Course title: Discrete Mathematics

Lecturer(s): Stojaković Z. Miloš, Mašulović M. Dragan

Status: elective

ECTS: 7

Requirements: -

Learning objectives

Introduction of advanced techniques for solving problems on discrete structures. Special attention will be devoted to problems in combinatorics, graph theory and discrete geometry.

Learning outcome

Upon completion of the course, the student should master the advanced techniques that are applicable on problems on discrete structures, and (s)he should be able to adjust those techniques to the related problems.

Syllabus

Applications of double-counting, Zarankiewicz problem, Theorem of Erdos and Szekeres. Sunflowers, basic model and variations, applications. Blocking sets. Density and universality of a set of vectors, hereditary sets, *k*-wise independence of random variables and permutations.

Van der Waerden Theomem, Hales-Jewett Theorem, Ramsey theory, Ramsey numbers, Theorems of Ramsey type, theorems on bipartite graphs, theorems on induced subgraphs. Euclidean Ramsey theory, unit distance problem.

Epsilon nets and VC-dimension, *k*-sets, counting *k*-sets. Helly's Theorem and generalizations, colored Caratheodory Theorem, Twerberg Theorem.

Incidence of points and lines, intersection theorem, intersection number of graphs. Art Gallery Problem.

Linear algebra method, linear spaces in combinatorics. Inclusive and disjoint matrices. Linear codes and linear combinations.

Recommended literature

1. Stasys Jukna: *Extremal Combinatorics,* Springer, 2001.
2. Ronald L. Graham, Bruce L. Rothschild, Joel H. Spencer: *Ramsey Theory,* John Wiley & Sons, Inc., 1990.
3. Jiri Matousek: *Lectures on Discrete Geometry,* Springer, 2002.

Weekly teaching load	Lectures: 2	Student research: 0

Teaching methodology

Lectures, with active participation of the students, discussion, etc. A student is supposed to write a seminar paper.

Grading method (maximal number of points 100)

Colloquia 30 points, oral exam 70 points