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
Enovit magistrski študijski program druge stopnje Predmetni učitelj	/		
Five-year master's degree program Subject Teacher	/	5.	9.

Vrsta predmeta / Course type   Izbirni / Elective

Univerzitetna koda predmeta / University course code:

Predavanja Lectures	Seminar Seminar	Vaje Tutorial	Lab. vaje Laboratory work	Terenske vaje Field work	Samost. delo Individ. work	ECTS
30			30		150	7

Nosilec predmeta / Lecturer: Aleksander Vesel

Jeziki / Languages:	Predavanja / Lectures:	slovenski / slovene
	Vaje / Tutorial:	slovenski / slovene

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	**Prerequisits:**
Jih ni.	There are none.

Vsebina:	**Content (Syllabus outline):**
Razreda NP in P. Primeri NP-polni polnih problemov. Problemi kombinatorične optimizacije. Algoritmi urejanja in njihova zahtevnost. Iskanje niza v besedilu. Klasični algoritmi: BoyerMooreov algoritem, Knuth-Morris-Prattov algoritem. Priponska drevesa: Ukkonenov algoritem.	Classes NP and P. NP-complete problems. Combinatorial optimization problems. Sorting algorithms in their complexity. String matching. Classical methods: Boyer-Moore algorithm, Knuth-Morris-Pratt algorithm. Suffix trees: Ukkonen's algorithm. Inexact matching.

Neeksaktno iskanje niza. Aproksimacijski algoritmi. Lokalno iskanje. Osnove hevrističnih in metahevrističnih algoritmov. Zahtevnejša analiza algoritmov. Metoda amortiziranih stroškov.	Approximation algorithms. Local search. Fundamentals of heuristics and metaheuristics methods. Advanced algorithm analysis. Amortized analysis.

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:

- Poglobiti znanje iz izbranih algoritmov, tehnik zahtevnejših analiz algoritmov in osnov teorije NPpolnosti.
- Poglobiti znanje iz načinov reševanja težkih (grafovskih) problemov.
- Predstaviti algoritme iskanja niza.

Objectives and competences:

- 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:

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.

Intended learning outcomes:

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.

Prenesljive/ključne spretnosti in drugi atributi:	Transferable/Key Skills and other attributes:
• Prenos znanja algoritmičnih tehnik na druga področja (diskretna matematika, biologija, ekonomija, ...).	• Knowledge transfer of algorithmic techniques into other fields (discrete mathematics, computer science, biology, economics, …).

Metode poučevanja in učenja:	Learning and teaching methods:
• Predavanja • Računalniške in teoretične vaje	• Lectures • Computer and theoretical exercises

Načini ocenjevanja:	Delež (v %) / Weight (in %)	Assessment:
Pisni izpit – teoretični del	60%	Written exam – theoretical part
Projekt – praktični del	40%	Project – practical part
Vsaka izmed naštetih obveznosti mora biti opravljena s pozitivno oceno. Pozitivna ocena pri projektu je pogoj za pristop k izpitu.		Each of the mentioned commitments must be assessed with a passing grade. Passing grade of the project is required for taking the exam.

Reference nosilca / Lecturer's references:

A. Vesel, Linear recognition and embedding of Fibonacci cubes. *Algorithmica*, 2013, str. 1-14.

A. Vesel, Fibonacci dimension of the resonance graphs of catacondensed benzenoid graphs. *Discrete appl. math.*, 2013, vol. 161, issue 13-14, str. 2158-2168.

Z. Shao, A. Vesel, Integer linear programming model and satisfiability test reduction for distance constrained labellings of graphs: the case of L(3,2,1) labelling for products of paths and cycles. *IET communications*, 2013, vol. 7, iss. 8, str. 715-720.

D. Korže, A. Vesel, A note on the independence number of strong products of odd cycles. *Ars comb.*, 2012, vol. 106, str. 473-481.

A. Vesel, 4-tilings of benzenoid graphs. *MATCH Commun. Math. Comput. Chem. (Krag.)*, 2009, vol. 62, str. 221-234.