36. Südwest-Doktorandenworkshop für quantitative Methoden an der Goethe-Universität Frankfurt

11. Oktober 2013

Campus Westend
Hörsaalgebäude
Raum HZ 12

Detlef-Hübner-Stiftungslehrstuhl für Betriebswirtschaftslehre, insbesondere Logistik und Supply-Chain-Management
Prof. Dr. Achim Koberstein

mit freundlicher Unterstützung der
ORCONOMY GmbH Paderborn

GOETHE UNIVERSITÄT FRANKFURT AM MAIN

Programm

VORMITTAG

9:30 Uhr — Eintreffen der Teilnehmer
Kaffee und kleines Frühstück

9:50 Uhr — Begrüßung
Achim Koberstein

1. Sitzung

Moderation: Achim Koberstein, Goethe-Uni Frankfurt

10:00 Uhr — **Granular Tabu Search for the Vehicle Routing Problem with Time Windows**
Fabian Schwahn, TU Darmstadt, Lst. Schneider

10:30 Uhr — **Wertorientierter Newsvendor**
Gerd Hahn, Uni Mannheim

11:00 Uhr — **Algorithms for Practical Districting Problems**
Alex Butsch, KIT, Lst. Nickel

11:30 Uhr — Kaffeepause

2. Sitzung

Moderation: Raik Stolletz, Uni Mannheim

11:45 Uhr — **Vehicle Routing Problem mit alternativen Perioden und Teillieferungen**
Heiko Breier, KIT, Lst. Furmanns

12:15 Uhr — **Master Surgical Scheduling bei stochastischen Operationszeiten**
Alexander Kressner, Uni Hohenheim, Lst. Schimmelpfeng

12:45 Uhr — Mittagspause
Gemeinsames Mittagessen im Restaurant „Sturm und Drang“ im selben Gebäude

NACHMITTAG

3. Sitzung

Moderation: Stefan Irnich, Uni Mainz

13:45 Uhr	Vortrag ORCONOMY
14:15 Uhr	**Applicability of advanced demand information in forecasting future demand for a supply chain** *Robert Zander, Uni Hohenheim, Lst. Meyr*
14:45 Uhr	Kaffeepause

4. Sitzung

Moderation: Katja Schimmelpfeng, Uni Hohenheim

15:00 Uhr	**Dynamic Programming Formulation for the Minimum Tour Duration Problem** *Christian Tilk, Uni Mainz, Lst. Irnich*
15:30 Uhr	**On-line algorithms for portfolio and conversion problems** *Robert Dochow, Uni des Saarlandes, Lst. Schmidt*
16:00 Uhr	Verabschiedung *Achim Koberstein*

Vortragsdauer: 20 Min. + 10 Min. Diskussion

Abstracts

Granular Tabu Search for the Vehicle Routing Problem with Time Windows

Fabian Schwahn, TU Darmstadt, Lst. Schneider

One way to improve the runtime of local-search based metaheuristics without compromising solution quality is the use of granular neighborhoods. So-called sparsification methods are applied to restrict the neighborhoods to include only elements which are likely to be part of high-quality solutions. The effectiveness of this approach has been shown in earlier works, e.g. for the Capacitated Vehicle Routing Problem.

This paper studies the application of granular neighborhoods for the Vehicle Routing Problem with Time Windows (VRPTW). We develop a tabu search (TS) method and investigate the effectiveness of several sparsification methods. Here, both heuristic measures that trade off travel distance and waiting time as well as reduced cost measures based on solutions of different assignment problems and network relaxations are studied. Moreover, we analyze the impact of the granular neighborhood size, which is defined as a percentage of the complete neighborhood, on the solution quality and runtime of our method. Finally, we investigate how dynamically altering neighborhood sizes can be used to assist diversification and intensification of the search.

With the right combination of sparsification method and neighborhood size, our TS is able to find high quality solutions for the notoriously hard VRPTW test instances of Solomon, achieving the best-known vehicle number of 405. The solution quality in terms of traveled distance is only marginally worse compared to the TS with regular, complete neighborhood (the average gap is below 1%), while runtime is reduced threefold.

Wertorientierter Newsvendor

Gerd Hahn, Uni Mannheim

Approaches for value-based management (VBM) are widely discussed in theory and practice to derive strategic and operational business decisions that ultimately increase shareholder value. In this presentation, we examine Economic Value Added (EVA) as a prevalent performance measurement concept in VBM and use the well-known newsvendor model to analyze corresponding optimal operations and financing decisions. The Capital Asset Pricing Model (CAPM) is applied to determine risk-adjusted weighted average cost of capital. Considering corporate taxes and bankruptcy costs, we investigate the setting of the “centralized firm” as well as the “decentralized supply chain” and shed light on the problem of managerial incentives when management control is also decentralized. Numerical examples are provided to illustrate the analytical findings.

