Univerza v Mariboru

Fakulteta za naravoslovje in matematiko

OPIS PREDMETA / SUBJECT SPECIFICATION	
Predmet:	**Diskretna matematika I**
Subject Title:	Discrete Mathematics I

Študijski program Study programme	Študijska smer Study field	Letnik Year	Semester Semester
Matematika / Mathematics		2.	3.

Univerzitetna koda predmeta / University subject code:

Predavanja Lectures	Seminar Seminar	Sem. vaje Tutorial	Lab. vaje Lab. work	Teren. vaje Field work	Samost. delo Individ. work	ECTS
45		45			120	**7**

Nosilec predmeta / Lecturer: Boštjan Brešar

Jeziki / Languages:	
Predavanja / Lecture:	SLOVENSKO/SLOVENE
Vaje / Tutorial:	SLOVENSKO/SLOVENE

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:

Jih ni.

Prerequisites:

There are none.

Vsebina:

Kombinatorično preštevanje: osnovna pravila preštevanja; urejene in neurejene izbire; binomska in multinomska števila; pravilo vključitev in izključitev; porazdelitve; linearna rekurzija; Stilingova števila prve in druge vrste; trdnjavski polinomi.

Teorija grafov: osnovni pojmi; sprehodi, poti in cikli; usmerjeni grafi; drevesa in razdalje; vpeta drevesa; Eulerjevi in Hamiltonovi grafi; ravninski grafi; barvanje grafov; povezanost; 2-povezani grafi; dvodelni grafi in prirejanja.

Teorija načrtov: načrti in *t*-načrti; ciklične konstrukcije načrtov; končne projektivne ravnine; Latinski kvadrati; ortogonalni Latinski kvadrati.

Contents (Syllabus outline):

Combinatorial counting: basic counting rules; ordered and unordered selections; binomial and multinomial numbers; inclusion-exclusion principle; distributions; linear recursion; Stirling numbers of the first and the second kind; rook polynomials.

Graph theory: basic concepts; walk, paths and cycles; digraphs; trees and distances; spanning trees; Euler and Hamilton graphs; planar graphs; graph colorings; connectedness; 2-connected graphs; bipartite graphs and matchings.

Design theory: designs and *t*-designs; cyclic constructions for designs; finite projective planes; Latin squares; orthogonal Latin squares.

Temeljni študijski viri / Textbooks:

N. L. Biggs, Discrete Mathematics. Second Edition. The Clarendon Press, Oxford University Press, New York, 1989. M. Juvan, P. Potočnik, Teorija grafov in kombinatorika, DMFA, Ljubljana, 2000. S. Klavžar, P. Žigert, Izbrana poglavja uporabne matematike, Pedagoška fakulteta, Maribor, 2002. 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. R. J. Wilson, J. J. Watkins, Uvod v teorijo grafov, DMFA, Ljubljana, 1997.

Cilji:	**Objectives:**
Spoznati temeljne koncepte in rezultate s področja diskretne matematike - kombinatorike, teorije grafov ter teorije načrtov.	Know fundamental concepts and results from discrete mathematics – combinatorics, graph theory and design theory.

Predvideni študijski rezultati:	**Intended learning outcomes:**
Znanje in razumevanje: • Razumevanje zahtevnejših principov diskretne matematike. • Spoznati različne uporabe diskretne matematike. • Prepoznati praktične probleme in njihovo modeliranje z orodji diskretne matematike. Prenesljive/ključne spretnosti in drugi atributi: • Prenos 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 know a variety of applications of discrete mathematics. • To recognize practical problems and their modeling with discrete mathematics tools. Transferable/Key Skills and other attributes: • Knowledge transfer of methods of discrete mathematics into other fields (computer science, chemistry, biology, optimization, …)

Metode poučevanja in učenja:	**Learning and teaching methods:**
• Predavanja • Teoretične vaje	• Lectures • Theoretical exercises

Načini ocenjevanja:	Delež (v %) / Weight (in %)	**Assessment:**
Način (pisni izpit, ustno izpraševanje, naloge, projekt) Pisni test – praktični del Izpit (ustni) – teoretični del Vsaka izmed naštetih obveznosti mora biti opravljena s pozitivno oceno. Pozitivna ocena pri pisnem testu je pogoj za pristop k izpitu. Pisni izpit se lahko nadomesti z vsaj dvema delnima testoma (sprotne obveznosti).	50% 50%	Type (examination, oral, coursework, project): Written test – practical part Exam (oral) – theoretical part Each of the mentioned commitments must be assessed with a passing grade. Passing grade of the written test is required for taking the exam. Written exam can be replaced with at least two mid-term tests.

Reference nosilca / Lecturer's references:

1. MANUEL, Paul, BREŠAR, Boštjan, KLAVŽAR, Sandi. The geodesic transversal problem on some networks. *Computational & Applied Mathematics*. Feb. 2023, vol. 42, iss. 1, art. 59 (12 str.). ISSN 2238-3603. https://link.springer.com/article/10.1007/s40314-023-02199-9, DOI: 10.1007/s40314-023-02199-9. [COBISS.SI-ID 140079107]

2. BREŠAR, Boštjan, SAMADI, Babak, YERO, Ismael G. Injective coloring of graphs revisited. *Discrete mathematics*. [Print ed.]. May 2023, vol. 346, iss. 5, art. 113348 (12 str.). ISSN 0012-365X. https://www.sciencedirect.com/science/article/pii/S0012365X23000341, DOI: 10.1016/j.disc.2023.113348. [COBISS.SI-ID 141111555]3. ANDERSON, Sarah, BREŠAR, Boštjan, KLAVŽAR, Sandi, KUENZEL, Kirsti, RALL, Douglas F. Orientable domination in product-like graphs. *Discrete applied mathematics*. [Print ed.]. Feb. 2023, vol. 326, str. 62-69. ISSN 0166-218X. https://www.sciencedirect.com/science/article/pii/S0166218X22004267, DOI: 10.1016/j.dam.2022.11.003. [COBISS.SI-ID 135012355]

4. BREŠAR, Boštjan, DRAVEC, Tanja, KLESZCZ, Elżbieta. Uniquely colorable graphs up to automorphisms. *Applied mathematics and computation*. [Print ed.]. Aug. 2023, vol. 450, art. 128007 (10 str.). ISSN 0096-3003. https://www.sciencedirect.com/science/article/pii/S0096300323001765, DOI: 10.1016/j.amc.2023.128007. [COBISS.SI-ID 147344899]

5. BREŠAR, Boštjan, MESARIČ ŠTESL, Daša. The independence coloring game on graphs. *Quaestiones mathematicae*. [Print ed.]. 2022, vol. 45, iss. 9, str. 1413-1434, ilustr. ISSN 1607-3606. https://www.tandfonline.com/doi/abs/10.2989/16073606.2021.1947919, DOI: 10.2989/16073606.2021.1947919. [COBISS.SI-ID 70914307]