

UČNI NAČRT PREDMETA / COURSE SYLLABUS (leto / year 2016/17)						
Predmet:		Diskretna matematika 2				
Course title:		Discrete mathematics 2				
Študijski program in stopnja Study programme and level		Študijska smer Study field		Letnik Academic year		Semester Semester
Univerzitetni študijski program Matematika		ni smeri		3		drugi
First cycle academic study programme Mathematics		none		3		second
Vrsta predmeta / Course type				izbirni / elective		
Univerzitetna koda predmeta / University course code:				M0236		
Predavanja Lectures	Seminar Seminar	Vaje Tutorial	Klinične vaje work	Druge oblike študija	Samost. delo Individ. work	ECTS
30		30			90	5
Nosilec predmeta / Lecturer:		prof. dr. Sandi Klavžar, prof. dr. Matjaž Konvalinka, prof. dr. Primož Potočnik, prof. dr. Riste Škrekovski				
Jeziki / Languages:		Predavanja / Lectures:		slovenski / Slovene		
		Vaje / Tutorial:		slovenski / Slovene		
Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:				Prerequisites:		
Vpis v letnik študija.				Enrolment in the programme.		
Vsebina:				Content (Syllabus outline):		

<p>Dimenzija delno urejenih množic. Dilworthov, Hallov in Spernerjev izrek. Teorija načrtov: načrti, t-načrti, ciklične konstrukcije načrtov, Fisherjeva neenakost. Polyeva teorija: permutacijske grupe, Burnsidova lema, simetrije in štetje. Simetrijske lastnosti grafov: grupa avtomorfizmov, vozliščno-tranzitivni, povezavno-tranzitivni, ločno-tranzitivni grafi, Cayleyjevi grafi, Sabidussijev izrek. Kartezični produkt grafov: vlakna, projekcije, povezanost, hiperkocke, Hammingovi grafi, hanojski grafi. Ramseyjeva teorija.</p> <p>Predavatelj izbere še eno temo iz teorije grafov ali kombinatorike.</p>	<p>Dimension of a partially ordered set. Dilworth's, Hall's, Sperner's theorem. Design theory: designs, t-designs, cyclic construction of designs, Fisher's inequality. Polya theory: permutation groups, Burnside lemma, symmetries and counting. Symmetry properties of graphs: automorphism group, vertex-transitive, edge-transitive, arc-transitive graphs, Cayley graphs, Sabidussi theorem. Cartesian product of graphs: fibers, projections, connectivity, hypercubes, Hamming graphs, Hanoi graphs. Ramsey theory. The lecturer selects one topic from graph theory or combinatorics.</p>
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Temeljni literatura in viri / Readings:

M. Aigner, G. M. Ziegler: Proofs from THE BOOK, 3. izdaja, Springer, Berlin, 2004.
C. Godsil, G. Royle: Algebraic Graph Theory, Springer, New York, 2001.

J. H. van Lint, R. M. Wilson: A Course in Combinatorics, 2. izdaja, Cambridge Univ. Press, Cambridge, 2001.

R. J. Wilson, J. J. Watkins: Uvod v teorijo grafov, DMFA-založništvo, Ljubljana, 1997.

Cilji in kompetence:

Študent pregledno spozna področja diskretne matematike: diskretno geometrijo, kombinatoriko in teorijo grafov. Pri študiju problemov so poudarjene povezave z drugimi področji matematike.

Objectives and competences:

A student gets an overview of the following discrete mathematics fields: discrete geometry, combinatorics and graph theory. During the study the connection with other fields of mathematics are emphasized.

Predvideni študijski rezultati:

Znanje in razumevanje: Pregledno poznavanje širokega spektra diskretnih matematičnih struktur in poglobljeno znanje o nekaterih izmed njih.
Uporaba: Matematične strukture, ki jih obravnava diskretna matematika, je moč uporabiti pri reševanju praktičnih problemov na

Intended learning outcomes:

Knowledge and understanding: General understanding of broad spectrum of discrete mathematical structures and in-depth knowledge about some of them.
Application: Mathematical structures from

primer v optimizaciji ali pri programiranju, pomembno vlogo pa imajo tudi v drugih vejah matematike.

Refleksija: Povezovanje teoretičnih spoznanj s praktičnimi uporabami na primer v optimizaciji in pri programiranju ter z uporabami na drugih področjih matematike. Sposobnost prepoznavanja problemov, ki jih lahko uspešno opišemo z diskretnimi matematičnimi modeli.

Prenosljive spretnosti – niso vezane le na en predmet: Slušatelj prek izbranih primerov spozna različne metode dokazovanja matematičnih rezultatov in uvidi povezave med različnimi vejami matematike. Sposoben je samostojno prebirati strokovno literaturo iz diskretne matematike in sorodnih področij.

discrete mathematics have applications in optimization and computer programming, and play an important role in some other fields of mathematics.

Reflection: Connection of theoretical knowledge with practical applications, for instance in optimization, computer programming and other fields of mathematics. Capability of recognizing problems that could be successfully described by discrete mathematical models.

