Operations Research Seminar Series in 2013

Seminars are listed in reverse chronological order, most recent first.

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20 November - Sanjeeb Dash (IBM Thomas J. Watson Research Center, New York)
Split cutting planes for mixed-integer programs and stochastic programming problems

Cutting planes (cuts, for short), or inequalities satisfied by integral solutions of systems of linear inequalities, are important tools used in modern solvers for integer programming problems. Split cuts -- which are related to Gomory mixed-integer cuts -- were first studied by Cook, Kannan and Schrijver (1990). In this talk we present computational results on the use of split cuts in two different contexts. We consider a family of quadratic unconstrained boolean optimization problems recently used in tests on the DWave quantum computer and discuss how they can be solved using special families of split cuts in reasonable time. We also show how to accelerate the solution of a special class of two-stage stochastic integer programming problems using split cuts.

This is joint work with Merve Bodur, Marcos Goycoolea, Oktay Gunluk, and Jim Luedtke.

13 November - Richard Weber (Cambridge)
A More General Pandora's Rule

In a famous model due to Weitzman (1979) an agent (Pandora) is presented with boxes containing prizes. She may open them however as she likes, discover prizes within, and optimally stop. Her aim is to maximize the expected value of the greatest prize she finds, minus the costs of opening boxes. This problem has an attractive solution by means of the so-called Pandora rule, and might be applied to searching for a research topic, house or job.

It does not, however, address the problem of a student who is searching for the subject to choose as her major and who benefits from all the courses she takes, not just from those taken once her major is chosen. So motivated, we set out to discover whether there exist any problems for which a Pandora rule is optimal when the aim is to maximize is a more general function of all the revealed prizes. We elucidate the connection between the Pandora rule and the Gittins index solution of an equivalent multi-armed bandit problem.

Although the Gittins index analysis tells most of the story, there do exist problems which are not equivalent to multi-armed bandits and for which a Pandora rule is

optimal. We give a sufficient conditions that can be used to identify this and an example of its application.

23 October - Thomas Lidbetter (LSE)
Optimal search for a small (or well hidden) object

In traditional models of search games, an immobile Hider picks a point in some search space and a Searcher picks a constant speed trajectory in the space with the aim of minimising the expected time to reach the Hider. However, in practice a Searcher's ability to detect a Hider may depend on the speed at which he is travelling. For example, when searching for a contact lens there are two possible modes of travel: a fast walking speed and a slow searching speed. Equally, an explosives expert searching for an IED may be able to move from place to place quickly in a vehicle, but in order to detect the IEDs he must get out of his vehicle and move at a slower pace. Hence we adapt the traditional model to allow the Searcher to move at either a slow speed at which he is able to detect the Hider, or a fast speed at which he cannot. We view this as a zero sum game and show that the solution of the game is complicated even if it is played on a single arc. We give the solution to this, and to the game played on trees and other networks. We also consider what happens if the Searcher is able to detect the Hider with a small probability when he is travelling at the fast speed.

16 October - Gah-Yi Vahn (London Business School)
Performance-based Regularisation in mean-CVaR Portfolio Optimization

Regularization is a technique widely used to improve the stability of solutions to statistical problems. We propose a new regularization concept, performance-based regularization (PBR), for data-driven stochastic optimization. The goal is to improve upon Sample Average Approximation (SAA) in finite-sample performance while maintaining minimal assumptions about the data. We apply PBR to mean-CVaR portfolio optimization, where we penalize portfolios with large variability in the constraint and objective estimations, which effectively constrains the probabilities that the estimations deviate from the respective true values.

This results in a combinatorial optimization problem, but we prove its convex relaxation is tight. We show via simulations that PBR substantially improves upon SAA in finite-sample performance for three different population models of stock returns. We also prove that PBR is asymptotically optimal, and further derive its first-order behaviour by extending asymptotic analysis of M-estimators.