Study programme(s): Mathematics (MA), Master in Mathematics Teaching(MP)

Level: master

Course title: Theory of Formal Languages (MA-13)

Lecturer: Petar V. Marković

Status: elective

ECTS: 5

Requirements: none

Learning objectives:
Introducing the students to basic concepts of the Theory of formal languages and exposing their applications in theoretical computer science.

Learning outcomes:
Minimal: Students will learn to apply elementary algorithms in formal languages and find the languages of easier grammars, and acquire basic understanding of the concepts in the area of computability.
Desired: Students will acquire deep understanding and ability to apply the basic principles of Theory of formal languages and learn how to independently and creatively solve problems related to the concepts taught.

Syllabus:
Theoretical instruction
Generative grammars. Chomsky hierarchy. Type 3 grammars and languages of finite automata. Context free languages. Normal forms of context free grammars. Pumping lemma for context free languages. Pushdown automata. Parsing. CKY algorithm. Dyck languages and Chomsky–Schützenberger theorem. Parikh's theorem. Context sensitive languages and noncontracting grammars. Turing machines. The concept of an algorithm and the Church thesis. Recursive and recursively enumerable languages. Universal Turing machine. Halting problem and undecidability.
Practical instruction
Ad hoc methods for finding the language of a given grammar and constructing the grammar of a given language. Connection between regular languages and finite automata. Parsing tree. Examples of context free languages. Applications of Pumping lemma for context free languages. Examples of noncontracting grammars. Reductions, nonrecursive languages and problems.

Literature
1. R. S. Madaras, S.Crvenković, Uvod u teoriju automata i formalnih jezika, Univerzitet u Novom Sadu, Stylos, Novi Sad, 1995.
2. J. E. Hopcroft, R.Motwani, J.D.Ullman, Introduction to Automata Theory, Languages, and Computation (2nd edition), Addison-Wesley, Reading, 2001.
3. D. C. Kozen, Automata and Computability, Springer-Verlag, New York, 1997.

Weekly teaching load				Other: 0
Lectures: 2	Exercises: 2	Other forms of teaching: 0	Student research: 0	

Teaching methodology
Lectures are presented using classical teaching methods and supported by beamer presentations. Exercises are used to practise and analyse typical problems and their solutions. The ability of application of theoretical knowledge is checked through independent solving of exercises on a mid-course colloquium, and on the colloquium at the end of the course. Only the students who score at least 25 points at the colloquia qualify for the final exam. The final exam is oral and the student is supposed to demonstrate general understanding of the presented theoretical material.

Grading (maximum number of points 100)

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