indian Institue of management, Vastrapur, Ahmedabad, Gu, #80015, India, nravi@iimahd.ernet.in

The present contribution is based on a case study related to the merger of two giant mutinatonal banks operated in India.The merger is considered as great success story in the Indian Banking circles.We treat this activity as a project and draw some lessons related to structure, planning, monitoring, bugeting, scheduling, productivity, leadership and risk management.The insights of his study are applicable to a large extent to soft projects as well.

■ WC03

R - 3rd Floor, Sienna II

Decision-Making in Supply Chains II

Contributed Session

Chair: Arnab Bisi, Professor, Purdue University, 403 State St, W. Lafayette, IN, 47906, United States, abisi@purdue.edu

1 - Purchasing under Asymmetric Cost and Demand Information

Dimitris Kostamis, University of Michigan, Industrial and Operations Engineering, 1205 Beal Ave., Ann Arbor, MI, 48109-2117, United States, dkostami@umich.edu, Izak Duenyas

We consider a game-theoretic setting with one supplier and one OEM who faces stochastic demand for a final product that requires assembly of two major components, one of which can only be purchased from an exclusive supplier. We characterize the supplier's optimal menu of contracts in the presence of OEM's demand and cost information asymmetry, and we provide conditions under which the OEM prefers to announce in advance part of his private information.

2 - Facility Location Under Economies of Scale and Uncertain Demand

Asgeir Tomasgard, Associate Professor, SINTEF Technology & Society, S.P.Andersens veg 5, Trondheim, 7465, Norway, Asgeir.tomasgard@sintef.no, Peter Schütz, Leen Stougie

This paper adresses facility location under uncertain demand and economies of scale. The methodology used is stochastic integer programming. The costs of operating the facilities are subject to economies of scale. These costs can be split into two parts: firstly the costs of investing in a facility as well as maintaining and operating it with strictly diminishing average costs, and secondly linear transportation cost.

3 - Impact of Early Forecast Information Sharing on Manufacturers Cost with Capacity Uncertainty

Ratna Babu Chinnam, Associate Professor, Wayne State University, 4815 Fourth Street, Industrial & Mfg. Engineering Department, Detroit, MI, 48202, United States, r_chinnam@wayne.edu, Pundarikaksha Baruah

Impulses in sales or demand induced by actions such as price adjustments, promotions or other marketing efforts are normally considered "atypical" behaviors; they are non-recursive and do not follow a discernible pattern over time. In this research, we show that there is opportunity to better plan production if information regarding these "atypical" demands are shared and used properly.

4- The Location-Routing Problem with Inventory Control Considerations

Selcuk Savas,Koc University, College of Engineering, Istanbul, Turkey, ssavas@ku.edu.tr, Zeynep Orman, Metin Turkay

We consider the multi-depot location-routing problem (MDLRP) with inventory control decisions. One type of product is sent from a single plant via warehouses to a set of customers each with uncertain demand. The decisions are to determine the location of depots, the optimal set of vehicle routes between depots and customers, quantity shipped from the plant to depots and the inventory level at each depot. A modified version of a two-phase tabu search algorithm is used to solve the problem.

5 - Dynamic Coordination Mechanism in a Supply Chain with Unknown Retail Demands

Arnab Bisi, Assistant Professor, Purdue University, 403 W. State Street, Krannert School of Management, West Lafayette, IN, 47907-2056, United States, abisi@mgmt.purdue.edu, Maqbool Dada

We address a finite-horizon two-echelon supply chain with one supplier and multiple retailers. Retailers periodically update their demand distributions that involve unknown parameters. We investigate how the decision maker can design a dynamically changing supply contract that will achieve channel coordination for the decentralized system.

■ WC05

H - 6th Floor, Powell B

Issues in Supply Chain Management II

Contributed Session

Chair: Jing-Sheng Song, Professor, Duke University, The Fuqua School of Business, 1 Towerview Drive, Durham, NC, 27708, United States, jssong@duke.edu

1 - Designing Distribution Channel for an Innovative Durable Product

Xiuli He, PhD Candidate, The University of Texas at Austin, 1632 w 6th st, Apt#P, Austin, TX, 78703, United States, xiuli.he@phd.mccombs.utexas.edu, Genaro Gutierrez

Consider a manufacturer who is about to launch an innovative durable good. On the demand side, we propose a generalized Bass model to estimate the demand dynamics of the innovative product. We generalize Bass model by incorporating the impact of the price and retailer competition on the demand diffusion process. On the supply side, we consider four distribution systems. We study the optimal dynamic decisions, such as pricing and production strategies made within various distribution systems.

2 - Production Coordination in a Global Supply Chain

Gang Wang, PhD Candidate, Wayne State University, 4815 Fourth Street, IME Building, Detroit, MI, 48202, United States, wanggang@wayne.edu, Jia Shu

We study a multi-stage job allocation problem for a global company with outsourcing options at each stage of production. We consider the trade off between shipment and production costs in such a system.The problem is to determine the job at each stage should be allocated to which plant for processing.The objective is to minimize the total production and shipment costs.

3 - Factors Influencing Component Sourcing Decisions for Mid-Volume, Moderately Complex Products

Kevin Caskey, Assoc Prof, State Univ of New York at New Paltz, 75 S. Manheim Blvd, SBB 146, New Paltz, NY, 12561, United States, caskeyk@newpaltz.edu

High volume, or relatively simple items (e.g. computer components and shoes) are often obtained from lower labor cost countries. Low volume or complex items, (e.g. industrial robots or aircraft) are frequently fabricated in countries with high labor costs. Mid-volume, moderately complex items (e.g. bicycles and skis) span the breakpoints on these continua. Factors influencing sourcing decisions for these products may include design complexity, production volume, and frequency of design changes.

4 - Quantifying the Value of Channel Coordination: Analytical and Numerical Results

Aysegul Toptal, Assistant Professor, Bilkent University, Department of Industrial Engineering, Ankara, 06800, Turkey, toptal@bilkent.edu.tr, Sila Cetinkaya

We investigate the cost improvement rate under channel coordination, both analytically and numerically, with and without explicit transportation considerations. We report that the average cost improvement rates are greater under explicit transportation considerations represented by generalized replenishment costs. We also document that our analytical results for the case without generalized replenishment costs prove to be useful for a careful numerical investigation.

5 - Turnkey or Inhouse Consignment: Who Benefits and When?

Yulan Wang, Duke University, 1 Towerview Dr., Durham, NC, 27708, United States, yulan.wang@duke.edu, Pengfei Guo, Jing-Sheng Song

We study a three-tier supply chain consisting of an OEM, a contract manufacturer (CM) and a supplier under two outsourcing structures: inhouse consignment and turnkey. We identify the CM's information distortion behavior and derive each party's best-response function. From those we investigate the impact of these structures on the individual party's as well as the entire chain's performances.

■ WC06

H - Ballroom Level, Imperial B

Coordination in Reverse Supply Chains

Cluster: Reverse Supply Chains

Invited Session

Chair: Gilvan Souza, Assistant Professor, University of Maryland, Smith School of Business, College Park, MD, 20742, United States, gsouza@rhsmith.umd.edu

1 - Supply Chain Coordination for False Failure Returns

Gilvan Souza, Assistant Professor, University of Maryland, Smith School of Business, College Park, MD, 20742, United States, gsouza@rhsmith.umd.edu, Mark Ferguson, V. Daniel Guide

False failure returns are products that are returned by consumers to retailers with no functional or cosmetic defect. The cost of a false failure return is significant, and is incurred primarily by the manufacturer. Reducing false failure returns, however, requires effort primarily by the retailer, for example informing consumers about the exact product that best fits their needs. We address the problem of reducing false failure returns via supply chain coordination methods.

2 - Value of Information in Closed Loop Supply Chains

Michael Ketzenberg, Assistant Professor, Colorado State University, College of Business, 218 Rockwell Hall, Fort Collins, CO, 80523, United States, Michael.Ketzenberg@business.colostate.edu, Erwin van der Laan, Ruud Teunter

We explore the value of information(VOI) for a firm that faces uncertainty with respect to demand, product return, and product recovery. Our objective is to evaluate the absolute and relative VOI for each type of information that such a firm may choose to invest in order to reduce the uncertainty it experiences. We test an analytical model that is predictive of 1) the value of each type of information, 2) sensitivity of the VOI, and 3) the relative value for each type of information.

3 - Remanufacturing Operations Management: Processing the Right Products in the Right Locations

Michael Galbreth, PhD Candidate, Vanderbilt University, Owen Graduate School of Management, 401 21st Avenue South, Nashville, TN, 37203, United States, michael.galbreth@owen.vanderbilt.edu, Joseph Blackburn

The disposition decision is a critical step in remanufacturing operations. During sorting, each used product is evaluated and an appropriate action is determined. We examine the issues of how many used products to acquire, which ones to remanufacture, and where to remanufacture given a multi-facility configuration with location/labor cost tradeoffs.

4 - Procurement Competition in Remanufacturing

Pranab Majumder, Assistant Professor, Duke University, Fuqua School of Business, Durham, NC, 27708, United States, majumder@duke.edu, Harry Groenevelt

We examine the nature of competitive behaviour by OEMs and local remanufacturers when the focus of competition occurs in procuring used items from consumers. We construct a multi-period model, examine conditions under which local remanufacturers act myopically, and characterise the competitive equilibrium. We end by presenting comparative static results for the game.

■ WC07

H - Ballroom Level, California

Information System Development Strategies

Contributed Session

Chair: David Heimann, Professor, University of Massachusetts Boston, MSIS Department, 100 Morrissey Blvd., Boston, MA, 02125, United States, david.heimann@umb.edu

1 - A Decision-Analytic Approach to Determining Mobile Enterprise Readiness

Rahul Basole, Graduate Student, Tennenbaum Institute, Industrial and Systems Engineering, Georgia Institute of Technology, Atlanta, GA, 30332, United States, rbasole@isye.gatech.edu

Enterprise adoption of mobile ICT solutions is a complex decision. This paper presents a conceptual framework that identifies critical adoption factors and their relationships, and determines an enterprise's mobile readiness in terms of its preparedness and potential for mobile ICT solutions using a decision-analytic approach. This paper enhances our understanding of mobile enterprise opportunities and facilitates the development of appropriate mobility strategies.

2 - ASPs versus MOTS Software Solutions

Dan Ma, Simon Business School, University of Rochester, Rochester, NY, 14627, United States, mada@simon.rochester.edu, Avi Seidmann

As an alternative to the modifiable off-the-shelf (MOTS) solution, Application Service Providers (ASPs) deliver software and services via the Internet. We study firms' choice between the ASP and the MOTS when the demand for the software is stochastic. We show when the two models will coexist in a competitive market, and when one will dominate. We find that the ASP's competitive advantages increase with demand volatility, and that reducing integration costs is a key determinant for ASPs' success.

3 - Managing Business Process Sourcing for Success: An Empirical Analysis

Ling Ge, University of Texas at Austin, Dept of IROM, University of Texas at Austin, Austin, TX, 78712, United States, geling@mail.utexas.edu, Prabhudev Konana

Promises of sourcing business processes from external vendors and/or offshore locations have not realized yet. The study investigates how firms' capabilities of making appropriate sourcing decision ex ante and capabilities of managing adaptation ex post affect the performance of business processes. Models that account for the two stages, sourcing decision making and management afterwards, and the complexity of performance measurement for knowledge intensive business processes will be presented.

4 - Metrics and Databases for Agile Software Development Projects

David Heimann, Professor, University of Massachusetts Boston, MSIS Department, 100 Morrissey Blvd., Boston, MA, 02125, United States, david.heimann@umb.edu

Agile software development processes often do not carry out enough measurement for a reliable process that can maintain agility's promise. The metrics process should have two parts; one for development and one for coordination. We outline such a two-pronged approach and describe its use for a sample agile development.

■ WC08

H - Ballroom Level, Imperial A

Modeling Call Center Applications

Sponsor: Manufacturing & Service Oper Mgmt
Sponsored Session

Chair: Zeynep Aksin, Koc University, Rumeli Feneri Yolu, Istanbul, 34450, Turkey, zaksin@ku.edu.tr

1 - Capacity Setting in Multi-Class Queues with Service Level Constraints

Fikri Karaesmen, Koc University, Rumelifeneri Yolu Sairyer, Istanbul, TR, 34450, Turkey, fkaraesmen@ku.edu.tr, Salah Aguir, Yves Dallery

Motivated by the case of a call center that sets different service levels for different classes of customers, we investigate optimal capacity setting problems for Markovian queues with multiple classes of customers. We first investigate strict priority type rules where a higher class customer always has service priority over all lower class customers. We then propose simple modifications of the strict priority rule that lead to optimal capacity levels.

2 - Call Center Outsourcing, Contract Design and Choice

Francis de Vericourt, Dr., Duke University, Fuqua School of Business, Durham, NC, 27708, United States, fdv1@mail.duke.edu, Zeynep Aksin, Fikri Karaesmen

We investigate a call center outsourcing contract choice problem, faced by an outsourcing vendor and a service provider. The service provider receives an uncertain call volume, and is considering outsourcing all or part of these calls to an outsourcing vendor. Faced with a choice between a volume-based and a capacity-based contract, the service provider determines optimal capacity levels. We partially characterize optimal capacity levels, and pricing decisions under each contract.

3 - The Value of Information-based Cross-sales Policies in Telephone Service Centers

Reynold Byers, Assistant Professor, University of California, Irvine, The Paul Merage School of Business, Irvine, CA, 92697, United States, RByers@uci.edu, Kut So

Cross-selling creates profit opportunities for a telephone service center, but can also degrade service quality. Real-time information including both customer characteristics and queuing status can be used to set an appropriate control policy. Representatives can then sell only to certain customers, during certain system states, or a combination of the two. Using analytical and numerical results we examine the use of both types of information in constructing an optimal cross-sales policy.

4 - Revenue Management through Dynamic Cross-Selling in Call Centers

Lerzan Ormeci, Assist. Prof., Koc University, Rumeli Feneri Yolu, Sariyer, istanbul, 34450, Turkey, lormeci@ku.edu.tr, Zeynep Aksin

We address the tradeoff between revenue generation and congestion in the cross-selling problem of a call center. We explore "when and to whom to cross-sell" in a dynamic framework. We show that optimal dynamic rules may target selected customers from different segments. Sufficient conditions are derived for the existence of preferred calls/classes. Dynamic and static rules are compared in numerical examples. A heuristic with sophisticated static rules is developed, which performs near optimal.

■ WC09

H - Ballroom Level, Yosemite A

Strategic Issues in Supply Chain

Cluster: Supply Chain Management
Invited Session

Chair: Shanling Li, Associate Professor, 1001 Sherbrooke Street West, Montreal, PQ, H3A 1G5, Canada, shanling.li@mcgill.ca

1 - Optimal Product Quality and Return Policy Strategies in a Reverse Supply Chain

Samar Mukhopadhyay, Associate Professor, SBA, U.of WI-Milwaukee, University of Wisconsin, P.O. Box 742, Milwaukee, WI, 53201, United States, samar@uwm.edu, Robert Setoputro

We study the relationship between product quality and the firm's return policy. Higher quality would reduce the need of return. A clearly explained and generous return policy can be used as a competitive weapon to enhance sales, but would increase cost. We develop a dynamic, profit-maximizing model to jointly obtain optimal policies for the product quality level and the return policy. Optimal policies and a number of managerial guidelines will be presented.

2 - Static and Dynamic Pricing Policies in Capacity Constrained Duopoly

Abdullah Dasci, Assistant Professor, UNC at Charlotte, Belk College of Business, UNC at Charlotte, Charlotte, NC, 28223, United States, adasci@email.uncc.edu

We present a two-firm and two period game to study the impact of different pricing policies on firm profits under competition. The firms offer homogenoues products and customers buy from the cheapest firm. Properties of equilibirium and the comparison of fixed, static, and dynamic pricing policies will be discussed.

3 - IT Outsourcing Strategy

Youxu C. Tjader, Katz Graduate SChool of Business, University of Pittsburgh, Pittsburgh, PA, 15260, United States, yotst1@katz.pitt.edu, Jen Shang

We identify appropriate IT Outsourcing strategies under different conditions. Specifically, we examine whether a firm should outsource? What business functions should be outsourced? Which type of IT supply model ought to be chosen? And finally, how should a firm select a provider from a pool of qualified candidates? Our research provides a systematic approach for the managers in dealing with complex IT outsourcing decision problems.

4 - Dynamic Joint Pricing and Inventory Control with Multiplicative Demand and Lost Sales

Yuyue Song, Faculty of Mgmt, McGill University, 1001 Sherbrooke St (W), Montreal, QC, Canada, yuyue.song@mcgill.ca, Saibal Ray, Tamer Boyaci

We consider the dynamic joint pricing and inventory control problem with multiplicative price-sensitive stochastic demand, fixed setup cost and lost sales. For the very general case with non-stationary parameters, we show that the optimal policy has an X-Y band structure. For some special cases, we show that either (s, S, P) policy or base-stock policy is optimal.

■ WC10

H - Ballroom Level, Yosemite B

Shipping, Transport, and Supply Chain Logistics: Management Aspect

Cluster: Supply Chain Management
Invited Session

Chair: John J. Liu, chair prof, hong kong polytech univ, m262, lks tower, polyu, hunghom, kln, Hong Kong, John.Jianhua.Liu@inet.polyu.edu.hk

1 - Channel Structure and Performance for Complementary Products with Price-sensitive Demand

Li Jiang, University of Michigan, Ross School of Business, 701 Tappan Street, Ann Arbor, MI, 48109, United States, ljiang@umich.edu, Yunzeng Wang

Consider n manufacturers, each producing one of a set of complementary products and selling it through a common retailer. Demand for the products is price-sensitive and uncertain. We examine how the choice of contractual arrangements among the retailer and the manufacturers affects channel and individual firms' performance.

2 - A New Model for Reverse Distribution Network in B2C Electrical Markets

Ziping Wang, Shanghai Jiao Tong University, School of Management, Shanghai, SH, China, wangziping@sjtu.edu.cn, Peiqing Huang

In this paper, one B2C firm with multi-suppliers and multi-distributions (third-party service possible) is considered. A model for reverse distribution network is proposed, where only direct reuse and repair are taken into account, to determine suitable location of collections and integrated with the analysis of inventory control in m distributions. A simulation-based algorithm is proposed and a small network is adopted to illustrate the proposed model.

3 - Vertical Information Sharing in a Supply Chain with Value-Adding Retailers

Xiaohang Yue, Assistant Professor, SBA, U.of WI-Milwaukee, University of Wisconsin, P.O. Box 742, Milwaukee, WI, 53201, United States, xyue@uwm.edu, Dong-qing Yao

We consider a supply chain consisting of one manufacturer and two value-adding retailers, and model the supply chain with a three-stage game-theoretic framework. Under certain conditions, we prove equilibrium prices exist and find when both retailers are unwilling to vertically share their private information with the manufacturer, when both retailers have incentives to reveal their cost information to the manufacturer, thus leading to a win-win situation for the whole supply chain.

4 - Strategic Decision-Making for An Optimal Number of Suppliers Under Supply and Demand Uncertainty

Seong-Hyun Nam, Associate Prof, Department of Management, College of Business, U. of North Dakota, Grand Forks, ND, 58202, United States, seong.nam@und.edu

In this paper, we analyze an optimal number of suppliers under conditions of demand and supply uncertainty. The uncertainty in demand and supply is modeled using linear stochastic differential equations. The objective is to maximize buyers expected profit over a finite planning time horizon under the uncertainty in supply and demand. We developed and demonstrate various properties of the strategic optimal policies for buyer using stochastic optimal control theory.

5 - Alignment of Information Systems and Supply Chain Management and its Performance Implications

Christina Wong, PhD Candidate, Hong Kong PolyU, Department of Logistics, Hong Kong PolyU, Hung Hom, HK, KLN, Hong Kong, lgtchris@polyu.edu.hk

One of the key issues concerning the implementation of information systems management (ISM) and supply chain management (SCM) the alignment between ISM and SCM practices however, is under-explored in the literature. Drawing on organization theory, this study examines the philosophical emphases of ISM and SCM and how they complement each other in their implementation. A research framework is developed to investigate the alignment between ISM and SCM and its performance implications.

6 - Analysis of Supply Chain's Strategic Resolutions to Order Variability under VAR Demand

Hisashi Kurata, PhD Candidate, U. Wisconsin-Milwaukee, School of Business, U. Wisconsin-Milwaukee, Milwaukee, WI, 53201, United States, hkurata@uwm.edu, John J. Liu, Dong-qing Yao

This paper analyzes the characteristics of two strategic solutions to order variability: risk pooling and bundling. We examine a system where a supplier provides parts to two manufacturers that produce their products. Our model describes customers' demands for the two products by VAR processes. We address: the magnitude of order variability; how key parameters influence the performance of variability reduction; and the managerial implication derived from our analytical results.

■ WC11

H - Ballroom Level, Yosemite C

Performance Analysis of Supply Chain Systems I

Contributed Session

Chair: Sachin Modi, Indiana University - Bloomington, 1309 East Tenth street, Kelley School of Business, BU570, Bloomington, IN, 47405, United States, smodi@indiana.edu

1 - Simulation of Replenishment Policies for Components Used in Make-to-order Final Assemblies

Vanessa Medina, Professor, Universidad Autonoma de Baja California, P.O. Box 5578, Calexico, CA, 92232-5578, United States, vmedina@uabc.mx, Paul Rogers

This paper describes a parametric simulation model for exploring replenishment policies for components used in the assembly of a range of final products. The model is driven by stochastic demand for the final products and includes the operation of the finite capacity feeder processes making the components used in the assembly of the final products. The model allows optimal policy parameters to be chosen to best meet performance goals in terms of component inventory levels and service levels.

2 - Supply Chain Disruption Management with Bayesian Update

Min Chen, McCombs School of Business, University of Texas at Austin, Austin, TX, 78712, United States, minchen@mail.utexas.edu, Yusen Xia, Sherry Wang

In this paper, we consider a manufacturer that faces possible disruptions. In a multi-period production and inventory setting, we formulate the problem as a stochastic dynamic program with information updating. We derive optimal production and inventory strategies for the manufacturer and illustrate the benefit of Bayesian update through simulation.

3 - The Efficiency of Market Based Supply Chains

Kaj Rosling, Professor, Växjö University, Technology and Design, Växjö University, Vaxjö, SE+35195, Sweden, Kaj.Rosling@vxu.se

A monopolistic manufacturer serves his customers through an independent retailer. In a game on pricing and inventory control, the manufacturer is shown to set his inventory policy to minimize the total cost of the chain, given the retailer's policy. The efficiency of market-based decentralization is studied numerically. The cost of double marginalization seems very small except when unsatisfied demand is lost, the manufacturer mark-up is high, and the retailer mark-up is small.

4 - Performance Analysis of Batch Ordering Policies in Capacitated Supply Chains

Abdullah Karaman, Graduate Student, Rutgers University, Department of Industrial Engineering, Piscataway, NJ, 08854, United States, akaraman@eden.rutgers.edu, Tayfur Altiok

We study a supply chain network and its operational rules, that is, production and inventory control policies. We develop a model to analyze system behavior using some key performance indicators such as average inventory and back-order levels, as well as customer service levels. The outcome of the model specifies how to move inventory across the supply chain and how to set inventory control parameters, that is, reorder levels and replenishment batch sizes.

5 - Impact of Supply Chain Capabilities on Innovation Performance

Sachin Modi, Indiana University - Bloomington, 1309 East tenth street, Kelley School of Business, BU570, Bloomington, IN, 47405, United States, smodi@indiana.edu, Vincent Mabert

Supply chain management involves the co-ordination of material and information flows within an organization and between an organization, its suppliers and its customers. Assessing customer requirements is vital to develop new innovative products/process. Further, being closely knit with suppliers allows a firm to leverage supplier capabilities for product/process innovation. The objective of this paper is to quantify the importance of supply chain capabilities on firm's innovation performance.

■ WC12

H - 4th Floor, Union Square 1

Routing and Scheduling in Transportation

Contributed Session

Chair: Efren Velazquez, Management Dean, Universidad Politécnica de Aguascalientes, Prol Mahatma Gandhi Km 2, Col San Francisco del Arenal, Aguascalientes, AG, 20280, Mexico, evez@upa.edu.mx

1 - Ship Scheduling with Limited Risk

Heesu Hwang, Ph.D. Student, The University of Texas at Arlington, PO Box 19017, Arlington, TX, 76019, United States, hxh9528@omega.uta.edu, Jay Rosenberger

Most existing ship-scheduling models ignore potential shifts in the market. We present a set-partitioning model that limits risk using a quadratic variance constraint. Generating first-order linear constraints to represent the variance constraint, we develop a branch-and-price-and-cut algorithm to solve medium-sized ship-scheduling problems. We provide computational results, and we discuss topics of future research.

2 - Time Windows for the TSN-based Multi Depot Vehicle Scheduling Problem

Stefan Bunte, DS&OR Lab, University of Paderborn, Warburger Str. 100, Paderborn, 33102, Germany, bunte@dsor.de, Natalia Kliewer, Leena Suhl

Our extension of the multi-depot vehicle scheduling problem by time windows uses a time-space-network based modelling approach. An extended network is transformed into a mathematical model and can be solved by standard optimization software. Different techniques for practical applications are developed which identify those trips, where small changes of their scheduled starting time result in big overall improvements.

3 - A Measure of the Difficulty of Instances for a Rich Vehicle Routing Problem

Paola Pellegrini, PhD student, University Ca' Foscari of Venice, Dorsoduro 3825/E, Venice, 30123, Italy, paolap@pellegrini.it

In recent years Rich Vehicle Routing Problem (R-VRP) has been object of particular interest. In this analysis we focus on the definition of a measure of difficulty of different classes of instances for a specific R-VRP. In particular, we consider the case of two hierarchical objectives (minimize first the number of vehicles and second the total time for completing the tours), including Multiple Time Windows constraints and Heterogeneous Fleet of vehicles.

4 - The Capacitated Prize-Collecting Rural Postman Problem (CPRPP)

Enrique Benavent, Universitat de ValËncia, Dep. Estad"stica, C/ Dr. Moliner 50, Burjasot (Valencia), 46100, Spain, enrique.benavent@uv.es, José M. Belenguer, David Gòmez-Cabrero

Given a graph and a subset of edges which have associated a demand and a profit that is collected if the edge is served, we study the problem of finding a route that serves a subset of the demand edges, in such a way that the total demand served is not greater than a given capacity, and the profit collected minus the traversing cost is maximized. We present a Branch-and-Cut algorithm and some heuristics for the CPRPP that are able to optimally solve medium size instances.

5 - The Application of Logistic Methods in the Railroad Route Design, in the West-Central-North of Mexico

Efren Velazquez, Management Dean, Universidad Politécnica de Aguascalientes, Prol Mahatma Gandhi Km 2, Col San Francisco del Arenal, Aguascalientes, AG, 20280, Mexico, evez@upa.edu.mx

The effective use of the railroad infrastucture is an imperative need in Mexico. Being the Automotive industry the heaviest user of transportation of inbound and outbound merchandise, this study presents the research or railroad transportation as a cost-effective and reliable alternative.

■ WC13

H - 4th Floor, Union Square 5

Scheduling Problems

Contributed Session

Chair: Xiaoqing Li, Assistant Professor, University of Illinois at Springfield, One University Plaza, UHB 4024, Springfield, IL, 52703-5407, United States, xli1@uis.edu

1 - On the Minimization of Weighted Waiting Time Variance

Xueping Li, University of Tennessee, 416 East Stadium Hall, Knoxville, TN, 37919, United States, Xueping.Li@utk.edu

This study considers the Weighted Waiting Time Variance (WWTV) minimization problem which finds its application in earliness and tardiness (E/T) penalties and Just-In-Time (JIT) scheduling in manufacturing systems and providing stabilized Quality of Service (QoS) in computers and networks. New scheduling methods are developed and numerical results are reported.

2 - Job Sequencing and Due Date Assignment in a Single Machine Shop with Uncertain Processing Times

Yu Xia, Middle Tennessee State Uni., 441 MTSU box, 1301 East Main Street, Murfreesboro, TN, 37132, United States, axia@mtsu.edu, Jinfeng Yue, Bintong Chen

This paper considers due date assignment and sequencing for multiple jobs in a single machine shop with uncertain processing time which is characterized by a mean and a variance with no knowledge of the entire distribution. The objective is to minimize the combination of three linear penalties: penalty on job earliness, penalty on job tardiness, and penalty associated with long due date assignment. Heuristic procedures are developed for the objective function.

3 - Short Term Equipment and Staff Scheduling for USPS Mail Processing Facilities

Xinhui Zhang, Assistant Professor, Wright State University, 207 Russ Center, 3640 Colonel Glen Hwy, Dayton, OH, 45459, United States, xinhui.zhang@wright.edu

We address the short term equipment and staff scheduling problem in USPS mail processing facilities in the faces disruptions such as demand variation and absenteeism. The problem is modeled as an integer program and the model integrates seamlessly with other research studies and provides the necessary tools to manage the resources in a facility on a routine basis. Results from Dallas facility suggest financial savings in the tens of millions of dollars annually could be achieved.

4 - A Genetic Algorithm for Generalized RCPSP with Irregular Objectives

Wotao Yin, Columbia University, Department of IEOR, 500 West 120th Street, New York, NY, 10027, United States, wy2002@columbia.edu, Akshay Katta, Amit Chakraborty

We study the structure of the generalized resource-constrained project scheduling problem (RCPSP). The goal is to choose the right execution modes and starting times of the activities such that all the constraints are respected and an irregular objective is optimized. A new solution representation based on random keys and pruned hyper unit cube is proposed and used in the genetic algorithm to produce a solution. Numerically examples are presented.

5 - Impacts of Domain Knowledge and Intelligent Agents

Xiaoqing Li, Assistant Professor, University of Illinois at Springfield, One University Plaza, UHB 4024, Springfield, IL, 52703-5407, United States, xli1@uis.edu

Intelligent agents (IA) work on behalf of users in task-specific domains. To improve the performance of IAs, existing research activities mainly focus on using various learning algorithms to make agents smarter. However, one important reason affecting IA's performance is domain knowledge. In our research, we analyze the importance of domain knowledge in business scenario and their impacts to intelligent agents' performance. The domain knowledge is the key to the success of agent application.

■ WC14

H - 4th Floor, Union Square 6

Military Applications at RAND

Sponsor: Military Applications
Sponsored Session

Chair: Louis Luangkesorn, Associate Operations Researcher, RAND, 201 N. Craig St., Suite 202, Pittsburgh, PA, 15213, United States, louisl@rand.org

1 - Using Risk Analysis to Understand Performance in the Balkans Support Contract

Victoria Greenfield, Senior Economist, RAND Corporation, 1200 South Hayes Street, Arlington, VA, 22202, United States, victoria@rand.org

This paper uses a 5 step risk management framework to analyze the performance of the Balkans Support Contract. The cost-plus-award-fee BSC has provided the U.S. Army with wide-ranging support services for over 5 years. Drawing on contract terms and evidence found in Army, GAO, and media reports, it uses the framework to explain observed phenomena in the BSC's performance record, especially cost and quality, and finds means to strengthen the performance of other such contracts in the future.

2 - Setting Inventory Levels Under Mobility Constaints

Elvira Loredo, Associate Researcher, RAND Corporation, 1776 Main Street, Santa Monica, CA, 90407, United States, loredo@rand.org, Carol Fan

Recent operations in Iraq have shown the importance of robust inventories to support the warfighter. The inventories at the Supply Support Activities (SSAs) must carry a wide range of materiel in order to fill customer demands while adhereing to mobility constraints. RAND has developed tools for integrating empirical data on deadlining demands into the algorithms used to determine SSA inventory levels.

■ WC15

H - 4th Floor, Union Square 9

Robust Scheduling

Contributed Session

Chair: Selcuk Colak, University of Florida, 393 Maguire Village #6, Gainesville, FL, 32603, United States, scolak@ufl.edu

1 - Mixture Experiments in Robust k Design

Jenny Chen, Research Assistant, Arizona State University, Department of Industrial Engineering, Arizona State University, Tempe, AZ, 85287, United States, jennychen@asu.edu, Michele Pfund, John Fowler, Douglas Montgomery

2-Phase Mixture Experiment method is proposed for setting robust scaling parameter values for composite dispatching rules to achieve good and stable scheduling performance for a given system where the characteristics of problem instances are reasonably uniform. The method is validated by comparison with existing method in the literature.

2 - Proactive Algorithm for Robust Scheduling

Ihsan Sabuncuoglu, Prof., Bilkent University, Bilkent, Ankara, TR, 06800, Turkey, sabun@bilkent.edu.tr, Selcuk Goren

Scheduling systems operate in dynamic and uncertain environments in which random interruptions prevent the execution of a schedule exactly as it is developed. In this study, we develop a branch-and-bound based proactive algorithm to generate robust and/or stable schedules in a single machine environment subject to random machine breakdowns and processing time variability. Optimality conditions and dominance rules are also discussed in the presentation.

3 - Balance Ratio Based Production Input Planning Considering the Reused Part Fluctuation

Hisaya Ishibashi, Production Engineering Research Laboratory, Hitachi, Ltd., 292, Yoshida-cho, Totsuka-ku, Yokohama-shi, 244-0817, Japan, ishibashi.hisaya@gm.perl.hitachi.co.jp, Jun Tateishi, Noboru Takizawa, Takahiro Tsukishima, Chiharu Nakagome

To improve the planning accuracy, we considered the fluctuation problem of the reused parts in material flows including the disassemble process. In such a problem, we developed the balance ratio concept between the new parts and the reused parts on each process and applied to production input planning.

4 - Parallel Machine Rescheduling with Linear Utility Function

Melih Ozlen, Research Assistant, Middle East Technical University Department of Industrial Engineering, Middle East Technical University, Department of Industrial Engineering, Ankara, 06531, Turkey, melih@ie.metu.edu.tr, Meral Azizoglu

In this study, we consider a rescheduling problem on parallel unrelated machines. We assume there is a disruption of known duration on one of the machines. After disruption, we aim to reschedule so as to minimize the total flow time and number of the disrupted jobs. We consider a linear utility function for the decision maker, show that an optimal solution is one of the supported efficient schedules, and propose an algorithm to generate all supported efficient schedules.

5 - The Resource Constrained Project Scheduling with Multiple Crashable Modes: A Heuristic Approach

Selcuk Colak, University of Florida, 393 Maguire Village #6, Gainesville, FL, 32603, United States, scolak@ufl.edu, S. Selcuk Erenguc, Anurag Agarwal

We present a neural networks based heuristic procedure for a nonpreemptive resource constrained project scheduling problem in which the duration/cost of an activity is determined by the mode selection and the duration reduction (crashing) applied within the selected mode. This problem is a natural combination of the time/cost trade-off problem and the resource constrained project scheduling problem. Computational results with a set of 100 test problems demonstrate the efficacy of our procedure.

■ WC16

H - 4th Floor, Union Square 10

Special Topics in Facilities Planning & Design

Contributed Session

Chair: MG Ow Yong, Purdue University, 315 N. Grant Street, Lafayette, IN, 47906, United States, mg@purdue.edu

1 - Optimal Timing and Size Parameters for a Capacity Expansion Problem

Rahul Marathe, Iowa State University, 2019 Black Engineering, Ames, United States, rahulm@iastate.edu, Sarah Ryan

Planning capacity for growing but uncertain demand is critical for a service provider when expansion lead times exist. Under a stationary policy, we choose the timing and size parameters of each expansion to minimize the infinite horizon expansion cost under a service level constraint. The similarity of capacity shortage to a financial barrier option facilitates the constraint formulation and evaluation.

2 - Applying Multiple Priority Rules to the QAP with Application to the Airline Industry

Ruben Mora, University of Louisville, Speed School of Engineering, Room 304, Louisville, KY, 40292, United States, prmora01@louisville.edu, Gail DePuy, John Usher

This paper explores the use of multiple priority rules to solve the QAP. This paper examines the use of multiple heuristics to a single problem, and the results of combining multiple greedy heuristics within a meta-heuristic. An application to the airline industry is examined, allowing for a reduction in the ground service cycle time.

3 - Layout Design in Semiconductor Manufacturing Facilities

Junjae Chae, Senior Engineeer, Samsung Electronics, 416, Maetan-3Dong, Yeongtong-Gu, Suwon, South Korea, junjae.chae@samsung.com, Bumjun Kim, SeokHee Park, Hakyong Kim, Sujeong Lee, Youngsoo Jeon

The facility layout problem in multi-bay manufacturing environments is concerned with determining the most efficient assignment of department to parallel bays, where the bays are connected at one or both ends by an inter-bay material handling system. This problem arises in the context of the semiconductor industry. In this study, an approach for the semiconductor manufacturing facility layout problem is presented and its applicability to a real-world problem is also discussed.

4 - Wave forming in Module-Based Fulfillment Center®: A Heuristic Approach

MG Ow Yong, Purdue University, 315 N. Grant Street, Lafayette, IN, 47906, United States, mg@purdue.edu, Yuehwern Yih

This paper considers operations in module-based fulfillment center with split-case picking. Orders are released in waves, picked simultaneously across modules, merged, automatically sorted and shipped to customer. We propose a heuristic approach to govern order selection and wave formation to balance the tradeoff between on time shipment and resource utilization.

■ WC17

H - 4th Floor, Union Square 11

Optimization Issues in Inventory Models

Contributed Session

Chair: Rui Yin, UCLA Anderson School, 110 Westwood Plaza, Suite B512, Los Angeles, CA, 90095, United States, ryin@anderson.ucla.edu

1 - Evaluating a Long-Term Contract for a Make-to-Stock Manufacturer in the Presence of Spot Market

Pang Zhan, PHD Student, Chinese University of HongKong, SEEM Department, Engineering Building Phase II, 609, Hong Kong, HK, China, zpang@se.cuhk.edu.hk, Youyi Feng

We consider an MTS commodity manufacturer who sells products in spot market and to institutional such as the OEM buyers through long-term contracts at the same time. The customers in spot market arrive according to a Markov Modulated Poisson process with random spot price, while orders from an OEM comes in a sequence of Poisson arrivals with a known deterministic arrival rate.In this paper we show how such an OEM contract should be evaluated fairly and how proper contracts should be stipulated.

2 - Coherent Risk Measures in Inventory Planning

Ulas Cakmak, Georgia Institute of Technology, School of Industrial & Systems Eng., Atlanta, GA, 30332, United States, ucakmak@isye.gatech.edu, Shabbir Ahmed, Alexander Shapiro

We analyze an extension of the classical multi-period, single-item, linear cost inventory problem where the objective function is a coherent risk measure. We show that a base-stock policy is optimal, and provide conditions for a stationary (myopic) policy. We also address the implications of degree of risk aversion on the optimal base-stock level.

3 - Optimality of (s,S) Policy in Inventory System with Advance Demand Information and Flexible Delivery

Tong Wang, Ph.D, INSEAD, Boulevard de Constance, Fontainebleau, 77305, France, tong.wang@insead.edu

Our model allows customers to place orders in advance, and early delivery is allowed. We consider two cases: (1) customers demand leadtimes are homogeneous. We show state-dependent modified (s,S) policy is optimal, where the state is the knowledge about advance demands outside the supply leadtime horizon. (2) Customers demand leadtimes are heterogeneous. Heuristics are developed. Numerical analysis quantifies the benefit of advance demand information and delivery flexibility.

4 - An Inventory System with Stock-dependent Demands and Random Deal Offerings

Emre Berk, Assistant Professor, Bilkent University, Faculty of Business Administration, Ankara, Turkey, eberk@bilkent.edu.tr

An inventory system with stock-dependent demand is considered. The typical examples are found in decaying perishables and in goods where consumption rates depend on the quantity purchased (by consumers) or the quantity displayed on the shelf (by vendors). Optimality of a three-parameter control policy is discussed; operating characteristics are developed. Numerical study will be presented to illustrate the system characteristics/sensitivity to environmental parameters.

5 - Joint Ordering and Pricing Strategies for Managing Substitutable Products

Rui Yin, UCLA Anderson School, 110 Westwood Plaza, Suite B512, Los Angeles, CA, 90095, United States, ryin@anderson.ucla.edu, Christopher Tang

We consider the joint ordering and pricing strategies for managing substitutable products. In the basic monopoly model where retailer adopts fixed/variable pricing strategies, closed-form solutions for the optimal order quantity and price are given. We also consider two extensions with capacity constraint and retail competition. We show the underlying structure of the optimal price/order quantity is preserved.

■ WC18

H - 4th Floor, Union Square 12

Aviation Applications I

Contributed Session

Chair: Raik Stolletz, Dr., University of Hannover, Koenigsworther Platz 1, Hannover, 30167, Germany, raik.stolletz@prod.uni-hannover.de

1 - Finding Alternative Routes between Airports under Weather Uncertainty

Wanjira Jirajaruporn, UC Berkeley, 107E Mc Laughlin Hall, Berkeley, CA, 94720, United States, wanjira@berkeley.edu, Mark Hansen

The stochastic dynamic ground-holding and rerouting model has been developed to enhance strategic planning tools, Ground Delay Programs for ground holding, and National Playbook for rerouting. The model combines the ground-holding and rerouting and is formulated as a heuristic shortest path problem. In order to yield the better storm predictability from the weather forecast, the probabilistic model is used to generate an input for the stochastic dynamic ground-holding and rerouting model.

2 - Retrieving Value of the US Air Traffic Control Services and Its Significance

Dipasis Bhadra, Principal Economist, MITRE/CAASD, 7515 Colshire Avenue, McLean, VA, 22102, United States, dbhadra@mitre.org, David Chin

The economic downturn following 9/11 has revealed the most apparent contradiction of providing for an ATC system that "directly" accrues marketable value to its users but paid for via "indirect" taxes and fees. The existing contradiction coupled with the expiry of current tax reauthorization code in September 2007 has also opened up a rare opportunity to realign the value of the system to that of the true opportunity cost. This paper measures the intrinsic market value of the US ATC system.

3 - Nonstationary Delay Analysis of Runway Systems with Arrival and Departure Banks

Raik Stolletz, Dr., University of Hannover, Koenigsworther Platz 1, Hannover, 30167, Germany, raik.stolletz@prod.uni-hannover.de

An important aspect of airport planning is the estimation of aircraft delays given time-varying demand and runway capacity. We analyze airports which are able to operate landings and takeoffs at the same runway. Two different regimes are compared: In the first regime arrivals and departures are served according to the First-Come-First-Served rule. In the second regime strings of arrivals are followed by strings of departures. These queueing models are analyzed with time dependent rates.

■ WC19

R - 3rd Floor, Sienna I

Analytic Hierarchy Process Theory and Applications

Contributed Session

Chair: Srihari Jaganathan, Graduate Assistant, Louisiana Tech University, 504 West Louisiana Ave, Apt 3, Ruston, LA, 71270, United States, sja015@latech.edu

1 - A Multi-objective Approach to Urban Transit Timetabling under Fuzzy Uncertainty

Ladi Ogunwolu, University of Lagos, Department of Systems Engineering,, University of Lagos, Lagos, 234, Nigeria, ogunwolu@yahoo.com, Oyewusi Ibidapo-Obe

This paper investigates fuzzy uncertainty effects in a multi-objective urban transit setting using a Constrained Mixed Integer Non-Linear Mathematical Programming and Max-Min multi-objective Genetic Algorithm search. It incorporates transit simulation algorithms for passenger boarding, de-boarding and transfer based on objectives catering for both passengers' and operators' interests within the Genetic Algorithm. The test on a scheduled bus-network underscores the approach.

2 - Parallel Systems are More Reliable

Mostafa Ghandehari, Senior Lecturer, Dept of Civil Engineering, University of Texas at Arlington, Box 19308, UTA, Arlington, TX 76019, United States, ghandeha@cse.uta.edu, Fred Kashefi

The arithmetic-geometric mean inequality is used to show the parallel system of n independent components is more reliable than the corresponding system of the same components in series.

