

# Syllabus

for course at advanced level

**Enumerative combinatorics**  
**Enumerativ kombinatorik**

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

<b>Course code:</b>	MM8018
<b>Valid from:</b>	Spring 2010
<b>Date of approval:</b>	2009-11-23
<b>Department</b>	Department of Mathematics (incl. Math. Statistics)
<b>Main field:</b>	Mathematics/Applied Mathematics
<b>Specialisation:</b>	AXX - Second cycle, in-depth level of the course cannot be classified

## Decision

This syllabus has been approved by the Board of the Faculty of Science at Stockholm University on 23 November 2009.

## Prerequisites and special admittance requirements

To qualify for the course knowledge equivalent to 90 credits in Mathematics is required, where Combinatorics II SL 7.5 credits is included. Also required is knowledge equivalent to Swedish upper secondary course English B or equivalent to one of the following tests. Cambridge CPE and CAE: Pass, IELTS: 6.0 (with no part of the test below 5.0), TOEFL (paper based): 550 (with minimum grade 4 on the written test part), TOEFL (computer based): 213, TOEFL (internet based): 79.

## Course structure

Examination code	Name	Higher Education Credits
F818	Enumerative combinatorics	7.5

## Course content

The course covers basic methods of enumerative combinatorics. "The twelve-fold way", sieve methods, for example various examples of inclusion-exclusion, the involution principle and determinant methods to count lattice paths. Different aspects of the theory of partially ordered sets, for example lattice theory, Möbius inversion in posets and connections with topology.

## Learning outcomes

It is expected that the student after taking the course will be able to

- define and prove properties of combinatorial standard objects and sequences of numbers
- reformulate and thereby solve combinatorial problems in terms of combinatorial standard objects
- do calculations and prove properties of formal power series
- prove recursions, generating functions and explicit expressions for combinatorically defined sequences
- construct combinatorial proofs of identities and inequalities
- use Möbius inversion, inclusion-exclusion and related sieve methods to solve enumerative problems
- define and prove properties of different classes of posets
- describe and perform calculations in the incidence algebra of a poset
- determine the Möbius function of posets with different methods and interpret them in topological terms

## Education

The education consists of lectures, exercises and submitted work.

### **Forms of examination**

a. Examination for the course is in the following manner: measurement of knowledge takes place through written or oral examination.

b. Grading is carried out according to a 7-point scale related to learning objectives:

A = Excellent

B = Very Good

C = Good

D = Satisfactory

E = Sufficient

Fx = Fail

F = Fail

c. Grading criteria for the course will be distributed at the start of the course.

d. A minimum grade of E and approved submitted work are required to pass the course.

e. Students who fail to achieve a pass grade in an ordinary examination have the right to take at least further four examinations, as long as the course is given. The term “examination” here is used to denote also other compulsory elements of the course. Students who have achieved a pass grade on an examination may not retake this examination in order to attempt to achieve a higher grade. Students who have failed to reach a pass grade on two occasions have the right to request that a different teacher be appointed to set the grade of the course. A request for such appointment must be sent to the departmental board.

### **Interim**

Students may request that the examination is carried out in accordance with this syllabus even after it has ceased to apply. This right is limited, however, to a maximum of three occasions during a two-year-period after the end of giving the course. A request for such examination must be sent to the departmental board.

### **Misc**

The course is a component in the master programs in mathematics and in applied mathematics, and it can also be taken as an individual course.

### **Required reading**

Course literature is decided by the departmental board and is described in an appendix to the syllabus.