



FSF3702 Algebraic Combinatorics 7.5 credits

Algebraisk kombinatorik

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

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

Establishment

Course syllabus for FSF3702 valid from Spring 2019

Grading scale

P, F

Education cycle

Third cycle

Specific prerequisites

A Master degree including at least 30 university credits (hp) in Mathematics. Basic courses in algebra and combinatorics.

Language of instruction

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

Intended learning outcomes

After passing the course the students will understand, and are able to apply, algebraic methods in combinatorial mathematics.

Course contents

An important part of the course is formed by the theory of symmetric functions. This is a classic topic in algebra, however the theory turns out to be of a mainly combinatorial character. The ring of symmetric functions has a basis consisting of the Schur functions. These are generating functions for so called Young tableaux.

On the combinatorial side the course will cover several topics from classical enumerative combinatorics. This concerns in the first instance partitions, permutations, plane partitions and tableaux, where some of the highlights are the hook-length formula for enumerating Young tableaux, MacMahon's enumeration formula for plane partitions, the Robinson-Schensted-Knuth correspondence between permutations (and more generally, nonnegative integer matrices) and pairs of tableaux, jeu de taquin, the theory of monotone subsequences, enumeration using non-crossing lattice paths, etc.

Disposition

Seminars and problem solving sessions.

Course literature

The indicated chapters of the following books:

- William Fulton, **Young Tableaux**, Cambridge Univ. Press, 1997. [Part 1]
- Donald E. Knuth, **The Art of Computer Programming, Vol.3/Sorting and Searching**, Addison-Wesley, 1973. [Chapter 5.1]
- Ian G. Macdonald, **Symmetric functions and Hall polynomials** (Second Edition), Oxford Univ. Press, 1995. [Chapter 1]
- Bruce E. Sagan, **The Symmetric Group** (Second Edition), Springer, 2001. [Chapters 3 and 4]

Examination

- INL1 - Assignment, 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.

Homework, possibly combined with some seminar/oral assignment.

Other requirements for final grade

Approved assignment/presentation.

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.