Probability Theory

Sannolikhetsteori
6 credits

Programme course

732A63

Valid from: 2025 Autumn semester

Determined by	**Main field of study**	
The Quality Board at the Faculty of Arts and Sciences	Statistics	
Date determined	**Course level**	**Progressive specialisation**
2016-09-30	Second cycle	A1F
Revised by	**Disciplinary domain**	
Chairman of the Course and Programme Syllabus Board at the Faculty of Arts and Sciences	Technology	
Revision date	**Subject group**	
2022-06-15; 2024-09-30	Statistics	
Offered first time	**Offered for the last time**	
Autumn semester 2016		
Department	**Replaced by**	
Institutionen för datavetenskap		

Course offered for

- Master's Programme in Statistics and Machine Learning

Entry requirements

- Bachelor's degree equivalent to a Swedish Kandidatexamen of 180 ECTS credits in one of the following subjects:
    - statistics
    - mathematics
    - applied mathematics
    - computer science
    - engineering
- Completed courses in
    - calculus
    - linear algebra
    - statistics
    - programming
- English corresponding to the level of English in Swedish upper secondary education (Engelska 6)
  Exemption from Swedish
- At least 24 ECTS credits passed in the main field of Statistics at second cycle and at least 5 ECTS credits passed in the main field of Computer Science at second cycle

Intended learning outcomes

After completing the course, the student shall be able to

- Apply central univariate and multivariate probability distributions to solve theoretical and practical problems in probability theory.
- Derive probability distributions for functions of random vectors.
- Analyze probability models using moment-generating functions and other transforms.
- Analyze probability models using conditioning.
- Explain fundamental models for stochastic convergence and derive limit distributions.

Course content

In the course, a theoretical foundation for models and methods based on probability concepts is established. The course covers:

- Probability distributions for univariate and multivariate random variables
- Expectation, variance, moments
- Joint distribution, conditional distribution, independence
- Fundamentals of Bayesian theory
- Transforms
- Order statistics
- Multivariate normal distribution and its properties
- Types of convergence and theorems related to the concept of convergence

Teaching and working methods

The teaching consists of lectures and problem-solving sessions. In addition, the student shall engage in self-study.

The language of instruction and examination is English. Language of instruction: English.

Examination

The course is examined through:

- Individual written examination, grading scale: EC
- To pass (E) as the final grade, a minimum of E is required in all components. Higher grades are based on the individual written examination.

Detailed information can be found in the study guide.

If special circumstances prevail, and if it is possible with consideration of the nature of the compulsory component, the examiner may decide to replace the compulsory component with another equivalent component.

If the LiU coordinator for students with disabilities has granted a student the right to an adapted examination for a written examination in an examination hall, the student has the right to it.

If the coordinator has recommended for the student an adapted examination or alternative form of examination, the examiner may grant this if the examiner assesses that it is possible, based on consideration of the course objectives.

An examiner may also decide that an adapted examination or alternative form of examination if the examiner assessed that special circumstances prevail, and the examiner assesses that it is possible while maintaining the objectives of the course.

Students failing an exam covering either the entire course or part of the course twice are entitled to have a new examiner appointed for the reexamination.

Students who have passed an examination may not retake it in order to improve their grades.

Grades

ECTS, EC

Other information

Planning and implementation of a course must take its starting point in the wording of the syllabus. The course evaluation included in each course must therefore take up the question how well the course agrees with the syllabus.

The course is conducted in such a way that there are equal opportunities with regard to sex, transgender identity or expression, ethnicity, religion or other belief, disability, sexual orientation and age.

If special circumstances prevail, the vice-chancellor may in a special decision specify the preconditions for temporary deviations from this course syllabus, and delegate the right to take such decisions.

About teaching and examination language

The teaching language is presented in the Overview tab for each course. The examination language relates to the teaching language as follows:

- If teaching language is “Swedish”, the course as a whole could be given in Swedish, or partly, or as a whole, in English. Examination language is Swedish, but parts of the examination can be in English.
- If teaching language is “English”, the course as a whole is taught in English. Examination language is English.
- If teaching language is “Swedish/English”, the course as a whole will be taught in English if students without prior knowledge of the Swedish language participate. Examination language is Swedish or English depending on teaching language.