

UČNI NAČRT PREDMETA / COURSE SYLLABUS

Predmet:	Multivariatne metode
Course title:	Multivariate Methods

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:

MVA

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:

Izr. prof. dr./Ph.D., Associate Professor Janez Povh

**Jeziki /
Languages:****Predavanja /
Lectures:** Slovensko / Slovenian, Angleško / English**Vaje / Tutorial:** Slovensko / Slovenian, Angleško / English**Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:**

Opravljen predmet Statistika 2 ali soroden predmet.

Prerequisites:

Completed course Statistics 2 or a similar course.

Vsebina:**Content (Syllabus outline):**

- Matrična algebra (lastne vrednosti, lastni vektorji, kovariančna in korelacijska matrika)
- Multivariatna normalna porazdelitev
- Analiza glavnih komponent
- Eksploratorna faktorska analiza
- Razvrščanje v skupine
- Linearna diskriminantna analiza
- Multivariatna analiza variance (MANOVA); Enofaktorska in dvofaktorska ANOVA
- Linearni regresijski model
- Večkratna (multipla) regresijo
- Uporaba programskih orodij za podporo pri statistični obdelavi podatkov.

- Matrix algebra (eigenvalues, eigenvectors, covariance and correlation matrix)
- Multivariate normal distribution
- Principal components analysis
- Exploratory factor analysis
- Clustering
- Linear discriminatory analysis
- Multivariate analysis of variance
- Single and two factor ANOVA
- Linear regression analysis
- Multiple multivariate regression
- Use of software tools to support the statistical data analysis.

Temeljni literatura in viri / Readings:

- Rencher, C. A. (2002): Methods of Multivariate Analysis. Second Edition. A Wiley-Interscience publication.
- Everitt, B. S., & Hothorn, T. (2011). An introduction to applied multivariate analysis with R. Springer.
- Kabacoff, R. (2011): R in Action, Data analysis and graphics with R. Shelter Islands: Manning.
- Sharma, S. (1996): Applied multivariate techniques, Wiley, New York.
- Omladič V. (1997): Uporaba linearne algebre v statistiki. Metodološki zvezki, 13, FDV, Ljubljana.

Cilji in kompetence:

- zahtevnejše obvladanje raziskovalnih metod, postopkov in procesov na področju družbenih ved;
- seznanjenost z raziskovalnimi metodami, postopki in procesi, sposobnost zbiranja in interpretiranja podatkov ter rezultatov raziskav;
- sposobnost timskega dela, tj. pripravljenost na sodelovanje, kooperativnost, upoštevanje mnenj drugih in izpolnjevanje dogovorjene vloge v okviru tima oz. skupine;
- poznavanje in razumevanje utemeljitev in zgodovine razvoja temeljnih družboslovnih disciplin (stroke) in sicer s področja; sociologije, političnih ved, komunikologije, ekonomije in menedžmenta, družboslovne

Objectives and competences:

- mastery of advanced research methods, procedures and processes in the field of social sciences;
- familiarity with research methods, procedures and processes, the capability of collecting and interpreting data and research results;
- ability to teamwork, i.e. willingness to cooperate, cooperation, respect the opinions of others and fulfil roles within the team or group;
- knowing and understanding the foundations and history of the development of the basic social science disciplines (professions), i.e. sociology, political science, economy and management, social science informatics, jurisprudence, social science statistics and qualitative methods;

informatike, pravoznanstva, družboslovne statistike in kvalitativnih metod;

- sposobnost za reševanje konkretnih družbenih in delovnih problemov z uporabo družboslovnih znanstvenih metod in postopkov;
- sposobnost povezovanja koherentno obvladanega temeljnega znanja, pridobljenega pri obveznih predmetih, ter njegova uporaba v praksi;
- 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;
- poznavanje in razumevanje teoretičnih osnov analitičnega in svetovalnega dela (prenos znanja do uporabnika);
- poznavanje in razumevanje procesov v poslovnem okolju organizacije in sposobnost za njihovo analizo, sintezo in predvidevanje rešitev ter njihovih posledic.

- the ability to solve concrete social and working problems using social scientific methods and procedures;
- the ability to connect coherently collected knowledge attained from the mandatory courses and its application in practice
- 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;
- knowledge and understanding of the theoretical bases of analytical and advisory work (transfer of knowledge to the user);
- knowledge and understanding of the processes in the business environment of the organization and its capacity for analysis, synthesis and forecasting solutions and their consequences.

Predvideni študijski rezultati:

Znanje in razumevanje:

- kompleksnih statističnih metod;
- algoritmov v ozadju statističnih metod;
- analize dejanskih podatkov;
- razumevanje pomena rezultatov analiz;
- programskih orodij za podporo pri statistični obdelavi podatkov.

Intended learning outcomes:

Knowledge and understanding:

- complex statistical methods;
- algorithms behind the statistical methods;
- analysis of actual data;
- the results of the analysis;
- software tools to support the statistical data.

