



**LUND**  
UNIVERSITY

Faculty of Science

## **MASA02, Mathematical Statistics: Basic Course, 15 credits**

*Matematisk statistik: Grundkurs, 15 högskolepoäng*

First Cycle / Grundnivå

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### **Details of approval**

The syllabus was approved by Study programmes board, Faculty of Science on 2019-11-20 to be valid from 2019-11-20, autumn semester 2020.

### **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 studies*

Mathematics

*Depth of study relative to the degree requirements*

G2F, First cycle, has at least 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 probability,
- relate questions about random variation and observed data 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 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 (examined through laboratory reports),
- make ethical considerations related to the use of statistics within science and society- ( Examined 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:

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). 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 at the end of the course, as well as through compulsory components. 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.

*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.

In order to pass the entire course, the student must pass all compulsory parts of the course.

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 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

Alternatively general entry requirements and knowledge equivalent to the courses:

MATA15 Algebra 1, 15 credits, MATA14 Analysis 1, 15 credits, MATB15 Analysis in Several Variables, 15 credits, MATB11 Linear Algebra, 7.5 credits and NUMA21 Tools in Computational Mathematics 7,5 credits.

## Further information

The course may not be included in a higher education qualification together with MASA01 Mathematical Statistics, basic course, 15 credits, or together with any course with coursecode starting with MASB.

## Subcourses in MASA02, Mathematical Statistics: Basic Course

Applies from H20

- 2001 A. Probability, 5,0 hp  
Grading scale: Fail, Pass, Pass with distinction
- 2002 Computer exercis A, 0,0 hp  
Grading scale: Fail, Pass
- 2003 Computer excercise B, 0,0 hp  
Grading scale: Fail, Pass
- 2004 B Infence theory, 5,0 hp  
Grading scale: Fail, Pass, Pass with distinction
- 2005 Oral exam, 5,0 hp  
Grading scale: Fail, Pass, Pass with distinction
- 2006 Computer based test, 0,0 hp  
Grading scale: Fail, Pass