



# FSF3965 Mathematics of Data Science 7.5 credits

Matematik för Data-analys

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

## Establishment

The course plan applies from and including HT2024 according to faculty board decision: S-2024-0066. Decision date: 2024-09-12.

## Grading scale

P, F

## Education cycle

Third cycle

## Specific prerequisites

Master of Science in Engineering or a Master's degree in Mathematics, Applied Mathematics, or a related field, including 30 ECTS credits in Mathematics. Recommended courses are SF2940 Probability Theory, SF2930 Regression Analysis and SF2822 Applied Nonlinear Optimization.

## 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 students to become well acquainted with fundamental probabilistic concepts, theorems, and solution methods.

- After completing the course, students are expected to be able to:
- Formulate, explain, and compare high-dimensional statistical models and optimization methods;
- Derive and explain mathematical inequalities in high-dimensional probability theory;
- Apply the theory of monotone operators to derive convergence results for optimization methods;
- Apply theoretical concepts and methods in high-dimensional statistics and optimization to solve problems involving high-dimensional data.

## Course contents

### Module 1

- Introduction to high-dimensional statistics and optimization
- Background on statistical models, optimization, and iterative methods

### Module 2

- Linear regression in high dimension, Lagrange relaxation and the Hahn-Banach theorem
- Concentration of measures and Fenchel duality

### Module 3

- Stochastic approximation and Monotone operators
- Compressed sensing / Random projections / Splitting methods

## Examination

- PRO1 - Project, 7.5 credits, grading scale: P, 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.