3 - The Perspective of Batch Processes in Mexico, An Approach to their Formalization

Francisco Briones, Director, Universidad Politecnica de Aguascalientes, Mahatma Gandhi Km 2, San Francisco del Arenal, Aguascalientes, Ag, 20280, Mexico, fbt@upa.edu.mx

This paper shows the status of the formal application of Bach processes in Mexico in the frame of international referents as the ISA SS 88.02 and the European experience in this topic. It identifies areas of opportunity to improve Mexican industries through applied research

4 - Modeling and Analysis of Dependent Failures by Using AHP and Bayesian Approach

Stephen Thompson, Associate Professor, Texas A&M University, 3367 TAMU, College Station, TX, 77843-3367, United States, Thompson@tamu.edu, Young Keun Choi

In this paper, we propose a novel reliability modeling method and analysis framework based on the AHP (Analytic Hierarchy Process) and Bayesian approach for the system in which the components interact with each other. The AHP is used to measure the interdependence between the components and the Bayesian approach is used to determine reliability of the system. To validate the proposed algorithm, a real world case study is presented.

5 - Comparative Study on Prioritization Techniques in Fuzzy Analytic Hierarchy Process

Srihari Jaganathan, Graduate Assistant, Louisiana Tech University, 504 West Louisiana Ave, Apt 3, Ruston, LA, 71270, United States, sja015@latech.edu, Jinson Erinjeri

Uncertainty in AHP can be expressed using fuzzy numbers, probability based methods and interval numbers. In this paper, we compare fuzzy preference programming (FPP) and two-stage logarithmic goal programming that are used to derive priorities from inconsistent fuzzy judgment matrices. With the help of numerical example, we show that the FPP is the only known prioritization method that can derive weights satisfactorily.

■ WC20

H - 6th Floor, Mason B

Forestry IV - Harvesting Applications

Sponsor: Energy, Natural Resources & the Environment / Forestry
Sponsored Session

Chair: Masashi Konoshima, Oregon state university, Oregon State University, 280 Peavy Hall, Corvallis, OR, 97331, United States, Masashi.Konoshima@oregonstate.edu

1 - Finding the Efficient Frontier of a Tri-Criteria, Spatially-explicit, Harvest Scheduling Problem

Sandor Toth, Research Assistant, Penn State School of Forest Resources, 214B Ferguson Bldg, University Park, PA, 16802, United States, sft108@psu.edu, Marc McDill

Public forests have many conflicting uses. Quantifying and visualizing trade-offs between these uses can facilitate consensus building among stakeholders. This study extends 4 existing methods to generate trade-offs between 3 or more objectives. Computational properties of the methods were evaluated on a hypothetical forest planning problem. The proposed Alpha-Delta and the traditional Weighted Method showed promising performance. These methods may be used in concert.

2 - Enforcing Harvest Opening Size Restrictions in Forest Planning Models with Shelterwood Treatments

Sonney George, Post Doctoral Scholar, Peen State School of Forest Resources, 214B Ferguson Bldg, University Park, PA, 16802, United States, sgp113@psu.edu, Marc McDill

Shelterwood treatments introduce new challenges to forest planning models. Shelterwood treatment is required before final harvesting in many forest districts in Pennsylvania. Incorporating generalized management units (GMUs) for restricting harvest opening sizes offer advantages over pairwise adjacency constraints. A spatially explicit forest planning model, that allows shelterwood treatments and incorporates GMUs, is presented. Solutions based on data from a forest district are presented.

3 - Using Tabu Search to Create Desired Patch Size Distributions

Evelyn Richards, Faculty of Forestry, University of New Brunswick, PO Box 44555, Fredericton, NB, E3B 6C2, Canada, ewr@unb.ca, Greg Paradis

We solve a multi-objective optimization problem with three goals: meeting a landscape-level patch size distribution target, minimizing cost of road construction, and minimizing harvest timing penalties. A tabu search method with feedback mechanisms to balance intensification and diversification in the search was developed to solve the optimization problem, with a view to producing trade-off curves for the competing objectives. Successes and limitations of the method are discussed.

4 - A Fractional Goal Programming Model for a Timber Harvest Scheduling Problem with Carbon Captured

Monica Hernandez, Dr, University of Malaga, Campus El Ejido s/n, Malaga, 29700, Spain, m_huelin@uma.es, Maria Amparo Leon, Trinidad Gomez, Rafael Caballero

A timber harvest scheduling problem is solved via a linear fractional goal programming model when carbon captured is considered. The problem is located in Cuba, where an important objective is to plan a redistribution of the forest into even-aged stands. This has been formalized in the model as fractional goals. The model allows the obtaining of good values from an economic point of view compatible with adequate levels of carbon captured and attaining a balance distribution by ages.

■ WC21

H - 4th Floor, Union Square 15

Innovations in Data Analysis, Prediction and Classification

Sponsor: Optimization/ Optimization and Data Mining
Sponsored Session

Chair: Fred Glover, University of Colorado, Leeds School of Business, Boulder, CO, United States, Fred.Glover@colorado.edu

1 - Graphical Models for Anomaly Detection

Rema Padman, Carnegie Mellon University, Pittsburgh, PA, United States, rpadman@andrew.cmu.edu, Xue Bai

Anomaly-detection at the level of user command traces in information systems is very difficult. It entails analysis of a large variety of actions from many different users. We propose a tabu search-enhanced feature extraction method to identify critical features for anomaly detection that improves efficiency and accuracy of the detection systems and reduces false alarms.

2 - Attractive Nonlinear Models for Clustering and Other Combinatorial Problems

Bahram Alidaee, University of Mississippi, School of Business Administration, University, MS, 38677, United States, balidaee@bus.olemiss.edu, Gary Kochenberger, Haibo Wang

Many combinatorial problems are modeled as linear integer programs and solved utilizing methods primarily designed for linear models such as branch and cut. In this talk we highlight alternative nonlinear models for such problems that can be efficiently solved by metaheuristic methods. Several examples will be presented comparing the approaches.

3 - A Markov Blanket/Tabu Search Methodology for Stock Market Prediction

Marco Better, University of Colorado, Leeds School of Business, Campus Box 419, Boulder, CO, 80302, United States, marco.better@colorado.edu

We propose an enhanced Markov Blanket/Tabu Search (MB/TS) procedure for stock market forecasting and trend analysis. The MB/TS method handles both feature selection and stock price forecasting, accompanied by an optimization model for portfolio selection. A computational study discloses the advances achieved compared to other approaches.

4 - On Greedy Approaches to MAX-CUT Problem

Sergiy Butenko, Assistant Professor, Texas A&M University, 236E Zachry Engineering Center, TAMU 3131, College Station, TX, 77843-3131, United States, butenko@tamu.edu, Illya Hicks, Sera Kahruman, Elif Kolotoglu

MAX-CUT problem is a well known NP-hard problem that finds applications in numerous areas, including classification. This talk will present a comparison of several greedy construction heuristics for MAX-CUT problem in terms of their theoretical worst-case performance ratio and practical performance

■ WC22

H - 4th Floor, Union Square 16

Data Mining in Decision-Making

Sponsor: Data Mining
Sponsored Session

Chair: Victoria Chen, Associate Professor, University of Texas at Arlington, Dept. of Ind. & Manuf. Sys. Eng., Campus Box 19017, Arlington, TX, 76019-0017, United States, vchen@uta.edu

1 - Robust Design Using Meta-Models of Loss-Scaled Principal Components

Terrence Murphy, Post Doctoral Research Fellow, Georgia Tech, 681 Cherry St. NW, Atlanta, GA, 30332-0600, United States, tmurphy@isye.gatech.edu, Kwok Tsui

We consider a principal components based decomposition of the expected value of the multivariate quadratic loss function. The resulting loss-scaled principal components are used to solve a robust design problem of full and reduced dimensionality with deterministic models in less computational time. We also compare the optimizing performance of response surface, Kriging and MARS versions of these deterministic "meta-models".

2 - A Stochastic Gradient Approach to Optimal Control using Neural Networks and Experimental Design

Aihong Wen, University of Texas At Arlington, 1110 S. Pecan St #1, Arlington, TX, United States, axw0932@omega.uta.edu, Victoria Chen, Cristiano Cervellera

Stochastic Optimal Control considers the problem of optimizing the control law of a stochastic dynamic system in the sense of minimizing the cost related to the control scheme. We present an approach that approximates the control law using

neural networks within a stochastic gradient algorithm that iterates over the stochastic space. Experimental designs are employed to mine the stochastic space.

3 - Ensemble Classification of Disparate Data Sets
Genetha Gray, Sandia National Labs, P.O. Box 969, MS9159, Livermore, CA, 94551-0969, United States, gagray@sandia.gov, Ken Sale

Detection systems have become increasingly important. Challenges include interpreting the data generated by sensors while simultaneously considering related information to confirm alarms or identify false positives. We describe the development and use of a data fusion technique targeted at this problem. We focus on an algorithm that includes separate base classifiers for each data type and a method of combining these individual classifications to act as a global discriminator.

4 - An Introduction to Support Vector Machines
Ed Wike, LoanPerformance, Inc., 13 Debra Lane, Framingham, MA, 01701, United States, ed.wike@loanperformance.com

SVMs evolved in the 1990s as a powerful and robust supervised learning method based on statistical learning theory, with successful applications in areas such as image detection, text mining, bioinformatics, and medical diagnosis. This introduction begins with a geometric representation of the linear support vector classifier; its formulation as an optimization problem; kernel methods; the non-separable case; solution methods and software; and a fast-solving variation of the linear SVM.

■ WC23

H - 4th Floor, Union Square 2

Demand and Traffic Models in Telecommunications

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 - Dynamic Item Combinatorial Auctions for Telecommunications
Roy Kwon, Assistant Professor, University of Toronto, 5 King's College Road, Toronto, ON, M5S 3G8, Canada, rkwon@mie.utoronto.ca

We present a new combinatorial auction mechanism with items that are dynamically created during rounds. We illustrate the benefit of such a mechanism in the context of a telecommunications resource (routing) allocation problem where there are capacity limits on edges and multiple users can access bandwidth on a link.

2 - Joint Demand Distributions for Broadband Access and Video on Demand
Joakim Kalvenes, Cox School of Business, SMU, P.O. Box 750333, Dallas, TX, 75275, United States, kalvenes@smu.edu, Neil Keon

We present a model of two complementary services adapting a widely used demand model in the IS literature. A prevalent demand model in IS has emerged using distributions to describe indivudal value or utility. We extend the model to a case of two complemtary services and solve the market equilibria using joint distributions. Analytical results and a numerical example will be presented.

3 - An Incentive Compatible Auction Mechanism for Allocating Bandwidth to Bidders
G. Anandalingam, University of Maryland, Van Munching Hall, College Park, MD, 20742, United States, ganand@rhsmith.umd.edu

Firms join a network market to be assigned bandwidth in some priority order which depends on elicited preferences. We propose a set of prices which ensures that preferences are revealed truthfully. These prices are extracted from the dual of a linear programming assignment problem. We also present an algorithm for optimally pricing and allocating bandwidth.

4 - Revenue Management in Service Systems without Reservations
Neil Keon, Assistant Professor, Cox School of Business, SMU, P.O. Box 750333, Dallas, TX, 75275, United States, nkeon@mail.cox.smu.edu, Joakim Kalvenes

We propose a revenue management approach for real-time service systems. Services are assumed to be purchased at a bulk rate as a subscription, such as in mobile telephony. All purchased services are eventually consumed. We study the user equilibrium for our proposed revenue management pricing mechanism, which is an amount of free service provided in exchange for delayed consumption. We study the effects of the user equilibrium as a component in a queuing model of the service system.

■ WC24

H - 4th Floor, Union Square 8

Applications of Decision Analysis

Contributed Session

Chair: Mehmet Barut, Assistant Professor, Wichita State University, 1845 Fairmount, Wichita, KS, 67260-0077, United States, mehmet.barut@wichita.edu

1 - A Fuzzy Rule Based Expert System for Supplier Selection Problems
Cuneyt Altinoz, East Carolina University, 3134 Bate Building, College of Business, Greenville, nc, 27858, United States, altinozc@mail.ecu.edu

This paper describes a new decision support methodology that combines three basic concepts: constraint networks, fuzzy logic and rule-based modeling. We use fuzzy rules to capture the thinking process of decision makers and evaluate alternatives accordingly. The linguistic rules are easily built with minimal training while allowing detailed modeling of complex criteria. In contrast to other rule based systems, the rule-set is scored based on several different procedures, and not inferred.

2 - Measuring Service Quality Level in Service Industry by Using DEA
Halime Sarihan, Senior Business Analyst, Wells Fargo Bank, William Barnhart Center, 18700 NW Walker Road Bld #92, Beaverton, OR, 97006, United States, halime.sarihan@wellsfargo.com

The purpose of this study is to propose a new managerial tool for evaluating and managing service quality levels in service industry. Data envelopment analysis DEA)is good methodology for measuring service level quality in different business units.The main advantage of DEA over other methods of performance evaluation is that it allows one to consider a number of outputs and inputs simultaneously, regardless of whether all the variables are measured in common units.

3 - Risk Taking with Thresholds-Based Payoffs
Ioanna Tziri, PhD Candidate, INSEAD, Boulevard de Constance, Fontainebleau, 77305, France, ioanna.tziri@insead.edu

We consider situations where compensation schemes are based on fixed thresholds. In our study, an agent gets payoff L if her performance is below T1, W above T2 and M between- e.g. a sales person might get a bonus for sales exceeding a quota, get fired for sales below a baseline and retain her job between these levels. Much literature has focused on how to maximize agent's effort. We look at the agent's risk response-with effort level fixed, whether to pursue a low risk, small order or a higher risk, larger order. We look at optimal risk strategies and implications for quota system design.

4 - Timing Effects on Capacity Rationing Models for Make-To-Order Environment
Mehmet Barut, Assistant Professor, Wichita State University, 1845 Fairmount, Wichita, KS, 67260-0077, United States, mehmet.barut@wichita.edu, Mehmet Yildirim

In this study, we revisit the short term capacity rationing models developed for MTO firms, and modify the procedure to reflect the true perishable behavior of the capacity. We also examine the timing effects of the incoming orders on the performance of rationing models, in term of profitability and fill rates. For effectiveness purpose, we provide the optimum solution for the two product class case and discuss the results.

■ WC26

H - 6th Floor, Sutter B

Applications of Operations Research

Contributed Session

Chair: Eliezer Geisler, Professor, Illinois Institute of technology, 565 WAams Street, Stuart Graduate Schol of Business, Chicago, IL, 60661, United States, geisler@stuart.iit.edu

1 - High-dose-rate Brachytherapy Dose Optimization for Prostate Cancer Using Linear Programming
Ron Alterovitz, University of California, Berkeley, 4141 Etcheverry Hall, Berkeley, CA, 94720-1777, United States, ron@ieor.berkeley.edu, Etienne Lessard, Jean Pouliot, I-Chow Hsu, Ken Goldberg, James F. O'Brien

We present a method using linear programming (LP) to optimize the dwell times of radioactive sources placed near cancerous tumors for HDR brachytherapy, a type of radiotherapy commonly used to treat prostate cancer. Dose constraints and the objective function are equivalent to those used in previously developed software based on simulated annealing used at UCSF Medical Center. We apply the LP method to 20 prostate cancer patient cases to compute optimal dwell times in under 1 minute per case.

2 - Laser Needles in Research and Practice
Donna Retzlaff-Roberts, Professor, University of South Alabama, Mitchell College of Business, Mobile, AL, 36688, United States, retzlaff@usouthal.edu, John Stump

A recent development in the field of acupuncture involves the use of laser needles where a laser is used in place of traditional needles. This study involved a group of subjects medically diagnosed into one of three chronic or one acute condition. The authors were interested in the effectiveness of laser therapy on the pain of these medically resistant conditions. Both short term and long term results were evaluated. The effects of age, gender, and frequency of treatment were also analyzed.

3 - Impact of Yield Uncertainty on Cournot Competition: Case of Influenza Vaccine Market
Sarang Deo, UCLA Anderson School of Management, 22110 Victory Blvd #C113, Woodland Hills, CA, 91367, United States, sdeo@anderson.ucla.edu, Charles Corbett

The number of firms producing influenza vaccine for the U.S. has been declining steadily in the recent past. However, current economic theory predicts that an oligopolistic market with unregulated but costly entry will experience excess entry and oversupply. In this paper, we show that introducing yield uncertainty in the production process and its interaction with firms' strategic consideration can explain for the high degree of concentration in the industry and the resultant under-supply.

4 - Medical technology and Quality of Healthcare Delivery: The Theory and Some Cases
Eliezer Geisler, Professor, Illinois Institute of technology, 565 WAams Street, Stuart Graduate Schol of Business, Chicago, IL, 60661, United States, geisler@stuart.iit.edu, Nilmini Wickramasinghe

This paper addresses the link between medical technology and the quality of health care delivery. The variables are defined and a relationship is suggested. The complex concept of quality of care is analyzed. The paper also describes two cases of the application of medical technology and their impacts on quality. The paper focuses on measurement of processes rather than outcomes as the acceptable means to assess the impacts of medical technology on quality of care.

■ WC27

H - 6th Floor, Taylor B

Evolutionary Computing and Intelligent Agents

Sponsor: Artificial Intelligence
Sponsored Session

Chair: Riyaz Sikora, Associate Professor, University of Texas at Arlington, Dept. of Information Systems, P.O. Box 19437, Arlington, TX, 76019, United States, rsikora@uta.edu

1 - Modeling Auctions in a Supply Chain Agent Community
Barin Nag, Towson University, Department of Management, Towson, MD, 21252, bnag@towson.edu, Sungchul Hong, Dong-qing Yao

Auction trading is an integral part of the Supply Chain in sales and procurement. Trading by intelligent agents, comparing and matching prices and quantities provides efficiencies of time and economy. We study actions and decisions of agents in communities, presenting models to optimize performance, and to reduce cost and time.

2 - A Bayesian Belief Network Approach to Risk Assessment for Information Security
Jackie Rees, Associate Professor, Purdue University, Krannert Graduate School of Management, 403 West State Street, West Lafayette, IN, 47907-2056, United States, jrees@purdue.edu

Enterprise information security programs are typically driven by risk management principles. However, assessing risk is problematic as users find it difficult to accurately gauge potential threats in terms of assigning a probability of occurrence as well as estimating corresponding potential for harm, particularly in dollar amounts. The application of Bayesian belief networks to the risk assessment process is studied and insights are generated from simple examples.

■ WC28

R - 4th Floor, DaVinci I

Topics in Revenue Management and Pricing

Sponsor: Revenue Management & Pricing
Sponsored Session

Chair: Darius Walczak, Senior Scientist, PROS RM, 3100 Main St., Suite 900, Houston, TX, 77002, United States, dwalczak@prosrm.com

1 - Dynamic Common Pricing for Multiple Products
Binbin Liu, PhD Candidate, Rotman School of Management, University of Toronto, 105 St. George Street, Toronto, ON, M5S 3E6, Canada, bLiu@rotman.utoronto.ca, Joseph Milner

We study how firms should dynamically price multiple products when by convention they are required to maintain a common price. We solve the deterministic problem and then investigate the stochastic case, establishing a multiple dimension threshold policy for the single markdown case. We then investigate heuristics for continuous dynamic prices and provide numerical results showing their effectiveness.

2 - Bundle Pricing of Inventories with Stochastic Demand
Alper Sen, Assistant Professor, Bilkent University, Department of Industrial Engineering, Bilkent, Ankara, TR, 06800, Turkey, alpersen@bilkent.edu.tr, Ulku Gurler, Zumbul Bulut

We consider a retailer selling a fixed inventory of two perishable products over a finite horizon. The products are sold individually or as part of a bundle. Assuming that the customers arrive following a Poisson Process and reservation prices follow a bivariate distribution, we determine the optimal product and the bundle prices that maximize the expected revenue. The performances mixed bundling, pure bundling and unbundling strategies under different demand and supply scenarios are compared.

3 - The Future of Hotel Rooms Distribution Channels
Natasa Christodoulidou, Student, University of Nevada-Las Vegas (UNLV), 3551 Shemtove Court, Las Vegas, NV, 89121, United States, chris120@unlv.nevada.edu, Pearl Brewer

In the 1990's hotels felt that the right approach was to use a rack rate for their base rate. The goal of the hotel was to have a single image inventory, i.e. the Holy Grail, which meant identical rates and availability throughout all the distribution outlets. Currently, many hotels are offering the low-rate guarantee if you book on their website. From the days of controlled rates, to the evolved nature of today's distribution channels, a new pyramid has been born in the hospitality industry.

4 - A Cruise Ship is not a Floating Hotel
Neil Biehn, Senior Scientist, PROS Revenue Management, 3100 Main Street, Suite 900, Houston, TX, 77002, United States, nbiehn@prosrm.com

The perception of the mainstream revenue management community is that cruise ships are nothing more than floating hotels. Although, the cruise and hospitality industry have many similarities when it comes to their revenue management and pricing practices, there are many key differentiators between the two business sectors. This talk will describe these key differences and why adopting a hotel revenue management strategy is a poor fit in the cruise line industry.

■ WC29

R- 4th Floor, DaVinci III

Modeling Segmentation and Choice in Revenue Management

Cluster: Pricing and Revenue Management for Non-Travel Industries
Invited Session

Chair: Ronald Menich, Director, Manugistics, 2839 Paces Ferry Road, Overlook II, Suite 900, Atlanta, GA, 30339, United States, rmenich@manu.com

1 - Revenue Management for Sports Ticket Packages
Matt Drake, Doctoral Student, Georgia Institute of Technology, School of Industrial and Sys Engineering, 765 Ferst Drive, Atlanta, GA, 30332, United States, gtg148k@prism.gatech.edu, Julie Swann, Paul Griffin

The sports and entertainment industries have been slow to adopt revenue management techniques. Although these industries face demand with similar characteristics to that of airlines, there are additional opportunities to manage demand by offering ticket packages for multiple events. We analyze two such ticket bundles comprised of different quantities of games and different quality characteristics and determine the optimal timing of the decision to market the smaller bundle to consumers.

2 - Evaluation of Three Pricing Approaches for Qualitative Choice Situations
Balaji Sampath, Research Assistant, The University of Texas at Austin, 307 E 31st Street, #201, Austin, TX, 78705, United States, balajis@mail.utexas.edu, William Lee, Luciano Correa, Harun Ahmet Kuyumcu

A qualitative choice situation is one in which a decision-maker faces different options among which one has to be selected. We simulated a demand arrival process and evaluated three random utility models (multinomial logit, two-stage logit, and simple logit) for a business situation where customer faces multiple choices.

3 - Price Segmentation for Profit Optimization

Carl Stutz, Vice President, Entrepreneurial Resources Group, 8 Faneuil Hall Marketplace, 3rd Floor, Boston, MA, 02109, United States, carl.stutz@erg-usa.com

Per traditional microeconomics, companies set a single product price to maximize variable profit. Companies selling only at this Standard Price do not realize all of the profits available. Purchasers who would have paid more benefit from "consumer surplus". Others would not pay the Standard Price but would have paid more than variable cost. This talk presents a framework for increasing profit through price segmentation such that each purchaser pays more in accordance with value perceived.

4 - Customer Choice Forecasting

Ronald Menich, Director, Manugistics, 2839 Paces Ferry Road, Overlook II, Suite 900, Atlanta, GA, 30339, United States, rmenich@manu.com, Mehmet Gulsen

A typical bottom-up forecast approach has been to forecast a particular product using as input to the forecasting algorithm historical demands observed for that particular product. We discuss a troublesome application area for the bottom-up approach, namely, the forecasting of specific items in a product catalog, many of which are either new to the catalog or else are bundled with other products in ways not previously observed. We relate this application area to customer choice concepts.

■ WC30

R- 4th Floor, DaVinci II

Technology / Strategic Planning

Contributed Session

Chair: Soo-Haeng Cho, UCLA Anderson School of Management, 110 Westwood Plaza, Gold Hall, Suite B512, Box 951481, Los Angeles, CA, 90095, United States, scho@anderson.ucla.edu

1 - Classification of the Mass Customization Phenomena

Klaus Moser, PhD Student, IOM, Technische Universitaet Muenchen, Leopoldstrasse 139, Muenchen 80804, Germany, k.moser@wi.tum.de, Frank Piller, Ralf Reichwald

The literature presents different models for classifying mass customization. Most of these existing models are not empirically derived or validated and are often special classifications, because they are applying a small number of attributes only. This research presents the application of existing classification models for mass customization cases. The results show their limitations and conclude an enhancement towards a comprehensive model for classifying the mass customization phenomena.

2 - Communication Structure, Information Flow, and Performance

Nelson Lammoglia, Doctoral Student, Universidad de los Andes, Calle 18a 1-37 Este, Bogota, Colombia, n-lammog@uniandes.edu.co, Henry Bustos, Roberto Zarama

This work studies the relation between performance, communicational structure, and information flow. We designed an experiment in which the participants try to maintain a temperature despite of the perturbations. Participants communicate by an application Web according to a structure. They send messages to the authorized others at the same time. For this the typology of flow process is a parallel duplication. We show that the diameter explains the performance in this typology.

3 - Need Assessment Before Strategic Plan For A Public Organization

Ozan Ozcan, Senior Researcher, MEB-TUBITAK Tusside, MEB-TUBITAK Tusside Gebze, Kocaeli, Turkey, oozcan@tusside.gov.tr

Need assessment is a process for pinpointing reasons for gaps in performance or a method for identifying new and future performance needs. A Need Assessment method is presented which is done before the Continuous Quality Improvement projects in a public organization that include preparing a strategic plan. The projects aim to provide continuous improvement for productivity, employee motivation, and strategy efficieny. Corporate culture and excellence assessment tools and interviews are used.

4 - Strategic Alliances, A Succesful Approach for Competitiveness in Corporate Management

Juan Bosco Arreola, Academy Director, Universidad Ploitécnica de Aguascalientes, Prol. Mahatma Gandhi, Km. 2, Aguascalientes, Mexico, jba@upa.edu.mx

Technological and commercial alliances had been proven succesful management strategies to increasing competitiveness of companies around the world. This paper summarizes the succesful application of this approach to a Mexican Company, which starting from a very low competitive level, became, in only three years, the best embroidery manufacturer in Mexico and the region.

5 - Adoption of New Technology with Economic Dependency between Multiple Technology Types

Soo-Haeng Cho, UCLA Anderson School of Management, 110 Westwood Plaza, Gold Hall, Suite B512, Box 951481, Los Angeles, CA, 90095, United States, scho@anderson.ucla.edu, Kevin McCardle

We consider the case of a firm that produces an assembled product considering the introduction of a new product with multiple new components. Economic dependency between multiple components results from economies of scope that arise due to savings in a fixed cost of adoption when multiple adoptions are chosen. We find that this economic dependency can either retard or expedite the adoption of a new technology depending on the firm's expectations of technological change of the other components.

■ WC31

H - 4th Floor, Union Square 25

OR/MS Modeling in Some Industrial Applications

Contributed Session

Chair: Deepak Tirumalasetty, Student, Clemson University, 110 Freeman Hall, Clemson, SC, 29634, United States, dtiruma@clemson.edu

1 - A Case Study for RFID Application to Business Process Automation in Container Depot

Jung-Woon Yoo, Wayne State University, 4815 Fourth Street, Detroit, MI, 48202, United States, jwyoo@wayne.edu, Namkyu Park, Youngil Kim, Tae-Su Cheong

One of the most expecting advantages in Radio Frequency Identification application is to automate business process with least intervention of human by informing decision systems of accurate, real-time, and up-to-date data. This paper presents an RFID based business process automation system for harbor operations in container depot. The core system extracts semantics from refined data repository through rule-based inference engine and automates back-end applications at the same time.

2 - Hydroelectric Power Plants Upgrade Strategies — Managing a Project Portfolio Over Time

Lars Hellemo, SINTEF Technology & Society, S.P. Andersensv. 5, Trondheim, 7465, Norway, lars.hellemo@sintef.no, Frode Romo, Stein-Erik Fleten

Hydro power plants suffer from decreasing performance and increased probability of failure over time. Norwegian hydro power companies evaluate several upgrade candidate projects each year. Budget constraints and other constraints exclude execution of all profitable projects. SINTEF is developing a framework for calculating NPV for multiple possible start times, including degradation effects. We are developing a model for choosing the best project portfolio for a time horizon of five years.

3 - Stabilizing Solutions to the Output Feedback Pole Placement Problem

Mei Kobayashi, Senior Researcher, IBM Research, Tokyo, 1623-14 Shimotsuruma, Yamato-shi, Kanagawa-ken, 242-8502, Japan, mei@jp.ibm.com, Kaiyang Yang

We present a method for stabilizing solutions to output feedback pole placement problems for real-world systems, which can be expected to experience some parameter drift. Our work extends an algorithm proposed by Yang and Orsi (2005) for solving the generalized static output feedback pole placement problem. The output feedback pole placement problem appears in the study of physical systems in a diverse range of fields, such as mechanical, scientific, engineering and biological systems.

4 - Selective Newsvendor Problems with All-or-Nothing Orders

Edwin Romeijn, Associate Professor, University of Florida, 303 Weil Hall, P.O. Box 116595, Gainesville, FL, 32611-6595, United States, romeijn@ise.ufl.edu, Kevin Taaffe, Deepak Tirumalasetty

We consider a newsvendor problem where the firm must also choose which uncertain demand sources or orders it plans to fulfill. Previous work on this "selective newsvendor problem" assumes normally distributed demands. In fact, a firm may face a small set of unconfirmed orders, and each order will often either come in at a predefined level, or it will not come in at all. We explore solution methods for this all-or-nothing demand case.

■ WC32

H - 6th Floor, Lombard

Optimization Techniques for AI Problems

Contributed Session

Chair: Daniel Spiegel, Professor, Kutztown University of PA, 254 Lytle Hall, Kutztown, PA, 19530, United States, spiegel@kutztown.edu

1 - Analysis of Local Filed Potentials from a Visual Discrimination Task Using SVM-Based Methods

Onur Seref, University of Florida, Dept. of Industrial and Systems Eng., 303 Weil Hall, P.O. Box 116595, Gainesville, FL, 32611, United States, seref@ufl.edu, Panos Pardalos, Steven L. Bressler, Mingzhou Ding, Claudio Cifarelli

We study local field potentials (LFPs) collected from three macaque monkeys as they performed a visual discrimination task. We use support vector machines (SVMs) to classify the single-trial LFPs with respect to stimulus and response types in order to distinguish the different phases in this task. We also apply SVM-based feature selection methods to identify the spatiotemporal dependencies of different cortical sites for each monkey and discuss the results. This work was supported by NIH grants MH64204, MH71620, and MH070498

2 - Mosel: The Next Generation Tool for Optimization Solution Development and Deployment

Nitin Verma, Dash Optimization Inc, 560 Sylvan Ave, Englewood Cliffs, NJ, 07632, United States, nitin.verma@dashoptimization.com, Horia Tipi

Mosel is unique because it is both a mathematical modeling and programming language. It has matured into the industry standard for modeling large and most sophisticated MILP, MIQP, MISLP, and MISP problems. We will demonstrate how Mosel can be used for: • Data I/O from memory • Infeasibility diagnostics • Debugging and Profiling models • Parallelizing sub-models • Developing GUIs for optimization software deployment.

3 - Linear Support Vector Regression

Girish Nehate, Kansas State University, 233 IMSE Durland Hall, Manhattan, KS, 66502, United States, girishn@ksu.edu, John Wu

Support vector machines (SVM) comprise a new class of learning algorithms, motivated by results of statistical learning theory (Vapnik, 1995). A modified version of the original support vector regression is presented in this research for the linear case. The problem is formulated as an unconstrained quadratic program and solved by using conjugate gradient methods. The method is suitable for medium sized problems is fast and efficient.

4 - A Novel E-mail Filtering System Using Human Brain Mapping

Seunghoon Lee, Doctoral Student, Sogang University, 1 Shinsu-dong, Mapo-gu, Seoul, Seoul, ., 121-742, South Korea, au4240@sogang.ac.kr, Jinhwa Kim, Hyunsoo Byun

The spam mail has increased in these days. E-mail account management system sets up protecting step blocking spam mails in its own ways. However, passively received e-mail is not able to filter information or e-mail user improperly. Thus, many methods are being developed to ward off unnecessary mails. In this study we propose a novel e-mail filtering system based on brain mapping, which simulates information processing in the human brain.

5 - A Panmictic Evolutionary Approach to the Set Covering Problem

Daniel Spiegel, Professor, Kutztown University of PA, 254 Lytle Hall, Kutztown, PA, 19530, United States, spiegel@kutztown.edu, Francis Vasko

It has been shown that genetic algorithms are effective within a strategy that augments an algorithm with optimization to rapidly find good solutions to instances of the set-covering problem. The classic genetic algorithm maintains a population where members are reproduced whole. In this paper, a panmictic evolutionary technique for reproduction is introduced, where population members of the following generation are selected with multiple members of the parent population serving as a gene pool.

■ WC33

H - 6th Floor, Mason A

Joint Session QSR/ Health: Quality and Statistical Decision Making in Healthcare Applications II

Sponsor: Quality, Statistics and Reliability, Health Applications
Sponsored Session

Chair: Jing Li, Industrial and Operations Engineering Department, University of Michigan, Ann Arbor, MI, United States, jinglz@engin.umich.edu

1 - Spatial Surveillance and Cumulative Sum Methods

Peter Rogerson, rogerson@buffalo.edu

This paper describes how cumulative sum methods may be used to monitor spatial phenomena over time. An application of interest is in the surveillance of health events that have either x-y coordinates or locations within predefined geographic regions. The objective is the quick detection of emergent clusters of health events.

2 - Optimal Cadaveric Liver Acceptance with an Explicit Model of the Waiting List

Burhaneddin Sandikci, bus2@pitt.edu, Oguzhan Alagoz, Mark Roberts, Lisa Maillart, Andrew Schaefer

We consider the problem faced by a liver patient who waits in a waiting list for liver transplantation. The suggested framework would also be appropriate for organs other than the liver. We use an MDP approach to model the problem of accepting or rejecting the organ once an organ offer is made. In doing so, we use the information from the waiting list explicitly in our models. We present structural properties as well as preliminary computational results.

3 - Health Deficiencies as Nursing Home Quality Measures

David Zimmerman, David_Zimmerman@chsra.wisc.edu

Health deficiencies have been widely used as a measure of nursing home care quality. A health deficiency index (HDI) was created to account for differences in state survey citation patterns. HDI methodological issues and alternative forms are presented using data for all 17000 U.S. nursing homes.

■ WC34

H - 6th Floor, Powell A

Process Modeling and Analysis (1)

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: Harriet Black Nembhard, Marcus Department of Industrial & Manufacturing Engineering, The Pennsylvania State University, 310 Leonhard Building, University Park, PA, 16802, hbnembhard@psu.edu

1 - Response Surface Methodology for Split-Plot Experiments: A Sequential Learning Strategy

Geoff Vining, vining@vt.edu

Properly applied, response surface methodology (RSM) is a sequential learning strategy. The traditional steps are screening experiments, followed by steppest ascent. After moving the experimental region, one conducts follow-up experiments. In many cases, the follow up experiments involve design augmentation. Crucial to this process is testing for lack-of-fit.

2 - A Bayesian Approach for Missing Observations in Experimental Designs for Nanomanufacturing

Harriet Black Nembhard, Marcus Department of Industrial & Manufacturing Engineering, The Pennsylvania State University, 310 Leonhard Building, University Park, PA, 16802, hbnembhard@psu.edu, Navin Acharya

In some nanomanufacturing situations, the experimenter is forced to deal with a design having one or more missing observations. We present new models and techniques for analyzing such experiments using a Bayesian predictive approach. These methods are illustrated through a series of gas-phase micro-electro-mechanical systems (MEMS) lubrication experiments.

3 - Integrating Statistics with Operational Modeling for Yield Management in Semiconductor Manufacturing

J. George Shanthikumar, Professor, University of California, Berkeley, Berkeley, CA, United States, shanthikumar@ieor.berkeley.edu

We demonstrate that statistical in-line binning algorithms, such as support vector machines, used for defect classification should be developed within the framework of excursion control and root cause analysis. As such sample planning for excursion control in semiconductor manufacturing should be integrated with the statistical model used for binning.

4 - Interactive Desirability Function Approach to Multiresponse Surface Optimization

In-Jun Jeong, mrking@postech.ac.kr, Kwang-Jae Kim

Multiresponse surface optimization requires the decision maker's preference information on the tradeoffs among multiple responses. This paper proposes an integration of the desirability function method and the interactive optimization method, where the desirability function is determined and optimized in an interactive manner.

■ WC35

H - 6th Floor, Sutter A

Frontiers in Enterprise Marketing

Sponsor: Marketing
Sponsored Session

Chair: Victor Cook, Professor of Marketing Strategy, Tulane University, Freeman School of Business, Goldring/Woldenberg Hall 650, New Orleans, LA, 70118, United States, Victor.Cook@tulane.edu

1 - When Marketing Science Meets Corporate Finance
Victor Cook, Professor of Marketing Strategy, Tulane University, Freeman School of Business, Goldring/Woldenberg Hall 650, New Orleans, LA, 70118, United States, Victor.Cook@tulane.edu, William Moult, Jim Spaeth

Both marketing science and corporate finance are about maximizing returns. Since corporate finance operates at the enterprise level so must marketing science, if the two disciplines are to meet. The missing link is that selling, general and administrative expenses capture all the costs of the people involved in creating and managing enterprising marketing assets. We show how maximizing returns on these assets increase earnings and contribute to shareholder value in the pharmaceutical industry.

2 - Earning Boardroom Respect for Marketing
Dave Sutton, Chief Executive Officer, Inforte, 150 N. Michigan Avenue, Suite 3400, Chicago, LA, 60601, United States, Dave.Sutton@inforte.com

Wise marketing investments can create a hefty annuity for the Enterprise, so why do most businesses still view marketing as an expense? Shifting from the use of ROI to justify marketing to using ROI to manage marketing will require more than just a change of measuring tools and techniques - you're going to have to transform your culture. Only by embracing a scientific, Enterprise Marketing perspective will marketers earn boardroom respect for truly driving shareholder value.

3 - Branding the Brands: Creating a Virtual Tracking Stock Market in Brand Names
Thomas H. Noe, A. B. Freeman Chair of Finance, Tulane University, Freeman School of Business, Golding/Waldenberg Hall M142, New Orleans, LA, 70118, United States, Tom.Noe@Tulane.edu, Edward C. Strong, Suman Banerjee

Strong brands that promise sustained quality are a powerful corporate asset. The value of a brand typically is calculated as the net present value of its stream of future earnings. This paper develops a framework that allows customers to place a value on a company's brand by creating a market trading on contingent claims. This process affords companies a direct measure of their brands' values relative to competition on a continuous basis providing feedback concerning tactics and strategies.

■ WC36

H - 6th Floor, Taylor A

Applied Probability: Queueing and Markov Models

Contributed Session

Chair: Manjunath Kamath, Professor, Oklahoma State University, School of Industrial Engr and Management, 322 Engineering North, Stillwater, OK, 74078, United States, mkamath@okstate.edu

1 - On Transience and Recurrence in Irreducible Finite-State Stochastic Systems
Peter Haas, IBM Almaden Research Center, 650 Harry Road, K55/B1, San Jose, CA, 95120-6099, United States, peterh@almaden.ibm.com, Peter Glynn

The generalized semi-Markov process (GSMP) is the usual model for the underlying process of a complex discrete-event stochastic system. The "clocks" in a GSMP govern the occurrence of state transitions. This talk focuses on irreducible finite-state GSMPs in which at least one clock is set according to a heavy-tailed distribution function. We show, perhaps surprisingly, that such a GSMP can have transient states when two or more of the clock-setting distributions have heavy tails.

2 - Two Moment Approximations for Performance Evaluation of Synchronization Stations
Ananth Krishnamurthy, Rensseaer Polytechnic Institute, CII 5225, Dept of DSES,, 110 8th Street,, Troy, NY, 12180, United States, krisha@rpi.edu, Ram Ramakrishnan

This research proposes two moment approximation for performance evaluation of synchronization operations having multiple (n>2) inputs with general characteristics. Kanban policy is used for setting population constraints. The approach used utilizes known results on fork/join synchronization with 2 inputs as a building block for the analysis. The approximations compare well with results from simulation.

3 - Application of the Markovian Principle to the NASA Advanced Life Support System Framework
Tze Chao Chiam, Research Assistant, Purdue University, 180 Burke Court, Apt 111, West Lafayette, IN, 47906, United States, tzechao@purdue.edu, Chit Hui Ang, Yuehwern Yih

This paper discusses the application of Markov principle to improve the configuration of the advanced life support system by developing tools and analytical approaches. States indicating the "health" of the system are defined based on the levels of oxygen and carbon dioxide in the system. Intricate dependence between human and plants is illustrated. Decision-making processes and possible decisions such as real-time scheduling of crewmembers activities are discussed to keep the system "healthy".

4 - Lumpability Approximation Methods for Markov Models
Lin Zhang, Purdue University, School of Industrial Engineering, West Lafayette, IN, 47907, United States, zhang39@purdue.edu, Marlin Thomas

When using state aggregation techniques to reduce the scale of large scale Markov models, the main drawback is the loss of Markov property and there is no known method to measure how much information is lost in aggregation. Some methods are proposed to measure the loss of the Markov property based on the theory of lumpability. Sample applications are provided for finding steady state probability vectors and solving Markov decision processes.

5 - Development of the Queueing Network Markup Language (QNML)
Manjunath Kamath, Professor, Oklahoma State University, School of Industrial Engr and Management, 322 Engineering North, Stillwater, OK, 74078, United States, mkamath@okstate.edu, Karthik Ayodhiramanujan, Mahesh Chalavadi

We discuss the development of the Queueing Network Markup Language (QNML), which is an XML-based markup language for describing queueing network models. The QNML is a starting point for a standard interchange format for queueing network model specifications. We present a preliminary metamodel for QNML that is based on the Queueing Network Analyzer framework. We also present an XML-based schema to validate QNML.

■ WC37

H - 6th Floor, Van Ness

Economic Aspect of Transport and Supply-Chain Logistics

Sponsor: Applied Probability
Sponsored Session

Chair: Jia Yanm Assistant Professor, Hong Kong Polytechnic University, Hung Hom, Kowloon, Hong Kong, HK, Hong Kong, lgtjiay@polyu.edu.hk

1 - Optimal Shipping Policies for a Production System with Transportation Disruption
Xiuli Chao, Professor, NCSU, Operations Research, Raleigh, NC, 27695, United States, xchao@eos.ncsu.edu, Chung-Yee Lee, Sean Xiang Zhou

Supply chain disruptions can cause severe financial losses. In this paper we consider a production system with transportation disruptions and characterize the optimal shipping strategy. Both the cases with and without setup cost are considered.

2 - Maritime Safety and Security for Chinese Energy Transportation
Kevin Li, Assistant Professor, Hong Kong Polytechnic University, Dept. of Logistics, The HK POLYU, Hong Kong, HK, Hong Kong, lgtkxli@polyu.edu.hk, Jin Cheng

To ensure the security of this area is in the best interests of all Asian countries, including China, whose energy transportation is mainly through Malacca Straits. It merits a thorough study on the implications of this issue from legal, technical and economic aspects, and makes suggestions to governments for further actions. The study will propose to establish an International Center for Maritime Safety and Security in Hong Kong under legal umbrella of the IMO.

3 - An Analysis of Airport Pricing and Regulation in the Presence of Competition
Tae Oum, Professor, University of British Columbia, Sauder School of Business, Vancouver, BC, Canada, tae.oum@sauder.ubc.ca, Mark Lijesen, Xiaowen Fu

Whether or not the privatized or commercialized airports should be left unregulated is still an open question.We answer this question by studying a duopoly model to capture the differential competitive effects of changing airport user charges on full service airlines and low cost carriers.

4 - Airlines Yield Management with Demand Driven Dispatch
Xiubin Wang, Assistant Professor, University of Wisconsin-Superior, Department of Business and Economics, Department of Business and Economics, Superior, WI, 54880, United States, XWang1@uwsuper.edu, Qiang Meng

We integrate dynamic yield management and fleet assignment to study the airlines yield management with demand driven dispatch.We show that the threshold policy holds in this dynamic yield management problem. Numerical examples are presented to show the optimal solutions.

