



Univerza v Mariboru



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Fakulteta za naravoslovje in  
matematiko

**UČNI NAČRT PREDMETA / COURSE SYLLABUS**

<b>Predmet:</b>	Algoritmi in podatkovne strukture
<b>Course title:</b>	Algorithms and data structures

Študijski program in stopnja Study programme and level	Študijska smer Study field	Letnik Academic year	Semester Semester
Izobraževalno računalništvo – dvopredmetni, 1. stopnja		2.	3.
Educational computer science – Double-major, 1 <sup>st</sup> degree		2.	3.

**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
30			30		105	6

**Nosilec predmeta / Lecturer:**

<b>Jeziki / Languages:</b>	<b>Predavanja / Lectures:</b>	SLOVENSKO/SLOVENE
	<b>Vaje / Tutorial:</b>	SLOVENSKO/SLOVENE

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

**Vsebina:**

**Content (Syllabus outline):**

**Analiza algoritma: časovna in prostorska zahtevnost.**

Algorithm analysis: time and space complexity.  
Elementary data structures: stack, queue and linked list. Implementations and applications.

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.

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.

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

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

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 heurističnih 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:

### Intended learning outcomes:

<b>Znanje in razumevanje:</b> <ul style="list-style-type: none"> <li>• Razumeti pomen ter uporabo osnovnih in zahtevnejših podatkovnih struktur.</li> <li>• Prepoznati vpliv izbire podatkovne strukture na zahtevnost algoritma pri različnih praktičnih aplikacijah.</li> <li>• Razumevanje principov analize algoritmov.</li> <li>• Razumeti pomen strategij snovanja algoritmov.</li> <li>• Spoznati različne strategije oziroma pristope pri snovanju algoritmov.</li> </ul>		<b>Knowledge and Understanding:</b> <ul style="list-style-type: none"> <li>• To understand the meaning and application of elementary and advanced data structures.</li> <li>• To recognize the influence of data structure to algorithm complexity in practical applications.</li> <li>• To understand principals of algorithm analysis.</li> <li>• To understand the meaning of algorithm design.</li> <li>• To know a variety of algorithm design techniques.</li> </ul>	
<b>Prenesljive/ključne spretnosti in drugi atributi:</b> <ul style="list-style-type: none"> <li>• Prenos znanja uporabe podatkovnih struktur ter metod snovanja in analize algoritmov na sorodna oziroma povezana področja (računalništvo, diskretna matematika, biologija, kemija...)</li> </ul>		<b>Transferable/Key Skills and other attributes:</b> <ul style="list-style-type: none"> <li>• Knowledge transfer of data structures theory and methods of algorithm analysis and design into other fields (discrete mathematics, computer science, biology, chemistry, ...)</li> </ul>	
<b>Metode poučevanja in učenja:</b> <ul style="list-style-type: none"> <li>• Predavanja</li> <li>• Računalniške vaje</li> </ul>		<b>Learning and teaching methods:</b> <ul style="list-style-type: none"> <li>• Lectures</li> <li>• Computer exercises</li> </ul>	
<b>Načini ocenjevanja:</b>		<b>Assessment:</b>	
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.	
<b>Reference nosilca / Lecturer's references:</b>			
<b>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 <a href="#">16138006</a>]</b>			

2. 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](https://doi.org/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. *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](#)]
4. VESEL, Aleksander. 4-tilings of benzenoid graphs. *MATCH Commun. Math. Comput. Chem. (Krag.)*, 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. *Discrete appl. math.*. [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](https://doi.org/10.1016/j.dam.2007.08.029). [COBISS.SI-ID [16140552](#)]