

UČNI NAČRT PREDMETA / COURSE SYLLABUS (leto / year 2017/18)							
Predmet:		Algoritmi					
Course title:		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		drugi
Interdisciplinary Master's study programme Computer Science and Mathematics		none			1		second
Vrsta predmeta / Course type					obvezni / compulsory		
Univerzitetna koda predmeta / University course code:					M2800		
Predavanja Lectures	Seminar Seminar	Vaje Tutorial	Klinične vaje work	Druge oblike študija	Samost. delo Individ. work	ECTS	
45	20	10			105	6	
Nosilec predmeta / Lecturer:		doc. dr. Tomaž Dobravec					
Jeziki / Languages:		Predavanja / Lectures: slovenski / Slovene, angleški / English					
		Vaje / Tutorial: slovenski / Slovene, angleški / English					
Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:				Prerequisites:			
Vpis v letnik študija.				Enrolment in the programme.			
Vsebina:				Content (Syllabus outline):			

<p>Osnovna vsebina predmeta zajema:</p> <p>Avtomati in gramatike.</p> <p>Slučajnostni algoritmi in verjetnostna analiza algoritmov.</p> <p>Amortizirana analiza algoritmov.</p> <p>Razpršene tabele: funkcije razprševanja, univerzalno razprševanje, popolno razprševanje, lokalno občutljivo razprševanje.</p> <p>Sortiranje s predpostavkami: korensko urejanje, sektorsko urejanje.</p> <p>Iskanje s predpostavkami: drevesa van Emde Boats.</p> <p>Iskanje v večdimenzionalnih prostorih: k-d drevesa in R drevesa.</p> <p>Hevristične metode reševanja problemov: lokalne metode.</p> <p>Biološko navdahnjene metode: diferencialna evolucija in metode roja.</p> <p>Računska geometrija: lastnosti daljic, konveksna ovojnica, par najbližjih točk.</p> <p>Linearno programiranje: metoda simpleksov, aproksimacije.</p> <p>Večnitni algoritmi.</p> <p>Porazdeljeni algoritmi.</p> <p>Vzporedni algoritmi.</p> <p>Študenti, ki na prvi stopnji še niso osvojili osnovnih algoritmov in podatkovnih struktur, bodo pod mentorstvom izvajalcev v obliki seminarjev in domačih nalog sproti obdelali še manjkajoče predznanje.</p>	<p>Basic topics:</p> <p>Automata theory and grammars.</p> <p>Randomized algorithms and probabilistic analysis.</p> <p>Amortized analysis of algorithms.</p> <p>Hash tables: hash functions, universal hashing, perfect hashing, locality-sensitive hashing.</p> <p>Sorting with assumptions: radix sort, bucket sort.</p> <p>Searching with assumptions: van Emde Boats trees.</p> <p>Searching in multidimensional spaces: k-d trees, R-trees.</p> <p>Heuristic programming: local methods.</p> <p>Biologically inspired methods: differential evolution, swarm intelligence.</p> <p>Computational geometry: line-segment properties, convex hull, closest pair of points.</p> <p>Linear programming: the simplex algorithm, LP-based approximations.</p> <p>Multithreaded algorithms.</p> <p>Distributed algorithms.</p> <p>Parallel algorithms.</p> <p>Students lacking a required background from the 1st degree courses will gain needed knowledge and skills through additional preparation of seminar papers and programming assignments throughout the course. The topics will be individually selected.</p>
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Temeljni literatura in viri / Readings:

T. H. Cormen, C.E. Leiserson, R.L. Rivest, C. Stein: Introduction to Algorithms, 3rd edition. MIT Press, 2009.

I. Kononenko, M. Robnik Šikonja, Z. Bosnić.: Programiranje in algoritmi. Založba FE in FRI, Ljubljana, 2008.

K.A.Berman, J.L. Paul: Algorithms: Sequential, Parallel, and Distributed. Thomson, 2005.

J. Kleinberg, E. Tardos: Algorithm Design. Pearson Education, 2006.

D.E. Knuth: The Art of Computer Programming, 2nd edition. Addison-Wesley, 1998.

R. Sedgewick, P. Flajolet: An Introduction to the Analysis of Algorithms. Addison-Wesley, 1995.

S.S. Skiena: The Algorithm Design Manual, 2nd edition. Springer, 2010.

