Syllabus: Mathematical Optimization (AQM 1142)

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Course	AQM1142 – Mathematical Optimization
Grading	Written exam, 60 minutes, at the end of the semester
ECTS-Credits	2 SWS - 3 Credits
Accompanying Material	Course slides, exercises and further information are available on the corresponding moodle course. Inscription is required to keep yourself up to date.
Prerequisites:	Analysis and Linear Algebra (AQM1041)
Lecturer	Prof. Dr. Hendrik Lambrecht Büro: W1.4.052 Office hours: Mi, 15.30-17.00 **after prior appointment (E-Mail)** e-mail: hendrik.lambrecht@hs-pforzheim.de Internet: http://umwelt.hs-pforzheim.de/team/hendrik-lambrecht/
Room and Time	cf. LSF

Outline of the course

Topic	Lecture
Linear Programming • Formulation of an LP • Graphical interpretation and solution • Simplex algorithm (primal, dual) • Duality • Software (Interpretation of solution reports)	1-6
Network problems • Graphs • Minimal spanning tree (Kruskal) • Shortest Paths (Dijkstra) • Maximal Flos	7-9
Project Networks (Project Management technique) • Activity lists • Time scheduling • Capacity and cost planning	10-12

Literature

Hillier, Frederick S.; Lieberman, Gerald J. (2005): Introduction to Operations Research: McGraw-Hill Science/Engineering/Math.

Rardin, Ronald L. (2000): Optimization in Operations Research. Upper Saddle River, New Jersey: Prentice Hall.

Gohout, Wolfgang (2009): Operations Research. 4. Aufl. München: Oldenbourg Verlag.

Mayer, Christoph; Weber, Carsten; Francas, David (2012): Lineare Algebra für Wirtschaftswissenschaftler. Mit Aufgaben und Lösungen. 5. Aufl. Wiesbaden: Springer Gabler.

Runzheimer, Bodo; Cleff, Thomas; Schäfer, Wolfgang (2005): Operations Research 1. Wiesbaden: Gabler.

Learning Objectives

By the end of the course, the students shall…

… know basic methods and algorithms of mathematical optimization and Operations Research (OR)

… be able to apply them to practical optimization problems in a business context

… know in particular the areas of application of linear programming (LP) as well as how to interpret results of the simplex algorithm (e.g. dual prices)

… know basic types of network optimization problems, i.e. shortest paths, maximal flow and minimal spanning trees

… know different types of project network planning techniques (activity on node vs activity on arrow) and

… be able to use them for time scheduling, capacity and cost planning in project management

My role as lecturer

I want to do my part to ensure that you successfully learn the contents and methods conveyed in this lecture and gain an understanding of their practical significance. However, the major part of the responsibility and work for successfully completing the course lies with you.

Teaching and Learning Approach

The course is a lecture in applied mathematics. Focus is not on rigorous proofs. You learn different optimization techniques by means of illustrative examples. You shall become familiar with the "optimization paradigm" and learn how to translate real world problems into mathematical optimization models. You shall understand both the algorithmic solution of optimization models and how to use software tools.

Regular exercise sheets and voluntary tutorials accompany the lecture. I highly recommend to practice the skills acquainted in the course and to work on these exercises in groups.

Questions are welcome! In particular right where they arise in the course: they will not only help yourself but also your fellow students. Your suggestions for improvements and comments, which serve the learning progress of all, are also very welcome.

If you are better at learning yourself with books. No problem, I will not blame anyone for absence. However, if you come: keep mentally track with the course and contribute to a productive working atmosphere.

Good luck!

Hendrik Lambrecht

Course contributions to bachelor programs' common learning goals:

	Learning Objective / Outcome	Contributions to learning objectives	Assessment
1	***Expert knowledge*** Students show that they have sound basic knowledge …		
1.1	… in Business Administration.	X	
1.2	… in Economics	X	
1.3	… in Business Law.	X	
1.4	… in Quantitative Methods	The application of the optimization algorithms discussed in the course requires a sound mathematical understanding and trains the modeling skills.	Discussions within class, Students' questions for voluntary tutorials, Written exam
	Use of information technology	X	
2.1	Students demonstrate proficiency in using computer programs to solve business problems.	Standard tools for solving linear programs like LINGO and EXCEL are introduced. Focus is on understanding and correctly interpreting software generated solution reports	Written exam
2.2	Students are able to use information systems effectively in real world business settings.	X	
3.	***Critical thinking and analytical competence*** Students are able to apply analytical and critical thinking skills to complex problems.	"Translation" of real world problems in mathematical optimization models improves the students abstraction skills	Discussions within class, Students' questions for voluntary tutorials, Written exam
4.	***Ethical awareness*** Students are able to develop business ethics strategies and apply them to typical business decision-making problems.	X	
5	***Communication skills***		
5.1	Students are able to express complex problems effectively in writing	X	
5.2	Students demonstrate their oral communication skills in presentations and papers.		
6.	***Capacity for teamwork*** Students show that they are able to work successfully in a team by performing practical tasks.	X	