Technische Universität München
School of Management

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Stochastic Optimization

Sumer Term 2017

Course Type	Lectures / Lab
Course Level	Master
ECTS / SWS	6 / 4
When & where	Lecture: Tuesdays 16:45-18:15, Room 0544
	Lab: Wednesdays 12:00-14:00, Room 0544
Lecturer	Prof. Dr. David Wozabal
	Adriana Kiszka
Language	English

General Information

The course gives an introduction to the topic of stochastic optimization. Students will learn about the underlying concepts and the theory of stochastic optimization as well as algorithmic solution techniques. The theory will be complemented by numerous illustrative classical stochastic optimization examples such as the newsvendor problem and examples from the field of energy markets. The lectures are complemented by a lab, which gives students the possibility to deepen their understanding of the theory and try out algorithms and techniques presented in the lecture.

The topics that will be covered are:

- Introduction & Basic Modelling
- Two-stage Linear Stochastic Optimization Models and their deterministic equivalents
- The L-Shaped Method for Two-Stage Stochastic Optimization
- Monte-Carlo Methods
- Multi-Stage Stochastic Optimization

Participation & Registration

The course is open to all master students of the TUM School of Management as well as for students from *Mathematics* and *Mathematics of Operations Research*. The number of participants is limited to 30 and a registration is required. Registration is done via TUMOnline. Seats are awarded on a *first-come-first-serve* basis.

Prerequisites

The required theory will be introduced in the lecture. However, a strong interest in mathematical modelling, quantitative analysis, and working with data and proficiency in MATLAB or a similar high level programming language is certainly an advantage. The course *Modeling and Optimization in Energy Markets* offers a solid theoretical and methodological underpinning for this course.

Teaching and learning methods

The course combines several learning methods. To facilitate a better understanding of the subject the course is divided into lectures and work in the lab.

In the lectures theory is presented which is subsequently applied by students in the lab working on problem sets. Students hand in a short write-up of their work on the problem sets, and present their results in the class. In private reading, students will complement the knowledge from the lecture with additional methods relevant for solving the problems in the problem sets. Students will reflect on the theory and their applicability in class and during class discussion. By working on real world stochastic optimization problems and designing numerical solution approaches as well as attending presentations of the other students and engaging in discussions of their projects, participants will get in-depth knowledge about stochastic optimization.

Assessment & Grading

The grading is based on a final exam (60%), the written solutions to the problem sets (40%). Additionally bonus points (worth 30%) can be earned by participating in discussions and in-class presentations. The exam is a means to assess students' understanding of theories and methods, while the problem sets test their ability to apply those to real world problems, and their critical reflection of the results and possible limitations of the theory.

Learning Objectives

After the successful completion of this module, students will be able to

1. to understand the basic theory of stochastic optimization,
2. to implement solution approaches for stochastic optimization using MATLAB in combination with numerical solvers,
3. to model real-world problems under uncertainty as stochastic optimization problems that can be treated with the methods introduced in the course,
4. to communicate the results to a scientific audience in written and oral form and to defend them if necessary..

Literature

- Birge, J. and Louveaux, F. *Introduction to Stochastic Programming*. Springer Series in Operations Research and Financial Engineering, 2011 (second edition).
- Shapiro, A. and Dentcheva, D. and Ruszczyński, A. *Lectures on Stochastic Programming: Modeling and Theory*. MOS-SIAM Series on Optimization. 2014 (second edition). http://www2.isye.gatech.edu/people/faculty/Alex_Shapiro/SPbook.pdf