



Univerza v Mariboru

Fakulteta za naravoslovje
in matematiko

UČNI NAČRT PREDMETA / COURSE SYLLABUS

Predmet: Diskretna matematika
Course title: Discrete Mathematics

Študijski program in stopnja Study programme and level	Študijska smer Study field	Letnik Academic year	Semester Semester
Matematika, 3. stopnja		1.	2.
Mathematics, 3 rd cycle		1 st	2 nd

Vrsta predmeta / Course type

obvezni ali izbirni/compulsory or
elective

Univerzitetna koda predmeta / University course code:

Predavanja Lectures	Seminar Seminar	Vaje Tutorial	Klinične vaje work	Druge oblike študija	Samost. delo Individ. work	ECTS
45					225	9

Nosilec predmeta / Lecturer:

Boštjan Brešar

**Jeziki /
Languages:**

**Predavanja /
Lectures:** Slovenski jezik; Slovene
Vaje / Tutorial:

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

Poznanje temeljnih konceptov diskretne matematike: klasične in algebraične kombinatorike, teorije grafov, teorije načrtov. Poznavanje osnov linearne algebre, teorije grup, kombinatorike delno urejenih množic.

Prerequisites:

Basic knowledge of fundamental concepts of discrete mathematics: classical and algebraic combinatorics, graph theory, design theory. Knowledge of basic linear algebra, group theory, combinatorics of partially ordered sets.

Vsebina:

Teorija grafov: hamiltonskost, ravninskost, povezanost, podgrafi, neodvisnost, barvanja, krožna barvanja, dominacija, Vizingova domneva.

Metrična teorija grafov: konveksnost, produkti in metrične škatle, metrično definirani razredi (delne kocke, ...), kanonična metrična reprezentacija. Algebrski vidiki diskretne matematike: faktorizacije in lastnost krajšanja, razlikovalno število, avtomorfizmi in homomorfizmi.

Uporabe diskretne matematike: matematična kemija, biologija, računalništvo.

Nekatere izmed teh tem so obdelane podrobneje, druge pa le na osnovni ravni. Pri izboru se upoštevajo interesi in raziskovalne usmeritve študentov.

Content (Syllabus outline):

Graph theory: hamiltonicity, planarity, connectivity, subgraphs, independence, colorings, circular colorings, domination, Vizing's conjecture.

Metric graph theory: convexity, products and metric boxes, metrically defined classes (partial cubes, ...), canonical metric representation.

Algebraic aspects of discrete mathematics: factorization and cancellation property, distinguishing number, automorphisms and homomorphisms.

Applications of discrete mathematics: mathematical chemistry, biology, computer science.

Some of these topics are treated in greater details and the others just at a basic level. The selection depends on students' interests and their research orientation.

Temeljni literatura in viri / Readings:

- M. Aigner, Discrete Mathematics, American Mathematical Society, Providence, 2007.
- R. Diestel, Graph Theory, Third Edition, Springer, Berlin, 2005.
- P. Hell, J. Nešetřil, Graphs and Homomorphisms, Oxford University Press, Oxford, 2004.
- W. Imrich, S. Klavžar, Product Graphs : Structure and Recognition, Wiley-Interscience, New York, 2000.
- J. H. van Lint, R. M. Wilson, A Course in Combinatorics, Cambridge University Press, Cambridge, 2001.
- J. Matoušek, J. Nešetřil, Invitation to Discrete Mathematics, Oxford University Press, Oxford, 1998.
- D. B. West, Introduction to Graph Theory, Second Edition, Prentice Hall, Upper Saddle River, 2001.

Cilji in kompetence:

- Doseči poglobljeno razumevanje teoretskih in metodoloških konceptov s področja diskretne matematike
- Razviti sposobnost samostojnega razvijanja novega znanja s področja diskretne matematike
- Razviti sposobnost za samostojno reševanje najzahtevnejših problemov iz diskretne matematike
- Razviti sposobnost izboljševanja znanih in odkrivanja novih rezultatov s področja diskretne matematike
- Zmožnost razvijanja kritične refleksije na področju diskretne matematike
- Razviti zmožnost vodenja najzahtevnejših znanstvenoraziskovalnih projektov s širšega področja diskretne matematike.

