



Univerza v Mariboru



Univerza v Mariboru

Fakulteta za naravoslovje in
matematiko

UČNI NAČRT PREDMETA / COURSE SYLLABUS

Predmet:	Algoritmi in podatkovne strukture
Course title:	Algorithms and data structures

Študijski program in stopnja Study programme and level	Študijska smer Study field	Letnik Academic year	Semester Semester
Matematika	Splošna matematika	2.	4.
Mathematics	General Mathematics	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		150	8

Nosilec predmeta / Lecturer:

Aleksander VESEL

Jeziki /

Languages:

Predavanja /

Lectures:

Vaje / Tutorial:

SLOVENSKO/SLOVENE

SLOVENSKO/SLOVENE

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

Jih ni.

Prerequisites:

There are none.

Vsebina:

Analiza algoritma: časovna in prostorska zahtevnost.

Osnovne podatkovne strukture: sklad, vrsta in povezani seznam. Predstavitve in uporaba.

Drevesa: dvojiško drevo, predstavitev in pregled. Kopica in vrsta s prednostjo.

Iskalna drevesa: dvojiška iskalna drevesa, AVL drevesa, rdeče črna drevesa, B drevesa.

Content (Syllabus outline):

Algorithm analysis: time and space complexity.

Elementary data structures: stack, queue and linked list. Implementations and applications.

Trees: binary tree, implementation and traversal. Heap and priority queue.

Search trees: binary search tree, AVL tree, red-black tree, B tree.

Deli in vladaj: bisekcija, urejanje (hitro urejanje, urejanje z zlivanjem). Požrešna metoda: preprosti problem nahrbtnika, minimalno vpeto drevo, drevo najkrajših poti. Dinamično programiranje: dolžine najkrajših poti v grafu, 0/1 nahrbtnik, problem trgovskega potnika. Sestopanje: barvanje grafa, problem n kraljic.	Divide and conquer: bisection, sorting (quick sort, merge sort). Greedy algorithms: fractional knapsack problem, minimum spanning tree, single-source shortest path in a graph. Dynamic programming: all-pairs shortest paths in a graph, 0/1 knapsack problem, traveling salesman problem. Backtracking: graph coloring, n-queens on a chessboard.
---	--

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. D. Harel, Y. Feldman, Algorithmics : the spirit of computing, AddisonWesley : Pearson Education, 2004. M.A. Weiss, Data structures and algorithms analysis, The Benjamin/Cummings Publishing Company, 1995.
--

Cilji in kompetence:

Spoznati osnovne analize zahtevnosti algoritmov. Spoznati temeljne koncepte podatkovnih struktur. Spoznati značilne podatkovne strukture: osnovne (sklad, vrsta, povezani seznam,...) ter zahtevnejše (drevesa, kopice, iskalna drevesa, imenike). 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 basic concepts from algorithm analysis. Know fundamental concepts of data structures as well as a variety of data structures: elementary (stack, queue, linked list, ...) and advanced (trees, heaps, search trees, dictionaries, ...). 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: • Razumeti pomen ter uporabo osnovnih in zahtevnejših podatkovnih struktur. • Prepoznati vpliv izbire podatkovne strukture na zahtevnost algoritma pri različnih praktičnih aplikacijah. • Razumevanje principov analize algoritmov. • Razumeti pomen strategij snovanja algoritmov. • Spoznati različne strategije oziroma pristope pri snovanju algoritmov.

Intended learning outcomes:

Knowledge and Understanding: • To understand the meaning and application of elementary and advanced data structures. • To recognize the influence of data structure to algorithm complexity in practical applications. • To understand principals of algorithm analysis. • To understand the meaning of algorithm design. • To know a variety of algorithm design techniques.
--

Prenesljive/ključne spretnosti in drugi atributi: • Prenos znanja uporabe podatkovnih struktur ter metod snovanja in analize algoritmov na sorodna oziroma povezana področja (računalništvo, diskretna matematika, biologija, ekonomija...)		Transferable/Key Skills and other attributes: • Knowledge transfer of data structures theory and 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:	
Način (pisni izpit, ustno izpraševanje, naloge, projekt) Pisni test – problemi Izpit (pisni) - teorija Naloge Vsaka izmed naštetih obveznosti mora biti opravljena s pozitivno oceno. Pozitivni oceni pri pisnem testu in nalogah sta pogoj za pristop k izpitu.	Delež (v %) / Weight (in %) 40% 40% 20%	Type (examination, oral, coursework, project): Written test - problems Exam (written) – theory Coursework Each of the mentioned commitments must be assessed with a passing grade. Passing grades of the written test and coursework are required for taking the exam.	
Reference nosilca / Lecturer's references:			
1. 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] 2. 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] 3. 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] 4. VESEL, Aleksander. 4-tilings of benzenoid graphs. <i>MATCH Commun. Math. Comput. Chem. (Krag.)</i>, 2009, vol. 62, no. 1, str. 221-234. [COBISS.SI-ID 16886536] 5. TARANENKO, Andrej, VESEL, Aleksander. Characterization of reducible hexagons and fast decomposition of elementary benzenoid graphs. <i>Discrete appl. math.</i>. [Print ed.], 2008, vol. 156, iss. 10, str. 1711-1724. http://dx.doi.org/10.1016/j.dam.2007.08.029, doi: 10.1016/j.dam.2007.08.029. [COBISS.SI-ID 16140552]			

--