



DEPARTMENT OF MATHEMATICAL SCIENCES

MMG631 Linear and Integer Optimization with Applications, 7.5 credits

Linjär och heltalsoptimering med tillämpningar, 7,5 högskolepoäng

First Cycle

Confirmation

This course syllabus was confirmed by Department of Mathematical Sciences on 2011-10-20 and was last revised on 2021-03-15 to be valid from 2021-03-22, spring semester of 2021.

Field of education: Science 100%

Department: Department of Mathematical Sciences

Position in the educational system

The course can be part of the following programme: 1) Bachelor's Programme in Mathematics (N1MAT)

Main field of studies

Mathematics

Specialization

G1F, First cycle, has less than 60 credits in first-cycle course/s as entry requirements

Entry requirements

General entry requirements and the equivalent of the courses *MMG200 Mathematics 1* and *MMG300 Multivariable Analysis*. We also recommend the equivalent of *MVG300 Programming with Matlab*.

Learning outcomes

A main purpose with the course is to give the students an overview of important areas where optimization problems often are considered in applications, and an overview of some important practical techniques for their solution. Another purpose of the course is to provide insights into such problem areas from the perspective of both application and theory, including the analysis of an optimization model and suitable choices of solution approaches. Work with concrete problems during the course enables the establishment

of these insights.

On successful completion of the course the student will be able to:

- identify the most important principles for describing linear and integer optimization problems as mathematical optimization models;
- distinguish between some important classes of linear and integer optimization problems;
- utilize linear programming duality for sensitivity analysis of optimal solutions to such problems.

Within each problem class the student will be able to

- develop mathematical models of relevant problems within the class;
- identify and describe the most important and useful mathematical properties of the developed models;
- select, adapt, or develop convergent and efficient suitable solution techniques and algorithms for problems within the class;
- implement the chosen/developed algorithms in appropriate software;
- interpret and assess the plausibility of the obtained solutions in relation to the original problem setting;
- examine the sensitivity of a resulting optimal solution with respect to changes in the problem data;
- explain the results of the sensitivity analysis in relation to the models at hand.

Course content

This course describes with the aid of case studies how optimization problems are modelled and solved in practice.

Some typical problems and algorithms that are covered are investment, blending, models of energy systems, production and maintenance planning, network models, routing and transport, multi-objective optimization and inventory planning, the simplex method for linear programming, heuristics, the branch-and-bound algorithm.

Form of teaching

The course will be taught in English unless everyone involved speaks Swedish.

Assessment

The examination consists of project assignments, written and oral presentations, opposition on other students' work at a seminar, and a written examination. Information for a particular year is found on the course home page.

If a student, who has failed the same examined component twice, wishes to change examiner before the next examination, a written application shall be sent to the department responsible for the course and shall be granted unless there are special

reasons to the contrary (Chapter 6, Section 22 of Higher Education Ordinance).

Grades

The grading scale comprises: Pass with Distinction (VG), Pass (G) and Fail (U).

Course evaluation

The course is evaluated with an anonymous questionnaire and/or a discussion with the student representatives. The results of and possible changes to the course will be shared with students who participated in the evaluation and students who are starting the course.

Additional information

The course *MMG631 Linear and Integer Optimization with Applications* has the same content as the course *MMG630*. It is not possible to be registered and/or examined on more than one of these courses.

For a list of course literature, see:

<https://www.chalmers.se/sv/institutioner/math/utbildning/grundutbildning-goteborgs-universitet/kurslitteratur/Sidor/Kurslitteratur-i-matematik.aspx>