Faculty of Science

MASM27, Mathematical Statistics: Nonparametric Inference, 7.5 credits

Matematisk statistik: Icke-parameterisk inferens, 7,5 högskolepoäng

Second Cycle / Avancerad nivå

Details of approval

The syllabus was approved by Study programmes board, Faculty of Science on 2016-09-22 and was last revised on 2016-09-22. The revised syllabus applies from 2016-09-22, spring semester 2017.

General Information

The course is an elective course for second-cycle studies for a Degree of Master of Science (120 credits) in Mathematical Statistics.

Language of instruction: English

Main field of studies	*Depth of study relative to the degree requirements*
Mathematical Statistics	A1N, Second cycle, has only first-cycle course/s as entry requirements

Learning outcomes

The overall goal is to provide the students with tools, and show results, that are used in modern inference theory. Important applications can be found in e.g. survival analysis, nonparametric methods for estimating densities, regression functions and spectral densities. The course can also serve as an introduction to these fields.

Knowledge and understanding

Upon completion of the course, the student is to be able to :

- account for weak convergence on general function spaces
- account for the basic properties of empirical processes, and the Donsker's and Glivenko-Cantelli theorems
- account for functional differentiability of statistical functionals, as well as applications to limit distributions of statistical functionals, and applications in survival analysis.

- account for the theory for nonparametric and parametric bootstrap methods, as well as bootstrap of limit distributions for statistical functionals
- account for the theory for nonparametric density estimation
- account for the theory for nonparametric regression
- account for the theory for M and Z estimators, as well as applications to maximum likelihood estimators and least squares estimators

Competence and skills

Upon completion of the course, the student is to be able to :

- summarise a scientific article in Inference theory and present this orally at a seminar

Course content

Description of the subject specific contents of the course:

- Weak convergence on general function spaces. Non-measurable functionals (Hoffman-Jörgensen's theory). Characterisation of tightness and convergence of finite dimensional distributions.
- Empirical processes. Covering numbers and bracketing numbers. VC classes (Vapnik–Chervonenki's classes) of functions.
- Functional differentiability (smooth statistical functionals). Application to survival analysis (Nelson-Aalen and Kaplan-Meier estimators).
- Quantile estimators.
- Bootstrap methods. Functional differentiability for bootstrap. Bootstrap for empirical processes.
- Nonparametric estimation of densities. Limit distributions. Convergence rates.
- The partial sum process. Donsker's theorem for this. Nonparametric estimations of regression functions.
- M and Z estimators. Applications to maximum likelihood och least square estimators.
- Empirical processes and partial sum process results for weakly and strongly dependent stationary data. Kernel estimation of densities and regression functions.
- The empirical spectral process. Nonparametric estimation of spectral densities.

Course design

The teaching consists of lectures and a compulsory self-study project to deepen the understanding of a chosen subject within the course.

Assessment

The examination consists of an oral exam and a project seminar.

Students who fail the regular exam are offered a re-examination shortly afterwards.

Subcourses that are part of this course can be found in an appendix at the end of this document.

Grades

Marking scale: Fail, Pass, Pass with distinction.
For a passing grade on the course the student should pass the oral exam as well the project presentation.

The final grade of the course is given by the grade of the oral exam.

Entry requirements

For admission to the course knowledge equivalent to MASC01 Probabilty theory, 7.5 credits, is required. English B.

Subcourses in MASM27, Mathematical Statistics: Nonparametric Inference

Applies from V17

1601 Examination, 7,5 hp
Grading scale: Fail, Pass, Pass with distinction