Faculties of Humanities and Theology

ÄMAD04, Mathematics 4, 30 credits

Matematik 4, 30 högskolepoäng

First Cycle / Grundnivå

Details of approval

The syllabus is an old version, approved by Study programmes board, Faculty of Science on 2018-10-22 and was valid from 2018-10-22 , autumn semester 2018.

General Information

The course is included in the Master's programme in Secondary Education at Lund University.

Main field of studies	*Depth of study relative to the degree requirements*
Mathematics	G1F, First cycle, has less than 60 credits in first-cycle course/s as entry requirements

Learning outcomes

The aim of the course is to enable students to acquire the following knowledge and skills on completion of the course.:

Knowledge and understanding

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

- use and account for basic mathematical concepts, methods, inference and techniques in geometry, discrete mathematics, and in probability and statistical theory
- perform different calculations of relevance to the subject areas of the respective modules
- relate issues of random variation and observed data to the concepts of random variables, distributions and relationships between variables
- describe basic techniques for statistical inferencing, use them on simple statistical models, and modify and adapt them to more complicated models

- account for current policy documents for upper secondary school

Competence and skills

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

- interpret relevant information, and independently identify, formulate and solve problems of relevance to the subject areas of the different modules
- design a statistical model based on a problem retrieved from the real world or from collected data
- use a calculation program for simulation and interpretation of statistical models and for the analysis of data
- select, modify, execute and interpret a statistical procedure that answers a set statistical question
- identify the logical structure in mathematical arguments and produce mathematical proof
- account for segments of mathematical history and their potential use in teaching situations
- plan and conduct teaching linked to a selection of course components from the modules Geometry, Probability Theory and Statistical Theory of relevance to upper-secondary school mathematics
- analyse and assess pupils' learning especially within basic geometry, inference and problem-solving
- communicate mathematical arguments in speech and writing

Judgement and approach

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

- review a statistical model and its ability to describe the real world
- evaluate and use a formal treatment of mathematics

Course content

The course consists of the modules:

Geometry including Subject Didactics, 7.5 credits

Euclidean geometry: Classical theorems in Euclidean geometry. Inference and problem-solving in geometry. Different axioms derived from Euclidean geometry, overview of non-Euclidean geometry. Problem-solving strategies including the use of software for dynamic geometry. Study resources for teaching mathematics in upper secondary school as well as policy documents in the form of course syllabi linked to geometry.

Discrete Mathematics, 7.5 credits

Combinatorics, generating functions, recurrence relations and difference equations. Rings and fields with application to coding theory.

Probability Theory including Subject Didactics, 7.5 credits

The probability axioms. Conditioned probability, independent events. Stochastic variables in one and several dimensions and their functions. Expectation, variance and covariance. Normal distribution, binomial distribution, the Poisson distribution and other important distributions. Conditioned distributions and conditioned expectations. Sums and linear combinations of stochastic variables. The law of large numbers and the central limit theorem. Planning and implementation of teaching activities linked to a selection of course components of relevance to upper secondary school mathematics.

Statistical Theory including Subject Didactics, 7.5 credits

Descriptive statistics. The properties of point estimations. The ML method and LS method. Principles of interval estimation and hypothesis testing. Methods for normal distribution observations. Approximative methods based on normal distribution. Correlation. Linear univariate and multiple regression; polynomial regression. Planning and implementation of teaching activities linked to a selection of course components of relevance to upper secondary school mathematics.

Course design

The teaching consists of lectures, seminars and laboratory sessions in small groups of students. An essential feature in the small group sessions is practice in problem-solving and oral communication in mathematics. The module "Geometry including Subject Didactics" also includes lesson planning and implementation. Participation in laboratory sessions and associated components is compulsory.

Assessment

The assessment is based on the following components of the different modules:

- Geometry, computer exercises, 1.5 credits
- Geometry, written presentation of exercises, 3 credits
- Geometry, planning and implementation of teaching, 3 credits
- Discrete Mathematics, written exam, 7.5 credits
- Probability Theory, written exam, 5 credits
- Statistiical Theory, written exam, 5 credits
- Didactic project in mathematical statistics, 5 credits

All modules are taught at a 50% rate of study. Geometry and Probability Theory are given in the first half of the semester, and Discrete Mathematics and Statistical Theory in the second half of the semester. Assessed components linked to Geometry are included throughout the module. All written exams take place at the end of the respective module. The didactic project in mathematical statistics is assessed at the end of the course.

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.
The grades awarded on all assessed components are Pass or Fail. The results of the written exams are presented as exam points, of which the total number of points per exam is proportionate to the number of credits for the relevant module. For a grade of Pass on each written exam, the student must have achieved at least 50% of the total available number of points. For a grade of Pass on the whole course, the student must have been awarded this grade on all assessed components. For a grade of Pass with Distinction, the student must have passed all assessed components and achieved at least 75% of the total available number of points.

Entry requirements

To be admitted to the course, the student must have passed at least 45 credits of the courses ÄMAD01 Mathematics with Didactics 1 (30 credits), ÄMAD02 Mathematics with Didactics 2 (15 credits) and ÄMAD03 Mathematics with Didactics 3 (15 credits).

Further information

The course is coordinated with MASA01 Mathematical Statistics: Basic Course, 15 credits, and MATB13 Discrete Mathematics, 7.5 credits and may not be included in a degree together with these.

Subcourses in ÄMAD04, Mathematics 4

Applies from H18

1801 Geometry, laboratory sessions, 1,5 hp
Grading scale: Fail, Pass
1802 Geometry, exercises, 3,0 hp
Grading scale: Fail, Pass
1803 Geometry, teaching, 3,0 hp
Grading scale: Fail, Pass
1804 Discrete Mathematics, written examination, 7,5 hp
Grading scale: Fail, Pass
1805 Probability Theory, written examination, 5,0 hp
Grading scale: Fail, Pass
1806 Mathematical Statistics, written examination, 5,0 hp
Grading scale: Fail, Pass
1807 Didactical project in Mathematical Statistics, 5,0 hp
Grading scale: Fail, Pass