5 - Exploiting Heterogeneous Preferences in Road Pricing Policy Design
Jia Yan, Assistant Professor, Hong Kong Polytechnic University, Hung Hom, Kowloon, Hong Kong, HK, Hong Kong, lgtjiay@polyu.edu.hk, Kenneth Small, Clifford Winston

We study road pricing policies accounting for the heterogeneity in users' preferences for travel time and time uncertainty. Based on empirical evidences, we show that pricing policies designed to cater to varying preferences can improve both the efficiency and political feasibility.

■ WC38

R - 2nd Floor, Corintia

Mixed Integer Nonlinear Programming

Sponsor: Optimization/ Nonlinear Programming
Sponsored Session

Chair: Jeff Linderoth, Lehigh University, 200 W Packer Ave, Bethlehem, PA, 18015, United States, jtl3@Lehigh.EDU

1 - Tutorial: Mixed Integer Nonlinear Programming
Jeff Linderoth, Lehigh University, 200 W Packer Ave, Bethlehem, PA, 18015, United States, jtl3@Lehigh.EDU, Sven Leyffer

Many optimization problems involve both nonlinear constraints to model physical phenomena and integer variables to model design decisions, giving rise to mixed integer nonlinear programming (MINLP) problems. The efficient solution of large MINLP problems remains an open question whose solution requires expertise in both integer and nonlinear optimization. This tutoriał will chart the state of the art in MINLP from the view of nonlinear programming and mixed integer linear programming.

■ WC39

R - 3rd Floor, Aragon

Pricing Strategies for Operations Management

Contributed Session

Chair: Betul Lus, University of Massachusetts, 160 Governors Drive, Amherst, MA, 01003, United States, blus@acad.umass.edu

1 - Newsvendor Product Design
Qin Geng, UIUC, 302 W. Locust, Apt 1., Urbana, IL, 61801, United States, qingeng@uiuc.edu, Nicholas Petruzzi

We examine an extension of the newsvendor problem in which stocking quantity, pricing and quality can be decision variables. We analyze how uncertainty affects pricing strategy and quality design for the single period problem. By introducing a base newsvendor model, we synthesize the results and develop additional insights to enrich the existing knowledge.

2 - Profit Smoothing and Product Pricing
Mahesh Kumar, Assistant Professor, Rutgers Business School, 180 University Avenue, Newark, NJ, 07102, United States, maheshk@rutgers.edu, Suresh Govindaraj

We present a new explanation for price discrimination in products and services that is based on the sellers' objective to smooth profits. We show that when sellers carry multiple products, the spread in buying and selling prices of any product depends on the profits and inventory positions of the other products. Consequently, sellers may price the same product differently depending on the range of products that they carry.

3 - Joint Determination of Sales Lever and Inventory Control with General Demand Functions
Ying Wei, Dept of Systems Engineering and Engineering Management, The Chinese University of CUHK, Shatin, N.T., HONG KONG, Hong Kong, ywei@se.cuhk.edu.hk, Youhua Chen

In a standard periodic review setting with setup costs, demand depends on the sales lever, such as price, promotion, and service package, or a combination of them. In general, the maximal expected one-period gross profit, as a function of inventory level, fails to be unimodal. We develop an efficient algorithm for finding the optimal (s,S,z) policy, and explore the conditions under which it is also globally optimal.

4 - On the Capacity Investment of Two Substitutable Services with Price Flexibility
Haiyan Wang, Olin School of Business, Washington University in St. Louis, Saint Louis, MO, 63130, United States, wangha@olin.wustl.edu, Zhongjun Tian, Ping Su, Panos Kouvelis

We consider two substitutable services with different qualities. In case that there are unsatisfied demands for one service and excess capacity of the other, we employ pricing strategy to motivate the unsatisfied customers to switch to the other service, which can be a substitution of the original service. We investigate the optimal pricing strategy and the optimal capacity setting. The benefits of pricing strategy and substitutability are illustrated.

5 - A Note on Linear Demand Models for Substitutable Products
Betul Lus, University of Massachusetts, 160 Governors Drive, Amherst, MA, 01003, United States, blus@acad.umass.edu, Ana Muriel

We study the performance of two types of linear demand functions for substitutable products in a variety of pricing and capacity models in monopolistic and competitive settings. While the first type leads to unrealistically high prices and profits as products become more substitutable, the results obtained with the second type are in line with intuition. We also discuss the impact of product substitutability on the optimal levels of flexible capacity under both demand fuctions.

■ WC40

R - 3rd Floor, Barcelona I

Special Topics in Networks & Graphs

Contributed Session

Chair: Hemanshu Kaul, University of Illinois at Urbana-Champaign, 1409, W. Green St., Altgeld Hall #273, Urbana, IL, 61801, United States, hkaul@uiuc.edu

1 - A New Approach to Revenue Management Network Optimization
Xiaoqing Sun, Sr. Enginerr, Schneider National, 3101 South Packerland Drive, Green Bay, WI, United States, SunP@schneider.com

In integrating airlines' revenue management funtion into capacity planning, the network optimization algorithm used in revenue management is faced with traffic under-estimation problem. The proposed method in solving the network optimization problem will solve the problem.

2 - On the Maximum Cardinality of k-regular Induced Subgraphs
Domingos Cardoso, Prof., Aveiro University, Math. Dep. of University of Aveiro, Campus de Santiago, Aveiro, 3810-193, Portugal, dcardoso@mat.ua.pt

A maximum stable set and a maximum induced matching are examples of maximum cardinality k-regular induced subgraphs. The high complexity and increased application of these sets implies the determination of polynomial-time upper and lower bounds on their size. In this presentation, a polynomial time upper bound on the maximum cardinality of a k-regular induced subgraph is proposed, a necessary and sufficient condition for this bound be tight is introduced and some applications are presented

3 - Improved Algorithms for Bottleneck Flow Problems
Abraham Punnen, Professor, Simon Fraser University, 14th Floor Central City Tower, 13450 - 102 AVE, Surrey, BC, V3T 5X3, Canada, apunnen@sfu.ca, Rounan Zhang

In this paper we consider the bottleneck network flow problem and propose several general purpose algorithms to solve the problem. All the algorithms are of polynomial complexity and some improves the best known time bounds. Various special cases are also discussed with improved time complexity.

4- Polynomial Reduction Rules to Decrease the Number of Dummy Arcs in an AoA Network
Sevil Sen,Hacettepe University, Hacettepe Universitesi, Bilgisayar Muh., Bolumu, Ankara, Turkey, sevil@cs.hun.edu.tr

In this paper, we have developed a set of reduction rules, for each of rules worst-case running time is polynomial, in order to decrease the number of dummy arcs without violating the precedence relations given in an AoA network. The developed rules don't contain a solution for set-cover(i.e. dummy-arc) problems not solvable in polynomial time and are examined under four different classifications: Dummy arc contraction, Dummy arc insertion, Node overlapping, Node insertion.

5 - Global Optima Results for the Kauffman NK Model
Hemanshu Kaul, University of Illinois at Urbana-Champaign, 1409, W. Green St., Altgeld Hall #273, Urbana, IL, 61801, United States, hkaul@uiuc.edu, Sheldon Jacobson

Kauffman NK model is a stochastic combinatorial optimization model for discrete systems, in theoretical biology, physics, and business organizations, with several interacting components that can be in various states. We describe a computational setup using a stochastic network model, which leads to strategies for computing bounds on its global optima. We also present theoretical bounds on the global optima using graph theory, probabilistic combinatorics and order statistics.

■ WC41

R - 3rd Floor, Barcelona II

Special Topics in Optimization II

Contributed Session

Chair: Feng Pan, TSM, Los Alamos National Laboratory, LANL, F604, Los Alamos, NM, 87545, United States, fpan@lanl.gov

1 - The Bridge Version of the Dynamic Transshipment Problem
Vardges Melkonian, Assistant Professor, Ohio University, 550 Morton Hall, Athens, OH, 45701, United States, vardges@math.ohiou.edu

A dynamic network consists of a graph with capacities and transit times on its edges. In a bridge version, an edge capacity limits the total flow on the edge at any given time. The goal is to send certain demand amounts through the network in a minimum possible time. We present solution methods for the problem.

2 - An Implementation of Benders' Decomposition Using a Genetic Algorithm for the Master Problem
Ming-Che Lai, Assistant Professor, Yu Da College of Business/Dept. of Marketing & Logistics Management, 168 Hsueh-fu Rd., Tanwen Village, Chaochiao Township, Miaoli County, 361, Taiwan, brnlai@ydu.edu.tw, Hansuk Sohn

Benders' decomposition algorithm has been successfully applied in many areas. A major difficulty with this decomposition lies in the solution of master problem, which is a "hard" problem, costly to compute. Our proposed algorithm incorporates a genetic algorithm to obtain "good" suboptimal solutions to the master problem at a tremendous saving in the computational effort. A classical capacitated plant location problem is used as an example to illustrate the implementation.

3 - Symmetry Breaking in IP Models: Parallel Machine Lot-sizing
Raf Jans, Assistant Professor, RSM Erasmus University, P.O. Box 1738, Rotterdam, 3000 DR, Netherlands, rjans@rsm.nl

The parallel machine lot-sizing problem consists of finding the optimal timing and level of production and the best allocation of products to machines. With multiple identical machines there are many alternative optimal solutions, which can be created by renumbering the machines. We propose new constraints to break this symmetry and discuss how these can be applied to other problems as well.

4 - Integer programming models for the q-mode problem
Girish Kulkarni, NC State University, 2152 Burlington Labs, NC State Universit, Box 7913, Raleigh, NC, 27695-7913, United States, girishmk@yahoo.com, Yahya Fathi

In this paper, we discuss the theoretical properties of an existing mixed integer programming (MIP) model for the q-mode problem and propose several enhancements to it. We also propose a new MIP model for this problem. Further, we investigate the Benders' decomposition for one of the MIP models and implement an exact algorithm based on it. The MIP models and the exact algorithm are investigated through a comprehensive computational experiment.

5 - Optimal Strategy Set for Zero-Sum Game under Extreme Uncertainty
Kevin Saeger, Los Alamos National Laboratory, LANL, Los Alamos, NM, 87545, United States, saeger@lanl.gov, Feng Pan

We consider a zero-sum game with uncertain payoff matrix and the uncertainty can't be quantified by probability measure. We derive a set of possible strategies to solve this problem and discuss the relevant properties of this solutions set. An algorithms is developed to construct this solution set, and we show a military application.

■ WC42

R - 4th Floor, Parc Ballroom I

Special Topics in Forecasting

Contributed Session

Chair: Zheng Li, GRA, University of Texas at Austin, 1 University Station C 1761, Austin, TX, 78712, United States, zhengli@mail.utexas.edu

1 - State-of-the-Art Approaches for Building Predictive Models in Data Mining
Mikhail Golovnya, Senior Statistician, Salford Systems, 4740 Murphy Canyon Rd., Suite 200, San Diego, CA, 92123, United States, golomi@salford-systems.com

Stochastic gradient boosting is Stanford University Jerome Friedman's latest advance in data mining. Classification and regression models are built up gradually through a large collection of small trees, each of which improves on its predecessors through an error-correcting strategy. The final model is a series expansion in which every term is a (small) tree. Key innovations in the methodology will be discussed. Analysis of churn modeling data will be shown.

2 - A Stackelberg Model of Pricing of Complementary Goods under Information Asymmetry
Xiaowei Zhu, SBA, U.of WI-Milwaukee, University of Wisconsin, P.O. Box 742, Milwaukee, WI, 53201, United States, xzhu@uwm.edu, Samar Mukhopadhyay, Xiaohang Yue

We consider two firms marketing complementary products following a leader-follower type Stackelberg game. Each firm has private forecast information giving rise to information asymmetry. We present optimal pricing policies for three cases: Strategic Alliance, Information Sharing and no Information Sharing. We study the value of information sharing and present several managerial insights.

3 - Explanation Characteristics and Forecast Adjustment
Dilek Onkal, Professor, Bilkent University, Faculty of Business Administration, Bilkent University, Ankara, 06800, Turkey, onkal@bilkent.edu.tr, Michael Lawrence, M.Sinan Gonul

This study outlines an experiment to investigate the effects of structural characteristics of provided explanations on forecast adjustment. Focusing on the effects of explanation length (short vs long) and the conveyed confidence level (weak vs strong confidence), we find that the strongly confident and long explanations are more effective in participants' acceptance of interval forecasts.

4 - A Semi-Parametric Time Series Approach in Modelling Hourly Electricity Loads
Jun Liu, Assistant Professor of Quantitative Methods, Georgia Southern University, Dept. of Finance and Quant. Analysis, P.O. Box 8151, Statesboro, GA, 30460, United States, jliu@georgiasouthern.edu, Rong Chen, Lon-Mu Liu, John Harris

A semi-parametric approach is developed to model nonlinear time series. This approach is used on hourly electricity load data, it considers the effect of temperature combined with those of time and day type. The temperature effect is modelled by nonparametric moothing. An ARIMA model is used to model the serial correlation. An iterative backfitting algorithm is proposed for estimation. The post sample forecasting performance and comparative results show good potential of this approach.

5 - Modeling Infrastructure Performance Using Bayesian Ordered Probit Models
Zheng Li, GRA, University of Texas at Austin, 1 University Station C 1761, Austin, TX, 78712, United States, zhengli@mail.utexas.edu, Jianming Ma

Most of existing infrastructure performance models are developed using traditional frequentist statistical methods which only provide the point estimates of model parameters and suffer from estimation convergence difficulty. Bayesian order probit model is proposed to solve these problems. Case study results based on the AASHO Road Test data shows that the developed Bayesian model can not only reduce the uncertainty of frequentist statistical method but also provide reliable predictions.

■ WC43

R - 4th Floor, Parc Ballroom II

Relaxation Adaptive Memory Programming (RAMP) for Combinatorial Optimization

Sponsor: INFORMS Computing Society/ Heuristic Search Sponsored Session

Chair: Cesar Rego, Associate Professor, University of Mississippi, University, Oxford, MS, 38677, United States, crego@bus.olemiss.edu

1 - RAMP for the Capacitated Minimum Spanning Tree
Frank Mathew, Student (Doctoral Candidate), University of Mississippi, P.o. Box 4999, University, MS, 38677, United States, fmathew@bus.olemiss.edu, Cesar Rego, Fred Glover

The capacitated minimum spanning tree (CMST) problem has been widely studied for its importance in practical applications. Nevertheless, most of the best methods to date still have difficulty finding solutions of highest quality. We show how the RAMP method succeeds in solving the CMST effectively.

2 - RAMP for Very Large Set Covering Problems
Jose Ablanedo, jablanedo@bus.olemiss.edu, Cesar Rego, Fred Glover

The Set Covering Problem (SCP) is a classical combinatorial problem used to model a wide range of applications such as airline and railway crew scheduling, political districting, and truck routing. We present a variant of a RAMP algorithm yielding exceedingly promising very large SCPs.

3 - RAMP for Resource Constrained Project Scheduling
Haitao Li, Assistant Professor, Troy University-Montgomery, Sorrell College of Business,, Montgomery Campus, 136 Catoma Street, 2n, Montgomery, AL, 36103-4419, hli_haitaoli@hotmail.com, Cesar Rego, Fred Glover

We present a RAMP algorithm to compute strong lower bounds and find high quality feasible solutions for a wide class of resource constraint project scheduling problems. A computational study carried out on a variety of classical benchmark problems is presented and discussed.

4 - A RAMP Approach for Large Scale Linear Ordering Problems
Dorabela Gamboa, Assistant Professor, Escola Superior de Tecnologia e Gestão de Felgueiras, Instituto Politécnico do Porto, Apt. 205, Felgueiras, 4610-156, Portugal, dgamboa@estgf.ipp.pt, Cesar Rego, Fred Glover

We propose a primal-dual RAMP algorithm derived from an effective combination of scatter search with cross-parametric relaxations for the solution of large scale difficult Linear Ordering Problems. Extensive computational testing is reported.

■ WC44

R - 4th Floor, Parc Ballroom III

Open-Source Tools for Mixed Integer Programming

Sponsor: INFORMS Computing Society/ Optimization Services and Open Source Software
Sponsored Session

Chair: Matthew Saltzman, Clemson University, Mathematical Sciences Dept., Martin Hall, Box 340975, Clemson, SC, 29634, United States, mjs@clemson.edu

1 - The SYMPHONY Callable Library
Ted Ralphs, Lehigh University, 200 West Packer Avenue, Easton, PA, 18015, United States, tkralphs@lehigh.edu, Menal Guzelsoy

We describe the latest developments in the SYMPHONY callable library for solving mixed-integer linear programs, focusing on new procedures for warm starting and sensitivity analysis.

2 - A Library Hierarchy for Implementing Scalable Parallel Search Algorithms
Yan Xu, Member of Applications Staff, SAS Institute Inc., SAS Campus Drive, Cary, NC, 27513, United States, yan.xu@sas.com, Laszlo Ladanyi, Ted Ralphs, Matthew Saltzman

We discuss a library hierarchy for implementing scalable parallel search algorithms: ALPS, BiCePS and BLIS. ALPS forms the base layer, which is also the search handling layer, BiCePS is the data handling layer, and BLIS implements LP-based branch and bound algorithms. We present computational results for solving large integer programs

3 - DECOMP: A Framework for Decomposition in Integer Programming
Matthew Galati, Optimization Developer, SAS Institute, SAS Campus Drive, Cary, NC, 27603, United States, matthew.galati@sas.com, Ted Ralphs

Decomposition techniques such as Lagrangian Relaxation and Dantzig-Wolfe decomposition are well-known methods of developing bounds for discrete optimization problems. We draw connections between these classical approaches and techniques based on dynamic cut generation. We discuss methods for integrating cut generation and decomposition in a number of different contexts and present DECOMP, an open-source framework that provides a uniform interface for implementation of these various techniques.

4 - Open-Source Branch-and-Bound Tree Size Prediction
Brady Hunsaker, Univeristy of Pittsburgh, Pittsburgh, PA, United States, hunsaker@engr.pitt.edu, Joseph Gallo

We present open-source implementations of the technique proposed by Cornuejols, Karamanov, and Li for predicting the eventual size of a branch-and-bound tree. We explore the ease of implementation in two open-source solvers, GLPK and CLP, and report on the effectiveness of the technique for these solvers.

■ WC45

R - 4th Floor, Raphael

Facility Layout

Sponsor: Transportation Science & Logistics
Sponsored Session

Chair: Anshu Jalora, Texas A&M University, 1100 Hensel Drive W3L, College Station, TX, 77840, United States, anshu@tamu.edu

1 - Analysis of Shop Floor Material Distribution Systems Used in Lean Manufacturing
David Ciemnoczolowski, PhD Candidate, University of Michigan, Industrial and Operations Engineering, 1205 Beal Ave., Ann Arbor, MI, 48105, United States, dciemnoc@engin.umich.edu, Yavuz A. Bozer

Cyclic, fixed-route-based material handling and parts-delivery systems (generally known as "milk run systems") are used widely in lean plants to enable frequent deliveries of containerized parts from a central storage area (or supermarket) to line-side delivery/storage points at multiple work centers on the factory floor. We develop a method determine how to assign work centers to routes and calculate the service level at each work center for a given number of kanbans.

2 - Grid Layout Design for Retail Stores
A. Reha Botsali, Ph.D. Student, Texas A&M University, Dept. of Industrial Engineering, College Station, TX, United States, reha@neo.tamu.edu, Brett A. Peters, Georgia-Ann Klutke

In this study, we analyze retail store layout design problem, which has an important influence on the sales revenue in retail sector. We use impulse purchase revenue and customer travel distance as the performance measures in retail store layout design. We provide a modular design structure for grid layout, one of the common layout types used in retail stores, and use this design structure in a simulated annealing algorithm to find good layouts in reasonable time.

3 - Design, Layout and Operations at a Cross-docking Facility
Anshu Jalora, Texas A&M University, 1100 Hensel Drive W3L, College Station, TX, 77840, United States, anshu@tamu.edu, Brett A. Peters

A new method for dispatching empty vehicles used to unload and load trucks at cross-docking facilities is integrated into design of efficient layouts and operating policies. This scheme significantly reduces the total internal material transport costs, which directly depend on the total loaded and empty travel of the transport vehicles.

■ WC46

R - 4th Floor, Rubens

Robustness and Transportation Networks

Sponsor: Transportation Science & Logistics
Sponsored Session

Chair: Satish Ukkusuri, Assistant Professor, Rensselaer Polytechnic Institute, 4036 Jonnson Engineering Center, Department of Civil & Environmental Engg, Troy, NY, 12180, United States, satish.ukkusuri@gmail.com

1 - Accounting for Robustness in the Network Design Problem under Uncertain Demand
Satish Ukkusuri, Assistant Professor, Rensselaer Polytechnic Institute, 4036 Jonnson Engineering Center, Department of Civil & Environmental Engg, Troy, NY, 12180, United States, satish.ukkusuri@gmail.com, Travis Waller, Tom Matthew

In this research, we study a new and important variation of the network design problem that explicitly accounts for long term demand uncertainty.We develop a methodology based on genetic algorithm (GA) to find robust network design solutions. We present computational results to demonstrate the value of robustness on multiple test networks and present insights into the problem

2 - Robust Initial Solution for Information-Based Control of Vehicular Traffic Systems
Srinivas Peeta, Associate Professor, Purdue University, School of Civil Engineering, 550 Stadium Mall Drive, West Lafayette, IN, 47907-2051, United States, peeta@ecn.purdue.edu, Alexander Paz

A robust initial solution to membership function parameters of a fuzzy information-based traffic control model is obtained using H-infinity and Kalman filtering approaches. The approach minimizes the maximum possible error that can be encountered at the beginning of the planning horizon for a day.

3 - Solution Methods for a SCGE Model for Multi-Layer Infrastructure Systems
Pengcheng Zhang, OR Analyst, American Airlines, 4333 Amon Carter Blvd., Fort Worth, TX, 76155, United States, zhangp@purdue.edu, Srinivas Peeta

Variational inequality and mathematical programming representations of a spatial computable general equilibrium model are discussed and implemented to capture interdependencies among civil infrastructure systems. Analytical and numerical solution approaches are proposed and tested on small scale networks of several layers. Implementation issues are discussed.

4 - Approximation Approaches for Evaluating the Traffic Equilibrium Problem under Uncertain Demand
Travis Waller, Assistant Professor, UT, ECJ 6.201, Austin, TX, 78712, United States, stw@mail.utexas.edu, Satish Ukkusuri

We propose different approaches for evaluating the expected value of the network performance under uncertain demand in the traffic equilibrium problem. Two fundamentally different approaches: single point approximations and response surface analysis will be discussed as potential solution approaches for large scale networks. Computational analysis on test networks will demonstrate the feasibility and the benefit of these approaches.

■ WC47

R - 4th Floor, Michelangelo

Planning and Design Issues in Distribution

Sponsor: Transportation Science & Logistics
Sponsored Session

Chair: Ann Campbell, Assistant Professor, University of Iowa, Department of Management Sciences, Iowa City, IA, 52242, United States, ann-campbell@uiowa.edu

1 - Upgrading Arcs to Minimize Maximum Travel Time
Ann Campbell, Assistant Professor, University of Iowa, Department of Management Sciences, Iowa City, IA, 52242, United States, ann-campbell@uiowa.edu, Timothy Lowe, Li Zhang

In transportation and telecommunication systems, the performance of the underlying network can often be improved by upgrading some of the arcs. Upgrading an arc corresponds to using a rapid mode of transit, such as using a plane instead of a truck. With respect to different minimax network objectives, we define a series of problems that involve finding the best q arcs to upgrade. We show that these problems are NP-hard on general graphs, but polynomially solvable on trees.

2 - Load Consolidation Optimization of Flows to a Single Destination
Shankara Kuppa, PhD Candidate, University of Michigan - Ann Arbor, Industrial and Operations Eng. Dept., 1205 Beal Avenue, Ann Arbor, MI, 48109, United States, skuppa@umich.edu, Richard Wong, Prabhakar Thyagarajan

We consider a fixed charge network flow problem to a single destination with service time constraints. We solve this problem using a dual ascent approach on a layered space time network representation and utilize the results to optimize the consolidation of loads to a single destination. Computational results will be presented.

3 - Driver Assignment for a Home-Delivery System under Uncertainty
Juan Carlos Munoz, Assistant Professor, Universidad Catòlica de Chile, V Mackenna 4860, Santiago, Santiago, 6904411, Chile, jcm@ing.puc.cl, Sebastian Genta

A firm providing one-hour home-delivery plans its driver needs weekly. The firm tells each driver which hours to work so that enough drivers are called and the total cost minimized. Typical labor constraints must be satisfied. Not all drivers are equivalent for the firm. Each of them may have a different type of contract, salary, historical absenteeism rate or productivity (tours per hour). The problem is formulated and solved using mathematical programming tools.

■ WC48

R - 4th Floor, Dante

Metaheuristic Approaches for Some Recent Problems

Contributed Session

Chair: Dr. Steven Yuhaski, Operations Research Analyst, Natick Soldier Center, Supporting Sci. & Tech. Directorate, 1 Kansas Street, Natick, MA, 01760, United States, steve.yuhaski@natick.army.mil

1 - A Hybrid Random-Key Genetic Algorithm for a Symmetric Multi-Objective Traveling Salesman Problem
Funda Samanlioglu, Assistant Professor, NC A&T State University, Industrial & Systems Engineering, 1601 East Market Street, Greensboro, NC, 27411, United States, fsamanli@ncat.edu, William G. Ferrell, Mary Beth Kurz

This paper finds approximate weakly Pareto optimal solutions to a symmetric multi-objective Traveling Salesman Problem (moTSP) using a hybrid approach that combines elements of a random key genetic algorithm (RKGA) like elitist reproduction, parameterized uniform crossover with tournament selection, immigration, and swap mutation with a local search procedure. The random keys representation insures that feasible tours are constructed during the application of genetic operators.

2 - A Tabu Search Algorithm for the Single Vehicle Routing Allocation Problem
J Beasley, Brunel University, Brunel University, Uxbridge, United Kingdom, john.beasley@brunel.ac.uk, Chandra Poojari, L Vogt

The single vehicle routing allocation problem involves deciding a route for a vehicle (starting and ending at given locations) such that it visits some customers. Customers not visited can either be allocated to their nearest customer on the route, or can be isolated; where the objective is to minimise a weighted sum of routing, allocation and isolation costs. Our tabu search algorithm includes aspiration, path relinking and diversification. Computational results are presented.

3 - A Tabu Search Interactive Metaheuristic to solve a Multiobjective Location Routing Problem.
Julian Molina, Associate prof., University of Malaga, Campus El Ejisdo s./n., Malaga, MA, Spain, julian.molina@uma.es, Rafael Caballero, Mercedes Gonzalez, Flor Guerrero, Concepciòn Paralera

We present an interactive TS metaheuristic to solve a Multiobjective Location Routing Problem. In this type of problem, we have to locate some plants within a set of possible locations to meet the demands of a number of clients (to be visited by a set of routes), where each possible solution is evaluated according multiple objectives. The method proposed is not only obtaining the Efficient Set of the problem, but also driving the decision maker to find the most prefered solution among this set.

4 - Application of a Genetic Programming Hybrid to the 3-D Orthogonal Packing Problem
Dr. Steven Yuhaski, Operations Research Analyst, Natick Soldier Center, Supporting Sci. & Tech. Directorate, 1 Kansas Street, Natick, MA, 01760, United States, steve.yuhaski@natick.army.mil, Dr. Louis Piscitelle

A genetic algorithm hybrid, having an embedded heuristic, is applied to the Orthogonal Packing Problem (OPP) in three dimensions. Application of the heuristic, which addresses some particular geometric properties of the rigid OPP, enhances significantly the computational efficiency in locating the feasible configurations. A significant aspect of the algorithm is that it determines the configurations under the condition that no space is allowed to exist between any of the contiguous surfaces.

■ WC49

R - 4th Floor, Medici

Planning for Surges in the Demand for Health Care

Cluster: Health Care
Invited Session

Chair: George Miller, The Altarum Institute, P.O. Box 134001, Ann Arbor, MI, 48113-4001, United States, george.miller@altarum.org

1 - A Stochastic Simulation Model of Hospital Surge Capacity
Nathaniel Hupert, Asst. Professor of Public Health and Medicine, Weill Medical College of Cornell University, 411 E. 69th St., KB 309, New York, NY, 10021, United States, nah2005@med.cornell.edu, Daniel Wattson

We developed a model to simulate single or multiple hospital response to terrorist, natural, or industrial events resulting in mass casualties, including chemical, biological, and nuclear/radiological scenarios. The specifications of the model conform to the nomenclature of the new Emergency Data Exchange Language (EDXL), a proposed set of standardized, NIMS-compliant data exchange specifications developed by Emergency Interoperability Consortium.

2 - Simulating Public Health and Acute Care Responses to a Smallpox Attack
George Miller, The Altarum Institute, P.O. Box 134001, Ann Arbor, MI, 48113-4001, United States, george.miller@altarum.org, Steve Randolph

We apply discrete event simulation to planning public health and acute care system responses to a terrorist-initiated smallpox outbreak in an urban setting. The Casualty Prediction Model projects disease transmission within the community. The Healthcare Complex Model then simulates effects of acute care delivery on resource requirements and patient outcomes. Insights support allocation of limited resources among public health and acute care response measures to minimize morbidity and mortality.

■ WC50

R - 4th Floor, Cervantes

Decision Analysis Arcade III

Sponsor: Decision Analysis
Sponsored Session

Chair: Eric Bickel, Assistant Professor, Department of Industrial and Systems Engineering, Texas A&M University, 236B Zachry Engineering Center, 3131 TAMU, College Station, TX, 77843-3131, United States, ebickel@tamu.edu

1 - Modeling Competition in Service Times
Amy Taylor, University of New Hampshire, 217-F McConnell Hall, Durham, NH, 03824, United States, William Tunnercliffe

Walmart has lower prices than Target but Target offers quicker checkout times. In this paper, we model competition in a Hotelling framework where firms first compete on the basis of service times and then engage in price competition.

2 - Eliciting the Regret Function through the Trade-off Method
Enrico Diecidue, Assistant Professor, INSEAD, Dd de constance, Fontainebleau, 77305, France, enrico.diecidue@insead.edu, Han Bleichrodt, Alessandra Cillo

Regret theory (Bell 1982, Loomes & Sugden 1982, 1987) is one of the most popular nonexpected utility theories. In this paper, we present a quantitative elicitation of the regret function through the trade-off method (Wakker & Deneffe 1996), one of the most robust methods for eliciting individual utility functions. We test whether the regret function has a convex shape as the theory predicts.

3 - Utilizing a Value of Information Framework to Improve Ore Classification and Collection Procedures
Julia Phillips, PhD Candidate, Colorado School of Mines, Division of Economics and Business, Golden, CO, United States, juphilli@Mines.edu

A mine must meet production targets for three ore types (differentiated by quality). Uncertainty of extracted ore quality can lead to missing production targets, loss of revenue and increased operating costs. This research utilizes a VOI framework to improve the quality of decisions regarding ore classification and collection procedures.

4 - Risk Analysis of Property and Casualty Insurers
Lea Deleris, Stanford University, Terman Engineering Center, Room 346, Stanford, CA, 94305, United States, ldeleris@stanford.edu, M. Elisabeth Pate-Cornell

We present an analysis of the risk of insolvency of property and casualty insurers. Based on several input stochastic process, we simulate an insurer balance sheet. This model enables to assess the risk of failure but also, the role played by both external factors and strategic decisions on that risk.

Wednesday, 3:30pm - 5:00pm

■ WD01

H - Lobby Level, Plaza A

Tutorial: Empirical versus Optimal Decision-making in Sequential Search Problems

Cluster: Tutorials
Invited Session

1 - Tutorial: Empirical versus Optimal Decision-making in Sequential Search Problems
Neil Bearden, Postdoctoral Student, Duke University, Durham, NC, United States, jneilb@gmail.com, Amnon Rapoport

This tutorial reviews some of the uses of operations research (OR) methods in experimental psychology. We begin by describing some basic methodological issues that arise in the study of human decision making. Next, we describe research in experimental psychology that uses methods common to OR (e.g., dynamic programming) to understand sequential observation and selection behavior. We then suggest ways in which experimental psychology and OR can each provide the other with new research questions.

■ WD02

H - Lobby Level, Plaza B

Business Applications II

Contributed Session

Chair: Viroj Buraparate, Manager, Hewlett-Packard, 20555 SH 249, Houston, TX, 77070, United States, viroj.buraparate@hp.com

1 - Optimization Technologies in Customer Services Business: A Case Study of Hewlett-Packard
Sung-Ho Chang, Director, Hewlett-Packard, 20555 SH 249, Houston, TX, 77070, United States, sung-ho.chang@hp.com, Viroj Buraparate

The presentation describes the customer service process for the IT industry which includes Call and Repair Centers. Background of the current processes and areas that optimization techniques can be applied will be given. The preliminary results based on the implementation of these techniques in HP Customer Services Operations will be provided.

2 - Call Center Forecasting Process
David Olsen, Senior Forecasting Analyst, Hewlett-Packard, 20555 SH 249, Houston, TX, 77070, United States, dolsen@hp.com, Ghanasham Apte

The process developed to support capacity planning and daily operations for the customer call centers is discussed. Details of the forecasting models, data inputs, and validation steps are provided. Also discussed is the quality control process that combines statistical forecasts along with expert business knowledge. Accurate forecasts and confidence bands are produced.

3 - Optimal Call Center Capacity Allocation Model
Will Lin, Senior Operations Research Analyst, Hewlett-Packard, 20555 SH 249, Houston, TX, 77070, United States, will.lin@hp.com, Atul Dhawan

The presentation describes the call volume allocation process, business constraints, and areas of improvement needed. The mathematical model (Linear Programming) that was built to optimally allocated call volumes and the detailed formulation of this model will be explained. The authors will compare the performance of this optimization with the current process and quantify the monetary benefits of using this model in real operations.

4 - Optimization Strategies for Resolving Inventory Problems in Customer Service Repair Centers
Steven Myles, Operations Research Analyst, Hewlett Packard, 20555 SH 249, Houston, TX, 77070, United States, steven.myles@hp.com, Terrell Thruston, Viroj Buraparate

The authors discuss an overall process for inventory management over the entire life cycle of consumer product support. Challenges and opportunities that exist in the current process are identified. The optimization techniques that fit the situation in different phases of the product life cycle (e.g., New Product Introduction (NPI) and End-of-Life (EOL)) will be shared along with the results of their implementation.

5 - On the Economic Properties of Software and Implications for Software Business
Olli-Pekka Mutanen, Markus Makela, Mika Ahokas

Software is a unique good, having properties of both material and information goods that come in a special combination. This uniqueness as an economic good results in many insights and problems for further inquiry for the research area of software business, indicating avenues for further research.

■ WD03

R - 3rd Floor, Sienna II

Systems Analysis of Supply Chains

Contributed Session

Chair: Pranab Majumder, Assistant Professor, Duke University, Fuqua School of Business, Durham, NC, 27708, United States, majumder@duke.edu

1 - Channel Structure, Cross Sales, and Vertical Integration in a Multi-Channel Distribution System
Chongqi Wu, University of Illinois at Urbana-Champaign, 1206 South Sixth Street, 339 Wohlers Hall, Champaign, IL, 61820, United States, cwu5@uiuc.edu, Suman Mallik

Consider two manufacturers, each producing a single substitutable product. There are two retailers through which the products are sold to the consumers. Each retailer could be privately owned or owned by a manufacturer. A manufacturer is not restricted to using only one retailer. Define cross sales to be the situation where at least one manufacturer sells product through both outlets. The research questions include: What are the equilibrium channel configurations? When will cross sales occur?

2 - Retailer Power in Supply Chains
Pranab Majumder, Assistant Professor, Duke University, Fuqua School of Business, Durham, NC, 27708, United States, majumder@duke.edu, Ashok Srinivasan

We examine large network supply chains where a common supplier sells to multiple retailers, with or without intermediaries. We model the network using a generalized Stackelberg leader-follower framework. We analyze the model for cases when the supplier is the leader of the network versus when one dominant retailer is the leader. We contrast our results on contract leadership with a profit sharing contract with bargaining power.

■ WD05

H - 6th Floor, Powell B

Contractual Issues in Supply Chain

Contributed Session

Chair: Hua Tao, National University of Singapore, DS DEPT., Business School, NUS, Singapore, Singapore, taohua@nus.edu.sg

1 - Endogenously Determined Supply Contracts for the Price-Setting Newsvendor Problem

Gal Raz, Assistant Professor, Australian Graduate School of Management (AGSM), Australian Graduate School of Management, UNSW, Sydney, 2052, Australia, galr@agsm.edu.au, Evan Porteus

This paper studies endogenously determined supply contracts between a supplier and a price-setting retailer. The retailer and the supplier use a three-stage contract that combines the revenue sharing and buyback contracts where in each stage, the deciding party makes a decision based on its self-interest. The solution to the contract we analyze, provides a natural baseline for supply chain contracting under endogenous retail pricing and help measure the power of each party in the negotiation.

2 - Impact of Exclusive Contract on the Entry and Investment Decisions in a Serial Supply Chain

Xiuli He, PhD Candidate, The University of Texas at Austin, 1632 W. 6th St, Apt#P, Austin, TX, 78703, United States, xiuli.he@phd.mccombs.utexas.edu

Consider a serial supply chain which consists an end-product manufacturer who purchases parts form a component supplier.To protect the trade between the incumbent manufacturer and his part supplier, end-product manufacturer and component supplier may have incentives to sign an exclusive contract that specify price, quantity, and penalty of default. This paper studies the impact of an exclusive contract on entry and capacity investment decisions.

3 - The Flexibility of Supply Contracts and Implications of Pooled Option

Hua Tao, National University of Singapore, DS DEPT., Business School, NUS, Singapore, Singapore, taohua@nus.edu.sg, Mabel Chou

We analyze the flexibility of supply chain contracts in view of real options. In particular, we examine and price the single-product reorder option, return option and multi-products pooled option under a manufacturer-retailer game theoretic framework. Their impact to the efficiency of the whole supply chain is analyzed and studied.

■ WD06

H - Ballroom Level, Imperial B

Designing a Reverse Logistics Strategy

Cluster: Reverse Supply Chains

Invited Session

Chair: Canan Savaskan, Assistant Professor, Kellogg School of Management, 2001 Sheridan Road, Evanstons, Chicago, IL, 60208, United States, r-savaskan@kellogg.northwestern.edu

1 - The Effect of Competition on Recovery Strategies

Mark Ferguson, Assistant Professor, Georgia Tech, College of Management, 800 West Peachtree St., NW, Atlanta, GA, 30307, United States, Mark.Ferguson@mgt.gatech.edu, Beril Toktay

We develop models to support a manufacturer's recovery strategy in the face of a competitive threat on the remanufactured product market. We first model the competition between new and remanufactured products produced by the same firm, then we model competition with an entrant firm. The average cost to collect/remanufacture is modelled as an increasing function of the quantity collected/remanufactured.

2 - Integrating Reverse Channel Design Decisions with Forward Distribution Network

Kristin Sahyouni, PhD Student, Northwestern University, Industrail Engineering and, Management Science Dept., Evanston, 60208, United States, kristin@iems.northwestern.edu, Mark Daskin, Canan Savaskan

This paper provides a foundation for developing integrated forward and reverse supply chain network design problems. We present both an analytical model and a discrete formulation for the optimal location of forward and reverse distribution centers for efficient product delivery and returns collection. Solution methods and results are also presented.

3 - Drivers of Remanufacturing Economics

Baris Yalabik, PhD Student, University of Illinois, Urbana-Champaign, Champaign, IL, yalabik@uiuc.edu

We model the product selection and sales contract decisions of a firm operating in new and remanufactured goods markets. We find that products that gradually provide value to customers are better candidates for remanufacturing. Also, the firm prefers to change its sales contract rather than its product design only if customer demand is sufficiently insensitive to that contract.

4 - Remanufacturing as a Marketing Strategy

Atalay Atasu, PhD Student, INSEAD, Fontainebleau, 77300, France, Atalay.ATASU@insead.edu, Miklos Sarvary, Luk Van Wassenhove

Remanufacturing decisions can be driven by factors such as cannibalization, competition and diffusion. We show that when costs are below certain thresholds, the higher the competition level, the higher is the remanufacturing benefit. Thus, remanufacturing can be viewed as an efficient tool to defend market share. We also show that product's diffusion rate is a significant driver of remanufacturing decisions. Higher diffusion rates accentuate the benefits or drawbacks of remanufacturing.

5 - Integrating Reverse Channel Design Decisions with Forward Distribution Network

Canan Savaskan, Assistant Professor, Kellogg School of Management, 2001 Sheridan Road, Evanstons, Chicago, IL, 60208, United States, r-savaskan@kellogg.northwestern.edu, Mark Daskin, Kristin Sahyouni

This paper provides a foundation for developing integrated forward and reverse supply chain network design problems. We present both an analytical model and a discrete formulation for the optimal location of forward and reverse distribution centers for efficient product delivery and returns collection. Solution methods and results are also presented.

■ WD07

H - Ballroom Level, California

Use of Information System in Organizations

Contributed Session

Chair: Edward Chen,Associate Professor, University of Massachusetts Lowell, One University Avenue, Management Department, Lowell MA 01854, United States, Edward_Chen@uml.edu

1 - Impact Assessment of Organizational Mergers on Information Systems:a case analysis

J. Hosseini, Intelekt, 5 Evelyn Rd., Waban, MA, 02468, United States, info@intelekt.com

The objective of this paper is to describe the impact that large organizational mergers have on Information systems, Infrastructure, Integration and IT workforce planning. Specifically the merger between Bank of America (BAC) and Fleet Bank will be illustrated.

2 - Managing the Transition: The Role of Information Technology in the Product-to-Service Deployment St

Jeremy Brann, PhD Student, Texas A&M University, 4217 TAMU, College Station, TX, 77843-4217, United States, jbrann@mays.tamu.edu, Rogelio Oliva

Contemporary management literature advocates the development of support services for product manufacturers as a means to cultivate additional revenue streams from existing customers. Inevitably, the transitioning firm must decide how to deal with the information technology demands of the service business. This paper examines the role of information technology in the product-to-service transition and considers the impact of IT choices on the success of the transition.

3 - Co-evolution of Interfirm Information Systems and Coordinative Methods

Sami Sarpola, Helsinki School of Economics, Runeberginkatu 14-16 00100 Helsinki, Helsinki, Finland, sami.sarpola@hkkk.fi, Sanna Laukkanen, Katariina Kemppainen

Numerous SCM studies have explored on one hand the adoption of enabling information technologies and on the other hand the status of SC practices. While research on these two topics is abundant, there is a call for synthesis of the perspectives. We propose a conceptual framework for the unified assessment of both enabling inter-firm information systems and organizational coordination mechanisms. Empirical evidence is used to illustrate the practical implications.

4 - Is IT Outsourcing a Fear Factor?

Edward Chen, Associate Professor, University of Massachusetts Lowell, One University Avenue, Management Department, Lowell, MA, 01854, United States, Edward_Chen@uml.edu, David Lewis

Information technology outsourcing causes a lot of fears in the downturn of IT job market and reduced IS enrollment in US universities. There are benefits to companies who may not have the resources or financial stability to staff their own IT by outsourcing IT functionalities. Along with the benefits, there are risks associated with outsourcing IT. We take an in-depth look at these issues related to IT outsourcing and offer some managerial implications.

■ WD08

H - Ballroom Level, Imperial A

Resource Allocation and Staffing

Contributed Session

Chair: Andrew Lim, Assistant Professor, IEOR Berkeley, 4135 Etcheverry Hall, University of California, Berkeley, CA, 94720, United States, lim@queue.ieor.berkeley.edu

1 - Determining Optimal Staff Mix in Banks

Murat Bayiz, Marshall School of Business, University of Southern California, Los Angeles, CA, 90089, United States, murat.bayiz@marshall.usc.edu

An efficient bank should be able to increase staff to meet customers peak time needs and reduce staff when traffic is slow. In this study we develop an integer program that considers the cost versus flexibility trade-off to determine the optimum staff mix that fits customer need fluctuations. The staff mix decisions define the number of full time, part time, and flex type staff with their total weekly hours. The suggested approach is applied to a large retail bank on the west cost.

