



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:

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

T.H. Cormen, C.E. Leiserson, R.L. Rivest, Introduction to algorithms, The MIT Press, 2022.

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 • Seminarske vaje 		<ul style="list-style-type: none"> • Lectures • Computer exercises • Seminary exercises 	
Načini ocenjevanja:		Assessment:	
<p><u>Sprotno preverjanje:</u> Pisni testi – teorija (vsaj trije pisni 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 (at least three 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. VESEL, Aleksander. Binary coding of resonance graphs of catacondensed polyhexes. *Match : communications in mathematical and in computer chemistry*. 2023, vol. 90, no. 2, str. 429-452. ISSN 0340-6253. DOI: [10.46793/match.90-2.429V](https://doi.org/10.46793/match.90-2.429V). [COBISS.SI-ID [148521219](#)]
2. KORŽE, Danilo, VESEL, Aleksander. General Position Sets in Two Families of Cartesian Product Graphs. *Mediterranean journal of mathematics*. Published 06 May 2023, 12 str. ISSN 1660-5446. DOI: [10.1007/s00009-023-02416-z](https://doi.org/10.1007/s00009-023-02416-z). [COBISS.SI-ID [151233539](#)]
3. KORŽE, Danilo, SHAO, Zehui, VESEL, Aleksander. New results on radio k-labelings of distance graphs. *Discrete applied mathematics*. [Print ed.]. 15 Oct. 2022, vol. 319, str. 472-479. ISSN 0166-218X. DOI: [10.1016/j.dam.2021.09.007](https://doi.org/10.1016/j.dam.2021.09.007). [COBISS.SI-ID [78298371](#)].
4. DENG, Fei, SHAO, Zehui, VESEL, Aleksander. On the packing coloring of base-3 Sierpiński graphs and H-graphs. *Aequationes mathematicae*. 2021, vol. 95, iss. 2, str. 329-341. ISSN 0001-9054. DOI: [10.1007/s00010-020-00747-w](https://doi.org/10.1007/s00010-020-00747-w). [COBISS.SI-ID [27121667](#)].
5. VESEL, Aleksander. Efficient proper embedding of a daisy cube. *Ars mathematica contemporanea*. [Tiskana izd.]. 2021, vol. 21, no. 2, str. 271-282. ISSN 1855-3966. <https://amc-journal.eu/index.php/amc/article/download/2454/1711>, <http://www.dlib.si/details/URN:NBN:SI:doc-LNSLRXNG>, DOI: [10.26493/1855-3974.2454.892](https://doi.org/10.26493/1855-3974.2454.892). [COBISS.SI-ID [72352259](#)].

