Course title: Algorithms and data structures 1

Course code: 63711

ECTS: 6

Professor: Jurij Mihelič

Undergraduate program

Prerequsite knowledge:

Courses with to the content of courses at UL FRI

- Discrete structures
- Calculus 1
- Programming 1 and 2

Short course decription:

- Basics of algorithms: notion of algorithm, problem, instance and solution, problem kinds, algorithm description, algorithm trace, design methods, correctness of algorithms
- Computational complexity of algorithms: computational resources, models of computation, RAM, asymptotic notation O, Ω, Θ, limits, complexity classes
- Basics of data structures: abstract data type (ADT), set, bag, stack, queue, double-ended queque, priority queue, dictionary, array for implementing ADTs, linked list for implementing ADTs, implicit and explicit data structures
- Trees: rooted tree, binary and k-ary trees, tree traversals, tree representations (implicit, pointers), heap
- Array sorting: selection sort, insertion sort, bubble sort, heapsort, mergesort, quicksort, bucket sort, counting sort, radix sort
- Order statistic: k-th smallest element, finding minimum and maximum at the same time, quickselect, median of medians
- Algorithm design techniques: overview, brute force, closest pair of points, substring search, exhaustive search, generating permutations and combinations
- Search tree: backtracking, branch and bound, maze, knights tour, optimization problems, 0/1 knapsack, pruning search tree
- Divide and conquer technique: analysis of recursive algorithms and recurrence equations, master theorem, closest pair of points
- Greedy method: exchanging coins, arranging files to track, scheduling records and tasks, Huffman codding, standard knapsack, k-center problem
- Basics of graphs: graph representation with adjacency lists, adjacency matrix, incidence matrix, depth-first search, breadth-first search, reachability, topological sorting of vertices and cycles, connectivity, strongly connected components
- Arithmetic algorithms: small and big numbers, arithmetic operations, modular arithmetic, multiplication of big integers with Karatsuba's algorithm, matrix multiplication with Strassen's algorithm, greatest common divisor Selected topics