Objectives and competences:

- To achieve a deeper understanding of theoretical and methodological concepts of discrete mathematics
- To develop the ability to independently develop new knowledge in the field of discrete mathematics
- To develop the ability for solving the most challenging problems in discrete mathematics
- To develop the ability of improving known results as well as obtaining new results in discrete mathematics
- Ability to develop critical reflection in discrete mathematics
- To develop the ability to lead the most challenging scientific research projects in the wider field of discrete mathematics

Predvideni študijski rezultati:

Znanje in razumevanje:

- poglobljeno razumevanje izbranih področij diskretne matematike;
- poglobljena zmožnost uporabe diskretne matematike na drugih področjih.

Prenesljive/ključne spretnosti in drugi atributi:

- podlaga za raziskovalno delo na področju diskretne matematike;
- pridobljeno znanje za uporabo diskretne matematike na drugih področjih.

Intended learning outcomes:

Knowledge and understanding:

- Deeper understanding of selected areas of discrete mathematics;
- Deeper ability to use discrete mathematics in other areas.

Transferable/Key Skills and other attributes:

- a basis for research in discrete mathematics;
- knowledge needed for applying discrete mathematics to other areas.

Metode poučevanja in učenja:

- predavanja;
- priprava seminarja;
- konzultacije;
- samostojni študij.

Learning and teaching methods:

- lectures;
- seminar work;
- consultations;
- self-study.

Delež (v %) /

Načini ocenjevanja:

Weight (in %)

Assessment:

Način (pisni izpit, ustno izpraševanje, naloge, projekt):

- seminarsko predavanje;
- pisni izdelek;
- ustni izpit.

20 %
30 %
50 %

Type (examination, oral, coursework, project):

- seminar talk;
- written work;
- oral examination.

Reference nosilca / Lecturer's references:

1. BREŠAR, Boštjan, VALENCIA-PABON, Mario. Independence number of products of Kneser graphs. *Discrete mathematics*. [Print ed.]. April 2019, vol. 342, iss. 4, str. 1017-1027. ISSN 0012-365X. <https://doi.org/10.1016/j.disc.2018.12.017>, DOI: [10.1016/j.disc.2018.12.017](https://doi.org/10.1016/j.disc.2018.12.017). [COBISS.SI-ID [18538073](https://doi.org/10.1016/j.disc.2018.12.017)], [JCR]

kategorija: 1A3

2. BREŠAR, Boštjan, FERME, Jasmina. Packing coloring of Sierpiński-type graphs. *Aequationes mathematicae*. Dec. 2018, vol. 92, iss. 6, str. 1091-1118. ISSN 0001-9054.

<https://doi.org/10.1007/s00010-018-0561-8>, DOI: [10.1007/s00010-018-0561-8](https://doi.org/10.1007/s00010-018-0561-8). [COBISS.SI-ID [18480985](https://doi.org/10.1007/s00010-018-0561-8)], [JCR]

kategorija: 1A2

3. BREŠAR, Boštjan, MOVARRAEI, Nazanin. On the number of maximal independent sets in minimum colorings of split graphs. *Discrete applied mathematics*. [Print ed.]. Oct. 2018, vol. 247, str. 352-356. ISSN 0166-218X. <https://doi.org/10.1016/j.dam.2018.03.083>, DOI: [10.1016/j.dam.2018.03.083](https://doi.org/10.1016/j.dam.2018.03.083). [COBISS.SI-ID [18422873](https://doi.org/10.1016/j.dam.2018.03.083)], [JCR]

kategorija: 1A3

4. BREŠAR, Boštjan, JAKOVAC, Marko, ŠTESL, Daša. Indicated coloring game on Cartesian products of graphs. *Discrete applied mathematics*. [Print ed.]. Jan. 2021, vol. 289, str. 320-326. DOI: [10.1016/j.dam.2020.11.007](https://doi.org/10.1016/j.dam.2020.11.007). [COBISS.SI-ID [41803267](#)], [JCR]

kategorija: 1A3

5. BREŠAR, Boštjan, ŠTESL, Daša. The independence coloring game on graphs. *Quaestiones mathematicae*. [Print ed.]. 2021, vol. , no. , str. 1-22. DOI: [10.2989/16073606.2021.1947919](https://doi.org/10.2989/16073606.2021.1947919). [COBISS.SI-ID [70914307](#)], [JCR]

kategorija: 1A1