

UČNI NAČRT PREDMETA / COURSE SYLLABUS

Predmet: Analiza omrežij
Course title: Network Analysis

Študijski program in stopnja Study programme and level	Študijska smer Study field	Letnik Academic year	Semester Semester
Uporabne družbene študije UN	/	2.,3.	4.,6.
Advanced Social Studies BA	/	2.,3.	4.,6.

Vrsta predmeta / Course type

Izbirni / Optional

Univerzitetna koda predmeta / University course code:

AO

Predavanja Lectures	Seminar Seminar	Vaje Tutorial	Klinične vaje work	Druge oblike študija	Samost. delo Individ. work	ECTS
20	0	40	0	0	120	6

Nosilec predmeta / Lecturer:

Doc. dr./Ph.D., Assistant Professor Zoran Levnajić

**Jeziki /
Languages:**

**Predavanja /
Lectures:** Slovensko / Slovenian, Angleško / English

Vaje / Tutorial: Slovensko / Slovenian, Angleško / English

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

Študent/študentka mora pred pristopom k izpitu pripraviti in zagovarjati projekt.

Prerequisites:

Before entering the exam, student must prepare and defend a project.

Vsebina:

1. UVOD:
 - namen in vsebina predmeta,
 - načini ocenjevanja,
 - študijska literatura.
2. UVOD V ANALIZO OMREŽIJ:
 - definicija analize omrežij,
 - pomen analize omrežij v družbenih vedah,
 - paradigma strukturalne analize,
 - družbeni odnosi in omrežja,
 - kategorizacija omrežij (socialna, informacijska, tehnološka in biološka omrežja).
3. OSNOVNI POJMI:
 - sociometrija in sociogram
 - definicija omrežja (graf, relacija, točka/vozlišče, povezava, omrežje)
4. SPOZNAVANJE OMREŽIJ:
 - egocentrična in popolna omrežja
 - omrežni podatki
 - zbiranje omrežnih podatkov
5. LASTNOSTI OMREŽJA:
 - glavne značilnosti omrežja
 - tipi omrežij (neusmerjeno, usmerjeno, splošno, dvovrstno omrežje)
 - mere središčnosti in pomembnosti
6. LASTNOSTI IN RELACIJE:
 - razbitje enot
 - skrčenje omrežja (lokalni, globalni, kontekstualni pogled na omrežja)
7. SKUPINE ENOT:
 - koncept kohezivnosti
 - gostota omrežja
 - usredinjenost omrežja
 - k -soseščina
 - komponente omrežja
 - k -jedra
 - triade in klike
8. POSREDNIŠKE VLOGE
9. STRUKTURA SKUPNOSTI:
 - omrežja s skupnostmi
 - metode odkrivanja skupnosti (Louvainova metoda, VOS grozdenje)

Content (Syllabus outline):

1. INTRODUCTION
 - purpose and content of the course,
 - forms of assessment,
 - main readings.
2. INTRODUCTION TO NETWORK ANALYSIS:
 - network analysis definition,
 - importance of network analysis in social sciences,
 - structural analysis paradigm,
 - social relations and networks,
 - network categorization (social, information, technological and biological networks).
3. FUNDAMENTAL CONCEPTS:
 - sociometry and sociogram
 - network definition (graph, relation, vertex, arcs/edges, network)
4. NETWORK INSIGHT:
 - egocentric and complete networks
 - network data
 - assembling network data
5. NETWORK ATTRIBUTES:
 - main characteristics of a network
 - network types (undirected, directed, general, two-mode network)
 - centrality and prestige measures
6. ATTRIBUTES AND RELATIONS:
 - concept of partition
 - network reduction (local, global, contextual view)
7. NETWORK CLUSTERS:
 - the concept of cohesion
 - network density
 - network centralization
 - k -neighborhood
 - components
 - k -cores
 - triads and cliques
8. BROKERAGE ROLES
9. COMMUNITY STRUCTURE:
 - networks with communities
 - community detection methods (Louvain method, VOS clustering)

