UNIVERSITY OF GOTHENBURG

DEPARTMENT OF MATHEMATICAL SCIENCES

MSA102 Computational Methods for Bayesian Statistics, 7.5 credits

Beräkningsmetoder för Bayesiansk statistik, 7,5 högskolepoäng

Second Cycle

Confirmation

This course syllabus was confirmed by Department of Mathematical Sciences on 2022-12-20 to be valid from 2023-08-28, autumn semester of 2023.

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

Position in the educational system

The course is part of the Master's Programme in Mathematical Sciences, but it is also open for students outside the program who meet the course prerequisites.

The course can be part of the following programmes: 1) Mathematical Sciences, Master's Programme (N2MAT) and 2) Applied Data Science Master's Programme (N2ADS)

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

Entry requirements

Basic skills in mathematical statistics.
Basic skills in scientific programming (for example in Matlab or R) as achieved by completing MSG400 "Stochastic Data Processing and Simulation".

Learning outcomes

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

- explain and apply a Bayesian approach to probability inference
- implement important computational algorithms for Bayesian inference, for example

Metropolis-Hastings MCMC
- make independent and informed decisions about statistical modeling and computational choices
- present his or her analysis in a structured and pedagogical way.

Course content
- Philosophy of Bayesian statistics.
- Conjugate priors and improper priors.
- Approximate methods for low-dimensional parameter spaces.
- Basic sampling methods.
- Monte Carlo integration.
- Advanced sampling methods such as Markov chain Monte Carlo (MCMC).
- Hierarchical models.
- Computations for Bayesian Networks.
- Basic information theory.
- The EM algorithm.
- Basic variational Bayes methods.

Form of teaching
Lectures and computer based hand-in assignments.

Language of instruction: English

Assessment
Compulsory computer based hand-in assignments. The grade will be based on a written examination at the end of the course.

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
Oral and/or written course evaluation will be performed. The results of the evaluation 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 *MSA102 Computational Methods for Bayesian Statistics* has partially the same content as the courses *MSA101 Computational Methods for Bayesian Statistics* and *MSA100 Computer Intensive Statistical Methods*. It is not allowed to be examined in more than one of these courses.