Course title: Theory of Algorithms

Lecturer(s): Stojaković Z. Miloš, Dolinka V. Igor

Status: elective

ECTS: 7

Requirements: --

Learning objectives

Introduction of advanced topics in theory of algorithms, and the application on solving various, sometimes NP-hard, problems.

Learning outcome

Upon completion of the course, the student should master the basic concepts in randomized algorithms, approximation algorithms, online algorithms, competitive analysis and parallel algorithms.

Syllabus

Probabilistic Turing machine, probabilistic algorithms, BPP, RP and co-RP complexity classes. Miller's test. Derandomization. Max-cut algorithm. Small sample spaces.

Approximation algorithms. NPO complexity class. Approximation ratio, inapproximability. Christofides algorithm, knapsack problem. Classification of NPO problems into approximation classes.

Online algorithms and competitive analysis. Competitive ratio. Probabilistic online algorithms. Weight distribution. The problem of k servers.

Parallel algorithms. PRAM machines and NC complexity class. P-completeness. Examples of efficient parallel algorithms, a communicational protocol on the hypercube.

Recommended literature

1. Rajeev Motwani, Prabhakar Raghavan: *Randomized Algorithms,* Cambridge University Press, 2000.
2. Vijay V. Vazirani: *Approximation Algorithms,* Springer-Verlag, 2006.

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