

Computational Statistics

Datorintensiva statistiska metoder
6 credits

Programme course

732A90

Valid from: 2017 Spring semester

Determined by	Main field of study	
The Quality Board at the Faculty of Arts and Sciences	Statistics	
Date determined	Course level	Progressive specialisation
2016-04-13	Second cycle	A1N
Revised by	Disciplinary domain	
	Social sciences	
Revision date	Subject group	
	Statistics	
Offered first time	Offered for the last time	
Spring semester 2017		
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

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

Course content

The course comprises a set of computational models and mathematical tools that enables performing computationally intensive statistical inference for complex challenging problems in statistics, machine learning and engineering.

The following topics are included in the course:

- 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 optimization and stochastic optimization.

Teaching and working methods

The teaching comprises lectures, computer exercises and seminars complemented by self-studies. The lectures are devoted to presentations of theories, concepts, and methods. Computer exercises provide practical experience of statistical analysis. Seminars are devoted to discussions of the computer exercises and student presentations.

Language of instruction: English.

Examination

Written reports on the computer assignments. Active participation in the seminars. One final written examination. 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 carried out in such a way that both men's and women's experience and knowledge is made visible and developed.

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.