Transferable skills: Through the presentation of various selected examples a student gets familiar with various methods for proving mathematical results and gets insight into connections between different fields of mathematics. It becomes capable of reading and understanding of expert literature on discrete mathematics and other closely related fields.

Metode poučevanja in učenja:

Predavanja, vaje, domače naloge, konzultacije

Learning and teaching methods:

Lectures, exercises, homework, consultations

Načini ocenjevanja:

Delež (v %) /
Weight (in %)

Assessment:

<p>Način (pisni izpit, ustno izpraševanje, naloge, projekt):</p> <p>2 kolokvija namesto izpita iz vaj, izpit iz vaj,</p> <p>izpit iz teorije</p> <p>ocene: 1-5 (negativno), 6-10 (pozitivno) (po Statutu UL)</p>	<p>50%</p> <p>50%</p>	<p>Type (examination, oral, coursework, project):</p> <p>2 midterm exams instead of written exam, written exam</p> <p>oral exam</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:

Sandi Klavžar:

ILIĆ, Aleksandar, KLAVŽAR, Sandi, RHO, Yoomi. Generalized Lucas cubes. *Applicable analysis and discrete mathematics*, ISSN 1452-8630, 2012, vol. 6, no. 1, str. 82-94. [COBISS.SI-ID 16242265]

BREŠAR, Boštjan, KLAVŽAR, Sandi, RALL, Douglas. Domination game and an imagination strategy. *SIAM journal on discrete mathematics*, ISSN 0895-4801, 2010, vol. 24, no. 3, str. 979-991. [COBISS.SI-ID 15648089]

HAMMACK, Richard H., IMRICH, Wilfried, KLAVŽAR, Sandi. *Handbook of product graphs, (Discrete mathematics and its applications)*. Boca Raton, London, New York: CRC Press, cop. 2011. XVIII, 518 str., ilustr. ISBN 978-1-4398-1304-1. [COBISS.SI-ID 15916121]

IMRICH, Wilfried, KLAVŽAR, Sandi, RALL, Douglas F. *Topics in graph theory : graphs and their Cartesian product*. Wellesley (Mass.): A. K. Peters, 2008. XIV, 205 str., ilustr. ISBN 978-1-56881-429-2. [COBISS.SI-ID 14965081]

Matjaž Konvalinka:

KONVALINKA, Matjaž. Skew quantum Murnaghan-Nakayama rule. *Journal of algebraic combinatorics*, ISSN 0925-9899, 2012, vol. 35, no. 4, str. 519-545. [COBISS.SI-ID 16250713]

KONVALINKA, Matjaž, PAK, Igor. Geometry and complexity of O'Hara's algorithm. *Advances in applied mathematics*, ISSN 0196-8858, 2009, vol. 42, iss. 2, str. 157-175. [COBISS.SI-ID 15545945]

KONVALINKA, Matjaž. On quantum immanants and the cycle basis of the quantum permutation space. *Annals of combinatorics*, ISSN 0218-0006, 2012, vol. 16, no. 2, str. 289-304. [COBISS.SI-ID 16310873]

Primož Potočnik:

KNOR, Martin, POTOČNIK, Primož, ŠKREKOVSKI, Riste. The Wiener index in iterated line graphs. *Discrete applied mathematics*, ISSN 0166-218X. [Print ed.], 2012, vol. 160, iss. 15, str. 2234-2345. [COBISS.SI-ID 16409945]

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, SPIGA, Pablo, VERRET, Gabriel. On the nullspace of arc-transitive graphs over finite fields. *Journal of algebraic combinatorics*, ISSN 0925-9899, 2012, vol. 36, no. 3, str. 389-401.

[COBISS.SI-ID 16162137]

JUVAN, Martin, POTOČNIK, Primož. Teorija grafov in kombinatorika : primeri in rešene naloge, (Izbrana poglavja iz matematike in računalništva, 39). Ljubljana: Društvo matematikov, fizikov in astronomov Slovenije, 2000. VI, 173 str., graf. prikazi. ISBN 961-212-105-2. [COBISS.SI-ID 106210560]

Riste Škrekovski:

FINK, Jiří, LUŽAR, Borut, ŠKREKOVSKI, Riste. Some remarks on inverse Wiener index problem. Discrete applied mathematics, ISSN 0166-218X. [Print ed.], 2012, vol. 160, iss. 12, str. 1851-1858. [COBISS.SI-ID 16295257]

GREGOR, Petr, ŠKREKOVSKI, Riste. Parity vertex colorings of binomial trees. Discussiones mathematicae, Graph theory, ISSN 1234-3099, 2012, vol. 32, no. 1, str. 177-180. [COBISS.SI-ID 16514649]

MADARAS, Tomáš, ŠKREKOVSKI, Riste. Lightness, heaviness and gravity. V: HORNÁK, Mirko (ur.), JENDROL, Stanislav (ur.). Cycles and colourings 2003 : Stará Lesná, Slovakia, August 31-September 5, 2003, (Discrete mathematics, ISSN 0012-365X, Vol. 307, Issues 7-8). Amsterdam: North-Holland, 2007, vol. 307, iss. 7-8, str. 939-951. [COBISS.SI-ID 14249817]