2 - An Iterative Multi-Layer Network Flow Approach to Personnel Duty Assignment

Ahmet Sen, Turkish Naval Academy, Deniz Harp Okulu K.ligi, Endustri Muh.Bl.Bsk.ligi Tuzla, Istanbul, 34942, Turkey, ahmetsen@su.sabanciuniv.edu, Senay Solak

We show that the problem of assigning officers optimally to the monthly officer of the watch list at a military institution is NP-hard, and propose an iterative multi-layer minimum cost network flow approach. The objective of the proposed network flow model is to minimize the dissatisfaction of officers by ensuring a fair and balanced load of monthly assignments for each officer. The decisions are constrained by the availability of officers on a given day and past dissatisfaction levels.

3 - A Queueing Model for Yield Management of Computing Centers

Yezekael Hayel, INRIA/IRISA, Campus Universitaire de Beaulieu, Rennes, France, yhayel@irisa.fr, Parijat Dube

Yield Management for computing infrastructures has recently been introduced as a decision tool for resource allocation and pricing of computing resources. One of the main difficulty in understanding yield management for computing resources is the complex dependence of sojourn times of jobs on factors like customers' choice, job service discipline etc. We propose a framework for modeling and analysing the benefits obtained from yield management in such a scenario.

4 - Flexible Resource and Quality of Information

Jian Yang, Assistant Professor, New Jersey Institute of Technology, 323 Martin Luther King Jr. Boulevard, Department of IME, GITC 2514, Newark, NJ, 07102, United States, yang@adm.njit.edu, Youhua Chen

We study a problem in which resources are built up first before they are used in the final production stage. We examine a simple two-stage two-product problem in which the information revealed between the two stages may be of variable quality. We propose a formal definition to the meaning of "quality of information", and derive results on the benefit of having better information.

5 - The Duality Between Robust Dynamic Pricing and Resource Allocation

Andrew Lim, Assistant Professor, IEOR Berkeley, 4135 Etcheverry Hall, University of California, Berkeley, CA, 94720, United States, lim@queue.ieor.berkeley.edu, Thaisiri Watewai, George Shanthikumar

We consider the problem of multi-product revenue management for which there is model uncertainty. Model uncertainty is described using the notion of relative entropy, and we discuss the duality between the multi-product problem and a resource allocation problem.

■ WD09

H - Ballroom Level, Yosemite A

Inventory Management and Competition

Cluster: Supply Chain Management
Invited Session

Chair: Victor Martinez de Albeniz, Assistant Professor, IESE Business School, Av. Pearson 21, Barcelona, 08034, Spain, valbeniz@iese.edu

1 - Coordinating and Rational Contracts in Supply Chains

David Simchi-Levi, dslevi@mit.edu, Xin Chen, Stephen Shum

We analyze a decentralized supply chain with multiple risk neutral or risk averse agents facing demand uncertainties. We define coordinating contracts and illustrate that, due to competition, not all coordinating contracts are achievable. Thus, we introduce the notion of rational contracts, which reflects the agents "bargaining power" and restricts the set of coordinating contracts to a subset which is "credible".

2 - The Competitive Impact of Fast Response in Inventory Management

Felipe Caro, UCLA Anderson School, 110 Westwood Plaza, Los Angeles, CA, 90095, United States, felipe.caro@anderson.ucla.edu, Victor Martinez de Albeniz

We present a duopoly newsvendor model. We focus on the case when one of the firms has a lower production cost but can only produce at the beginning of the selling season in a make-to-stock fashion, whereas the second firm has higher costs but more frequent replenishment opportunities. We characterize the equilibrium and investigate the impact of competition on the industry inventory and production modes. The extension to a larger number of players is discussed.

3 - Asymmetric Consumer Learning and Inventory Competition

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

We develop a model of consumer learning and choice behavior in response to uncertain service at the marketplace. Learning can be asymmetric, i.e., consumers may associate different weights with positive and negative experiences. Using a non-cooperative game between two retailers competing on the basis of their in-stock service levels, we show how asymmetry in consumer learning has a significant impact on the optimal service levels, market shares and profits of the retailers.

4 - Pricing in a Duopoly with a Lead Time Advantage

Victor Martinez de Albeniz, Assistant Professor, IESE Business School, Av. Pearson 21, Barcelona, 08034, Spain, valbeniz@iese.edu

We analyze the price competition between two suppliers offering two different lead-times to a buyer. The buyer replenishes inventory using a base-stock policy with each one of the suppliers. In essence, the fast and expensive supplier is used only in emergencies; and the slow and cheap supplier receives the bulk of the orders. Based on the buyer's behavior, the suppliers set static prices that maximize their long-term average profit. We study the equilibrium of the pricing game.

■ WD10

H - Ballroom Level, Yosemite B

Inventory Problems in Supply Chains

Contributed Session

Chair: Jun-Yeon Lee, Assistant Professor, University of Houston-Victoria, 14000 University Boulevard, Sugar Land, TX, 77479, United States, leej@uhv.edu

1 - Coordinating Supply Chain Inventories with Mode Selection

Juan Gaytan, Professor, Instituto Tecnològico y de Estudios Superiores de Monterrey, Eduardo Monroy Càrdenas #2000, Toluca, Mx, 50110, Mexico, jgaytan@itesm.mx, Elias Jimenez

We consider the mode selection problem inspired by an automotive company that imports products and has to coordinate the suppliers' replenishments. In the model we consider explicitly service level, lead time, and transportation, setup and holding costs over the planning horizon. This is a bi-criteria multi-item joint replenishment problem with common replenishment epochs. We propose a genetic algorithm. Tests are conducted on problems from the automotive company and from the literature.

2 - A Continuous-Review Production-Inventory System with Markov-Modulated Demand and Supply Processes

Esmail Mohebbi, Dept.of Industrial and Management Systems Engineering, University of Nebraska-Lincoln, Lincoln, NE, 68588-0518, United States, emohebbi@unlnotes.unl.edu

We present a capacitated stochastic production-inventory model with Markov-modulated demand and/or supply processes. Utilizing a continuous-review production control policy we characterize exact expressions for a number of performance measures in the steady state and present some numerical results.

3 - Leadtime Management in a Periodic-Review Inventory Model: An Agency Perspective

Jun-Yeon Lee, Assistant Professor, University of Houston-Victoria, 14000 University Boulevard, Sugar Land, TX, 77479, United States, leej@uhv.edu, Leroy Schwarz

We consider a simple periodic-review inventory model from an agency perspective, in which the owner of the inventory system delegates its operation to an agent (internal manager or external supplier). In this model, a replenishment order is delivered immediately or one-period later, depending probabilistically on the effort expended by the agent. We provide the form of optimal payment scheme and suggest that a state-dependent base-stock policy is optimal.

■ WD11

H - Ballroom Level, Yosemite C

Contract Management in Supply Chain Systems

Contributed Session

Chair: Hongxia Xiong, Ph.D. Candidate, Stanford University, Terman Engineering Center, Stanford University, Stanford, 94305, United States, hxiong@stanford.edu

1 - Warranty Sharing Contract with Root Cause Analysis in Supply Chains

Gary Chao, Northwestern University, garychao@iems.northwestern.edu, Seyed Iravani, Canan Savaskan

We will characterize the incentives of the supplier(s) and the manufacturer to invest in the reliability of their supply process under various warranty sharing relationships. We investigate the effectiveness of selective root cause analysis in coordinating such quality improvement effort and compare it to group warranty schemes which have been discussed in literature. It is shown that this contract results in the same outcome in centralized and decentralized supply chains.

2 - Contracting under Asymmetric Production Cost Information

Xianghua Gan, Hong Kong Polytechnic University, Department of Logistics, Hong Kong, China, ganxianghua@hotmail.com, Metin Cakanyildirim, Suresh P. Sethi

We study a supply chain consisting of a supplier and a retailer. The supplier has better information on his unit production cost than the retailer does. We model this problem as a game of adverse selection. In this model the retailer offers a menu of contracts. We derive an optimal contract menu for the retailer under a general assumption about the supplier's reservation profit, and we find that in some cases the supply chain can be coordinated even with asymmetric information.

3 - Design of Extended Warranties in Supply Chains

Kunpeng Li, University of Illinois at Urbana-Champaign, 350 Wohlers Hall, MC-706, 1206 S. Sixth Street, Champaign, IL, 61801, United States, kli@uiuc.edu, Dilip Chhajed, Suman Mallik

Using a single manufacturer and retailer supply chain framework, we develop a game theoretic model to study two commonly observed practices of selling extended warranties: through the manufacturer or through the retailer. We show that offering extended warranty through the retailer generates more system profit and provides longer extended warranty protection. We identify the different causes of inefficiencies in the two decentralized models and propose coordination mechanisms to eliminate them.

4 - Contract Design in Mixed Multiple Principal-Agent Supply Chains

Hongxia Xiong, Ph.D. Candidate, Stanford University, Terman Engineering Center, Stanford University, Stanford, 94305, United States, hxiong@stanford.edu

We study a multi-principal multi-agent game in a complete-information supply chain setting and determine coordinating equilibrium transfer schedules when the payoffs of the principals and the system can depend on the actions of both the principals and the agents. We apply the results to a multiple supplier-retailer supply chain when the suppliers (agents) decide on capacity allocation and the retailers (principals) decide on retail prices.

■ WD12

H - 4th Floor, Union Square 1

Scheduling Modeling in Transportation

Contributed Session

Chair: Anne Goodchild, University of California at Berkeley, 945 Ohlone Ave #964, Albany, CA, United States, anne_g@berkeley.edu

1 - Computing Dynamic User Equilibria for Large-Scale Transportation Networks

Mansoureh Jeihani, Senior Associate, Resource Systems Group, 46A Barrister Dr. Apt#307, White River Junction, VT, 05001, United States, mjeihani@vt.edu, Hanif Sherali, Antoine Hobeika

An approach for computing dynamic user equilibria is developed to address the traffic assignment process using disaggregated microscopic simulation-based models. The proposed method is implemented within TRANSIMS, Transportation Analysis and Simulation System, and is applied to a large-scale and a medium-scale network. Our results exhibit that an improved distribution of travelers is obtained while consuming less than 17-33% of the computing effort required by the current version of TRANSIMS.

2 - The Full-truck Delivery Planning Problem with Time Windows and Side Constraints: A Proposed Algorithm

Manuel G. De La Rosa, Instituto Tecnologico y de Estudios Superiores de Monterrey Campus Toluca, Eduardo Monroy Càrdenas #2000, Toluca, Mexico, al01050550@invitados.itesm.mx, Juan Gaytan

The problem is faced everyday by a single factory. This factory has to deliver full-truckloads to several warehouses. The demand for each warehouse and a receiving time window is known in advance. Side constraints are considered and include the ability to load only one truck in a specific loading period. The solution algorithm is based on network flow and lagrangian relaxation. The proposed schedule includes a minimum number of trucks used and a maximum utilization of trucks

3 - Train Scheduling as Limited Buffer Job Shop Scheduling

Sam Pyke, Queensland University of Technology, Gpo Box 2434, Brisbane, Australia, sj.pyke@student.qut.edu.au, Erhan Kozan

This paper describes a railway scheduling model which allows branch lines and trains which are longer than some crossing loops and allows for acceleration time. The Shifting Bottleneck Heuristic (SBH) assumes infinite capacity buffers between machines, and when applied to train scheduling tends to produce "solutions" which exceed the capacity of crossing loops. The modified version of SBH in this paper allows buffer capacity constraints, allowing it to be used for railway scheduling problems.

4 - Modeling the Truck Scheduling Problem for Solid Waste Collection

Denis Borenstein, Associated Professor, Federal University of Rio Grande do Sul, Av. Washington Luis 855, Porto Alegre, RS, 90010, Brazil, denisb@ea.ufrgs.br, Jing-Quan Li, Pitu Mirchandani

This paper discusses the development of a model for the truck scheduling problem for the solid waste collection in a Brazilain city. Our study has as main objective to investigate a scheduling pattern that not only attempts to minimize the total costs involved, including operational (related to distances traveled) and fixed (related to the number of trucks required to pick up the waste) costs, but also to balance the collection trip assignments to each recycle unit due to social perspectives.

5 - The Feasibility of a Private Airline for a College Sports League

Anne Goodchild, University of California at Berkeley, 945 Ohlone Ave #964, Albany, CA, United States, anne_g@berkeley.edu, Gautam Gupta, Mark Hansen

In this research we address the feasibility of a dedicated airline for a sports league. Given a game schedule, fleet and operating constraints, a routing and scheduling is determined. A generalized model is developed and results are compared to those of a case-based simulation tool. We comment on strategies for creating schedules to minimize transportation cost, and the economic feasibility of semi-private sports league operations.

■ WD13

H - 4th Floor, Union Square 5

Innovation in Optimization

Contributed Session

Chair: Byung-In Kim, Assistant Professor, POSTECH, San 31, Hyoja-Dong, Pohang, 790-784, South Korea, bkim@postech.ac.kr

1 - On the Aspect of Maximum Resolution Topology (MRT) Modeling of Online Auction Market Data

Sydney Chu, University of Hong Kong, Department of Mathematics, Hong Kong, China, schu@hku.hk

We consider a topologically driven MRT optimization model for the intriguing question of what "shape" the given online market data is in. Our model bases on operational data from sources like eBay.com to visualize the dimensions of the markets and determine maximally the resolution of buyer/seller market dichotomy.

2 - Pricing American-Style Options Using Model Reference Adaptive Search

Huiju Zhang, PhD Student, University of Maryland, Van Munching Hall, College Park, MD, 20742, United States, huizhang@rhsmith.umd.edu, Michael Fu

We apply a randomized optimization algorithm based on Model Reference Adaptive Search to pricing American-style options through parameterizing the early exercise boundary. Numerical results are provided for American call and put options written on underlying assets following geometric Brownian motion and jump-diffusion processes.

3 - Theory and Application of Optimality Conditions for the Linear Assignment Problem

Mohammad S. Sabbagh, Professor, Isfahan University of Technology, Department of Industrial Engineering, Isfahan, Iran, sabbagh2@yahoo.com

In this paper we prove some necessary and sufficient optimality conditions for the assignment problem (AP) and then present some application for it. We start with a given feasible solution for our (AP) and then, if possible, try to improve it while maintaining its feasibility then test its optimality. Since any tour of a traveling salesman problem is a feasible (AP) solution of its corresponding cost matrix these results can be used to improve any given tour of the traveling salesman problem.

4 - A Hybrid Meta Heuristic Approach for the Traveling Salesman Problem with Time Windows

Byung-In Kim, Assistant Professor, POSTECH, San 31, Hyoja-Dong, Pohang, 790-784, South Korea, bkim@postech.ac.kr

An iterative insertion algorithm and a hybrid meta heuristic of simulated annealing and tabu search with 2-interchange and a simple move is suggested for the traveling salesman problem with time windows (TSPTW). New best known heuristic values for many benchmark problem sets are obtained by the proposed approach.

5 - What was John Kerry's Optimal Strategy and Would it Have Been Enough?

James Cochran, Department of Marketing and Analysis, College of Administration and Business, Louisiana Tech University, Ruston, LA, 71272, jcochran@cab.latech.edu, Jeffrey Camm, Jon Pinnell, David Curry, Rajesh Radhakrishnan

We treat the problem of finding the optimal political platform for a U.S. Presidential candidate as a special case of the share of choices problem. We use our approach to find the projected winner in each state, estimate variance and bias of the estimated Electoral College votes for each candidate, assess the sensitivity of each candidate's support to changes in his position on various issues, find the optimal platform for each candidate relative to the positions assumed by his opponent(s), and identify key issues for the 2004 U.S. Presidential election.

■ WD14

H - 4th Floor, Union Square 6

Air Force Supply Chain Management

Sponsor: Military Applications
Sponsored Session

Chair: Alan Johnson, Associate Professor, Air Force Institute of Technology, AFIT/ENS, 2950 Hobson Way, Bldg 641, W-P AFB, OH, 45433-7765, United States, alan.johnson@afit.edu

1 - Estimating Transportation Requirements for Multi-Echelon F-15 Deployments

William Cunningham, Professor of Logistics Management, Air Force Institute of Technology, AFIT/ENS, 2950 Hobson Way, Wright-Patterson AFB, OH, 45433-7765, United States, william.cunningham@afit.edu, David Maxwell, Martha Cooper

Since the end of the Cold War, the military has become focused on the capability to rapidly respond to emerging crises anywhere. In order to quickly develop transportation requirements for deployment scenarios, a regression-based forecasting tool is developed to identify the factors related to transportation needs for support of an F-15E fighter squadron. This will allow more accurate assessments of plan feasibility and transportation supportability in a shorter time frame.

2 - The Algebra of Tankers

Alan Johnson, Associate Professor, Air Force Institute of Technology, AFIT/ENS, 2950 Hobson Way, Bldg 641, W-P AFB, OH, 45433-7765, United States, alan.johnson@afit.edu, Margaret Romero

Air refueling-the in-flight transfer of fuel from a tanker to a receiver aircraft-is essential for military deployment and combat operations. Tanker studies are currently constrained by a lack of fundamental algebraic relationships between key metrics and associated quick look tools that can accommodate rapid, rough-cut analyses across a wide range of potential scenarios, parameter values, and assumptions. This presentation summarizes our research in this area.

3 - Comparing F-16 Maintenance Scheduling Philosophies

John Bell, Assistant Professor of Logistics Management, Air Force Institute of Technology, AFIT/ENS, 2950 HobsonWay, Bldg 641, W-P AFB, OH, 45433-7765, United States, john.bell@afit.edu, Maj Victor Wiley

A simulation model is used to test flying schedule philosophies for the Air Force's F-16 aircraft. A multiple round Delphi study of maintenance officers was conducted to capture historical scheduling practices used by managers. Then, an extensive simulation model was created to model the F-16 flying process, and a full factorial experiment identified significant differences among the scheduling methods. The results indicate when to use certain scheduling methods to improve maintenance health.

4 - The Future of Space Transportation for Cargo Movement

Robert Brigantic, Senior Scientist, Pacific Northwest National Laboratory, 902 Battelle Boulevard, P.O. Box 999, Richland, WA, 99352, United States, robert.brigantic@pnl.gov

The Space Shuttle was to be the our nation's gateway to space, delivering large payloads and being capable of relaunch within a few weeks. However, the shuttle has not delivered on its vision for easy access to space. If a future spacecraft could be quickly launched and recovered it could offer a huge advantage in rapid delivery of large payloads. We explore this potential for rapidly delivering military and civil cargos worldwide.

■ WD15

H - 4th Floor, Union Square 9

Scheduling Models, Methodologies and Tools

Contributed Session

Chair: Dagan Gilat, IBM, IBM Haifa Research Lab, Haifa, No, 31905, Israel, dagang@il.ibm.com

1 - A Branch-and-Price Approach for Large-Scale Employee Tour Scheduling Problems

Hua Ni, IBM, 12902 Federal Systems Park Dr., Fairfax, VA, 22033, United States, huani@us.ibm.com, Hernan Abeledo

We propose an integer programming model where tours are decomposed into shifts and start-times. This formulation can model complex shift and start time rules for both continuous and discontinuous scheduling problems. A branch-and-price approach is devised to solve this model efficiently. The methodology was tested on the largest tour scheduling problems found in the open literature. In comparison with an alternative implicit model, our approach showed superior computational performance.

2 - Integrating Nurse and Surgery Scheduling

Jeroen Beliën, Katholieke Universiteit Leuven, Naamsestraat 69, Leuven, 3000, Belgium, jeroen.belien@econ.kuleuven.be, Erik Demeulemeester

Integrating the surgery scheduling with the nurse scheduling process is a simple, yet effective way to achieve considerable savings in staffing costs. We present a model that integrates both the nurse and the surgery scheduling process. We show how the column generation technique that is often employed for nurse scheduling problems can easily cope with this model extension. The computational results section provides an idea of the cost saving opportunities and required solution times.

3 - Evaluating Structural Effects on the Scheduling Performance of Multi-Project Systems

Olga Kaminer, PhD Candidate, York University, 4700 Keele Street, Toronto, ON, M3J1P3, Canada, okaminer@schulich.yorku.ca, Boaz Golany

This paper offers a comprehensive study of the structural effects of multi-project multi-mode networks on their scheduling performance in resource-constrained environments. In order to select the proper operational mode for each activity, we employed an artificial agents' approach. We found that in contrast to single project environments, the make-span is not a monotonically increasing function of the network complexity.

4 - Solving a Production Scheduling Challenge with Project Scheduling — Part 1: Model and Optimization

Christian Wernz, Ph.D. Candidate, University of Massachusetts Amherst, 160 Govenors Drive, E-Lab, Amherst, MA, 01003, United States, cwernz@ecs.umass.edu

A scheduling problem, as it can be found in the process industry is formulated using a project scheduling approach based upon binary programming. Besides a comprehensive set of constraints, a new formulation for break calendars and a new type of constraint for process-accompanying resources are presented. A newly developed, integrated solution procedure transforms the real world data into an optimal schedule.

5 - SWOPS — A General Shift Work Optimized Planning & Scheduling Tool

Dagan Gilat, IBM, IBM Haifa Research Lab, Haifa, No, 31905, Israel, dagang@il.ibm.com, Yossi Shiloach, Segev Wasserkrug, Ariel Landau

SWOPS (Shift Work Optimized Planning and Scheduling) is a general tool for multi-skill, multi-activity shift work scheduling. It is an extension of a former tool (CCS) that concentrated on Call Center Scheduling. SWOPS approach is to translate the problem into a 0-1 assignment problem and solve it by integer programming. This approach enables the tool to deal with a large set of business rules and incorporate new rules easily. The tool is based on 10 year experience with various customers.

■ WD16

H - 4th Floor, Union Square 10

Special Topics in Economics and OR

Contributed Session

Chair: Yanni Papadakis, Assist. Professor of Decision Sciences, Drexel University, 3147 Chestnut Street, Philadelphia, PA, 19104, United States, isp@drexel.edu

1 - Level of Collaboration Between Firms in a Global Value Chain.

Hakon Hynne, Senior Research Scientist, SINTEF Technology & Society, S.P. Andersens vei 5, Trondheim, 7465, Norway, hakon.hynne@sintef.no

The main objective of this paper is to develop a theoretical framework for effective collaboration between companies in a global value chain, which can be used as a decision making system. The major research questions are: What kind of collaboration between companies in a value chain is most effective under different circumstances? How should coordination and the management of the value chain be to ensure efficiency?

2 - Implicit Collusion in a Repeated Cournot Market

Eddie Anderson, Australian Graduate School of Management, University of New South Wales, Sydney, NSW 2052, Australia, eddiea@agsm.edu.au, Andy Philpott

In a competitive marketplace with few firms, the Nash equilibrium for the one-shot game is one possible outcome. But in a repeated game (e.g. an electricity market) the effects of punishment and reward become important. We analyze a simple duopoly model with uncertain demand in which players choose strategies that depend on the market price in the previous round. We show that firms can capture monopoly profits in expectation by using mixed strategies. This is a form of implicit collusion.

3 - Choosing Opponents in Games of Cooperation and Coordination

Peter Engseld, Lund University, P.O. Box 7082, SE-220 07, Lund, Sweden, peter.engseld@nek.lu.se, Andreas Bergh

We analyze a cooperation game and a coordination game in an evolutionary environment. Agents make noisy observations of opponent's propensity to play dove and form preferences over opponents based what they observe. A game takes place when two agents agree to play. Socially optimal cooperation is evolutionarily stable when reputation perfectly reflects propensity to cooperate. In the coordination game, the efficient equilibrium is chosen and agents with better skills to observe earn more.

4 - Existence Results on a Two-Stage Cournot game

Che-Lin Su, Northwestern University, CMS-EMS, Kellogg School of Management, Evanston, IL, 60208, United States, clsu@stanford.edu

We establish the existence results for Saloner's two-stage Cournot game when M producers have different convex quadratic cost functions. We also consider an example with three asymmetric producers. The computational results supplement the conclusion in that producing in the frist period would increase market effciency.

5 - On the Economics of Operations Research / Management Science Consulting

Yanni Papadakis, Assist. Professor of Decision Sciences, Drexel University, 3147 Chestnut Street, Philadelphia, PA, 19104, United States, isp@drexel.edu

The economics of Operations Research / Management Science (ORMS) consulting projects is investigated with emphasis on institutional barriers to the implementation of these business planning exercises that require disparate skills and thus may be performed more cost-effectively by more than one party. A basic understanding of ORMS methods by the management of organizations commissioning a planning exercise is shown to increase the likelihood of these projects taking place.

■ WD17

H - 4th Floor, Union Square 11

Stochastic Modeling and Multi-Echelon Inventory Systems

Contributed Session

Chair: Bin Zhou, Ph.D. Candidate, Rutgers University, Dept. of MSIS, Rutger Business School, 180 University Avenue, Newark, NJ, 07102, United States, zhou@rbs.rutgers.edu

1 - Collaborations in Supply Chain - Value of Information Sharing

Namit Mehta, Consultant, Infosys Technologies Limited, 160 S Virgil Ave Apt # 126, Los Angeles, CA, 90004, United States, namitmehta@gmail.com

An inventory policy model for the supplier is developed in a multi-echelon setting under different levels of collaboration. We show how the information shared between members of a supply chain can be utilized for taking replenishment decisions. We measure the value of this shared information in terms of percentage change in the supplier's inventory holding and stock-out cost and customer service levels. In our model, the distributors are assumed to follow a known order up-to inventory policy.

2 - Echelon Base-Stock Policies are Not Financially Optimal

Qiaohai (Joice) Hu, Case Western Reserve University, Dept of Operations, 10900 Euclid, Cleveland, United States, qxh3@case.edu, Matthew Sobel

This talk concerns a manufacturer's optimization of the expected present value of dividends. If (a) there were a single echelon or if (b) there were no financial constraints, then an echelon base-stock policy would be optimal. Such a policy is not generally optimal if a model lacks (a) and (b).

3 - Optimal Ordering Policy: Stochastic Production and Demand Rates

Keqi Yan, Univ of North Carolina at Chapel Hill, Dept of Stat & Oper Res, Smith Building, CB# 3180, UNC, Chapel HIll, NC, 27599, United States, keqiyan@email.unc.edu, Vidyadhar Kulkarni

We study a type of production-inventory models with the inventory level fluctuating according to the system's environmental process modeled as a CTMC. The main contributions of this paper: (1) Under certain conditions we show that the inventory level has uniform distribution in steady state and is independent of the environmental process. (2) We show that the equivalent of the classical deterministic EOQ formula remains optimal in this stochastic environment, even without the conditions above.

4 - An Efficient Heuristic Policy for Stochastic Inventory Systems with Minimum Order Quantity

Bin Zhou, Ph.D. Candidate, Rutgers University, Dept. of MSIS, Rutger Business School, 180 University Avenue, Newark, NJ, 07102, United States, zhou@rbs.rutgers.edu, Yao Zhao, Michael Katehakis

We consider a single-item, periodic-review inventory system with stochastic demand and linear costs in an infinite horizon. In each period, the system can order either none or at least as much as a minimum order quantity (MOQ). The optimal policies of such a system are quite complex. We propose a heuristic policy of simple structure and show numerically that the heuristic's performance is close to that of an optimal policy.

■ WD18

H - 4th Floor, Union Square 12

Aviation Applications II

Contributed Session

Chair: Rusty Burlingame, Sr. Developer, Southwest Airlines, 2702 Love Field Dr., HDQ-4SY, Dallas, TX, 75235, United States, rusty.burlingame@wnco.com

1 - Value at Risk Approach in Airline Pricing

Zichao Li, Mr, National University of Singapore, The Logistics Institute Asia Pacific, National University of Singapore, Singapore, 119081, Singapore, zichao.li@nus.edu.sg

Value-at-Risk (VaR) is a technique to estimate the likelihood that a given portfolio's losses will exceed a certain amount in risk-management. By observing financial failures among airlines, the author conducted comparisons between the standard maximizing total expected profit approach and the new VaR approach under different market conditions, from which, the author conclude that the new approach is better in ensuring the security and stability in bad market condition.

2 - Southwest Tactical Aircraft Routing and Recovery

Kevin Chang, Southwest Airlines, 2702 Love Field Dr. HDQ 4SY, Dallas, TX, 75235, United States, kevin.chang@wnco.com

The objective is to help Dispatch fulfill near-term MX plans and execute the published schedule. Dispatch SODs are responsible for routing aircraft into maintenance, balancing work loads among MX stations in the next 7 days and recovering MX routings when day-of-ops disruptions arise. The problem is divided into "Tactical Routing" and day-of-ops "Recovery". The development of the Tactical Routing Optimizer will be presented which will be the foundation for the Recovery Optimizer.

3 - Future Flight Schedule and Flight Plan Generation Tool

Alex Huang, Sensis Corporation, 1700 Dell Avenue, Campbell, CA, 95008, United States, alex.huang@sensis.com, David Schleicher

We create a National Airspace System (NAS) flight schedule and flight plan generation tool to reduce the time and effort required to create and validate future flight demand sets. The application addresses the resource-intensive and complex process of developing NAS-wide flight schedules and flight plans for simulation-based applications. The research also identifies approaches to generate different future scheduling scenarios, such as hub-and-spoke or point-to-point scheduling concepts.

4 - Formation of Scale-free Networks: A Discrete-Event Simulation Approach

Rex Kincaid, Professor of Mathematics, Department of Mathematics, College of William and Mary, Williamsburg, VA, 23187-8795, United States, rrkinc@wm.edu, Natalia Alexandrov

A discrete-event simulation aids in understanding the organizing principles of scale-free networks. Degree distribution of the networks formed follow power laws and exhibit modularity. CDF shape for the clustering coefficient detects modularity. The underlying application is U.S. air transport system. Capacity restrictions result in truncated power laws.

5 - Crew Optimization at Southwest Airlines
Rusty Burlingame, Sr. Developer, Southwest Airlines, 2702 Love Field Dr., HDQ-4SY, Dallas, TX, 75235, United States, rusty.burlingame@wnco.com

An overview of crew optimization at Southwest Airlines, including pairing optimization, recurrent training, instructor scheduling, monthly and vacation overlap, and open time reoptimization. Business problems and optimization processes will be discussed.

■ WD19

R - 3rd Floor, Sienna I

Decision Support Systems: Modeling and Applications

Contributed Session

Chair: Horia Tipi, Dash Optimization, 560 Sylvan Avenue, Englewood Cliffs, NJ, United States, horia.tipi@dashoptimization.com

1 - Optimizing Oil Cargo Heating Practices
Ian Fichtenbaum, Centre for Operations Excellence, Sauder School of Business, University of British Columbia, 2053 Main Mall - Room 209, Vancouver, BC, V6T1Z2, Canada, ian.fichtenbaum@coe.ubc.ca, Jack Chong, Eric Cope, Neda Salehirad

The physical properties of certain crude oils require that they remain at elevated temperatures during transport. Heating oil cargos consumes significant amounts of fuel and hence incurs major costs for the shipper. We developed a decision support tool that recommends the lowest cost heating method for a given cargo profile. The tool employs a statistically validated model of cargo cooling and heating, and incorporates it into an optimization model with related temperature constraints.

2 - Dispatching Buses in a Depot Considering Random and Stochastic Arrival
Mohamed Hamdouni, PHD Student, Ecole Polytechnique de Montreal, 4608 Decarie #15, Montreal, QC, H3X 2H5, Canada, mohamed.hamdouni@polymtl.ca

In this paper, we study dispatching buses in a depot considering random and stochastic arrival. First, we consider random arrival of buses where each bus can arrive late than as planned with at most k positions; We present a linear integer program and simulations results to show the effectiveness of our program. Second, we consider stochastic arrival, a linear integer program is presented and computational results are discussed.

3 - Estimating Profitability of Agricultural Subsurface Drainage Improvements using Simulation
Venkatesh Sundaresan, The Ohio State University, c/o Dr. Clark A. Mount-Campbell, 210 Baker Systems, 1971 Neil Avenue, Columbus, OH, 43210, United States, sundaresan.10@osu.edu, Marvin Batte, Larry Brown, Clark Mount-Campbell

Improvements in agricultural water management strategies are relevant to sustain agricultural production. To quantitatively estimate the profitability of such improvements correctly, neither a calculation that combines expected values is sufficient nor is a tool based on a sound technique available currently. We present a technique using simulation for making realizations of profitability by considering investment, crop yield, crop price, crop nutrients applied to the soil and income taxes.

4 - Interaction Design in a Mobile Clinical Decision Support System: The Met System Example
Marta Kersten, Queen's University, School of Computing, Kingston, Canada, kersten@cs.queensu.ca, Wojtek Michalowski, Szymon Wilk

Poorly designed man-machine interactions in a clinical decision support system (CDSS) can cause more problems than the system is intended to solve, ultimately diminishing quality of health care services. MET (Mobile Emergency Triage), a CDSS designed for mobile devices, facilitates triage of children with varying acute conditions in Emergency Rooms (ERs). We present specific interaction solutions and discuss experience from a clinical trial of the MET system at a teaching hospital.

5 - Rapid Interactive Optimization with Xpress Application Developer and Xpress Mosel
Horia Tipi, Dash Optimization, 560 Sylvan Avenue, Englewood Cliffs, NJ, United States, horia.tipi@dashoptimization.com, Nitin Verma

Traditional approaches to embedding optimization within a decision support system used to mean compromising convenience and productivity. As the prototype evolved, maintaining data compatibility between a mathematical model, a database and a GUI required constant tweaking, reducing overall productivity. Xpress Application Developer and Xpress Mosel offer a seamless platform where model development, optimization techniques and visual design are all expressed in a single intuitive language.

■ WD20

H - 6th Floor, Mason B

Forestry V - Harvesting Applications

Sponsor: Energy, Natural Resources & the Environment / Forestry Sponsored Session

Chair: Stephanie Snyder, Operations Research Analyst, USDA Forest Service, North Central Research Station, 1992 Folwell Ave, St. Paul, MN, 55108, United States, stephaniesnyder@fs.fed.us

1 - Integrated Timber Harvest and Fire Management Planning
Mauricio Acuna, Grad student, Oregon State University, Forest Engineering Department, 204 Peavy Hall, Corvallis, OR, 97331, United States, mauricio.acuna@oregonstate.edu, Cristian Palma, Wenbin Cui, David Martell, Andres Weintraub

An integrated fire and forest management planning methodology is presented. It was applied to a forest unit in the boreal region of Canada and basically consists of a fire simulation model, a network model that identifies stands influencing the spread of fires across a landscape and a spatially explicit timber harvest scheduling model.

2 - Comparison of Methodologies for Limiting Opening Sizes in Forest Harvest Scheduling
Juan Pablo Vielma, Georga Institute of Technology, School of Industrial and Systems Eng., Atlanta, GA, jvielma@bellsouth.net, Andres Weintraub, Marcus Goycoolea, Alan Murray

Two integer programming formulations have been proposed for solving the Area Restriction Model. The first, the "cluster" formulation, defines a variable for each acceptable harvest region. The second, the "cell" model, defines a variable for each management unit, and imposes constraints prohibiting unacceptable harvest regions. We compare aspects of these models.

3 - On Developing a Theory of Optimization for Natural Resource
Darek Nalle, Assistant Professor, College of Natural Resources, University of Idaho, Moscow, ID, 83843, nalle@uidaho.edu, Jeffrey L. Arthur

Numerous models and algorithms for commodity extraction, land acquisition, and ecosystem conservation have been proposed. As the natural resource community in the U.S. redefines its missions, we explore the existence of a theory of optimization for resource management and how such generalizations might increase ecosystem capacities.

4 - Strategic Conservation Planning in an Uncertain World: Locating and Protecting Critical Reserve Site
Jesse O'Hanley, Environmental Change Institute, University of Oxford, johanley@nature.berkeley.edu, Richard Church

Formulation and solution techniques are presented for the problem of selecting nature reserves in order to minimize species losses given uncertain site destruction. We investigate this problem from both an expected value and worst-case analysis perspective. By incorporating site destruction uncertainty directly into the decision planning process, a more strategic approach to reserve selection can be taken that targets acquisition at high-value / high-risk sites.

■ WD21

H - 4th Floor, Union Square 15

Diagnosis Models for Port of Entry Inspections

Sponsor: Optimization/ Optimization and Data Mining Sponsored Session

Chair: Endre Boros, Professor, Rutgers University, RUTCOR, 640 Bartholomew Road,, Piscataway, NJ, 08854, United States, boros@rutcor.rutgers.edu

1 - Modeling Cargo Flow Security Operations in Marine Ports
Kevin Saeger, Los Alamos National Laboratory, LANL, Los Alamos, NM, 87545, United States, saeger@lanl.gov, Benjamin Melamed, Tayfur Altiok

We model cargo security operations in a container port including handling, storage and inspection. Here, vessel arrival processes, vessel unloading operations and the inspection process are critical modeling components. The impact of the arrival process and the inspection ratio on the overall marine port operation will be discussed.

2 - Decision Support Algorithms for Port-of-Entry Inspection
Phillip D. Stroud, Los Alamos National Laboratory, Mail Stop F607, Los Alamos, NM, 87545, United States, stroud@lanl.gov, Fred S. Roberts

We describe approaches to efficiently discover smuggling attempts at U.S. ports of entry. We use a sequential decision making model: Containers are routed to different tests depending on outcomes of earlier tests. We describe ways to find inspection schemes minimizing cost, including "cost" of false positives and negatives.

3 - Optimum Inspection Strategies for Port Entry Containers
Elsayed Elsayed, Rutgers University, Department of Industrial and Systems Eng, 96 Frelinghuysen Road, Piscataway, NJ, 08854, United States, elsayed@rci.rutgers.edu, Phillip D. Stroud, Endre Boros, Hao Zhang, Liliya Fedzhora

We develop a network optimization type linear programming model for sequential container inspection. In this model we determine optimum routing and inspection sequence as well as the optimum sensors threshold levels that minimize the total "cost", including expenses arising from storage, inspection and delays, as well as the estimated cost incurred by false positives and negatives.

4 - Data Mining Complex Sensor Simulations for Optimal Security
Paul B. Kantor, Rutgers University, 4 Huntington St., New Brunswick, NJ, 08904, United States, kantor@scils.rutgers.edu, Phillip D. Stroud, Alexander Kogan, Brenda Latka

Rigorous calculation of screening schemes produces a rich database with over 10,000 instances of parameters settings and expected performance levels. These are mined to extract heuristic relations that will will be useful when the number of sensors makes direct exploration computationally intractable.

■ WD22

H - 4th Floor, Union Square 16

Optimization in Clustering

Sponsor: Data Mining
Sponsored Session

Chair: Sergiy Butenko, Assistant Professor, Texas A&M University, 236E Zachry Engineering Center, TAMU 3131, College Station, TX, 77843-3131, United States, butenko@tamu.edu

Co-Chair: Vladimir Boginski, Florida State University, 2525 Pottsdamer Street, Tallahassee, FL, 32301, United States, vb@ufl.edu

1 - Optimization Framework for Feature Selection, Classification and Outlier Detection
Stanislav Busygin, University of Florida, busygin@ufl.edu, Panos Pardalos, Oleg Prokopyev

Let a training set classification be given and it is required to determine classes of a number of test samples. Usually, not all features of the data set are informative for discovering the classes, so a subset of relevant features should be found. We consider some unsupervised clustering principles and use them as constraints of an optimization problem, while representing the desirable properties of feature selection as its objective function. Test results on microarray data sets are presented.

2 - New Advances and Applications of Discriminant Analysis Optimization Models in Data Mining
Fang Liang, University of Colorado, Leeds School of Business, Campus Box 419, Boulder, CO, 80302, United States, Fang.liang@colorado.edu, Manoj Nanda, Fred Glover, Marco Better

Discriminant Analysis is widely used in data mining, and motivates the use of special mathematical programming models that offer useful advantages of flexibility over other approaches. We delineate the nature of these models and explore their implications in a computational study of several important data mining applications.

3 - Clique Relaxations in Social Network Analysis: The Maximum k-plex Problem
Balabhaskar Balasundaram, Doctoral Student, Texas A&M University, 401 Stasney Street #219, College Station, TX, 77840, United States, baski@tamu.edu, Sandeep Sachdeva, Sergiy Butenko, Illya Hicks

Cliques and their relaxations are used to model "cohesive subgroups" in social network analysis. These models have several important graph based data mining and clustering applications. A degree based model known as k-plex will be discussed. Complexity results, integer programming model, polyhedral properties and computational performance of exact algorithms and heuristics for the maximum k-plex problem will be presented.

4 - Clustering Stocks Using Network Models
Vladimir Boginski, Florida State University, 2525 Pottsdamer Street, Tallahassee, FL, 32301, United States, vb@ufl.edu, Sergiy Butenko, Panos Pardalos

We discuss an alternative approach to clustering stocks using network models of the stock market based on the correlations between time series representing stock price fluctuations. Combinatorial optimization problems on these networks are interpreted in terms of data mining applications, and conclusions regarding the stock market structure and dynamics are derived.

■ WD23

H - 4th Floor, Union Square 2

Decision Analysis Arcade IV

Sponsor: Decision Analysis
Sponsored Session

Chair: Eric Bickel, Assistant Professor, Department of Industrial and Systems Engineering, Texas A&M University, 236B Zachry Engineering Center, 3131 TAMU, College Station, TX, 77843-3131, United States, ebickel@tamu.edu

1 - Service Quality Judgment under Uncertainty
Chongyan Gao, Research Associate, Chinese University of Hong Kong, Dept. of Marketing, Shatin, NT, Hong Kong, jia@baf.msmail.cuhk.edu.hk, Jianmin Jia

This paper investigates service quality judgment under the distribution of customer satisfaction ratings. In the positive domain of customer satisfaction ratings, managers would be averse to uncertainty; and in the negative domain, they would prefer uncertainty. There is also an asymmetric effect such that the managers' evaluation of service quality is more sensitive to customer dissatisfaction than customer satisfaction. We propose a model to capture these empirical findings.

2 - Exact Inference in Hybrid Bayes Nets Using Mixtures of Gaussians
Prakash P. Shenoy, Distinguished Professor, Kansas University Business School, 1300 Sunnyside Ave, Summerfield Hall, Lawrence, KS, 66045-7585, United States, pshenoy@ku.edu

I will describe a method for exact inference in general hybrid Bayesian networks. Our method consists of approximating general hybrid Bayesian networks by a mixture of Gaussians Bayesian networks. The method described in this paper will enable us to use the Lauritzen-Jensen algorithm for a bigger class of hybrid Bayesian networks.

3 - Making the Even Swaps Method Even Easier
Raimo Hamalainen, Helsinki University of Techology, Systems Analysis Laboratory, Espoo, Finland, 02015 HUT, raimo@hut.fi, Jyri Mustajoki

The basic idea is that the Even Swaps process is carried out as usual, but in parallel the evolution of the decision maker's preferences is modeled with Preference Programming. This provides information to help identify practically dominated alternatives and to find candidate attributes for the next even swap. Our SmartSwaps web software (www.smart-swaps.hut.fi) demonstrates the method in practice.

4 - RPM — Robust Portfolio Modeling for Project Selection
Ahti Salo, Professor, Helsinki University of Technology, Systems Analysis Laboratory, P.O. Box 1100, TKK, 02015, Finland, ahti.salo@hut.fi, Juuso Liesiˆ, Pekka Mild

We present the RPM methodology for the selection of project portfolios in the presence of multiple criteria and incomplete information. In RPM, a core index is derived by computing all non-dominated portfolios, with the aim of conveying which projects can be accepted or rejected, and how further preference elicitation efforts should be focused.

