Study Program: Informatics

Type and level of studies: Bachelor studies

Course name: Algorithms and Data Structures

Lecturer: Petrović J. Milena

Status: Compulsory

ECTS: 7

Attendance Prerequisites: /

Course aims

Understanding basic concepts of data structures, fundamental algorithms, analysis and the algorithm construction principles.

Course outcome

The students possess knowledge about data structures, analysis and the construction principles of algorithms, and are able to use this knowledge in problem-solving.

Course content

Theoretical part

Arrays: definition, operations, strings. Linked lists: singly linked list, doubly linked list, multiply linked list, circular linked list, basic operations (transversal, insertion, deletion), advanced operations, static and dynamic implementation of linked lists. Queue, stack, deque: definition, static and dynamic implementation of queues, stacks and deques, basic operations (transversal, insertion, deletion) with static and dynamic implementation. Hash table: definition of terms and structure (hash function, collision), collision resolution (open addressing, separate chaining), hash table implementation, basic operations (searching, reading/deletion). Trees: basic notions, binary and general trees, basic operations (transversal, node insertion and deletion), sorted binary trees, static and dynamic implementation of trees. Introduction to analysis and construction of algorithms. Time complexity algorithm (NlogN). Linear time sorting, lower bound complexity sorting. Algorithm analysis: asymptotic analysis for worst case and average case; asymptotic notations, O, o, Ω, Θ; time and space complexity; calculating final total sum, recurrent relations, basic theorem. Graphs: basic notions, depth-first search, breadth first search graphs, algorithm strategies, brute force algorithm, greedy algorithms, recursive divide-and-conquer based strategy; backtracking algorithm, branch-and-bound strategy, heuristic algorithms. String-searching algorithm. Numerical algorithm examples. Recursion implementation. Converting tail recursion to iterative.

Practical part

Teaching is done using computers and in accordance with the aforementioned topics. Students apply their skills independently.

Literature

1. M.T.Goodrich, R.Tamassia, D. Mount, Data Structures and Algorithms in C++, John Wiley, 2004, ISBN 0-471-42924-4;
2. T. H. Cormen, C. E. Leiserson, R. L. Rivest, C. Stein, Introduction to Algorithms, The MIT Press, Cambridge, 2001;
3. Kleinberg J., Tardos, E., Algorithm Design, Pearson International Edition, USA, 2006.

Number of active classes				Other classes
Lectures: 2	Practical classes: 2	Other forms of teaching:	Students' research work	

Teaching methods

Lectures, calculation exercises, laboratory exercises, consulting, term papers, homework, written exam.

Assessment (maximum 100 points)

Course assignments	**points**	Final exam	**Points**
activity during lectures	**10**	written exam	**30**
practical classes		oral exam	**20**
term test(s)	**20**	.....	
seminar(s)	**20**		
Total	**50**		**50**