I011	Obligatory - Semester 3	**Introduction to Data Structures and Algorithms**	L+P+S 2+2+0	ECTS 5

Course objectives. The main course objectives are to teach students introductory concepts in algorithms and data structures. Moreover, one of the main goals will be to improve students' capabilities in programming (C++, Java) on basic data structures and algorithms.

Course prerequisites. Introduction to Computer Science, Introduction to Programming.

Syllabus.

1. Introduction. Basic notions and definitions. Data types: from basic to advanced data structures – from instructions to functions and programs. Abstract structures. Algorithms. Asymptotic analysis. Recursions. Master method.
2. Sequential and binary search. Different algorithms for sorting: bubble sort, insertion sort, heap sort, selection sort, quicksort, etc.
3. N-th power of number. N-th Fibonacci number. MergeSort. Matrix multiplication in recursive fashion. Strassen's algorithm.
4. Data structures. Arrays. Lists (single linked, double linked lists, rings). Queues. Stacks. Trees. Trees representation in an array. Walk on the tree. Priority queues. Heaps. Binary Search Trees.
5. Dynamic programming. Longest common prefix problem.

Expected learning outcomes.

After completing the course, students are expected to:

- demonstrate the knowledge and intelligence as the basis for the original work and development of ideas;
- apply their knowledge, understanding and ability to problem solving in a wider context in the area of algorithms and data structures;
- be capable of integrating new knowledge in the area of algorithms and data structures;
- be able to communicate their conclusions and supporting arguments to both experts and non-experts;
- possess the learning ability for continuing education and lifelong learning in this area.

Teaching methods and student assessment. During lectures students will be introduced to the theory and basic problems as well as to the ways of solving them. Exercises will be held in specialized computer-based laboratories where students will learn how to analyze and created algorithms for different problems. The final exam will be held upon the completion of lectures and exercises, and it will contain a practical and an oral part. Acceptable mid-term exam scores replace the written examination. Students can influence the final grade if they actively participate in homework assignments during the semester.

Can the course be taught in English: Yes

Basic literature:

1. T. H. Cormen, C. E. Leiserson, R. L. Rivest, C. Stein, Introduction to Algorithms, 2nd Ed, MIT Press, 2001.
2. Materials on the website of the course.

Recommended literature:

1. S. Lipschutz, M. Lipson, Schaum's Outline of Discrete Mathematics, Mc-Graw Hill, New York, USA, 1997.
2. S. Lipschutz, Theory and Problems of Data Structures, Mc Graw-Hill, New York, USA, 1986.
3. D. Knuth, The Art of Computer Programming, Vol. 1, Fundamental Algorithms, Addison-Wesley, Reading, MA, USA, 1997.
4. M.A. Weiss, Data Structures and Problem Solving Using Java, Addison Wesley, USA, 2001.
5. D. A. Bailey, Java Structures, McGraw-Hill Education, 2002.

M. T. Goodrich, R. Tamassia, D. Mount, Data structures and Algorithms in C++, John Wiley and Sons, 2011.