



LUNDS UNIVERSITET
Lunds Tekniska Högskola

Course syllabus

Linjär och kombinatorisk optimering Linear and Combinatorial Optimization

FMAF35, 6 credits, G2 (First Cycle)

Valid for: 2021/22

Faculty: Faculty of Engineering, LTH

Decided by: PLED F/Pi

Date of Decision: 2021-04-23

General Information

Main field: Technology.

Elective for: BME4, C4, D4-pv, E4, F4, F4-pv, F4-bs, Pi4-bs, Pi4-pv

Language of instruction: The course will be given in English on demand

Aim

In science, technology and economics, linear and combinatorial optimization problems appear more and more often. The most well known example is linear programming, where the so called *simplex method* has been of utmost importance in industry since it was invented in the middle of the 20th century. Other important problems, e.g. for effective data processing, contain discrete variables, for example integers. In connection with these, the importance of combinatorial methods has grown. The aim of the course is to make the students aware of problems in linear and combinatorial optimization which are important in the applications, and to give them knowledge about mathematical methods for their solution. The aim is also to make the students develop their ability to solve problems, with and without the use of a computer.

Learning outcomes

Knowledge and understanding

For a passing grade the student must

- understand and be able to clearly explain the theory behind the simplex method.
- be able to describe and informally explain the mathematical theory behind central algorithms in combinatorial optimization (including local search, branch and bound methods, simulated annealing, genetic optimization, neural networks).

Competences and skills

For a passing grade the student must

- be able to show a good capability to (i) identify problems in the area, (ii) formulate these in mathematical terms, (iii) choose an appropriate method to solve them, and finally (iv) carry out the solution, possibly with the help of a computer.
- be able to write computer programs to solve linear and combinatorial optimization problems.
- with proper terminology, in a well structured way and with clear logic be able to explain the solution to a problem within linear and combinatorial optimization.

Contents

Linear programming. Integer programming. Transport problems. Assignment problems. Maximal flow. Local search. Simulated annealing. Genetic optimization. Neural networks. Dynamic programming. Algorithm complexity.

Examination details

Grading scale: TH - (U,3,4,5) - (Fail, Three, Four, Five)

Assessment: Oral or written examination, to be decided by the examiner. Computer sessions.

The examiner, in consultation with Disability Support Services, may deviate from the regular form of examination in order to provide a permanently disabled student with a form of examination equivalent to that of a student without a disability.

Parts

Code: 0117. **Name:** Examination.

Credits: 6. **Grading scale:** TH.

Code: 0217. **Name:** Computer Exercises.

Credits: 0. **Grading scale:** UG.

Admission

Assumed prior knowledge: FMAB20 Linear Algebra.

The number of participants is limited to: No

The course overlaps following course/s: FMA240

Reading list

- Holmberg, K.: Optimering, Metoder, modeller och teori för linjära, olinjära och kombinatoriska problem. Liber, 2010, ISBN: 978-91-47-09935-1. Supplementary reading in Swedish.
- Kolman, B. & Beck, R.E.: Elementary Linear Programming with Applications. Academic Press, 1995, ISBN: 0-12-417910. Available as E-book from the Maths Library.
- Supplementary material.

Contact and other information

Course coordinator: Studierektor Anders Holst, Studierektor@math.lth.se

Course homepage: <http://www.maths.lth.se/course/linkomboptnykod/>