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|  **UNIVERSITY OF NIŠ** |
| **Course Unit Descriptor** | **Faculty**  | **Faculty of Sciences and Mathematics** |
| **GENERAL INFORMATION** |
| Study program  | **Computer Science** |
| Study Module (if applicable) |  |
| Course title | **Design and Analysis of Algorithms** |
| Level of study | [x] Bachelor [ ]  Master’s [ ]  Doctoral |
| Type of course | [x]  Obligatory [ ]  Elective |
| Semester  |  [ ]  Autumn [x] Spring |
| Year of study  | second |
| Number of ECTS allocated | 8.00 |
| Name of lecturer/lecturers | **Miroslav Ćirić** |
| Teaching mode |  [x] Lectures [ ] Group tutorials [ ]  Individual tutorials [ ] Laboratory work [ ]  Project work [ ]  Seminar [ ] Distance learning [ ]  Blended learning [ ]  Other |
| **PURPOSE AND OVERVIEW (max. 5 sentences)** |
| The main purpose is to give the introduction to the most important algorithms and algorithmic strategies being used to solve practical problems in computer science, and a comparison of various algorithms in terms of their effectiveness in various specific situations. At the end of the course students should be able to understand the basic mathematical con-cepts used in the design and analysis of algorithms, to be able to choose and use algorithms that are more appropriate in a given concrete situation, and to implement these algorithms. |
| **SYLLABUS (brief outline and summary of topics, max. 10 sentences)** |
| * **Introduction to algorithms** - algorithms and complexity
* **Algorithms with numbers** – basic arithmetic, modular arithmetic, primality testing, applications to cryptography;
* **Divide-and-conquer strategy** – the basic ideas, multiplication, subproblems tree, the Master theorem, binary search, mergesort, medians, the selection problem, matrix multiplication, the fast Fourier transform;
* **Graph algorithms** - depth-first search in undirected graphs, depth-first search in directed graphs, strongly connected components, shortest paths in graphs, breadth-first search, Dijkstra's algorithm, shortest paths in the presence of negative edges, the Bellman-Ford algorithm, shortest paths in dags
* **Greedy algorithms** - minimum spanning trees, Kruskal's algorithm, disjoint sets, Prim's algorithm, Huffman encoding, Horn formulas, set cover;
* **Dynamic programming** - the basic ideas, longest increasing subsequences, edit distance, knapsack problem, chain matrix multiplication, all-pairs shortest paths, the Floyd-Warshall algorithm, the traveling salesman problem, independent sets in trees;
* **Linear programming** - the basic ideas, examples: product maximization, production planning, optimum bandwidth allocation, variants of linear programming, flows in networks, bipartite matching, duality, zero-sum games, the simplex algorithm.
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| **LANGUAGE OF INSTRUCTION** |
| [x] Serbian (complete course) [ ]  English (complete course) [ ]  Other \_\_\_\_\_\_\_\_\_\_\_\_\_ (complete course)[ ] Serbian with English mentoring [ ] Serbian with other mentoring \_\_\_\_\_\_\_\_\_\_\_\_\_\_ |
| **ASSESSMENT METHODS AND CRITERIA** |
| **Pre exam duties** | **Points** | **Final exam** | **Points** |
| **Activity during lectures** | **10** | **Written examination** | **25** |
| **Practical teaching** | **–** | **Oral examination** | **40** |
| **Teaching colloquia** | **25** | **OVERALL SUM** | **100** |
| **\*Final examination mark is formed in accordance with the Institutional documents** |