Programme doctoral en recherche opérationnelle

Zinal Seminar 2012, January 15-19

	Sunday 15	Monday 16	Tuesday 17	Wednesday 18	Thursday 19
08:30 - 09:00		El Ghaoui	Martel	El Ghaoui	Martel
09:00 - 09:30					
09:30 - 10:00					
10:00 - 10:30		break	break	break	break
10:30 - 11:00		Martel	El Ghaoui	Martel	El Ghaoui
11:00 - 11:30					
11:30 - 12:00					
12:00 - 17:00		Sport and dicussions			
17:00 - 17:30		Atasoy	Respen	Thevenin	
17:30 - 18:00		Katsifou	Moldenhauer	Hähnle	
18:00 - 18:30	Welcome cocktail	Baumann	Uldry	Morić	
18:30 - 19:00		Fulek	Weyland	Zeballos	

Venue:
Hotel Europe
3961 Zinal
Tel.: 027 475 44 04

Keynote presentations

Laurent El Ghaoui (UC Berkeley)

Title: **Robust Optimization and Machine Learning**

Abstract:
Convex optimization (Convex duality; special problem classes; examples; CVX)
Basics of robust optimization (Motivations; tractable models; chance constraints)
Machine learning (Optimization models in machine learning; robustification)
Algorithms (First- and second-order algorithms; CVX; large-scale algorithms)

Alain Martel (CIRRELT and Université Laval Quebec)

Title: **Designing Robust Value-Creating Supply Chain Networks**

Abstract: The design of Supply Chain Networks (SCN) under uncertainty is a complex decision problem that must be addressed using operations research models and techniques. The seminars will discuss various aspects of the problem such as value creation, design decisions, random, hazardous and deep-uncertainty events, resilience and responsiveness. We will initially show how various dimensions of the problem can be addressed using mixed-integer programming models. We will then give an introduction to stochastic programming and show how the SCN design problem under uncertainty can be formulated as a stochastic program with recourse. A solution approach based on scenario generation, SCN design generation and design evaluation and selection processes will also be discussed.

PhD presentations

Bilge Atasoy (EPFL)

Title: **Demand based airline scheduling for a new flexible aircraft**

Abstract: Clip-Air is a new transportation system which introduces flexibility in various aspects of air transportation. In order to assess the potential advantages of Clip-Air we developed an integrated schedule design and fleet assignment model where we model supply-demand interactions through an itinerary choice model. The resulting mixed integer nonlinear problem is highly complex and to deal with this complexity we propose a heuristic based on Lagrangian relaxation. The results on the performance of the heuristic will be presented during the seminar. Furthermore we will present a comparative analysis on the performance of Clip-Air together with its impact on multi-modal networks.

Philipp Baumann (University of Bern)

Title: **Heuristic decomposition and LP-based scheduling in make-and-pack production**

Abstract: In this paper, we are concerned about the short-term scheduling of industrial make-and-pack production processes. The planning problem consists in minimizing the production makespan while meeting given end-product demands. Sequence-dependent changeover times, multi-purpose storage units with finite capacities, quarantine times, batch splitting, partial equipment connectivity, material transfer times, and a large number of operations contribute to the complexity of the problem. Known MILP formulations cover all technological constraints of such production processes, but only small problem instances can be solved in reasonable CPU times. In this paper, we develop a heuristic in order to tackle large instances. Under this heuristic, groups of batches are scheduled iteratively using a novel MILP formulation; the assignment of the batches to the groups and the scheduling sequence of the groups are determined using a priority rule. We demonstrate the applicabi lity by means of a real-world production process.

Radoslav Fulek (EPFL)

Title: **Hanani-Tutte and Level Planarity**

Abstract: A drawing of a graph is x-monotone if every edge intersects every vertical line at most once and every vertical line contains at most one vertex. Pach and Toth showed that if a graph has an x-monotone drawing in which every pair of edges crosses an even number of times, then the graph has an x-monotone embedding in which the x-coordinates of all vertices are unchanged. We give a new proof of this result and strengthen it by showing that the conclusion remains true even if adjacent edges are allowed to cross oddly. This answers a question posed by Pach and Toth. We apply our results to level-planarity: we obtain a new and simple algorithm to test level-planarity in quadratic time, and we find a way to relax the definition of level-planarity. This is a joint work with M.J.Pelsmajer, M.Schaefer and D.Stefankovic.

Nicolai Hähnle (EPFL)

Title: **On sub-determinants and the diameter of polyhedra**

Abstract: We derive a new upperbound on the diameter of polyhedra P. If P is an n-dimensional polyhedron defined by a matrix A such that the absolute value of its subdeterminants is bounded by D, then the diameter is bounded by O(D^2n^4lognD). For the special case where A is totally unimodular, this implies an upper bound of O(n^4logn), which significantly improves the previous bound of Dyer and Frieze. The proof uses isoperimetric inequalities and a volume expansion argument for the normal cone of P.

