GHENT UNIVERSITY

Course Specifications

Valid as from the academic year 2019-2020

Discrete Mathematics II (E001470)

Course size (nominal values; actual values may depend on programme)

Credits	6.0	Study time	180 h
Contact hrs	60.0 h		

Course offerings and teaching methods in academic year 2020-2021

A (semester 2)	Dutch	lecture	30.0 h
		seminar: coached exercises	30.0 h

Lecturers in academic year 2020-2021

Walraevens, Joris	TW07	lecturer-in-charge

Offered in the following programmes in 2020-2021	crdts	offering
Bachelor of Science in Engineering (main subject Computer Science Engineering)	6	A
Bachelor of Science in Computer Science Engineering	6	A
Brugprogramma Master of Science in Bioinformatics (main subject Engineering)	6	A
Bridging Programme Master of Science in Computer Science Engineering	6	A
Bridging Programme Master of Science in Computer Science Engineering	6	A

Teaching languages

Dutch

Keywords

Algebraic structures, polynomials and rational expressions, finite fields, generating functions, matching problems

Position of the course

This course introduces a number of advanced topics from discrete mathematics. It builds upon mathematical courses of the first three semesters in the bachelor program of engineering (predominantly on Discrete mathematics I) and serves as a useful preparation to more applied courses in the bachelor and the master of computer science engineering and the master of electrical engineering (Algorithms and data structures, Automata, Compilers, Information theory, Queueing theory)

Contents

- Chapter 1: Introduction to algebraic structures: groups, rings, integral domains, fields, polynomial rings, congruence
- Chapter 2: Polynomials and rational expressions: polynomials with coefficients in a field, division with remainder, divisibility, greatest common divisor, factorization into irreducible polynomials, congruence modulo an irreducible polynomial, zeroes, derivatives, construction of rational expressions, partial fractions, rational expressions with real or complex coefficients
- Chapter 3: Finite fields - Galois fields: definition, basic properties, prime fields and extension fields, existence and uniqueness, construction of finite fields, properties of the multiplicative group, logarithm table
- Chapter 4: Generating functions: formal power series, derivatives, Newton's binomial, ordinary and exponential generating functions, arithmetic rules, convergence of power series, inversion, rational generating functions, tail approximation, dominant singularity, applications (Catalan numbers, Bell numbers, Stirling numbers, ...)
- Chapter 5: Discrete optimization: general aim, matching problems, scheduling problems, Hungarian algorithm

Initial competences

This course builds on certain learning outcomes of course units 'Discrete mathematics I' and 'Geometry and linear algebra'.

Final competences

1 To have insight in algebraic structures and their properties
2 To be familiar with polynomials and rational expressions with coefficients in a (finite) field and with real coefficients
3 To construct and connect the different representations of finite fields and to understand the specific properties of finite fields
4 To transform relations between sequences of numbers to generating functions and vice versa
5 Solve combinatorial problems
6 Recognize and solve simple matching problems

Conditions for credit contract

Access to this course unit via a credit contract is determined after successful competences assessment

Conditions for exam contract

This course unit cannot be taken via an exam contract

Teaching methods

Lecture, seminar: coached exercises

Learning materials and price

Syllabus

References

- J.H. van Lint, J.W. Nienhuys: 'Discrete Wiskunde', Academic Service, 1991 (ISBN: 90-6233-368-0)
- V. Shoup, A Computational Introduction to Number Theory and Algebra, Cambridge University Press, 2005
- H.S. Wilf, Generatingfunctionology, A K Peters, Ltd., 2006

Course content-related study coaching

By the lecturer and the assistants: contact is possible during and after classroom lectures and classroom problem solving sessions.

Evaluation methods

end-of-term evaluation

Examination methods in case of periodic evaluation during the first examination period

Written examination with open questions, open book examination

Examination methods in case of periodic evaluation during the second examination period

Written examination with open questions, open book examination

Examination methods in case of permanent evaluation

Possibilities of retake in case of permanent evaluation

not applicable

Calculation of the examination mark