Cilji in kompetence:

Cilj predmeta je pridobiti znanje s področja načrtovanja in analize algoritmov in podatkovnih struktur.

Objectives and competences:

The goal of this course is to gain the knowledge of the design and analysis of algorithms and data structures.

Predvideni študijski rezultati:

Znanje in razumevanje: Sposobnost samostojnega načrtovanja in analiziranja algoritmov in podatkovnih struktur.

Uporaba: Uporaba naučenih principov pri programiranju in načrtovanju obsežnih programskih sistemov.

Refleksija: Razumevanje delovanja, načrtovanja in analiziranja algoritmov in podatkovnih struktur.

Prenosljive spretnosti - niso vezane le na en

predmet: Zmožnost načrtovanja postopkov za reševanje različnih problemov.

Intended learning outcomes:

Knowledge and understanding: The design and analysis of algorithms and data structures.

Application: The ability to use algorithms and data structures as a basic blocks when designing large-scale applications.

Reflection: The understanding of the design and analysis of algorithms and data structures.

Transferable skills: The design of procedures and methods for solving a wide range of different real-world problems.

Metode poučevanja in učenja:

Predavanja in domače naloge, pomembno je sprotno oddajane domačih nalog.

Mentorsko delo s študenti, ki si na prvi stopnji še niso pridobili potrebnih predznanj iz dela osnovnih vsebine predmeta. Manjkajče znanje si bodo ti študenti pridobili s seminarskimi nalogami in programskimi projekti.

Learning and teaching methods:

Lectures and homework, assignments are to be assigned regularly and delivered on time. For students without required knowledge of part of the basic topics from previous 1st degree study, individual work (seminal papers and programming assignments) will be assigned according to the student's existing knowledge.

Načini ocenjevanja:

Delež (v %) /

Weight (in %)

Assessment:

Način (pisni izpit, ustno izpraševanje, naloge, projekt):

Sprotno preverjanje (domače naloge, kolokviji in projektno ali seminarsko delo)

Končno preverjanje (pisni in ustni izpit)

Ocene: 6-10 pozitivno, 1-5 negativno

(v skladu s Statutom UL)

50%

50%

Type (examination, oral, coursework, project): Continuing (homework, midterm exams, project work or seminar paper)
Final (written and oral exam)
Grading: 6-10 pass, 1-5 fail (according to the rules of University of Ljubljana)

Reference nosilca / Lecturer's references:

DOBRAVEC, Tomaž, ROBIČ, Borut, ŽEROVNIK, Janez. Permutation routing in double-loop networks : design and empirical evaluation. Journal of Systems Architecture, ISSN 1383-7621. [Print ed.], 2003, vol. 48, str. 387-402, ilustr. [COBISS.SI-ID 3475796]

DOBRAVEC, Tomaž, ŽEROVNIK, Janez, ROBIČ, Borut. An optimal message routing algorithm for circulant networks. Journal of Systems Architecture, ISSN 1383-7621. [Print ed.], 2006, vol. 52, no. 5, str. [298]-306, ilustr. [COBISS.SI-ID 5323348]

DOBRAVEC, Tomaž, ROBIČ, Borut. Restricted shortest paths in 2-circulant graphs. Computer communications, ISSN 0140-3664. [Print ed.], March 2009, vol. 32, no. 4, str. 685-690, ilustr. [COBISS.SI-ID 6966356]

BULIĆ, Patricio, DOBRAVEC, Tomaž. An approximate method for filtering out data dependencies with a sufficiently large distance between memory references. The journal of supercomputing, ISSN 0920-8542, 2011, vol. 56, no. 2, str. 226-244, ilustr. [COBISS.SI-ID 7412820]

ČEŠNOVAR, Rok, RISOJEVIĆ, Vladimir, BABIĆ, Zdenka, DOBRAVEC, Tomaž, BULIĆ, Patricio. A GPU implementation of a structural-similarity-based aerial-image classification. The journal of supercomputing, ISSN 0920-8542, Aug. 2013, vol. 65, no. 2, str. 978-996, ilustr. [COBISS.SI-ID 9619028]

MIHELIČ, Jurij, DOBRAVEC, Tomaž. SicSim : a simulator of the educational SIC/XE computer for a system-software course. Computer applications in engineering education, ISSN 1061-3773. [Print ed.], Jan. 2015, vol. 23, no. 1, str. 137-146, ilustr. [COBISS.SI-ID 10241620]