Operations Research, Extended Course

Programme course

4 credits

Optimeringslära, fortsättningskurs

TAOP37

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

Course level
First cycle

Advancement level
G2X

Course offered for
- Industrial Engineering and Management - International, M Sc in Engineering
- Industrial Engineering and Management, 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
Introduction to Operations Research

Intended learning outcomes

Optimization deals with mathematical theory and methods aiming at analyzing and solving decision problems that arise in technology, economy, medicine, etc. The course gives a broad orientation of the field of optimization, with emphasis on basic theory and methods for discrete optimization problems in finite dimension, and it also gives some insight into its use for analyzing practical optimization problems. After the course, the student shall:

- be able to explain important classes of optimization problems and to be able to classify them according to their properties, into, for example, linear and discrete problems
- be able to model mathematical models of simple optimization problems
- be able to explain basic concepts, such as, for example, optimal conditions, valid inequalities, weak and strong duality
- have knowledge about and be able to apply basic theory for some common types of optimization problems, such as, for example, duality theory for linear optimization problems, and have knowledge about and be able to use optimality conditions, such as, for example, Bellman-conditions, to determine the optimality of a given solution
- be able to explain and to apply basic principles for solving some common types of optimization problems, such as, for example, the branch-and-bound method for discrete problems
- be able to use relaxations, and especially Lagrangian duality, to approximate optimization problems, and be able to estimate the optimal objective value through lower and upper bounds
- be able to use commonly available software for solving optimization problems of standard type
- have some knowledge of practical applications of optimization

Course content

- Network optimization: Shortest path problems, maximum flow problems, minimum cost network flow problems, the network simplex method, integer problems with graph structure.
- Integer programming: Model formulation, branch-and-bound methods, cutting plane methods, applications to special structured integer problems.
- Dynamic programming: Formulation of deterministic problems, the principle of optimality, applications to network, inventory and resource allocation problems

Teaching and working methods

Lectures which include theory, problem solving and applications. Exercises which are intended to give individual training in problem solving. A laboratory course with emphasis on modelling and the use of optimization software.

Examination

LAB1	Laboratory work	1 credits	U, G
TEN1	Written examination	3 credits	U, 3, 4, 5

Grades

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

Other information

Supplementary courses: Large Scale Optimization, Supply Chain Optimization, Matematical Optimization, Financial Optimization

Department

Matematiska institutionen

Director of Studies or equivalent

Ingegerd Skoglund

Examiner

Elina Rönnberg

Course website and other links

http://courses.mai.liu.se/GU/TAOP37

Education components

Preliminary scheduled hours: 40 h
Recommended self-study hours: 67 h

Course literature

Lundgren J, Rönnqvist M, Värbrand P: Optimeringslära. Studentlitteratur (2003, reviderad 2008), ISBN: 9789144053141. Henningsson M, Lundgren J, Rönnqvist M, Värbrand P: Optimeringslära övningsbok (2010), ISBN: 9789144067605