■ WD24

H -4th Floor, Union Square 8

Applications of Decision Support Systems

Contributed Session

Chair: Mehmet Erdem, Asst. Prof. of Hospitality IT, University of New Orleans, BA 205, 2000 Lakeshore Dr., New Orleans, LA, 70148, United States, merdem@uno.edu

1 - Executive Use of Decision Support Tools
Sari Stenfors, SCANCOR, Stanford University, CERAS 531, Stanford University, Stanford, CA, 94305-3084, United States, sari@stenfors.us, Leena Tanner

This study investigates how executives use decision support tools. The executives' use of tools is embedded in social processes and the tools often serve as an interface between diverse parties. Executives use an average of five different strategic-level tools. Approximately ten percent of the tools used could be identified as OR/MS type, these often suit the needs of larger companies with strategic logistical or production functions and compared to other tools, have a specific profile.

2 - Bottom-up Construction of Minimum Cost AND/OR Trees for Sequential Fault Diagnosis

Tonguç Ünlüyurt, Assistant Professor, Sabancy University, Orhaný Tuzla, Istanbul, Turkey, tonguc@sabanciuniv.edu, Erhun Kundakcioglu

The problem of generating the sequence of tests required to reach a diagnostic conclusion with minimum average cost, which is also known as test sequencing problem, is considered. Our approach is based on integrating concepts from one-step look-ahead heuristic algorithms and basic ideas of Huffman coding to construct AND/OR decision tree bottom-up as opposed to heuristics proposed in the literature that construct the AND/OR trees top-down.

3 - Improving Oil and Gas Business Performance Through Project Portfolio Optimization

Otto Aristeguieta, MSc Candidate, Australian School of Petroleum, Adelaide University, Adelaide, SA, 5005, Australia, otto.aristeguietaalfonzo@student.adelaide.edu.au, Reidar Bratvold, Steve Begg, Andres Medaglia

Most oil and gas companies have more investment opportunities than resources. Therefore, decision makers need to choose an investment strategy that optimizes the objectives of the company. This involves the selection of optimal project shares whilst minimizing risks and obeying constraints. This talk discusses suitable models (single and multi-objective, deterministic and stochastic) to optimize the selection of oil and gas investment portfolios and describes their assumptions and limitations.

4 - A Rule Based Reasoning Decision Support System for Maintenance of Cougar Helicopters

Yavuz Gunalay, Bilkent University, Faculty of Business Administration, Ankara, Turkey, gunalay@bilkent.edu.tr, Kurtulus Dogan

In this study, we develop a DSS for the maintenance personnel of Cougar helicopters. The system is designed using Rule-Based Reasoning and its performance is compared with the decision making of novice maintenance personnel. Test results show that the DSS cause a considerable improvement in the decision making process.

5 - Assessing Revenue Management Decision Systems: A Qualitative Approach to Identifying Challenges

Mehmet Erdem, Asst. Prof. of Hospitality IT, University of New Orleans, BA 205, 2000 Lakeshore Dr., New Orleans, LA, 70148, United States, merdem@uno.edu

The important role IT plays in successful revenue management is increasingly realized across all segments of the hotel industry. A large portion of companies utilize revenue management decision systems to handle essential operational functions. There are, however, a series of issues and challenges and no single system is deemed operationally self-sustaining and reliable. This study offers a survey of existing systems and provides an evaluation of system specifics and problems.

■ WD26

H - 6th Floor, Sutter B

Statistical Testing and Inference Applications

Contributed Session

Chair: Young Chun, Professor, Louisiana State University, 3190 CEBA Building, Baton Rouge, LA, 70803, United States, chun@lsu.edu

1 - Sequential Testing of Simple Hypothesis About Compound Poison Processes

Semih Sezer, PhD Candidiate, Dept. of Operations Res. and Financial Eng., Princeton University, ORFE, E-Quad, Princeton University, Princeton, 08544, United States, ssezer@princeton.edu, Savas Dayanik

One of two simple hypotheses is correct about the unknown arrival rate and jump distribution of a compound Poisson process. We start observing the process, and the problem is to decide on the correct hypothesis as soon as possible and with the smallest probability of wrong decision. We find a Bayes-optimal sequential decision rule and describe completely how to calculate its parameters without any restrictions on the arrival rate and the jump distribution.

2 - Inspection and Quality Improvement in Printed Circuit Board Assembly Systems

Jeroen Vits, visiting assistant professor, University of Massachusetts, 160 Governors Drive, Amherst, MA, 01003, United States, vits@ecs.umass.edu, Philippe Chevalier

Because inspection and process quality improvement in manufacturing are interrelated, a model is proposed for their integrated management. For multi-stage systems the optimality of an interrupted policy is shown. An application of the model in a printed circuit board assembly system is discussed.

3 - The PAV Algorithm Under a Lipschitz Constraint

Lana Yeganova, Systems Analyst, National Institutes of Health, 4998 Battery Lane, #418, Bethesda, MD, 20814, United States, yeganova@mail.nih.gov, W John Wilbur

The Pool Adjacent Violators is an efficient algorithm for nonparametric isotonic regression problems that provides the maximum likelihood solution. However it makes no assumption on the nature of the true regression function. We formulate the problem assuming that data was generated by continuous monotonic function obeying a Lipschitz condition. We develop an algorithm that provides a maximum likelihood solution under the Lipschitz constraint and examine the complexity of the algorithm.

5 - Bayesian Screening Procedures with Inspection Errors

Young Chun, Professor, Louisiana State University, 3190 CEBA Building, Baton Rouge, LA, 70803, United States, chun@lsu.edu, Robert Sumichrast

All the items in a lot have been inspected, but there could be some defective items still remaining in the lot. The number of defective items undetected can be estimated by a Bayesian method, in which the prior distribution is often a member of a family of subjective prior distributions. We propose two conditions that should be put forth as desirable properties for any prior distribution. We then review various prior distributions that have been proposed in literature.

■ WD27

H - 6th Floor, Taylor B

OR Modeling for Some Artificial Intelligence Problems

Contributed Session

Chair: Jirachai Buddhakulsomsiri, Assistant Professor, University of Michigan-Dearborn, 4901 Evergreen Road, IMSE Department, Dearborn, MI, 48128, United States, jirachai@umich.edu

1 - Assembly Process Planning, with the Application of the Evolution Algorithm

Piotr Lebkowski, prof, University of Mining and Metallurgy, Department of CIM, al. Mickiewicza 30, Krakow, PL, 30-059, Poland, kamieniczka@poczta.fm

Assembly process planning consists in the determination of various sequence options for the assembly operations, as well as the evaluation of such options with the intention to establish an optimum sequence. In my approach, sequences are equivalent to chromosomes. The system generating an assembly sequence performs the reproduction process. Computer simulation results confirm the correct application of evolution algorithms in flexible assembly systems, primarily during operational control.

2 - Neural Network for Selecting Dispatching Rules of a Semiconductor Final Testing Factory

James Chen, Chung-Yuan Christian University, Department of Industrial Engineering, Ch, Chung Li, 320, Taiwan, jamesc@cycu.edu.tw, Kung-Jeng Wang, Yun-Syuan Lin

This developed a hybrid knowledge discovery model, using a conjunction of decision tree and back-propagation neural network, to determine an appropriate dispatching rule using production data with noise information, and to predict its performance. We built an object-oriented simulation model to mimic shop floor activities of a semiconductor testing plant and collect system. A model is developed to determine the most suitable dispatching rule from the perspective of different performance index.

3 - Automatic Generation of Plant and Warehouse Budgets using Neural Networks

Javier Faulin, Associate Professor, Public University of Navarre, Campus Arrosadia-UNED, Pamplona, NA, 31006, Spain, javier.faulin@unavarra.es, Alejandro G. del Valle

Some companies, such as ACERIUSA, sell plants and industrial warehouses giving their potential customers appropriate budgets according to a range of characteristics. The budget elaboration is a time and money consuming activity. Managing a big database, with thousands of developed budgets in the past, we have estimated future budgets for potential clients using neural networks with an error below 1 percent. These operations will be implemented in a webpage to generate automatic budgets.

4 - Utilizing Domain Specific Knowledge in SVMs

Enes Eryarsoy, Assistant Professor, Sabanci University, Orhanlý, Tuzla, Istanbul, 34956, Turkey, eneseryarsoy@hotmail.com, Gary Koehler, Haldun Aytug

Various learning tasks are accomplished via learning algorithms. According to the literature using domain information may enhance the task. In this study, we incorporate domain specific knowledge into Support Vector Machines. Incorporating domain knowledge is carried out by forming linear constraints with attributes of the data. We measure the impacts of incorporating domain knowledge on error bounds for learning and show an improvement over fat and VC dimension bounds.

5 - Association Rule Generation Algorithm for Warranty Data Mining
Jirachai Buddhakulsomsiri, Assistant Professor, University of Michigan-Dearborn, 4901 Evergreen Road, IMSE Department, Dearborn, MI, 48128, United States, jirachai@umich.edu

This study presents an association rule generation algorithm for warranty data mining. The algorithm extracts useful knowledge from large warranty data sets and represents this knowledge using IF-THEN association rules. Application of the algorithm is demonstrated with an industrial automotive warranty data set. Examples of generated rules are given, where IF statements contain vehicle features, production periods, and/or mileage-at-repair clusters, and THEN statements contain warranty problems.

■ WD28

R - 4th Floor, DaVinci I

Optimization Modeling in Telecommunication Systems

Contributed Session

Chair: Xiao Hua, Graduate Assistant, New Mexico State University, Industrial Engineering Department, Dept. 4230, P.O. Box 30001, Las Cruces, NM, 88003, United States, xhua@nmsu.edu

1 - Improved Wireless Network Performance through Pricing Integration for Admission
Saravut Yaipairoj, Research Assistant and PhD Candidate, Stevens Institute of Technology, Castle Point on Hudson, Hoboken, NJ, 07030, United States, syaipair@stevens.edu, Fotios Harmantzis

We study the performance models for mobile services that combine the effect of pricing incentives for encouraging a more efficient service admission control. We propose two pricing approaches. One is the demand-based pricing scheme namely, Dynamic Pricing with alternatives, which combines the efficiency of dynamic pricing and simplicity of flat pricing scheme. The other is the auction-based pricing scheme, which employs the auction reserve prices to effectively reduce network traffic load.

2 - Logistics of Components used by a Telecom Company
Nikolaos Geroliminis, PhD Student, UC berkeley, 416F McLaughlin Hall, #1720, Berkeley, 94720-1720, United States, nikolas@berkeley.edu, Gautam Gupta, Ankit Jain

In this paper distribution network of a Telecom Company is reengineered using logistics analysis. A multi echelon distribution network is developed and total cost is calculated which includes inventory, transportation, handling and operating costs based on continuous approximation. Different scenarios have been considered, by making realistic changes in parameters. The study also includes a sensitivity analysis for the various parameters in the problem.

3 - The Inverse Shortest-path Problem: Some Recent Results
Eric Gourdin, France Telecom, R&D, 38 rue du General-Leclerc, 92794 Issy-les-Moulineaux cedex 9, Issy-les-Moulineaux, France, eric.gourdin@francetelecom.com

The inverse shortest path problem consists in finding a set of routing weights in a graph, such that each one of a set of given paths is a shortest-path or a unique shortest-path. This problem has received considerable attention in the last few years, since it is of practical importance in Internet networks, where the demands are still mostly routed according to shortest-path rules. In this talk, several models are presented and compared.

4 - Connectivity Issues in Large-scale Sensor Networks
Usha Nandini Raghavan, Student, The Pennsylvania State University, 310 Leonhard Blgd., University Park, PA, 16802, United States, uxr102@psu.edu, Soundar kumara, Hari Prasad Thadakamalla

Recent advances in technology have enabled the development of low-cost, low-power sensor nodes that are small in size and can communicate only within short distances. A large number of such sensor nodes are thrown in a sensing region that are usually unmanned and lack a central control authority. In this presentation, we mainly focus on connectivity issues in self-organizing sensor networks and provide critical thresholds on the transmission radius of these sensors.

5 - Unbiased Estimations of Signal to Noise plus Interference Levels in Wireless Networks
Xiao Hua, Graduate Assistant, New Mexico State University, Industrial Engineering Department, Dept. 4230, P.O. Box 30001, Las Cruces, NM, 88003, United States, xhua@nmsu.edu, John Mullen

Recent field work with Mobile Ad Hoc Networks (MANETs) indicates the signal strength varies greatly, causing a severe degradation of service. This paper presents an estimator of Signal to Noise plus Inference Ratio (SNIR), which accounts for missing values. Also the noise plus interference and received power levels are estimated independently by MLE (maximum-likelihood estimators) and the SNIR is estimated by their ratio. This improved estimation is expected to improve the performance of MANETs.

■ WD29

R- 4th Floor, DaVinci III

Optimization and Heuristic

Contributed Session

Chair: Sang Hyuck Park, RIST, #32 Hyoja-Dong, Nam-Ku, Pohang, South Korea, parksh@rist.re.kr

1 - Information-theoretic Approaches to Branching in Search
Andrew Gilpin, PhD student, Carnegie Mellon University, Computer Science Department, 5000 Forbes Avenue, Pittsburgh, PA, 15213, United States, gilpin@cs.cmu.edu, Tuomas Sandholm

We present several families of MIP branching strategies that are information-theoretically motivated to reduce uncertainty in remaining subproblems. In one family, a good variable to branch on is selected based on lookahead computations performed at each node. Another family exploits features of the underlying structure of the problem. Experiments show that these families significantly outperform the state-of-the-art branching strategy for a variety of problems.

2 - Genetic Algorithm for Sequencing Problems in Mixed-model Assembly Line
Ghorbanali Mohammadi, Dr., University of Kerman, Shahid Bahonar university of Kerman, Kerman, Iran, gmohammadi@mail.uk.ac.ir

Mixed model assembly lines are a type of production line where a variety of product models similar in product characteristics are assembled.In this paper, The problem first considered is a comparison between an existing heuristic and the proposed Genetic algorithm to get the usage variation and the set-up costs for various test-bed problems.Three practically important objectives are minimizing usage variation, minimizing the workload smoothing and minimizing total set-up cost.

3 - Projection Based Multiscale Optimization for Interior Eigenvalue Problems
Peter Graf, NREL, 1617 Cole Blvd mailstop 1608, Golden, CO, 80401, United States, peter_graf@nrel.gov

In multiscale optimization, steps using approximations at a coarse scale alternate with corrections by occasional calculations at a finer scale. We present a projection based implementation for interior eigenvalue optimization. We study an example in the context of electronic structure optimization. Theoretical analysis and numerical experiments provide estimates of the expected efficiency and guidelines for parameter selection.

4 - An Efficient Algorithm for Global Optimization in Quadratic Fractional Program
Archana Khurana, Research Engineer, The Logistics Institute - Asia Pacific, 11 Law Link, Singapore, 119260, Singapore, archana2106@rediffmail.com, S.R. Arora, Arul Sundaramoorthy, I. A. Karimi

In this paper, we develop an efficient algorithm to find global optimal solution for quadratic fractional program. The algorithm maximizes a pseudo-convex quadratic fractional function over a convex compact polytope. Since maximum of a pseudo-convex function is obtained at an extreme point of the feasible region, we employ a systematic ranking of the extreme point solutions to reach the global solution. We present a numerical example to illustrate the performance of our algorithm.

5 - Two-dimensional Bin-packing Optimization Model
Sang Hyuck Park, RIST, #32 Hyoja-Dong, Nam-Ku, Pohang, South Korea, parksh@rist.re.kr

We considered a two-stage guillotine-cutting problem, where we are allowed to set the width, length of the mother plate while keeping its area fixed. In this paper, we proposed an efficient heuristic algorithm for solving this problem and summarized computational experiments.

■ WD30

R- 4th Floor, DaVinci II

Strategic Planning Systems

Contributed Session

Chair: Henry Amato, Professor of Supply Chain Management, University of Nevada Reno, 9th and Virginia St, MS 028, Reno, NV, 89557, United States, hna@unr.edu

1 - Solving the Interaction Value Analysis Equations

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

The Interaction Value Analysis (IVA) model of organizations has replicated a few contingency theory (CT) rules-of-thumb from a set of axioms, and correlated financial performance to adherence to its version of CT rules. This was done using numerical solutions to the equations of the IVA model. A simplified version of the equations now allows an analytic solution. This paper will present the simplified model and success to date in relating the parameters of the organization to the value added.

2 - Development and Implementation of A Quantiative Industry Analysis Methodology

Faysal Yalynkylyç, Senior Researcher, Turkish Institute for Industrial Management, TUSSIDE Baris Mah. Kosuyolu Cad. No: 48, P.K.:14 Gebze, Kocaeli, 41401, Turkey, fyalinkilic@tusside.gov.tr, Seçkin Polat

This study presents a comprehensive framework to help a firm analyze its industry as a whole and to translate this analysis into a competitive strategy. The main contribution of this study is evaluation tables, which make the model quantitative and complete inadequacy of the previous models. In the study, 176 training and consulting institutions in Turkey have been investigated. Attractive segments in the industry are determined and simple strategies that should be followed are formulated.

3 - Agent-Based Social Simulation: A Micro Perspective in Organizational Learning

Brent Capps-Zenobia, Ph.D. Student, Portland State University - ETM, bcapps@hevanet.com

Historically, organizational learning has focused on the macro-perspective (learning curve, Lotka-Volterra equations). The the point of view of the individual has not been discussed exhaustively. Agent-based social simulation, an approach in which human behavior is simulated by automata, presents itself as an alternative. A case from innovation adoption is presented.

4 - Screen Job Applicants with a Neural Network

Henry Amato, Professor of Supply Chain Management, University of Nevada Reno, 9th and Virginia St, MS 028, Reno, NV, 89557, United States, hna@unr.edu, Linda Barrenchea

To screen hundreds of job application for a picker in a warehouse or a busboy in a restaurant is a tedious task dreaded by HR personnel A neural network is applied to screening job application forms for non-technical and non-professional positions and the resultant hiring decisions made by an HR screener to discern the decision pattern of the screener. The trained network is used to screen future applicants.

■ WD31

H - 4th Floor, Union Square 25

Decision Analysis in Technology Management

Contributed Session

Chair: Dundar F. Kocaoglu, Portland State University, Department of Engineering and Technology, Portland, OR, 97207, kocaoglu@etm.pdx.edu

1 - Using AHP for Technology Assessment on the Reduction of the Internal Digital Divide in Costa Rica

Audrey Alvear, Portland State University, Portland, OR, alveara@etm.pdx.edu, Dundar F. Kocaoglu

This study presents a systematic approach to identify Information and Communication Technologies (ICTs), technology applications and key sectors that most impact the internal digital divide in developing countries. The methodology selected is Analytic Hierarchy Process (AHP). The results of this research suggest that the role of technology in 2010 will be distinctively oriented toward Internet mobility and collaboration in Costa Rica.

2 - Hierarchical Decision Modeling for Quantifying the Value of Technologies

Nathasit Gerdsri, Portland State University, Portland, OR, nathasitg@gmail.com, Dundar F. Kocaoglu

This presentation presents a quantitative model used for evaluating the impact value of technologies on a company's objective. The hierarchical decision making approach is applied to construct the model. Both quantitative and qualitative aspects of technology evaluation are also integrated into the model development process. The impact of technologies on a company's objective is calculated as a composite index called Technology Value.

3 - HDM Sensitivity Analysis

Hongyi Chen, Portland State University, Portland, OR, Hongyi_chen123@yahoo.com, Dundar F. Kocaoglu

Hierarchical Decision Model (HDM) is a vital and widely used model in multi-level criteria decision making. The HDM yields a ranking of the decision alternatives according to their contributions to the overall goal through judgment quantifications. In the case when decision makers might have a range of values for the model parameters, sensitivity analysis brings insights on the stability of the result under changing values. In this paper, an algorithm of sensitivity analysis is developed to determine the allowable ranges within which perturbations can be induced on values at different levels of the hierarchy without changing the original ranking of the decision alternatives, sensitivity coefficient of contribution vectors on different levels of the hierarchy, and the critical criteria for keeping current ranking. Data from a case study in technology assessment are used to illustrate the usefulness and validity of the algorithm. The study is independent upon the techniques from which the contributions are acquired. Single or multiple perturbations can be induced on contributions from sub-criteria (or alternatives) to criteria (or sub-criteria) while keeping other levels of the decision hierarchy unchanged.

4 - Detecting Technological Changes and Capturing Potential Emerging Alternatives: A Case Study of I/O Technologies

Tugrul U. Daim, Portland State University, Portland, OR, tugrul@etm.pdx.edu, Nathasit Gerdsri

This paper presents a case study of integrating use of patent and literature searches to identify technology trends and growth curves to predict the future growth of such indicators. The paper also investigates representing technology replacement with the data acquired through patent and literature searches. The results indicate that the patent and literature trends mapped out to growth curves can be used to understand the performance of technological parameters. The paper focuses on interconnect technologies in computer systems

■ WD32

H - 6th Floor, Lombard

Analysis and Design of Hardware and Other Systems

Contributed Session

Chair: J. Brian Adams, Asst. Professor of Computer Science, Franklin & Marshall College, Dept. of Mathematics and Computer Scienc, Box 3003, Lancaster, PA, 17604-3003, United States, brian.adams@fandm.edu

1 - Performance Analysis of the Disk Subsystem

Ozlem Akpinar, Rutgers University Industrial and Systems, Eng. Dept., 96 Frelinghuysen Rd., Piscataway, NJ, 08854, United States, ozlemakp@eden.rutgers.edu, Tayfur Altiok

In distributed computing, disk and database activity continue to be a bottleneck. Performance of a disk subsystem in terms of response times and throughput is studied using an analytical approach. We have considered both single disk and RAID architectures. Results are validated using simulation.

2 - An Optimization Model to Minimize Power Consumption in Nanoscale Microprocessors

Karthik Thyagarajan, PhD Student, University at Buffalo (SUNY), 341 Bell Hall, UB North Campus, Buffalo, NY, 14214, United States, kt25@eng.buffalo.edu, Ramalingam Sridhar, Praveen Elakkumanan

The problem of minimizing power consumption in nanoscale microprocessors is formulated as an integer linear program (ILP). The formulation optimally assigns threshold voltages to the gates to minimize total leakage power and inserts buffers to minimize glitches. The ILP is solved using CPLEX. Simulation results for benchmark circuits are reported.

3 - A Branch-and-Cut-and-Price Approach for Artificial Intelligence Planning

Thomas Vossen, University of Colorado, Leeds School of Business, Boulder, United States, vossen@colorado.edu, Menkes van den Briel, Subbarao Kambhampati

Artificial Intelligence (AI) planning is concerned with the development of automated methods for generating and reasoning about sequences of actions to perform certain tasks or achieve certain goals. We present a series of integer programming (IP) formulations that show significant promise in their ability to solve classical AI planning problems, and describe how they can be solved within a Branch-and-Cut-and-Price framework. We provide an extensive empirical analysis to validate our approach.

4 - Analyzing and Predicting Elections: A Neural Network Approach
J. Brian Adams, Asst. Professor of Computer Science, Franklin & Marshall College, Dept. of Mathematics and Computer Scienc, Box 3003, Lancaster, PA, 17604-3003, United States, brian.adams@fandm.edu

Campaign strategy requires insight into the electorate. Thus polls are conducted. In the absence of polling data, demographics can be used with logistic regression models to predict election outcomes. If the model is linear, then such an approach is warranted. Further, the significance of the inputs to such models can also be analyzed. But what if the response is nonlinear? In this paper, neural networks are used for predicting election results from available demographic data.

■ WD33

H - 6th Floor, Mason A

Process Modeling, Analysis, and Control (2)

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: Kwang-Jae Kim, kjk@postech.ac.kr

1 - Cluster Analysis for Correlated Bernoulli Data
Dingxi Qiu, d-qiu@northwestern.edu, Ajit C. Tamhane, Bruce Ankenman

Binary Mixture Models exists both in social sciences and nature. Traditional way to handle binary mixture models is to assume the independence structure of the manifest variables conditional on the cluster identity. We propose to model the component distribution with a continuous latent variables model that can handle correlations. Robustness studies show that the proposed model is relatively robust with respect to the traditional independence model in terms of the misclassification rates.

2 - Optimal Adjustment Strategies in Multi-Station Manufacturing Processes
Pornpen Chaipradubkiat, PhD Candidate, The University of Michigan, 1205 Beal Avenue, Ann Arbor, MI, 48109-2117, United States, pchaipra@umich.edu, Jan Shi

In discrete-part manufacturing, machine setup has effects on quality of parts produced in batches. A setup error may cause an unacceptable quality of the whole batch. Therefore, the objective is to determine an optimal adjustment strategy based on the quadratic off-target cost and the fixed adjustment cost in the batch-to-batch multi-station manufacturing process.

3 - A Systematic Generation of CTQ Candidates in DFSS: Methodology Development and A Case Study
Kwang-Jae Kim, kjk@postech.ac.kr, Deok-Hwan Kim

The project objectives, called critical-to-quality (CTQs) in six sigma, should be defined to faithfully reflect the customer requirements. This paper proposes a systematic method for generating CTQ candidates in the DFSS (Design for Six Sigma) context. The unique characteristics of the proposed method are demonstrated via a case study.

4 - Determining the Number of Clusters in Baseline Multivariate SPC Data
Hang Zhang, zhangh@eden.rutgers.edu, Susan Albin

In multivariate SPC there may be several clusters in baseline data reflecting different operation modes. We propose a scale-based clustering method to determine the number of clusters. Unlike standard methods, we can detect whether there is only one cluster for convex or non-convex clusters. Simulation and case study results are shown.

■ WD34

H - 6th Floor, Powell A

Maintenance Optimization

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: Richard Cassady, Associate Professor of Industrial Engineering, University of Arkansas, 4207 Bell Engineering Center, Fayetteville, AR, 72701, United States, cassady@uark.edu

1 - Integrated Multi-Action Maintenance and Production Decision Making
Yi-Pin Wang, CASE|Weatherhead School of Management, 10900 Euclid Ave, Cleveland, OH, United States, yxw51@case.edu, Lisa Maillart

We consider a make to stock production system with backordering, silent failures, variable capacity due to time consuming preventive maintenance actions, and wear-dependent yield. In each period, based on the state of the machine and the inventory position, the manager selects a level of preventive maintenance and decides whether or not to produce. The objective is to minimize the total expected discounted costs of production, holding, backordering and maintenance over the infinite horizon.

2 - Pricing Extended Warranties
Joseph Hartman, Lehigh University, ISE Dept., Mohler Lab, 200 W. Packer Ave., Bethlehem, PA, 18015, United States, jch6@lehigh.edu, Kamonkan Laksana

Manufacturers and retailers offer extended warranties on a variety of products, from automobiles to electronic gadgets. Pricing an extended warranty can depend on the product's age, reliability, maintenance costs, and length of coverage. We model this problem with the use of dynamic programming and examine the consumer's optimal warranty and replacement strategies in light of pricing decisions. This in turn provides further insight into pricing strategies.

3 - Warranty Programs with Incentive for Cooperative Maintenance
Marlin Thomas, Professor, Purdue University, 315 N. Grant St., West Lafayette, IN, 47907-2023, United States, muthomas@purdue.edu, Kun Ren

A method is described for improving product quality and reducing warranty costs through strategic maintenance incentives. The concept is to embed maintenance incentives into the warranty program to encourage proper maintenance thus increasing product life while reducing warranty cost and promoting customer loyalty. Customer's utility and choice of maintenance policies are examined under static and dynamic maintenance incentives and conditions for optimal reward policies are presented.

4 - Allocating and Deploying Maintenance Resources for a Set of Multi-State Systems
Thomas Yeung, Graduate Research Assistant, University of Arkansas, 4207 Bell Engineering Center, Fayetteville, AR, 72701, United States, tyeung@uark.edu, Richard Cassady, Edward Pohl

Selective maintenance is the process of identifying the subset of maintenance activities to perform from a set of desired actions. We develop a methodology for managing selective maintenance decisions for multi-state systems. We define a scenario in which systems in various states of maintenance need must perform a number of different missions requiring different maintenance profiles. We formulate a non-linear mathematical program and explore three solution procedures.

■ WD35

H - 6th Floor, Sutter A

Modeling Approaches to Distribution Channels

Sponsor: Marketing
Sponsored Session

Chair: Chuck Ingene, Hearin Chair of Business Administration, University of Mississippi, P.O. Box 1848, 220 Holman Hall, University, MS, 38677, United States, cingene@bus.olemiss.edu

1 - Fair Investment
Tony H. Cui, Assistant Professor of Marketing, University of Minnesota, 3-150 CSOM, 321 - 19th Ave South, Minneapolis, MN, 55455, United States, tcui@csom.umn.edu, Jagmohan Singh Raju, Z. John Zhang

Fairness plays an important role in developing and maintaining distribution channel relationships. However, analytical research on the effect of fairness on channel relationship is rare. In this paper, we incorporate the concept of fairness into a dyadic distribution channel to see how fairness may affect the interactions between a manufacturer and a retailer and how fairness may affect firms' decisions on investment.

2 - Choice of Exclusivity Decisions
Jun Yang, Assistant Professor, University of Mississippi, P.O. Box 1848, University, MS, 38677, United States, jyang@bus.olemiss.edu, Amiya Basu, Tridib Mazumdar

In the presence of a positive indirect network externality, the value of a hardware increases with the availability of software. When software and hardware manufacturers are not integrated, they enter into a contract to decide whether the software should be exclusive to the contracting hardware. In this paper, using a standard Stackelberg leader and follower approach, we also study the impact of brand equity in the existence of network externality effect.

3 - A Model of Multichannel Retailing: The Informational Role of the Internet
Xubing Zhang, University of Toronto, 105 St. George St., Toronto, ON, Canada, Xubing.Zhang99@Rotman.Utoronto.Ca

The Internet provides consumers with low cost information unavailable in conventional retailing. Extending the work by Zhang 2005, the present research focuses on information issues involved in multichannel retailing. In particular, it attempts to answer two questions: How does the dissemination of offline price information online differ from the conventional price advertising, and How does this information provision function of the Internet affect retailers' multichannel retailing strategies?

■ WD36

H - 6th Floor, Taylor A

From Queues to MDPs

Sponsor: Applied Probability
Sponsored Session

Chair: Mariana Olvera-Cravioto, Stanford University, Terman Engineering Center, Rm. 321, Stanford, CA, 94305, United States, marianao@stanford.edu

1 - Queues with Markov Modulated Service Rates
Melike Baykal-Gursoy, Associate Prof., Rutgers, The State University of NJ, I&SE Dept., 96 Frelinghuysen Rd., Piscataway, NJ, 08855-8018, United States, gursoy@rci.rutgers.edu, Weihua Xiao

Motivated by the need to study transportation systems in which incidents cause traffic to slow down, we consider M/M/C queues subject to random interruptions of exponentially distributed durations. System breakdowns as well as partial failures, where all servers work with lower efficiency, are investigated. For the M/M/∞ queue, in both cases, it is shown that the number of customers present in equilibrium is the sum of two independent random variables.

2 - Approximating the Waiting Time of Customers in a Heavy-tailed Queue
Mariana Olvera-Cravioto, Stanford University, Terman Engineering Center, Rm. 321, Stanford, CA, 94305, United States, marianao@stanford.edu, Peter Glynn

We study the waiting time of customers in the M/G/1 queue with heavy-tailed processing times. Our first result gives a heavy-traffic approximation that is valid on the whole real line, and that explains when the decay of the tail transitions from being exponential to being subexponential. The second result considers truncated heavy-tailed processing times, and it analyzes the relationship between the tail value, the truncation level, and the validity of different approximations commonly used.

3 - A Neuro-Dynamic Programming Approach to Optimize Job Sequencing in a Reentrant Manufacturing Line
Jose Ramirez-Hernandez, Ph.D. Student, Dept. Electrical & Comp. Eng. & Comp. Sci. University of Cincinnati, 707 MLK Dr W Apt 506E, Cincinnati, Oh, 45220, United States, ramirejs@ececs.uc.edu, Emmanuel Fernandez

We present initial results of a research study in the optimization of job sequencing of Reentrant Manufacturing Lines (RML) by utilizing a Neuro-Dynamic Programming approach. A simple benchmark RML and the Q-Learning algorithm were utilized to obtain near to optimal scheduling policies for an infinite horizon discounted cost problem. Results show that an approximation to the optimal policy is gradually obtained, and that state aggregation can be utilized to reduce computational costs.

4 - Probabilistic Analysis of a MDP Arising from Database
Nariankadu Shyamalkumar, Assistant Professor, The University of Iowa, 241 Schaeffer Hall, Iowa City, IA, 52242, United States, shyamal-kumar@uiowa.edu, Ralph Russo

The ability to produce join results early is dependent on the reading policy. The search for an optimal policy is a MDP. Using a probabilistic approach we identify the optimal policy in the case of an infinite number of records. Moreover, we compare the asymptotic performance of the policy that is commonly used with that of the optimal. In the case of a finite number of records, while showing that an optimal policy does not always exist, we identify a policy which beats the one in common use.

■ WD37

H - 6th Floor, Van Ness

Applied Probability: Optimization

Contributed Session

Chair: Andres Sarmiento, Graduate student, Universidad de los Andes, Carrera 1 No. 18A-10, Bogota, N/A, Colombia, an-sarmi@uniandes.edu.co

1 - Optimal Flow Control of Two Parallel Queues
Bing Lin, Nanyang Technological University, PhD Office Nanyang Business School, Singapore, 639798, Singapore, pg07372359@ntu.edu.sg, Shaoxiang Chen, Michael Z.F. Li

In this paper, we develop dynamic flow models for combined admission and routing control of a parallel queue with two servers. The problem with Poisson arrivals and exponential servers is formulated as a Markov decision process (MDP). Monotonic results for the optimal value function are obtained. The structure of the optimal policy is shown to be characterized as three switching curves.

2 - Regret and Convergence Bounds for Continuum-Armed Bandits
Eric Cope, University of British Columbia, Sauder School of Business, 2053 Main Mall, Vancouver, BC, V6T1Z2, Canada, eric.cope@coe.ubc.ca

I consider immediate-reward reinforcement learning problems with continuous action sets, also known as "continuum-armed bandit problems." Both lower bounds on the growth rate of the regret as well as upper bounds on the rates of convergence of the control values to the optimum are derived. The bounds can be used to demonstrate the asymptotic optimality of the Kiefer-Wolfowitz method of stochastic approximation with regard to a large class of possible mean reward functions.

3 - Optimal Pricing for a Service Facility with Holding Costs
Idriss Maoui, Ph.D. Candidate, Georgia Institute of Technology, School of ISyE, Atlanta, GA, 30332, United States, imaoui@isye.gatech.edu, Robert D. Foley, Hayriye Ayhan

We study a service facility modelled as a queueing system where arriving customers enter if they are willing to pay the price posted by the service provider. Congestion penalizes profit through state-dependent holding costs. In both static and dynamic pricing settings, we demonstrate that there exists an optimal pricing solution that maximizes the long-run average profit per unit time. We provide explicit expressions as well as structural and ordering properties of our pricing solutions.

4 - Approximate LP Sequences for Network Control
Michael Veatch, Gordon College, 255 Grapevine Rd, Wenham, MA, 01984, United States, veatch@gordon.edu

A sequence of linear programs is constructed that converges to the optimal average cost of a queueing network control problem. Convergence is achieved by increasing the buffer truncation. Selection of quadratic and other basis functions to approximate the relative cost makes convergence more rapid than standard methods, allowing larger problems to be solved. Performance of the method in heavy traffic is considered.

5 - JMDP: An Object Oriented Framework for Modeling MDPs
Andres Sarmiento, Graduate student, Universidad de los Andes, Carrera 1 No. 18A-10, Bogota, N/A, Colombia, an-sarmi@uniandes.edu.co, German Riano

The present work describes a generic solver for Markov Decision Processes (MDPs). The framework is intended for general purpose problems and its structure permits independent modeling and solving. It is designed to capture the essential modeling elements of the stochastic optimization problem in a natural way, maintaining an parallelism between mathematical elements and their computational representation.

■ WD38

R - 2nd Floor, Corintia

Direct Search Methods for Nonlinear Programming

Sponsor: Optimization/ Nonlinear Programming
Sponsored Session

Chair: Virginia Torczon, Associate Professor, College of William & Mary, Department of Computer Science, P.O. Box 8795, Williamsburg, VA, 23187-8795, United States, va@cs.wm.edu

1 - Using APPSPACK to Identify Optimal Model Parameters
Genetha Gray, Sandia National Labs, P.O. Box 969, MS9159, Livermore, CA, 94551-0969, United States, gagray@sandia.gov

Simulation is an important tool that is often used to reduce the costs associated with the study of complex systems in science and engineering. In recent years, simulation has been paired with optimization in order to design and control such systems. In this presentation, we will discuss using APPSPACK, a derivative optimization software, to identify appropriate parameters and improve the underlying simulation models.

2 - Second-order Convergence of Mesh Adaptive Direct Search
Mark Abramson, Assistant Professor, Air Force Inst of Technology, Dept of Mathematics & Statistics, 2950 Hobson Way, Wright Patterson AFB, OH, 45433-7765, United States, Mark.Abramson@afit.edu

We characterize 2nd-order behavior of the class of derivative-free mesh adaptive direct search (MADS) algorithms for general set-constrained optimization. Included in this class is generalized pattern search (GPS) for linearly constrained problems. Under reasonable conditions, we can establish 2nd-order convergence properties for an implementable instance of MADS.

3 - Generalized Pattern Search Algorithms with Adaptive Precision Function Evaluations
Michael Wetter, Senior Research Scientist, United Technologies Research Center, 411 Silver Lane, East Hartford, CT, 06108, United States, WetterM@utrc.utc.com, Elijah Polak

Our adaptive simulation-precision control subprocedures for GPS algorithms provably construct sequences of iterates with stationary accumulation points, even though they only use function values of the discontinuous approximating cost functions. Numerical experiments demonstrate that our adaptive simulation-precision control subprocedure reduced the computation time from five days to one day, making optimization fast enough to be applicable for the design of building envelope and energy systems.

4 - Implementing Generating Set Search (GSS) Methods for Linearly Constrained Optimization

Virginia Torczon, Associate Professor, College of William & Mary, Department of Computer Science, P.O. Box 8795, Williamsburg, VA, 23187-8795, United States, va@cs.wm.edu, Robert Michael Lewis, Anne Shepherd

We discuss implementation details of derivative-free GSS methods for linearly constrained optimization including choosing and calculating the set of search directions, augmenting the set of directions to improve progress, and choosing appropriate step lengths. Our implementation handles degeneracy in the working set of constraints so we can tackle problems with network constraints and we will present numerical results demonstrating our success on problems with up to two hundred variables.

■ WD39

R - 3rd Floor, Aragon

Operations Management in Production Systems

Contributed Session

Chair: Qing Ye, University of Michigan, 2007 Huron Parkway Apt 9, Ann Arbor, MI, 48104, United States, yeq@umich.edu

1 - Examining Dampening Effects for Alternative Dampening Procedures to Cope with System Nervousness

Chrwan-jyh Ho, Professor, Oklahoma State University, 342 BUS, Oklahoma State University, Stillwater, OK, 74078, United States, hocj@okstate.edu

System nervousness in material requirements planning has been considered an important operational problem. Its negative effects may be trickled down to the other operational subsystems in enterprise resource planning (ERP) systems which, in turn, deteriorate the overall ERP system performance. The purpose of this paper is to examine the dampening effects of three dampening procedures to reduce system nervousness under various operating environments by a simulation experiment.

2 - A Comprehensive Framework for Manufacturing Flexibility

Sanjeev Bordoloi, College of William & Mary, School of Business, Williamsburg, United States, skbord@business.wm.edu

'Flexibility' has gained a lot of attention in recent years as a strategic weapon in manufacturing planning. We provide a general framework for manufacturing flexibility with simultaneous consideration of concepts such as efficiency and adaptability. Our framework is comprehensive enough to subsume other definitions of flexibility in the literature.

3 - A Simulator For Analysis Of Feedback And Control Mechanisms In Hierarchical Production Planning

Larry White, Assistant Professor, Prairie View A&M University, College of Business, P.O. Box 638, Prairie View, TX, 77446, United States, lrwhite@pvamu.edu

We demonstrate a Hierarchical Production Planning System Simulator (HPPSS) to analyze feedback and control mechanisms between models within a Hierarchical Production Planning system. These feedback and control mechanisms reduce information asymmetry between the different levels of a hierarchy. An example of the utility of the HPPSS is provided to show the potential benefits of increased planning horizon lengths, increased information exchange between levels, and looser control structures.

4 - Optimal Capacity Setting and Product Differentiation with Customer Demand Uncertainty

Dennis Z. Yu, Olin School of Business, Washington University in St. Louis, Campus Box 1133, 1 Brookings Dr., St. Louis, MO, 63130, United States, yuz@wustl.edu, Panos Kouvelis

The manufacturer wants to produce vertically differentiated products to satisfy customer demand. Customers are heterogeneous in their preference on product quality level. Before the selling season, there is uncertainty in both market size and customer preference. The manufacturer needs to make capacity setting and quality differentiation decisions before the customer demand is realized. We investigate the manufacturer's optimal strategy on the provision of single and multiple quality levels.

5 - The Effects of Capacity Information Asymmetry on Production

Qing Ye, University of Michigan, 2007 Huron Parkway Apt 9, Ann Arbor, MI, 48104, United States, yeq@umich.edu, Izak Duenyas, Roman Kapuscinski

In this paper we analyze how information asymmetry about competitor's capacity influences the set of equilibria (pooling and separating equilibria) in a multi-period production setting. Our aim is to explore the effect of this information asymmetry on the production quantities of the firms in a multi-period game, where a firm has to decide whether is wants to preserve ambiguity about its production capacity or to reveal it.

■ WD40

R - 3rd Floor, Barcelona I

Network Theory and Applications

Contributed Session

Chair: Svyatoslav Trukhanov, Texas A&M University, TAMUS 3131, College Station, TX, 77843-3131, United States, slavik@tamu.edu

1 - Optimizing Security Investments in Transportation and Telecommunication Networks

Maria Paola Scaparra, Assistant Professor, Kent Business School, University of Kent, Canterbury, CT1 3LA, United Kingdom, m.p.scaparra@kent.ac.uk, Paola Cappanera

We present new mathematical models for allocating security resources among the nodes of a network so as to optimize the flow of goods and information after worst-case losses of unprotected nodes. We introduce potential applications arising in the areas of technology and transportation management.

2 - Evolving Bayesian Graphs

Kemal Gursoy, Associate Professor, Kean University, Willis Hall, Man. Dept., 1000 Morris Avenue, Union, NJ, 07083, United States, kemalgursoy@netscape.net

This work aims to develop models for identifying operating conditions of Bayesian networks, as representatives for computer and communication networks.

3 - Optimization of Workstation Location Assignment via Heuristic Algorithms

Feng Du, University of Louisville, South 3rd st, Louisville, United States, f0du0001@louisville.edu, Gerald Evans

The workstation location assignment problem is an example of the quadratic assignment problem (QAP), which belongs to a classical combinatorial optimization problem. This paper first reviews the previous research on the QAP. Secondly, discusses some heuristic algorithms and then applies these heuristic algorithms to a real-world case to find an improved solution to the workstation location assignment. Finally, the paper discusses the performance of the heuristic algorithms.

4 - Solving the Maximum Independent Set Problem in Graphs with Large Independence Number

Svyatoslav Trukhanov, Texas A&M University, TAMUS 3131, College Station, TX, 77843-3131, United States, slavik@tamu.edu, Sergiy Butenko

The problem of finding a maximum independent set in an undirected graph is a well known NP-hard problem. On the other hand, the critical independent set problem is polynomially solvable. The relationship between these two problems was studied and a method that utilizes a nonempty critical independent set for solving the maximum independent set problem was developed. The theoretical results were confirmed by extensive numerical experiments on large-scale graphs with large independence number.

■ WD41

R - 3rd Floor, Barcelona II

Heuristics Solutions in Production and Scheduling

Contributed Session

Chair: SugJe Sohn, Sr. Industrial Engineer, Ph.D., Intel Corporation, 5000 W. Chandler Blvd CH3-68, Chandler, 85226, United States, sugje.sohn@intel.com

1 - Minimization of Makespan in Multi-Stage Group Scheduling Problems with Sequence-Dependent Setups

Nasser Salmasi, PhD Candidate, Oregon State University, Dept. of Industrial and Mfgr. Engr., 118 Covell Hall, Corvallis, OR, 97331-2407, United States, salmasi@engr.orst.edu, Rasaratnam Logendran

We present a mathematical programming model for sequence-dependent group scheduling problems by considering makespan minimization as the criterion. Heuristic algorithms based on tabu search are developed to solve industry size problems. To evaluate the quality of solutions, a lower bounding technique is also developed by relaxing the mathematical model.

