Study programme(s): Informatics (IM), Teaching Informatics (IC)

Level: master

Course title: Combinatorial algorithms

Lecturer: Miloš Z. Stojaković

Status: elective

ECTS: 7

Requirements: none

Learning objectives

Students should learn and understand how to use algorithms that deal with discrete data structures, especially networks.

Learning outcomes

Minimal: Students should be familiar with the concept of computer processing of discrete data structures, and particularly graphs and networks, some basic algorithms, their cons and pros, and their complexity.

Optimal: Students should be able to find the most suitable algorithm for a given problem, to modify it and adjust if needed, and implement it.

Syllabus

Theoretical instruction

Data structures for storing sets, arrays and networks. Generating and enumerating the elements of the partitive set, subsets of fixed size, permutations. Dynamic programming, examples. Algorithms on networks. Network representation. Algorithms for finding a Hamiltonian cycle, a vertex cover, an edge cover, a dominating set, or a proper colouring. Steiner trees. Knapsack problem, Bin packing, TSP.

Practical instruction

Implementing standard algorithms for dealing with the mentioned data structures. Choosing, modifying and implementation of algorithms on the way to solving more complex problems.

Literature

1. Dieter Jungnickel: *Graphs, Networks and Algorithms*, Springer, 2005.
2. Steven S. Skiena: *The Algorithm Design Manual*, Springer, 1998.
3. Cormen, Leiserson, Rivest, Stein: *Introduction to algorithms*, 3rd edition, MIT Press, 2009.

Weekly teaching load				Other:
Lectures: 2	Exercises: 3	Other forms of teaching:	Student research:	

Teaching methodology

Exercises serve to practise the techniques that students were shown in the lectures, and discuss the possible applications on concrete problems, possibly including a modification of the approach used. In practical part of the exercises, students try to apply the techniques they learned, progressively attacking harder problems towards the end of the course.
Knowledge is tested through the final exam. Exercises comprise tutorials, where teaching assistants give examples, and practicing sessions, where students try to solve problems on their own. In the exam, students demonstrate to what extent they understood the concepts of graph theory and networks.

Grading (maximum number of points 100)

Pre-exam obligations	**points**	**Final exam**	**points**
Colloquia	**50**	Oral exam	**50**