MATH-261

Discrete optimization

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Cursus	Sem.	Type
Chemistry	BA6	Opt.
Electrical and Electronical Engineering	MA2, MA4	Opt.
Energy Science and Technology	MA2	Opt.
Mathematics	BA4	Opt.

Language of teaching	English
Credits	5
Session	Summer
Semester	Spring
Exam	Written
Workload	150h
Weeks	14
Hours	**4 weekly**
Courses	2 weekly
Exercises	2 weekly
Number of positions	

Summary

This course is an introduction to linear and discrete optimization. We will discuss linear programming and combinatorial optimization problems like bipartite matchings, shortest paths and flows. Warning: This course is for mathematicians! Strong emphasis is put on formal mathematical proofs.

Content

- Linear Programming
- Simplex Algorithm
- Cycling and termination of the simplex algorithm
- Algorithms and Running times
- Diameter of Polyhedra
- Duality Theory
- Graphs and shortest paths
- Max. weight bipartite matchings
- Maximum flows
- Integer Programming and relaxations

Keywords

Linear Programming
Algorithms
Complexity
Graphs

Learning Prerequisites

Required courses

Linear Algebra
Discrete Mathematics or Discrete Structures

Important concepts to start the course

The student needs to be able to prove theorems

Learning Outcomes

By the end of the course, the student must be able to:

- Choose appropriate method for solving basic discrete optimization problem
- Prove basic theorems in linear optimization
- Interpret computational results and relate to theory
- Implement basic algorithms in linear optmization
- Describe methods for solving linear optimization problems
- Create correctness and running time proofs of basic algorithms
- Solve basic linear and discrete optimization problems

Transversal skills

- Continue to work through difficulties or initial failure to find optimal solutions.
- Use both general and domain specific IT resources and tools

Teaching methods

Ex cathedra lecture, exercises in the classroom and with a computer

Expected student activities

Attendance of lectures and exercises
Completion of exercises
Solving supplementary programs with the help of a computer

Assessment methods

Written exam during the exam session

Resources

Bibliography

Dimitris Bertsimas and John N. Tsitsiklis: Introduction to Linear Optimization, Athena Scientific
Alexander Schrijver: Theory of Linear and integer Programming, Wiley

Ressources en bibliothèque

- Introduction to Linear Optimization / Bertsimas
- Theory of Linear and Integer Programming / Schrijver

Notes/Handbook

Lecture notes