



# SF2944 Foundations of Probability Theory 7.5 credits

Sannolikhetsteorins grunder

This is a translation of the Swedish, legally binding, course syllabus.

## Establishment

The course plan is affective from Fall 2025 according to the Faculty Boards decision S-2024-0066. Date of decision: 2024-10-07

## Grading scale

A, B, C, D, E, FX, F

## Education cycle

Second cycle

## Main field of study

Mathematics

## Specific prerequisites

English B / English 6

Completed course in Probability theory and statistics (SF1918, SF1922 or similar)

## Language of instruction

The language of instruction is specified in the course offering information in the course catalogue.

## Intended learning outcomes

The overall aim of the course is for the students to become well acquainted with fundamental concepts, theorems and solution methods of probability theory.

After the course the student should be able to:

- formulate central definitions and theorems within the subject area of the course;
- apply and generalize methods within the subject area of the course;
- read and understand a mathematical text, in order to learn how to solve problems involving proofs of basic concepts within probability theory.

## Course contents

- Basic concepts: Probability spaces, Kolmogorov axioms, random variables, distributions.
- Expectation: Integration with probability measures, dominated and monotone convergence theorems, Markov inequality.
- Independent algebras and random variables, Borel-Cantelli lemma.
- Weak law of large numbers: L<sup>2</sup>-convergence, convergence in probability, weak law of large numbers.
- Strong law of large numbers: Almost sure convergence, Kolmogorov's law.
- Weak convergence: Convergence in distribution, characteristic function, Lévy's continuity theorem, central limit theorem.
- Conditional expectation: conditional expectation and variance, martingales, Doob inequalities and martingale convergence.

## Examination

- TEN1 - Written exam, 7.5 credits, grading scale: A, B, C, D, E, FX, F

Based on recommendation from KTH's coordinator for disabilities, the examiner will decide how to adapt an examination for students with documented disability.

The examiner may apply another examination format when re-examining individual students.

If the course is discontinued, students may request to be examined during the following two academic years.

## Ethical approach

- All members of a group are responsible for the group's work.
- In any assessment, every student shall honestly disclose any help received and sources used.
- In an oral assessment, every student shall be able to present and answer questions about the entire assignment and solution.