- modularnost
10. PROGRAMSKA OPREMA ZA ANALIZO OMREŽIJ:
- Pajek
 - R
 - USENET
 - Gephi
 - GraphViz
 - NetworkX
11. IZBRANI PRIMERI ANALIZE OMREŽIJ

- modularity
10. NETWORK ANALYSIS SOFTWARE
- Pajek
 - R
 - USENET
 - Gephi
 - GraphViz
 - NetworkX
11. SELECTED EXAMPLES OF NETWORK ANALYSIS

Temeljni literatura in viri / Readings:

- WASSERMAN, S. in K. FAUST (1995): *Social Network Analysis: Methods and Applications*. New York: Cambridge University Press.
- de NOOY, W., MRVAR, A. in V. BATAGELJ (2005): *Exploratory Social Network Analysis with Pajek*. New York: Cambridge University Press.
- SCOTT, J. (2000): *Social Network Analysis: A Handbook*. London, Thousand Oaks, ew Delhi: SAGE Publications.
- NEWMAN, M.E.J. (2010): *Networks: introduction*. Oxford University Press.
- Dodatna literatura s strani nosilca / additional literature proposed by lecturer.

Cilji in kompetence:

SPLOŠNE KOMPETENCE:

- poznavanje in razumevanje družbenih procesov ter sposobnost za njihovo analizo, sintezo in predvidevanje rešitev in njihovih posledic
- seznanjenost z raziskovalnimi metodami, postopki in procesi, sposobnost zbiranja in interpretiranja podatkov ter rezultatov raziskav
- zahtevnejše obvladanje raziskovalnih metod, postopkov in procesov na področju družbenih ved
- razvoj kritične in samokritične presoje
- sposobnost fleksibilne uporabe znanja v praksi
- sposobnost uporabe in ustreznega navajanja relevantnih domačih in mednarodnih virov, uporabe elektronskih virov in kritične analize relevantne literature

Objectives and competences:

GENERAL COMPETENCES:

- knowledge and understanding of social processes and the ability for their analysis, synthesis, foreseeing solutions and their consequences
- familiarity with research methods, procedures and processes, the capability of collecting and interpreting data and research results
- mastery of advanced research methods, procedures and processes in the field of social sciences
- development of critical and self-critical judgement
- The ability of the flexible use of knowledge in practice
- the ability to use and properly refer to relevant domestic and international sources, to use electronic sources and to provide critical analysis of the relevant literature

PREDMETNO SPECIFIČNE KOMPETENCE

- sposobnost za reševanje konkretnih družbenih in delovnih problemov z uporabo družboslovnih znanstvenih metod in postopkov
- sposobnost pridobivanja, selekcije, ocenjevanja in umeščanja novih informacij in zmožnost interpretacije v kontekstu družboslovja
- razvoj veščin in spretnosti pri uporabi znanja na področju družbenih ved s pomočjo reševanja teoretičnih ali empiričnih problemov
- sposobnost uporabe informacijsko-komunikacijske tehnologije in sistemov na področju družbenih ved
- razumevanje odnosov med posamezniki, organizacijami in družbenim okoljem, zmožnost za kompleksno sistemsko gledanje in delovanje

COURSE SPECIFIC COMPETENCES

- the ability to solve concrete social and working problems using social scientific methods and procedures
- the ability to collect, select, evaluate and include new information and the ability to interpret it in the context of social science
- the development of skills and abilities to apply knowledge in the field of social sciences by solving theoretical and empirical problems
- ability to use information and communications technologies and systems in the field of social sciences
- understanding of the relations between individuals, organisations and social environment, the ability of complex systems thinking and action

Predvideni študijski rezultati:

Znanje in razumevanje:

- poznavanje paradigm strukturalne teorije in teorije omrežij
- razumevanje družbenih odnosov med akterji omrežij
- poznavanje pristopov k zbiranju in analiziranju omrežnih podatkov
- poznavanje osnovnih pojmov teorije omrežij
- poznavanje osnovnih značilnosti omrežij
- poznavanje strukturalnega pristopa k analizi omrežij
- poznavanje in samostojna uporaba osnovnih in naprednih metod in tehnik analize omrežij
- poznavanje najpomembnejših programskih orodij za analizo omrežij

Intended learning outcomes:

Knowledge and understanding:

- knowledge of structural theory and network theory paradigms
- understanding of social relations between network actors
- knowledge of network data assemblance and their analysis
- knowledge of fundamental concepts in network theory
- knowledge of basic network characteristics
- knowledge of structural approach to network analysis
- knowledge and autonomous application of basic and applied network analysis methods and techniques
- knowledge of main software tools for network analysis

Metode poučevanja in učenja:

- Predavanja z aktivno udeležbo študentov (razlaga snovi, pogovori, vprašanja, primeri, reševanje problemov),
- Vaje, kjer bodo študentje teorijo prevedli v prakso,
- Konzultacije (pogovori, dodatna razlaga, obravnava specifičnih vprašanj).

Learning and teaching methods:

- Lectures with active participation of students (explanation, discussion, questions, examples, problem solving),
- Tutorial, where students will apply theoretic notions into practice,
- Consultation (discussion, additional explanation, dealing with specific issues).

Delež (v %) /

Načini ocenjevanja:

Weight (in %)

Assessment:

<ul style="list-style-type: none"> • Pisni/ustni izpit • Projekt 	<p>60%</p> <p>40%</p>	<ul style="list-style-type: none"> • Written/oral examination • Project
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Reference nosilca / Lecturer's references:

- LUŽAR, Borut, LEVNAJIĆ, Zoran, POVH, Janez, PERC, Matjaž. Community structure and the evolution of interdisciplinarity in Slovenia's scientific collaboration network. *PloS one*, ISSN 1932-6203, 2014, vol. 9, iss. 4, str. e94429-1-e94429-5.
- YAVEROĞLU, Ömer Nebil, LEVNAJIĆ, Zoran, PRŽULJ, Nataša, et al. Revealing the Hidden Language of Complex Networks. *Scientific reports*, ISSN 2045-2322, 2014, vol. 4, art. no. 4547, 9.
- LEVNAJIĆ, Zoran, PIKOVSKY, Arkady. Untangling complex dynamical systems via derivative-variable correlations. *Scientific reports*, ISSN 2045-2322, 2014, vol. 4, art. no. 5030, 6 str.
- LEVNAJIĆ, Zoran. Derivative-variable correlation reveals the structure of dynamical networks. *The European physical journal. B, Condensed matter physics*, ISSN 1434-6028, 2013, issue 7, art. no. 298, str. 1-7.
- LEVNAJIĆ, Zoran. Evolutionary design of non-frustrated networks of phase-repulsive oscillators. *Scientific reports*, ISSN 2045-2322, 2012, vol. 2, art. no. 967, 6 str.
- LEVNAJIĆ, Zoran, PIKOVSKY, Arkady. Network reconstruction from random phase resetting. *Physical review letters*, ISSN 0031-9007. [Print ed.], 2011, vol. 107, no. 3, str. 034101-1-034101-4.
- LEVNAJIĆ, Zoran. Emergent multistability and frustration in phase-repulsive networks of oscillators. *Physical review. E, Statistical, nonlinear, and soft matter physics*, ISSN 1539-3755, 2011, vol. 84, no. 1, str. 016231-1-016231-10.
- LEVNAJIĆ, Zoran, LUŽAR, Borut, POVH, Janez, PERC, Matjaž. Interdisciplinarity of Slovenian research. V: 5th International Conference on Information Technologies and Information Society [also] ITIS 2013, Dolenjske toplice, 7-9 novembar 2013. LEVNAJIĆ, Zoran (ur.). *Proceedings*. Novo mesto: Fakulteta za informacijske študije, 2013, str. 15-20.