operational peripatetic research postgraduate program

EURO
The Association of European Operational Research Societies

ORP^3
Operational Research Peripatetic Postgraduate Program

July 16-20, 2012
Linz, Austria

Contents

Committees

Scientific Committee

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Claudia Archetti	Universiy of Brescia, Italy
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Additional Reviewers

Michael Bögl	Johannes Kepler University Linz, Austria
Roland Braune	Johannes Kepler University Linz, Austria
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Stefanie Kritzinger	Johannes Kepler University Linz, Austria
Fritz Payr	Salzburg Research, Austria
Michael Schilde	Johannes Kepler University Linz, Austria
Verena Schmid	University of Vienna, Austria
Alexander Schnell	University of Vienna, Austria

Local Organizing Committee

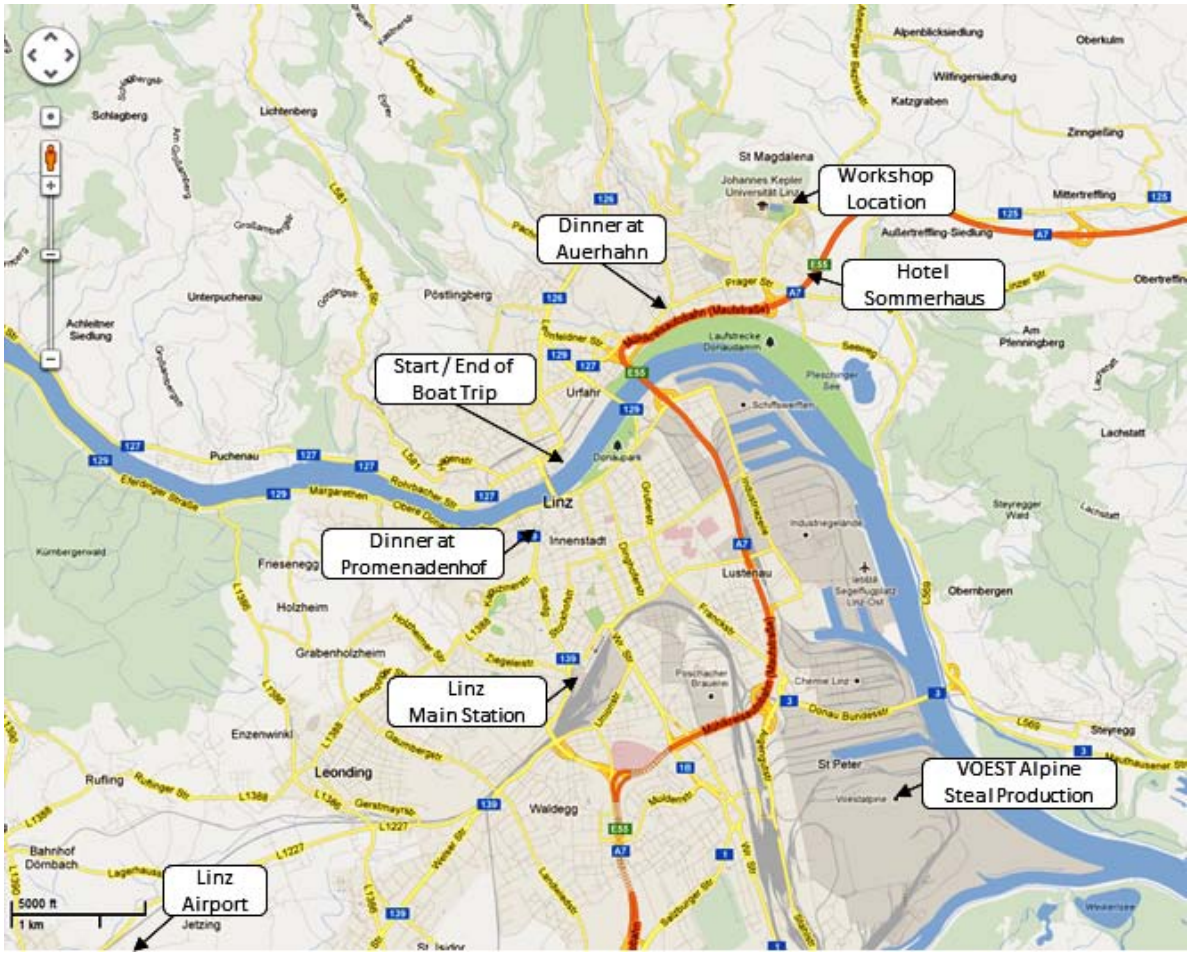
Karl F. Dörner
Michael Bögl
Roland Braune
Sabine Frank
Elisabeth Gussmagg-Pfliegl
Tanja Hintenaus
Andrea Irreiter
Stefanie Kritzinger
Michael Schilde
Gabriele Traugott

Information for Conference Participants

Venue

The ORP[3] workshop will take place at the Johannes Kepler University Linz in Austria. Linz is the third-largest city of Austria and capital of the state of Upper Austria. It is located in the north centre of Austria, approximately 30 km south of the Czech border, on both sides of the river Danube. The population of the city is 191.107, and that of the Greater Linz conurbation is 330.000.

Linz offers a broad spectrum of culture events and a considerable number of cultural institutions. The events are especially remarkable for being diverse, innovative and varied. In 2009, Linz was the Euro-



pean Capital of Culture. More than 2.5 million people took this opportunity to get to know the cultural qualities of the city. Several newly constructed cultural venues reinforce Linz's image as a dynamic city of culture and industry.

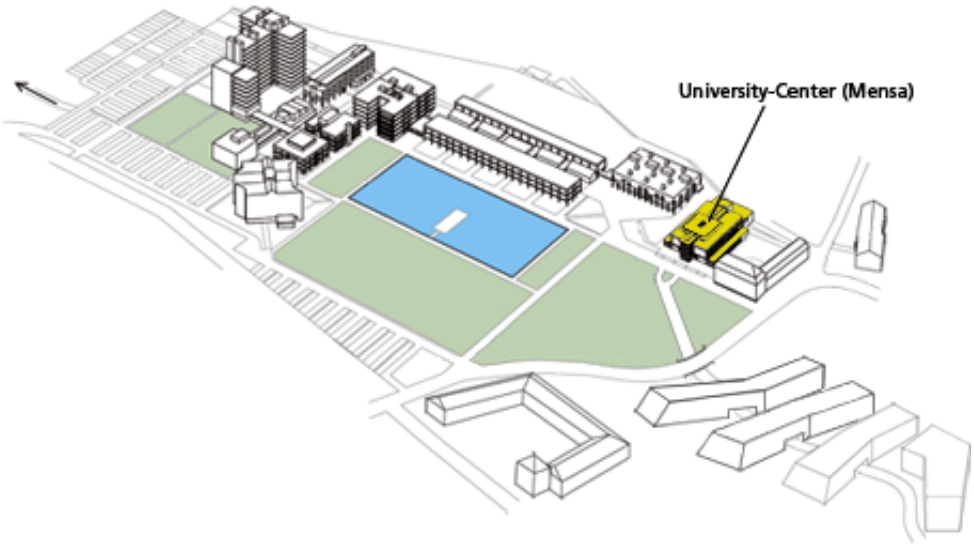
The Johannes Kepler University (JKU) in Linz, one of the most modern universities in Austria, was founded in 1966 as an Academy for Social and Economic Sciences. Teaching and research activities initially began with a faculty focused on academic studies in the fields of social sciences, economics and legal studies, serving a student body of approximately 600. The Faculty of Technical and Natural Sciences was introduced in 1969, followed by the Faculty of Law in 1975. In the same year, the Academy transitioned to become the JKU, named after the world-famous and renowned mathematician and astronomer Johannes Kepler.

In the beginning, the idea of a "university campus setting" was a completely new concept in Austria. Situated on the north-eastern outskirts of the Upper Austrian capital of Linz, the campus accommodates approximately 16.000 students and employs over 2.000 faculty and staff. JKU currently offers 59 Bachelor, Masters and Doctorate programs.

