UNIVERSITY OF GOTHENBURG

DEPARTMENT OF MATHEMATICAL SCIENCES

MMA511 Large-Scale Optimization, 7.5 credits

Storskalig optimering, 7,5 högskolepoäng

Second Cycle

Confirmation

This course syllabus was confirmed by Department of Mathematical Sciences on 2011-10-20 and was last revised on 2020-10-30 to be valid from 2020-10-30, autumn semester of 2020.

Field of education: Science 100%
Department: Department of Mathematical Sciences

Position in the educational system

The course Large-Scale Optimization, 7.5 higher education credits, is one of several single subject courses included in the two-year Masters Program in Mathematical Sciences. The course is also open for eligible students outside the program.

The course can be part of the following programmes: 1) Mathematical Sciences, Master's Programme (N2MAT) and 2) Bachelor's Programme in Mathematics (N1MAT)

Main field of studies	*Specialization*
Mathematics	A1N, Second cycle, has only first-cycle course/s as entry requirements

Entry requirements

General entry requirements and the equivalent of the course *MMG621* Nonlinear Optimization or *MMG631* Linear and Integer Optimization with Applications.

Learning outcomes

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

- independently analyze and suggest modelling and method principles for a variety of practical large-scale optimization problems,
- have sufficient knowledge to use these principles successfully in practice through the use of computation software for optimization problems.

Course content

Large-scale optimization problems almost always have inherent structures that can be exploited in order to solve such problems efficiently. The course deals with a number of such principles through which large-scale optimization problems can be attacked. A common term for such techniques is decomposition–coordination (or, distributed algorithm–consensus); convexity and duality theory underlie its development. The course includes practical elements: exercises in the modelling and solution of optimization problems with complicating constraints and/or variables, and project assignments in which large-scale optimization problems are to be solved through the use of duality theory and techniques presented during the lectures.

Contents in brief: complexity, simple/difficult optimization problems, integer linear optimization problems, unimodularity, convexity. Decomposition–coordination, restriction, relaxation, bounds on the optimal value, projection, variable fixing, dualization, neighbourhoods, heuristics, local search methods. Lagrangean duality, subgradient methods, (ergodic) convergence, recovery of integer solutions, Lagrangean heuristics, cutting planes, column generation, coordinating master problem, Dantzig–Wolfe decomposition, Benders decomposition.

Form of teaching

Language of instruction: English

Assessment

The course is examined by a written examination, by the student taking active part in mandatory workshops, and by two practical course projects. The projects are to be presented in the form of written reports as well as orally presented during seminars. Each group also acts as opponents/discussants on another group's projects, and each student must take active part in all these activities.

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 *MMA511* Large-Scale Optimization replaces the course *MMA510* Project Course in Optimization. It is not allowed to get 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