Faculty of Science

MASM38, Mathematical Statistics: Survival Analysis, 7.5 credits

Matematisk statistik: Analys av överlevnadsdata, 7,5 högskolepoäng

Second Cycle / Avancerad nivå

Details of approval

The syllabus was approved by Study programmes board, Faculty of Science on 2023-05-26 to be valid from 2023-05-26, spring semester 2024.

General Information

The course is an elective course for second-cycle studies for a Master of Science 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 purpose of the course is that the students after the course should have acquired knowledge of survival data and related questions that occur in medical, technical and econometric investigations containing survival data. Important applications are e.g. when a certain disease occurs or when a symptom stops. Also modelling of times for disasters or times for defaults of companies are possible applications.

Knowledge and understanding

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

- describe the fundamental concepts that are used in survival analysis, such as hazard function and survival function.
- describe semi parametric regression models such as Cox regression model and Aalens regression model.
- give account of basic non parametric methods for estimation of the survival function and the cumulative hazard function

Competence and skills

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

- be able to do basic non parametric methods for estimation of the survival function and the cumulative hazard function as well as using density estimates of the hazard function.
- be able to estimate parameters and functions in Cox and Aalens models.
- be able to use a statistical computer program to perform fundamental investigations of survival data in medical statistics or other applications.
- be able to use residual analysis to check model assumptions for survival data.
- be able to analyze data with various kinds of censuring and truncation.
- be able to handle model choices and quantitatively give account of a model's pros and cons.
- use residual analysis for control of model assumptions for survival data.
- use counting processes as models for survival data, statistical functionals for obtaining distributions of estimates in survival analysis.

Judgement and approach

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

- be able to evaluate if a model is good enough to answer the underlying statistical question.
- be able to qualitatively decide which model structure that answers the underlying statistical question in the best way.

Course content

The course treats:

- Survival data; censured and truncated data.
- Covariates.
- Distributions and models for survival data.
- Counting processes and martingale theory.
- Estimation of survival function and cumulative hazard function (Kaplan-Meier and Nelson-Aalen estimators).
- Non parametric one and multiple sample tests.
- Kernel estimates of hazard function.
- Semi parametric regression models for data with covariates.
- Cox model and Aalens model.
- Likelihood-theory for estimation in the Cox model.
- Breslow estimator of cumulative hazard in the Cox model.
- Projection methods in counting processes for estimation in the Aalen model.
- Bootstrap methods for survival data.
- Statistical functionals for limiting distributions in survival analysis.

Course design

Teaching consists of lectures, computer exercises and projects. Participation in project work, computer exercises is compulsory.

Assessment

The examination are done through written project reports during the course and an oral exam at the end of the course.

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

The examiner, in consultation with Disability Support Services, may deviate from the regular form of examination in order to provide a permanently disabled student with a form of examination equivalent to that of a student without a disability.

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 oral exam and a passing grad on the project reports as well as participation in compulsory parts are required.

For the project reports, only the grades Fail or Pass are given while for the written exam the grades are Fail, Pass and Pass with Distinction.

The final grade is the grade on the oral examination.

Entry requirements

For admission to the course English 6/B and 90 ECTS credits including knowledge corresponding to one of the following courses:

MASA02 Mathematical statistics:Basic course, 15 ECTS,

MASB13 Mathematical Statistics for Physicists 7.5 ECTS,

MASB02 Mathematical Statistics for Chemists 7.5 ECTS.

Further information

The course replaces MASMM21 Survival Analysis 7,5 credits and may not be included in a degree together with this course or FMSN10 Survival Analysis, 7,5 credits.

The course is given by Centre for Mathematical Sciences, Lund University.

Subcourses in MASM38, Mathematical Statistics: Survival Analysis

Applies from V24

2401 Oral exam, 5,0 hp
Grading scale: Fail, Pass, Pass with distinction
2402 Project, 2,5 hp
Grading scale: Fail, Pass