Algorithms for Practical Districting Problems

Alex Butsch, KIT, Lst. Nickel

Districting or territory design is the task of grouping small geographic areas (so called basic areas) into larger geographic clusters (so called territories or districts) in a way that the latter are acceptable with respect to relevant planning criteria. Districting problems are motivated by quite different applications like the design of political boundaries, sales districts, police districts, school districts, home health care districts, districts for waste collection or winter road maintenance. Examples for basic areas are counties, zip code areas, streets or addresses of customers. Typical planning criteria are balance, compactness and contiguity. Balance describes the requirement for districts to have approximately the same size in terms of workload, number of customers or voters. A territory is said to be geographically compact if it is closely and firmly packed together, e.g. nearly round-shaped or square and undistorted. Compact territories usually reduce the unproductive travel time. In the context of political districting compactness prevents Gerrymandering. Figuratively, contiguity means that within a district each basic area is reachable from each other basic area without leaving the district. It is required for administrative reasons or, like compactness, to reduce travel time.

In this talk we will address practical problems in the context of sales districting. In this case, the locations of the sales persons are often given in advance. Therefore, the territories have to be designed in a way that the territory of a sales person is around his location or as close as possible to his location.

We will focus on an approach for solving the problem, which is based on ideas from the field of computational geometry. The main idea is to recursively subdivide the problem geometrically into smaller and smaller subproblems until an elementary level is reached, at which point we can efficiently solve the problem. Our procedure to subdivide a problem into two subproblems works as follows: At first, we determine two parallel lines which limit the feasible subdivisions with respect to the balance. After that, in order to obtain compact territories, we assign each basic area located between these lines to exactly one subproblem taking into account the distances to the existing sales persons locations.

Vehicle Routing Problem mit alternativen Perioden und Teillieferungen

Heiko Breier, KIT, Lst. Furmanns

In diesem Beitrag wird das Vehicle Routing Problem mit alternativen Perioden und Split Deliveries (VRPASD) vorgestellt. Durch die Betrachtung alternativer Lieferperioden je Kunde und der Möglichkeit eine Lieferung über mehrere Perioden zu verteilen, ist es eine Relaxation des Vehicle Routing Problems mit Split Deliveries (VRPSD). Das Problem wird mit Hilfe des Branch-and-Price-Verfahrens gelöst. Die Hinzunahme alternativer Lieferperioden gibt dem Tourenplaner mehr Handlungsfreiheit, dadurch werden effizientere Touren ermöglicht. Der Beitrag zeigt auf wie sich Touren im Vergleich mit und ohne alternativen Perioden verändern.

Master Surgical Scheduling bei stochastischen Operationszeiten

Alexander Kressner, Uni Hohenheim, Lst. Schimmelpfeng

Der OP-Saal eines Krankenhauses ist eine der bedeutendsten Ressourcen zur Wiederherstellung der Gesundheit derjenigen Patienten, die operiert werden müssen. Zugleich ist er aber auch einer der kostenintensivsten Arbeitsplätze. Aus diesem Grund besteht das Ziel der OP-Saalplanung, d.h. der Zuteilung von verfügbarer OP-Saalzeit zu operierenden Fachgebieten und somit Patienten, neben der bestmöglichen Patientenversorgung in der Regel in einer hohen Auslastung der einzelnen OP-Säle. Eine große Herausforderung bei der Planung stellen hierbei die hohe Variabilität von Operationszeiten sowie das zufällige Eintreffen von Notfallpatienten dar. Werden diese Rahmenbedingungen bei der Planung nicht beachtet, kann dies in über- oder unterausgelasteten Kapazitäten resultieren und den Patientenservice erheblich beeinträchtigen. Hinzu kommt, dass der OP-Saalplan die Arbeitslast nachfolgender Abteilungen (z.B. Intensiv- oder Normalstationen) maßgeblich bestimmt. Eine gute Planung sollte diesem Sachverhalt in ausreichender Weise Rechnung tragen.
Vor diesem Hintergrund beschäftigt sich das Dissertationsprojekt mit der Entwicklung eines integrativ geprägten Ansatzes zur mittelfristigen OP-Saalplanung (Master Surgical Scheduling). Hierbei wird auf bestehende Ansätze aufgesetzt, um diese anschließend gezielt um stochastische Aspekte zu erweitern. In diesem Vortrag sollen erste Ideen für eine Modellformulierung zur Kontrolle von Überstunden bei stochastischen Operationszeiten mittels geeigneter Kennzahlen im Sinne von Servicegraden präsentiert werden, wie sie aus dem Bestandsmanagement bekannt sind.

