UČNI NAČRT PREDMETA / COURSE SYLLABUS

Predmet:	Napredni algoritmi
Course title:	Advanced algorithms

Študijski program in stopnja Study programme and level	Študijska smer Study field	Letnik Academic year	Semester Semester
Matematika, 2. stopnja		**1. ali 2.**	**1. ali 3.**
Mathematics, 2nd degree		**1. or 2.**	**1. or 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
45			**30**		**135**	**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:

Prerequisits:

Vsebina:	Content (Syllabus outline):
Razreda NP in P. Primeri NP-polni polnih problemov. Problemi kombinatorične optimizacije.	Classes NP and P. NP-complete problems. Combinatorial optimization problems.
Algoritmi urejanja in njihova zahtevnost.	Sorting algorithms in their complexity.
Iskanje niza v besedilu. Klasični algoritmi: Boyer-Mooreov algoritem, Knuth-Morris-Prattov algoritem. Priponska drevesa: Ukkonenov algoritem in Weinerjev algoritem. Neeksaktno iskanje niza.	String matching. Classical methods: Boyer-Moore algorithm, Knuth-Morris-Pratt algorithm. Suffix trees: Ukkonen's algorithm, Weiner's algoritem. Inexact matching.
Aproksimacijski algoritmi. Lokalno iskanje.	Approximation algorithms. Local search. Fundamentals of heuristics and metaheuristics methods.

Osnove hevrističnih in metahevrističnih algoritmov.	Advanced algorithm analysis. Amortized analysis.
Zahtevnejša analiza algoritmov. Metoda amortiziranih stroškov.	

Temeljni literatura in viri / Readings:

M. A. Weiss, Data Structures and Algorithm Analysis in C++, Addison-Wesley, 2007.

C.H. Papadimitriou, K. Steiglitz, Combinatorial Optimization - Algorithms and Complexity, Prentice-Hall, 1998.

M. Dorigo, T. Stutzle, Ant colony optimization, MIT Press, 2004.

D. Gusfield, Algorithms on strings, trees and sequences, Cambridge University Press, 1999.

M. Mitchell, An introduction to genetic algorithms, MIT Press, 2002.

Cilji in kompetence:	**Objectives and competences:**
Poglobiti znanje iz izbranih algoritmov, tehnik zahtevnejših analiz algoritmov in osnov teorije NP-polnosti. Poglobiti znanje iz načinov reševanja težkih (grafovskih) problemov. Predstaviti algoritme iskanja niza.	To deepen the knowledge of selected algorithms, techniques for advanced algorithm analysis and the principles of NP-completeness theory. To deepen the knowledge of skills for solving hard (graph) problems. To present string matching algorithms.

Predvideni študijski rezultati:	**Intended learning outcomes:**
Znanje in razumevanje: - Poglobiti znanje iz osnovnih in zahtevnejših grafovskih algoritmov. - Prepoznati težke probleme. - Razumeti pomen aproksimacijskih algoritmov. - Poglobiti znanje iz različnih vrst hevrističnih in metahevrističnih tehnik. - Razumevanje zahtevnejših postopkov analize algoritmov. Prenesljive/ključne spretnosti in drugi atributi: - Prenos znanja algoritmičnih tehnik na druga področja (diskretna matematika, biologija, ekonomija, ...).	Knowledge and Understanding: • To deepen the knowledge of elementary and advanced graph algorithms • To recognize hard problems. • To understand the importance of approximation algorithms. • To deepen the knowledge of a variety of heuristics and metaheuristics techniques. • To understand techniques for advanced algorithm analysis Transferable/Key Skills and other attributes: - Knowledge transfer of algorithmic techniques 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 %)	
Sprotno preverjanje:		Mid-term testing:
Projekt	40%	Project
Pisni testi – teorija (3 do 5 pisnih testov na semester)	40%	Written tests – theory (from 3 to 5 written tests during the semester)
Izpit:		Exams:
Pisni izpit – problemi	20%	Written exam - problems
Vsaka izmed naštetih obveznosti mora biti opravljena s pozitivno oceno.		Each of the mentioned commitments must be assessed with a passing grade.
Opravljene sprotne obveznosti so pogoj za pristop k izpitu.		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]