LINKÖPINGS UNIVERSITET

Computational Statistics

Datorintensiva statistiska metoder
6 credits

Programme course

732A89

Valid from: 2025 Spring semester

Determined by	Main field of study	
Course and Programme Syllabus Board at the Faculty of Arts and Sciences	Statistics	
Date determined	**Course level**	**Progressive specialisation**
2024-04-09	Second cycle	A1N
Revised by	**Disciplinary domain**	
	Natural sciences	
Revision date	**Subject group**	
	Statistics	
Offered first time	**Offered for the last time**	
Spring semester 2025		
Department	**Replaced by**	
Institutionen för datavetenskap		

Course offered for

- Master's Programme in Statistics and Machine Learning

Entry requirements

- Bachelor's degree equivalent to a Swedish Kandidatexamen of 180 ECTS credits in one of the following subjects:
    - statistics
    - mathematics
    - applied mathematics
    - computer science
    - engineering
- Passed courses in
    - calculus
    - linear algebra
    - statistics
    - programming
- English corresponding to the level of English in Swedish upper secondary education (Engelska 6)
  Exemption from Swedish
- Passed Advanced Academic Studies, 3 ECTS credits

Intended learning outcomes

After completion of the course the student should be able to:

- account for how computer arithmetics affects statistical computations
- develop computer implementations of standard methods for simulating from complex statistical distributions
- develop computer implementations of commonly used deterministic and stochastic optimization methods in statistics and machine learning
- select a suitable computer intensive uncertainty estimation methods for a given problem, and develop an implementation of the algorithm in a programming language
- interpret the results obtained by various simulation and estimation methods
- plan and carry out course work within given time frames

Course content

The course covers the following topics:

- effect of computer arithmetics on statistical computations
- basic methods for random number generation, including inverse CDF method and acceptance/rejection method
- Monte Carlo methods for simulation and inference, including bootstrap and jackknife
- Markov Chain Monte Carlo (MCMC) simulation, including Metropolis-Hastings and Gibbs samplers
- introduction to unconstrained deterministic and stochastic optimization methods

Teaching and working methods

The teaching comprises lectures, computer exercises and seminars.
Independent study are a necessary complement to the course.

Language of instruction and examination: English

Examination

The course is examined through:

- written reports on computer assignments in groups, grading scale: EC P/F
- active participation in seminars, grading scale: EC P/F
- individually written computer examination, grading scale: EC

The final grade for the course is based on grade from the written examination and requires Pass from all remining examination parts.

Detailed information about the examination can be found in the course's study guide.

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.

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

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

Grades

ECTS, EC

Other information

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 could be given in Swedish, or partly, or as a whole, in English. Examination language is Swedish, but parts of the examination can be in English.
- If teaching language is "English", the course as a whole is taught in English. Examination language is English.
- 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.