

| UČNI NAČRT PREDMETA / COURSE SYLLABUS (leto / year 2017/18)                  |                           |  |                              |                                    |                                      |                             |
|--|---------------------------|--|------------------------------|------------------------------------|--------------------------------------|-----------------------------|
| <b>Predmet:</b>  |                           | Uporabna diskretna matematika  |                              |                                    |                                      |                             |
| <b>Course title:</b>   |                           | Applied discrete mathematics   |                              |                                    |                                      |                             |
| <b>Študijski program in stopnja</b><br>Study programme and level             |                           | <b>Študijska smer</b><br>Study field   |                              | <b>Letnik</b><br>Academic year     |                                      | <b>Semester</b><br>Semester |
| Magistrski študijski program<br>Matematika                                   |                           | ni smeri   |                              | 1 ali 2                            |                                      | prvi ali drugi              |
| Master's study programme<br>Mathematics                                      |                           | none   |                              | 1 or 2                             |                                      | first or second             |
| <b>Vrsta predmeta / Course type</b>  |                           |  |                              | izbirni / elective                 |                                      |                             |
| <b>Univerzitetna koda predmeta / University course code:</b>                 |                           |  |                              | M2216                              |                                      |                             |
| <b>Predavanja</b><br>Lectures  | <b>Seminar</b><br>Seminar | <b>Vaje</b><br>Tutorial  | <b>Klinične vaje</b><br>work | <b>Druge oblike študija</b>        | <b>Samost. delo</b><br>Individ. work | <b>ECTS</b>                 |
| 30   | 15                        | 30   |                              |                                    | 105                                  | 6                           |
| <b>Nosilec predmeta / Lecturer:</b>  |                           | doc. dr. Alen Orbanić, prof. dr. Primož Potočnik, prof. dr. Riste Škrekovski |                              |                                    |                                      |                             |
| <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> |                                      |                             |

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| <p>Predstavimo več modelnih problemov, ki jih lahko rešimo s pomočjo modeliranja z metodami iz diskretne matematike.</p> <p>Osredotočimo se na proces obravnave problema: identifikacija entitet in odnosov med njimi, identifikacija ciljev, postavitve podatkovnega modela, izdelava algoritmov, predvidevanje testiranja in testni podatki, specifikacije, implementacija, ocenjevanje in kakovostna presoja rezultatov.</p> <p>Glede na izbrane modelne probleme se po potrebi spoznamo z matematičnimi orodji in metodologijo za naslavljanje problemov, npr. orodja in metode iz heuristične optimizacije, vizualizacije in predstavitve podatkov (grafi, diagrami ...), kvalitativne analize diskretnih dinamičnih sistemov in drugo.</p> <p>V seminarskem delu predmeta bodo študenti dobili individualne ali skupinske uporabne ter raziskovalne projekte, lahko tudi v sodelovanju s podjetji ali preko vključitve na domače ali mednarodne projekte.</p> | <p>Several model problems are presented and modeled by using methods from discrete mathematics.</p> <p>We focus on the process of addressing a problem: identification of entities and relationships among them, identification of goals, data model design, algorithm implementation, design of testing procedures and test data, specification, implementation, evaluation and qualitative evaluation of the results.</p> <p>Depending on the choice of the model problems, students get familiar with various mathematical tools and methodologies for addressing the problems, e.g. heuristic optimization procedures, data visualisation methods (graphs, charts, etc.), qualitative analysis of discrete dynamic systems, etc.</p> <p>During the course seminar work, students will be assigned individual and team applied and research projects. If possible the students will be involved in projects with companies or in national or international applied research projects.</p> |
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#### **Temeljni literatura in viri / Readings:**

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| <p>E. Zakrajšek: Matematično modeliranje, DMFA-založništvo, Ljubljana, 2004.</p> <p>R. Aris: Mathematical modelling techniques, Dover, 1994.</p> <p>M. Jünger, P. Mutzel: Graph Drawing Software, Springer-Verlag, Berlin, 2004.</p> <p>Z. Michalewicz: Genetic Algorithms + Data Structures = Evolution Programs, Springer-Verlag, Berlin, 1999.</p> <p>R. A. Holmgren: A First Course in Discrete Dynamical Systems, Springer-Verlag, Berlin, 1996.</p> |
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#### **Cilji in kompetence:**

#### **Objectives and competences:**

Študenti se naučijo identificirati problem, ki ga je mogoče obravnavati z matematičnimi tehnikami, problem formulirati v matematično obvladljivi obliki, identificirati orodja, s katerimi se problema lahko lotimo, preiskati kompetentno literaturo, razviti ali prilagoditi ustrezen model za reševanje, poiskati kritične dejavnike modela, rešitev problema implementirati v praksi. Pri izdelavi projekta je poudarek tudi na posebnostih skupinskega dela.

Students become capable of identifying problems that can be addressed by various mathematical techniques. They learn how to formulate problems in mathematical form, identify relevant tools to deal with the problem, search through the relevant literature, develop or adapt a relevant model for solving the problem, find critical aspects of it and implement a solution in practice. Specifics of team work are emphasised during the work on projects.