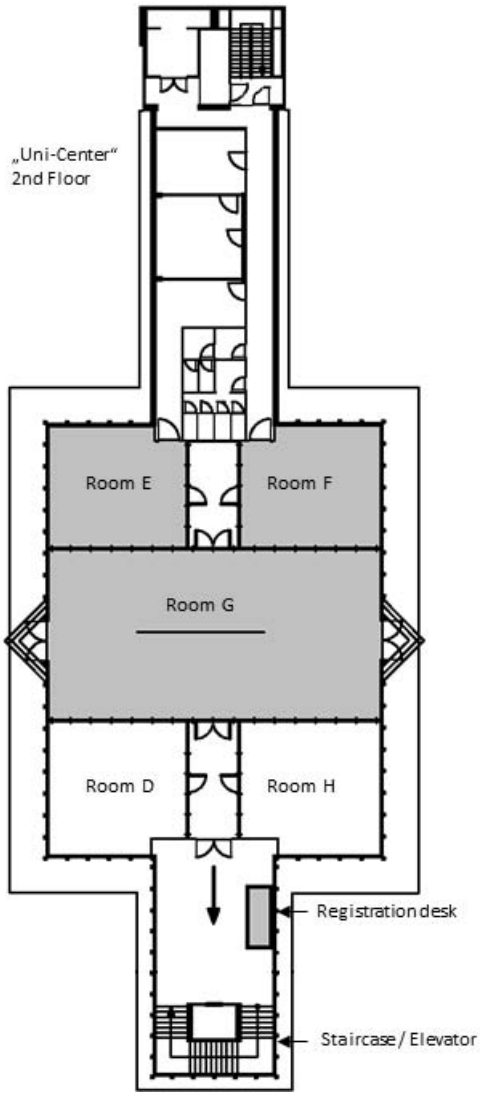
The department of Productions and Logistics Management under Karl F. Dörner's leadership is part of the Faculty of Social Sciences, Economics and Business. The research focuses on logistics, transport, and supply chain services and networks by combining new scientific research with practical solution methods.

Facilities layout

All sessions, the coffee breaks and the welcome reception will be held at the campus of the JKU in the University-Center on the second floor.



All sessions take place in "Room G", the welcome reception (Monday), coffee breaks and the packed lunch (Wednesday) will be served in "Room E" and some desks for further discussions are available in "Room F".



ORP3 office

Before and after the conference please contact:
Stefanie Kritzinger, Sabine Frank, Tanja Hintenaus
Production and Logistics Management
Johannes Kepler University Linz
Altenberger Straße 69
4040 Linz, Austria
[T] +43 732 2468 9465
[F] +43 732 2468 9422
[E] orp3@jku.at
[U] http://orp3.jku.at

During the conference please contact a member of the local organizing committee with the colored name badge. If there is none available, contact Stefanie Kritzinger: [T] +43 680 30 68 716.

Registration

The registration desk will be open at
Sunday. July 15: 17.00 - 20.00 at Hotel Sommerhaus (near reception)
Monday. July 16: 7.30 - 10.30 at the University-Center 2nd Floor, Johannes Kepler University Linz

Registration Fee, Badges

All participants are required to register. Registered individuals will receive an identification badge that authorizes them access to the workshop venue. Please wear your badge at all times when attending sessions or social events. In case you lose your badge, please contact a member of the local organizing committee to receive a new one.

The registration fee for a full **Participant** covers the following:

- Accommodation at hotel Sommerhaus from Sunday to Friday
- Workshop material (workshop program, data stick and other goodies)
- Participation and attendance to the scientific program (sessions)
- Vouchers for lunches (Monday (green), Tuesday (blue), Thursday (pink) and Friday (orange)) and a packed lunch (Wednesday)
- Coffee breaks between the sessions
- Welcome reception (Monday)
- Dinner at restaurant Auerhahn (Tuesday)
- Dinner at restaurant Promenadenhof (Thursday)
- Excursion to VOEST Alpine Steel Production including bus transfer (Wednesday)
- Boat trip on the river Danube including a traditional fish lunch (Wednesday)
- Ticket for public transport in Linz from Monday to Friday valid in combination with your badge

Internet access

Nearly the whole campus of the Johannes Kepler University Linz is provided with internet via wifi. You find the description of your individual internet access in the conference bag.

Session Chairs

The role of the Session Chair is to ensure the smooth running of the session. In particular, the Session Chair shall perform the following duties:

- Contact the talk contributors before the session to clarify who will be presenting and to preempt any technical problems.
- Open and close the session with a few short remarks.
- Introduce each speaker and the title of each presentation.
- Ensure that presentations are delivered in the order listed in the program.

- Act as a strict timekeeper and provide (if necessary) visual warnings to speakers as to the number of minutes left.
- Officiate the Q&A at the end of each talk.

Speakers

Although the duration of a presentation is 30 minutes (keynote talk 90 minutes), speakers should plan to leave at least 5 minutes (keynote talk 15 minutes) of remaining time for Q&A. Please feel free to bring along copies of your paper to distribute or to provide audience members a handout with relevant information.

The room will be equipped with standard video projector. A PC or laptop and a laser pointer provided by the organizers will be set up. This computers will have Microsoft Powerpoint and Adobe Acrobat Reader installed as well as USB ports for use with USB-portable memory devices (e.g., memory stick). Please be on time for your session and check in with the Session Chair.

In order to minimize setup time, speakers are kindly asked to upload and to test their presentation before the session starts. We encourage to have their presentation available on USB-portable devices. If necessary, you may also plug in your own laptop; however, make sure that you have the required adapters for external video output and the appropriate wall plug types for 230V/50Hz AC (European voltage applies). For any special requirements, please let us know well in advance.

Technical support will be available in the room to assist you if you encounter any problems during your presentation.

Welcome reception, coffee breaks and lunches

Coffee breaks, welcome reception (Monday) and packed lunch (Wednesday) will be served in Room E. Lunches (Monday, Tuesday, Thursday and Friday) will be on self-service in the canteen on the ground floor of the University-Center. Use the appropriate colored voucher for lunch: **Monday is green**, **Tuesday is blue**, **Thursday is pink** and **Friday is orange**. There are two possibilities to use the voucher:

1. **Menu** includes a soup, a salad, a main dish and a drink. As in July are holidays, there is only one menu available.
   Please exchange the voucher for a coin in the Cafeteria and use the coin to enter the queue.

2. **Choice**: Everyday there is a soup, buffet of salads and vegetables, a vegetarian dish, two other dishes (brainfood and meat dish) pasta, pizza, grilled food, a sweet dish and drinks.
   Pay with the appropriate voucher.

Overview of social events

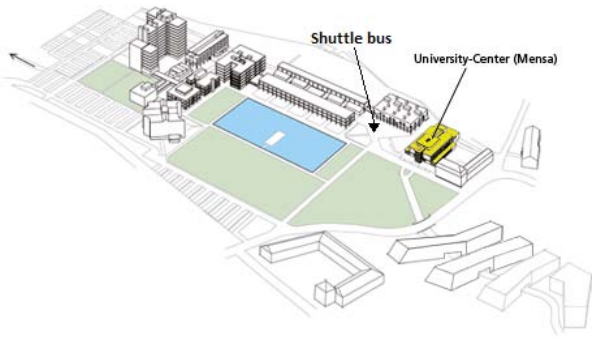
Monday. July 16, 18.00
On invitation of the major: Welcome reception at University-Center 2nd floor.

