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
Izobraževalno računalništvo – dvopredmetni, 1. stopnja		**2.**	**3.**
Educational computer science – Double-major, 1st 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		**15**	**30**		**105**	**6**

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:
Jih ni.	There are none.

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:

Objectives and competences:

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.

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, dictionarys, ...).
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:	Knowledge and Understanding:
• 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. 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, kemija...)	• To understand the meaning and application of elementary and advanced data stuctures. • 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. 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, chemistry, …)

Metode poučevanja in učenja:

Learning and teaching methods:

• Predavanja • Računalniške vaje	• Lectures • Computer exercises

Načini ocenjevanja:

Assessment:

Sprotno preverjanje:	Delež (v %) / Weight (in %)	Mid-term testing:
		Homework
Domače naloge	20%	Exams:
Izpit:		
Pisni izpit – problemi	40%	Written exam – problems
Ustni izpit – teorija	40%	Oral exam – theory
Vsaka izmed naštetih obveznosti mora biti opravljena s pozitivno oceno.		Each of the mentioned assessments must be assessed with a passing grade.
Opravljene sprotne obveznosti so pogoj za pristop k pisnemu izpitu – problemi. Opravljen pisni izpit – problemi je pogoj za pristop k ustnemu izpitu – teorija.		Passing grades of all mid-term testings are required for taking the written exam – problems. Passing grade of written exam – problems is required to take the

		oral exam – theory.
Reference nosilca / Lecturer's references:		

1. VESEL, Aleksander. Linear recognition and embedding of Fibonacci cubes. *Algorithmica*, ISSN 0178-4617, 2015, vol. 71, no. 4, str. 1021-1034, doi: 10.1007/s00453-013-9839-3.

2. SHAO, Zehui, VESEL, Aleksander. Modeling the packing coloring problem of graphs. *Applied mathematical modelling*, ISSN 0307-904X. [Print ed.], 2015, vol. 39, issue 13, str. 3588-3595. http://www.sciencedirect.com/science/article/pii/S0307904X14006556, doi: 10.1016/j.apm.2014.11.060.

3. VESEL, Aleksander. Fast computation of clar formula for benzenoid graphs without nice coronenes. *MATCH Communications in Mathematical and in Computer Chemistry*, ISSN 0340-6253, 2014, vol. 71, no. 3, str. 717-740.

4. VESEL, Aleksander. Fibonacci dimension of the resonance graphs of catacondensed benzenoid graphs. *Discrete appl. math.*. [Print ed.], 2013, vol. 161, issue 13-14, str. 2158-2168, doi: 10.1016/j.dam.2013.03.019.

5. 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.