



Univerza v Mariboru

Fakulteta za naravoslovje
in matematiko

UČNI NAČRT PREDMETA / COURSE SYLLABUS

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|----------------------|------------|
| Predmet: | Algoritmi |
| Course title: | Algorithms |

| Študijski program in stopnja Study programme and level | Študijska smer Study field | Letnik Academic year | Semester Semester |
|-----------------------------------------------------------|-------------------------------|-------------------------|----------------------|
| Matematika, 1. stopnja | | 2. | 4. |
| Mathematics, 1 st degree | | 2. | 4. |

Vrsta predmeta / Course type

Univerzitetna koda predmeta / University course code:

| Predavanja Lectures | Seminar Seminar | Sem. vaje Tutorial | Lab. vaje Laboratory work | Teren. vaje Field work | Samost. delo Individ. work | ECTS |
|------------------------|--------------------|-----------------------|------------------------------|---------------------------|-------------------------------|------|
| 45 | | 15 | 30 | | 120 | 7 |

Nosilec predmeta / Lecturer:

Aleksander VESEL

Jeziki /

Languages:

Predavanja /

Lectures:

SLOVENSKO/SLOVENE

Vaje / Tutorial:

SLOVENSKO/SLOVENE

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:

Podatkovne strukture

Prerequisites:

Data structures

Vsebina:

Analiza algoritma: časovna in prostorska zahtevnost.

Deli in vladaj: bisekcija, urejanje (hitro urejanje, urejanje z zlivanjem), iskanje k -tega najmanjšega elementa v zaporedju, množenje velikih števil, množenje matrik.

Požrešna metoda: preprosti problem nahrbtnika, minimalno vpeto drevo, drevo najkrajših poti, Huffmanovo kodiranje.

Content (Syllabus outline):

Algorithm analysis: time and space complexity.

Divide and conquer: bisection, sorting (quick sort, merge sort), selection problem, big numbers multiplication, matrix multiplication.

Greedy algorithms: fractional knapsack problem, minimum spanning tree, single-source shortest path in a graph, Huffman codes.

Dinamično programiranje: dolžine najkrajših poti v grafu, 0/1 nahrbtnik, problem trgovskega potnika.

Sestopanje: barvanje grafa, problem n kraljic, igre za dva igralca, α - β obrezovanje.

Verjetnostni algoritmi: testiranje praštevilstva, verjetnostni heuristični algoritmi.

Dynamic programming: all-pairs shortest paths in a graph, 0/1 knapsack problem, traveling salesman problem.

Backtracking: graph coloring, n -queens on a chessboard, strategic games, α - β pruning.

Randomized algorithms: primality testing, randomized heuristics.

Temeljni literatura in viri / Readings:

T.H. Cormen, C.E. Leiserson, R.L. Rivest, Introduction to algorithms, The MIT Press, 2001.

J. Kozak, Podatkovne strukture in algoritmi, Ljubljana, DMFA, 1997.

S.S. Skiena, The Algorithm Design Manual, Springer, 1998.

Cilji in kompetence:

Spoznati temeljne koncepte analize algoritmov. Spoznati osnovne strategije snovanja algoritmov: deli in vladaj, požrešne algoritme, dinamično programiranje in sestopanje. Spoznati verjetnostne algoritme in osnove heurističnih algoritmov.

Objectives and competences:

Know fundamental concepts from algorithm analysis.
Know basic algorithm design techniques: divide and conquer, greedy algorithms, dynamic programming, backtracking. Know randomized algorithms and the principles of heuristics.

Predvideni študijski rezultati:

Znanje in razumevanje:

- Razumevanje principov analize algoritmov.
- Razumeti pomen strategij snovanja algoritmov.
- Spoznati različne strategije oziroma pristope pri snovanju algoritmov.
- Razumeti pomen verjetnostnih algoritmov.

Prenosljive/ključne spretnosti in drugi atributi:

- Prenos znanja metod snovanja in analize algoritmov na sorodna oziroma povezana področja (računalništvo, diskretna matematika, biologija, ekonomija...)

Intended learning outcomes:

Knowledge and Understanding:

- To understand principals of algorithm analysis.
- To understand the meaning of algorithm design.
- To know a variety of algorithm design techniques.
- To recognize the meaning of randomized algorithms.

Transferable/Key Skills and other attributes:

- Knowledge transfer of methods of algorithm analysis and design into other fields (discrete mathematics, computer science, biology, economics, ...)

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| Metode poučevanja in učenja: | | Learning and teaching methods: | |
| <ul style="list-style-type: none"> • Predavanja • Računalniške vaje | | <ul style="list-style-type: none"> • Lectures • Computer exercises | |
| Načini ocenjevanja: | | Assessment: | |
| <p><u>Sprotno preverjanje:</u> Pisni testi – teorija (3 do 5 pisnih testov na semester) Naloge</p> <p><u>Izpit:</u> Pisni izpit – problemi</p> <p>Vsaka izmed naštetih obveznosti mora biti opravljena s pozitivno oceno.</p> <p>Opravljene sprotne obveznosti so pogoj za pristop k izpitu.</p> | <p>Delež (v %) / Weight (in %)</p> <p>40%</p> <p>20%</p> <p>40%</p> | <p><u>Mid-term testing:</u> Written tests – theory (from 3 to 5 written tests during the semester) Coursework</p> <p><u>Exams:</u> Written exam - problems</p> <p>Each of the mentioned commitments must be assessed with a passing grade.</p> <p>Passing grades of all mid-term testings are required for taking the exam.</p> | |
| Reference nosilca / Lecturer's references: | | | |
| <p>1. VESEL, Aleksander. Fibonacci dimension of the resonance graphs of catacondensed benzenoid graphs. <i>Discrete appl. math.</i>. [Print ed.], 2013, str. 1-11, doi: 10.1016/j.dam.2013.03.019.</p> <p>2. SHAO, Zehui, VESEL, Aleksander. A note on the chromatic number of the square of the Cartesian product of two cycles. <i>Discrete math.</i>. [Print ed.], 2013, vol. 313, iss. 9, str. 999-1001.</p> <p>3. KORŽE, Danilo, VESEL, Aleksander. A note on the independence number of strong products of odd cycles. <i>Ars comb.</i>, 2012, vol. 106, str. 473-481. [COBISS.SI-ID 16138006]</p> <p>4. TARANENKO, Andrej, VESEL, Aleksander. 1-factors and characterization of reducible faces of plane elementary bipartite graphs. <i>Discuss. Math., Graph Theory</i>, 2012, vol. 32, no. 2, str. 289-297, doi: 10.7151/dmgt.1607. [COBISS.SI-ID 19104264]</p> <p>5. SALEM, Khaled, KLAVŽAR, Sandi, VESEL, Aleksander, ŽIGERT, Petra. The Clar formulas of a benzenoid system and the resonance graph. <i>Discrete appl. math.</i>. [Print ed.], 2009, vol. 157, iss. 11, str. 2565-2569. http://dx.doi.org/10.1016/j.dam.2009.02.016. [COBISS.SI-ID 15142489]</p> | | | |