Tuesday. July 17, 19.30
Restaurant Auerhahn is a typical austrian restaurant located near the university and hotel Sommerhaus.
Address: Freistädter Straße 228, 4040 Linz, [U] http://www.auerhahn-linz.at

The easiest and fastest way is by foot. You can either find your way alone or follow the members of the local organizing committee:

from	meeting point	meeting time	time needed
hotel Sommerhaus	reception	19.00	20min

Wednesday. July 18, 12.00
Visit of VOEST Alpine Steel Production, [U] http://www.voestalpine.com.
The bus leaves from the Main Campus Library next to the University-Center at 12.00.



Before the visit, please read the security information of VOEST Alpine Steel Production: For your visit, we recommend you wear clothing that is not sensitive to dirt or particularly delicate. Please also wear sturdy shoes!
The guided tour starts at 13.00 and ends at 16.00. After the bus transfer to the Danube, the boat trip starts at 17.00 and ends at 19.00.

Thursday. July 19, 20.00
Restaurant Promenadenhof is a typical austrian restaurant located near the university.
Address: Promenade 39, 4020 Linz, [U] http://www.promenadenhof.at

The easiest and fastest way is by public transport. You can either find your way alone or follow the members of the local organizing committee:

from	meeting point	meeting time	time needed
hotel Sommerhaus	reception	19.15	30min

Scientific program

Monday. July 16, 2012

Monday 0: 08.00 - 08.30 **Workshop Opening**

Friedrich Roithmayr, Karl F. Dörner

Monday 1: 08.30 - 10.00 **Keynote Talk** Chair: Karl F. Dörner

Gilbert Laporte
Scheduling issues in vehicle routing

Monday 2: 10.30 - 12.00 Chair: Martin Grunewald

Mauro Dell'Amico, Eleni Hadjicostantinou, Manuel Iori, ***Stefano Novellani***
Optimization of a Bike Sharing System: Solving the Static Rebalancing Problem

Marco Oberscheider*, Jan Zazgornik, Christian Bugge Henriksen, Manfred Gronalt, Patrick Hirsch*
Minimizing driving times and greenhouse gas emissions in timber transport with a near-exact solution approach

Reut Bonshtain-Noham*, Michal Tzur*
The Single and Multi-Item Transshipment Problem with Fixed Transshipment Costs

Monday 3: 13.30 - 15.00 Chair: Nils-Hassan Quttineh

Martin Grunewald*, Thomas Volling, Thomas S. Spengler*
An integrated inventory-transportation system with periodic pick-ups and leveled replenishment

Stefan Vonolfen*, Michael Affenzeller*
Adaption of Waiting Strategies for Dynamic Pickup and Delivery Problems Using Historical Data

Ulrike Ritzinger*, Jakob Puchinger, and Richard Hartl*
Hybrid Metaheuristic for the Dial-a-Ride Problem

Monday 4: 15.30 - 16.30 Chair: Maria De Cola

Nils-Hassan Quttineh*, Torbjörn Larsson, Kristian Lundberg, Kaj Holmberg*
Military Aircraft Mission Planning - A Generalized Vehicle Routing Model with Synchronization and Precedence

Line Blander Reinhardt*, Tommy Clausen, David Pisinger*
Synchronized dial-a-ride transportation of disabled passengers at airports

Monday 5: 17.00 - 18.00 Chair: Agata Banaszewska

Maria De Cola*, Giovanni Felici, Marta Szachniuk*
The Orderly Colored Longest Path Problem

Ravi Kothari*, Diptesh Ghosh*
Tabu search for the single row facility layout problem using exhaustive 2-opt and insertion neighborhoods

Tuesday. July 17, 2012

Tuesday 1: 08.30 - 10.00 **Keynote Talk** Chair: Karl F. Dörner

Richard F. Hartl
Metaheuristics

Tuesday 2: 10.30 - 12.00 Chair: Alba Agustin

Agata Banaszewska*, Frans Cruijssen, J.G.A.J. (Jack) van der Vorst, Frits Claassen, Han Kampman*
A comprehensive Dairy Valorization Model

Mario Guajardo*, Martin Kylinger, Mikael Rönnqvist*
Divergent supply chain optimization: from a decoupled to an integrated planning approach

Renate Traxler*, Christian Almeder*
How to model and solve multi-level lot-sizing and scheduling problems?

Tuesday 3: 13.30 - 15.00 Chair: Joachim Schauer

Alba Agustin*, Angel A. Juan, Cesar Cuenca, Oscar Dominguez, Javier Faulin*
A Biased-Randomized Algorithm for solving the Two-Dimensional Loading Vehicle Routing Problem

Andrea Rendl*, Matthias Prandtstetter, Gerhard Hiermann, Jakob Puchinger, Günther Raidl*
A Hybrid Heuristic for Multimodal Homecare Scheduling

John D. Lees-Miller
Lower Bounds on Passenger Waiting Time in Personal Rapid Transit and Taxi Systems

Tuesday 4: 15.30 - 16.30 Chair: Xin Tang

***Joachim Schauer**, Cornelius Schwarz*
A generalized job-shop problem with multi-constrained operations

***Philipp Baumann**, Norbert Trautmann*
A hybrid approach to large-scale short-term scheduling in make-and-pack production

Tuesday 5: 17.00 - 18.00 Chair: Mor Kaspi

***Xin Tang**, Ameur Soukhal, Vincent T'kindt*
Preprocessing for a map sectorization problem by means of mathematical programming

Mariá C. V. Nascimento
A Novel Spectral Method for the Community Detection Problem

Wednesday. July 18, 2012

Wednesday 1: 08.30 - 10.00 **Keynote Talk** Chair: Richard F. Hartl

Paolo Toth
Models and Algorithms for Passenger Railway Optimization Problems

Wednesday 2: 10.30 - 11.30 Chair: Ward Romeijnders

***Mor Kaspi**, Tal Raviv*
Service-Oriented Line Planning and Timetabling for Passenger Trains

***Uğur Arıkan**, Sinan Gürel, M. Selim Aktürk*
Aircraft and Passenger Recovery with Cruise Speed Control

Thursday. July 19, 2012

Thursday 1: 08.30 - 10.00 **Keynote Talk** Chair: Xavier Gandibleux

Walter J. Gutjahr
Heuristic Techniques for Stochastic Combinatorial Optimization

Thursday 2: 10.30 - 12.00 Chair: Evrim Ursavas

***Ward Romeijnders**, Maarten H. van der Vlerk*
A Convex Three-Stage Approximation for Two-Stage Mixed-Integer Recourse Models: Concept and Initial Analysis

Jaroslav Janáček, ***Marek Kvet***
Dynamic Zone Adjustment for Approximate Approach to the p-Median Problem

***Anna Gustafsson**, Tobias Andersson Granberg*
Using variable neighborhood search to locate fire and rescue resources

Thursday 3: 13.30 - 15.00 Chair: Åsa Holm

Deniz Ozdemir, ***Evrim Ursavas***
Bi-objective Berth-Crane Allocation Problem

Nils Boysen, ***Simon Emde****, Malte Fliedner*
Determining crane areas for balancing workload among interfering and non-interfering cranes

Massimiliano Caramia, ***Renato Mari***
Lower bound improvements of penalty parameters for discrete - continuous linear bilevel problems reformulation

Thursday 4: 15.30 - 16.30 Chair: Gokhan Kirlik

Åsa Holm*, Åsa Carlsson Tedgren, Torbjörn Larsson*
Heuristics for Integrated Optimization of Catheter Positioning and Dwell Time Distribution in Prostate HDR Brachytherapy

Arieh Gavious, ***Dan Yamin***
Incentives' Effect in Influenza Vaccination Policy

Friday. July 20, 2012

Friday 1: 08.30 - 10.00 **Keynote Talk** Chair: Walter J. Gutjahr

Xavier Gandibleux
Multiobjective Optimization

Friday 2: 10.30 - 11.30 Chair: Stefano Novellani

Gokhan Kirlik*, Serpil Sayın*
A New Algorithm for Generating All Non-dominated Solutions for Multiobjective Discrete Optimization Problems

Rui Borges Lopes*, Carlos Ferreira, Beatriz Sousa Santos*
An interactive method for multi-objective integer and mixed integer programming

Abstracts

Monday. July 16, 2012

Monday 1: 08.30 - 10.00

Gilbert Laporte

Scheduling issues in vehicle routing

Most vehicle routing problems are solved with a distance minimization objective, subject to side constraints, without any consideration for vehicle scheduling. Yet, there are many practical situations where scheduling plays an important role and cannot be dissociated from the routing decisions. In this talk I will describe five routing problems on which I have worked over the past few years, together with a variety of colleagues and students, and in which scheduling plays a crucial role. These problems arise in

1. pickup and delivery operations, including dial-a-ride problems
2. ship routing and scheduling
3. green vehicle routing
4. long-haul vehicle routing with driver working rules
5. synchronized arc routing for snow ploughing

The talk will be centered on problem descriptions and insights, as opposed to algorithms.

