Applied Optimization I

Programme course

6 credits

Tillämpad optimering I

TNK104

Valid from: 2017 Spring semester

Determined by
Board of Studies for Industrial Engineering and Logistics

Date determined
2017-01-25

Main field of study
Mathematics, Applied Mathematics, Transportation Systems Engineering

Course level
Second cycle

Advancement level
A1X

Course offered for
- Intelligent Transport Systems and Logistics, Master's programme
- Communication and Transportation Engineering, M Sc in Engineering

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
Basic knowledge in linear programming and integer programming

Intended learning outcomes
The course is aimed at providing the participants with knowledge in applied optimization, with focus on the application of theory and methods in combinatorial optimization for modeling and solving optimization problems originating from the area of transport and communication. The course also aims at letting the participants gain insights and practical skills in setting up mathematical models and using optimization methods. After completing the course, the participants shall be able to

- connect the subjects of the course to their study program
- describe fundamental theory and methods in combinatorial optimization and integer programming
- describe classical optimization problems in the area of transport and communications
- explain concepts related to problem complexity and the impact of complexity on large scale optimization
- use a modeling system for setting up optimization models and problem solving
- describe and apply modern heuristics for solving large scale optimization

Course content

Basics of combinatorial optimization; integer programming models; relations between combinatorial optimization, linear programming, and integer programming; branch and bound, and cutting plane for solving integer models; classical combinatorial optimization problems: shortest path, maximum flow, minimum spanning tree, matching, facility location, traveling salesman, and graph coloring; problem complexity: complexity classes, theoretical and practical impact of complexity on large scale optimization; the impact of the choice of integer model in large scale optimization; basic column generation; problem relaxation and relaxation methods; application of heuristics and relaxation methods. heuristics: greedy heuristic, local search, tabu search, simulated annealing.

Teaching and working methods

The course consists of lectures, seminars and computer labs.

Examination

LAB1	Laboratory work	3 credits	U, G
PRA1	Project work	3 credits	U, 3, 4, 5

Grades

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

Department

Institutionen för teknik och naturvetenskap

Director of Studies or equivalent

Erik Bergfeldt

Examiner

Nikolaos Pappas

Education components

Preliminary scheduled hours: 30 h
Recommended self-study hours: 130 h

Course literature

Föreläsningsmaterial och hänvisningar till referensartiklar för specifika modeller och metoder.

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.