



# SF1630 Discrete Mathematics

## 9.0 credits

### Diskret matematik

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 SF1630 valid from Autumn 2015

### Grading scale

A, B, C, D, E, FX, F

### Education cycle

First cycle

### Main field of study

Mathematics, Technology

### Language of instruction

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

### Intended learning outcomes

The general objective is to give basic knowledge in Discrete Mathematics, especially in the solution of combinatorial problems, the knowledge of some important algebraic structures and basic knowledge of graph theory. Also the ability to perform a stringent mathematical discussion is trained.

After passing the course a student should be able to

- formulate basic theorems and definitions of important concepts in discrete mathematics,
- apply theorems and methods in discrete mathematics.

## Course contents

Linear recursion with constant coefficients. The Master theorem.

Graphs. Euler circuits, Hamilton cycles. Trees. Graph coloring. Planar graphs. Euler's polyhedron formula, Kuratowski's theorem. Bipartite graphs. Hall's marriage theorem. Augmenting alternating paths. Transversals.

Integer arithmetic. Divisibility. Euclid's algorithm for the greatest common divisor. Linear Diophantine equations with two unknowns. Unique factorization. Modular arithmetic. Chinese remainder theorem. Euler's  $\phi$  - and Möbius'-function. Euler's theorem and Fermat's little theorem.

Bijections, injections, surjections. Cardinality. Finite, countable and uncountable sets.

Combinatorics. Pigeon principle. Addition and multiplication principles. Different kinds of selections. Binomial numbers, multinomial numbers. Inclusion/exclusion. Partitions and equivalence relations. Stirling numbers of the second kind.

Permutations. Cycle notation. Conjugated permutations. Even and odd permutations.

Basic group theory. Order of group elements and group. Cyclic groups. The symmetric group. Subgroups, cosets. Lagrange's theorem. Group actions on sets. Burnside's lemma.

Rings and fields. Factorization of polynomials. Irreducible polynomials. Finite fields.

Error correcting linear binary codes. RSA cryptosystem. Primality tests.

## Specific prerequisites

SF1604 Linear algebra II (or equivalent)

## Course literature

Biggs: Discrete Mathematics, 2:nd ed.

Hand-out material.

## Examination

- TENA - Examination, 6.0 credits, grading scale: A, B, C, D, E, FX, F
- TENB - Examination, 3.0 credits, grading scale: A, B, C, D, E, FX, 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.

## Other requirements for final grade

Two written exams (TENA; 6 credits), (TENB; 3 cr).

## 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.