Monday 2: 10.30 - 12.00

Mauro Dell'Amico, Eleni Hadjicostantinou, Manuel Iori, ***Stefano Novellani***

Optimization of a Bike Sharing System: Solving the Static Rebalancing Problem

We study a real-world bike sharing program arising in the town of Reggio Emilia, Italy, by analyzing the flows and behaviors of users for a seven-month period. The results we obtain show that users that pick up a bike from one station and leave it into another station are quite common. It is thus important to redistribute bicycles during the night, so as to achieve the best possible fillings for the stations for the next day. The resulting optimization problem, that we call Bike sharing Rebalancing Problem

(BRP), is to move bicycles among stations through a fleet of identical capacitated vehicles, with the aim of achieving the best possible fillings with a minimum transportation cost.
The BRP is a particular one-commodity pickup-and-delivery capacitated vehicle routing problem. To model it, we propose four mixed integer linear formulations, derived from classical results in the literature. All formulations have an exponential number of constraints, hence we solve them with branch-and-cut.
Apart from the Reggio Emilia test case, we also collected information from other bike sharing systems located in several cities, and created a set of benchmark instances for the newly introduced problem. This set is used to evaluate the branch-and-cut algorithms and obtain an interesting computational comparison of the four mathematical formulations.

***Marco Oberschneider**, Jan Zazgornik, Christian Bugge Henriksen, Manfred Gronalt, Patrick Hirsch*

Minimizing Driving Times and Greenhouse Gas Emissions in Timber Transport with a Near-Exact Solution Approach

In addition to minimizing driving times, the objective of reducing environmental impacts is discussed for an application in timber transport. Therefore, a new iterative near-exact solution approach (NE) for solving this specific multi depot vehicle routing problem with pick up and delivery and time windows is introduced. Small real life instances are solved to validate the optimality of the NE. For bigger problem instances a Tabu Search strategy with a dynamically alternating neighborhood structure is used as benchmark. The extensive numerical studies reveal the potential of the new approach and give interesting insights into the objective of reducing CO_2-equivalent emissions.

***Reut Bonshtain-Noham**, Michal Tzur*

The Single and Multi-Item Transshipment Problem with Fixed Transshipment Costs

This paper deals with supply chain systems in which lateral transshipments are allowed. For a system with two-retailers facing stochastic demand, we relax the assumption of negligible fixed transshipment costs, thus extending existing results for the single-item case and introducing a new model with multi items. The goal is to determine optimal transshipment and replenishment policies, such that the total centralized expected profit of both retailers is maximized. We first analyze the single-item problem with fixed transshipment costs, prove concavity for several special cases and find the optimal policy in these cases. We then extend our analysis to a problem with multi items with a joint fixed transshipment cost, which has not been investigated previously in the literature. For any number of items, we show how the optimality conditions may be extended. Due to the complexity involved in solving these conditions, we suggest a simple heuristic for the problem, which is based on the single-item results. In a numerical study we show that the suggested heuristic performs very well.

Monday 3: 13.30 - 15.00

***Martin Grunewald**, Thomas Volling, Thomas S. Spengler*

An Integrated Inventory-Transportation System with Periodic Pick-Ups and Leveled Replenishment

In this paper we develop a combined inventory-transportation system. The general idea is to integrate a simple replenishment policy with a routing component to derive operationally consistent standard routes as a basis for a milk-run design. The most interesting feature of the approach is that we combine stochastic vehicle routing with a replenishment policy which makes use of inventory to level the variability propagated into transportation operations. To evaluate the approach, we compare its performance with stochastic vehicle routing as well as sequential vehicle routing and replenishment planning. With respect to these approaches, substantial gains are achieved.

***Stefan Vonolfen**, Michael Affenzeller*

Adaption of Waiting Strategies for Dynamic Pickup and Delivery Problems Using Historical Data

Pickup and delivery problems have numerous applications in practice such as parcel delivery and passenger transportation. In the dynamic variant of the problem, not all information is available in advance but is revealed during the planning process. Thus it is crucial to anticipate future events in order to generate high-quality solutions. Previous work has shown, that the use of waiting strategies has the potential to save costs and maximize service quality. In this work, we propose a novel waiting strategy that can utilize historical data to consider anticipatory knowledge. We show how this data-based approach allows us to automatically adapt the strategy to different problem environments by simulation based evolution. We test our approach on standard benchmark instances and show that significant savings can be achieved by using waiting strategies that are adapted to a certain problem environment and utilize historical data. We also analyze the influence of spatial and temporal properties of problems to the potential savings that can be achieved by anticipatory waiting.

***Ulrike Ritzinger**, Jakob Puchinger, Richard Hartl*

Hybrid Metaheuristic for the Dial-a-Ride Problem

Considering the relative increase of the aging population, health care logistic become an increasingly important topic in recent years. An essential part is the organization of a specialized transportation system to perform transports for elderly and handicapped people. Usually, users place transportation requests with a specified pickup and delivery location and the requests have to be completed under user inconvenience considerations by a specified fleet of vehicles. This can be modeled as a dial-a-ride problem. In the dial-a-ride problem, the aim is to minimize the total travel times respecting time windows, maximum user ride times, and vehicle restrictions. In this paper, a restricted dynamic programming algorithm computing good starting solutions is proposed, as well as, a hybrid metaheuristic approach incorporating an exact dynamic programming algorithm. The results of the algorithm are tested on a set of benchmark instances from the literature.

Monday 4: 15.30 - 16.30

***Nils-Hassan Quttineh**, Torbjörn Larsson, Kristian Lundberg, Kaj Holmberg*

Military Aircraft Mission Planning - A Generalized Vehicle Routing Model with Synchronization and Precedence

We introduce a military aircraft mission planning problem where a given fleet of aircraft should attack a number of ground targets. Due to the nature of the attack, two aircraft need to rendez-vous at the target, that is, they need to be synchronized in both space and time. At the attack, one aircraft is launching a guided weapon, while the other is illuminating the target. Each target is associated with multiple attack and illumination options. Further, there may be precedence constraints between targets, limiting the order of the attacks. The objective is to maximize the outcome of the entire attack, while also minimizing the mission timespan. We give a linear mixed integer programming model of the problem, which can be characterized as a generalized vehicle routing problem with synchronization and precedence side constraints. Some results for small test cases are presented to verify the model.

***Line Blander Reinhardt**, Tommy Clausen, David Pisinger*

Synchronized Dial-a-Ride Transportation of Disabled Passengers at Airports

The largest airports have a daily average throughput of more than 500 passengers with reduced mobility. The problem of transporting these passengers is in some cases a multi-modal transportation problem with synchronization constraints. A description of the problem together with a mathematical model is presented. The objective is to schedule as many of the passengers as possible, while ensuring a smooth transport with short waiting times. A simulated annealing based heuristic for solving the problem is presented. The algorithm makes use of an abstract representation of a candidate solution which in each step is transformed to an actual schedule by use of a greedy heuristic. Local search is performed on the abstract representation using advanced neighborhoods which modify large parts of the candidate solution. Computational results show that the algorithm is able to find good solutions within a couple of minutes, making the algorithm applicable for dynamic scheduling. Moreover high-quality solutions can be obtained by running the algorithm for 10 minutes.

