

UČNI NAČRT PREDMETA / COURSE SYLLABUS (leto / year 2017/18)						
Predmet:		Podatkovne strukture in algoritmi 1				
Course title:		Data structures and algorithms 1				
Študijski program in stopnja Study programme and level		Študijska smer Study field		Letnik Academic year		Semester Semester
Univerzitetni študijski program Matematika		ni smeri		3		prvi
First cycle academic study programme Mathematics		none		3		first
Vrsta predmeta / Course type				izbirni / elective		
Univerzitetna koda predmeta / University course code:				M0234		
Predavanja Lectures	Seminar Seminar	Vaje Tutorial	Klinične vaje work	Druge oblike študija	Samost. delo Individ. work	ECTS
30		30			90	5
Nosilec predmeta / Lecturer:		prof. dr. Sergio Cabello Justo, prof. dr. Sandi Klavžar, doc. dr. Alen Orbanić				
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):		

<ul style="list-style-type: none"> • Algoritmi, podatkovne strukture, časovna zahtevnost. • Tabela, sklad, vrsta, seznam. • Deli in vladaj: binarno iskanje, urejanje z zlivanjem, Strassenov algoritem, rešitev rekurzivnih enačb, hitro urejanje, mediana, itd. • Sestopanje. • Dinamično programiranje: najdaljše naraščajoče podzaporedje, Levenshteinova razdalja, množenje več matrik, 0/1-nahrbtnik, problem trgovskega potnika, itd. • Predstavitve grafov in omrežij. Osnovni algoritmi na grafih: pregledi, topološko urejanje, Floyd-Warshallov algoritem, Dijkstrov algoritem (kopice), Bellman-Fordov algoritem, itd. 	<ul style="list-style-type: none"> • Algorithms, data structures and time complexity • Arrays, stacks, queues and lists. • Divide and conquer: binary search, mergesort, Strassen's algorithm, solving recursive equations, Quicksort, median, and others. • Backtracking. • Dynamic programming: longest increasing subsequence, Levenshtein's distance, product of several matrices, 0/1-knapsack, travelling salesman problem, and others. • Representations of graphs and networks. Basic algorithms on graphs: traversals, topological sorting, Floyd-Warshall algorithm, Dijkstra's algorithm (heaps), Bellman-Ford algorithm, and others.
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Temeljni literatura in viri / Readings:

T. H. Cormen, C. E. Leiserson, R. L. Rivest, C. Stein: Introduction to Algorithms, 2. izdaja, MIT Press, Cambridge, 2001.

S. Dasgupta, C. H. Papadimitriou, and U. V. Vazirani: Algorithms, McGraw-Hill, 2008.

J. Erickson: Zapiski za Undergraduate Algorithms, 2012.

J. Kleinberg, E. Tardos: Algorithm design, Pearson/Addison-Wesley, 2005.

J. Kozak: Podatkovne strukture in algoritmi, DMFA-založništvo, Ljubljana, 1997.

Cilji in kompetence:

Študent spozna osnovne podatkovne strukture in z njimi povezane algoritme, ki se uporabljajo pri programiranju. Seznan se z matematično analizo pravilnosti ter časovne in prostorske zahtevnosti algoritmov.

Objectives and competences:

The student gets familiar with data structures and related algorithms that are used in programming. It gets familiar with mathematical analysis of correctness, time and space complexity of algorithms.

Predvideni študijski rezultati:

Intended learning outcomes:

Znanje in razumevanje: Poznavanje nekaterih osnovnih podatkovnih struktur in algoritmov ter praktičnih problemov, pri katerih se jih lahko smiselno uporabi. Ugotavljanje pravilnosti računskih postopkov.

Uporaba: Snovanje učinkovitih računalniških programov in napovedovanje njihovega obnašanja s pomočjo matematičnih metod.

Refleksija: Povezanost med teoretičnimi napovedmi o obnašanju računalniških programov in njihovim dejanskim obnašanjem.

Prenosljive spretnosti – niso vezane le na en predmet: Pomen matematične analize računskih postopkov in njena praktična uporabnost

Knowledge and understanding: Getting familiar with some basic data structures and algorithms, and some practical problems with relevant applications. Determining of correctness of computational procedures.

