LUND UNIVERSITY

Faculty of Science

MASM17, Mathematical Statistics: Time Series Analysis, 7.5 credits

Matematisk statistik: Tidsserieanalys, 7,5 högskolepoäng

Second Cycle / Avancerad nivå

Details of approval

The syllabus was approved by Study programmes board, Faculty of Science on 2007-06-14 and was last revised on 2007-06-14. The revised syllabus applies from 2007-07-01, autumn semester 2007.

General Information

The course is an elective course for second-cycle studies for a Master of Science in Mathematical statistics.

Language of instruction: Swedish and English

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

Learning outcomes

The aim of the course is that students on completion of the course should have acquired the following knowledge and skills:

Knowledge and understanding

On completion of the course, the students are expected to:

- be able to construct a model based on data for a concrete practical time series problem,
- be able to perform simple transformations of a non-stationary time series into a stationary time series,

- be able to predict and interpolate in linear time series models,
- be able to estimate parameters in linear time series models and validate a resulting model,
- be able to construct a Kalman-filter based on a linear state model,
- be able to estimate in time varying stochastic systems using recursive and adaptive techniques.

Competence and skills

On completion of the course, the students are expected to:

- be able to present the analysis of a practical problem in a written report and present it orally.

Course content

Time series analysis concerns the mathematical modelling of time varying phenomena, e.g., ocean waves, water levels in lakes and rivers, demand for electrical power, radar signals, muscular reactions, ECG-signals, or option prices at the stock market. The structure of the model is chosen both with regard to the physical knowledge of the process, as well as using observed data. Central problems are the properties of different models and their prediction ability, estimation of the model parameters, and the model's ability to accurately describe the data. Consideration must be given to both the need for fast calculations and to the presence of measurement errors. The course gives a comprehensive presentation of stochastic models and methods in time series analysis. Time series problems appear in many subjects and knowledge from the course is used in, i.a., automatic control, signal processing, and econometrics.

Further studies of ARMA-processes. Non-stationary models, slowly decreasing dependence. Transformations. Optimal prediction and reconstruction of processes. State representation, principle of orthogonality, and Kalman filtering. Parameter estimation: Least squares and Maximum likelihood methods as well as recursive and adaptive variants. Non-parametric methods,covariance estimation, spectral estimation. An orientation on robust methods and detection of outliers.

Course design

Teaching consists of lectures, exercises, computer exercises and projects. Participation in computer exercises, projects and thereby integrated teaching is compulsory.

Assessment

The examination is done by written and oral presentation of the the project and a written exam.

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 entire course a passing grade on the written exam and on the project presentation, and participation in compulsory parts are required. The final grade is formed by weighing together the results on the parts which are included the examination.

Entry requirements

For admission to the course knowledge equivalent to the course MASC04, Stationary Stochastic processes, 7.5 credits is required together with English B.

Subcourses in MASM17, Mathematical Statistics: Time Series Analysis

Applies from H15

0703 Project, 4,5 hp
Grading scale: Fail, Pass
0704 Exam, 2,0 hp
Grading scale: Fail, Pass, Pass with distinction
0705 Laboratory Work part 1, 0,5 hp
Grading scale: Fail, Pass
0706 Laboratory Work part 2, 0,5 hp
Grading scale: Fail, Pass

Applies from V08

0701 Project, 7,5 hp
Grading scale: Fail, Pass, Pass with distinction
0702 Computer Exercises, 0,0 hp
Grading scale: Fail, Pass