

UČNI NAČRT PREDMETA / COURSE SYLLABUS (leto / year 2017/18)						
<b>Predmet:</b>		Podatkovne strukture in algoritmi 3				
<b>Course title:</b>		Data structures and algorithms 3				
<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
Magistrski študijski program Matematika		ni smeri		1 ali 2		prvi ali drugi
Master's study programme Mathematics		none		1 or 2		first or second
<b>Vrsta predmeta / Course type</b>				izbirni / elective		
<b>Univerzitetna koda predmeta / University course code:</b>				M2613		
<b>Predavanja</b> Lectures	<b>Seminar</b> Seminar	<b>Vaje</b> Tutorial	<b>Klinične vaje</b> work	<b>Druge oblike študija</b>	<b>Samost. delo</b> Individ. work	<b>ECTS</b>
30	15	30			105	6
<b>Nosilec predmeta / Lecturer:</b>		prof. dr. Sergio Cabello Justo				
<b>Jeziki / Languages:</b>		<b>Predavanja / Lectures:</b> slovenski / Slovene, angleški / English				
		<b>Vaje / Tutorial:</b> slovenski / Slovene, angleški / English				
<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>			

<p>Predavatelj izbere teme iz naslednjega seznama:</p> <p>Uravnotežena iskalna drevesa.</p> <p>Zgoščene tabele.</p> <p>Binomske in Fibonaccijeve kopice.</p> <p>Vodenje disjunktnih množic.</p> <p>Algoritmi na nizih (Rabina in Karpa, Knutha, Morrisa in Pratta, Boyerja in Moora).</p> <p>Računanje konveksne ovojnice.</p> <p>Voronojev diagram in Delauneyeva triangulacija.</p> <p>Iskanje maksimalnega pretoka s predtokom.</p> <p>Iskanje največjega (uteženega) prirejanja v splošnem grafu.</p> <p>Algoritem alpha-beta.</p> <p>Algoritmi za ravninske grafe.</p> <p>Algoritmi za zunanji pomnilnik.</p> <p>Vztrajne podatkovne strukture.</p> <p>Podatkovne strukture za cela števila.</p> <p>Enostavni vzporedni algoritmi.</p> <p>Dinamična drevesa.</p>	<p>The lecturer chooses topics from the following list:</p> <p>Balanced search trees.</p> <p>Hash tables.</p> <p>Binomial and Fibonacci heaps.</p> <p>Union-find for disjoint sets.</p> <p>Algorithms for strings (Rabin and Karp, Knuth, Morris and Pratt, Boyer and Moore).</p> <p>Computation of convex hulls.</p> <p>Voronoi diagram and Delaunay triangulation.</p> <p>Finding maximum flows with preflows.</p> <p>Finding largest (weighted) matchings in general graphs.</p> <p>Alpha-beta algorithm.</p> <p>Algorithms for planar graphs.</p> <p>Algorithms for external memory.</p> <p>Persistent data structures.</p> <p>Data structures for integers.</p> <p>Simple parallel algorithms.</p> <p>Dynamic trees.</p>
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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, 2001.

D. C. Kozen: The Design and Analysis of Algorithms, Springer, 1991.

D. E. Knuth: Selected Papers on Analysis of Algorithms, Cambridge University Press, 2000.

S. Even, G. Even: Graph Algorithms, 2. izdaja, Cambridge University Press, 2011.

Znanstveni članki.

### **Cilji in kompetence:**

Študent nadgradi poznavanje podatkovnih struktur in z njimi povezanih algoritmov, ki se uporabljajo pri načrtovanju učinkovitih algoritmov. Ob tem poglobi znanje o matematični analizi pravilnosti ter časovne in prostorske zahtevnosti algoritmov.

### **Objectives and competences:**

The students improve their knowledge of data structures and related algorithmic techniques used in the design of efficient algorithms. They also develop the knowledge of mathematical analysis for the correctness and the time/space complexity of algorithms.

### **Predvideni študijski rezultati:**

Znanje in razumevanje: Poznavanje zahtevnejših podatkovnih struktur in algoritmov, praktičnih in teoretičnih problemov, pri katerih se jih lahko smiselno uporabi, ter poznavanje osnov teorije računske zahtevnosti. Uporaba: Snovanje učinkovitih računalniških programov in napovedovanje njihovega obnašanja v praksi s pomočjo matematičnih metod.

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

Prenosljive spretnosti – niso vezane le na en predmet: Pomen matematične analize računskih postopkov in njena praktična uporabnost. Ločevanje med računsko zahtevnimi in manj zahtevnimi problemi.

### **Intended learning outcomes:**

Knowledge and understanding: Learning more about complex data structures and algorithms, practical and theoretical problems where this knowledge can be applied, and the basics of computational complexity. Application: The design of efficient computer programs and prediction of their behavior in practice by using mathematical methods. Reflection: The correlation between theoretical predictions about the behavior of computer programs and their actual behavior.

Transferable skills: The importance of mathematical analysis of computational processes and its practical application.

Classification into difficult and less complex problems.

### **Metode poučevanja in učenja:**

### **Learning and teaching methods:**

predavanja, seminar, vaje, domače naloge, konzultacije in samostojno delo študentov	Lectures, seminar, exercises, homework, consultations and independent work by the students
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Delež (v %) /

**Načini ocenjevanja:**

Weight (in %) **Assessment:**

Način: izpit iz vaj (2 kolokvija ali pisni izpit) ali domače naloge, ustni izpit Ocene: 1-5 (negativno), 6-10 (pozitivno) (po Statutu UL)	50%	Type: exam of exercises (2 midterm exams or written exam) or homework
	50%	oral exam.  Grading: 1-5 (fail), 6-10 (pass) (according to the Statute of UL)

**Reference nosilca / Lecturer's references:**

Sergio Cabello:

CABELLO, Sergio, COLIN DE VERDIÈRE, Éric, LAZARUS, Francis. Algorithms for the edge-width of an embedded graph. V: 26th Annual Symposium on Computational Geometry, June 13th-16th, 2010, Snowbird, Utah. 26th Annual Symposium on Computation Geometry at Snowbird, Utah, USA : Special issue, (Computational geometry, ISSN 0925-7721, Vol. 45, iss. 5-6, 2012). Amsterdam: Elsevier, 2012, str. 215-224. [COBISS.SI-ID 16093017]

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. Many distances in planar graphs. Algorithmica, ISSN 0178-4617, 2012, vol. 62, no. 1-2, str. 361-381. [COBISS.SI-ID 15702873]