



Univerza v Mariboru

Fakulteta za naravoslovje
in matematiko

UČNI NAČRT PREDMETA / COURSE SYLLABUS

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 cycle		2.	4.

Vrsta predmeta / Course type

Obvezni / Compulsory

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: primeri verjetnostnih algoritmov, npr. testiranje praštevilstvi.

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: examples of randomized algorithms, e.g. primality testing.

Temeljni literatura in viri / Readings:

T.H. Cormen, C.E. Leiserson, R.L. Rivest, Introduction to algorithms, The MIT Press, 2009.

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

S.S. Skiena, The Algorithm Design Manual, Springer, 2008.

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 hevrističnih 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, ...)

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:

1. KORŽE, Danilo, MARKUŠ, Žiga, VESEL, Aleksander. A heuristic approach for searching (d,n) -packing colorings of infinite lattices. *Discrete applied mathematics*, ISSN 0166-218X. [Print ed.], March 2019, vol. 257, str. 353-358. <https://doi.org/10.1016/j.dam.2018.09.018>, [COBISS.SI-ID [21821462](#)].
2. KORŽE, Danilo, VESEL, Aleksander. Packing coloring of generalized Sierpiński graphs. *Discrete mathematics and theoretical computer science*, ISSN 1365-8050, 2019, vol. 21, no. 3, str. 1-18. <https://dmtcs.episciences.org/5178/pdf>. [COBISS.SI-ID [22126870](#)].
3. VESEL, Aleksander. Cube-complements of generalized Fibonacci cubes. *Discrete Mathematics*, ISSN 0012-365X. [Print ed.], April 2019, vol. 342, iss. 4, str. 1139-1146. <https://doi.org/10.1016/j.disc.2019.01.008>, [COBISS.SI-ID [18539097](#)].
4. SHAO, Zehui, VESEL, Aleksander, XU, Jin. The k -distance independence number and 2-distance chromatic number of Cartesian products of cycles. *Bulletin of the Malaysian Mathematical Society*, ISSN 0126-6705, 2018, vol. 41, iss. 3, str. 1377-1391, doi: [10.1007/s40840-016-0397-0](https://doi.org/10.1007/s40840-016-0397-0). [COBISS.SI-ID [22601992](#)].
5. KORŽE, Danilo, VESEL, Aleksander. (d,n) -packing colorings of infinite lattices. *Discrete applied mathematics*, ISSN 0166-218X. [Print ed.], March 2018, vol. 237, str. 97-108, doi: [10.1016/j.dam.2017.11.036](https://doi.org/10.1016/j.dam.2017.11.036). [COBISS.SI-ID [21067542](#)].