# Optimization, Modeling and Planning

Programme course

6 credits

Optimering, modellering och planering

TNSL05

Valid from: 2017 Spring semester

**Determined by**
Board of Studies for Industrial
Engineering and Logistics

**Date determined**
2017-01-25

## Main field of study

Applied Mathematics, Logistics

## Course level

First cycle

## Advancement level

G2X

## Course offered for

- Air Transportation and Logistics, Bachelor's Programme
- Civic Logistics, Bachelor´s Programme

## 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 courses in Math Analyses, Algebra and Logistics.

## Intended learning outcomes

This course gives an introduction to operations reseach, in particular modelling and solving linear programming problems, optimization problems with network structures and integer programming proglems. The application focus is on models related to logistics and supply chain management. After completed course the students shall

- have the knowledge on how to formulate and analyze optimization models in economic applications.
- understand the basic mathematical theories that are the foundation for models and algorithms.
- Analyze and understand sensitivity analyses for linear programming problems and network problems
- be able to use and draw conclusions from optmization methods for linear programming, especially the Simplex method, for integer prrogramming, especially tree-search methods, and network/graph based methods.

## Course content

The course covers the following areas:

- Introduction to mathematical modelling
- Introduction to algortihms for optimization
- Classification of problems
- Optimality conditions
- Modelling of linear programming problems
- Methods for linear programming problems (basic solution concept)
- Sensitivity analyses
- Network modelling
- Basic problem types and methods for network problems (shortest path and minimum cost flow problems)
- Integer programming problems modelling

## Teaching and working methods

The lectures introduce concepts and methods. Lessons are used for exercises and computer laborations are used for solving larger optimization models.

## Examination

| UPG1 | Group assignments | 2 credits | U, G |
|------|-------------------|-----------|------|
| LAB1 | Laboratory work | 2 credits | U, G |
| TEN1 | Written examination | 2 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

Joakim Ekström

## Education components

Preliminary scheduled hours: 50 h
Recommended self-study hours: 110 h

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# Course literature

## Additional literature

**Books**

Henningsson, Lundgren, Rönnqvist, Värbrand,, *Optimeringslära: övningsbok* 2:a
uppl
ISBN: 91-44-06760-7
Lundgren, Jan, Author, Rönnqvist, Mikael, Author, Värbrand, Peter, Author,
Linköpings universitet, Institutionen för teknik och naturvetenskap, Originator,
Linköpings universitet, Tekniska högskolan, Originator, Linköpings universitet,
Matematiska institutionen, Optimeringslära, Originator, (2003) *Optimeringslära*
Lund: Studentlitteratur, 2003.

# 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.