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, 1st 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			**45**		**150**	**8**

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:	**Prerequisits:**
Podatkovne strukture	Data structures

Vsebina:	**Content (Syllabus outline):**
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.	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. Dynamic programming: all-pairs shortest paths

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 praštevilskosti, verjetnosti hevristični algoritmi.	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:	**Objectives and competences:**
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.	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:	**Intended learning outcomes:**
Znanje in razumevanje: • Razumevanje principov analize algoritmov. • Razumeti pomen strategij snovanja algoritmov. • Spoznati različne strategije oziroma pristope pri snovanju algoritmov. • Razumeti pomen verjetnostnih algoritmov. Prenesljive/ključne spretnosti in drugi atributi: • Prenos znanja metod snovanja in analize algoritmov na sorodna oziroma povezana področja (računalništvo, diskretna matematika, biologija, ekonomija...)	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:**
• Predavanja • Računalniške vaje	• Lectures • Computer exercises

Načini ocenjevanja: / **Assessment:**

	Delež (v %) / Weight (in %)	
<u>Sprotno preverjanje:</u> Pisni testi – teorija (3 do 5 pisnih testov na semester) Naloge <u>Izpit:</u> Pisni izpit – problemi Vsaka izmed naštetih obveznosti mora biti opravljena s pozitivno oceno. Opravljene sprotne obveznosti so pogoj za pristop k izpitu.	 40% 20% 40%	<u>Mid-term testing:</u> Written tests – theory (from 3 to 5 written tests during the semester) Coursework <u>Exams:</u> Written exam - problems Each of the mentioned commitments must be assessed with a passing grade. Passing grades of all mid-term testings are required for taking the exam.
Reference nosilca / Lecturer's references:		

1. VESEL, Aleksander. Fibonacci dimension of the resonance graphs of catacondensed benzenoid graphs. *Discrete appl. math.*. [Print ed.], 2013, str. 1-11, doi: 10.1016/j.dam.2013.03.019.

2. SHAO, Zehui, VESEL, Aleksander. A note on the chromatic number of the square of the Cartesian product of two cycles. *Discrete math.*. [Print ed.], 2013, vol. 313, iss. 9, str. 999-1001.

3. KORŽE, Danilo, VESEL, Aleksander. A note on the independence number of strong products of odd cycles. *Ars comb.*, 2012, vol. 106, str. 473-481. [COBISS.SI-ID 16138006]

4. TARANENKO, Andrej, VESEL, Aleksander. 1-factors and characterization of reducible faces of plane elementary bipartite graphs. *Discuss. Math., Graph Theory*, 2012, vol. 32, no. 2, str. 289-297, doi: 10.7151/dmgt.1607. [COBISS.SI-ID 19104264]

5. SALEM, Khaled, KLAVŽAR, Sandi, VESEL, Aleksander, ŽIGERT, Petra. The Clar formulas of a benzenoid system and the resonance graph. *Discrete appl. math.*. [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