UČNI NAČRT PREDMETA / COURSE SYLLABUS	
Predmet:	Matematika 2
Course title:	Mathematics 2

Študijski program in stopnja **Study programme and level**	**Študijska smer** **Study field**	**Letnik** **Academic year**	**Semester** **Semester**
Računalništvo in spletne tehnologije, visokošolski strokovni študijski program prve stopnje	-	Prvi	Drugi
Computer Science and Web Technologies, first cycle Professional Study Programme	-	First	Second

Vrsta predmeta / Course type	Obvezni / Obligatory
Univerzitetna koda predmeta / University course code:	2-RST-VS-M2-2020-05-14

Predavanja **Lectures**	**Seminar** **Seminar**	**Vaje** **Tutorial**	**Klinične vaje** **work**	**Druge oblike študija**	**Samost. delo** **Individ. work**	**ECTS**
30	-	45	-	-	105	6

Nosilec predmeta / Lecturer:	izr. prof. dr. Borut Lužar

Jeziki / Languages:	**Predavanja / Lectures:**	Slovenski / Slovenian, Angleški / English
	Vaje / Tutorial:	Slovenski / Slovenian, Angleški / English

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	**Prerequisites:**
Pogoj za vključitev v delo je poznavanje osnov srednješolske matematike. Vsak vpisan študent se lahko udeleži pisnega izpita.	The prerequisite is basic knowledge of high-school mathematics. Every enrolled student can attend written exams.

Vsebina:	**Content (Syllabus outline):**
• *Matrike in sistemi linearnih enačb*: definicija, računske operacije nad matrikami, determinanta in rang matrike, inverzna matrika, matrične enačbe, reševanje sistemov linearnih enačb (Gaussova metoda, Cramerjevo pravilo), pomen in uporaba v računalništvu in informatiki. • *Kombinatorika*: permutacije, variacije in kombinacije.	• *Matrices and systems of linear equations:* linear matrix calculus, determinant and rank of a matrix, matrix inverse, matrix equations, methods to solve systems of linear equations (Gauss pivoting method, Cramer rule). Application in computer science. • *Combinatorics*:

- *Uvod v verjetnostni račun:* poskusi, dogodki, operacije nad dogodki, statistična definicija verjetnosti dogodka, pogojna verjetnost, formula o popolni verjetnosti, Bayesova formula, zaporedja neodvisnih poskusov, diskretne slučajne spremenljivke in njihove številske karakteristike (matematično upanje, varianca in standardni odklon), Binomska in Poissonova porazdelitev, zvezne slučajne spremenljivke (enakomerna, normalna, studentova, hi-kvadrat porazdelitev, limitni izreki.
- *Teorija grafov*: definicije osnovnih pojmov, osnove teorije grafov, osnovni pojmi o relacijah in omrežjih, prirejanja, pretoki, nekateri problemi na grafih (problem Hamiltonovega cikla, problem barvanja grafa, problem neodvisnega števila grafa), algoritmi za pregled grafov (pregled v širino in v globino), posebni grafi (ravninski, regularni).
- *Linearno programiranje*: zapis nekaterih standardnih optimizacijskih problemov v obliki linearnega programa, dualni problem, grafična metoda, simpleksna metoda, analiza občutljivosti optimalne rešitve in optimalne baze, uporaba računalnika.

permutations, variations and combinations.

- *Introduction to probability:* experiments, events, operations related to events, definition of event probability (statistical, classical), conditional probability, the perfect probability formula, Bayesian formula, sequence of independent experiments, discrete random variables and their characteristics (mean, variance, standard deviation), Binomial and Poisson distribution, continuous random variables (uniform, normal, student, chi-square distribution), limit theorems.
- *Graph theory*: definitions of basic notions, basics of graph theory, basic notions on relations and networks, assignments, flows, some problems on graphs (Problem of Hamiltonian cycle, Graph coloring problem, Stable set problem), algorithms for graph exploration (depth first search, breath first search), special graphs (planar, regular).
- *Linear programming*: modelling some standard optimization problems with linear programming (LP), dual problem, graphical method, simplex method, sensitivity and postoptimal analysis, solving LP using computer.

Temeljni literatura in viri / Readings:

- Jamnik, R. (1990). *Matematika*. Ljubljana: Društvo matematikov, fizikov in astronomov.
- Usenik, J. (2006). *Matematične metode v logistiki*. Krško: Valvasorjev raziskovalni center.
- Žerovnik, J. (2003). *Osnove teorije grafov in diskretne optimizacije*. Maribor: Univerza v Mariboru.
- Hvalica, D. (2005). *Linearno programiranje in njegova uporaba*. Ljubljana: Univerza v Ljubljani, Ekonomska fakulteta.
- Pustavrh, S., Povh, J. & Medic, V. (2010). *Zbirka rešenih nalog iz Matematike 2*. Ljubljana: Vega.
- Povh, J., Pustavrh, S., Fošner, M., Gorše Pihler, M. & Zalar, B. (2010). *Matematične metode v uporabi*. Ljubljana: Društvo matematikov, fizikov in astronomov Slovenije.