Monday 5: 17.00 - 18.00

***Maria De Cola**, Giovanni Felici, Marta Szachniuk*

the Orderly Colored Longest Path Problem

We consider the problem of finding a longest path in a graph where edges can have one out of c colors, under the constraints that the edges of the path must follow a given order of colors. The problem is referred to as the Orderly Colored Longest Path on a c-edge colored graph.
We consider two alternative models for this problem and then show its relations with other well known NP-complete problems.
The first model is based on a longest path problem in a n-partite graph with a number of partitions

equal to the number of vertices of the original graph, and additional constraints over the partition. The second model is a transformation of the latter, where the number of partite sets depends on the number of colors.
For both models an integer programming formulation is obtained straight-forwardly with a max flow problem on a directed graph with packing constraints over the partitions. Both models absorb the color information on the edges via the proper definition of the partitions and the edges of the graph; the first model is larger in size but, differently from the second one, is based on an acyclic graph.
A justification for this problem is found in an important bioinformatics application, related with the interpretation of NMR spectroscopy.
Both integer programming formulations have been implemented and compared on a set of randomly generated instances that respect the characteristics of RNA structure focused on NMR spectroscopy.

***Ravi Kothari**, Diptesh Ghosh*

Tabu Search for the Single Row Facility Layout Problem Using Exhaustive 2-opt and insertion neighborhoods

The single row facility layout problem (SRFLP) is the problem of arranging facilities with given lengths on a line, while minimizing the weighted sum of the distances between all pairs of facilities. The problem is NP-hard. In this paper, we present two tabu search implementations, one involving an exhaustive search of the 2-opt neighborhood and the other involving an exhaustive search of the insertion neighborhood. We also present techniques to significantly speed up the search of the two neighborhoods. Our computational experiments show that the speed up techniques are effective, and our tabu search implementations are competitive. Our tabu search implementations improved previously known best solutions for 24 out of the 40 large sized benchmark SRFLP instances.

Tuesday. July 17, 2012

Tuesday 1: 08.30 - 10.00

Richard F. Hartl

Metaheuristics

For np-hard combinatorial optimization problems that frequently arise in production, logistics, and transportation exact solution methods are only applicable up to a certain problem size. On the other hand, simple constructive heuristics and improvement heuristics can be used to obtain good solutions quickly. These heuristics are typically tailored to a certain application area and are likely to get stuck in a local optimum. Since a few decades researchers have tried to approach the global optimal solution by proposing some general purpose metaheuristics.
Many such metaheuristics have been developed. Some are nature inspired, some are population based, and most of them are stochastic. Some are constructive; others are based on local search. The talk will briefly mention the historical development and give an overview of the most popular and successful metaheuristics. It will be pointed out that the key success factor is to strike a proper balance between diversification (i.e. coverage of all regions of the search space) and intensification (i.e. more aggressive search for a close local optimum).

Tuesday 2: 10.30 - 12.00

***Agata Banaszewska**, Frans Cruijssen, J.G.A.J.(Jack) van der Vorst, Frits Claassen, Han Kampman*

A Comprehensive Dairy Valorization Model

Every day dairy processors face numerous challenges resulting both from unsteady dairy markets and from specific characteristics of dairy supply chains. To maintain a competitive position on the market companies must look beyond standard solutions that are currently used in practice. This paper presents a comprehensive Dairy Valorization Model, which serves as a decision support tool for mid-term allocation of raw milk to end products and production planning. The developed model is used to identify the optimal product portfolio composition. In other words, the model allocates raw milk to the most profitable dairy products, while taking important constraints into account, i.e.: recipes, composition variations, dairy production interdependencies, seasonality, demand, supply, capacities, and transportation. The model is tested at the international dairy processor FrieslandCampina. To illustrate the functionality of the model the impact of seasonality, which is indicated in literature as a key aspect for valorization, is analyzed. Results indeed show that seasonality has a large impact on the valorization of raw milk, because it affects the choice and volumes of products to be produced.

***Mario Guajardo**, Martin Kylinger, Mikael Rönnqvist*

Divergent Supply Chain Optimization: from a Decoupled to an Integrated Planning Approach

We study a problem of tactical planning in a divergent supply chain. It involves decisions regarding

production, inventory, internal transportation, sales and distribution to customers. The problem is motivated by the context of a company in the speciality oils industry. The overall objective at tactical level is to maximize contribution and, in order to achieve this, the planning has been divided into two separate problems. The first problem concerns sales where the final sales and distribution planning is decentralized to individual sellers. The second problem concerns production, transportation and inventory planning through refineries, hubs and depots and is managed centrally with the aim of minimizing costs. Due to this decoupling, the solution of the two problems needs to be coordinated in order to achieve the overall objective. In the company, this is pursued through an internal price system aiming at giving the sellers the incentives needed to align their decisions with the overall objective. We propose and discuss linear programming models for the decoupled and integrated planning problems. We present numerical examples to illustrate potential effects of integration and coordination and discuss the advantages and disadvantages of the integrated over the decoupled approach. While the total contribution is higher in the integrated approach, it has also been found that the sellers' contribution can be considerably lower. Therefore, we also suggest contribution sharing rules to achieve that both the company and sellers get a better outcome under the integrated planning.

***Renate Traxler**, Christian Almeder*

How to Model and Solve Multi-Level Lot-Sizing and Scheduling Problems?

Determining lot sizes is an essential step during the material requirements planning phase influencing costs and lead time of a production system. It is well-known that lot-sizing and scheduling decisions are intertwined. If this relation is neglected, inefficient - sometimes infeasible - plans are the consequence. In this work we compare different approaches for integrating the lot-sizing and the scheduling decisions in multi-stage systems. For that purpose, we consider different models adapted from the research literature and show their abilities and limitations in describing relevant aspects of a production environment. Furthermore, we show the computational behavior of the models by applying them to benchmark instances using a standard optimization software. The structural and numerical comparisons show that there are considerable differences between the approaches. They allow us to provide a guideline for selecting the right modeling approach for different planning situations.

Tuesday 3: 13.30 - 15.00

***Alba Agustin**, Angel A. Juan, Cesar Cuenca, Oscar Dominguez, Javier Faulin*

A Biased-Randomized algorithm for Solving the Two-Dimensional Loading Vehicle Routing Problem

This work introduces a biased-randomized algorithm for solving the capacitated vehicle routing problem with two-dimensional loading (2LCVRP). The proposed algorithm deals with the combination of two of the most important problems in logistics, i.e. vehicle routing and vehicle packing. The algorithm uses a multi-start approach, which is both designed to avoid local minima and also to make the algorithm an embarrassingly parallelizable one. At each restart, the algorithm will apply a biased randomization Clarke and Wright saving matrix and will merge routes that minimize distance costs and ensure loading feasibility, such that each customer demand is satisfied. Some experimental results contribute to validate our approach as a promising one, both in terms of the quality of the solutions as in terms of the computational time needed to obtain them.

***Andrea Rendl**, Matthias Prandtstetter, Gerhard Hiermann, Jakob Puchinger, Günther Raidl*

A Hybrid Heuristic for Multimodal Homecare Scheduling

In this work we consider solving a large-scale real-world multimodal homecare scheduling problem (MHS), where the objective is to find a roster for homecare nurses that travel from patient to patient in a tour, using different modes of transport, respecting a set of side constraints, and maximising customer, nurse and employer satisfaction. We tackle the problem using a metaheuristical approach, where in a first step, we generate a valid initial solution using Constraint Programming (CP) and in a second step we use different metaheuristics to improve the solution. We present a novel and efficient CP-model for the MHS and introduce an effective clustering technique to decompose the problem into simpler subproblems by which valid initial solutions can be generated in very little time. Our experimental results show how the metaheuristics' performance is considerably improved by using valid initial solutions and produce useful rosters for the MHS Problem.