2 - Mixed-Integer Programming Models for an Employee Scheduling Problem

Salem Al-Yakoob, Assistant Prof., Kuwait University, College of Science, Dept of Math, Kuwait, Kuwait, salem@al-yakoob.com, Hanif Sherali

We develop mixed-integer programming models and algorithms for assigning employees to about 86 gas stations distributed all over Kuwait. Although similar employee scheduling problems have been addressed in the literature, certain peculiarities of the problem require novel mathematical models to deal with the specific nature and size of this problem. Computational results related to solving the formulated models directly via CPLEX and by specialized heuristics are reported.

3 - Comparison of Heuristics for In-Process Inventory Minimization in Flow Shop Sequencing

Marcelo Nagano, Assistant Professor, University of São Paulo, Av. Trabalhador Sào-Carlense, 400, Sào Carlos, SP, 13566-590, Brazil, drnagano@usp.br, João Moccellin

This paper deals with the Permutation Flow Shop scheduling problem with the objective of minimizing mean flow time, therefore reducing in-process inventory. By using computational experience, the two best existing heuristics are compared between themselves. The experimental results are discussed.

4 - Heuristics for Hybrid Flow Shop Scheduling with Asymmetric Sequence Dependent Setup Times

João Moccellin, Professor, University of Sào Paulo, Av. Trabalhador Sào-Carlense, 400, Sào Carlos, SP, 13566-590, Brazil, jvmoccel@sc.usp.br, Hélio Fuchigami

This paper addresses the hybrid flow shop scheduling problem with asymmetric sequence dependent setup times, in which the objective is to minimize the total time to complete the schedule (makespan). Four constructive heuristic methods are introduced. With the use of computational experiment, their relative performances are evaluated.

5 - Modified Apparent Tardiness Cost with Setup (MATCS) with Grid Search (GS) for Sequence Dependent Set

SugJe Sohn, Sr. Industrial Engineer, Ph.D., Intel Corporation, 5000 W. Chandler Blvd CH3-68, Chandler, 85226, United States, sugje.sohn@intel.com

A heuristic approach of Modified Apparent Tardiness Cost with Setup (MATCS) with Grid Search (GS) is presented for the sequence dependent setup scheduling of non-identical parallel machines with product mix. MATCS generates the operations schedules with different combinations of scaling factors and GS determines the most desirable schedule from the consideration of multiple objectives including cycle time reduction. An example in semiconductor manufacturing is introduced with MATCS-GS algorithm.

■ WD42

R - 4th Floor, Parc Ballroom I

Modeling and Approaches in Systems Analysis

Contributed Session

Chair: Yue Xie, George Mason University, 4400, University Dr., Fairfax, VA, 22030, United States, yxie@gmu.edu

1 - Uncovering Complex Relationships in Service Operations:Using CART, CHAID and SEM for System Dynamics

Kalyan Pasupathy, Virginia Tech, 1741 N. Troy St # 426, Arlington, VA, 22201, United States, kalyan@vt.edu, Alexandra Medina-Borja

System dynamics presumes that variable relationships assumed by the modeler would make the model useful. With automated data collection methods, service companies collect large amounts of data on customers' perceptions and service characteristics. We present three methodologies to uncover/confirm significant variable interactions: Classification and Regression Trees, Chi-Squared Automatic Interaction Detector and Structural Equation Modeling. An application will be discussed.

2 - The Silicon Valley Entrepreneurial System and the San Jose Bio Center

Asbjorn Osland, Professor, San Jose State University, College of Business, One Washington Square, San Jose, CA, 95192-0070, United States, osland_a@cob.sjsu.edu, Burton Dean

Soft systems methodology is applied to establish the concept of an entrepreneurial system and apply it to the evolution of the San Jose Bio Center, an incubator for biotech startup companies. The San Jose Redevelopment Agency fostered and continues to nurture incubators in partnership with San Jose State University, which operates the fairly autonomous loosely coupled San Jose Bio Center. These entities are all part of the entrepreneurial system that characterizes Silicon Valley.

3 - The Role of Individuals' Learning Attributes on the Dynamics of Opinion Formation

Yaneth Cristina Correa-Martinez, PhD Student, Old Dominion University, 1245 Westover Av. Apt B-10, Norfolk, VA, 23507, United States, ycorream@odu.edu, Leonardo Bedoya-Valencia, Charles Keating

Basic features of opinion formation patterns when individuals with different learning attributes coexist are presented. A synergetic approach is used and models from statistical physics are considered to represent the dynamics of the opinion formation phenomenon. An Agents Based Model is proposed as an empirical system from which data is gathered. The results of both models are compared quantitatively and a qualitative analysis is used to interpret the evolution of the resulting patterns.

4 - A Systems Approach for Border Security

Niyazi Onur Bakir, University of Southern California, 3710 McClintock Ave, RTH 322, Los Angeles, 90089, United States, nbakir@usc.edu

The terrorist attacks of 9/11 demonstrated the persistence of terrorists to launch attacks in American homeland. US Borders are particularly vulnerable to terrorism. A terrorist attack can devastate the supply-chain, trade and may result in a high number of casualties. We provide a systems-based approach to evaluate value of alternative investments to improve border security and to reduce the probability of terrorist and illegal weapon penetration through borders.

5 - A New Safety Metric to Measure Air Transportation System Safety

Yue Xie, George Mason University, 4400, University Dr., Fairfax, VA, 22030, United States, yxie@gmu.edu, John Shortle, George Donohue

Aviation safety is usually measured by accident rates. Research has indicated that safety is related with the internal and external factors of the system in a nonlinear manner. We recognize that a linear measuring metrics is not sufficient to communicate the changes of safety. In this paper, we propose a safety metric in logarithmic scale based on the research in aviation safety. The new metric is expected to reflect the nonlinear characteristics of aviation safety more efficiently.

■ WD43

R - 4th Floor, Parc Ballroom II

Inventory Control

Contributed Session

Chair: Yanyi Xu, PhD, Purdue University, 1397-13 West State Street, W. Lafayette, IN, 47906, United States, xu21@mgmt.purdue.edu

1 - Single-Period Pricing Models with Demand Substitution

Tao Huang, UNC-Chapel Hill, 1100 Hwy 54 Byp Apt 74, Chapel Hill, NC, 27516, United States, tauhuang@hotmail.com

We consider capacity investment problems with ex-post pricing and demand substitution effects. We develop and solve two-stage stochastic programming models for two single-period scenarios: implicit substitution and explicit substitution. We characterize the optimal prices and thus demands in the second stage as well as the optimal capacity investment decisions in the first stage. In addition, we find that allowing cross-price elasticity and capacity flexibility increases the total revenues.

2 - Inventory Cost Management in a Generalized ABC Classification System

Robert Stanford, Professor, UAB School of Business, Dept. of FEQM, Birmingham, 35294, United States, stanford@uab.edu, Warren Martin

We establish a general inventory classification system as the foundation for a normative model of the maintenance cost structure of a large, multi-item inventory system with constant demand. For any number of inventory classes, the model expresses the minimum system ordering plus holding costs in terms of (i) the re-ordering frequencies for the items in each inventory class, and (ii) the proportion of the total system's items that are in each inventory class.

3 - Joint Pricing and Ordering Decisions for Different Aged Products

Ek Peng Chew, Associate Professor, National University of Singapore, 10 Kent Ridge Crescent, Singapore, 119260, Singapore, isecep@nus.edu.sg, Chul Ung Lee, Rujing Liu

This paper focuses on the joint pricing and ordering decisions for different aged products. Demands for these products are dependent on the retail price and discounted prices. The problem with two different aged products is modeled as a stochastic dynamic program. For more than two aged products, a heuristic based on a myopic approach is used to jointly determine the pricing and ordering decisions.

4 - Evaluating Reorder Point Methods using Real Data on Spare Parts Demand

Rommert Dekker, Prof, Erasmus University Rotterdam, Burg. Oudlaan 50, Rotterdam, 3062PA, Netherlands, rdekker@few.eur.nl, Eric Porrasmusalem

Using a database of 5 years of real demand occurrences for spare parts in a refinery we test various reorder point methods for inventory control. We compare Poisson, normal and various empirical distributions with the actual policy, while balancing ordering and holding costs with fill rates. It appears that both the normal and an empirical method are performing much better than the Poisson method.

5 - Inventory Models with Backorders and Lost sales

Yanyi Xu, PhD, Purdue university, 1397-13 West State Street, W. Lafayette, IN, 47906, United States, xu21@mgmt.purdue.edu, Arnab Bisi, Maqbool Dada

In an (R, T) system, an order is placed every T periods to bring the inventory up to the base stock R. A new control is introduced to develop an exact and efficient analysis of the (R, T) inventory system that guarantees the satisfaction of the key assumption that backorders are cleared, as in the approach of Hadley and Whitin (1963).

■ WD44

R - 4th Floor, Parc Ballroom III

Open Source Software for Semidefinite Programming

Sponsor: INFORMS Computing Society/ Optimization Services and Open Source Software
Sponsored Session

Chair: Brian Borchers, New Mexico Tech, Department of Mathematics, 801 Leroy Place, Socorro, NM, 87801, United States, borchers@nmt.edu

1 - Recent Improvements in CSDP

Brian Borchers, New Mexico Tech, Department of Mathematics, 801 Leroy Place, Socorro, NM, 87801, United States, borchers@nmt.edu

CSDP is an open-source package for semidefinite programming that has been under development since 1997. In this presentation we will describe CSDP and some of its recent enhancements.

2 - SDPA (SemiDefinite Programming Algorithm) and its Parallel/Completion versions

Makoto Yamashita, Dr, Kanagawa University, 3-27-1 Rokkakubashi Kanagawa-Ku, Yokohama, 221-8686, Japan, Makoto.Yamashita@ie.kanagawa-u.ac.jp, Katsuki Fujisawa, Mituhiro Fukuda, Masakazu Kojima, Kazuhide Nakata

We have developed the SDPA, a sophisticated software for solving general SDPs based on a primal-dual interior-point method, since 1995. On the basis of its outstanding achievements, we have implemented its parallel version which solves extremely large-scale SDPs on multiple processors. We have also combined with the completion method to exploit efficiently structural sparsities of SDPs. In this talk, we outline the features of each software and introduce their online interface.

3 - New Features and Improvements in SeDuMi

Imre Polik, McMaster University, Department of Mathematics, ITB/116, Hamilton, ON, L8S 4K1, Canada, poliki@mcmaster.ca, Tamas Terlaky

Following the tragic death of Jos Sturm, the Advanced Optimization Lab at McMaster University took over the development of the SeDuMi package in 2004 and the first new version was released in May 2005. This talk summarizes the new features and improvements as well as our future plans. Our major topics are preprocessing, starting-point selection, sparse/dense issues and adaptive heuristics. Numerical experiments showing the effect of these techniques are also presented.

4 - Inexact Path-following Algorithms for Some Convex Quadratic SDP Problems

Mike Todd, Cornell University, School of OR, Rhodes Hall, Cornell University, Ithaca, NY, 14853, United States, miketodd@cs.cornell.edu, Reha Tutuncu, Kim Toh

We propose a primal-dual path-following interior-point method for solving certain convex quadratic semidefinite programming (QSDP) problems, using a preconditioned iterative method to solve the Schur complement equation. Numerical experiments on a variety of QSDPs with matrices of dimensions up to 2000 are described.

■ WD45

R - 4th Floor, Raphael

Stochastic Modeling in Transportation Problems

Contributed Session

Chair: Pei-Wei Lin, Ph.D. Candidate, University of Maryland, Dep. Civil and Environmental Engineering, University of Maryland, College Park, MD, 20742, United States, pwlin@wam.umd.edu

1 - Real-Time Travel Time Prediction Under The Optimal Distribution Of Surveillance Sensors

Nan Zou, Department of Civil and Environmental Engineering, University of Maryland, College Park, United States, nanzou@wam.umd.edu, Jianwei Wang, Gang-Len Chang

This paper presents a set of models developed with Neural Networks and Bayesian approaches for on-line prediction of travel time during recurrent congestion. The proposed set of models features their strengths of using the day-to-day traffic queue information and weekly as well as daily patterns in capturing the travel time uncertainty under the optimal distribution of surveillance sensors. Field evaluation results with those developed models will also be discussed in the presentation.

2 - Coping with Time Variability in Routing Problems

Christophe Lecluyse, Research Assistant, UA, Prinssstraat 13, Antwerp, Belgium, christophe.lecluyse@ua.ac.be, Tom van Woensel, Herbert Peremans, Nico Vandaele

In routing problems, the variability on travel times can not be ignored in order to carry out a realistic optimization. The approach proposed introduces a travel time distribution based on queueing theory resulting in a stochastic dynamic routing problem. The approach allows for evaluating routes on the travel time risk involved. The models are validated using numerical results based on standard datasets.

3 - Beliefs and Overconfidence of Entrepreneurs

Dharma Kwon, UCLA Anderson School, B512, Los Angeles, 90095, United States, dharma.kwon@gmail.com

We formulate and study, using a game theory framework, the competition between individuals with different subjective beliefs about the state of the world, and find which individuals win and become leaders. We obtain a quantitative description of winning beliefs and an optimal policy to avoid overconfident entrepreneurship.

4 - A Robust Information Algorithm for Estimating a Dynamic O-D Matrix under Uncertainty

Pei-Wei Lin, Ph.D. Candidate, University of Maryland, Dep. Civil and Environmental Engineering, University of Maryland, College Park, MD, 20742, United States, pwlin@wam.umd.edu, Gang-Len Chang, Xiaorong Lai

Most existing studies assume the traffic volume information is available and accurate. However, due to the limit deployment of traffic sensors and potential measurement errors, the traffic volume is often incomplete and subject to some variation. This study attempts to provide a robust solution algorithm that can estimate the dynamic O-D matrix from realistic constraints. A simulated system will be created to generate example data and perform the numerical evaluation of the developed algorithm.

■ WD46

R - 4th Floor, Rubens

Day-to-day Traffic Dynamics and Traffic Equilibria

Sponsor: Transportation Science & Logistics
Sponsored Session

Chair: Fan Yang, Transportation Research Analyst, ESRI, Inc, 380 New York St, Redlands, CA, 92373, United States, fyang@esri.com

1 - Robust Behavior-Consistent Day-to-Day Traffic Routing under Route Guidance

Alexander Paz, Student, Purdue University, 270 Littleton St, Apt 440, West Lafayette, IN, 47906, United States, apaz@purdue.edu, Srinivas Peeta

Robust behavior-consistent pre-trip information strategies are determined based on a history of previous experiences, an estimated driver behavior, and a system optimal traffic assignment. A fuzzy control mechanism is used to robustly identify the pre-trip information strategies that will initially guide the system as close as possible to the ideal system optimum traffic assignment solution.

2 - Properties of Traffic Equilibria through Multi-Agent Simulation of Day-to-Day Route Choice

Roger Chen, Maryland Transportation Initiative, University of Maryland, College Park, MD, 20742, United States, rbc@wam.umd.edu, Hani Mahmassani

Day-to-day network traffic flows are the collective outcome of decentralized individual route choices over time. Through multi-agent simulation of user decision strategies and learning mechanisms, we investigate the short- and long-run properties of the system in terms of stability, robustness and uniqueness of associated equilibria.

3 - Day-to-day Stationary Link Flow Pattern

Ding Zhang, Professor, State University of New York at Oswego, School of Business, State University of New York, Oswego, NY, 13126, United States, zhang@oswego.edu, Fan Yang

We investigate stationary link flow (SLF) pattern in static, dynamic, stochastic, and multi-class transportation network problems and prescribe a general behavior norm of travelers' day-to-day adjustment under which the equivalence of SLF to the corresponding user equilibrium concept can be proved. We show that all the well known day-to-day route choice adjustment processes so far studied in the literature satisfy this general behavioral norm and thus reiterate the relevance of SLF study.

4 - Efficiently Computing Stationary Link Flow Distribution for Discrete-time Markov Traffic Assignment

Fan Yang, Transportation Research Analyst, ESRI, Inc, 380 New York St, Redlands, CA, 92373, United States, fyang@esri.com, Bin Ran

We present an efficient algorithm to solve the stationary link flow distribution for day-to-day discrete time Markov model. The stationary link flow distribution can be approximated by a multivariate normal distribution. We propose a novel way to compute the mean and covariance matrix of this multi-normal distribution in many cases.

■ WD47

R - 4th Floor, Michelangelo

Topics in Transportation Science and Logistics II

Sponsor: Transportation Science & Logistics
Sponsored Session

Chair: Pablo Durango-Cohen, Assistant Professor, Northwestern University, 2145 Sheridan Road, A335, Evanston, IL, 60208, United States, pdc@northwestern.edu

1 - Online Capacitated Routing Optimization Problems

Michael R. Wagner, MIT Operations Research Center, 77 Massachusetts Avenue, Bldg. E40-149, Cambridge, MA, 02139, United States, mikew@mit.edu, Patrick Jaillet

We present very recent results on online routing optimization problems. We consider capacitated versions of the online TSP, where a single server is restricted in the number of customers he can visit in a given tour. Additionally, we also study the case where there are multiple servers. We present online algorithms and evaluate them using competitive analysis.

2 - Reformulation and Algorithms for OD Estimation: A Traffic Assignment Model with Side Constraints

Xuesong Zhou, Research Assistant Professor, University of Maryland, College Park, MD, 20742, United States, xszhou@mail.umd.edu, Chung-Cheng Lu

We present a single-level OD demand estimation model that fully integrates the traffic state estimation process into the traffic assignment process though a Variational Inequality formulation with side constraints. An augmented Lagrangian solution algorithm is used to construct trade-off curves between estimation quality and violations from ideal Wardrop equilibria.

3 - Mode Choice Model for Long Distance Travel in the USA

Isaradatta Rasmidatta, PhD candidate, University of Texas at Arlington, Arlington, Arlington, TX, 76013, United States, ixr6048@exchange.uta.edu

Long distance travel (more than 50 miles) has been rapidly increasing every year due to economic growth and activity. Characteristics that influence long-distance trips in USA will be analyzed by logistic regression to specify mode choice models and develop better strategies for infrastructure investments.

4 - Capacity Estimation of Two-Sided Type C Weaves on Freeway

Phong Vo, ptv8196@exchange.uta.edu, Stephen P. Mattingly, James C. Williams

This research develops a new model for calculating the capacity of two-sided type C weaves on freeways. The model is developed based on a reasonable selection of field studies and extensive microscopic traffic simulation. The model can be used to recommend minimum design specifications and assist with optizing operational improvements.

■ WD48

R - 4th Floor, Dante

Select Topics in Metaheuristics Development

Contributed Session

Chair: Kok-Hua Loh, student, R.H. Smith School of Business, University of Maryland, College Park, MD, 20742, United States, kloh@rhsmith.umd.edu

1 - GRASP with Memory-based Mechanisms for Single Machine Scheduling with Setup Times

Vinicius Armentano, Professor, Universidade Estadual de Campinas, Av. Albert Einstein, 400, Campinas, SP, 13083-970, Brazil, vinicius@densis.fee.unicamp.br, Olinto César Bassi de Araujo

This work addresses the problem of scheduling jobs in a single machine with sequence dependent setup times in order to minimize the total tardiness with respect to job due dates. This problem is solved by variants of the GRASP metaheuristic that incorporate memory-based mechanisms. The first mechanism extracts attributes from elite solutions in order to influence the construction of an initial solution, while the second one makes use of path relinking. Computational tests are reported.

2 - Simulated Annealing for the Golomb Ruler Problem

Oleksii Ursulenko, Graduate student, Texas A&M University, 3131 TAMU, College Station, TX, 77843, United States, ursul@tamu.edu

The Golomb ruler problem is a hard combinatorial problem, and it is believed that it can not be solved by a polynomial time algorithm. Various heuristics have been proposed for it, including evolutionary techniques, GRASP, etc. This work proposes a simulated annealing approach to the Golomb ruler problem and presents numerical results.

3 - TABU Search Algorithm for an Allocation Problem

Alfredo G. Hernandez-Diaz, Associate Prof., Carretera de Utrera nº 1, Seville, Spain, agarher@upo.es, Rafael Caballero, Flor Guerrero, Julian Molina

The distribution of room/offices is a real problem consisting in the assignment different sets of spaces (offices, rooms, halls, etc.) to a given number of people. These spaces are distributed in buildings and/or floors and have to be assigned among several groups of people. This situation give rise to a quadratic combinatorial problem, which make it difficult to be solved with an exact method. We propose a Tabu Search algorithm and test it on a real case.

4 - A Competitive Heuristic Algorithm for Multi-Mode Resource-Constrained Project Scheduling Problem

Selcuk Colak, University of Florida, 393 Maguire Village #6, Gainesville, FL, 32603, United States, scolak@ufl.edu

The Multi-Mode Resource-Constrained Project Scheduling Problem is a well-known NP-Hard problem. In this study, a heuristic algorithm based on the neural networks is proposed. The approach is tested on benchmark problem instances from PSPLIB. The results are very competitive with other meta-heuristic approaches, both in terms of solution quality and computational times.

5 - Solving the Bin Packing Problem with a Weight Annealing Heuristic: A Computational Study

Kok-Hua Loh, student, R.H. Smith School of Business, University of Maryland, College Park, MD, 20742, United States, kloh@rhsmith.umd.edu, Bruce Golden, Edward Wasil

In this paper, we describe the concept of weight annealing. When applied to a combinatorial optimization problem, it assigns variable weights to different parts of the problem, based on the insights gained from one iteration to the next. In particular, we compare and contrast its performance with that of other heuristics in a computational experiment that focuses on the bin packing problem.

■ WD49

R - 4th Floor, Medici

Joint Session Health/ Optimization: OR-based Methods of Diagnosis and Prognosis

Cluster: Health Care, Optimization/OR and Medicine
Invited Session

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

1 - Logical Analysis of Diffuse Large B-Cell Lymphomas

G. Alexe, IBM, Yorktown Heights, NY, United States, alexe@rutcor.rutgers.edu, Sorin Alexe, David Axelrod, Peter L. Hammer, David Weissmann

A novel combinatorial method called Logical Analysis of Data is applied to the Affymetrix lymphoma dataset of Ship et al. (www. genome.wi.mit.du/MPR/lymphoma) for identifying ensembles of combinations of genes which are highly predictive of different types of non-Hodgkin lymphomas.

2 - Robust Diagnosis of Non-Hodgkin Lymphoma Phenotypes Validated on Gene Expression Data

Gabriela Alexe, T.J. Watson IBM Research Center, Yorktown Heights, NY, United States, galexe@us.ibm.com, Gyan Bhanot, A. Levine, Gustavo Stolovitzky

We apply a meta-classification scheme which combines data from different laboratories and predict that combinations of some genes in the p53 pathway are highly predictive of non-Hodgkin lymphoma phenotype. In particular, we find that the combination p53, PLK1 and CDK2 can accurately discriminate between follicular and diffuse large B-cell lymphomas. Robust diagnosis of non-Hodgkin lymphoma phenotypes validated on gene expression data from different laboratories

3 - Logical Analysis of Computed Tomography Data for Idiopathic Interstitial Pneumonias

Irina Lozina, Rutgers University, RUTCOR, Piscataway, NJ, United States, ilozina@rutcor.rutgers.edu, Michel Brauner, Nadia Brauner, Peter L. Hammer, Dominique Valeyre

We analyze computed tomography data by using Logical Analysis of Data methodology to distinguish between three types of idiopathic interstitial pneumonias, and show that LAD can distinguish with high accuracy the different forms of IIP. LAD provides additional information about outliers, significance of attributes, identification of promoters and blockers, etc.

■ WD50

R - 4th Floor, Cervantes

Stocahstic Problems in Decision Analysis

Contributed Session

Chair: Michael Fry, Assistant Professor, Department of Quantitative Analysis and Operations Management, University of Cincinnati, University of Cincinnati, Cincinnati, OH, 45221, United States, FRYML@UCMAIL.UC.EDU

1 - A Joint Venture UniAndes-BP Colombia for Improving Decision Making Quality

Mario Castillo, Associate Professor, University of Los Andes, Calle 19A # 1-37 Este Of. W510, Cra. 8 # 85-31 Ap. 801, Bogotà, DC, Colombia, mcastill@uniandes.edu.co, Sergio Cabrales, Alvaro Mendoza

This paper presents the experience of a conjoint work between UniAndes and BP-Colombia, consisting in a training-consulting program in decision analysis for solving BP decision problems of high economic impact, related to technologies selection, oil exploitation strategies, and reserves estimation probabilistic models. Around 60 engineers have been trained in the use of Decision Trees, I. Diagrams, Bayesian Networks and AHP. The program has had a remarkable impact on BP decision making culture.

2 - A Discrete-Time Approach to Valuing Real Options with Underlying Mean-Reverting Stochastic Processes

Warren Hahn, Strategy & Planning Analyst, BP America, 501 Westlake Park Blvd., Houston, TX, 77079, United States, Warren.Hahn@phd.bus.utexas.edu, James Dyer

We utilize a general binomial approximation to model simple mean-reverting processes as recombining lattices, and extend to two-factor and dual correlated one-factor mean-reverting processes. This approach is illustrated by implementing in binomial decision tree format and applying to an oil and gas switching option that requires a binomial model of two correlated one-factor commodity price models.

3 - Production and Labor Planning Strategies for Volatile Demand

Rajesh Veliyanallore, Oklahoma State University, 322 Engineering North, Oklahoma State University, Stillwater, OK, 74078, United States, rajesh.veliyanallore@okstate.edu, Ricki Ingalls

Cyclical demand pattern combined with its volatility provides a challenge in planning production activities and the related capacity planning issues. Traditionally researchers have addressed the problem of production planning and capacity planning as separate issues. This research addresses the core issues in unison through a scenario-based approach, which deals with different scenarios on which the organization may have to operate.

4 - Decision Making Subject to Risk Perceptions from Extreme Events

Michael Fry, Assistant Professor, Department of Quantitative Analysis and Operations Management, University of Cincinnati, University of Cincinnati, Cincinnati, OH, 45221, United States, FRYML@UCMAIL.UC.EDU, Matthew Bailey

We introduce sequential decision making models that account for changes in consumer perceptions due to introduced risks from extreme events such as natural disasters and terrorism. We develop explicit models for the short-term and long-term effects on consumer risk perceptions due to the occurrence of extreme events. These risk perception models are then incorporated into standard MDP formulations for decision making related to capacity allocation, inventory models, etc.

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Celik, Sabri SA07
Centeno, Efraim MD20
Centeno, Grisselle SD46
Cerda Salzmann, Ximena MA36 MB27, IS-T
Cerisola, Santiago SA20
Cervellera, Cristiano WC22
Cetinkaya, Sila MB10 TC10, TC45, WC05
Ceyhan, Mehmet SC32
Ceylan, Ismail MC12
Chacko, Rosemary WA22
Cha, CPT Young-ho TC04
Chae, Junjae WC16
Chaipradubkiat, Pornpen WD33
Chakrabarti, Ajoy SD50
Chakraborty, Amit WC13
Chakravarty, Amiya WA10
Cha, KyungDuck TD26
Chalavadi, Mahesh WC36
Chan, Ben TC48, TD48
Chand, PhD, Suresh WC02
Chandra, Charu SA31, WA11
Chandran, Deepak MA43
Chand, Suresh SB11
Chang, Elaine SB47
Chang, Gang-Len SD47, WD45
Chang, Hwan WA47
Chang, Kevin WD18
Chang, Kyung-Soo MA26
Chang, Mei-Shiang SB46
Chang, Michael SC21
Chang, Seok Ho WA16
Chang, Sung-Ho WD02
Chang, Yih-Long WA16
Chankong, Vira TD31
Chan, Timothy WB48
Chan, Victor SC02
Chan, Wai Kin MC36
Chan, Yupo WA46
Chao, Gary MC16, WD11
Chao, Hung Po MB20
Chao, Raul MB17 TA17
Chaovalitwongse, Wanpracha Art TB49, WA26
Chao, Xiuli MC37, WC37
Chapin, Patrick TD04
Charikar, Moses SB40, MC40
Charness, Gary SB49
Chassiakos, Anastasios WA47
Chaturvedi, Alok WA27
Chaudry, Joseph TA49
Chava, Sudheer SD23
Chawla, Shuchi TB40
Chayes, Jennifer MD12
Chayet, Sergio SA09
Cheatham, Josh TB05
Chellappa, Ramnath MC22
Chelst, Kenneth MB03, TA31
Chelst, Kenneth MD25
Chen, Anthony SC46
Chen, Bintong WC13
Chen, Cheng-Kang SA03
Chen, Chialin SB02
Chen, Chun-Hung MC36, MD36
Chen, Di MB33
Chen, Di SC34
Chen, Edward WD07
Chen, Fangruo MB07
Chen, Feng MB09
Chen, Feng WA38
Chen, Frank TD11
Cheng, Clark MA35
Cheng, Feng TB36
Cheng, Hsing MD29
Cheng, Hung-Pi MB25
Cheng, Jin WC37
Chen, Gongtao (Lucy) MD09
Cheng, Russell SA36
Cheng, Shih-Fen IS-T, WA46
Cheng, T. C. Edwin SD15
Chen, Hong MB11, TC08
Chen, Hongyi WD31
Chen, Huey-Kuo SB46
Chen, James WD27
Chen, Jean-Marc MC02
Chen, Jenny WC15
Chen, Jian TB15
Chen, Jing WB08
Chen, Jinlin TD21, WA22
Chen, Kay-Yut SB10, WB31
Chen, Li TA09
Chen, Li TD05
Chen, Lijian SC28, MC28
Chen, Liuxin WB35
Chen, LiWen WB29
Chen, Mike TA37
Chen, Min WC11
Chen, Ming SA18
Chen, Nan MD24, TB24, TD37
Chen, Pei-yu SB23
Chen, Qiming TB20
Chen, Qiyang TD27
Chen, Rachel SB07
Chen, Roger WD46
Chen, Rong WC42
Chen, Shaoxiang MA28, WD37
Chen, Shuohui SA33
Chen, Si SC44, MA44
Chen, Victoria SC21, MB18 MD20, WA22, WC22
Chen, Wei MB25
Chen, Wenqing WA30
Chen, Xianqiao MC20
Chen, Xin MC39, WD09
Chen, Yao TA02
Chen, Yihsu IS-M
Chen, Yiling TC11
Chen, Ying-Ju SC12, SD38
Chen, Yingwu WA30
Chen, Yiyu TB05
Chen, Yong SA34 SC34, MA34, MC33 MD26, MD34
Chen, Youhua WC39, WD08
Chen, Yuwen TD09
Chen, Zhi-Long SC15 SD15, MC10, TC15, TD29
Chen, Zhiying (Amy) MA47
Chen, Zhiyong TD36
Cheong, Michelle L.F. SB32
Cheong, Tae-Su WC31
Chepaitis, Elia MA03
Chesman, Michael SD31
Chesnut, Eddie TD14
Cheung, Raymond MA45
Chevalier, Philippe WD26
Chew, Ek Peng TC46, WD43
Chew, Song WA36
Chhajed, Dilip WD11
Chiam, Tze Chao WC36
Chiang, I-Hsuan Ethan SA23
Chiang, Mung SD40, WA23
Chiang, Wen-Chyuan MA25 WA38
Chick, Stephen MD36
Chi, Jie WA27
Chinchuluun, Altannar MB38
Chin, David WC18
Chinnam, Ratna Babu TA11, WB35, WC03
Chinneck, John MA38
Chisolm, Deena MB48
Chiu, Chun-chih TC07
Chiu, Wai F. TB26
Chiu, Yi-Chang SA46 MA47, TA46, TC47
Cho, Byung Rae MB34
Cho, HyunWoo SC32
Choi, Changhui SC38
Choi, Hyun-cheol WA11
Cho, In-Koo TA37
Choi, Young Keun WC19
Cho, Jung Jin MD34
Cholette, Susan SD06
Chomiakow, Daniel SD47
Chong, Jack IS-M, WD19
Chong, Wang TB50
Choobineh, Fred TC07
Cho, Soo-Haeng WC30
Choueiki, Hisham SD21
Choueiry, Berthe TC03
Chouinard, Marc TA06

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Chou, Mabel MC39, WB41 WD05
Chouman, Mervat TD28
Chou, Philip A. TA40
Christiansen, Marielle TA45 TD11
Christodoulidou, Natasa WC28
Christophel, Philipp TC41
Chuang, Hsiao-Min TC07
Chu, Chao-Hsien TC11
Chu, Chih-Yuan WB47
Chudak, Fabian SA39
Chu, Leon TD12
Chu, Millie TA49
Chun, Leung WB29
Chun, Young WD26
Church, Richard WD20
Chu, Sydney WD13
Ciemnoczolowski, David WC45
Cifarelli, Claudio WC32
Cillo, Alessandra WB50, WC50
Cirinei, Fabien SA28
Civelek, Ismail SD36
Claerhout, Diederik SA11
Clarke, John-Paul MA18
Clausen, Jens MC42
Cleary, Pat SC06
Clemen, Bob TC50, TD50
Cochran, James SA32, IS-M TA01, WD13
Codenotti, Bruno MB40
Coen, Corinne WB30
Cohen, Morris SC10, SD10
Cohen, Shoshanah SC09
Cohn, Amy SA31, MA30 MB18, TA03, WB47
Coit, David MA34
Cojocaru, Monica-Gabriela WB46
Colak, Selcuk WC15, WD48
Coldren, Gregory SB18
Cole, Richard TB12
Collins, John R. SC32
Collins, John MD22
Collins, Michael J. WB14
Colmenares, Leopoldo WB19
Comeau, Jules WC02
Comez, Nagihan SD08
Commander, Clayton TB14
Conejo, Antonio SB20 SD20, MA20
Conerly, Michael TD03
Conner, Whitney MA06
Conrad, Stephen WA34
Contreras, Javier SC20
Cook, David WB48
Cook, Victor WC35
Cook, Wade TA02
Coombs, Joseph TC19
Cooper, Martha WD14
Cooper, William SC28, SD28
Cope, Eric IS-M, IS-T, WD19 WD37
Cope, Eric MB27
Coppersmith, Don TD40
Corbett, Charles WC26
Cork, Tom MC31
Cornuejols, Gerard TA41
Corrêa Netto, Osvaldo TC16
Correa, Jose R. SA40, WA15
Correa, Luciano WC29
Correa-Martinez, Yaneth Cristina WB15, WD42
Cossiavelou, Vassiliki TC23
Costa, Anthony MC50
Côté, Murray SC48, MA48 TD48, WA48
Coughlan, Anne T. MB08
Craft, David WB48
Crainic, Teodor Gabriel SB46 TD45, WA43
Crama, Pascale SA17, TB50
Cramer, Roxy SB28
Cramton, Peter MD47
Crissey, Mary SA06
Croll, Grenville SC06
Crook, Kevin MA35
Crowder, Harlan SC27
Crowe, Bruce MB49
Cruz, Jose SA02
Cui, Tony H. WD35
Cui, Wenbin WD20
Cunha, Claudio SA06, SB01
Cunningham, William WD14
Curry, David WD13

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da Gama, Gonzaga SC32
Dada, Maqbool WC03 WD43
Dadvand, Arash TD17
Daganzo, Carlos WB03
Dai, Jim SA37
Daim, Tugrul U. WD31
Dai, Tinglong WA17
Dalkilic, Veysel TD30, WA17
Dallery, Yves WC08
Dalton, Chris TA13
Damien, Paul SD34
D'Amours, Sophie TA06
Dandamudi, Sashidhar TA33
Daniels, Lorraine TB33
Daouia, Abdelaati MB02
Darabi, Houshang TB11
Darbha, Swaroop TB14
Darby- Dowman, Ken SD42
Dasci, Abdullah WA15, WC09
Dasgupta, Anirban MC40
DasGupta, Bhaskar TB49
Dash, Sanjeeb SD41
Dash, Sanjeeb TA15
Daskin, Mark MA25, WD06
d'Aspremont, Alexandre SA39 SB38, MB23
Das, Tapas K. SA44, MA20 TA34, WA33
Dasu, Sriram MB11 MC11 WA05
Davenport, Andrew SC12 TA43
Davidovic, Tatjana WA43
Davies, Ruth TA48 TC31
Davis-Blake, Alison SC17
Davis, Dave TA14
Davis, Gary SA18
Davis, Ron MD27, WA34
Davydov, Dmitry TB24
Dawande, Milind MA15 MB15, TC15
Dawson, Peter TA25
Dawson, SMSgt Michael TC04
Dayanik, Savas SA26, WD26
Day, Bob SB27, MD12
Day, Jamison WB30
de Bruin, Arnoud TB48
De Bruyn, Arnaud TA35
de Farias, Ismael SA26 MC41, TA41
de Klerk, Antonie WB42
De Kok, Ton SC11, WB36
de la Peña, Victor SC21
De La Rosa, Manuel G. WD12
de Mast, Jeroen TB33
de Matta, Renato SB11
De Reyck, Bert SA17 TB50
de Sousa, Amaro TA23
de Vericourt, Francis SC37 MC14 WC08
Dean, Brian C. TD40
Dean, Burton WD42
Deane, Jason WB27
Dearing, P.M. MB32
Debo, Laurens SD10 TA07, TB06, WA39
Deckro, Richard TA14, WB39
DeCroix, Gregory SD05, TB06
Deeds, David TC19
Degbotse, Alfred MA31
Degraeve, Zeger SA17, TB50
DeHoratius, Nicole SA09, TB08
Dekker, Rommert WD43
del Castillo, Enrique MA06 MB33
Delaney, James MB34
Delen, Dursun WB22
Deleris, Lea WC50
Dellarocas, Chrysanthos SC22
DelliFraine, Jami SC48
Delquié, Philippe WB50
Demeester, Lieven MA10
Demeulemeester, Erik MA36 TD16, WD15
DeMiguel, Victor MC28, TA24
Demirci, Mehmet SA42
Demmel, James WA41
Dempsey, James TD31
Dempster, Arthur P. TB26
Deng, Shi-Jie SB22, SD20
Deniz, Borga MA28, TC08
Dentcheva, Darinka SC39, SC42
Denton, Brian MC04
Deokar, Vijay WB23
Deo, Sarang WC26
DePuy, Gail WC16
Derigs, Ulrich TB18
Derpich, Ivan TD41
Desai, Aniket MD30
Desai, Jitamitra TA38
Deshler, Barbara MB49
Deshmukh, Abhijit SD26, WB33
Deshpande, Vinayak SC10 MD10, TA09
DeSilva, Dakshina MC12
Dessouky, Maged SA18, MB45
Devapriya, Priyantha MA15
Devarajan, Vijay MA31
Dewan, Pooja SA35, SB35
Dexter, Franklin SC48, MC48
Dey, Santanu MB41
Deza, Antoine SD38
Dhanda, Kanwalroop Kath WB06
Dhawan, Atul WD02
Dhumal, Parag TD17
Diamond, James MC08
Diecidue, Enrico TA50 WC50
Dietrich, Brenda TB03
Dillon Merrill, Robin SC50 MC50
Ding, Li SA37
Ding, Mingzhou WC32
Ding, Shengwei SC19
Ding, Xin TA29
Ding, Yu SA34, SB34 MB33, MD34, TD21, WB33
Dink, Delal TD26
Dirkse, Steve MC13
Discenza, Joseph H. TA04
Disney, Steve TC11
Dittmann, David TB31
Diwekar, Urmila SA02
Djurdjanovic, Dragan IS-T
D'Mello, Joseph MA03
Dobson, Gregory MA48, WB48
Dobson, Stephen TA25, TB25
Dodin, Bajis MA03
Doebbeling, Bradley WC02
Dogan, Kurtulus WD24
Dogru, Mustafa SC11
Dolk, Daniel WA27
Dong, Jing SA18
Dong, Lingxiu SD07
Dong, Rui MD47
Dong, Yan MA29
Donohue, George WA18, WD42
Donohue, Karen TB09
Doraszelski, Ulrich SB08
Dorne, Raphael MB43
Dourandish, Robert MD29
Down, Douglas SA37, SB37 WA37
Downs, Brian TA27
Drake, David TA16
Drake, Matt SA03, WC29
Drezner, Tammy MB32, TB32
Drezner, Zvi MB32, TB32 TC32, WA32
Druehl, Cheryl MB17
D'Souza, Warren WB49
Duan, Rong WA22
Dube, Parijat MD27, WD08
Duckro, Donald TD04
Du, Donglei SB38
Duenyas, Izak MC23 MD08, WB08, WC03, WD39
Du, Feng WD40
Duhalde, Juan Manuel WA13
Du, Jie MC31
Dula, Jose TB02
Dulin, John TB04
Dunkel, Joern SC30
Dunne, Timothy MC12
Dunscombe, Peter TC31
Durango-Cohen, Elizabeth SD10
Durango-Cohen, Pablo TA47, WB47
Duran, Marco WA41
Duran, Rodrigo TD34
Duran, Serhan TD29
Duthie, Jennifer TA46, TB46

Dutta, Goutam SD05
Dyer, James WD50
Dyer, James MB25
Dyer, Jim MD50

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Eapen, Gill MA23
Easton, Fred TD05
Easton, Kelly SA32
Easton, Todd WB24
Eckstein, Jonathan WB41
Edelstein, Barak MA02
Edirisinghe, Chanaka MA42 MC42, WA24, WB11
Egan, Dave TB20
Ehrenmann, Andreas SC20
Ehrman, Chaim TC35
Eichler, Knut MA10
Eiselt, H.A. TA32
Eisenhauer, William WA19
Eisenman, Stacy SA47
Eisenstein, Don MC16
Eiter, Thomas TD22
Ekaette, Edidiong TC31
Ekollu, Goutham SC18
Eksioglu, Burak SB32
Eksioglu, Sandra SB32
El Ouardighi, Fouad WA03
Elahi, Ehsan TB09
Elakkumanan, Praveen WD32
Elbassioni, Khaled SD43, TD22
Elhafsi, Mohsen WA35
Elimam, Abdelghani MA03
Elkins, Debra MA37
Elmaghraby, Wedad SC31 MA30, TB09
Elsayed, Elsayed SD33, WD21
Elshennawy, Ahmad MC26
El-Taha, Muhammad WB36
Emir-Farinas, Hulya TD06
Enders, Johannes TB20
Engau, Alexander MA24
Engelbrecht-Wiggans, Richard SB07
Engseld, Peter WD16
Epelman, Marina IS-T, WA46
Epstein, Rafael WB09
Erat, Sanjiv SB17
Erde, Elif Tokar TA32
Erdem, Mehmet WD24
Erdirik, Muge SB41
Erdogan, Emre SA24 SC02, TD42
Erenguc, S. Selcuk WC15
Eren, Serkan SB28
Erera, Alan SC45 SD45, TA33, WA08
Ergun, Ozlem SA40 SC45, SC47, SD26 MB18, MC47, MD05, TA45
Erhun, Feryal MA27 MC07, WA10, WB09
Erinjeri, Jinson TC26, WC19
Erkan, Hafize MA42
Erkip, Nesim TA11, TC10
Erkut, Erhan MB31
Errais, Eymen SA30
Ervolina, Tom TB36
Eryarsoy, Enes WD27
Eryilmaz, Atilla TA12
Escalera, Jaime WA47
Eskandari, Hamidreza MA36 TC14
Esserman, Laura SD48
Evans, Gerald TA48, WB47 WD40
Even-Dar, Eyal SD40
Everson, Mark SA31
Evlioglu, Rahmi TC36
Ewing, Paul MC50
Ezawa, Kazuo SD50, MD50

