

M016	MR – elective- Year 1	Concrete Mathematics	L+P+S 2+2+0	ECTS 5
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Course objectives. The objective of this course is to familiarize students with the techniques of operating with discrete objects, analogous to the known techniques of operating with continuous objects. The subject matter presents a combination of continuous and discrete mathematics. During the course we will emphasize the importance of the subject matter for computer science, especially in the analysis of algorithms.

Course prerequisites. Combinatorics and Discrete Mathematics.

Syllabus.

1. Introduction. Notation. Some well-known recursive problems.
2. Calculation of sums and manipulation with sums. Notations connected with sums. Sums and recursions. Transformations of sums. General summing methods. Indefinite and definite sums. Partial summation.
3. Integer functions. Floor and ceiling functions. Application of integer functions. Sums and integer functions.
4. Binomial coefficients. Basic identities. Sums and binomial coefficients. Generating functions.
5. Hypergeometric functions. Hypergeometric transformations. Partial hypergeometric sums and Gosper's algorithm. Mechanical summation..

Expected learning outcomes.

After passing the exam, students are expected to:

- identify applications of recursive problems;
- classify recursive problems depending on solving methods;
- acquire basic methods of manipulating with sums;
- interpret the properties of integer functions in practice;
- construct generating functions for certain sequences;
- use the properties of binomial coefficients;
- apply Gosper's algorithm and the notion of hypergeometric functions for summability testing.

Teaching methods and student assessment. Attendance at lectures and exercises is required. The exam consists of a written and an oral part, and it can be taken after completion of all lectures and exercises. During the course students can take mid-term exams that replace the written examination. During the semester students can prepare a seminar paper. Successful seminar papers influence the final grade.

Can the course be taught in English: Yes.

Basic literature:

1. K. Graham, D.E. Knuth, O. Patashnik, Concrete Mathematics, Addison – Wesley, Boston, 2003.

Recommended literature:

1. K. Graham, D.E. Knuth, O. Patashnik, Concrete Mathematics: a foundation for computer science, Addison – Wesley, Boston, 1994.
2. D.E. Knuth, The Art of Computer Programming, Volume 1: Fundamental Algorithms, Addison – Wesley, Boston, 1997.
3. D. Veljan, Kombinatorna i diskretna matematika, Algoritam, Zagreb, 2001.