Faculty of Science

MASA03, Mathematical Statistics: Basic Course, 15 credits
Matematisk statistik: Grundkurs, 15 högskolepoäng
First Cycle / Grundnivå

Details of approval

The syllabus was approved by The Education Board of Faculty of Science on 2024-11-27. The syllabus comes into effect 2024-11-27 and is valid from the autumn semester 2025.

General information

The course is a mandatory course for first-cycle studies for a Bachelor of Science in mathematics.

Language of instruction: English

Main field of study	Specialisation
Mathematics	G1F, First cycle, has less than 60 credits in first-cycle course/s as entry requirements

Learning outcomes

The overall aim of the course is that students shall have acquired basic knowledge of the probability theory and statistics on completion of the following learning outcomes.

Knowledge and understanding

On completion of the course, the students shall be able to:

- explain the fundamental concepts in the mathematical foundation of of probability,
- understand how questions about random variation and observed data are linked to the concepts random variables, distributions and relations between variables,
- explain the concepts of independence, probability, conditional probability, distribution, expectation, variance, and covariance,

- calculate the probability of an event, and the expectation and variance from a given distribution in a one or multi-dimensional model,
- describe fundamental mathematical techniques to make statistical inference based on observations of data,
- describe how to use to use distributions of estimators to describe properties of estimators,
- describe how to use distributions of estimators to construct confidence intervals and tests.

Competence and skills

On completion of the course, the students shall be able to:

- construct a simple statistical model describing a problem based on a real life situation or on a collected data material,
- use a computational program for simulation and interpretation of statistical models, as well as for data analysis,
- choose, modify, perform, and interpret a statistical procedure that answers a given statistical problem,
- use statistical terms within the field in writing,
- solve a given problem within a given time frame (examinated through labboration reports),
- make ethical considerations related to the use of statistics within science and society- (Examinated through a computer based test).

Judgement and approach

On completion of the course, the students shall be able to:

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

Course content

The course is divided into two halves, the first covers probability theory and the second covers statistics. The course covers:

Probability theory

- Sample space
- Events
- Basic set theory
- Axioms of probability
- Conditional probability, Independent events
- Stochastic variables in one and several dimensions
- Expectation, variance, and covariance
- Normal distribution, binomial distribution, Poisson distribution and other important distributions

- Conditional distributions and conditional expectations. Sums and linear combination of random variables
- The law of large numbers, the central limit theorem and the law of rare events (Poisson limit).

Statistics.

- Point estimates and their properties
- Maximum likelihood, Least squares and plugin estimators
- Principles of interval estimates and hypothesis testing
- Non-parametric test
- Methods for observed data from standard distribution such as normal distribution, Binomial, Poisson and related distribution
- Approximation methods based on the normal and Poisson distribution
- Correlation
- Linear regression.

Course design

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

Assessment

The examination is done in form of two written exams, one after each half of the course, and an oral exam after each of the written exams, as well as through computer based test and computer exercises.

Students who did not pass the ordinary exam are offered a re-examination shortly after.

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.

Grades

Grading scale includes the grades: Fail, Pass, Pass with distinction
In order to pass the entire course, the student must pass all exams, computer based test and computer exercises.

The grades awarded for the exams are Fail, Pass and Pass with Distinction. The grades awarded for the computer exercises and computer based test are Fail and Pass.

The final grade is based on the acquired results for the different parts of the exams.

Entry requirements

For admission to the course, general entry requirements as well as 45 credits of Science studies including knowledge equivalent to:

MATA31 Analysis in One Variable, 15 credits

MATA32 Algebra and Vector Geometry, 7.5 credits

NUMA01 Computational Programming with Pyhon, 7.5 credits

MATB21 Analysis in Several Variables 1, 7.5 credits

MATB32 Linear Algebra, 7.5 credits

Alternatively general entry requirements and knowledge equivalent to the courses:

MATA21 Analysis in One Variable, 15 credits
MATA22 Linear Algebra 1, 7.5 credits
MATA23 Foundations of Algebra, 7.5 credits
NUMA01 Computational Programming with Python, 7.5 credits
MATB21 Analysis in Several Variables, 1 7.5 credits
MATB22 Linear algebra 2, 7.5 credits

Further information

The course replaces MASA02 Mathematical Statistics, basic course, 15 credits and credits from that course cannot count towards a degree together with this course, or together with MASA02 Mathematical Statistics, basic course, 15 credits, or together with MASA01 Mathematical Statistics, basic course, 15 credits or together with any course with coursecode starting with MASB.

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