LUNDS UNIVERSITET
Lunds Tekniska Högskola

Course syllabus

Matematisk statistik, allmän kurs
Mathematical Statistics, Basic Course

FMSF50, 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

Main field: Technology.
Compulsory for: C2, L2, M3, V3
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, both in probability theory, inference as well as in applications such as design of experiments, control theory, maskin learning and logistics.

Learning outcomes

Knowledge and understanding
For a passing grade the student must

- be able to relate questions regarding random variation and observed data, as they appear in applications relevant to the students, 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.
- understand the a statistical relationship between two variables does not necessarily imply couse-effect.

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 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 present a statistical analysis and its interpretation in a report with two parts, where one is technical and the other a short summary aimed at a layman with limited technical knowledge

Judgement and approach
For a passing grade the student must

- be able to examine a statistical model and its ability to describe reality.
- be able to examine a simple measurement situation and judge whether data is collected in a way that allows further analysis.

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 applications in civil engineering and surveying. 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. Different types of measurement errors and error propagation are studied.

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.

In regression analysis we study how the relationship between two or more variables can be described. Most often the relationship will be linear. Models using indicator variables can occur. 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 exam, 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: 0117. **Name:** Examination.
Credits: 5,5. **Grading scale:** TH. **Assessment:** Written exam.
Code: 0217. **Name:** Laboratory Work.
Credits: 1,5. **Grading scale:** UG. **Assessment:** Computer exercises and written project report.
Code: 0317. **Name:** Computational Ability Test.
Credits: 0,5. **Grading scale:** UG. **Assessment:** Computer based test

Admission

Admission requirements:

- FMAA01 Calculus in One Variable or FMAA05 Calculus in One Variable or FMAB30 Calculus in Several Variables or FMAB35 Calculus in Several Variables or FMAB45 Calculus in One Variable A1 or FMAB50 Calculus in One Variable A2 or FMAB65 Calculus in One Variable B1 or FMAB70 Calculus in One Variable B2
- FMAA01 Calculus in One Variable or FMAA05 Calculus in One Variable or FMAB30 Calculus in Several Variables or FMAB35 Calculus in Several Variables or FMAB45 Calculus in One Variable A1 or FMAB60 Calculus in One Variable A3 or FMAB65 Calculus in One Variable B1 or FMAB70 Calculus in One Variable B2
- FMAA01 Calculus in One Variable or FMAA05 Calculus in One Variable or FMAB30 Calculus in Several Variables or FMAB35 Calculus in Several Variables or FMAB50 Calculus in One Variable A2 or FMAB60 Calculus in One Variable A3 or FMAB65 Calculus in One Variable B1 or FMAB70 Calculus in One Variable B2

Assumed prior knowledge: Calculus in one variables and Linear algebra.
The number of participants is limited to: No
The course overlaps following course/s: FMSF20, FMSF25, FMSF30, FMSF35, FMSF40, FMSF45, MASB03, FMSF55, FMSF70, MASB02, FMSF75, MASA01, FMS032, FMS033, MASA02, FMSF80

Reading list

- Vännman K, Jonsson A: Matematisk statistik, tredje upplagan. Studentlitteratur, 2020, ISBN: 9789144133249.
- Lena Zetterqvist och Johan Lindström: Räkna med variation - Ett arbetsmaterial i sannolikhetslära och statistisk inferens. Studentlitteratur, 2017, ISBN: 9789144113142.

Contact and other information

Director of studies: Johan Lindström, studierektor@matstat.lu.se
Course administrator: Susann Nordqvist, expedition@matstat.lu.se
Course homepage:
https://www.maths.lu.se/utbildning/civilingenjoersutbildning/matematisk-statistik-paa-civilingenjoersprogram/
Further information: Replaces FMSF55 for M & C after a merger of the two courses. The course may not be included together with FMSF25. The course is also given for physicists at the faculty of science with the code MASB13.