GHENT UNIVERSITY

Course Specifications

Valid as from the academic year 2024-2025

Discrete Mathematics I (C003550)

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

Credits 6.0 **Study time 180 h**

Course offerings and teaching methods in academic year 2024-2025

A (semester 1)	Dutch	Gent	seminar
			lecture

Lecturers in academic year 2024-2025

Storme, Leo	WE16	lecturer-in-charge

Offered in the following programmes in 2024-2025	**crdts**	**offering**
Bachelor of Arts in Moral Sciences	6	A
Bachelor of Arts in Philosophy	6	A
Bachelor of Science in Mathematics	6	A

Teaching languages

Dutch

Keywords

Logic, set theory, elementary combinatorics, prime numbers, modular arithmetic, algebraic structures, recurrence relations, generating functions.

Position of the course

The objectives of this course are twofold.
1. The prerequisites of the incoming students in mathematics are diverse. The aim of this course is to extend the preknowledge of the students in such a way that they are ready to attend successfully the other courses in mathematics within the curriculum. Some topics from logic, set theory and the theory of algebraic structures will be introduced in a systematic way such that it can immediately be applied in other courses. The way of setting up the course, will stimulate the student to be skilled in handling more abstract mathematical reasoning, without ignoring the applications to other mathematical and non-mathematical topics.
2. This course is part I of the package "Discrete mathematics" in the curriculum for the bachelor in mathematics. Within the mathematical framework that will be built up from chapter one, some very important topics from discrete mathematics will be treated. Emphasis will be put on elementary and more advanced techniques from combinatorics, (elementary) number theory and modular arithmetic, and an introduction to algebra.

Contents

Chapter 1: Logic: propositional logic, predicate logic, some proof techniques.
Chapter 2: Set theory, with a practical approach while mentioning the axiomatic set up; relations; maps and cardinalities.
Chapter 3: Combinatorics: counting principles, combinations, variations, permutations and their variants allowing repetition, Stirling numbers of the second kind, multinomial numbers.
Chapter 4: Number theory: foundations from elementary number theory: prime numbers, Fermat's little theorem, Eulers totient function, modular arithmetic, Chinese remainder theorem, quadratic congruences, the Legendre symbol.
Chapter 5: Algebraic structures: groups, rings, fields and skewfields; introduction to algebraic number theory: quadratic reciprocity.
Chapter 6: Recurrence relations and generating functions: linear recurrences, formal power series, generating functions, applications in combinatorial problems.

Initial competences

None

Final competences

1 Being able to use fluently topics from logic and set theory within other courses.
2 Being able to apply counting techniques.
3 Having insight in elementary number theory.
4 Being able to implement the knowledge on elementary algebra within the courses of Algebra, Discrete Mathematics, and Geometry.
5 Being able to think and reason in an abstract, logical and structured way.

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

Seminar, Lecture

Extra information on the teaching methods

Theory: many parts of the theory are presented by ex-cathedra lectures, but some parts are selfstudy. This is supported by the electronic learning environment UFORA. The theory lectures are given at the level of the first bachelor student and aim at a detailed treatment of the topics that need to be known. The lecture notes contain all the theory material.
Exercises: half of the contact hours are dedicated to exercises, made under supervision of the assistant. The exercise lectures are very much intended to have the students make actively exercises on the topics of the theory lectures.

Study material

Type: Syllabus

Name: Discrete mathematics I
Indicative price: Free or paid by faculty
Optional: no

References

1 M. Aigner and G. M. Ziegler, Proofs from The Book, Springer-Verlag, Berlin, 1999. Including illustrations by Karl H. Hofmann, Corrected reprint of the 1998 original.
2 A. Baker, A concise introduction to the theory of numbers, Cambridge University Press, Cambridge, 1984.
3 N. L. Biggs, Discrete mathematics, Oxford Science Publications, The Clarendon Press Oxford University Press, New York, 1985.
4 P. J. Cameron, Sets, logic and categories, Springer Undergraduate Mathematics Series, Springer-Verlag London Ltd., London, 1999.
5 K. Devlin, Sets, functions, and logic, Chapman & Hall/CRC Mathematics, Chapman & Hall/CRC, Boca Raton, FL, third ed., 2004. An introduction to abstract mathematics.
6 M. du Sautoy, Finding Moonshine, Harper Perennial, 2009. ISBN: 978-0-00-721462-4.
7 R. L. Graham, D. E. Knuth, and O. Patashnik, Concrete mathematics, Addison-Wesley Publishing Company, Reading, MA, second ed., 1994. A foundation for computer science.
8 K. E. Hummel, Introductory concepts for abstract mathematics, Chapman & Hall/CRC, Boca Raton, FL, 2000.
9 D. E. Knuth, The art of computer programming, volume 2 (3rd ed.): seminumerical algorithms, Addison-Wesley Longman Publishing Co., Inc., Boston, MA, USA, 1997.
10 M. E. Larsen, Summa summarum, CMS Treatises in Mathematics, Canadian Mathematical Society, Ottawa, ON, 2007.
11 K. H. Rosen, Elementary number theory and its applications, Addison-Wesley, Reading, MA, fourth ed., 2000.
12 A. Schmidt, Einführung in die algebraische Zahlentheorie, Springer-Verlag, 2009.
13 J. H. van Lint and R. M. Wilson, A course in combinatorics, Cambridge University Press, Cambridge, second ed., 2001.
14 J. von zur Gathen and J. Gerhard, Modern computer algebra, Cambridge University Press, Cambridge, second ed., 2003.

Course content-related study coaching

Students can always ask questions on the theory and the exercises. This is also possible on appointment or by email. There is interactive support via the electronic environment UFORA.

Assessment moments

end-of-term assessment

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

Oral assessment, Written assessment with open-ended questions

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

Oral assessment, Written assessment with open-ended questions

Examination methods in case of permanent assessment

Possibilities of retake in case of permanent assessment

not applicable

Extra information on the examination methods

Exams on theory are oral, while exams on exercises are written. The understanding, knowledge and skills are evaluated.

Calculation of the examination mark

Theory 50%
Exercises 50%