Mathematcs: Intriduction to Operations Research

Matematik: Optimeringslära, grundkurs
4 credits

Programme course

93MA53

Valid from: 2024 Spring semester

Determined by	**Main field of study**	
The Board of Educational Science	Mathematics	
Date determined	**Course level**	**Progressive specialisation**
2018-09-11	First cycle	GXX
Revised by	**Disciplinary domain**	
Course Syllabus Board at the Faculty of Educational Sciences	Natural sciences	
Revision date	**Subject group**	
2021-03-08; 2019-09-10; 2021-05-10; 2023-09-11	Mathematics	
Offered first time	**Offered for the last time**	
Spring semester 2018		
Department	**Replaced by**	
Matematiska institutionen		

Course offered for

- Secondary School Teacher Programme with a specialization in Teaching in the Upper-Secondary School

Intended learning outcomes

After completing the course, the student should be able to

- M1 (Modelling):
  identify questions of an optimization nature in order to construct mathematical models for simpler optimization problems
- M2 (Theory and Method):
  use the basic concepts and theorems described by the course content, as well as choose and apply appropriate methods in order to solve commonly occurring optimization problems
- M3 (Accounting):
  argue for their approaches using relevant concepts within the course, and present clear calculations and reasoning
- M4 (Software):
  use available optimization software to solve standard optimization problems.

Course content

Within optimization theory, mathematical theories and methods are treated that aim to analyze and solve decision problems that arise in technology, economics, medicine, etcetera. The course provides a broad orientation to optimization theory, but a focus on basic theory and methods for continuous optimization problems in finite dimension, as well as an insight into its application to analyze practical optimization questions. The course content includes:

- General optimality concepts: Basic convexity theory for functions and sets, optimality conditions, local and global optima, relaxation and restriction.
- Linear programming: Linear optimization models with continuous decision variables, graphical solution, mathematical theory of linear programming, the simplex method, duality, sensitivity analysis.
- Nonlinear programming: Nonlinear optimization models continuous decision variables, with/without subconditions, steepest slope method, Newton's (modified) method, exact line search, interval bisection, the Karush-Kuhn-Tucker conditions.

Teaching and working methods

Lectures, lessons, laboratories and independent studies.

Examination

The course is examined through computer labs, including a project report, and a written exam.

Applies to all courses regardless of grading scale.

- Students failing an exam covering either the entire course or part of the course two times are entitled to have a new examiner appointed for the reexamination.

If the course has a three-graded grading scale (U - VG), following applies:

- Students who have passed an examination may not retake it in order to improve their grades.

The following applies to courses that include a compulsory component:

- If special circumstances prevail, and if it is possible with consideration of the nature of the compulsory component, the examiner may decide to replace the compulsory component with another equivalent component.

If the LiU coordinator for students with disabilities has granted a student the right to an adapted examination for a written examination in an examination hall, the student has the right to it.

If the coordinator has recommended for the student an adapted examination or alternative form of examination, the examiner may grant this if the examiner assesses that it is possible, based on consideration of the course objectives.

An examiner may also decide that an adapted examination or alternative form of examination if the examiner assessed that special circumstances prevail, and the examiner assesses that it is possible while maintaining the objectives of the course.

Grades

Three-grade scale, U, G, VG

Other information

Course revised 2020-04-02; Dnr LiU-2020-01361
Planning and implementation of a course must take its starting point in the wording of the syllabus. The course evaluation included in each course must therefore take up the question how well the course agrees with the syllabus.

The course is conducted in such a way that there are equal opportunities with regard to sex, transgender identity or expression, ethnicity, religion or other belief, disability, sexual orientation and age.

If special circumstances prevail, the vice-chancellor may in a special decision specify the preconditions for temporary deviations from this course syllabus, and delegate the right to take such decisions.

About teaching and examination language

The teaching language is presented in the Overview tab for each course. The examination language relates to the teaching language as follows:

- If teaching language is Swedish, the course as a whole or in large parts, is taught in Swedish. Please note that although teaching language is Swedish, parts of the course could be given in English. Examination language is Swedish.
- If teaching language is Swedish/English, the course as a whole will be taught in English if students without prior knowledge of the Swedish language participate. Examination language is Swedish or English (depending on teaching language).
- If teaching language is English, the course as a whole is taught in English. Examination language is English.