Metode poučevanja in učenja:

Learning and teaching methods:

<ul style="list-style-type: none"> • Predavanja z aktivno udeležbo študentov (razlaga, diskusija, vprašanja, primeri, reševanje problemov); • Vaje, kjer bodo študentje pri konkretnih statističnih problemih ponovili, utrdili in dodatno osvetlili pojme in metode, spoznane na predavanjih; • Vaje v računalniški učilnici: pri teh vajah bodo študentje spoznali nekaj najaktualnejših programskih orodij za statistično obdelavo podatkov, s katerimi se bodo naučili izvajati vse statistične metode, ki so jih srečali na predavanjih in vajah. • Redno oddajanje domačih nalog, kar spodbuja sprotno delo. • Projekt, ki ga bodo študentje pripravili samostojno ali v manjših skupinah. Vključeval bo konkreten statistični problem, ki ga bodo morali študentje v celoti rešiti z metodami, spoznanimi na predavanjih in vajah. • Kolokviji: z njimi bodo študentje stimulirani, da sproti študirajo snov, ki bo obravnavana na predavanjih in vajah. 	<ul style="list-style-type: none"> • Lectures with active participation of students (explanation, discussion, questions, examples, problem solving); • Seminar where students will learn the practical problems of statistical repeated, consolidate and shed further light on concepts and methods, perceived lectures; • Seminar in the computer lab: in these exercises, students will learn some of the very latest software tools for statistical data processing, they will learn to perform all statistical methods, and they met at lectures and tutorials. • Regular exercises, which enhance practical work. • Project, which will prepare students individually or in small groups. It will include specific statistical problem that will have students fully resolved by the methods emerged at lectures and tutorials. • Partial test: With them, students will have an incentive to keep studying material that will be discussed in lectures and tutorials.
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Delež (v %) /

Načini ocenjevanja:

Weight (in %)

Assessment:

<ul style="list-style-type: none"> • Aktivno sodelovanje na vajah (domače naloge) • Delo v okviru seminarskih vaj in individualno • Pisni izpit ali kolokviji 	<p>15 %</p> <p>15 %</p> <p>70 %</p>	<ul style="list-style-type: none"> • Active participation at the lectures (exercises) • Work within the seminars and individually • Written examination or colloquium
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Reference nosilca / Lecturer's references:

- BURGDORF, Sabine, CAFUTA, Kristijan, KLEP, Igor, POVH, Janez. Algorithmic aspects of sums of Hermitian squares of noncommutative polynomials. Computational optimization and applications, ISSN 0926-6003. [Print ed.], 2013, vol. 55, iss. 1, str. 137-153.
- DICKINSON, Peter J. C., POVH, Janez. Moment approximations for set-semidefinite polynomials. Journal of optimization theory and applications, ISSN 1573-2878, 2013, vol. 159, issue 1, str. 57-68.
- EICHFELDER, Gabriele, POVH, Janez. On the set-semidefinite representation of nonconvex quadratic programs over arbitrary feasible sets. Optimization letters, ISSN 1862-4480, 2013, vol. 7, issue 6, str. 1373-1386.

- POVH, Janez. Contribution of copositive formulations to the graph partitioning problem. Optimization, ISSN 0233-1934, 2013, vol. 62, issue 1, str. 71-83, ilustr.
- CAFUTA, Kristijan, KLEP, Igor, POVH, Janez. NCSOStools: a computer algebra system for symbolic and numerical computation with noncommutative polynomials. V: 3rd Veszprém Optimization Conference: Advanced Algorithms, Veszprém, Hungary, December 15-17, . VOCAL 2008, (Optimization methods & software (Print), ISSN 1055-6788, Vol. 26, no. 3, 2011). Reading: Taylor & Francis, 2011, str. 363-380.
- POVH, Janez. Semidefinite approximations for quadratic programs over orthogonal matrices. Journal of global optimization, ISSN 0925-5001, nov. 2010, vol. 48, no. 3, str. 447-463.
- CAFUTA, Kristijan, KLEP, Igor, POVH, Janez. A note on the nonexistence of sum of squares certificates for the Bessis-Moussa-Villani conjecture. Journal of mathematical physics, ISSN 0022-2488, 2010, vol. 51, iss. 8, str. 083521-1-083521-10.
- POVH, Janez, KLEP, Igor. Semidefinite programming and sums of hermitian squares of noncommutative polynomials. Journal of Pure and Applied Algebra, ISSN 0022-4049. [Print ed.], 2010, vol. 214, iss. 6, str. 740-749.
- POVH, Janez, RENDL, Franz. Copositive and semidefinite relaxations of the quadratic assignment problem. Discrete optimization, ISSN 1572-5286, 2009, vol. 6, iss. 3, str. 231-241.
- MALICK, Jérôme, POVH, Janez, RENDL, Franz, WIEGELE, Angelika. Regularization methods for semidefinite programming. SIAM journal on optimization, ISSN 1052-6234, 2009, vol. 20, no. 1, str. 336-356.
- POVH, Janez, RENDL, Franz. A copositive programming approach to graph partitioning. SIAM journal on optimization, ISSN 1052-6234, 2007, vol. 18, no. 1, str. 223-241.
- GORŠE PIHLER, Melita, KRAMBERGER, Tomaž, POVH, Janez. Kvantitativne metode v logistiki - vaje. Celje; Krško: Fakulteta za logistiko, 2007.
- POVH, Janez, PUSTAVRH, Simona, BLAŽIČ, Marjan (urednik). Zbirka rešenih nalog iz operacijskih raziskav. Novo mesto: Visoka šola za upravljanje in poslovanje, 2001.
- POVH, Janez. Semidefinitno programiranje in njegova uporaba. Ljubljana: Vega, 2011. III, 104 str., graf. prikazi, tabele.
- POVH, Janez, PUSTAVRH, Simona, FOŠNER, Maja, GORŠE PIHLER, Melita, ZALAR, Bojana. Matematične metode v uporabi, (Izbrana poglavja iz matematike in računalništva, 42). 1. natis. Ljubljana: DMFA - založništvo, 2010.