

# Computational Statistics

Single subject and programme course

6 credits

Datorintensiva statistiska metoder

732A90

Valid from: 2017 Spring semester

**Determined by**

The Quality Board at the Faculty of Arts  
and Sciences

**Date determined**

2016-04-13

## Main field of study

Statistics

## Course level

Second cycle

## Advancement level

A1X

## Course offered for

- Masters Programme in Statistics and Machine Learning

## Entry requirements

A bachelor's degree in one of the following subjects: statistics, mathematics, applied mathematics, computer science, engineering, or equivalent. Completed courses in calculus, linear algebra and programming are required.

The student should also have passed the following courses at advanced level:

- a course in Statistics;
- a course including multiple linear regression.

Documented knowledge of English equivalent to Engelska B/Engelska 6.

## 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.

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.

Department  
Institutionen för datavetenskap