

# Syllabus

for course at advanced level

**Linear Algebra and Learning from Data**  
**Linjär algebra och inläring från data**

**7.5 Higher Education  
Credits**  
**7.5 ECTS credits**

<b>Course code:</b>	MM7024
<b>Valid from:</b>	Autumn 2019
<b>Date of approval:</b>	2019-05-13
<b>Department</b>	Department of Mathematics (incl. Math. Statistics)
<b>Main field:</b>	Mathematics/Applied Mathematics
<b>Specialisation:</b>	A1N - Second cycle, has only first-cycle course/s as entry requirements

## Decision

This syllabus was approved by the Board of the Faculty of Science at Stockholm University on 13 May 2019.

## Prerequisites and special admittance requirements

Admission the course requires knowledge equivalent to:

- \* Mathematics II - Analysis, part A (MM5010),
- \* Mathematics II - Linear Algebra (MM5012),
- \* Numerical Analysis (MM5014),
- \* Programming Techniques for Mathematicians (DA2004),
- \* Probability Theory I (MT3001),
- \* and English 6 or equivalent.

## Course structure

Examination code	Name	Higher Education Credits
HELA	Linear algebra and learning from data	7.5

## Course content

- \* Basic computationally efficient algorithms for large matrices
- \* Principal Component Analysis
- \* Sparse and underdetermined systems and their relation to data compression
- \* Construction of neural networks and models for deep learning
- \* Fitting hyperparameters
- \* Selected topics on particular types of matrices

## Learning outcomes

Upon completion of the course, students are expected to:

- \* have a good command of basic computationally efficient algorithms for large matrices
- \* be able to use methods from linear algebra to identify data patterns, define models and set up neural networks
- \* be able to account for the balancing of bias and variance
- \* be able to account for and apply dimension reduction

## Education

Instruction consists of lectures, exercises, and computer projects.

**Forms of examination**

a. The course is examined as follows: Knowledge assessment takes the form of written examination and hand-in exercises.

b. Grades will be set according to a seven-point scale related to the learning objectives of the course:

A = Excellent

B = Very good

C = Good

D = Satisfactory

E = Adequate

Fx = Fail, some additional work required

F = Fail, much additional work required

c. The grading criteria will be distributed at the beginning of the course.

d. To be awarded a pass, the minimum grade E is required.

e. Students who receive a failing grade on a regular examination are allowed to retake the examination as long as the course is still provided. The number of examination opportunities is not limited. Other mandatory course elements are equated with examinations. A student who has received a pass grade on an examination may not retake the examination to attain a higher grade. A student who has failed the same examination twice is entitled to have another examiner appointed, unless there are special reasons to the contrary. Such requests should be made to the department board.

The course includes at least two examination opportunities per year when the course is given. At least one examination opportunity will be offered during a year when the course is not given.

f. Students awarded the grade Fx are given the opportunity to improve their grade to E. The examiner decides the supplementary assignments to be performed and the pass mark criteria. The supplementary assignments will take place before the next examination session.

**Interim**

Students may request that the examination be conducted in accordance with this course plan even after it has ceased to be valid. However, this may not take place more than three times over a two year period after course instruction has ended. Requests must be made to the departmental board. The provision also applies in the case of revisions to the course plan.

**Misc**

The course can be included in the Master's Program in Mathematics or Mathematical Statistics but can also be read as a separate course.

**Required reading**

The course literature is decided by the department board and published on the website of the Department of Mathematics ([www.math.su.se](http://www.math.su.se)) at least two months before the start of the course.