Linnæus University

Jnr: 2019/4024-3.1.2.2

Course syllabus

Faculty of Technology
Department of Mathematics

1MA902 Diskret matematik, 7,5 högskolepoäng
Discrete Mathematics, 7.5 credits

Main field of study
Mathematics

Subject Group
Mathematics

Level of classification
First Level

Progression
G1N

Date of Ratification
Approved by Faculty of Technology 2019-12-06
The course syllabus is valid from autumn semester 2020

Prerequisites
General entry requirements and Chemistry 1, Mathematics 4, Physics 2 or Chemistry A, Mathematics E, Physics B (Field-specific entry requirements 9/A9).

Objectives

After completing the course, the student should be able to:
A. *Knowledge and understanding*

- A.1 Explain central concepts in discrete mathematics as relation, function, graph, difference equation, divisibility, induction, r-permutation, r-combination, discrete random variable, graph, as well as
- A.2 formulate, and explain the relevance of, central results in discrete mathematics as The fundamental theorem of arithmetics, The binomial theorem, and Baye's theorem, the theorem about the number of paths of a given length between two nodes in a graph.

B. *Ability and skills*

- B.1 Use and combine knowledge about different concepts, methods and results from logic, set theory, functions, relations, number theory, induction, combinatorics, probability theory and graph theory in calculations and problem solving activities,
- B.2 present and explain calculations and mathematical reasoning in written form in a mathematically correct, structured and logically coherent way,
- B.3 use mathematical software in problem solving and visualisation.

C. *Judgement and approach*

C. Judgement and approach

- C.1 Use models and methods from discrete mathematics in problem solving activities (this includes e.g. introducing adequate variables and statistical models, reformulating a problem as an appropriate mathematical problem, devise a plan, carry out the plan, and looking back), as well as
- C.2 interpret and judge results in problem solving. This may also include reformulating the result as solution of a more general problem.

Content

The main purpose of the course is to give an introduction to discrete mathematics, mathematical thinking and mathematical communication. Another important purpose is to prepare the students for further studies in mathematics and computer science, e.g. probability theory, optimaization and operations research, programming and database technology. Examples from applications in computer science and operations research are introduced during the course.
The following content is covered:

- Introduktion to writing in LaTeX.
- Logic: formalism of predicate logic, logical reasoning and proof.
- Sets: cardinality, countable and uncountable sets, the principle of inclusion and exclusion.
- Sequences, sums and difference equations: sequence, arithmetic and geometric progression and series respectively, solutions of linear difference equations.
- Functions: domain of definition, target, range, injectivity, surjectivity, bijectivity, composition of functions.
- Number theory: divisibility and modular arithmetic, integer representation, primes and grates common divisor.
- Induction: well ordering principle, mathematical induction, strong induction.
- Counting: multiplication principle, division principle, pigeon hole principle, r-permutation, r-combination and binomial coefficient, binomial theorem, multinomial theorem, generalized permutations and combinations.
- Polyas four steps in problem solving.
- Discrete probability theory: Laplace definiton of uniform probability, relative frequency approach, Kolmogorov's axoim's for probability, disjoint events, conditional probability, independent events, Baye's rule and Baye's theorem, applications to spam filters, discrete random variable, Bernoulli trial, Bernoulli distribution and Geometric distribution, applications in quality control.
- Graph theory: graph, Handshaking theorem and Handshaking lemma, sums of in-degree and out-degree for directed graphs, incidence matrix, adjacency matrix, number of paths of a given length between two nodes, shortest path problems, Dijkstra's algorithm, Euler- and Hamilton circuits, coloring of graphs.
- Relations: properties, matrix- and graph representation, equivalence relations, orderings, Hasse diagram's.

Type of Instruction

Lectures, exercise sessions and tutoring of assignments.

Examination

The examination of the course is divided as following:

Code	Appellation	Grade	Credits
2101	Written exam	AF	5.00
2102	Assignment	U/G	2.50

The course is assessed with the grades A, B, C, D, E, Fx or F.

To pass the course it is required to get at least E on the written exam, and to pass the assignment. The final grade is determened by the grade on the written exam.

Repeat examination is offered in accordance with Local regulations for courses and examination at the first and second-cycle level at Linnaeus University.

If the university has decided that a student is entitled to special pedagogical support due to a disability, the examiner has the right to give a customised exam or to have the student conduct the exam in an alternative way.

Objectives achievement

The examination parts are linked to the learning outcomes as follows:

Goal	2101	2102
A.1	✓	
B.1	✓	✓
B.2	✓	✓
B.3	✓	✓
C.1	✓	✓

Course Evaluation

During the implementation of the course or in close conjunction with the course, a course evaluation is to be carried out. Results and analysis of the course evaluation are to be promptly presented as feedback to the students who have completed the course. Students who participate during the next course instance receive feedback at the start of the course. The course evaluation is to be carried out anonymously.

Credit Overlap

The course cannot be included in a degree along with the following courses of which the content fully, or partly, corresponds to the content of this course: 1MA405 Discrete mathematics and mathematical thinking, 7.5 credits and 1MA462 Discrete mathematics, 7.5 credits

Other

The course will be performed in way that the experience and knowledge of the students becomes visible and develops. For example, this means that we have an including approach and that no one should feel excluded. This can be manifest in various ways, for example the teacher is supposed to use examples that are neutral with respect to gender.

Grade criteria for the A–F scale are communicated to the student through a special document. The student is to be informed about the grade criteria for the course by the start of the course at the latest.

Required Reading and Additional Study Material

Required reading

Rosen, Kenneth H, Discrete mathematics and its applications, McGraw-Hill, latest edition. Number of pages: 450 out of 1024.

Additional reading

Vivaldi, Franco, Mathematical writing, Springer, 2014 or later.