

UČNI NAČRT PREDMETA / COURSE SYLLABUS (leto / year 2017/18)						
<b>Predmet:</b>		Izbrana poglavja iz računalniške matematike				
<b>Course title:</b>		Topics in mathematical foundations of computer science				
<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>				M2609		
<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. Andrej Bauer, prof. dr. Sergio Cabello Justo, prof. dr. Marko Petkovšek				
<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 nekatere pomembne teme s področja računalniške matematike, kot so na primer:</p> <p>Računska geometrija in geometrijska optimizacija.</p> <p>Računska topologija.</p> <p>Algoritmi na grafih.</p> <p>Vizualizacija grafov in podatkov.</p> <p>Računalniška grafika.</p> <p>Računalniški vid.</p> <p>Matroidi.</p> <p>Algoritmična teorija iger.</p> <p>Aproksimacijski algoritmi.</p> <p>Vzporedni algoritmi.</p> <p>Algoritmi za tokove podatkov.</p> <p>Simbolno računanje.</p> <p>Bioinformatika.</p>	<p>The lecturer selects some important topics in computational mathematics, such as:</p> <p>Computational geometry and geometric optimization.</p> <p>Computational topology.</p> <p>Graph algorithms.</p> <p>Graph and data visualization.</p> <p>Computer graphics.</p> <p>Computer vision.</p> <p>Matroids.</p> <p>Algorithmic game theory.</p> <p>Approximation algorithms.</p> <p>Parallel algorithms.</p> <p>Algorithms for data streams.</p> <p>Symbolic computation.</p> <p>Bioinformatics.</p>
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### **Temeljni literatura in viri / Readings:**

M. de Berg, O. Cheong, M. van Kreveld, M. Overmars: Computational Geometry: Algorithms and Applications, 3. izdaja, Springer-Verlag, 2008.

S. Har-Peled: Geometric approximation algorithms, AMS, 2011.

H. Edelsbrunner, J.L. Harer: Computational Topology. An Introduction, AMS, 2010.

G. Di Battista, P. Eades, R. Tamassia, I.G. Tollis: Graph Drawing: Algorithms for the Visualization of Graphs, Prentice Hall, 1998.

C. H. Lampert: Kernel Methods in Computer Vision, Foundations and Trends in Computer Graphics and Vision 4 (2009) 193-285.

B. Mohar: Teorija matroidov, DMFAS, Ljubljana, 1996.

N. Nisan, T. Roughgarden, E. Tardos (ur.): Algorithmic Game Theory, Cambridge University Press, 2007.

D.P. Williamson, D.B. Shmoys: The Design of Approximation Algorithms, Cambridge University Press, 2011.

J. JaJa. Introduction to parallel algorithms. Addison-Wesley, 1992.

S. Muthukrishnan: Data Streams: Algorithms and Applications, Foundations & Trends in Theoretical Computer Science, 2005.

J. von zur Gathen, J. Gerhard: Modern Computer Algebra, 3rd ed., Cambridge University Press, 2013.

M. Kauers, P. Paule: The concrete tetrahedron. Symbolic sums, recurrence equations, generating functions, asymptotic estimates, Springer, 2011.

N. C. Jones, P. A. Pevzner: An Introduction to Bioinformatics Algorithms, MIT Press, Cambridge MA, 2004.

Znanstveni članki.

**Cilji in kompetence:**

Študent spozna osnove nekaterih pomembnih področij računalniške matematike.

**Objectives and competences:**

The students get acquainted with some important and actual areas of computational mathematics.

**Predvideni študijski rezultati:**

Znanje in razumevanje: Slušatelj se natančneje seznanj z izbranim področjem računalniške matematike. Spozna teoretične osnove ter praktične prijeme z izbranega področja. Uporaba Reševanje računalniških problemov iz različnih področij.

Refleksija: Študentje spoznajo računalniške probleme in modeliranje. Povezanost med teorijo in prakso.

**Intended learning outcomes:**

Knowledge and understanding: Students gain deeper knowledge of selected areas in computational mathematics. They become familiar with both the theoretical foundations and the techniques for solving problems in these areas. Application: Solving computational problems from different areas. Reflection: The students see computational problems and modelling. Connection between theory and praxis. Transferable skills: Use of algorithmic thinking for solving imperfectly defined

Prenosljive spretnosti – niso vezane le na en predmet: Uporaba algoritmičnega mišljenja pri reševanju nepopolno definiranih problemov

problems.

**Metode poučevanja in učenja:**

predavanja, seminar, vaje, domače naloge, konzultacije in samostojno delo študentov

**Learning and teaching methods:**

Lectures, seminar, exercises, homework, consultations and independent work by the students

**Načini ocenjevanja:**

Delež (v %) /

Weight (in %)

**Assessment:**

Način:izpit iz vaj (2 kolokvija ali pisni izpit) or homework ustni izpit  
Ocene: 1-5 (negativno), 6-10 (pozitivno) (po Statutu UL)

50%

50%

Type:  
exam of exercises (2 midterm exams or written exam) or homework

oral exam.

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

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

Andrej Bauer:

BAUER, Andrej, STONE, Christopher A. RZ: a tool for bringing constructive and computable mathematics closer to programming practice. Journal of logic and computation, ISSN 0955-792X, 2009, vol. 19, no. 1, str. 17-43. [COBISS.SI-ID 15325785]

BAUER, Andrej, CLARKE, Edmund, ZHAO, Xudong. Analytica - An experiment in combining theorem proving and symbolic computation. Journal of automated reasoning, ISSN 0168-7433, 1998, vol. 21, no. 3, str. 295-325. [COBISS.SI-ID 10606425]

BAUER, Andrej, PETKOVŠEK, Marko. Multibasic and mixed hypergeometric Gosper-type algorithms. Journal of symbolic computation, ISSN 0747-7171, 1999, let. 28, št. 4-5, str. 711-736. [COBISS.SI-ID 9210969]

Sergio Cabello:

CABELLO, Sergio, KREVELD, Marc van. Approximation algorithms for aligning points. Algorithmica, ISSN 0178-4617, 2003, vol. 37, no. 3, str. 211-232. ,19,105,linkingpublicationresults,1:100117,1. [COBISS.SI-ID 13352793]

CABELLO, Sergio. Approximation algorithms for spreading points. *Journal of algorithms*, ISSN 0196-6774, 2007, vol. 62, no. 2, str. 49-73. [COBISS.SI-ID 14298201]

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]

Marko Petkovšek:

PETKOVŠEK, Marko. Counting Young tableaux when rows are cosets. *Ars combinatoria*, ISSN 0381-7032, 1994, let. 37, str. 87-95. [COBISS.SI-ID 8048473]

PETKOVŠEK, Marko, WILF, Herbert S., ZEILBERGER, Doron. *A=B*. Wellesley (Massachusetts): A. K. Peters, cop. 1996. VII, 212 str. ISBN 1-56881-063-6. [COBISS.SI-ID 4085337]

PETKOVŠEK, Marko. Letter graphs and well-quasi-order by induced subgraphs. *Discrete Mathematics*, ISSN 0012-365X. [Print ed.], 2002, vol. 244, no. 1-3, str. 375-388. [COBISS.SI-ID 11414873]