**Analysis of algorithms**

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Course outcome:

Students, who take and successfully pass the exam in the course will be able to: - understand the concept of complexity of algorithms; - gaining the skills necessary to select the appropriate algorithm for solving the problem - implementation and use of algorithms that are most suitable in a particular situation in terms of efficiency.

Theory:

The concept of algorithm and its history. Turing machines. Advanced data structures.  The trees and the graphs. Sorting algorithms. The shortest paths between all pairs of nodes.  Components of strong connectivity. Pairing in a graph. Algebraic algorithms.  Text algorithms: low hash, z-string, pattern search in text, longest palindromes, regular expressions, formal grammars. Geometric algorithms: scalar and vector product, collinearity and normality of vectors, collinear points, distance of a point from a line, point in a triangle, long section, triangle area of given vertices, polar coordinates, transformation of Cartesian into polar coordinates, transformation of polar coordinates into Cartesian. Polygons. Fundamentals of algorithm time complexity theory.

Laboratory exercises cover the following topics:

Largest XOR segment, longest common prefix, word appearing most times, sum of segments, increasing segments. The shortest path from one node, the shortest path between two cities, transitive closure of the graph. Prim's algorithm. Kraskel's algorithm. Clusters. Components of strong connectivity. Transport network optimization. Finding the Euler cycle. Chaining words. Hamilton pathways and cycles. Modular arithmetic. Operations per module. Number theory. Perfect numbers, friendly numbers. Prime number, nearest prime number. Disassembly into simple factors. Complement to full square. Polynomial value. Arithmetic over polynomials. Polynomial multiplication. Search for a pattern in the text, prefix, suffix, number of subheadings. The longest palindromic base. Geometric algorithms. Scalar and vector product. The distance of a point from a line. The area of a triangle of given vertices. Transformation of Cartesian into polar coordinates. Area of polygons.