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Fagerholt, Kjetil TA45
Fampa, Marcia SC38
Fan, Carol WC14
Fan, David MA45
Fan, David WA47
Fang, Xiang TD10 WA07
Fan-Orzechowski, Xiaofei MD37
Fan, Yueyue MC46
Farahat, Amr SA40, TA23
Farahvash, Pooya TD17
Fard, Nasser TA26, TB26
Fare, Rolf MD02
Faria, Jose A. TC30
Farmer, Adam SD32
Farnum, Nicholas TC25
Farzinnia, Neda SA49
Fathi, Yahya TD44, WC41
Faulin, Javier WD27
Faulkner, Eli TD24
Favaretto, Fábio TC16
Federgruen, Awi TA07, WB17
Fedzhora, Liliya WD21
Feinberg, Eugene MC37, MD37
Felder, Wilson MC08
Felin, Teppo SA19
Felli, James C. SD50
Feng, Hanhua WB37
Feng, Jane TB44, WB12
Feng, Keli TD30
Feng, Liming MD24
Feng, Qi TB05, TD30
Feng, Qianmei TC26
Feng, Tianjun MD11
Feng, Youyi SD20, WB08, WB35, WC17
Ferguson, Mark WB10, WC06 WD06
Fernandez, Emmanuel WD36
Fernández-Menéndez, Félix SB20
Ferratt, Tom MA22
Ferreira, Pedro TA19
Ferrell, William G. MA15, WC48
Ferrer, Geraldo TD06
Ferris, Michael SA46, TC47
Fiat, Amos MA40
Fichtenbaum, Ian IS-M, WD19
Figliozzi, Miguel SD45
Fildes, Robert SD21
Firestone, Ryan TC20
Fisher, Marshall SC05
Fishman, Lyubov WA22
Fitzgerald, Lin WA02
Fixson, Sebastian MA17 MB17, TB19
Flannery, William WB42
Flatto, Jerry TB36
Flaxman, Abraham D. SB40
Fleischer, Lisa K. MB40 TB12, TD40
Fleming, Lee SC16
Fleten, Stein-Erik SD20, WC31
Flores, Pedro SD44
Florian, Michael SB46 MA46, MC46, TC47
Floros, Vaggelis SB47
Floudas, Christodoulos MC38
Flowers, A. Dale TD07
Fodstad, Marte TB11
Fogal, James TA11
Foley, Robert D. WD37
Fontanesi, John IS-T
Forgionne, Guisseppi TA29
Forrester, Richard MA01
Forrest, John MC04
Foster, Glenn TC18
Foulk, Victor TC44
Fourer, Robert SB44 SC13, MB44, MC43, TC44 TD43 TD43
Fowler, John SA36, SB15 MD31, WB15, WC15
Fradkin, Yakov SA31
Francis, Peter MD05
Francis, Vernon MA11
Frank, Murray MB11
Fransoo, Jan SC10, TC39 TD17, WB36
Franz, Eldon MD49
Frazier, Chris SC46
Freedman, Jerry TC18
Freimer, Mike SD08, TD36
Freund, Robert M. SB39
Friedrich, Lars WB30
Friesz, Terry SB20 TA05, TB05, WB46
Frieze, Alan SB40
Frikken, Keith TA09
Fritz, Kenneth SC21
Fry, Michael SC11, IS-M, WD50
Fuchigami, Hélio WD41
Fuchs, Erica TB19
Fujisawa, Katsuki WD44
Fukuda, Mituhiro WD44
Fuller, David SA20
Fuller, Jack MA23
Fu, Michael MC36 MD36, WD13
Funck, Jim WA20
Fu, Qi TC10
Furman, Kevin TB45, WA41
Furterer, Sandra TA03
Futrell, Doris TD04
Fu, Xiaowen WC37
Fylstra, Daniel H. MB13

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G. del Valle, Alejandro WD27
Gabriel, Steven MB20 MD30, TA30, TC30
Gabteni, Sami MD46
Gafni, Amiram IS-T
Gaimon, Cheryl SB17 SC19, SD17, TA17
Gaines, David A. SD22
Galati, Matthew WC44
Galbreth, Michael SD06, WC06
Galea, François TD26
Galenko, Alexander SD34 MA34
Galiana, Francisco D. SB02 TC20
Galis, Zorina SA44
Gallay, Olivier MC11
Gallego, Guillermo SA24 SD30, MA12, TD28
Gallien, Jeremie MB27, WA07
Gallo, Joseph WC44
Galvào, Flavio SA06
Galvin, Cristina MD48
Gamalski, Andrew SB15
Gamarnik, David SD37, TA37
Gamboa, Dorabela WC43
Gamvros, Ioannis MC04, TC23
Gandhi, Bansri WB29
Ganesan, Rajesh SA44, TA34 TB34, WA33
Gans, Noah MC14
Gan, Xianghua WD11
Gao, Chongyan WD23
Gao, Chungua SC47
Gao, David MB38
Gao, Feng TA20
Gao, Guodong TB08
Gao, Hongman TD24
Gao, Long SD08, TD05
Gao, Puxian WA33
Gao, Robert WB33
Gao, Su MC15
Garber, Russ WB50
Garcia, Alfredo SC08, TA36
Garcia-Diaz, Alberto MD35
Garcia, Guiselle SB47
Garcia, Hugo MD34
Gardner, Leslie TB36
Garg, Amit TD07
Garg, Manish TB23, WB36
Garlappi, Lorenzo TA24
Garner, Dave SB31
Garrido, Rodrigo MC45
Garrow, Laurie SD18
Gassmann, Horand I. MB42 MC43
Gass, Saul I. TB39
Gaukler, Gary MD34, TB07
Gaur, Vishal SA09 SC10, TA08, WD09
Gautam, Natarajan TB05
Gau, Tony MA38
Gaver, Donald P. WA14
Gavetti, Giovanni SD16
Gavirneni, Srinagesh TD10 WA11

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Gebraeel, Nagi SC34, MC34
Geiger, Christopher D. TC14
Geisler, Eliezer WC26
Geismar, H. Neil MA15 MB15, TC15
Gel, Esma MB36, MC16, MD16
Ge, Ling WC07
Gellrich, Tom SB30, WB30
Gelogullari, Cumhur WB15
Genc, Latife TC43
Genc, Talat WB16
Gendreau, Michel SC44 MC45, TD45
Geng, Qin WB11, WC39
Geng, Xianjun SA22
Genta, Sebastian WC47
George, Abraham SB42
George, Sonney WA20, WC20
Gerchak, Yigal MB09
Gerdes, John WB07
Gerdsri, Nathasit WD31
Geroliminis, Nikolaos WD28
Gerschman, Mats MA36 MB27, IS-M, IS-T, TD05
Gershwin, Stanley B WA16
Getty, Iain TD32
Geunes, Joseph MA06 MA09, MB10, TB01, TD09
Ghandehari, Mostafa WC19
Ghate, Archis V TB38
Ghose, Anindya SB22 MB22, MD22
Ghosh, Ranjan TC02
Ghosh, Soumyadip TB36
Giachetti, Ronald TD48
Giesecke, Kay SC24, MC24
Giesecke, Kay SD24
Gilat, Dagan MB06, WD15
Gilbert, François SD18
Gilbert, Stephen TD09, TD39
Gilland, Wendell SC05, TB17
Gillis, Lynette SD16
Giloni, Avi SA11, WA05
Gilpin, Andrew TA12, WD29
Gingras, Lin WB07
Gini, Maria MD22
Gino, Fransesca MB16, TA17
Gintner, Vitali MB43
Giraud-Carrier, Christophe TD29
Girotra, Karan SC17 MC09, TA17
Glasserman, Paul SD24 TB24, TD36, TD37
Glazebrook, Kevin SA37
Glockner, Greg TA43
Glover, Fred SC43, IS-T, TD24 WA21, WA43, WC43, WD22
Glowacka, Karolina MC27
Glynn, Peter SC20, WC36 WD36
Gnanlet, Adelina SC05
Goadrich, Laura WB48
Goddard, John TA25, TB25
Godinho, Teresa TD41
Godin, Robert WB21
Goel, Ankur MD11
Goel, Piyush TB05
Goemans, Michel MB40
Goerger, Dr. Niki SD14, MD14
Goerger, LTC Simon SD14, TA14
Goes, Paulo MD22
Goettler, Ronald SD09
Goffin, Jean-Louis WB41
Golany, Boaz TA28, WD15
Goldberg, Andrew MA40
Goldberg, Ken WC26
Goldberg, Lisa SD24
Golden, Bruce SA18 SC44, MA44, WD48
Goldfarb, Donald SA38
Goldman, Larry TC13
Goldner, Daniel TD18
Goldsman, David MB30 MD36, TA03, IS-T, TC36
Goldsman, Paul MB30
Golnabl, Saeed IS-M
Golovnya, Mikhail MD13, WC42
Gomes, Carla SD43
Gómez-Cabrero, David WC12
Gomez, Trinidad WC20
Goncalves, Joao MD39
Goncalves, Paulo MB17
Gondzio, Jacek MD39
Gonul, M.Sinan WC42
Gonzalez, Ed MC35
Gonzalez, Mercedes WC48
Goodchild, Anne TB45, WD12
Goodman, Brandi SC27
Goodwin, Paul SD21
Goossens, Dries SD12
Goossens, Nico TA10
Gopalappa, Chaitra TB34
Goradia, Pratik WB06
Goren, Selcuk WC15
Gorman, Michael MB35, WA31
Gorman, Michael MD04
Gosavi, Abhijit MB44, TC29
Gouel, Phil MB17
Gourdin, Eric WD28
Gouveia, Luis TA23, TB23 TC41, TD41
Govil, Sandeep TA31
Govindaluri, Srikrishna SC32
Govindaraj, Suresh WC39
Govind, Nirmal MA31
Govindu, Ramakrishna WB35
Goyal, Manu TA08
Goycoolea, Marcus WD20
Grabis, Janis SA31
Graf, Peter WD29
Granados, Nelson F. SB22
Grande, Darby MB04
Granot, Daniel MB09, WB32
Granot, Frieda MB09, WB32
Grant, Ed TB06
Grant, Michael SB44
Graves, Greg TD14
Graves, Stephen SB32 SD27, MB27
Gray, Andrew TA48
Gray, Genetha WC22, WD38
Gray, John TA19, TB08
Greenfield, Victoria WC14
Green, John SD14
Greenland, Arnie SD31
Green, Linda SA27, SB27 MA08, MB30
Green, Tuell SB29, SC18
Grefe, Johannes WA19
Greiner, Russ WA21
Greistorfer, Peter MD44
Greve, Robert WB41
Grewal, Rajdeep MB29
Griffin, Jack SB05
Griffin, MAJ Greg SD14
Griffin, Paul MB48, TA02, IS-T TC05, WC29
Grinde, Roger SB06
Groenevelt, Harry MA09 MA11, WC06
Groleau, Thomas TC25
Gronhaug, Roar TD11
Gross, Donald TC36
Gross, George SC20
Grosskopf, S. MD02
Grossman, Ph.D., Thomas SB06 TB03
Grossmann, Ignacio SB41
Grundel, Don TC41
Guan, Yongpei MD41
Guan, Ziming SB12
Gubbala, Prabhakar MC40
Gu, Bin MC22
Gue, Kevin MD45
Guerrero, Flor WC48, WD48
Guide, Jr., V. Daniel R. TC06
Guide, V. Daniel WC06
Guignard, Monique MB43
Guikema, Seth MA49
Gulabani, Vimla SA44
Gulcu, Altan TD29
Guler, Kemal SB07, MC12
Guler, Osman SD39
Gulsen, Mehmet WB19, WC29
Gunalay, Yavuz WD24
Gunasekaran, Senthil WC02
Gunes, Evrim SC05, MB48
Gunluk, Oktay SD41
Gunn, Eldon WB20, WC02
Guo, Huairui MB26
Guo, Pengfei SA11, WC05
Gupta, Alok SB22, MD22
Gupta, Aman WB47
Gupta, Aparna SB23, SC48
Gupta, Ashish WB41
Gupta, Barun TB36
Gupta, Diwakar SD05, IS-T TD10
Gupta, Gautam TB47, WD12 WD28
Gupta, Jatinder N. D. MA15
Gupta, Skylab TA16
Gupta, Sudheer WA06
Gupta, Surendra M. MC06
Gupta, Sushil MA15
Gupta, Vijay TB05
Gurbuz, Mustafa TC45
Gurel, Sinan MA16
Gurgur, Cigdem SB30
Gurkan, Gul MA28, TD38
Gurkan, Korhan MC07
Gurler, Ulku WB08, WC28
Gurnani, Haresh TD10, TD35
Gursoy, Kemal WD40
Gurtuna, Filiz SD39
Gurvich, Itay TC37
Gurvich, Vladimir TD22
Gusikhin, Oleg SA31
Guslitser, Elana MB07
Gutierrez, Genaro MD11, WC05
Guyton, John SD31
Guzelsoy, Menal WC44

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Haasis, Hans-Dietrich TB11
Haas, Peter WC36
Hackethal, Andreas SB30
Hackman, Steve SB47, WB45
Hackney, Bert TC18
Hager, William MC38
Haghani, Ali MA25, MB06
Hahn, Peter MB32
Hahn, Warren WD50
Haight, Daniel MB31
Haight, Robert TD20, WB20
Hajiaghayi, Mohammad MD40 TB12
Hall, Alexander MD40
Hall, John MA04
Hall, Nicholas SB15 SC15, MD15
Hall, Randolph MB45
Hall, Shane TB38
Hamalainen, Raimo P. WD23
Hamdouni, Mohamed WD19
Hammer, Peter L. SA44, SB38 SC41, WA21, WB21, WD49
Handal, Jady TB47
Han, Dong SA33
Han, Jiarui (Jared) SA24
Hann, Il-Horn SA22
Hansen, Mark SC18 MC18, TB18, WB18, WC18 WD12
Hansen, Robert IS-T
Hanson, Donald MD20
Hanson, Timothy SD34
Harahush, Shawn MA13
Harchol-Balter, Mor WA37
Hardgrave, Bill TB22
Hardin, J. Michael TD03
Hardin, Jill TB03, WA03
Hargrave, Ashton WB20
Harker, Patrick MA05, MB05
Harmantzis, Fotios WD28
Harmon, Robert SB02, WA19
Harrington, Joe SB20
Harris, James TD04
Harris, John WC42
Harrison, Michael TB28, WA05
Harrison, Terry SD27
Harsha, Pavithra MD12, MD47
Hartley, Dean TC04
Hartline, Jason MA40
Hartman, Joseph MA31, WD34
Hart, William E. WB14
Haruvy, Ernan SB07
Harvey, Nick TA40
Hasan, Masroor MB35
Hasan, Shahab TD18
Hasegawa, Toshiharu MB36 TA27, TD46
Hasenbein, John SC37, MB37 MD31, TA16
Hasija, Sameer MD07 WA05, WB48
Hatch, Nile SB19
Hatfield, Donald SA16

Haugh, Martin SC24
Hausman, Warren MD34, TB07
Havlicek, Maj Jeffrey SC14
Hawkins, Douglas SB33
Hayel, Yezekael WD08
Hayrapetyan, Ara MC40, TB12
Hazan, Elad TC40
Hazelrigg, George MA37
Hazen, Gordon WA50
Head, Larry SA47
Heal, Geoffrey SA50
Hearn, Don MB46
Heching, Aliza MB11
He, David TA34
He, Donghai MD36
Heese, H. Sebastian SC05, TB17
Hees, Jing WB18
He, Fangyi TD21
Heidelbaugh, Clark TD04
Hei, Long TC38
Heimann, David WC07
Heimlich, John TA18
Helgason, Richard MD23
Hellemo, Lars TC03, WC31
Heltne, David SB44
Helvie, Donald MA45
Henderson, Andrew MC17
Henderson, Shane SC01 MD37, TA49, TD36
Henderson, Darrall IS-T
Hendricks, Kevin SC09
Henrion, Max SD13
Henrion, Rene MD42
Hepdogan, Seyhun MA36
Herbots, Jade TD16
Hernandez Duque, Guillermo WA47
Hernandez-Diaz, Alfredo G. WD48
Hernandez, Irma MD39
Hernandez, Monica WC20
Hernandez, Salvador TB46
Hernu, Geneviéve TD45
Herrmann, Jeffrey TA15
Herroelen, Willy MA16, TD16
Hertzberg, Steven SC36
He, Shuguang MC46
Hesterly, William SA19
Heukamp, Franz TD50
He, Xiuli WC05, WD05
Heyde, Chris SC24
He, Yi TA42
He, Yongfu SA12
Hickey, Shauna TD48
Hickman, Mark SA46
Hicks, Illya SA41, MD35, MD41 TD01, WC21, WD22
Higbie, Jon WB19
Higginson, James K. TB45
Hightower, William MB32
Higle, Julia SB42, MB18 MC01, TA42, TB35
Hill, Christopher TD04
Hill, Craig MA11
Hillis, Mike MA31
Hill, Thomas SB19
Hinds, Allison MA04
Hines, J. Wesley TC21
Hirokawa, Koichiro TA02
Hirotsu, Nobuyoshi SD32
Hitt, Lorin SB23, MA05, TB08
Hjorring, Curt SC47, MD18
Hobbs, Benjamin SB20 MA49, MB20, IS-M
Hobeika, Antoine WD12
Hoberg, Kai TC11
Hochbaum, Dorit S. SB40
Ho, Chrwan-jyh WD39
Hodgson, M. John TD32, WB32
Hoehn, Gerard SA44
Hoffman, Karla MD47
Hoffman, Robert TC18
Hogan, Brendan SB18
Hohner, Abigail MB12
Holder, Allen TC31
Holguin-Veras, Jose SB45
Hollenbeak, Christopher SC29
Hollywood, John MB04
Holsapple, Clyde W. SD22
Holsenback, James MA16
Holzhaeuser, Markus SB30
Homem-de-Mello, Tito SC28 MC28, TC42
Hong, Sungchul WC27
Hong, Yoon G. SA14
Hong, Yoo-Suk MD17
Hong, Yushin MD11
Honhon, Dorothee SA09
Honig, Michael WA23
Hooker, John SA43, TA38, TC43
Hoos, Holger TB43
Hopperstad, Craig MB28
Hopp, Wallace SC26 SD17, MC16, MC33 MD32, TC39, TD08
Hopp, Wally SA37, SD29
Hora, Manpreet WA30
Hosanagar, Kartik SC22 MC44, TB44
Hosken, Laura SA12
Hosseini, J. WD07
Ho, Teck SB10
Houck, Mark H MD30
Hough, Patricia MC35
Houghtalen, Lori SC47
Houle, Alain MD23
Howard, Ron SC49
Hoyos, Ignacio MD20
Hsiao, Chieh-Yu TB18, WB18
Hsueh, Che-Fu SB46
Hsu, Hsiu-Yueh Sonya TC17
Hsu, I-Chow WC26
Huang, Alex WD18
Huang, Deng SC36
Huang, Howard WB33
Huang, Jianwei WA23
Huang, Kai TD41
Huang, Kenneth G TC17
Huang, Min WA50
Huang, Paul WA37
Huang, Peiqing WC10
Huang, Philip WB03
Huang, Qiang MD26, TC34 WA26
Huang, Suzhou WB31
Huang, Tao WD43
Huang, Tin-chung TC11
Huang, Wei WB17
Huang, Xiao MA12
Hua, Xiao WD28
Huchzermeier, Arnd SB03, WB09
Huff, David SD08
Hughes, Ed MD13
Huggins, Eric IS-M
Huh, Woonghee Tim MA12
Hui, Kai-Lung SA22
Hu, Jian WA46
Hu, Jiaqiao MC36
Hu, Ming-Che MA49, MB20
Hum, Marcus MB27
Hung, Hui-Chih MC15
Hunsaker, Brady SA42, SB48 MB44, MC41, TB41, WC44
Hunter, Keith WA32
Huntington, Hillard G. SD50
Huo, Xiaoming MB33
Huo, Yumei SC15
Hu, Paul TA29
Hupert, Nathaniel WC49
Hu, Qiaohai (Joice) WD17
Hurink, Johann SB32
Hu, Shanshan SD12
Hutson, Kevin WB40
Hwang, Heesu WC12
Hwang, Juhwen MD11, TD39
Hwang, Yuhchang TB08
Hynne, HÂkon WD16

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Iacobucci, Dawn MB05
Iansiti, Marco MC19
Ibidapo-Obe, Oyewusi WC19
Ibrahim, Walid MA38
Iezzi, Jana TC33
Ilhan, Taylan MA25
Im, Cheolsoon SA29
Immorlica, Nicole MA40, MD12
Inderfurth, Karl MC06
Infanger, Gerd SC20, MB42
Ingalls, Ricki SB46 MB36, MC29
Ingalls, Ricki WD50
Ingene, Chuck MB08
Ingolfsson, Armann MD07
Inman, Lane WA19
Inman, Robert SA10
Inniss, Tasha R. SC03, SD03
Inon, Javier MB20
Insea Correa, Ayoub SA43
Ioannou, Petros SB45, WA47
Io, Emily TB07
Irarrazabal, Anibal TC27
Iravani, Seyed SA37, SB37 MC16, TC39, TD08, WD11
Iravani, Seyed MA25
Ish, Teresa IS-M
Ishibashi, Hisaya WC15
Ivarsson, Johan SC47, MD18
Ivy, Julie Simmons SC29 SD48, MA08, IS-T, WB34
Iyengar, Garud SA24, TA28 TC40, TD12, TD42, WA40
Iyer, Ananth SC10, WB35
Iyigum, W. WB47

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Jackman, John SA03
Jackson, Craig IS-M
Jacobson, Sheldon SA43, MC48 TA18, TB38, TB41, WC40
Jacobs, Patricia A. WA14
Jaganathan, Srihari WC19
Jagerman, David SD36, WB36
Jaillet, Patrick SD45, WD47
Jain, Aditya MA09
Jain, Ankit WD28
Jain, Ashish SC24
Jain, Kamal TA40
Jain, Pramod SB32
Jaisingh, Jeevan SB26, MB29
Jalora, Anshu TC07, WC45
James, Tabitha WA43
Jammernegg, Werner WA17
Janakiraman, Ganesh MD10
Janak, Stacy MC38
Janjarassuk, Udom TB42
Jank, Wolfgang TC18
Jans, Raf WC41
Jarrah, Ahmad SA18
Jarrar, Saib MD23
Jaruphongsa, Wikrom TC46
Jaumard, Brigitte MD23
Jayanthi, Shekhar MC19
Jay, Mike MC31
Jeet, Vishv WA41
Jeffcoat, David TB14
Jeffery, Mariah MD11
Jeffery, Mark MC19
Jeffries, Neal SA44
Jeihani, Mansoureh WD12
Jelenkovic, Predrag MD40
Jeng, Shuen-Lin WA33
Jenkins, Mark SD09
Jenni, Karen MB49
Jennings, Otis SC37
Jensen, Bo SD38
Jensen, Chris MA21
Jensen, Paul SA06
Jeong, In-Jun WC34
Jeong, Myong K. MB33 TB34, TC21
Jeong, Myong K. SC32
Jeon, Youngsoo WC16
Jeppesen, Lars Bo SC16
Jetton, Martin TC27
Jha, Krishna SA35
Jia, Hongzhong TA32
Jia, Jianmin WB13, WD23
Jiang, Guoping WA30
Jiang, Hai SC47
Jiang, Jennifer TA24
Jiang, Lan TB49
Jiang, Li MC09, WC10
Jiang, Wei SA33, SD34 MB21, TD21, WA22
Jiang, Xiaoyue TA26
Jiang, Yabing WB16
Ji, Jun MA39
Jim Pruyne, Jim SD44

IS-M: Interactive Session, Monday (12:30-1:30pm) ***IS-T: Interactive Session, Tuesday (12:30-1:30pm)***

Jimenez, Elias WD10
Jing, Bing MC44, TC35
Jin, Holly SC39
Jin, Judy TA34
Jin, Mingzhou TC12, WA03
Jin, Nong WB33
Jin, Wenlong WB46
Jirajaruporn, Wanjira WC18
Ji, Yonghua MC22
Joglekar, Nitin SD19 MA17, TB17
Johari, Ramesh SC40, SD40
Johnson, Alan WD14
Johnson, Andrew TA02
Johnson, Anne MB18
Johnson, Arvid SD21
Johnson, Colin SC32
Johnson, Ellis SA18 SC47, MB18, MD18, MD39 TC29, TC36
Johnson, Eric SB03
Johnson, Joshua Benjamin MA36
Johnson, Michael MB30, WA32
Johnson, Rachel MD31
Johnson, Sharon TC25
Jones, Dean MC45, TB47
Jones, Erick WB03
Jones, Katherine MC45
Jones, Keithly G. MD02
Jones, Nancy MA50
Jordan, Bob TD14
Jordan, David A. SB13
Jordan, William SA10
Joshi, Abhay SA34
Joshi, Ashwin TC06
Jotshi, Arun SB14
Juda, Adam WB12
Judd, Bruce SB50
Judd, Kenneth SB08, IS-T, WB38
Judice, Joaquim MB39, TA44
Jula, Hossein WA47
Julian, Teresa MB48
Juliussen, Erik SD20
Jun, Chi-Hyuck MA26, MB14
Juneja, Sandeep MD36, TD37
Jung, Changmi WA32
Junkunc, Marc MB19
Juul, Svenne TD13

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Kababji, Hani TC34
Kachani, Soulaymane TA05 TC28, TD28
Kah, Jainaba TC22
Kah, Muhammadou TC22
Kahraman, Aykut TC29
Kahruman, Sera WC21
Kainuma, Yasutaka WB06
Kaisar, Evangelos MB06
Kalafatas, Georgios TB46
Kalagnanam, Jayant SC12, TA15
Kale, Sayten TC40
Kallehauge, Brian SC45
Kallesen, Royce MB28
Kalvenes, Joakim TC23, WB07, WC23
Kamath, Manjunath SB46 WB41, WC36
Kambhampati, Subbarao WD32
Kambour, Ed SB28
Kaminer, Olga TC06, WD15
Kaminsky, Philip MB15, MC10
Kampas, Frank J. MB38
Kang, Chang-Muk MD17
Kang, Sukho TA33
Kang, Wanmo MA12, TD37
Kankanamge, Anuruddha MC12
Kannan, Karthik SC22
Kanthak, Sebastian MB32
Kantor, Paul B. WD21
Kaplan, Edward MA07, MB04
Kapoor, Aloak WA21
Kapur, Kailash MB26, TC26
Kapuscinski, Roman SD10 SD12, MD08, WD39
Kapuscinski, Roman MC25, WB08
Karabuk, Suleyman SA29
Karaer, Ozgen TB06, WA10
Karaesmen, Fikri SD12, WC08
Karaesmen, Itir MA28, TC08
Karagiozova, Adriana MC40
Karakayali, Ibrahim TD06
Karakul, Mustafa WA15
Karaman, Abdullah WC11
Karamanov, Miroslav TA41
Kar, Anirban TB16
Karayel, Mahmut SA13
Kardes, Erim TC17
Karger, David R. TD40
Karimi, I. A. WA35, WB26, WB35,WD29
Karisch, Stefan MA18, TA31
Karlsson, Joakim MD47
Karmarkar, Uday MA05, MB05
Karoonsoontawong, Ampol TA46, WA46
Karwan, Mark SA14
Kashefi, Fred WC19
Kasilingam, Raja TC29, TD05
Kassmann, Dean MB27
Katehakis, Michael WA35 WD17
Katila, Riitta SB16, MC17
Katok, Elena SB07, MC12, TD08
Katriel, Irit SD43
Katta, Akshay SB28 TB16, WC13
Katz, Myron TC26
Kauffman, Robert J. SB22
Kaufman, David MB37
Kaul, Hemanshu SA43, WC40
Kavadias, Stylianos SB17 MB17, TA17
Kavlak, Nursel WB24
Kaya, Murat SB10
Kayande, Ujwal TA35
Kaya, Onur MB15
Kayis, Enis MC07
Kaymaz, Pinar MA20
Keairns, Dale MD20
Keating, Charles WD42
Keblis, Matthew TC05
Kee, Jackie TD18
Keeney, Ralph SA49
Keeton, Kimberly SD44
Keha, Ahmet MB41
Keisler, Jeffrey MC49 TA50, TB50
Kekre, Sunder SA08, MB17
Keles, Sunduz SA38
Kelle, Peter WA47
Keller, Dan SD31, TD20
Keller, L. Robin MA50, TC50
Kemahlioglu Ziya, Eda SB09
Kempf, Karl MD04, TA42, TC24, WB36
Kemppainen, Katariina TC16 WD07
Kennedy, Michael H. WA22
Kennington, Jeffery TC23
Keon, Neil WC23
Keppo, Jussi SB24 MC37, TB09, TB24, IS-T
Keppo, Jussi MB25
Kerivin, Herve SA41
Kersten, Marta WD19
Keser, Claudia TD19
Keskin, Burcu B. MB10
Keskinocak, Pinar MA30 MB08, IS-T, TC29, TD29
Ketter, Wolfgang MD22
Ketzenberg, Michael WC06
Khachatryan, Margarit WB45
Khachiyan, Leonid TD22
Khandakar, Samina MD07
Khare, Rahul TB48
Kharoufeh, Jeffrey MC34 MD25
Khator, Suresh SB45
Khot, Subhash MA40
Khurana, Archana WD29
Kieffel, Hervé MB49
Kiessler, Peter MA37, TB26
Kikuchi, Shinya SD46
Kimbler, Del MB47
Kimbrough, Steve SC20
Kimbrough, Steven WA27
Kim, Bum-Jin MB32
Kim, Bumjun WC16
Kim, Byung-In WD13
Kim, David SA05, SB05
Kim, Deok-Hwan MA33, WD33
Kim, Hakyong WC16
Kim, Hyun WB13
Kim, Hyunook TA30
Kim, Jaemyoung TC24
Kim, Jinhwa TB29, WC32
Kim, Keunpyo TB33
Kim, Kilsun SB02
Kim, Kwang-Jae MA33, WC34 WD33
Kim, Minseok MC45
Kim, Pansoo MB33
Kim, Sang-Hyun SD10
Kim, San-Gook WB33
Kim, Sang-Won WA17
Kim, Seong-Hee MD36 TA36 TD34
Kim, Seongmoon TD48
Kim, Seoung Bum SC21, WA44
Kim, Song-Kyoo TC16
Kim, Sonyoung MD38
Kim, Sujin TD36
Kim, Taebok MD11
Kim, Youngil WC31
Kim, Youngsoo WB07
Kincaid, Rex WD18
Kindall, Kevin MC20
Kindler, Guy TC40
Kirby, Maurice TB39
Kirchain, Randolph TB19
Kirkwood, Craig MA50, MC49
Kischka, Peter WA17
Kishore, Shalinee TC23
Klabjan, Diego SB42, SD08, MC08, TB07
Klampfl, Erica SA31
Klastorin, Ted MD17
Klein, Alexander WB18
Kleinberg, Jon SC40, MC40
Kleinberg, Robert TA40, TB12
Kleindorfer, Paul MB11
Klein, Philip N. TB40
Kleywegt, Anton SD30, TA42
Kliewer, Natalia WC12
Klimack, William MC50
Kloeber, Jack MC49
Klutke, Georgia-Ann TB26, WC45
Knight, Peter TA48
Knorr, David TD18, WA18 WB18
Kobayashi, Mei WC31
Kobza, John TA18, TB41
Kocabasoglu, Canan TA06
Kocabiyikoglu, Ayse TD28, WB28
Kocaga, Y. Levent TD17
Kocamustafaogullari, Erdem MB24
Kocaoglu, Dundar F. WB42 WD31
Kochenberger, Gary WA21, WC21
Kockelman, Kara TC26
Koçlar, Ayse WB26
Koehler, Gary WA27, WD27
Koenigsberg, Ernest TB39
Koenigsberg, Oded MA05, WB10
Kogan, Alexander SB38 WD21
Kohli, Amarpreet MB36
Koide, Takeshi TB26
Kojima, Masakazu MD38, WD44
Kok, Gurhan SA26, SB09
Köksalan, Murat MB24, TD41
Kolekar, Vaibhav WA44
Kolfal, Bora SB37
Kolotoglu, Elif MD41, WC21
Komanduri, R. TC34
Konak, Abdullah MA44, SD34
Konana, Prabhudev WC07
Kong, Nan SA42, SB48 MC41, TB35, WA26
Kong, Seunghyun MD39
Konoshima, Masashi TD20
Konstantinow, George WA39
Koole, Ger MB45, MD37, TB48
Koppelman, Frank S. SB18
Korhonen, Pekka TB02
Kornish, Laura SA49
Kornish, Laura TB08
Kortelainen, Mika TD02
Korugan, Aybek MD06
Kosmopoulou, Georgia MC12
Kostamis, Dimitris WC03

Koster, Arie MD23, TD01
Kou, Steven SC24, MD24, TD37
Kouvelis, Panos SC07, SD07 WD39
Kouvelis, Panos WC39
Kovach, Jami MB34
Kozan, Erhan WB48, WD12
Krahl, Dave MA13
Kramlich, Gary MA14
Krasachat, Wirat TC02
Krasik, Vladimir SA15
Krass, Dmitry MA24, TB32
Kreke, Jennifer SB48, MA48
Kremidas, James P. SD50
Kress, Moshe MA07, WA14
Krishnamoorthy, Bala SD41 TA41, WA44
Krishnamoorthy, Srinivas MC14
Krishnamurthy, Ananth SA11 TA10, WA16, WC36
Krishnamurthy, Vijayalakshmi MC16
Krishnan, Harish TC09
Krishnan, Jayanth SC05, MB11
Krishnan, Ramayya WB07
Krishnan, Vish SD17
Krishnarao, Pinnamaneni MC20
Krishnaswamy, Shekar MA31, WC31
Kristal, Murat MA10
Kristjansson, Bjarni SC13 MC43, WB43
Kroeker, Jeff MA36, IS-M
Kroese, Dirk TC01
Kroes, James TD27
Krokhmal, Paul TB14, TC41
Kropf, Peter WA43
Kros, John F. MC21
Kruger, Michael SD21
Kuchta, Mark TA15
Kucukyavuz, Simge SA41
Kuhn, Kenneth TA47
Kulkarni, Devadatta MA19
Kulkarni, Girish TD44, WC41
Kulkarni, Vidyadhar MD25 WA38, WB17, WD17
Kulp, Susan SC09
Kulturel, Sadan MA34
Kumar, Anuj TD12
Kumar, Arvind SA35
kumara, Soundar TC46, WB33 WD28
Kumar, Mahesh WC39
Kumar, Naveen MA33
Kumar, Sanjay WB14
Kumar, Sunil SD37, TB28, TC37
Kundakcioglu, Erhun WD24
Kunreuther, Howard SA50 SC50, TC50
Kuo, April MB47
Kuosmanen, Timo TD02
Kuper, Gerard TB25
Kuppa, Shankara TC46, WC47
Kurata, Hisashi WC10
Kurtulus, Mumin SA09
Kurz, Mary Beth MD03 SA29 SA35 TA16 WB06 WC48
Kusiak, Andrew MB21
Kutanoglu, Erhan SD15 MD31, TA16, WA41
Kuttava, Praveen WC02
Kuyumcu, Harun Ahmet SD30 MA28, WA29, WB29, WC29
Kuyzu, Gultekin MC47
Kvam, Paul SC34, TA33, WA33
Kvam, Paul SA32
Kveton, Scott WB43
Kwak, N. K. TC02
Kwasnica, Anthony MC12, TC11
Kwinn, Michael TA14
Kwon, Changhyun TA05
Kwon, Dharma WD45
Kwon, Roy WC23
Kytojoki, Jari SC44

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Lada, Emily K. TA36
Ladanyi, Laszlo WC44
LaFleur, Chris MA37
Lago, Alejandro WB17
Lahmar, Maher TC45
Lai, Bogumila SC39
Lai, Ming-Che WC41
Laitner, Skip MA49
Lai, Tze Leung SC33, MD26
Lai, Xiaorong WD45
Lai, Yung-Cheng SA35
Lakhani, Karim R. SC16
Laksana, Kamonkan WD34
Lall, Upmanu SC21
Lambert, Fred MC06
Lambert, LTC Garry MA14
Lambrecht, Marc TC11
Lambrechts, Olivier TD16
Lammoglia, Nelson WC30
Lancaster, John WB19
Landa Silva, Dario MB43
Landau, Ariel MB06, WD15
Landry, Brett SA29
Langberg, Michael TA40
Lange, Donald SD16
Langella, Ian M. MC06
Langer, Mark TD26
Langevin, André SA43, SB32
Langiville, Amy MA21
Lan, Yingjie TD29
Lanza, Alessandro WB39
Laporte, Gilbert WA45
Lapre, Michael SD19
Larsen, Christopher MC50
Larsen, Jesper SC45
Larson, Kate MA12
Larson, Nathan TB09
Larson, Richard TD32
Lartigue, Andrés WA13
LaScola Needy, Kim TD03
Lasdon, Leon MA38, MB25
Lasry, Arielle SD48, IS-T
Lassenovski, Vladimir TD32
Latka, Brenda WD21
Latorre, Jes's SA20
Laukkanen, Sanna WD07
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Leachman, Rob SC19
Lebkowski, Piotr TD24, WD27
LeBlanc, Larry SD06
Lecluyse, Christophe TD46 WD45
Lederer, Phil SD08
Ledermann, Daniel TD14
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Lee, Chang W. TC02
Lee, Chi-Guhn SA10
Lee, Chris MA08
Lee, Chul Ung WD43
Lee, Chung-Yee SB11 MC15, TC10, WC37
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Lee, William WC29
Lee, Young TB36
Lee, Yuhwa SA46
Lee, Zu-Hsu TD27
Lefeber, Erjen TD07
Lehman, April Rasala TA40
Lei, Lei SA15, MC15
Lejeune, Miguel SB38
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Lemmon, Michael TA08
Lenneberg, Evan WA19
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Leon, Maria Amparo WC20
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Levi, Moti TA22
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Levin, Tanya TC28
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Liesiö, Juuso WD23
Li, Fei MD15
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Li, Haibing TC15
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Lijesen, Mark WC37
Li, Jian SB11
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Li, King SA44
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Li, Michael Z.F. MA28, WD37
Lim, Jarvis SB45
Lim, Ryan TC03
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Lin, Bing MA28, WD37
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Liu, Kai WA03
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Liu, Paul SD09
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Lus, Betul WC39
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McKay, Kenneth TB39
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McLay, Laura TA18 TB38 TB41
McNair, Ph.D., Lisa TB03
McNeill, Jennifer SA36
McWilliams, Douglas MC05 MD35
Mease, David SC34
Medaglia, Andres SB47 MC45, WD24
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Medina-Borja, Alexandra WD42
Medina, Rodolfo MA25
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Meeraus, Alex MB43
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Meindl, Peter SA23, SA24
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Molnar, Eva MA11
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Molyboha, Anton SD42
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Mookherjee, Reetabrata SB20 TA05 TB05 WB46
Moonen, Mark TC14
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Morgan, Kara MA50
Morita, Hiroshi TA02
Moritz, Dennis SA13
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Morrice, Douglas SB15 TD07
Morris, Kendall WA26
Morrison, Layne SD31
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Morton, David SC37 TB42
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Muharremoglu, Alp SA07 WA11
Mukherjee, Avijit SC18 MC18, MD47
Mukherjee, Kampan MC06
Mukhopadhyay, Samar WC09 WC42
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Mullen, John WD28
Mullen, Tracy TC11
Muller, Amanda SB14
Muller, Carol MC30
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Mulley, Albert WA50
Munoz, Juan Carlos SD46 WC47
Munson, Todd MB39 TC38 TD43
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Murphy, Daniel TD18
Murphy, Fred SC20, SD27 MD32
Murphy, Terrence WC22
Murray, Alan WD20
Murray, Fiona TC17
Murray-Tuite, Pamela SD47
Murray, Walter MB39
Mustajoki, Jyri WD23
Mutanen, Olli-Pekka WD02
Muthuraman, Kumar SB24
Mutlu, Fatih TC45
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Nag, Barin WC27
Nagi, Rakesh SA34 TC32
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Nair, Vijay SC34 SD33 TD33
Nakagome, Chiharu WC15
Nakata, Kazuhide WD44
Nalle, Darek WD20
Namatame, Takashi TD24
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Nam, Seong-Hyun WC10
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Nanda, Manoj WD22
Nandiraju, Srinivas MC47
Nanduri, Vishnuteja MA20
Naraharisetti, Pavan Kumar WB35
Narasimhan, Ram SC18
Narayanan, S. SB14
Narsimhan, Ram WA03
Narula, Subhash C. MC26
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Nasrallah, Walid WD30
Nassar, Raja TC26
Natarajan, Ajay SB11
Natarajan, Hari TD35
Natarajan, Madhu IS-T
Natarajarathinam, Malini WA03
Nau, Robert SB49
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Nazzal, Dima WA45
Nediak, Mikhail TC28
Nedich, Angelia WB15
Neelakantan, Jay TC29
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Neise, Frederike TA42
Nelson, Barry SA36, MD36
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Nembhard, David MD16
Nembhard, Harriet Black SA33 SC29, WB34, WC34
Nemhauser, George SA32, MD41
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Nenes, George MC26
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Neubert, Luke SA18
Neumayer, Sebastian TA37
Neureuther, Brian WB11
Newberry, Peter SA12
Newman, Alantha SB40
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Nickerson, Jeffrey SD42
Ni, Daiheng SA45
Nidel, Richard MC04
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Nieman, Tim MB49
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Ni, Hua WD15
Nikolopoulos, Konstantinos SD21
Nikolova, Eddie TD40
Nimitkiatklai, Kanoktip TB26
Niznik, Tim SC18, MA18
Nocedal, Jorge TC38 WB38
Noe, Thomas H. WC35
Norback, Ph.D., Judith TB03
Norde, Henk WB11
Norman, Bryan SB15 MC05, MD16, TD03
Norman, John TA25
Norrell, Juaida TB47
Norris, John WC02
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Noyan, Nilay SC42 WB41
Nozick, Linda MC45 MD46 TB47
Nsakanda, Aaron L. TC07
Ntaimo, Lewis TB35
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O'Brien, Fred MB43
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Oddi, Angelo SB43
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Oh, Se-Kyoung SC31
Oh, Sherry TB48
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Oliveira, Pedro TA19
Oliveros, Santiago SA50
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Olson, David L. WB22
Olvera-Cravioto, Mariana WD36
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Onal, Hayri SA35
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O'Neill, Craig TA48
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Ordonez, Fernando MA41 MB17 SA18 TA28
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Ormeci, Lerzan SC05 WC08
Ormeci, Melda SA37
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Ortiz, Olga L. WA08
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Osei-Bryson, Kweku-Muata TC22
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Osland, Asbjorn WD42
Osogami, Takayuki WA37
Ostrowski, David A. SA31
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Ou, Jihong TD05
Ou, Jinwen MA15
Oum, Tae WC37
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Ovchinnikov, Anton MA24 WB28
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Owen, Jonathan H. IS-M
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Pan, Feng WC41
Pangburn, Michael TA22
Pang, Jong-Shi SB20 TD38
Pani, Abhishek SC31, MD12
Pan, Rong WA11
Pan, Xia SC30
Pan, Xiajun (Amy) WA29
Pan, Yunpeng TD15
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Papadakis, Yanni WD16
Papush, Philip WA33
Paradi, Joseph C. MA02
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Park, SeokHee
Parker, Geoffrey SC17 WA10
Parker, Peter SB33
Parker, Rodney WB10
Parker, Roger SD18
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Parkinson, Anita MD15
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Park, Jin-Kyu TB19
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Sunday, 8:00am - 9:30am