John D. Lees-Miller

Lower Bounds on Passenger Waiting Time in Personal Rapid Transit and Taxi Systems

Personal Rapid Transit (PRT) is an emerging urban transport mode. A PRT system operates much like a conventional hackney taxi system, except that the vehicles are driven by computer (no human driver) between stations in a dedicated network of guideways. The world's first two PRT systems began operating in late 2010 and early 2011. In both PRT and taxi systems, passengers request immediate service (they do not book ahead), so perfect information about future requests is not available, but statistical information about future requests is available from historical data. If the system does not use this statistical information to position empty vehicles in anticipation of future requests, long passenger waiting times result, which makes the system less attractive to passengers, but using it gives rise to a difficult stochastic optimisation problem. This paper develops three lower bounds on achievable mean passenger waiting time, one based on queueing theory, one based on the static problem, in which it is assumed that perfect information is available, and one based on a Markov Decision Process model. Evaluation of these lower bounds, together with a practical heuristic developed previously, in simulation shows that these lower bounds can often be nearly attained, particularly when the fleet size is large. The results also show that low waiting times and (fairly) high utilisation can be simultaneously obtained when the fleet size is large, which suggests important economies of scale.

Tuesday 4: 15.30 - 16.30

***Joachim Schauer**, Cornelius Schwarz*

A Generalized Job-Shop Problem with Multi-Constrained Operations

We study a generalized job-shop problem called the Laser Sharing Problem with fixed tours (LSPT) where the operations may need more than one "machine" simultaneously. This property is used for taking possible collisions between industrial robots into account. For three jobs we will show that the special case where only one machine is used by more than one job is already NP-hard. This also implies that one machine scheduling with chained min delay precedence constraints is NP-hard for at least three chains. On the positive side, we present a polynomial algorithm for the two job case and

a pseudo-polynomial algorithm together with an FPTAS for an arbitrary but constant number of jobs. This gives a sharp boundary of the complexity status for a constant number of jobs.

***Philipp Baumann**, Norbert Trautmann*

A Hybrid Approach to Large-Scale Short-Term Scheduling in Make-and-Pack Production

We investigate short-term scheduling of industrial make-and-pack production processes. The planning problem consists of minimizing the production makespan while meeting given end-product demands. A large number of operations, sequence-dependent changeover times, multi-purpose storage units with finite capacities, batch splitting, quarantine times, partial equipment connectivity, and material transfer times render the problem a challenging task. Known MILP formulations for such production processes can solve only small and medium-sized problem instances in reasonable CPU times. In this paper, we present a hybrid heuristic approach to tackle large-scale instances. Under this approach, the set of batches is divided into several subsets according to a priority rule. The subsets are then scheduled iteratively using a MILP model. We enhance the performance of the heuristic by eliminating redundant constraints and variables after each iteration. The applicability of the proposed heuristic is demonstrated by means of a real-world production process.

Tuesday 5: 17.00 - 18.00

***Xin Tang**, Ameur Soukhal, Vincent T'kindt*

Preprocessing for a Map Sectorization Problem

The sectorization problem is a particular case of partition problems occurring in cartography. The aim is to partition a territory into sectors such that the statistical activity measure of each sector is as close as possible to a given target value. We model this as a problem of minimizing the maximum deviation among all the sectors between their activity measure and their target value. We propose a mathematical programming formulation for the problem, we add some valid inequalities to restrict the solution space and develop a preprocessing procedure to reduce the number of variables. Computational results on different maps highlight the strong efficiency of this reduction procedure.

Mariá C. V. Nascimento

A Novel Spectral Method for the Community Detection Problem

The community detection problem in networks consists in determining a clustering of "related" vertices in a graph or network. Nowadays, studies involving this problem are composed primarily of modularity maximization based heuristics. One of the major reasons for such is the appealing results obtained by these heuristics. Nevertheless, new developments in literature suggest some drawbacks of the modularity maximization problem. Accordingly, alternatives to the community detection in networks must be and have been provided to overcome the limitations of other approaches and, most important, to give new insights to the community detection problem. In this paper, the author propose integer programs to detect communities in networks as well as a spectral algorithm to heuristically solve them. The computational experiments indicate a very successful performance of the proposed heuristic, mainly for weighted graphs. In these experiments, the results of the proposed heuristic are compared with the best graph clustering algorithm according to an study from literature.

Wednesday. July 18, 2012

Wednesday 1: 08.30 - 10.00

Paolo Toth

Models and Algorithms for Passenger Railway Optimization Problems

Passenger railway systems are highly complex systems requiring the solution of several planning problems that can be analyzed and solved through the application of mathematical models and optimization techniques, which generally lead to an improvement in the performance of the system, and as well to a reduction in the time required for solving these problems.
The planning process is generally divided into several phases: Line Planning, Train Timetabling, Train Platforming, Rolling Stock Circulation and Crew Planning. In this lecture, after a description of the whole planning process and of its main phases, the Platforming and Rolling Stock Circulation phases are considered in more detail.
In the Train Platforming Problem, which is the routing problem following the timetabling phase (where the timetable for each train has been fixed), we are given a set of timetabled trains, and the objective is to find the best assignment of the trains to the platforms (and to the routing paths connecting the arrival/departure tracks to the assigned platforms) in a railway station. We consider a general formulation of the problem, which contains as special cases all the versions previously considered in the literature, as well as a case study from the main Italian Infrastructure Manager. An Integer Linear Programming (ILP) formulation is presented, and a column generation procedure is proposed for the solution of the corresponding continuous relaxation. An effective heuristic algorithm, driven by the continuous relaxation of the ILP formulation, is proposed as well. Computational results on real-world instances are reported.
An important problem, arising in the Rolling Stock Circulation phase, is the Train-Unit Assignment Problem. A train unit consists of a self-contained train with an engine and a set of wagons with passenger seats. The Train-Unit Assignment Problem calls for the definition of the "best" train units to be assigned to a given set of timetabled trips, each with a given number of passenger seats requested. Heuristic algorithms based on the solution of Integer Linear Programming models are presented. The heuristics are combined with local search procedures to improve the best solution found. Computational results on real-world instances are reported.

Wednesday 2: 10.30 - 11.30

***Mor Kaspi**, Tal Raviv*

Service-Oriented Line Planning and Timetabling for Passenger Trains

An integrated line planning and timetabling model is formulated with the objective of minimizing both user inconvenience and operational costs. User inconvenience is modeled as the total time passengers spend in a railway system, including waiting at origin and transfer stations. The model is solved using a Cross-Entropy metaheuristic. The line plan and timetable of Israel Railways is used as a benchmark. Using the same amount of resources, the average journey time of passengers is reduced by 20%.

***Uğur Arıkan**, Sinan Gürel, M. Selim Aktürk*

Aircraft and Passenger Recovery with Cruise Speed Control

Disruptions in airline operations can result in infeasibilities in aircraft and passenger schedules. Airlines typically recover aircraft schedules and disruptions in passenger itineraries, sequentially. However, passengers are severely affected by disruptions and recovery decisions. In this paper, we present a mathematical formulation for aircraft and passenger recovery problem that considers aircraft and passenger related costs simultaneously. Passenger itineraries are explicitly modeled and detailed passenger recovery plans are created. In addition to the common routing recovery actions, we integrate several passenger recovery actions and cruise speed control in our solution approach. Cruise speed control is a very beneficial action for mitigating delays. On the other hand, it adds complexity to the problem due to the nonlinearity in fuel cost function. The problem is formulated as a mixed integer nonlinear programming (MINLP) model. We first linearize the nonlinear objective function, and then show that modified model is second-order conic quadratic (SOCP) representable. We generate conic quadratic constraints to solve the problem with commercial MIP solvers such as CPLEX. We test our approach using publicly available schedules of a major U.S. airline. About 97% of the test problems are solved to optimality within 41 seconds on the average. We conclude that proposed approach is able to find optimal tradeoff between operating and passenger-related costs in real time.