Cilji in kompetence:

Učna enota prispeva k razvoju naslednjih splošnih in predmetno-specifičnih kompetenc:

Splošne kompetence:

- poznavanje osnov računalništva in informacijske tehnologije

Objectives and competences:

The instructional unit contributes to the development of the following general and subject-specific competences:

General competences:

- familiarity with the basics of computer science and information technology

- poznavanje pomena kakovosti in prizadevanje za kakovost strokovnega dela skozi avtonomnost, samoiniciativnost, (samo)kritičnost, (samo)refleksivnost in (samo)evalviranje v strokovnem delu
- sposobnost fleksibilne uporabe znanja v praksi
- sposobnost logičnega sklepanja, ocenjevanja velikostnega reda rezultata, natančnosti izražanja, pisanja in razmišljanja

Predmetno-specifične kompetence:
- poznavanje temeljnih matematičnih metod iz področja linearne algebre, verjetnosti, matematične optimizacije in teorije grafov
- sposobnost pretvorbe matematičnih metod v algoritem in izvajanje tega algoritma v primernem računalniškem okolju

- familiarity with the importance of quality, striving to maintain the quality of professional work through practicing autonomous behavior, showing initiative, as well as through (self-) criticism, (self-)reflection and (self-) evaluation
- ability to use the acquired knowledge in practice in a flexible manner
- ability to make logical conclusions, to estimate the order of magnitude of the results well as the ability to express oneself, write and think in an accurate manner

Subject-specific competences:
- familiarity with the fundamental mathematical methods from linear algebra, probability, mathematical optimization and graph theory
- ability to transform a mathematical method into an algorithm and coding this algorithm within an appropriate software framework

Predvideni študijski rezultati:

Znanje in razumevanje:

Študent/študentka:
- usvoji pojme iz linearne algebre, verjetnosti, teorije grafov in linearne optimizacije
- razvije algoritmične sposobnosti ter sposobnost matematičnega modeliranja
- se usposobi za uporabo matematike kot teoretičnega orodja v računalništvu in družboslovju

Intended learning outcomes:

Knowledge and understanding:

The student:
- learns basics of linear algebra, probability, graph theory and linear optimization
- develops algorithmic and mathematical modelling skills
- is trained for the usage of mathematics as a theoretical tool in computer and social sciences

Metode poučevanja in učenja:	**Learning and teaching methods:**
• *predavanja* z aktivno udeležbo študentov (razlaga, diskusija, vprašanja, primeri, reševanje problemov) • *vaje,* kjer bodo študentje na konkretnih problemih ponovili, utrdili in dodatno osvetlili pojme in metode spoznane na predavanjih • *kolokviji* - z njimi bodo študentje stimulirani, da sproti študirajo snov, ki bo obravnavana na predavanjih in vajah	• *lectures* with active student participation (explanation, discussion, questions, examples, problem solving) • *tutorials* where students will rehearse, revise and lit up notions and methods encountered during lectures • *mid-term examinations,* which will stimulate students to study the matter dealt with at lectures and tutorials simultaneously

Načini ocenjevanja:	Delež (v %) / Weight (in %)	**Assessment:**
Način (pisni izpit, ustno izpraševanje, naloge, projekt): • pisni izpit Pisni izpit je sestavljen iz teoretičnega in praktičnega dela. Študentu, ki doseže pozitivno oceno s kolokvijema, ni potrebno pristopiti k pisnemu izpitu. Kadar študent s pisnim izpitom oziroma s kolokvijema ne zbere dovolj točk (prag je določen na začetku vsakega študijskega leta), mora opraviti še ustni izpit.	100	Type (examination, oral, coursework, project): • written exam Written exam consists of a theoretical part and practical exercises. Students who are successful at mid-term examinations are exempt from written examination. Students who do not achieve enough points on a written exam or mid-term examinations have to pass oral examination.

Reference nosilca / Lecturer's references:

- L. Bezegová, B. Lužar, M. Mockovčiaková, R. Soták, R. Škrekovski, Star edge colorings of some classes of graphs, J. Graph Theory 81 (2016), 73-82.
- P. Gregor, B. Lužar, R. Soták, On incidence coloring conjecture in Cartesian products of graphs, Discrete Appl. Math. 213 (2016), 93-100.
- P. Gregor, B. Lužar, R. Soták, Note on incidence chromatic number of subquartic graphs, J. Combin. Optim. 34 (2017), 174-181.
- M. Janicová, B. Lužar, T. Madaras, R. Soták, From NMNR-coloring of hypergraphs to homogenous coloring of graphs, Ars Math. Contemp. 12 (2017), 351-360.
- M. Bonamy, M. Knor, B. Lužar, A. Pinlou, R. Škrekovski, On the difference between the Szeged and the Wiener index, Appl. Math. Comput. 312 (2017), 202-213.
- B. Lužar, M. Petruševski, R. Škrekovski: On vertex-parity edge-colorings, J. Combin. Optim. 35 (2018), 373-388.
- V. Andova, B. Lidický, B. Lužar, R. Škrekovski: On facial unique-maximum (edge-)coloring, Discrete Appl. Math. 237 (2018), 26-32.
- B. Lužar, P. Ochem, A. Pinlou: On repetition thresholds of caterpillars and trees of bounded degree, Electron J. Combin. 25 (2018), #P1.61.
- B. Lužar, J. Przybyło, R. Soták: New bounds for locally irregular chromatic index of bipartite and subcubic graphs, J. Combin. Optim. 36 (2018), 1425-1438.
- B. Lužar, M. Mockovčiaková, R. Soták: Note on list star edge-coloring of subcubic graphs, J. Graph Theory 90 (2019), 304-310.