Course title: Discrete Random Structures

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

Status: elective

ECTS: 7

Requirements: --

Learning objectives

Introduction of advanced discrete probability theory, and its application on discrete structures and combinatorial problems.

Learning outcome

Upon completion of the course, the student should master the basic concepts of discrete probability theory, as well as basic methods for its application in solving combinatorial problems. Special attention will be devoted to random graphs.

Syllabus

Basics of the probabilistic method. Applications of linearity of expectation and the first moment method, graph subdivision, Ramsey numbers, independent set of vertices, colorings. The second moment method. Concentration of a parameter. Chernoff bounds.
Random graphs. Appearance of a fixed subgraph, connectivity, largest clique, chromatic number, giant component, phase transition. Positional games on random graphs. Pseudo-random graphs. Lovasz-Local-Lemma, applications. Discrepancy, linear and hereditary. Coding, game theory, Liar game. Derandomization, small sample spaces. Random walks. Entropy.

Recommended literature

1. Noga Alon, Joel H. Spencer: The Probabilistic Method, John Wiley & Sons, Inc., 2000.
2. Svante Janson, Tomasz Luczak, Andrzej Rucinsky: Random Graphs, John Wiley & Sons, Inc., 2000.

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