



Banff International Research Station

for Mathematical Innovation and Discovery

“Combinatorial Optimization under Uncertainty” Workshop November 29 – December 4, 2009

MEALS

*Breakfast (Buffet): 7:00 – 9:30 am, Sally Borden Building, Monday – Friday

*Lunch (Buffet): 11:30 am – 1:30 pm, Sally Borden Building, Monday – Friday

*Dinner (Buffet): 5:30 – 7:30 pm, Sally Borden Building, Sunday – Thursday

Coffee Breaks: As per daily schedule, 2nd floor lounge, Corbett Hall

*Please remember to scan your meal card at the host/hostess station in the dining room for each meal.

MEETING ROOMS

All Monday and Friday scientific activities will be held in Max Bell 159 (Max Bell Building accessible by walkway on 2nd floor of Corbett Hall). Scientific activities on Tuesday, Wednesday and Thursday will be held in the lower level of Max Bell, Rooms 155-159, as indicated in the schedule or on Monday. **Please respect that all other space has been contracted to other Banff Centre guests, including any Food and Beverages in those areas.**

SCHEDULE

Sunday, November 29

- 16:00 Check-in begins (Front Desk – Professional Development Centre - open 24 hours)
- 17:30-19:30 Buffet Dinner
- 20:00 Informal gathering in 2nd floor lounge, Corbett Hall
Beverages and small assortment of snacks available on a cash honour-system.

Monday, November 30

- 7:00-8:45 Breakfast
- 8:45-9:00 Introduction and Welcome to BIRS by BIRS Station Manager, Max Bell 159
- 9:00-9:15 Workshop introduction (M. Gendreau and S. Sen)
- 9:00-10:15 Overview lecture on Stochastic Mixed Integer Programming (S. Sen),
- 10:15-10:45 Coffee Break, 2nd floor lounge, Corbett Hall
- 10:45-11:45 Overview lecture on Simulation-Optimization (M. Fu)
- 11:45-13:00 Lunch
- 13:00-14:00 Guided Tour of The Banff Centre; meet in the 2nd floor lounge, Corbett Hall
- 14:00-15:00 Overview lecture on Dynamic Games under Uncertainty (A. Kleywegt)
- 15:00-15:30 Coffee Break, 2nd floor lounge, Corbett Hall

All activities in the 15:30-18:00 block will be held jointly with the Search in Constraint Programming Workshop

- 15:30-16:30 Overview lecture on Binary Decision Diagrams (J. Hooker)
- 16:30-16:45 Discussion
- 16:45-17:45 Overview lecture on Robust Optimization (C. Smith)
- 16:45-18:00 Discussion
- 18:00-19:30 Dinner

Tuesday, December 1st

- 7:00-9:00 Breakfast
- 9:00-10:00 Presentation of the first Research Challenge, “Designing for Resilience”, Max Bell 156
- 10:00-10:30 Coffee Break, 2nd floor lounge, Corbett Hall
- 10:30-12:00 Working session in small groups
- 12:00-13:30 Lunch
- 13:30-13:45 Group Photo; meet on the front steps of Corbett Hall
- 13:45-15:00 Working session in small groups
- 15:00-15:30 Coffee Break, 2nd floor lounge, Corbett Hall
- 15:30-18:00 Wrap-up session on the Research Challenge “Designing for Resilience”, Max Bell 156
- 18:00-19:30 Dinner

Wednesday, December 2

- 7:00-9:00 Breakfast
- 9:00-10:00 Presentation of the second Research Challenge, “Optimal Decisions for Stochastic Hybrid Systems”, Max Bell 159
- 10:00-10:30 Coffee Break, 2nd floor lounge, Corbett Hall
- 10:30-12:00 Working session in small groups
- 12:00-13:30 Lunch
- 13:30-15:00 Working session in small groups
- 15:00-15:30 Coffee Break, 2nd floor lounge, Corbett Hall
- 15:30-18:00 Wrap-up session on the Research Challenge “Optimal Decisions for Stochastic Hybrid Systems”, Max Bell 159
- 18:00-19:30 Dinner

Thursday, December 3

- 7:00-9:00 Breakfast
- 9:00-10:00 Presentation of the third Research Challenge, “Dynamic Combinatorial Games with Incomplete Information”, Max Bell 159
- 10:00-10:30 Coffee Break, 2nd floor lounge, Corbett Hall
- 10:30-12:00 Working session in small groups
- 12:00-13:30 Lunch
- 13:30-15:00 Working session in small groups
- 15:00-15:30 Coffee Break, 2nd floor lounge, Corbett Hall
- 15:30-18:00 Wrap-up session on the Research Challenge “Dynamic Combinatorial Games with Incomplete Information”, Max Bell 159
- 18:00-19:30 Dinner

Friday, December 4

- 7:00-9:00 Breakfast
- 9:00-10:00 Global wrap-up on the workshop
- 10:00-10:30 Coffee Break, 2nd floor lounge, Corbett Hall
- 10:30-11:30 Discussion on future perspectives for combinatorial optimization under uncertainty
- 11:30-13:30 Lunch

Checkout by 12 noon.



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RESEARCH CHALLENGES

1) Designing for Resilience

In a variety of systems, we try to choose designs and operations that will perform well under given nominal conditions. In designing deterministic systems (say a network), we address this phase of the analysis. However failures, attacks etc. are part of the operations of a real-world system, and it is important to design in such a manner that recovery from failures can be accomplished without extensive loss in system performance for an extended period of time. In many applications (e.g. routing during a disaster), the system operators use modeling tools that help cope with lost capacity within the system. A resilient system is one for which the "outage" does not cause havoc, and recovery can be managed without significant losses. We wish to study formal methodologies that will incorporate designing systems that will operate well under nominal circumstances, and be resilient when circumstances change. For these problems, recovery may be centralized or decentralized depending on the context of the problem, and the study of adaptive behaviors become necessary even when the recovery is guided by optimization models.

b) Optimal Decisions for Stochastic Hybrid Systems

Hybrid systems are dynamic systems in which the states of the system contain both continuous and discrete variables, and the decisions themselves include both continuous and discrete choices. Such models are becoming more common in engineering, finance, supply chains and other applications. The presence of stochastic conditions, as well as continuous and discrete choices leads to very challenging stochastic optimization models. Our plan is to examine different settings for such problems, and investigate a range of methods that may be necessary.

c) Dynamic Combinatorial Games with Incomplete Information

Here we wish to study multi-player games in which decision-makers make combinatorial decisions based on incomplete information. As with the other two challenges, the interaction between combinatorial optimization and uncertainty raise significant questions regarding existence of strategies, as well as, methods for finding game theoretic solutions. We also note that traditional games model players' strategies either as being revealed sequentially or as being revealed simultaneously. Less extreme information structures are not only of practical interest, but also bring significant challenges.