



Univerza v Mariboru

Fakulteta za naravoslovje
in matematiko

UČNI NAČRT PREDMETA / COURSE SYLLABUS

Predmet:	Računalniška matematika
Course title:	Computer Mathematics

Študijski program in stopnja Study programme and level	Študijska smer Study field	Letnik Academic year	Semester Semester
Matematika, 3. stopnja		1.	2.
Mathematics, 3 rd cycle		1 st	2 nd

Vrsta predmeta / Course type

Univerzitetna koda predmeta / University course code:

Predavanja Lectures	Seminar Seminar	Vaje Tutorial	Klinične vaje work	Druge oblike študija	Samost. delo Individ. work	ECTS
45					225	9

Nosilec predmeta / Lecturer:

Jeziki / Languages:
Predavanja / Lectures:
Vaje / Tutorial:

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:

Poznanje temeljnih konceptov računalniške in diskretne matematike: algoritmov, podatkovnih struktur, kombinatorike, teorije grafov. Poznavanje osnov linearne algebre, teorije števil, matematične logike.

Prerequisites:

Basic knowledge of fundamental concepts of computer and discrete mathematics: algorithms, data structures, graph theory. Knowledge of basic linear algebra, number theory, mathematical logic.

Vsebina:

Teorija algoritmov: formalizacija algoritma, izražanje algoritma, analiza algoritma.

Modeli računanja: Turingov stroj, RAM, RASP, PRAM.

Teorija izračunljivosti: odločitveni problemi, odločitveni problemi in jeziki, razredi odločitvenih problemov oziroma jezikov, razreda P in NP, nedeterministični Turingov stroj, NP-polni problemi, odprta vprašanja.

Algoritmi za PRAM.

Nekatere izmed teh tem so obdelane podrobneje, druge pa le na osnovni ravni. Pri izboru se upoštevajo interesi in raziskovalne usmeritve študentov.

Content (Syllabus outline):

Algorithms: formalization of algorithms, expressing algorithms, algorithm analysis.

Models of computation: Turing machine, RAM, RASP, PRAM.

Theory of computation: decisions problems, decisions problems and languages, classes of languages/decisions problems, classes P and NP, nondeterministic Turing machine, NP-complete problems, open questions.

PRAM algorithms.

Some of these topics are treated in greater detail, and some of them only at a basic level. The selection depends on students' interests and their research orientation.

Temeljni literatura in viri / Readings:

- M. Sipser, Introduction to the Theory of Computation, Course Technology, 2012.
- M. R. Garey, D. S. Johnson, Computers and Intractability: A Guide to the Theory of NP-Completeness, W. H. Freeman, New York, 1979.
- T.H. Cormen, C.E. Leiserson, R.L. Rivest, Introduction to algorithms, The MIT Press, 2002.
- M.A. Weiss, Data structures and algorithms analysis, The Benjamin/Cummings Publishing Company, 1995.

Cilji in kompetence:

- Doseči poglobljeno razumevanje teoretskih in metodoloških konceptov s področja računalniške matematike
- Razviti sposobnost samostojnega razvijanja novega znanja s področja računalniške matematike
- Razviti sposobnost za samostojno reševanje najzahtevnejših problemov iz računalniške matematike
- Razviti sposobnost izboljševanja znanih in odkrivanja novih rezultatov s področja računalniške matematike
- Razviti zmožnost vodenja najzahtevnejših znanstvenoraziskovalnih projektov s širšega področja računalniške matematike.

Objectives and competences:

- To achieve a deeper understanding of theoretical and methodological concepts of computer mathematics
- To develop the ability to independently develop new knowledge in the field of computer mathematics
- To develop the ability for solving the most challenging problems in computer mathematics
- To develop the ability of improving known results as well as obtaining new results in computer mathematics
- To develop the ability to lead the most challenging scientific research projects in the wider field of computer mathematics

Predvideni študijski rezultati:

Znanje in razumevanje:

- poglobljeno razumevanje izbranih področij računalniške matematike;
- poglobljena zmožnost uporabe računalniške matematike na drugih področjih.

Prenesljive/ključne spretnosti in drugi atributi:

- podlaga za raziskovalno delo na področju računalniške matematike;
- pridobljeno znanje za uporabo računalniške matematike na drugih področjih.

Intended learning outcomes:

Knowledge and understanding:

- Deeper understanding of selected areas of computer mathematics;
- Deeper ability to use computer mathematics in other areas.

Transferable/Key Skills and other attributes:

- a basis for research in computer mathematics;
- knowledge needed for applying computer mathematics to other areas.

Metode poučevanja in učenja:

- predavanja;
- priprava seminarja;
- konzultacije;
- samostojni študij.

Learning and teaching methods:

- lectures;
- seminar work;
- consultations;
- self-study.

Delež (v %) /

Načini ocenjevanja:

Weight (in %)

Assessment:

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

- seminarsko predavanje;
- pisni izdelek;
- ustni izpit.

20 %
30 %
50 %

Type (examination, oral, coursework, project):

- seminar talk;
- written work;
- oral examination.

Reference nosilca / Lecturer's references:

1. VESEL, Aleksander. Cube-complements of generalized Fibonacci cubes. *Discrete mathematics*. [Print ed.]. April 2019, vol. 342, iss. 4, str. 1139-1146. ISSN 0012-365X.

<https://doi.org/10.1016/j.disc.2019.01.008>, DOI: [10.1016/j.disc.2019.01.008](https://doi.org/10.1016/j.disc.2019.01.008). [COBISS.SI-ID [18539097](https://doi.org/10.1016/j.disc.2019.01.008)], [JCR]

kategorija: 1A3

2. VESEL, Aleksander. Linear algorithms for the Hosoya index and Hosoya matrix of a tree. *Mathematics*. 2021, vol. 9, iss. 2, str. 1-11. ISSN 2227-7390.

<https://doi.org/10.3390/math9020142>, DOI: [10.3390/math9020142](https://doi.org/10.3390/math9020142). [COBISS.SI-ID [46938627](https://doi.org/10.3390/math9020142)], [JCR]

kategorija: 1A1

3. VESEL, Aleksander. Efficient proper embedding of a daisy cube. *Ars mathematica contemporanea*. [Tiskana izd.]. 2021, vol. 21, no. 2, str. 271-282. ISSN 1855-3966. <https://amc-journal.eu/index.php/amc/article/download/2454/1711>, DOI: [10.26493/1855-3974.2454.892](https://doi.org/10.26493/1855-3974.2454.892).

[COBISS.SI-ID [72352259](https://doi.org/10.26493/1855-3974.2454.892)], [JCR]

kategorija: 1A3

4. KORŽE, Danilo, SHAO, Zehui, VESEL, Aleksander. New results on radio k-labelings of distance graphs. *Discrete applied mathematics*. [Print ed.]. 15 Oct. 2022, vol. 319, str. 472-479. ISSN 0166-218X. DOI: [10.1016/j.dam.2021.09.007](https://doi.org/10.1016/j.dam.2021.09.007). [COBISS.SI-ID [78298371](#)], [JCR]
kategorija: 1A3

5. VESEL, Aleksander. Binary coding of resonance graphs of catacondensed polyhexes. *Match : communications in mathematical and in computer chemistry*. 2023, vol. 90, no. 2, str. 429-452. ISSN 0340-6253. DOI: [10.46793/match.90-2.429V](https://doi.org/10.46793/match.90-2.429V). [COBISS.SI-ID [148521219](#)], [JCR]
kategorija: 1A2