

UČNI NAČRT PREDMETA / COURSE SYLLABUS						
Predmet:		Izbrana poglavja iz računalniške matematike				
Course title:		Topics in mathematical foundations of computer science				
Študijski program in stopnja Study programme and level		Študijska smer Study field		Letnik Academic year	Semester 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	
Vrsta predmeta / Course type				izbirni		
Univerzitetna koda predmeta / University course code:				M2609		
Predavanja Lectures	Seminar Seminar	Vaje Tutorial	Klinične vaje work	Druge oblike študija	Samost. delo Individ. work	ECTS
30	15	30			105	6
Nosilec predmeta / Lecturer:		prof. Andrej Bauer, prof. Marko Petkovšek, prof. Sergio Cabello Justo				
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:		
Vsebina:				Content (Syllabus outline):		
Predavatelj izbere nekatere pomembne teme s področja računalniške matematike, kot so na primer:				The lecturer selects some important topics in computational mathematics, such as: Computational geometry and geometric		

Računska geometrija in geometrijska optimizacija.	optimization.
Računska topologija.	Computational topology.
Algoritmi na grafih.	Graph algorithms.
Vizualizacija grafov in podatkov.	Graph and data visualization.
Računalniška grafika.	Computer graphics.
Računalniški vid.	Computer vision.
Matroidi.	Matroids.
Algoritmična teorija iger.	Algorithmic game theory.
Aproksimacijski algoritmi.	Approximation algorithms.
Vzporedni algoritmi.	Parallel algorithms.
Algoritmi za tokove podatkov.	Algorithms for data streams.
Simbolno računanje.	Symbolic computation.
Bioinformatika.	Bioinformatics.

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 seznanil 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.

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

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 problems.

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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:

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

Delež (v %) /

Weight (in %)

Assessment:

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)

50%

50%

Reference nosilca / Lecturer's references:

Andrej Bauer:

- 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]

- 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, 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]

Sergio Cabello Justo:

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