Thursday. July 19, 2012

Thursday 1: 08.30 - 10.00

Walter J. Gutjahr

Heuristic Techniques for Stochastic Combinatorial Optimization

The tutorial starts with a very short recapitulation of the most important types of stochastic combinatorial optimization (SCO) problems, as they occur in production, logistics, scheduling, facility location, energy, environment, healthcare management, telecommunication and other areas. Since in many cases, already the deterministic counterparts of these problems are NP-hard and can often not be solved exactly, it is no surprise that also in the SCO domain, problem instances of realistic size and complexity frequently require heuristic solution techniques. The tutorial addresses some approximate or heuristic SCO solution approaches either derived from exact methods (as branch-and-bound or progressive hedging) or from prominent metaheuristics (as variants of local search, simulated annealing, evolutionary algorithms, or swarm intelligence algorithms). Special emphasis is given to a discussion of fixed-sample and variable-sample Monte Carlo techniques in SCO. Known results on analytical properties of the considered SCO algorithms are indicated. Finally, a short outline of multi-objective SCO problems and their solution is provided.

Thursday 2: 10.30 - 12.00

***Ward Romeijnders**, Maarten H. van der Vlerk*

A Convex Three-Stage Approximation for Two-Stage Mixed-Integer Recourse Models: Concept and Initial Analysis

In this paper we discuss a new solution method for solving mixed-integer recourse models. This new solution method approximates mixed-integer recourse models by using the results of Van der Vlerk (2004) for pure integer recourse models. We investigate the characteristics of this approximation and prove a uniform error bound for the case of simple mixed-integer recourse. In addition to results that support the use of our new method, we also show that the main theorem in Van der Vlerk (2004) is incorrect. This questions not only the performance of our new solution method, but also the performance of the existing method for pure integer recourse models.

*Jaroslav Janáček, **Marek Kvet***

Dynamic Zone Adjustment for Approximate Approach to the p-Median Problem

This paper deals with the problem of designing the optimal structure of most public service systems. This task is often formulated as a p-median problem and described by a location-allocation model. Real instances of these problems are characterized by considerably big number of possible service center locations, which can take the value of several hundreds or thousands. Current exact approaches to the p-median problem must face up to big demand on computational time and often fail when a large instance is solved. In this contribution, we present an approximate method based on a reformu-

lation of the p-median problem to a case of well solvable covering problem. This approach uses an approximation of a common distance by some pre-determined distances given by so called dividing points. Deployment of dividing points influences the accuracy of the solution. To improve this approach, we have developed a sequential method of dividing points deployment. We study here the accuracy of suggested method using the upper and lower distance approximation in comparison to saved computational time.

__Anna Gustafsson__, Tobias Andersson Grandberg

Using Variable Neighborhood Search to Locate Fire and Rescue Resources

To utilize fire and rescue resources effectively, an essential issue is the resources' strategic location. An adequate location can reduce response times to accidents, which is one of the most important factors in the rescue effort. A mathematical model is developed for locating a fixed number of fire and rescue resources in order to minimize response times to different types of accidents. The model considers both the response time when the first resource arrive to an accident as well as the time when all the requested resources have arrived to the accident site. The response time can be weighted to obtain solutions with different characteristics. Solutions to the model are produced by a reduced variable neighborhood search heuristic. The work is based on a case study that attempts to locate fire and rescue resources in the county of Östergötland in Sweden in order to minimize the response time to housing fires and traffic accidents. Results for a number of scenarios with different characteristics are presented and these may serve as a basis for strategic decisions concerning rescue resource management in the county.

Thursday 3: 13.30 - 15.00

Deniz Ozdemir, __Evrim Ursavas__

Bi-Objective Berth-Crane Allocation Problem

This study attempts to simultaneously determine the berthing and crane allocations under objectives of minimizing the total service time and cost of crane setups. We contribute to the literature both in theory and in practice by formulating the problem as a bi-objective integer linear programming model embedding realistic issues raised by port authorities and proposing a solution algorithm that incorporates existing optimization solver with a scalarization technique, namely, ε-constraint method. Consequently, we provide the non-dominated berth-crane assignments and schedules as Pareto optimal front that can be used as a decision support tool. We demonstrate the effectiveness of our solution algorithm through a real case study and report a meaningful set of optimal solutions.

Nils Boysen, __Simon Emde__, Malte Fliedner

Determining Crane Areas for Balancing Workload Among Interfering and Non-Interfering Cranes

This paper treats the problem of subdividing an area for storing containers, such that the workload is evenly shared among the cranes operating the resulting subareas. We consider two crane sets: while

non-crossing constraints between cranes of the same set need to be observed, cranes of different sets do not interfere. Such a problem setting is, for instance, relevant for scheduling the (un-)loading of vessels by parallel quay cranes operating on opposing berths or in container yards with cross-over cranes. We formalize the resulting optimization problem, prove computational complexity, and present exact and heuristic solution procedures.

Massimiliano Caramia, ***Renato Mari***

Lower Bound Improvements of Penalty Parameters for Discrete-Continuous linear bilevel Problems Reformulation

In this paper we consider a particular class of linear bilevel problems in which the variables controlled by the leader are required to be discrete. It is a well known result that such a problem is equivalent to a continuous linear bilevel problem in which the integrality requirements are relaxed and the leader's objective function is modified including a concave penalty function weighted by a parameter μ. This equivalence is true for a sufficiently large value of μ. A valid lower bound for μ is already known. In this paper we provide two improvements of this existing lower bound and experiment the two new lower bounds on a set of test problems.

Thursday 4: 15.30 - 16.30

Åsa ***Holm****, Åsa Carlsson Tedgren, Torbjörn Larsson*

Heuristics for Integrated Optimization of Catheter Positiioning and Dwell Time Distribution in Prostate HDR Brachytherapy

High dose-rate (HDR) brachytherapy is a kind of radiotherapy used to treat, among others, prostate cancer. When applied to prostate cancer a radioactive source is moved through catheters implanted into the prostate. For each patient a treatment plan is constructed that decide for example catheter positions and dwell time distribution, that is where to stop the radioactive source and for how long.
Mathematical optimization methods have been used to find quality plans with respect to dwell time distribution; however few optimization approaches regarding catheter positioning have been studied. In this article we present an integrated optimization model that optimize catheter positioning and dwell time distribution simultaneously. Our results show that integrating the two decisions yields greatly improved plans, from 15% to 94% improvement.
Since the presented model is computationally demanding to solve we also present three heuristics: tabu search, variable neighbourhood search and genetic algorithm. Of these variable neighbourhood search is clearly the best, outperforming a state-of-the-art optimization software (CPLEX) and the two other heuristics.

Arieh Gavious, ***Dan Yamin***

Incentives' Effect in Influenza Vaccination Policy

In the majority of developed countries, the level of influenza vaccination coverage in all age groups is sub-optimal. Hence, the authorities offer different kinds of incentives for people to become inocu-

lated such as subsidizing immunization or placing immunization centers in malls to make the process more accessible. We built a theoretical epidemiological game model to find the optimal incentive for inoculation and the corresponding expected level of vaccination coverage. The model was supported by survey data from questionnaires about people's perceptions about influenza and the vaccination against it. Results suggest that the optimal magnitude of the incentives should be greater when less contagious seasonal strains of influenza are involved, greater for the non-elderly population rather than the elderly, and should rise as high as $60 per inoculated individual so that all children between the ages of six months and four years will be inoculated.