Application: Design of efficient computer programs and forecasting of their behavior by using mathematical methods.

Reflection: Connection between theoretical forecasts about behavior of computer programs and actual behavior.

Transferable skills: The importance of mathematical analysis of computational procedures and its practical applicability

Metode poučevanja in učenja:

Predavanja, vaje, domače naloge, konzultacije

Learning and teaching methods:

Lectures, exercises, homework, consultations

Načini ocenjevanja:

Delež (v %) /

Weight (in %)

Assessment:

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

50%

Type (examination, oral, coursework, project):

Domače naloge z zagovorom

50%

homeworks with defense

2 kolokvija namesto izpita iz vaj, izpit iz vaj,

2 midterm exams instead of written exam, written exam

izpit iz teorije

oral exam

ocene: 1-5 (negativno), 6-10 (pozitivno) (po Statutu UL)

grading: 1-5 (fail), 6-10 (pass) (according to the Statute of UL)

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Reference nosilca / Lecturer's references:

Sergio Cabello:

CABELLO, Sergio. Finding shortest contractible and shortest separating cycles in embedded graphs. V: 20th Annual ACM-SIAM Symposium on Discrete Algorithms, January 4-6, New York. SODA 2009 : special issue, (ACM transactions on algorithms, ISSN 1549-6325, Vol. 6, iss. 2). New York: Association for Computing Machinery, 2010, article No.: 24 (18 str.). [COBISS.SI-ID 15572057]

CABELLO, Sergio, KNAUER, Christian. Algorithms for graphs of bounded treewidth via orthogonal range searching. Computational geometry, ISSN 0925-7721. [Print ed.], 2009, vol. 42, iss. 9, str. 815-824. [COBISS.SI-ID 15160409]

CABELLO, Sergio, HAVERKORT, Herman Johannes, KREVELD, Marc van, SPECKMANN, Bettina. Algorithmic aspects of proportional symbol maps. Algorithmica, ISSN 0178-4617, 2010, vol. 58, no. 3, str. 543-565. [COBISS.SI-ID 15151193]

Sandi Klavžar:

KLAVŽAR, Sandi, MOLLARD, Michel. Cube polynomial of Fibonacci and Lucas cubes. Acta applicandae mathematicae, ISSN 0167-8019, 2012, vol. 117, no. 1, str. 93-105. [COBISS.SI-ID 16191833]

ILIĆ, Aleksandar, KLAVŽAR, Sandi, RHO, Yoomi. Generalized Lucas cubes. Applicable analysis and discrete mathematics, ISSN 1452-8630, 2012, vol. 6, no. 1, str. 82-94. [COBISS.SI-ID 16242265]

BATAGELJ, Vladimir, KORENJAK-ČERNE, Simona, KLAVŽAR, Sandi. Dynamic programming and convex clustering. Algorithmica, ISSN 0178-4617, 1994, let. 11, št. 2, str. 93-103. [COBISS.SI-ID 6799364]

KLAVŽAR, Sandi, LOKAR, Matija, PETKOVŠEK, Marko, PISANSKI, Tomaž. Izbrana poglavja iz računalništva. Del 2, Diskretna optimizacija, (Matematični rokopisi, 15). Ljubljana: Društvo matematikov, fizikov in astronomov SRS, 1986. 128 str. [COBISS.SI-ID 13496065]

Alen Orbanić:

PERME, Tomaž, NOVAK, Matjaž, STRAŠEK, Rok, KAVKLER, Iztok, ORBANIĆ, Alen. A model for technical optimisation of the distribution centre, 2011, Acta technica corviniensis, tome 4, fasc. 2, str. 39-43. [COBISS.SI-ID 4154583]

ORBANIĆ, Alen. F -actions and parallel-product decomposition of reflexible maps. Journal of algebraic combinatorics, ISSN 0925-9899, 2007, issue 4, vol. 26, str. 507-527. [COBISS.SI-ID 14429529]

ORBANIĆ, Alen, BOBEN, Marko, JAKLIČ, Gašper, PISANSKI, Tomaž. Algorithms for drawing polyhedra from 3-connected planar graphs. *Informatica*, ISSN 0350-5596, 2004, vol. 28, no. 3, str. 239-243. [COBISS.SI-ID 13285977]