



Univerza v Mariboru

Fakulteta za naravoslovje  
in matematiko

### UČNI NAČRT PREDMETA / COURSE SYLLABUS

<b>Predmet:</b>	Računalniška matematika
<b>Course title:</b>	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 <sup>rd</sup> Degree		1 <sup>st</sup>	2 <sup>nd</sup>

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:

<b>Jeziki / Languages:</b>	<b>Predavanja / Lectures:</b>	Slovenski in angleški jezik; Slovene and English
	<b>Vaje / Tutorial:</b>	Slovenski in angleški jezik; Slovene and English

**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.

Teorija avtomatov in jeziki.

Modeli računanja: Turingov stroj, RAM, RASP.

Churcheva teza.

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

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.

Automata theory and languages.

Models of computation: Turing machine, RAM, RASP.

Church's thesis.

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.

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, 2005.
- 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, 2001.
- 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
- Zmožnost razvijanja kritične refleksije na področju 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
- Ability to develop critical reflection 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.

**Načini ocenjevanja:**

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

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

Delež (v %) /

Weight (in %) /

**Assessment:**

Type (examination, oral, coursework, project):

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

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

1. SHAO, Zehui, VESEL, Aleksander, XU, Jin. The k-distance independence number and 2-distance chromatic number of Cartesian products of cycles. *Bulletin of the Malaysian Mathematical Society*, ISSN 0126-6705, 2016, str. 1-15, doi: [10.1007/s40840-016-0397-0](https://doi.org/10.1007/s40840-016-0397-0). [COBISS.SI-ID [22601992](https://www.cobiss.si/id/22601992)]
2. SHAO, Zehui, VESEL, Aleksander, XU, Jin. Frequency assignment problem in networks with limited spectrum. *Central European Journal of Operations Research*, ISSN 1435-246X, 2016, 1-15 str., doi: [10.1007/s10100-016-0462-7](https://doi.org/10.1007/s10100-016-0462-7). [COBISS.SI-ID [22869512](https://www.cobiss.si/id/22869512)]
3. VESEL, Aleksander. Regular coronoids and 4-tilings. *Discrete applied mathematics*, ISSN 0166-218X. [Print ed.], 2016, str. 1-11, doi: [10.1016/j.dam.2016.07.022](https://doi.org/10.1016/j.dam.2016.07.022). [COBISS.SI-ID [22600712](https://www.cobiss.si/id/22600712)]
4. RHO, Yoomi, VESEL, Aleksander. Linear recognition of generalized Fibonacci cubes  $Q_h^{(1)}$  (111). *Discrete mathematics and theoretical computer science*, ISSN 1365-8050, 2016, vol. 17, no. 3, str. 349-362. <https://www.dmtcs.org/dmtcs-ojs/index.php/dmtcs/article/view/2756/4766.html>. [COBISS.SI-ID [22599944](https://www.cobiss.si/id/22599944)]
5. VESEL, Aleksander. Linear recognition and embedding of Fibonacci cubes. *Algorithmica*, ISSN 0178-4617, 2015, vol. 71, no. 4, str. 1021-1034, doi: [10.1007/s00453-013-9839-3](https://doi.org/10.1007/s00453-013-9839-3). [COBISS.SI-ID [20093448](https://www.cobiss.si/id/20093448)]