Examples of
6860: Advanced Topics in Quantitative Economics
for
Operations and Supply Chain Analytics

Content

Dependent on the field of the PhD student in Operations and Supply Chain Analytics, course content 6860: Advanced Topics in Quantitative Economics is selected to match that field. Here are examples of past course content:

- **Advanced Inventory and Supply Chain Planning Methods**: The students started to study the classic inventory and supply chain planning models based on a couple of textbooks. Then, the critical thinking is provided to discover the challenges and opportunists to integrated the data science methods and OR methods.
- **Location Science**: The student started with an introduction to Location Science by becoming familiar with topics such as p-median problems, fixed-charge problems, and covering (and anti-covering) problems. The student then studied various versions of location-routing problems, and finally, the student went into depth with the maximal covering problem. As part of the process, the student implemented several of the models in cplex.
- **Price and revenue optimization**: The student started with the introduction of fundamental pricing and revenue optimization about demand estimation, consumer choice theory and commonly see pricing models, network allocation models, and SC contracts etc. Then she studied how to integrate the quality into the SC contracts.
- **Advanced Excel and Vehicle Routing**: This course was offered in 2019 and involved the Advanced Excel master course, which was upgraded to PhD level by combining it with studies in vehicle routing, where the book by Toth and Vigo (2014) was used as the main source. The student would study variants of vehicle routing problems as well as techniques for solving them, including implementations in Excel/VBA. The course was evaluated with a 25-page report where one or several of the topics of the course were presented and discussed. The report could be purely theoretical or could include Excel/VBA implementation of one or more algorithms related to the studied subjects.
- **Truck Routing and Scheduling for Just-in-time Applications:** The student started by giving an overview over models and methods for the classic vehicle routing problem. This included different formulations of the problem as a mixed-integer programming model as well as heuristics and metaheuristics. Subsequently, the student investigated just-in-time

applications in scheduling and routing and how they affect constraints (e.g., time windows), objectives (e.g., earliness-tardiness), and solution methods. Finally, the student proposed some adaptations to extant solution methods and tested some different model formulations in CPLEX.

- **Green vehicle routing problems:** This course aims to give the student a detailed overview of the literature on vehicle routing problems in general and of the literature on green vehicle routing problems in particular. *The first part* of the course covers the fundamental models in the routing literature and is based on Toth and Vigo (2014). *The second part* of the course covers selected advanced methodologies for solving routing problems such as row and column generation. *The third part* of the course goes into further depth with the state-of-the-art in green vehicle routing problems. Here the student should make a thorough review of the literature in the field and write a report 25 pages report discussing the methodologies proposed in the literature for solving green vehicle routing problems.
- **Multi-objective optimization**: This course aims to give the student a detailed overview of the literature on multi-objective branch and bound, multi-objective linear programming techniques, and advanced methods for generating strong lower bounds in single objective optimization. *The first part* of the course covers the foundation of multi-objective optimization and is based on Chapters 1-4 in Ehrgott (2005). *The second part* of the course covers a selection of advanced topics and is based on Chapters 8-10 in Ehrgott (2005) and two papers. *The third part* of the course goes into further depth with the topic "multi objective branch and bound". Here the student should make a thorough review of the literature in the field and write a report 25 pages report discussing the methodologies proposed in the literature for solving multi-objective combinatorial optimization problems.

Teaching approach

Independent study with supervision. There are regular meetings between the student and the lecturer to discuss the topics.

Hours and period

Depends on the material. Typically it is 2-4 hours per week in 14 weeks.

ECTS

10

Grading

7-point grading scale