**Predvideni študijski rezultati:**

Znanje in razumevanje: spoznavanje procesa obravnave problema od njegove identifikacije, prek formulacije in obravnave modela do implementacije rešitve.

Uporaba: izdelava modelov pri reševanju realnih problemov.

Refleksija: presojanje veljavnosti predpostavk teoretičnih modelov, kritično vrednotenje izdelanih rešitev, vrednotenje skupinskega dela.

Prenosljive spretnosti – niso vezane le na en predmet: sposobnost prepoznavanja relevantnih dejstev, formuliranja problema, prilagajanja znanih rešitev, predstavitve konceptov.

**Intended learning outcomes:**

Knowledge and understanding: Learning of the process of a problem identification and problem addressing, starting by forming of a model, dealing with it and progressing towards a solution implementation.

Application: Construction of models for solving of real problems.

Reflection: evaluation of validity of assumptions for theoretical models, critical evaluation of constructed solutions, evaluation of team work.

Transferable skills: Capabilities of recognizing of relevant facts, problem formulation, adaptation of known solutions, concept presentation.

**Metode poučevanja in učenja:**

predavanja, vaje, skupinsko načrtovanje rešitev, projektno delo, seminarski nastopi, konzultacije

**Learning and teaching methods:**

Lectures, exercises, team solution planning, projects, seminar presentations, consultations

**Načini ocenjevanja:**

Delež (v %) /

Weight (in %)

**Assessment:**

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| <p>Način (domaće naloge, pisni izpit, ustno izpraševanje, naloge, projekt):</p> <p>projektna naloga (načrt, izvedba, dokumentacija, poročilo, predstavitev, zagovor)</p> <p>Ocene: 1-5 (negativno), 6-10 (pozitivno) (po Statutu UL)</p> | <p>100%</p> | <p>Type (homeworks, examination, oral, coursework, project):</p> <p>project assignment (plan, execution, documentation, report, presentation, defense)</p> <p>Grading: 1-5 (fail), 6-10 (pass) (according to the Statute of UL)</p> |
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**Reference nosilca / Lecturer's references:**

Alen Orbanic:

HUBARD, Isabel, ORBANIĆ, Alen, PELLICER, Daniel, IVIĆ WEISS, Asia. Symmetries of equivelar 4-toroids. *Discrete & computational geometry*, ISSN 0179-5376, 2012, vol. 48, iss. 4, str. 1110-1136. [COBISS.SI-ID 16478297]

ORBANIĆ, Alen, PELLICER, Daniel, IVIĆ WEISS, Asia. Map operations and k-orbit maps. *Journal of combinatorial theory. Series A*, ISSN 0097-3165, 2010, vol. 117, iss. 4, str.411-429. [COBISS.SI-ID 15553625]

HUBARD, Isabel, ORBANIĆ, Alen, IVIĆ WEISS, Asia. Monodromy groups and self-invariance. *Canadian journal of mathematics*, ISSN 0008-414X, 2009, vol. 61, no. 6, str. 1300-1324. [COBISS.SI-ID 15369817]

Primož Potočnik:

POTOČNIK, Primož. Tetravalent arc-transitive locally-Klein graphs with long consistent cycles. *European journal of combinatorics*, ISSN 0195-6698, 2014, vol. 36, str. 270-281. [COBISS.SI-ID 16862041]

POTOČNIK, Primož, SPIGA, Pablo, VERRET, Gabriel. Cubic vertex-transitive graphs on up to 1280 vertices. *Journal of symbolic computation*, ISSN 0747-7171, 2013, vol. 50, str. 465-477. [COBISS.SI-ID 16520537]

POTOČNIK, Primož. Edge-colourings of cubic graphs admitting a solvable vertex-transitive group of automorphisms. *Journal of combinatorial theory. Series B*, ISSN 0095-8956, 2004, vol. 91, no. 2, str. 289-300. [COBISS.SI-ID 13087321]

Riste Škrekovski:

GOVORČIN, Jelena, KNOR, Martin, ŠKREKOVSKI, Riste. Line graph operation and small worlds. *Information processing letters*, ISSN 0020-0190. [Print ed.], 2013, vol. 113, iss. 5-6, str. 196-200.

[COBISS.SI-ID 16561497]

DVOŘÁK, Zdeněk, LIDICKÝ, Bernard, ŠKREKOVSKI, Riste. Randić index and the diameter of a graph. European journal of combinatorics, ISSN 0195-6698, 2011, vol. 32, iss. 3, str. 434-442. [COBISS.SI-ID 17410905]

KAISER, Tomáš, STEHLÍK, Matěj, ŠKREKOVSKI, Riste. On the 2-resonance of fullerenes. SIAM journal on discrete mathematics, ISSN 0895-4801, 2011, vol. 25, no. 4, str. 1737-1745. [COBISS.SI-ID 16244569]