UČNI NAČRT PREDMETA / COURSE SYLLABUS (leto / year 2017/18)			
Predmet:	Aproksimacijski in naključnostni algoritmi		
Course title:	Approximation and randomized algorithms		

Študijski program in stopnja **Study programme and level**	**Študijska smer** **Study field**	**Letnik** **Academic year**	**Semester** **Semester**
Interdisciplinarni magistrski študijski program Računalništvo in matematika	ni smeri	1 ali 2	prvi
Interdisciplinary Master's study programme Computer Science and Mathematics	none	1 or 2	first

Vrsta predmeta / Course type	izbirni / elective
Univerzitetna koda predmeta / University course code:	

Predavanja **Lectures**	**Seminar** **Seminar**	**Vaje** **Tutorial**	**Klinične vaje** **work**	**Druge oblike študija**	**Samost. delo** **Individ. work**		**ECTS**
45		**30**			**105**		**6**

Nosilec predmeta / Lecturer:	prof. dr. Borut Robič

Jeziki / Languages:	**Predavanja / Lectures:**	slovenski / Slovene
	Vaje / Tutorial:	slovenski / Slovene

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	**Prerequisites:**
Vpis v letnik študija.	Enrolment in the programme.
Vsebina:	**Content (Syllabus outline):**

Predmet bo vseboval naslednje vsebine: Uvod: Računska zahtevnost odločitvenih in optimizacijskih problemov NP-polni in NP-težki problemi Hevristični algoritmi, kakovost suboptimalnih rešitev, (ne)obstoj zagotovila za kakovost Približno reševanje NP-težkih problemov: Aproksimacijski algoritmi Kakovost približnih rešitev Razred APX Tehnika z vrzeljo Aproksimacijske sheme Razreda PTAS in FPTAS Meje približnega reševanja Razvoj aproksimacijskih algoritmov: Požrešna metoda Osredotočanje na podporobleme Zaporedno razdeljevanje Dinamično programiranje Naključnostno reševanje NP-težkih problemov: Las Vegas in Monte Carlo algoritmi Razredi RP, co-RP, ZPP, PP, BPP Razvoj naključnostnih algoritmov: Naključno vzorčenje Zagotavljanje obilice prič Naključno preurejanje vhoda Zgoščanje Enakomerno porazdeljevanje bremen	The course will offer the following themes: Introduction: Computational complexity of decision and optimization problems NP-complete and NP-hard problems Heuristic algorithms, quality of suboptimal solutions, (non)existence of a guarantee of quality Approximate solving of NP-hard problems: Approximation algorithms Quality of approximate solutions The class APX Gap technique Approximation schemes The classes PTAS and FPTAS Limits of approximate solving The design of approximation algorithms: Greedy method Focusing on subproblems Iterative partitioning Dynamic programming Randomized solving of NP-hard problems: Las Vegas and Monte Carlo algorithms The classes RP, co-RP, ZPP, PP, BPP The design of randomized algorithms: Random sampling Establishing abundance of witnesses Random reordering Hashing Load balancing

Temeljni literatura in viri / Readings:

B. Robič, Aproksimacijski algoritmi, Založba FE in FRI, 2.izd., 2009.
D.P. Williamson, D.B. Shmoys, The Design of Approximation Algorithms, Cambridge University Press, 2011.
V. V. Vazirani, Approximation Algorithms, Springer, 2004.
D. Hochbaum, Approximation Algorithms for NP-hard Problems, Course Technology, 1996.
R. Motwani, P.Raghavan, Randomized Algorithms, Cambridge University Press, 1995.
M. Mitzenmacher, E. Upfal, Probability and Computing: Randomized algorithms and Probabilistic Analysis, Cambridge University Press, 2005.

Cilji in kompetence:	Objectives and competences:
Slušatelji bodo na teoretičnem nivoju in prek praktičnih primerov osvojili znanja za približno in naključnostno reševanje praktičnih problemov, ki so v razumnem času drugače neobvladljivi.	Students will learn, both theoretically and through practical examples, how to use approximation and randomization techniques to solve practical yet intractable computational problems.

Predvideni študijski rezultati:	Intended learning outcomes:
Znanje in razumevanje: Študent bo usposobljen za reševanje neobvladljivih računskih problemov, ki se pojavljajo v praksi.	Knowledge and understanding: The student will be able to tackle intractable problems that often appear in practice.

Metode poučevanja in učenja:	Learning and teaching methods:
Predavanja, domače naloge, seminarski način dela pri vajah.	Lectures, homeworks, and exercise groups.

Načini ocenjevanja:	Delež (v %) / Weight (in %)	Assessment:
Način (pisni izpit, naloge, projekt)		Type (examination, coursework, project):
Sprotno preverjanje (domače naloge, praktično delo)		Continuing (homework, practical work)
Končno preverjanje (pisni izpit)		Final (written exam)
Ocene: 6-10 pozitivno, 1-5 negativno (skladno s Statutom UL)	50 % 50 %	Grading: 6-10 pass, 1-5 fail (in accordance with the rules of the University of Ljubljana)

Reference nosilca / Lecturer's references:

ROBIČ, Borut. The foundations of computability theory. Heidelberg [etc.]: Springer, cop. 2015. XX, 331 str., ilustr. ISBN 978-3-662-44807-6. ISBN 978-3-662-44808-3. [COBISS.SI-ID 1536557251]
BEZENŠEK, Mitja, ROBIČ, Borut. A survey of parallel and distributed algorithms for the Steiner tree problem. International journal of parallel programming, ISSN 0885-7458. [Print ed.], 2014, vol. 42, no. 2, str. 287-319. [COBISS.SI-ID 9891924]
MIHELIČ, Jurij, MAHJOUB, Amine, RAPINE, Christophe, ROBIČ, Borut. Two-stage flexible-choice problems under uncertainty. European journal of operational research, ISSN 0377-2217. [Print ed.], Mar. 2010, vol. 201, no. 2, str. 399-403, ilustr. [COBISS.SI-ID 7087444]

MIHELIČ, Jurij, ROBIČ, Borut. Flexible-attribute problems. Computational optimization and applications, ISSN 0926-6003. [Print ed.], 2010, vol. 47, no. 3, str. 553-566, ilustr. [COBISS.SI-ID 7087700]

TROBEC, Roman, ŠTERK, Marjan, ROBIČ, Borut. Computational complexity and parallelization of the meshless local Petrov-Galerkin methods. Computers & Structures, ISSN 0045-7949. [Print ed.], 2009, vol. 87, no. 1/2, str. 81-90. [COBISS.SI-ID 21895463]