Study programme(s): Applied Mathematics (MAP)

Course title: AUTOMATA AND ALGORITHMS (P115)

Lecturer(s): Madaras Rozalija, Boris Šobot

Course status: elective

ECTS points: 5

Requirements:

Learning Objectives

Introducing students to the basic notions of the theory of finite automata and computability, and emphasizing their importance within algebra and theoretical computer science.

Learning Outcomes

Upon completion of the course, the student should be familiar with the basics of the theory of finite automata and the theory of computability, as well as their numerous connections to various areas of algebra and discrete mathematics. The student will be able to apply basic algorithms related to the finite automata and Turing machines, as well as to independently and creatively solve problems related to the adopted notions.

Syllabus

Theoretical instructions

Words and languages. Deterministic and nondeterministic finite automata. The language of an automaton, regular languages. The equivalence of DFA and NFA. Regular expressions. The pumping lemma. The Turing machines. Decidability.

Complexity theory, spatial and time complexity. Complexity classes P, NP and co-NP. Designing polynomial algorithms, examples. Polynomial reductions, NP-complex problems, NP-completeness, examples of NP-complete problems. Spatial complexity, PSPACE-complex problems, PSPACE-completeness.

Practical instructions

Introduction to the notions adopted in theoretical instructions through problem solving sessions.

Literature

1. M. Sipser, **Introduction to the Theory of Computation**, Cengage Learning, 2013.
2. R. S. Madaras, S. Crvenković, **Uvod u teoriju automata i formalnih jezika**, Univerzitet u Novom Sadu, Stylos, Novi Sad, 1995.
3. I. Dolinka, **Kratak uvod u Analizu algoritama**, PMF, Novi Sad, 2008.
4. S. Crvenković, R. S. Madaras, N. Mudrinski, **Zbirka zadataka iz teorije automata**, Prirodno-matematički fakultet, Novi Sad, 2006.
5. J. Hromkovič, **Theoretical Computer Science: Introduction to Automata, Computability, Complexity, Algorithmics, Randomization, Communication, and Cryptography**, Springer, 2011.

Number of active classes	**Lectures: 2**	**Exercises: 2**

Teaching methods

Classical teaching methods are used in classes. In exercises the exposed principles are practiced and typical problems and their solutions are analyzed. Student knowledge is tested on two colloquia, where the

degree of adopted theoretical knowledge is tested through questions and typical exercises. The final oral exam serves to test the student's comprehensive understanding of the exposed material.			
Grading (maximum number of points 100)			
Pre-exam obligations	Points	**Final exam**	Points
Two colloquia	**50**	Oral exam	**50**