Argyro Katsifou (EPFL)

Title: **Joint Product Assortment and Inventory Management Optimization**

Abstract: We study a retailer's joint problem of product assortment planning and inventory management given limited shelf space. The product assortment is composed of 'standard' and 'variable' products. Standard products are offered on an ongoing basis with the purpose of attracting and retaining loyal customers. Variable products are offered for a limited time, in limited quantities and, usually, at attractive prices to increase store traffic by attracting non-loyal customers. In our paper we model the heterogeneous customers' store and product preferences using the Multinomial Logit (MNL) framework. The associated inventory problem is different for each type of products due to the different cost structures. We propose an iterative heuristic to find the optimal combined product assortment and the inventory level for each product that maximize retailer's overall profitability.

Carsten Moldenhauer (EPFL)

Title: **Approximation algorithms and inapproximability results for the Single-Source Rent-or-Buy Problem**

Abstract: We consider the Single-Source Rent-or-Buy problem, its current best inapproximability result and further discuss the current best approximation algorithms.

Filip Morić (EPFL)

Title: **Large simplices determined by finite point sets**

Abstract: Given a set P of n points in R^d, denote by $d_1 > d_2 > ...$ all inter-point distances generated between point pairs in P. It was shown by Schur, Martini, Perles, and Kupitz that there is at most one d-dimensional regular simplex of edge length d1 whose every vertex belongs to P. We extend this result by showing that for any k the number of d-dimensional regular simplices of edge length d_k generated by the points of P is bounded from above by a constant that depends only on d and k. We also make some progress towards Schur's conjecture, according to which the maximum number of $(d-1)$-dimensional regular simplices of edge length d_1 is n. We prove this statement under an additional condition and conjecture that this condition is always satis fied.

Jean Respen (University of Geneva)

Title: **Smoothing costs in a scheduling problem with major and minor setup times and costs**

Abstract: Consider a scheduling problem where n jobs have to be scheduled on m non identical machines. The goal consists in minimizing a weighted function of smoothing costs, setup costs and a component proportional to the makespan. Among the constraints are setup times and the fact that any job cannot be performed on any machine. For such a difficult problem, we propose an exact method for small instances, as well as a tabu search and an adaptive memory algorithm for large instances.

Simon Thevenin (University of Geneva)

Title: **Heuristics for a single machine scheduling problem with rejection and setup costs**

Abstract: We consider a single machine scheduling problem with n jobs and setup times and setup costs. For each job, we know its duration, its release date (it is impossible to start a job before it), and its deadline (it is impossible to finish a job after it). It is also possible to reject a job, in such a case, a penalty cost is encountered. For each job a regular (i.e. non decreasing) objective function is given. The problem is to determine which jobs to schedule and their sequence in order to minimize a global objective function. We propose greedy algorithms, tabu search and adaptive memory methods, which are able to tackle instances with up to 500 jobs in a reasonable amount of time.

Marc Uldry (University of Fribourg)

Title: **Implementing a Tabu Search method to solve a real life Split Delivery Vehicle Routing Problem**

Abstract: A cement supplier company delivers every day from several depots different cement types to its customers with a heterogeneous fleet of vehicles. The demands of the customers are often larger than the capacity of the vehicles. For this purpose, most customers are visited several times. This is a split delivery vehicle routing problem with additional constraints, which can be solved with a Tabu Search method. Information about the implementation of this metaheuristic are given, as results of experiments on real life instances. Comparisons between these results and those obtained using a MILP formulation and those given by the cement supplier company are also presented.

Dennis Weyland (IDSIA)

Title: **Hardness Results for the Probabilistic Traveling Salesman Problem with Deadlines**

Abstract: The Probabilistic Traveling Salesman Problem with Deadlines (PTSPD) is a Stochastic Vehicle Routing Problem with a computationally demanding objective function. We show that it is even #P-hard to compute the probability of deadli-

ne violations. Based on this result we additionally show that the evaluation of the objective function, delta evaluation in reasonable local search neighborhoods, the decision variant of the PTSPD and the optimization variant of the PTSPD are all #P-hard.

Ariel Zeballos (EPFL)

Title: **Financial Supply Chain Management: Working Capital Requirements with Short-term Debt**

Abstract: We formulate a mathematical model that includes key financial aspects such as working capital restrictions, payment delays and multiple sources of financing in a standard operational setting. We solve for the optimal working capital allowance using an embedded Nelder-Mead optimization. We perform sensitivity analysis on cash flows and short-term debt usage. While Modigliani and Miller established that the financial choices of a firm do not play a role in its valuation, we examine the robustness of this result in a richer setting where we depart from their underlying assumptions. Our numerical experiments show that when access to short-term debt is granted, the expected cash flows are indeed fairly insensitive to varying short-term debt premiums. However, when short-term debt access as such becomes prohibitive or when downstream payment delays increase, the required working capital allowance inflates rapidly.