

Syllabus

for course at advanced level

Computer algebra

Datoralgebra

7.5 Higher Education

Credits

7.5 ECTS credits

Course code:	MM7025
Valid from:	Spring 2020
Date of approval:	2019-08-19
Department	Department of Mathematics (incl. Math. Statistics)
Main field:	Mathematics/Applied Mathematics
Specialisation:	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 2019-08-19.

Prerequisites and special admittance requirements

Admission to the course requires knowledge equivalent to

1. Computer Science for Mathematicians, 7.5 ECTS (DA3018) and Mathematics III - Abstract algebra, 7.5 ECTS (MM5020)

or

2. Algorithms and Complexity, 7.5 ECTS (DA3004) and Mathematics II - Algebra and combinatorics, 7.5 ECTS (MM5013).

Course structure

Examination code	Name	Higher Education Credits
TENT	Theory	4
LABB	Practical exercises	1
PROJ	Project	2.5

Course content

a. The course deals with computer algebraic aspects of polynomial rings by means of the theory of Gröbner bases. The following topics and results are covered: ideals, Hilbert's basis theorem, affine varieties, Hilbert's nullstellensatz, monomial orderings, Gröbner bases, Buchberger's algorithm, elimination, quotient rings. The course also includes an introduction to a modern computer algebra system (CAS) with focus on how to use it to solve applied problems from graph theory, theoretical computer science, and optimization.

b. The course consists of the following parts: Theory, 4 ECTS credits, Computer lab, 1 ECTS credit, Project, 2.5 ECTS credits.

Learning outcomes

Having passed this course, the student is expected to be able to:

Part 1, Theory, 4 ECTS:

- Define basic concepts within the theory of Gröbner bases.
- Present and prove basic theorems within the theory of Gröbner bases.

Part 2, Practical exercises, 1 ECTS:

- Be able to use a computer algebra system in order to perform basic computations.

Part 2, Project, 2,5 ECTS:

- Interpret applied problems in terms of polynomial equations and solve these by means of a computer algebra system.

Education

Instruction consist of lectures, practical exercises and projects.

The course is offered in English.

Forms of examination

a. The course is examined the following manner: Knowledge assessment takes the form of written examination.

b. Grades are assigned according to a 7-point scale related to the learning objectives of the course:

A = Excellent

B = Very good

C = Good

D = Satisfactory

E = Sufficient

Fx = Fail, some more work required.

F = Fail, much more work required.

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

d. To pass, a grade of at least E is required.

e. Students who fail an ordinary examination are entitled to take additional examinations as long as the course is offered. There is no restriction on the number of examinations. Examinations also include other obligatory elements of the course. Students who have passed an examination may not retake it in order to achieve a higher grade. Students who have failed on two occasions are entitled to request the appointment of a different examiner for the next examination, unless there are special reasons against this. Any such request must be made to the departmental board.

The course has at least two examinations for each academic year in the years in which instruction is provided. Intervening years include at least one examination.

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 is offered as part of the Master's programmes in Mathematics and as a separate course.

Required reading

Course literature is decided by the departmental board and published on the web site of the Department of Mathematics by the latest 2 months before the course begins.