UČNI NAČRT PREDMETA / COURSE SYLLABUS

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
Matematika, 2. stopnja		1.	2.
Mathematics, 2nd degree		1.	2.

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
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:

Poznavanje teorije grafov.

Prerequisits:

Knowledge of graph theory.

Vsebina:

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).

Content (Syllabus outline):

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).

Kode za popravljanje napak: osnovni pojmi; linearne kode; konstrukcije linearnih kod; popravljanje napak; ciklične kode; klasifikacija cikličnih kod.

Error-correcting codes: basic concepts; linear 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.

M. Aigner, Discrete Mathematics, *American Mathematical Society, Providence RI*, 2007.

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

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

J. H. van Lint, R. M. Wilson, A Course in Combinatorics, *Cambridge University Press, Cambridge*, 2001.

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

Cilji in kompetence:

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.

Objectives and competences:

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. Prenosljive/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:

Metode poučevanja in učenja:	Learning and teaching methods:
• Predavanja • Seminarske vaje	• Lectures • Tutorial

Načini ocenjevanja:

Assessment:

Način (pisni izpit, ustno izpraševanje, naloge, projekt)	Delež (v %) / Weight (in %)	Type (examination, oral, coursework, project):
- Seminarska naloga	25%	- Seminar exercise
- Pisni testi	25%	- Written tests
- Ustni izpit	50%	- Oral exam
Vsaka izmed naštetih obveznosti mora biti opravljena s pozitivno oceno. Pozitivna ocena pri seminarski nalogi in pisnih testih sta pogoja za pristop k ustnemu izpitu.		Each of the mentioned commitments must be assessed with a passing grade. Passing grade of the seminar and of written tests are required for taking the oral exam.

Reference nosilca / Lecturer's references:

1. BREŠAR, Boštjan, KRANER ŠUMENJAK, Tadeja. The hypergraph of [Theta]-classes and

[Theta]-graphs of partial cubes. *Ars combinatoria*, ISSN 0381-7032, 2014, vol. 113, str. 225-239. [COBISS.SI-ID 16824153]

2. BREŠAR, Boštjan, CHALOPIN, Jérémie, CHEPOI, Victor, GOLOGRANC, Tanja, OSAJDA, Damian. Bucolic complexes. *Advances in mathematics*, ISSN 0001-8708, 2013, vol. 243, str. 127-167. http://dx.doi.org/10.1016/j.aim.2013.04.009. [COBISS.SI-ID 16633177]

3. BREŠAR, Boštjan, KLAVŽAR, Sandi, KOŠMRLJ, Gašper, RALL, Douglas F. Domination game: extremal families of graphs for 3/5-conjectures. *Discrete Applied Mathematics*, ISSN 0166-218X. [Print ed.], 2013, vol. 161, iss. 10-11, str. 1308-1316. http://dx.doi.org/10.1016/j.dam.2013.01.025. [COBISS.SI-ID 16614745]

4. BREŠAR, Boštjan, JAKOVAC, Marko, KATRENIČ, Ján, SEMANIŠIN, Gabriel, TARANENKO, Andrej. On the vertex k-path cover. *Discrete Applied Mathematics*, ISSN 0166-218X. [Print ed.], 2013, vol. 161, iss. 13/14, str. 1943-1949. http://dx.doi.org/10.1016/j.dam.2013.02.024. [COBISS.SI-ID 19859464]

5. BREŠAR, Boštjan, KLAVŽAR, Sandi, RALL, Douglas F. Domination game played on trees and spanning subgraphs. *Discrete Mathematics*, ISSN 0012-365X. [Print ed.], 2013, vol. 313, iss. 8, str. 915-923. http://dx.doi.org/10.1016/j.disc.2013.01.014. [COBISS.SI-ID 16564313]