

| UČNI NAČRT PREDMETA / COURSE SYLLABUS (leto / year 2016/17) | | | | | | |
|--|---------------------------|---|------------------------------|------------------------------------|--------------------------------------|-------------|
| Predmet: | | Kombinatorika | | | | |
| Course title: | | Combinatorics | | | | |
| Študijski program in stopnja Study programme and level | | Študijska smer Study field | | Letnik Academic year | Semester Semester | |
| Interdisciplinarni univerzitetni študijski program Računalništvo in matematika | | ni smeri | | 2 | prvi | |
| Interdisciplinary first cycle academic study programme Computer Science and Mathematics | | none | | 2 | first | |
| Vrsta predmeta / Course type | | | | obvezni / compulsory | | |
| Univerzitetna koda predmeta / University course code: | | | | 27208 | | |
| Predavanja Lectures | Seminar Seminar | Vaje Tutorial | Klinične vaje work | Druge oblike študija | Samost. delo Individ. work | ECTS |
| 45 | | 45 | | | 120 | 7 |
| Nosilec predmeta / Lecturer: | | prof. dr. Sandi Klavžar, prof. dr. Matjaž Konvalinka, prof. dr. Primož Potočnik | | | | |
| 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): | | |

Osnovna načela preštevanja. Binomski koeficienti, razdelitve, Stirlingova števila 1. in 2. vrste, Bellova števila, Lahova števila, razčlenitve naravnega števila. Dvanajstera pot. Načelo vključitev in izključitev in trdnjavski polinomi. Polyeva teorija: delovanje grupe na množici, Burnsidova lema, število orbit. Rodovne funkcije in uporaba pri rekurzivnih enačbah. Catalanova števila. Delno urejene množice in mreže: verige in antiverige, Dilworthov izrek, Spernerjev izrek. Teorija načrtov: načrti, t-načrti, ciklične konstrukcije načrtov.

Basic principles of counting. Binomial coefficients, set partitions, Stirling numbers of the first and second kind, Bell numbers, Lah numbers, partitions of integers. Twelve-fold way. Inclusion exclusion principle, rook polynomials. Polya theory: action of groups on sets, Burnside lemma, number of orbits. Generating function and applications to recurrence relations. Catalan numbers. Partially ordered sets and lattices: chains and antichains, Dilworth's theorem, Sperner's theorem. Design theory: designs, t-designs, cyclic constructions of designs.

Temeljni literatura in viri / Readings:

Miklos Bona, A Walk Through Combinatorics, 2nd ed. World Scientific, New York, 2006.

N. Biggs, Discrete Mathematics, 2nd ed., Oxford University Press (2002)

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

Primož Potočnik, Zapiski predavanj iz Diskretne matematike I, <http://www.fmf.uni-lj.si/~potocnik/Ucbeniki/DM-Zapiski2010.pdf>

Cilji in kompetence:

Študent se spozna z nekaterimi klasičnimi problemi kombinatorike in se jih nauči samostojno reševati.

Objectives and competences:

Students familiarize themselves with some classical problems of combinatorics and learn how to independently solve them.

Predvideni študijski rezultati:

Znanje in razumevanje: Poznavanje osnovnih pojmov iz klasične kombinatorike ter razumevanje osnovnih povezav med njimi. Osnovno znanje natančnega štetja objektov z določenimi lastnostmi iz dane množice.

Uporaba: Uporaba diskretnih matematičnih

Intended learning outcomes:

Knowledge and understanding: Knowledge about basic concepts from classical combinatorics, and understanding of basic connections among them. Basic knowledge of exact counting of objects from a given set and with specific properties.

struktur za predstavitev različnih objektov in procesov. Tovrstne predstavitve so nepogrešljive na primer pri obdelavi podatkov z računalniki.

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

Prenosljive spretnosti – niso vezane le na en predmet: Poznavanje osnovnih prijemov za delo z diskretnimi matematičnimi strukturami. Natančnost pri razmišljanju in reševanju problemov. Sposobnost prebiranja strokovne literature iz diskretne matematike in sorodnih področij.

Application: Use of discrete mathematical structures for representation of various objects and processes. Such representations play a key role in data processing with computers.

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

Transferable skills: Knowledge about basic approaches regarding use of discrete mathematical structures. Exactness at thinking and problem solving. Capability of reading and understanding of expert literature on discrete mathematics and other closely related fields.

Metode poučevanja in učenja:

Predavanja in vaje.

Learning and teaching methods:

Lecture and exercises.

Načini ocenjevanja:

Pisni in ustni izpit.

Delež (v %) /
Weight (in %)

100%

Assessment:

Written and oral exam.

Reference nosilca / Lecturer's references:

Sandi Klavžar:

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:

POTOČNIK, Primož. Tetravalent arc-transitive locally-Klein graphs with long consistent cycles. European journal of combinatorics, ISSN 0195-6698, 2014, vol. 36, str. 270-281. [COBISS.SI-ID 16862041]

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. Edge-colourings of cubic graphs admitting a solvable vertex-transitive group of automorphisms. Journal of combinatorial theory. Series B, ISSN 0095-8956, 2004, vol. 91, no. 2, str. 289-300. [COBISS.SI-ID 13087321]