Combinatorial Optimization, Introductory Course

Programme course

4 credits

Kombinatorisk optimering gk

TAOP33

Valid from: 2017 Spring semester

Determined by
Board of Studies for Computer Science and Media Technology

Date determined
2017-01-25

Main field of study
Mathematics, Applied Mathematics

Course level
First cycle

Advancement level
G2X

Course offered for
- Computer Science and Engineering, M Sc in Engineering
- Computer Science and Software Engineering, M Sc in Engineering

Specific information
The course is not allowed in the diploma together with TAOP07.

Entry requirements
Note: Admission requirements for non-programme students usually also include admission requirements for the programme and threshold requirements for progression within the programme, or corresponding.

Prerequisites
Linear Algebra

Intended learning outcomes

The course deals with mathematical tools for solving and analyzing combinatorial optimization problems. Focus lies on choosing and using the most efficient algorithm for each specific problem structure. The algorithms are suitable for implementation on computer. After finished course, the student shall be able to:

- describe important types of combinatorial optimization problems
- formulate combinatorial optimization problems as mathematical models and determine the difficulty of the problems with the help of complexity theory
- explain the design of and the principles behind efficient solution methods and use the methods for solving combinatorial optimization problems
- use available software for solving optimization problems
- take part of development of software for optimization problems
- develop a simple heuristic for a structured combinatorial optimization problem
- explain and use basic concepts, such as local and global optimality, convexity, extreme point, complexity, duality, basic graph theory and branch-and-bound

Course content

Introduction to optimization, problem formulation, graphical solution, computational complexity. The simplex method, linear duality and sensitivity analysis. Basic graph theory, models and methods for finding minimal spanning tree, traveling salesman tour, postman tour, shortest path, minimum cost flow and maximal flow. Methods for integer programming, such as branch-and-bound. Problem complexity, heuristics.

Teaching and working methods

The lectures and lessons treat theory, methods and models, as well as exercises in model formulation and problem solving. The computer exercises contain both implementation of optimization algorithms and solution of combinatorial optimization problems with the help of available software.

Examination

LAB2	Laboratory work	1 credits	U, G
TEN2	Written examination	3 credits	U, 3, 4, 5

Grades

Four-grade scale, LiU, U, 3, 4, 5

Department

Matematiska institutionen

Director of Studies or equivalent
Ingegerd Skoglund

Examiner
Kaj Holmberg

Course website and other links
http://courses.mai.liu.se/GU/TAOP33

Education components
Preliminary scheduled hours: 42 h
Recommended self-study hours: 65 h

Course literature
Kaj Holmberg: Optimering (Liber, 2010).

Common rules

Regulations (apply to LiU in its entirety)

The university is a government agency whose operations are regulated by legislation and ordinances, which include the Higher Education Act and the Higher Education Ordinance. In addition to legislation and ordinances, operations are subject to several policy documents. The Linköping University rule book collects currently valid decisions of a regulatory nature taken by the university board, the vice-chancellor and faculty/department boards.

LiU's rule book for education at first-cycle and second-cycle levels is available at http://styrdokument.liu.se/Regelsamling/Innehall/Utbildning_pa_grund-_och_avancerad_niva.