Friday. July 18, 2012

Friday 1: 08.30 - 10.00

Xavier Gandibleux

Multiobjective Optimization

The development of efficient exact algorithms for Multi-Objective Combinatorial Optimization (MOCO) problems is a central research topic in operations research. Major advances have been recorded these last 10 years. One example is the two phase method which is now able to deal with situations presenting more than two objectives. Another example is the definition of the multi-objective branch and bound principle and its successful applications on several optimization problems. Nevertheless, real-life applications complexify the picture. Large scale multiple objective combinatorial optimization problems, and/or formulation combining continuous and discrete variables have to be considered.
This talk introduces some recent advances and open questions in that field, and develops an example of recent exact algorithms proposed.

Friday 2: 10.30 - 11.30

***Gokhan Kirlik**, Serpil Sayın*

A New Algorithm for Generating All Non-dominated Solutions for Multiobjective Discrete Optimization Problems

Most of the real-life decision-making activities require more than one objective to be considered. Therefore, several studies have been presented in the literature considering multiple objectives in decision models. In a mathematical programming context, the majority of these studies deal with two objective functions which is known as bicriteria optimization, while few of them consider more than two objective functions. In this study, a new algorithm is proposed to generate all non-dominated solutions for multiobjective discrete optimization problems with any number of objective functions. In this algorithm, the search is managed over (p - 1)-dimensional rectangles where p represents the number of objectives in the problem and for each rectangle two-stage optimization problems are solved. The algorithm is motivated by the well-known ε-constraint scalarization. The algorithm is compared with former studies on multiobjective knapsack and multiobjective assignment problem instances. The method is highly competitive in terms of solution time and the number of optimization models solved.

***Rui Borges Lopes**, Carlos Ferreira, Beatriz Sousa Santos*

An Interactive Method for Multi-Objective Integer and Mixed Integer Programming

This paper proposes an interactive method, following an open communication protocol, for multi-objective integer and mixed integer programming. In each step of the human/computer dialogue, the decision maker (DM) provides indications about the subregions she/he desires to continue the search for non-dominated solutions. The method enables to progressively eliminate criteria regions, either by dominance or unfeasibility, and ends when the DM considers to have sufficient knowledge about the

set of non-dominated solutions. The proposed method is applied to a facility location problem (the set covering problem).

Name	University, Country	Email
Alba Agustin	IN3-Open University of Catalonia, Spain	albamaria.agustin@unavarra.es
Uğur Arıkan	Middle East Technical University, Turkey	arikan@ie.metu.edu.tr
Agata Banaszewska	Wageningen University and Research Centre, The Netherlands	agata.banaszewska@wur.nl
Philipp Baumann	University of Bern, Switzerland	philipp.baumann@pqm.unibe.ch
Reut Bonshtain-Noham	Tel-Aviv University, Israel	reutbons@post.tau.ac.il
Maria De Cola	University of Rome La Sapienza, Italy	mariacristina.decola@uniroma1.it
Simon Emde	Friedrich-Schiller-Universität Jena, Germany	Simon.Emde@uni-jena.de
Xavier Gandibleux	University of Nantes, France	Xavier.Gandibleux@univ-nantes.fr
Martin Grunewald	TU Braunschweig, Germany	m.grunewald@tu-bs.de
Walter J. Gutjahr	University of Vienna, Austria	walter.gutjahr@univie.ac.at
Mario Guajardo	NHH Norwegian School of Economics, Norway	Mario.Guajardo@nhh.no
Anna Gustafsson	Linköping University, Sweden	anna.gustafsson@liu.se
Richard F. Hartl	University of Vienna, Austria	richard.hartl@univie.ac.at
Åsa Holm	Linköping University, Sweden	asa.holm@liu.se
Mor Kaspi	Tel-Aviv University, Israel	morkaspi@post.tau.ac.il
Gokhan Kirlik	Koç University, Turkey	gkirlik@ku.edu.tr
Ravi Kothari	Indian Institute of Management Ahmedabad, India	ravikothari@iimahd.ernet.in
Marek Kvet	University of Žilina, Slovak Republic	Marek.Kvet@fri.uniza.sk
Gilbert Laporte	CIRRELT Montreal, Canada	Gilbert.Laporte@cirrelt.ca
John Lees-Miller	University of Southampton, United Kingdom	jdleesmiller@gmail.com
Rui Borges Lopes	University of Aveiro, Portugal	rui.borges@ua.pt
Renato Mari	University of Rome "Tor Vergata", Italy	mari@disp.uniroma2.it
Mariá C.V. Nascimento	Federal University of São Paulo, Brazil	mcv.nascimento@unifesp.br
Stefano Novellani	University of Bologna, Italy	stefano.novellani@gmail.com
Marco Oberscheider	University of Natural Resources and Life Sciences, Austria	marco.oberscheider@boku.ac.at
Nils-Hassan Quttineh	Linköping University, Sweden	nils-hassan.quttineh@liu.se
Line Blander Reinhardt	Technical University of Denmark, Denmark	lbre@dtu.dk
Andrea Rendl	AIT - Austrian Institute of Technology, Austria	Andrea.Rendl@ait.ac.at
Ulrike Ritzinger	AIT - Austrian Institute of Technology, Austria	Ulrike.Ritzinger.fl@ait.ac.at
Ward Romeijnders	University of Groningen, The Netherlands	w.romeijnders@rug.nl
Joachim Schauer	University of Graz, Austria	joachim.schauer@uni-graz.at
Xin Tang	University François Rabelais Tours, France	xin.tang@etu.univ-tours.fr
Paolo Toth	University of Bologna, Italy	paolo.toth@unibo.it
Renate Traxler	European University Viadrina, Germany	Traxler@europa-uni.de
Evrim Ursavas Guldogan	Yasar University, Turkey	evrim.guldogan@yasar.edu.tr
Stefan Vonolfen	FH Hagenberg, Austria	Stefan.Vonolfen@fh-hagenberg.at
Dan Yamin	Ben-Gurion University, Israel	dan.yamin@gmail.com

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Event time line

DATE	TIME	EVENT
Sunday. July 15	17.00 – 20.00	Registration desk at Hotel Sommerhaus
Monday. July 16	07.30 – 10.30	Registration desk at the "Uni-Center"
	08.00 – 08.30	Workshop Opening
	08.30 – 10.00	Keynote Talk
	10.00 – 10.30	Coffee break
	10.30 – 12.00	Session Monday 1
	12.00 – 13.30	Lunch
	13.30 – 15.00	Session Monday 2
	15.00 – 15.30	Coffee break
	15.30 – 16.30	Session Monday 3
	16.30 – 17.00	Coffee break
	17.00 – 18.00	Session Monday 4
	18.00	Welcome reception
Tuesday. July 17	08.30 – 10.00	Keynote Talk
	10.00 – 10.30	Coffee break
	10.30 – 12.00	Session Tuesday 1
	12.00 – 13.30	Lunch
	13.30 – 15.00	Session Tuesday 2
	15.00 – 15.30	Coffee break
	15.30 – 16.30	Session Tuesday 3
	16.30 – 17.00	Coffee break
	17.00 – 18.00	Session Tuesday 4
	19.30	Dinner at restaurant "Auerhahn"
Wednesday. July 18	08.30 – 10.00	Keynote Talk
	10.00 – 10.30	Coffee break
	10.30 – 11.30	Session Wednesday 1
	11.30 – 12.00	Packed lunch
	12.00 – 16.00	Visit of VOEST Alpine Steel production
	17.00 – 19.00	Boat trip on the river Danube
Thursday. July 19	08.30 – 10.00	Keynote Talk
	10.00 – 10.30	Coffee break
	10.30 – 12.00	Session Thursday 1
	12.00 – 13.30	Lunch
	13.30 – 15.00	Session Thursday 2
	15.00 – 15.30	Coffee break
	15.30 – 16.30	Session Thursday 3
	20.00	Dinner at restaurant "Promenadenhof"
Friday. July 20	08.30 – 10.00	Keynote Talk
	10.00 – 10.30	Coffee break
	10.30 – 11.30	Session Friday 1
	11.30 – 13.00	Lunch