

UČNI NAČRT PREDMETA / COURSE SYLLABUS (leto / year 2016/17)						
<b>Predmet:</b>		Podatkovne strukture in algoritmi 1				
<b>Course title:</b>		Data structures and algorithms 1				
<b>Študijski program in stopnja</b> Study programme and level		<b>Študijska smer</b> Study field		<b>Letnik</b> Academic year		<b>Semester</b> Semester
Univerzitetni študijski program Matematika		ni smeri		3		prvi
First cycle academic study programme Mathematics		none		3		first
<b>Vrsta predmeta / Course type</b>				izbirni / elective		
<b>Univerzitetna koda predmeta / University course code:</b>				M0234		
<b>Predavanja</b> Lectures	<b>Seminar</b> Seminar	<b>Vaje</b> Tutorial	<b>Klinične vaje</b> work	<b>Druge oblike</b> študija	<b>Samost. delo</b> Individ. work	<b>ECTS</b>
30		30			90	5
<b>Nosilec predmeta / Lecturer:</b>		prof. dr. Sergio Cabello Justo, prof. dr. Sandi Klavžar, doc. dr. Alen Orbanić				
<b>Jeziki / Languages:</b>		<b>Predavanja / Lectures:</b>		slovenski / Slovene		
		<b>Vaje / Tutorial:</b>		slovenski / Slovene		
<b>Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:</b>				<b>Prerequisites:</b>		
Vpis v letnik študija.				Enrolment in the programme.		
<b>Vsebina:</b>				<b>Content (Syllabus outline):</b>		

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