Applicability of advanced demand information in forecasting future demand for a supply chain

Robert Zander, Uni Hohenheim, Lst. Meyr

Accurately forecasting future demand is of high importance to steer and manage a supply chain effcient and effectively. Supply chain planning will likely yield suboptimal results, if based on forecasts deviating significantly from the actual demand. Numerous forecasting methods have been developed to predict future demand and minimize the risk of misdirected planning. As of late several methods have been introduced leveraging the available advanced demand information in existing customer orders as a source of future demand. The results from the employment of these methods have been mixed. In so- me situations forecasts with promising accuracy were computed. Especially sudden strong changes in demand volume were reflected early in the advan- ced demand information and consequently in the forecasts. However forecast accuracy did not always outperform other more conventional methods.
As the implementation of such forecasting methods typically involves a significant share of scarce IT resources, it is beneficial for a supply chain, if it can estimate the expected forecast accuracy beforehand. Hence the aim of our research was to identify the key drivers that impact this accuracy, allowing us to provide a framework with a set of decision criteria to a supply chains whether or not to implement such a forecasting method. The framework provides a structured ex-post approach to analyze the available advanced demand in- formation together with a set of indicators to assess the expected forecasting accuracy. It allows supply chains to base their implementation decision on the likely benefits the methods will yield.

Dynamic Programming Formulation for the Minimum Tour Duration Problem

Christian Tilk, Uni Mainz, Lst. Irnich

In this presentation, we consider a variant of the traveling salesman problem with time windows (TSPTW), called minimum tour duration problem (MTDP), where the objective is the minimization of the tour duration. We present a new effective dynamic programming (DP) approach to solve the MTDP. It is motivated by the results recently presented by Baldacci et al. (2011), who solve the TSPTW with a DP-based algorithm. When solving TSPTW, two independent resources are propagated along partial paths, one for costs and one for earliest arrival times. For dealing with tour duration minimization, we define consistent resource extension functions meaning that dominance is straightforward and the forward DP and any of its relaxations provide bounds for the backward DP, and vice versa. This is a non-trivial task because in the MTDP at least three resources are needed, and two resources depend on each other in a non-additive and non-linear way. To obtain lower bounds, we present a new relaxation for the MTDP with only one resource, which is attractive due to its low computational complexity. This and other relaxations can be combined with the ng-tour relaxation and the ngL-tour relaxation. To improve the lower bounds, we use two methods: First, we adapt a penalty method. Second, we generate the neighborhoods for the ng-tour and ngL-tour relaxations dynamically. To our knowledge, we present the first exact algorithm for the MTDP.

On-line algorithms for portfolio and conversion problems

Robert Dochow, Uni des Saarlandes, Lst. Schmidt

The objective of on-line financial algorithms is to maximize the terminal wealth. Algorithms solving the portfolio selection problem balance the initial wealth among a set of assets. Whereas algorithms solving the conversion problem convert the initial wealth into one asset. We highlight similarities and differences of the respective problems from a theoretical and an empirical perspective. We present and analyze results of known portfolio and conversion algorithms from the literature.

Anfahrt

Anschrift:

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Mit dem Auto:

Sollten Sie planen mit dem PKW anzureisen, so teilen Sie uns dies bitte bis zum 4.10. unter Angabe ihres Kennzeichens mit. Wir werden Ihnen dann einen Parkplatz direkt auf dem Campus reservieren.
Fahren Sie dazu am Nordwestkreuz Frankfurt auf die A66 in Richtung Miquelallee. Ordnen Sie sich nach der Brücke auf der vierspurigen Straße rechts ein und biegen Sie an der 1. Ampel rechts in die Hansaallee ab. Fahren Sie auf der Hansaallee nach etwa 300m rechts in die Bremer Straße und biegen Sie an der nächsten Kreuzung rechts in die Fürstenberger Straße ab. Die Zufahrt zum Campus folgt nach 300m auf der rechten Seite.
Die Adresse für Navigationssysteme lautet Fürstenberger Straße 233, 60323 Frankfurt.

Mit der Bahn:

Vom Frankfurter Hauptbahnhof haben Sie alle 3-5 Minuten Anschluss zum Campus. Nehmen Sie dazu die S-Bahn in Richtung Hauptwache (alle Züge von Gleis 101 und 102). Wechseln Sie dort in die U-Bahn der Line 1, 2, 3 oder 8 (alle Linien am selben Bahnsteig; nicht in Richtung Südbahnhof). Von der Haltestelle Holzhausenstraße sind es noch gute 5 Minuten Fußweg bis zum Hörsaalzentrum (siehe nachfolgende Grafik).