Course syllabus

Matematisk statistik
Mathematical Statistics

FMSF32, 7,5 credits, G2 (First Cycle)

Valid for: 2023/24
Faculty: Faculty of Engineering, LTH
Decided by: PLED I
Date of Decision: 2023-04-14

General Information

Compulsory for: IBYI2, IBYV2
Language of instruction: The course will be given in Swedish

Aim

The course is intended to give the student the basics in mathematical modelling of random variation and an understanding of the principles behind statistical analysis. It shall also give the students a toolbox containing the most commonly used models and methods, as well as the ability to use these in practical situations.

The course fills two purposes, providing a fundamental knowledge of mathematical statistics, as well as giving a foundation for further studies.

The fundamental knowledge is essential for those who, in their professional lives, will not necessarily be involved in statistical analyses on a daily basis, but who, on occasion, will be expected to perform basic statistical tests and present the results to their colleagues. They will also be expected to be able to read and assess the analyses of others.

The course shall also give a basis for further studies, particularly in statistics.

Learning outcomes

Knowledge and understanding
For a passing grade the student must

- be able to relate questions regarding random variation and observed data to the concepts of random variables, distributions, and relationships between variables,

- be able to explain the concepts of independence, probability, distribution, expectation, and variance,
- be able to calculate the probability of an event, and the expectation and variance from a given distribution,
- be able to describe fundamental techniques for statistical inference and be able to use them on basic statistical models.

Competences and skills
For a passing grade the student must

- be able to construct a simple statistical model describing a problem based an a real life situation or on a collected data material,
- be able to examine a statistical model and its ability to describe reality,
- be able to use a computational program for simulation and interpretation of statistical models, as well as for data analysis,
- be able to choose, perform, and interpret a statistical procedure that answers a given statistical problem,
- be able to use statistical terms within the field in writing.
- be able to present a statistical analysis in a technical report.

Judgement and approach
For a passing grade the student must

- be able to examine a statistical model and its ability to describe reality.

Contents

The course contains fundamental concepts in probability theory, inference theory, and regression analysis.

In probability theory the concepts used are random variables and distributions for describing variation and random phenomena, often related to engineering applications. Different distributions, such as binomial, Poisson, normal, exponential, and log normal distributions, are studied and the concept of expectation and variance of a distribution is introduced. Special attention is paid to the normal distribution and its property as a limit distribution. Simulations from the distributions and studies of the models are performed in Matlab.

In inference theory we start with observed data and estimate parameters in simple probability models, and describe the uncertainty of the estimates. Emphasis is placed on the relationship between the model and the reality based problem, as well as the conclusions that can be drawn from observed data. In this analysis we use basic techniques, such as confidence intervals and hypothesis testing. Examples of applications are given.

In regression analysis we study how the relationship between two or more variables can be described. Most often the relationship will be linear. We study techniques for comparing and choosing among different models. This part rests heavily on the use of Matlab.

Examination details

Grading scale: TH - (U,3,4,5) - (Fail, Three, Four, Five)
Assessment: Written examination, computer exercises, project report and computational ability test.

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.

Parts
Code: 0121. **Name:** Examination.
Credits: 5. **Grading scale:** TH. **Assessment:** Written exam.
Code: 0221. **Name:** Laboratory Work.
Credits: 2. **Grading scale:** UG. **Assessment:** Computer exercises and written project report.
Code: 0321. **Name:** Computational Ability Test.
Credits: 0,5. **Grading scale:** UG. **Assessment:** Computer based test

Admission

Assumed prior knowledge: FMAA50 Calculus and FMAA55 Mathematics, Linear Algebra.
The number of participants is limited to: No
The course overlaps following course/s: VTVA30, MASB02, MASB03, FMS601, FMSF35, FMSF40, FMAF30, FMSF20, FMSF45, FMSF50, FMSF55, FMSF70, FMSF75, MASA01, FMSF30, FMSF25

Reading list

- Vännman K, Jonsson A: Matematisk statistik, 3:e upplagan. Studentlitteratur, 2020, ISBN: 9789144133249.

Contact and other information

Director of studies: Johan Lindström, studierektor@matstat.lu.se
Course administrator: Susann Nordqvist, expedition@matstat.lu.se
Course homepage: https://maths.lu.se/utbildning/hoegskoleingenjoersutbildning/
Further information: The course may not be included in a degree together with the course VTVA30, FMSF25 or FMSF30.