Univerza v Mariboru

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Fakulteta za naravoslovje in matematiko

UČNI NAČRT PREDMETA / COURSE SYLLABUS	
Predmet:	Diskretna matematika II
Course title:	Discrete Mathematics II

Študijski program in stopnja **Study programme and level**	**Študijska smer** **Study field**	**Letnik** **Academic year**	**Semester** **Semester**
Matematika, 2. stopnja		**1.**	**2.**
Mathematics, 2nd degree		**1.**	**2.**

Vrsta predmeta / Course type

Univerzitetna koda predmeta / University course code:

Predavanja **Lectures**	**Seminar** **Seminar**	**Sem. vaje** **Tutorial**	**Lab. vaje** **Laboratory work**	**Teren. vaje** **Field work**	**Samost. delo** **Individ. work**	**ECTS**
60	**15**	**30**			**195**	**10**

Nosilec predmeta / Lecturer: Boštjan Brešar

Jeziki / **Languages:**	**Predavanja /** **Lectures:**	SLOVENSKO/SLOVENE
	Vaje / Tutorial:	SLOVENSKO/SLOVENE

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	**Prerequisits:**
Poznavanje teorije grafov.	Kknowledge of graph theory.

Vsebina:	**Content (Syllabus outline):**
Algebraična kombinatorika: rodovne funkcije; uporabe rodovnih funkcij (Catalanova števila, število particij naravnega števila); ciklični indeks; teorija Polya; linearna algebra v diskretni matematiki (načrti in Fisherjeva neenakost; pokritja s polnimi dvodelni grafi; prostori ciklov, kroženja in prerezi; uporabe lastnih vrednosti). Kode za popravljanje napak: osnovni pojmi;	Algebraic combinatorics; generating functions; applications of generating functions (Catalan numbers, partitions of a positive integer); cyclic index; Polya theory; linear algebra in discrete mathematics (designs and Fisher's inequality; coverings with complete bipartite graphs; cycle space, circulations and cuts; applications of eigenvalues). Error-correcting codes: basic concepts; linear

linearne kode; konstrukcije linearnih kod; popravljanje napak; ciklične kode; klasifikacija cikličnih kod.	codes; constructions of linear codes; correcting errors; cyclic codes; classification of cyclic codes.
Teorija grafov: dodatna poglavja iz barvanja grafov (dokaz Brooksovega izreka, kritični grafi, krožna barvanja); k-povezani grafi (dokaz Mengerjevega izreka); omrežja in pretoki v omrežjih; dokaz izreka Kuratowskega; neodvisne in dominirajoče množice.	Graph theory: additional graph coloring topics (proof of Brooks theorem, critical graphs, circular colorings); k-connected graphs (proof of Menger's theorem); networks and flows in networks; proof of Kuratowski theorem; independent and dominating sets.
Kombinatorika delno urejenih množic: linearne razširitve; dimenzija delne urejenosti; Dilworthov izrek; Spernerjev izrek. Schnyderjev izrek.	Combinatorics of partially ordered sets: linear extensions; dimension of a partial order; Dilworth's theorem; Sperner's theorem. Schnyder's theorem.
Ramseyeva teorija: število monokromatičnih trikotnikov; Ramseyev izrek; Ramseyeva števila; uporabe izreka, grafovska Ramseyeva števila.	Ramsey theory: number of monochromatic triangles; Ramsey theorem; Ramsey numbers; applications of the theorem, graph Ramsey numbers.

Temeljni literatura in viri / Readings:

N. L. Biggs, Discrete Mathematics. Second Edition. *The Clarendon Press, Oxford University Press, New York,* 1989.

R. Diestel, Graph Theory, Springer-Verlag, Berlin Heidelberg, 2005.

M. Juvan, P. Potočnik, Teorija grafov in kombinatorika, DMFA, Ljubljana, 2000.

J. H. val Lint, R. M. Vilson, A Course in Combinatorics, Cambridge University Press, Cambridge, 2001.

J. Matoušek, J. Nešetril, Invitation to Discrete Mathematics, Oxford University Press, Oxford, 1998.

D. B. West, Introduction to Graph Theory, Second Edition. *Prentice Hall, Inc., Upper Saddle River, NJ,* 2001.

Cilji in kompetence:	**Objectives and competences:**
Poglobiti zahtevnejša področja sodobne diskretne matematike in njene uporabe: algebraično kombinatoriko, kode za popravljanje napak, dodatna poglavja iz teorije grafov, kombinatoriko delno urejenih množic, metode linearne algebre v diskretni matematiki in Ramseyevo teorijo.	To deepen the knowledge of more demanding areas of temporary discrete mathematics and its applications: algebraic combinatorics, error-correcting codes, additional topics from graph theory, combinatorics of partially ordered sets, tools from linear algebra in discrete mathematics, and Ramsey theory.
Predvideni študijski rezultati:	**Intended learning outcomes:**

Znanje in razumevanje: • Razumevanje zahtevnejših principov diskretne matematike. • Poglobiti netrivialne uporabe diskretne matematike. • Povezati diskretno matematiko z drugimi matematičnimi področji. Prenesljive/ključne spretnosti in drugi atributi: • Prenos zahtevnejšega znanja metod diskretne matematike na druga področja (računalništvo, kemija, biologija, optimizacija, ...)	Knowledge and Understanding: • Be able to understand more demanding principals of discrete mathematics. • To deepen the knowledge of nontrivial applications of discrete mathematics. • To connect discrete mathematics with other fields of mathematics. Transferable/Key Skills and other attributes: • Knowledge transfer of more demanding methods of discrete mathematics into other fields (computer science, chemistry, biology, optimization, …)
Metode poučevanja in učenja:	**Learning and teaching methods:**
• Predavanja • Seminarska vaje	• Lectures • Tutorial
Načini ocenjevanja:	**Assessment:**

Način (pisni izpit, ustno izpraševanje, naloge, projekt)	Delež (v %) / Weight (in %)	Type (examination, oral, coursework, project):
Seminarska naloga Ustni izpit Vsaka izmed naštetih obveznosti mora biti opravljena s pozitivno oceno. Pozitivna ocena pri seminarski nalogi je pogoj za pristop k izpitu.	25% 75%	Seminar exercise Oral exam Each of the mentioned commitments must be assessed with a passing grade. Passing grade of the seminar is required for taking the exam.
Reference nosilca / Lecturer's references:		

1. BOKAL, Drago, BREŠAR, Boštjan, JEREBIC, Janja. A generalization of Hungarian method and Hall's theorem with applications in wireless sensor networks. *Discrete appl. math.*. [Print ed.], 2012, vol. 160, iss. 4-5, str. 460-470. http://dx.doi.org/10.1016/j.dam.2011.11.007. [COBISS.SI-ID 16191577]

2. BREŠAR, Boštjan, CHALOPIN, Jérémie, CHEPOI, Victor, GOLOGRANC, Tanja, OSAJDA, Damian. Bucolic complexes. *Preprint series*, 2012, vol. 50, št. 1171, str. 1-24. http://www.imfm.si/preprinti/PDF/01171.pdf. [COBISS.SI-ID 16207961]

3. BALAKRISHNAN, Kannan, BREŠAR, Boštjan, CHANGAT, Manoj, KLAVŽAR, Sandi, PETERIN, Iztok, SUBHAMATHI, Ajitha R. Almost self-centered median and chordal graphs. *Taiwan. j. math.*, 2012, vol. 16, no. 5, str. 1911-1922. http://journal.taiwanmathsoc.org.tw/index.php/TJM/article/view/2393/1403. [COBISS.SI-ID 16376409]

4. BREŠAR, Boštjan, KARDOŠ, František, KATRENIČ, Ján, SEMANIŠIN, Gabriel. Minimum k-path vertex cover. *Discrete appl. math.*. [Print ed.], 2011, vol. 159, iss. 12, str. 1189-1195. http://dx.doi.org/10.1016/j.dam.2011.04.008. [COBISS.SI-ID 15929689]

5. BREŠAR, Boštjan, KRANER ŠUMENJAK, Tadeja, TEPEH, Aleksandra. The geodetic number of the lexicographic product of graphs. *Discrete math.*. [Print ed.], 2011, vol. 311, iss. 16, str. 1693-1698. http://dx.doi.org/10.1016/j.disc.2011.04.004. [COBISS.SI-ID 15929945]