SA01 Tutorial: Decision Analysis = Decision Engineering
SA02 Optimization Modeling in Environmental/ Natural Resources Planning
SA03 Advances in Teaching Operations Research and Management Science
SA05 Panel Discussion: The Academic Job Search
SA06 Joint Session Practice/CPMS: Spreadsheets in Practice
SA07 Pricing and Revenue Management in Operations
SA08 Global Production and Innovation Management
SA09 Retail Operations Management
SA10 Manufacturing Flexibility in the Automotive Industry
SA11 Queuing and Other Stochastic Models in Supply Chain Management
SA12 Empirical Analysis of Online Auction Marketplaces
SA13 Software Demonstration
SA14 Optimization and Simulation Approaches for Some Military Applications
SA15 Scheduling and Optimization
SA16 R&D and Product Performance
SA17 Models for Pharmaceutical R&D Management
SA18 Large Scale Problems in Transportation
SA19 KLIC I — Individual-Organizational Linkages (Knowledge, Learning & Intellectual Capital)
SA20 Equilibrium and Simulation Models for Power Generation Planning in Wholesale Electricity Markets
SA21 Learning to Rank: ROC Optimization in Data Mining
SA22 Information Systems Economics
SA23 Best Financial Services Student Paper Competition
SA24 Financial Models and Analysis I
SA26 JFIG- Paper Competition I
SA27 2005 Dantzig Dissertation Award Finalists
SA28 Consumer-Based Revenue Management
SA29 OR and Computing
SA30 Finance Engineering in Investment Decsion Making
SA31 Joint Session OR Practice/Roundtable: Supply Chain Management in the Automotive Industry
SA32 Recent Advances in Sports Modeling
SA33 Process Monitoring and Diagnosis(2)
SA34 Sensor II
SA35 Rail Applications Academic Session
SA36 Joint Session Simulation/QSR: Design and Analysis of Simulation Experiments
SA37 Joint Session AP/Workforce: Queueing Systems with Flexible Servers I
SA38 Applications of Semidefinite and Second-Order Cone Programming
SA39 Modern Gradient Methods for Large-scale Optimization Problems
SA40 Computational Game Theory and the Price of Anarchy
SA41 Joint Session Optimization/Minority: Cutting Planes in Mixed Integer Programming
SA42 Solving Specially Structured Stochastic Programs
SA43 Integrated Methods for Optimization I
SA44 Joint Session Optimization/Minority: Computing/Health: Computational Biomedicine
SA45 Urban Transportation Planning Models V: Transportation Planning
SA46 Urban Transportation Planning Models I: Urban System Design and Modeling
SA47 Optimization Models for Traffic Signal Priority
SA48 Operating Room Management
SA49 Dynamic Programming Applications
SA50 Applications of Decision Analysis to Homeland Security

Sunday, 10:00am - 11:30am

SB01 Tutorial: Transforming Railroads Through Cutting-Edge Operations Research
SB02 Special Topics in Environmental/Natural Resourses
SB03 New Cases in Supply Chain Management and Information Technology
SB05 Panel Discussion: The Industry Job Search
SB06 Research About Spreadsheets
SB07 Auction
SB08 Dynamic Models of Imperfect Competition I
SB09 Analyzing Competitive and Cooperative Behavior in Supply Chains
SB10 Sales Channel
SB11 Optimization Models for Inventory System in Supply Chain Management
SB12 Auctions, Games and Equilibria in Industry
SB13 Software Demonstration
SB14 Sensor and Search Problems for Military Applications
SB15 Scheduling Models and Systems
SB16 Evolution, Innovation & Competitive Heterogeneity
SB17 New Product/Service Development
SB18 AGIFORS Spotlight: Anna Valicek Awards and Current Hot Topics
SB19 KLIC II — Fundamental Models and Processes (Knowledge, Learning & Intellectual Capital)
SB20 Electricity Market Modeling
SB21 Clustering Methods for Knowledge Discovery
SB22 Economic Analysis of Pricing and E-Business
SB23 Modeling Financial Services
SB24 Computational Methods for Portfolio Optimization
SB26 JFIG- Paper Competition II
SB27 2005 Dantzig Dissertation Award Finalists
SB28 Pricing and Revenue Management in Service Systems
SB29 Joint Session Research/JFIG: JFIG Research Clinic- Operations Management with Weather Forecasts
SB30 Problems in the Management of Finance Risk
SB31 Joint Session Practice/Roundtable: OR at UPS - Making a Difference with Technology
SB32 Issues in Logisitcs and Scheduling
SB33 Journal of Quality and Reliability Engineering International
SB34 QSR Best Student Paper Competition
SB35 RASIG Student Paper Competition
SB36 Joint Sim/Artificial Intell :Tutorial on Agent-based Modeling and Simulation
SB37 Joint Session AP/Workforce: Queueing Systems with Flexible Servers II
SB38 Optimization Models in Finance
SB39 Advances in Interior Point Methods for Linear and Cone Programming
SB40 Location and Clustering Problems
SB41 Joint Session Optimization Integer/Nonlinear Programming: Mathematical Programming in the Petroleum and Chemical Process Industries
SB42 Stochastic Optimization in Transportation
SB43 Constraint Programming
SB44 Panel Discussion: Creating an Testbed of Industry Problems for OR Model and Algorithm Development
SB45 Urban Transportation Planning Models VI: Microsimulation and Evaluation of Traffic Flow
SB46 Urban Transportation Planning Models II: Freight Models and Planning
SB47 Network Routing and Assignment under Uncertainty
SB48 Recent Advances in Disease Modeling and Treatment
SB49 Game Theory and Decision Analysis
SB50 Decision Analysis Practice

Sunday, 1:30pm - 3:00pm

SC01 Tutorial: Useful Recent Trends in Simulation Methodology
SC02 Nicholson Student Paper Prize Competition, I
SC03 Teaching Case Competition I
SC05 OR/MS Applications in the Service Industry
SC06 Spreadsheets and Sarbanes-Oxley
SC07 Panel Discussion: Research Opportunities at the MS/OM-Finance Interface
SC08 Dynamic Models of Imperfect Competition II
SC09 Empirical Research in Supply Chain Management Using Secondary Data
SC10 Empirical Research in OM Using Primary Data
SC11 Inventory Management in Supply Chain Management
SC12 Applications of Auctions to Supply Chains
SC13 Software Demonstration
SC14 Air Mobility
SC15 Contemporary Scheduling
SC16 Engineering Networks
SC17 Experimental and Empirical Research in NPD
SC18 OR Applications for Off-Schedule Operations (OSO) in the Airline Industry
SC19 KLIC III — Knowledge Transfer Decision Support (Knowledge, Learning & Intellectual Capital)
SC20 Electricity Markets Development & Planning
SC21 Joint Session DM/CPMS/DM: Data Mining in Ecology and the Environment
SC22 The Economics of Information Exchange
SC23 Stochastic Modeling in Financial Services
SC24 Financial Models and Analysis II
SC26 Panel Discussion: Research and Publications
SC27 Panel Discussion: How to Have an OR Career
SC28 The Re-Solving Issue in Revenue Management
SC29 Joint Session Research/QSR: QSR Research Clinic- Quality and Statistics in Healthcare Modeling and Decision Making
SC30 Risk Analysis
SC31 Auctions in the Supply Chain
SC32 Quality and Reliability
SC33 Panel Discussion: New Research Directions in Process Monitoring
SC34 Reliability Testing and Modeling
SC35 RASIG Roundtable: Part I
SC36 Simulation Optimization Methods and Applications In The Medical, Voting, and Software Industries
SC37 Queueing Networks Approximations
SC38 Applications in Cone Programming
SC39 Special Topics in Nonlinear Programming
SC40 Networking Issues
SC41 QUBO: Quadratic Unconstrained Binary Optimization
SC42 Risk-Averse Stochastic Optimization
SC43 Joint Session Computing/Health: Computational Biology and Bioinformatics
SC44 Vehicle Routing
SC45 Vehicle Routing
SC46 Urban Transportation Planning Models III: Travel Demand Experiments and Models
SC47 Optimization in Airline Planning I
SC48 Healthcare Decision Making
SC49 Using the Precise Decision Language
SC50 Risk Analysis vs. Decision Analysis

Sunday, 4:30pm- 6:00pm

SD01 Tutorial: Therapeutic Optimization via Markov Decision Processes
SD02 Nicholson Student Paper Prize Competition, II
SD03 Teaching Case Competition II
SD05 New Applications of Revenue Management
SD06 Managing Spreadsheet Risks
SD07 The Interface Between Operations Management and Finance
SD08 Inventory Management
SD09 Dynamic Models of Imperfect Competition III
SD10 Pricing, Capacity and Competition in Supply Chains
SD11 Pricing Strategies in Supply Chain Management
SD12 Special Topics in Auction/Bidding
SD13 Software Demonstration
SD14 Urban Operations Modeling and Simulation
SD15 Recent Advances in Machine Scheduling
SD16 Organization Science: Perpectives on the Jounal
SD17 Panel Discussion: New Product Development, Innovation and Technology Management
SD18 Airline Pricing and Revenue Management
SD19 KLIC IV Organizing for Learning (Knowledge, Learning & Intellectual Capital)
SD20 Valuation and Risk Management in Energy Markets
SD21 Data Mining in Market Research
SD22 Behavioral Issues in IS
SD23 Basel Accord and Portfolio Management
SD24 Recent Developments in Financial Engineering
SD26 Panel Discussion: Do's and Do Not's of NSF Grant Proposals
SD27 Panel Discussion: How to Write a Good Practice Paper. What Makes a Good Practice Paper, Why You Should Write One, Who is the Audience and What are you Trying to Accomplish.
SD28 Modeling and Optimization in Revenue Management
SD29 Product Strategy
SD30 Joint Session Research/Revenue Management: Revenue Management Research Clinic- Pricing for Computer Distributors
SD31 Joint Session Practice/Roundtable: Applying OR/MS in the Public Sector to Benefit Citizens
SD32 spORts Arcade
SD33 Research Advancement and Vision in Quality, Statistics, Reliability
SD34 Reliability Research I
SD35 RASIG Roundtable: Part II
SD36 Input Modeling and Applications
SD37 Asymptotic Analysis of Stochastic Systems
SD38 Linear Programming and Equilibria
SD39 Algorithms in Structured Convex Programming
SD40 Characterizing and Controlling Congestion
SD41 Integer Programming
SD42 Risk-Averse Stochastic Optimization
SD43 Robust Search in CP
SD44 Heuristics for Large Scale Computing Systems
SD45 Dynamic Routing
SD46 Urban Transportation Planning Models IV: Transit Models and Planning
SD47 Emergency and Security Planning in Transportation Systems
SD48 Planning and Evaluating Healthcare Interventions
SD49 Analysis of Complex Systems for Decision Making
SD50 DAS Practice Award Finalists

Monday, 8:00am - 9:30am

MA01 Tutorial: Attractive Formulations of Integer Programs
MA02 Software Development and Bank Branch Performance Under the DEA Microscope
MA03 Innovation in Teaching OR/MS
MA04 Emergency Preparedness, Disaster Response, and Homeland Security
MA05 Interface between Marketing and Service Operations Management
MA06 Modeling and Algorithms in Logistics I
MA07 Operations Research and Homeland Security
MA08 Health Care
MA09 Flexibility and Pricing in Operations Management
MA10 Empirical Research in Supply Chain Management
MA11 Strategies Issues in Supply Management
MA12 Joint Session Auction & Game Theory/JFIG: Auction and Game Theory in Supply Chains
MA13 Software Demonstration
MA14 Industry Solutions Applied to Military Problems
MA15 Supply Chain Scheduling
MA16 Single Machine Scheduling
MA17 Models of Human Behavior in New Product Development
MA18 Airline Responses to Air Traffic Control Constraints
MA19 Exploring Product and Process Architecture with the Design Structure Matrix
MA20 Dealing with Risk and Competition in Electricity Markets
MA21 Text Mining/Data Mining: Applications and Theory
MA22 Managing Information Technology
MA23 Joint Session Financial Services/Practice: Financial Services Practice
MA24 Multicriteria Decision Making Analysis: Modeling and Applications I
MA25 Modeling and Algorithms in Logistics II
MA26 Data-Driven Statistical Techniques in Quality Control
MA27 Joint Session Practice/Roundtable: Adapting Supply Chains for Uncertainty
MA28 Multi-Market Yield Management & Pricing
MA29 Supply Chain Networks
MA30 Panel Discussion: Swinging Past Balance
MA31 Joint Session Practice/ Roundtable: Semiconductor Manufacturing O.R. Practice
MA32 Enhancing OR Education Through Sports Applications
MA33 Process Monitoring and Diagnosis (1)
MA34 Reliability Research II
MA35 Railway Optimized Equipment Distribution: Success or Failure?
MA36 Simulation Techniques for Practical Applications
MA37 Analysis and Modeling of Design and Development Activities
MA38 Joint Session Optimization/ Computing: Computational Global Optimization
MA39 Recent Advances in Interior-Point Methods for Linear Programming and Linear Complementarity Problems
MA40 Auctions
MA41 Robust Optimization
MA42 Stochastic Programming in Finance
MA43 Joint Session Computing/Health Applications: Bioinformatics
MA44 Genetic Algorithms
MA45 Modeling of Transportation Problems
MA46 50th Anniversary of Studies in the Economics of Transportation
MA47 Hazard Management and Evacuation I
MA48 Innovative Applications of Management Science in Healthcare - 1
MA49 Joint Session Decision Analysis/Energy: Decision Analysis and the Environment
MA50 Dana Clyman's Decision Analysis Arcade

Monday, 10:00am - 11:30am

MB01 Tutorial: An Introduction to Revenue Management
MB02 Robust Nonparametric Frontier Estimators: Theoretical and Practical Issues
MB03 Tutorial: Bring OR into your Local High School: Mission Not Impossible
MB04 Contemporary Issues in Public Sector OR
MB05 Panel Discussion: On the Interface between Marketing and Service Operations Management
MB06 Scheduling and Routing Problems in Logistics
MB07 Product Variety and the Operations/Marketing Interface
MB08 Pricing and Incentive Mechanisms
MB09 Competition and Cooperation in Supply Chain Management
MB10 Optimization in Supply Chain Management
MB11 Supply Chain Management in Practice
MB12 Joint Panel Discussion Auction and Game Theory/ Practice: Combinatorial Auctions for Industrial Procurement
MB13 Software Demonstration
MB14 Problems in Applied Probability
MB15 Scheduling and Due Date Quotation
MB16 Joint Session Workforce/ Social Science: Behavioral Ops
MB17 New Product Development Topics
MB18 Optimization in Airline Planning II
MB19 2005 TMS Best Dissertation Award
MB20 Investment, Planning and Resource Adequacy in Restructured Electricity Markets
MB21 Tutorial: Data Mining
MB22 Competition in Electronic Markets
MB23 Financial Modeling
MB24 Multi-Objective Approaches in Multicriteria Decision Making
MB25 Cost/Performance & Decision Analysis
MB26 Reliability Modeling and Analysis
MB27 Dynamic Operating Decisions in Fulfillment Operations
MB28 Airline Revenue Management for Less Restricted Fares
MB29 Management/Strategy Issues in e-Business
MB30 Serving Communities with OR
MB31 Student Projects: Learning through Practice
MB32 Location - QAP
MB33 Technometrics Session: Statistical Techniques for Processes
MB34 Design of Experiments with Industrial Applications
MB35 Yield Management in Railroads
MB36 Methods and Algorithms in Simulation
MB37 Analysis of Queueing Systems
MB38 Joint Session Optimization/ Computing: Global Optimization and Applications
MB39 Applications of Mathematical Programs with Equilibrium Constraints
MB40 Auctions and Assignment Problems
MB41 Advances in Mixed Integer Programming
MB42 Stochastic Programming with Financial Applications I
MB43 Heuristic Methods for Timetabling and Rostering
MB44 Open Source Modeling Tools
MB45 Logistics
MB46 50th Anniversary of Studies in the Economics of Transportation
MB47 Hazard Management and Evacuation II
MB48 Innovative Applications of Management Science in Healthcare - 2
MB49 Applications of DA to Environmental Issues
MB50 Ward Edwards Memorial Session

Monday, 12:30pm - 1:30pm

Interactive Session

Monday, 1:30pm - 3:00pm

MC01 Tutorial: Stochastic Programming: Optimization When Uncertainty Matters
MC02 Data Envelopment Analysis Applications
MC04 Daniel H. Wagner Prize Competition
MC05 Transportation Service
MC06 Disassembly, Rework and Remanufacturing
MC07 Product Design, R&D Expenditures and Licensing
MC08 Joint Session Research/ Aviation Applications: Aviation Applications Research Clinic- Expertsí Perspectives on Aviation
MC09 Supply Chain Management
MC10 Inventory and Transportation in Supply Chains
MC11 Risk Management in Supply Chain Management
MC12 Auctions in Theory versus Practice
MC13 Software Demonstration
MC14 Revenue Management with Contracts and Spot Markets
MC15 Logistics Scheduling
MC16 Worker Cross-training in Production Systems
MC17 Joint Panel Discussion New Product/ Technology Management: How Organization Science Should Influence New Product Development & Management of Innovation Research
MC18 Air Traffic Management
MC19 Some Theoretical and Empirical Issues in the Management of Technology
MC20 New Developments/Solutions in the Energy Industry
MC21 Issues in Data Mining
MC22 Software Development and Piracy
MC23 MSOM Fellows 2005
MC24 Finance and Stochastics
MC25 Issues in Supply Chain Management I
MC26 Forecasting and Prediction in Statistics/Quality Control
MC27 Selected Topics in Project Management
MC28 Topics on Revenue Management
MC29 Marketing Issues in e-Business
MC30 Tutorial: Mentoring: What We've Learned about Effective Practices through the Design and Development of MentorNet
MC31 Joint Session OR Practice/ Roundtable: Transportation Optimization at Roundtable Companies
MC32 UPS-SOLA Dissertation Awards
MC33 Panel Discussion: Journal Editor's Vision on Challenges and Trends in Quality, Statistics, and Reliability Research
MC34 Degradation Modeling and Replacement Policies
MC35 Numerical Optimization and Applications
MC36 Simulation Optimization
MC37 Extensions of Inventory Models
MC38 Joint Session Optimization/ Computing: Nonlinear and Global Optimization with Applications
MC39 Approximation of Stochastic Programming: A Robust Optimization Perspective
MC40 Network Design
MC41 Strong Formulations for Mixed Integer Programs
MC42 Stochastic Programming with Financial Applications II
MC43 Standards for Optimization Problem Representation
MC44 IT Modeling
MC45 Routing and Management of Hazardous Materials
MC46 Urban Transportation Planning Models VII: Fleet and Location Responses to Network Congestion
MC47 Auctions in Transportation
MC48 Pierskalla Award - 1
MC49 Joint Session DA/Research: Research Clinic on Decision Analysis in Portfolio Management and Capital Budgeting
MC50 Joint Session DA/ Military Applications: Military Decision Analysis Applications

Monday, 4:30pm - 6:00pm

MD01 Tutorial: Bilevel Models for Protecting Critical Infrastructure
MD02 DEA Applications in Agriculture
MD03 INFORM-ED 10th Anniversary
MD04 Daniel H. Wagner Prize Competition
MD05 Models in Transportation Logistics
MD06 Disassembly Operations
MD07 Call Center Service Levels and Staffing
MD08 Optimal Use of Capacity
MD09 Supply Chain Disruptions
MD10 Inventory & Capacity Issues in Supply Chain Management
MD11 Multi-Echelon Supply Chain Systems
MD12 Auctions with Budget Restrictions
MD13 Software Demonstration
MD14 Military Operations Research Activities at USMA
MD15 Scheduling Theory and Applications
MD16 Workforce Scheduling in Dynamic Environments
MD17 OR/MS Issues in New Product Development
MD18 Advances in Airline Crew Scheduling
MD19 Technology Management Section Distinguished Speaker
MD20 Environmental & Energy Planning Models
MD21 Data Mining in Planning and Logistics
MD22 Electronic Markets: Performance and Measurements
MD23 WDM and MPLS Network Design
MD24 Financial Engineering: Models and Computation
MD25 Auctions and Queues
MD26 Statistical Quality Control for Processes with Complex Topologies
MD27 Lessons in Project Management
MD28 Cutting Edge Research in Revenue Management
MD29 Social and Public Policy Issues
MD30 Critical Infrastructure Security, Performance, and Sustainability
MD31 Operations Research Applications in Semiconductor Manufacturing
MD32 Panel Discussion: Meet the Editors
MD33 Recent Developments in Computer Experiments
MD34 Sensor I
MD35 General Optimization Problems
MD36 Simulation Methods for Selecting the Best System
MD37 Joint Session AP/ Monority/ Workforce: Call Centers
MD38 LP and SDP Approaches to Global Optimization
MD39 New Algorithmic Development for Linear Programming
MD40 Network Discovery, Routing, and Caching
MD41 Advances in Mixed Integer Programming
MD42 Probabilistic Programming
MD43 Global Constraints in Constraint Programming
MD44 Recent Advances in Metaheuristics
MD45 Facility Logistics
MD46 TSL/RASIG: Emerging Trends in Rail Optimization
MD47 Economic Incentives and Mechanisms for Air Traffic Management
MD48 Pierskalla Award - 2
MD49 Some Representative Applications of Decision Analysis
MD50 DAS 2005 Awards Session

Tuesday, 8:00am - 9:30am

TA01 Tutorial: Active Learning in the OR Classroom
TA02 New Developments in DEA
TA03 Recent Innovations in Teaching OR/MS
TA04 Daniel H. Wagner Prize Competition Awards
TA05 Dynamic and Game Theoretic Models for Service Operations Management I
TA06 Closed-Loop Supply Chain Design
TA07 Queuing and Congestion in Service Competition
TA08 Empirical Research in Operations Management using Secondary Data
TA09 Information and Forecasting
TA10 Stochastic Models for Manufacturing Systems and Supply Chains
TA11 Supply Chain Systems with Service Level Requirement
TA12 Game Theoretic Methods in Computer Science and Engineering I
TA13 Software Demonstration
TA14 Modeling and Assessment of Stabilization
TA15 Real-world Production Scheduling Systems
TA16 Scheduling Methods and Applications
TA17 Managing the R&D Pipeline
TA18 Some Issues in Aviation Security
TA19 Engineering and Technology Management
TA20 Agent-based and Complementarity Programming Modelling of Energy Markets
TA21 Joint Session DM Appl./DM: Industrial and Applied Data Mining
TA22 Information and Pricing Issues in Supply Chains
TA23 Design Issues in Optical Network Design
TA24 Financial Strategies
TA25 A View from Abroad I
TA26 Studies in Maintenance
TA27 Joint Session: Practice/CPMS: Edelman - reprise of 2005 Edelman Award Finalists
TA28 Robust Revenue Management
TA29 Analysis of Customer Behavior for E-Commerce
TA30 Statistical and Optimization Modeling at Wastewater Treatments Plants
TA31 Joint Session Practice/ Roundtable: Applying OR in the INFORMS Roundtable Companies
TA32 Network Location
TA33 Data Mining and Statistics in Supply-Chain Management and Logistics
TA34 Multiscale Wavelet Analysis and Applications
TA35 OR/MS Modeling and Algorithms in Marketing II
TA36 Simulation Output Analysis
TA37 Stochastic Networks
TA38 Convexification Techniques
TA39 Special Topics in Theory and Applications of Linear Programming Modeling
TA40 Network Coding
TA41 Integer Programming
TA42 Stochastic Programming for Operations Issues
TA43 Applications of Constraint Programming
TA44 Feasibility and Infeasibility Analysis in Optimization
TA45 Marine Transportation & Logistics I
TA46 Transportation Network Modeling I
TA47 Transportation Infrastructure Management I
TA48 Simulation Applications in Health Services Research - 1
TA49 Optimization in Healthcare Applications
TA50 Normative Target-Based Decision Making

Tuesday, 10:00am - 11:30am

TB01 Tutorial: Integrated Production and Demand Planning Models
TB02 Geometry and Computations in DEA.
TB03 Workforce Communication for Undergraduate IE Schools and for Analytical Work in Business Schools
TB04 Air Force Academy UnderGraduate OR Initiatives
TB05 Dynamic and Game Theoretic Models for Service Operations Management II
TB06 Closed-Loop Supply Chains
TB07 RFID and Supply Chain Management
TB08 Empirical Supply Chain Research
TB09 Designing Competitive Procurement Events
TB10 Newsboy Characterizations, Bounds, and Heuristics for Multi-Echelon Inventory Systems
TB11 Optimization Models in Supply Chain Management
TB12 Game Theoretic Methods in Computer Science and Engineering II
TB13 Software Demonstration
TB14 Munition Applications
TB15 Production Planning, Booking, and Pricing
TB16 Game-Theoretic Issues in Scheduling
TB17 Product Design and Supply Chain Issues
TB18 From Ground to Air: Capacity Planning
TB19 Technology Strategy and Global Competition
TB20 Estimation and Optimization Issues in Electric Power and LNG
TB21 Data Mining in the Auto Industry
TB22 Managing the Adoption and Usage of Radio Frequency Identification (RFID)
TB23 Telecommunications Network Design
TB24 Optimal Exercise and Hedging
TB25 A View from Abroad II
TB26 New Models and Algorithms in Reliability
TB27 Sense and Respond Logistics
TB28 Revenue Management for Queueing Systems
TB29 Decision Support Issues for E-Commerce
TB30 Public Sectors and OR
TB31 Joint Session Practice/ Roundtable: Improving Consumer's Lives Through Applied OR
TB32 Location Models
TB33 Journal of Quality Technology Invited Session
TB34 Wavelet and Statistical Modeling of Multiple Curves and Spatial Data
TB35 Stochastic Programming
TB36 Simulation Analysis in Supply Chain and Resource Management
TB37 Special APS Session: QED Queues: Empirically-Based Theory of Queues in Call Centers
TB38 Stochastic Search Methods for Global Optimization
TB39 Special Session- History of OR/MS
TB40 Travelling Saleman and Related Problems
TB41 Integer Programming Techniques
TB42 Stochastic Programming: Theory to Computation
TB43 Structure and Randomization
TB44 Economic Mechanisms in Information Search
TB45 Marine Transportation & Logistics II
TB46 Transportation Network Modeling II
TB47 Transportation Infrastructure Management II
TB48 Simulation Applications in Health Services Research - 2
TB49 Mathematical Biology and Bioinformatics
TB50 Portfolio Decision Analysis

Tuesday, 12:30pm - 1:30pm

Interactive Session

Tuesday, 1:30pm - 3:00pm

TC01 Tutorial: Solving Difficult Optimization and Counting Problems via the Cross-Entropy Method
TC02 Data Evelopment Analysis: Methodololgy and Applications
TC03 Use of OR/MS Techniques for Designing Better Education Stretegies
TC04 Using Excel to Solve Real World Problems
TC05 Demand Modeling and Cost Reduction in Service Industry
TC06 Closed-Loop Supply Chain Models
TC07 Computational and Modeling Issues in Manufacturing Systems
TC08 Inventory Models and Industry Equilibrium
TC09 Coordinating Competitive and Dynamic Supply Chains
TC10 Managing Supply Risk and Uncertainty
TC11 Bullwhip Effect in Supply Chain Management
TC12 Auctions in Supply Chains
TC13 Software Demonstration
TC14 Multicriteria Decision Making Analysis: Modeling and Applications II
TC15 Order Scheduling and Scheduling in Robotic Cells
TC16 Special Topics in Production & Scheduling
TC17 Issues in Information & Knowledge
TC18 Predicting Air Transportation System Performance I
TC19 Entrepreneurship
TC20 Economic Models of Distributed Energy Resources
TC21 Data Mining in Manufacturing and Logistics
TC22 Joint Session DMA/DM: Data Mining Applications in Developing Countries
TC23 Optimization Problems in Wireless Networks
TC24 Financial Engineering Models
TC25 Innovations in Education
TC26 Some Applications and Modeling Issues in Satistics/Quallity Control
TC27 Analyzing Populations for Business Applications
TC28 Dynamic Pricing and Revenue Management
TC29 Revenue Management in Non-Passenger Streams
TC30 Applications to Land Development
TC31 Joint Session Practice/ Health Applications: Healthcare Practical Applications
TC32 Variants of Traditional Location Problems
TC33 Joint Session: Quality and Statistical Decision Making in Healthcare Applications I
TC34 Sensor IV
TC35 OR/MS Modeling and Algorithms in Marketing I
TC36 Aviation Applications in Simulation
TC37 Economic Analysis and Control of Stochastic Service Systems
TC38 Advances in Large-Scale Nonlinear Optimization
TC39 Special Topics in Operations Management I
TC40 Combinatorial Quadratic Optimization
TC41 Integer Programming: Theory and Algorithms
TC42 Topics in Stochastic Programming
TC43 Integrated Methods for Optimization II
TC44 Optimization Tools and Modeling Languages
TC45 Integrated Inventory Distribution Systems
TC46 Vehicle Routing Problems
TC47 Dynamic Traffic Assignment: Theory, Algorithms, and Models (I)
TC48 Healthcare Resource Planning and Flow Management - 1
TC49 Recent Innovations in Health Care Modeling
TC50 Joint Session DA/ Research: Research Clinic- The Future of Decision Analysis Research

Tuesday, 4:30pm - 6:00pm

TD01 Tutorial: Branch and Tree Decomposition Techniques for Discrete Optimization(Joint)
TD02 Data Envelopment Analysis: Advances in Environmental Performance, Productivity, and Portfolio Efficiency Analysis
TD03 New Horizons for Higher Education
TD04 Army Analysis Shaping the Future
TD05 Service Capacity Planning and Scheduling
TD06 Closed-Loop Supply Chain Economics
TD07 OR/MS Modeling in Some Key Manufacturing Problems
TD08 Human Aspects in Operations Management
TD09 Issues in Supply Chain Management
TD10 Pricing and Coordination Issues in Supply Chains
TD11 Supply Chain Management Planning and Integration
TD12 Auction and Game Theory
TD13 Software Demonstration
TD14 OR Supporting Force Protection
TD15 Recent Developments in Scheduling Theory
TD16 Project Scheduling
TD17 Special Topics in Inventory Management
TD18 Predicting Air Transportation System Performance II
TD19 Theoretical, Experimental, and Econometric Approaches to Entrepreneurship and Innovation
TD20 Forestry I: Fire Applications
TD21 Advances in Data Mining Techniques for Industrial Applications
TD22 Enumeration Problems (in memory of Leo Khachiyan)
TD23 Robustness and Reliability in Networks
TD24 Special Topics in Financial Engineering
TD25 ICS Prize
TD26 OR and Radiation Therapy
TD27 Some Planning Problems in Business Environment
TD28 New Approaches to Revenue Management and Pricing
TD29 Pricing and Revenue Management in Manufacturing and Retail
TD30 Two-Stage Inventory Models
TD31 Optimization in Radiation Treatment Planning
TD32 Location Modeling
TD33 Statistical Issues in Networking
TD34 Process Monitoring and Diagnosis(3)
TD35 Marketing and Operations Interfaces
TD36 Advances in Simulation Methodology
TD37 Simulation and Financial Engineering
TD38 Large-Scale Nonlinear Programming
TD39 Operations Management in Supply Chains
TD40 Optimal Paths and Orderings
TD41 Integer Programming: Applications and Implementations
TD42 Robust Optimization
TD43 Distributed Optimization Systems
TD44 Heuristic Search
TD45 Intermodal Transportation
TD46 User Behavior Analysis in Transportation
TD47 Dynamic Traffic Assignment: Theory, Algorithms, and Models (II)
TD48 Healthcare Resource Planning and Flow Management - 2
TD49 Stochastic Models in Health Care
TD50 Behavioral Decision Theory

Wednesday, 8:00am - 9:30am

WA01 Tutorial: Adaptive Memory Programming: A Key to Breakthroughs for Solving Hard Problems
WA02 DEA for Managerial Benchmarking
WA03 Decision-Making in Supply Chains I
WA05 Service System Design: Probabilistic Models
WA06 Reverse Supply Chains in Manufacturing
WA07 Assortment Planning under Operational Considerations
WA08 Supply Chain Management
WA09 Risk, Financing and Supply Chains
WA10 Marketplace and its Impact on Supply Chain Management
WA11 Value of Information in Supply Chain Management
WA13 MARA 2005
WA14 The Role of Search and Tracking in Domain Awareness
WA15 Production and Scheduling
WA16 Production Scheduling Modeling in Manufacturing
WA17 Newsvendor Model and Multiple Supplier Systems
WA18 Measuring the Impact of National Air Transportation System Changes
WA19 Management Applications of DEA
WA20 Forestry II: Forest Product Applications
WA21 Optimization and Data Mining I
WA22 Joint Session DA Appl./ DA/ Health Care: Applications of Data Mining to Healthcare
WA23 Optimization and Games in Communication Networks
WA24 Optimization Approaches in Financial Engineering
WA26 Computational Approaches in Medical Research
WA27 Multi-Agent System Applications
WA28 New Applications of Pricing and Revenue Optimization
WA29 Modeling Customer Behavior for Offer Optimization
WA30 Studies in Risk Ananlysis
WA31 Applications in Transporatation, Inventory and Logistics
WA32 Joint Session Location Analysis/PP & P/ Minority: Public-Sector Applications
WA33 Statistics and Reliability in Nano-Technology
WA34 Stochastic Problems
WA35 Issues in Supply Chain Management III
WA36 Interesting Problems in Flexible Manufactuing
WA37 Joint Session AP/ Workforce: Stochastic Models in Computer Science and Call Center Operations
WA38 Manufacturing System Design and Control
WA39 Operations Management in Healthcare and Other Service Industries
WA40 Mathematical Programming for Network Problems
WA41 Some Recent Developments in Global Optimization
WA42 Robust Optimization
WA43 Parallel Metaheuristics
WA44 Joint Session Computing/ Health: OR Applications in Computational Biology
WA45 Material Handling Systems
WA46 Information and Control in Transportation Networks
WA47 Transportation Intrastructure Problems
WA48 Joint Panel Discussion Health/ Education: Education in OR & Healthcare
WA49 Healthcare System Modeling and Operations Management
WA50 Medical Decision Analysis

Wednesday, 10:00am - 11:30am

WB01 Tutorial: Stochastic Dynamic Optimization with Model Uncertainty and Learning
WB02 Performance and Efficiency Analysis
WB03 Performance Analysis of Supply Chains Systems II
WB06 Special Topics in Reverse Supply Chains
WB07 Information System Research and Practice
WB08 Special Topics in Operations Management II
WB09 Risk Management and Supply Chains
WB10 Strategic Issues in Supply Chain Design
WB11 Game Theory in Supply Chain Management
WB12 New Topics in Online Auctions
WB13 Decision and Decision Making
WB14 Optimization for Supply Chain Disruptions, Crew Composition, Spare Parts and Strategic Mobility
WB15 Multi-Machine Scheduling
WB16 Optimization Modeling in Economics
WB17 Planning and Control in Inventory Systems
WB18 Measuring Air Transportation System Performance
WB19 Analytic Hierarchy Process Applications and Decision Support
WB20 Forestry III - Land Acquisition and Planning Applications
WB21 Optimization and Data Mining II
WB22 Joint Session DA/Health: Data Mining in Medicine
WB23 Strategic Models in Telecommunications
WB24 Some Important Issues in Group Decisions & Negotiations
WB26 Problems in Production & Scheduling
WB27 Some Heuristic-based Applications
WB28 Pricing and Revenue Management with Endogenous Demand
WB29 Evaluation of Pricing Policies
WB30 OR /MS Issues in Organization Theory
WB31 Applications of OR to Demand Chain Management.
WB32 Location Analysis
WB33 Sensor III
WB34 Joint Session QSR/ Health: Quality and Statistical Decision Making in Healthcare Applications III
WB35 Issues in Supply Chain Management IV
WB36 Recent Developments in Stochastic Processes
WB37 Resource Allocation for Computer Systems
WB38 Algorithms for Mathematical Programs with Equilibrium Constraints
WB39 Benchmarking and Performance Evaluation in Operations Management
WB40 Shortest Path and Maximum Flow Problems
WB41 Special Topics in Optimization I
WB42 Panel Discussion: ETMERC - Engineering and Technology Management Education and
WB43 Open Source, Open Data, and Open Standards
WB45 Improving Warehouse Operations
WB46 General Transportation Dynamics
WB47 Topics in Transportation Science and Logistics I
WB48 OR/MS Modeling of Healthcare Applications
WB49 Optimization for Radiation Therapy Treatment Planning
WB50 Decision Analysis Arcade II

Wednesday, 1:30pm - 3:00pm

WC01 Tutorial: The COIN-OR Branch and Cut Solver
WC02 Business Applications I
WC03 Decision-Making in Supply Chains II
WC05 Issues in Supply Chain Management II
WC06 Coordination in Reverse Supply Chains
WC07 Information System Development Strategies
WC08 Modeling Call Center Applications
WC09 Strategic Issues in Supply Chain
WC10 Shipping, Transport, and Supply Chain Logistics: Management Aspect
WC11 Performance Analysis of Supply Chain Systems I
WC12 Routing and Scheduling in Transportation
WC13 Scheduling Problems
WC14 Military Applications at RAND
WC15 Robust Scheduling
WC16 Special Topics in Facilities Planning & Design
WC17 Optimization Issues in Inventory Models
WC18 Aviation Applications I
WC19 Analytic Hierarchy Process Theory and Applications
WC20 Forestry IV - Harvesting Applications
WC21 Innovations in Data Analysis, Prediction and Classification
WC22 Data Mining in Decision-Making
WC23 Demand and Traffic Models in Telecommunications
WC24 Applications of Decision Analysis
WC26 Applications of Operations Research
WC27 Evolutionary Computing and Intelligent Agents
WC28 Topics in Revenue Management and Pricing
WC29 Modeling Segmentation and Choice in Revenue Management
WC30 Technology / Strategic Planning
WC31 OR/MS Modeling in Some Industrial Applications
WC32 Optimization Techniques for AI Problems
WC33 Joint Session QSR/ Health: Quality and Statistical Decision Making in Healthcare Applications II
WC34 Process Modeling and Analysis (1)
WC35 Frontiers in Enterprise Marketing
WC36 Applied Probability: Queuing and Markov Models
WC37 Economic Aspect of Transport and Supply-Chain Logistics
WC38 Mixed Integer Nonlinear Programming
WC39 Pricing Strategies for Operations Management
WC40 Special Topics in Networks & Graphs
WC41 Special Topics in Optimization II
WC42 Special Topics in Forecasting
WC43 Relaxation Adaptive Memory Programming (RAMP) for Combinatorial Optimization
WC44 Open-Source Tools for Mixed Integer Programming
WC45 Facility Layout
WC46 Robustness and Transportation Networks
WC47 Planning and Design Issues in Distribution
WC48 Metaheuristic Approaches for Some Recent Problems
WC49 Planning for Surges in the Demand for Health Care
WC50 Decision Analysis Arcade III

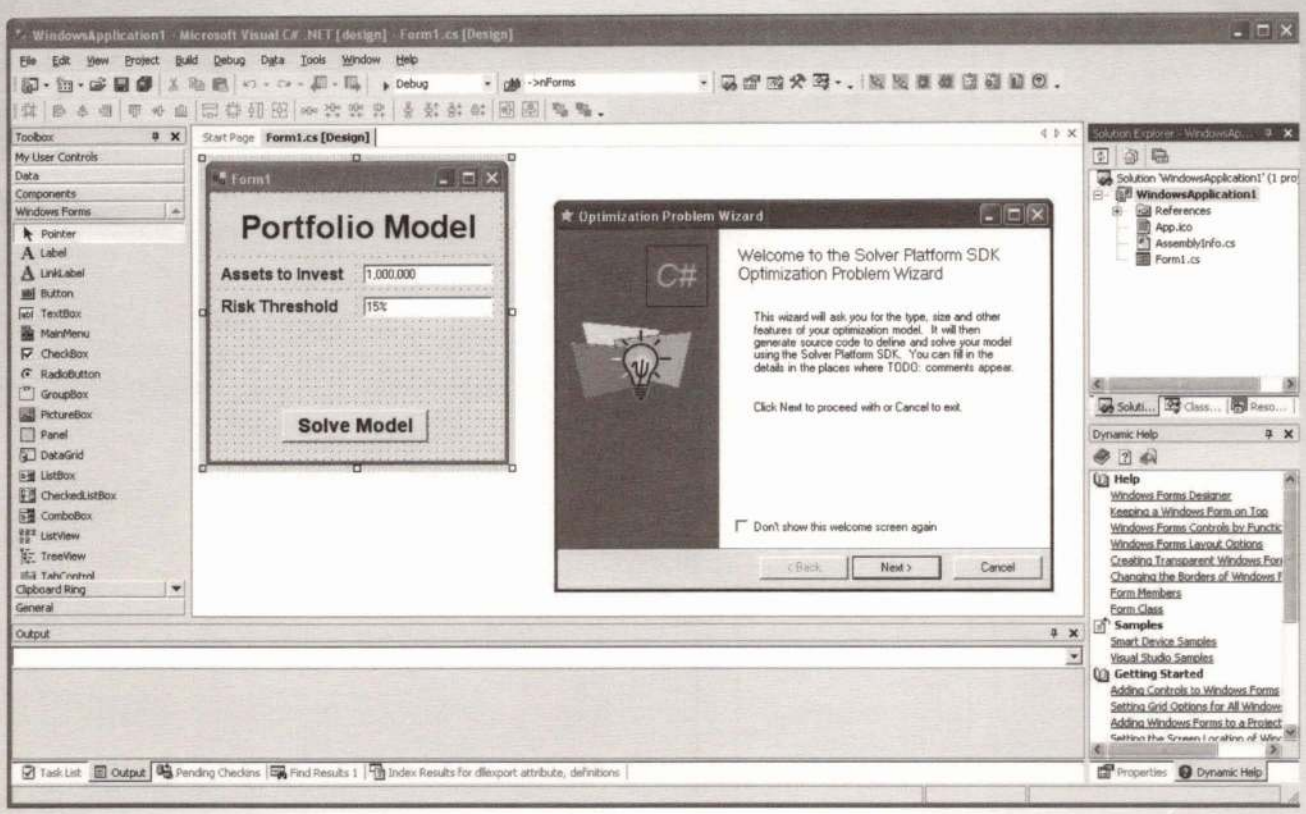
Wednesday, 3:30pm - 5:00pm

WD01 Tutorial: Empirical versus Optimal Decision-Making in Sequential Search Problems
WD02 Business Applications II
WD03 Systems Analysis of Supply Chains
WD05 Contractual Issues in Supply Chain
WD06 Designing a Reverse Logistics Strategy
WD07 Use of Information System in Organizations
WD08 Resource Allocation and Staffing
WD09 Inventory Management and Competition
WD10 Inventory Problems in Supply Chains
WD11 Contract Management in Supply Chain Systems
WD12 Scheduling Modeling in Transportation
WD13 Innovation in Optimization
WD14 Air Force Supply Chain Management
WD15 Scheduling Models, Methodologies and Tools
WD16 Special Topics in Economics and OR
WD17 Stochastic Modeling and Multi-Echelon Inventory Systems
WD18 Aviation Applications II
WD19 Decision Support Systems: Modeling and Applications
WD20 Forestry V - Harvesting Applications
WD21 Diagnosis Models for Port of Entry Inspections
WD22 Optimization in Clustering
WD23 Decision Analysis Arcade IV
WD24 Applications of Decision Support Systems
WD26 Statistical Testing and Inference Applications
WD27 OR Modeling for Some Artificial Intelligence Problems
WD28 Optimization Modeling in Telecommunication Systems
WD29 Optimization and Heuristic
WD30 Strategic Planning Systems
WD31 Decision Analysis in Technology Management
WD32 Analysis and Design of Hardware and Other Systems
WD33 Process Modeling, Analysis, and Control (2)
WD34 Maintenance Optimization
WD35 Modeling Approaches to Distribution Channels
WD36 From Queues to MDPs
WD37 Applied Probability: Optimization
WD38 Direct Search Methods for Nonlinear Programming
WD39 Operations Management in Production Systems
WD40 Network Theory and Applications
WD41 Heuristics Solutions in Production and Scheduling
WD42 Modeling and Approaches in Systems Analysis
WD43 Inventory Control
WD44 Open Source Software for Semidefinite Programming
WD45 Stochastic Modeling in Transportation Problems
WD46 Day-to-day Traffic Dynamics and Traffic Equilibria
WD47 Topics in Transportation Science and Logistics II
WD48 Select Topics in Mataherustucs Development
WD49 Joint Session Health/ Optimization: OR-based Methods of Diagnosis and Prognosis
WD50 Stocahstic Problems in Decision Analysis

NOTES

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A *Brighter* Idea: Develop and Deploy Your Optimization Model



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