Univerza v Mariboru

Fakulteta za naravoslovje in matematiko

UČNI NAČRT PREDMETA / COURSE SYLLABUS								
Predmet:	**Verjetnost**							
Course title:	Probability							
Študijski program in stopnja Study programme and level		**Študijska smer Study field**			**Letnik Academic year**		**Semester Semester**	
Matematika					**3.**		**5.**	
Mathematics					**3rd**		**5th**	
Vrsta predmeta / Course type				obvezni/compulsory				
Univerzitetna koda predmeta / University course code:								
Predavanja Lectures	**Seminar Seminar**	**Sem. vaje Tutorial**	**Lab. vaje Laboratory work**	**Teren. vaje Field work**	**Samost. delo Individ. work**		**ECTS**	
60		**45**			**105**		**7**	
Nosilec predmeta / Lecturer:	Dominik BENKOVIČ							
Jeziki / Languages:	**Predavanja / Lectures:**	SLOVENSKO/SLOVENE						
	Vaje / Tutorial:	SLOVENSKO/SLOVENE						

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	**Prerequisits:**
Jih ni.	There are none.
Vsebina:	**Content (Syllabus outline):**
• Osnovni pojmi verjetnosti: Poskus, dogodek in algebra dogodkov. Klasična, statistična, geometrijska in aksiomatična definicija verjetnosti. Osnovne lastnosti verjetnosti. • Pogojna verjetnost: Neodvisni dogodki. Relejni poskusi, formula za popolno verjetnost in Bayesova formula. • Zaporedja neodvisnih poskusov: Bernoullijevo zaporedje poskusov. Binomska porazdelitev. Limitni izreki:	• Basic concepts of probability: experiment, event and sample space. The classical, statistical, geometrical and axiomatic definition of probability. Basic properties of probability. • Conditional probability: Independent events. The formula of total probability and the Bayes' rule. • Sequences of independent trials: Bernoulli trials. The binomial distribution. Limit theorems: Poisson's theorem, local and

Poissonova formula, Laplaceova lokalna in integralska formula. Bernoullijev zakon velikih števil.	integral Laplace theorems. The Bernoulli's law of large numbers.
• Slučajne spremenljivke: Porazdelitvena funkcija in njene osnovne lastnosti. Diskretne in zvezne porazdelitve. Pomembne porazdelitve. Funkcije slučajnih spremenljivk.	• Random variables: The distribution function and its basic properties. Discrete and continuous distributions. Examples of most important distributions. Functions of random variables.
• Številske karakteristike slučajnih spremenljivk: Matematično upanje in disperzija. Višji momenti in vrstilne karakteristike.	• Numerical characteristics of random variables: Mathematical expectation and variance. Higher moments and order characteristics.
• Slučajni vektorji. Diskretni in zvezni slučajni vektorji. Neodvisnost slučajnih spremenljivk. Funkcije slučajnih vektorjev. Kovarianca in korelacijski koeficient.	• Random vectors: Discrete and continuous random vectors. Independence of random variables. Functions of random vectors. Covariance and correlation coefficient.
• Rodovne in karakteristične funkcije: Definicija in osnovne lastnosti rodovnih in karakterističnih funkcij.	• Generating and characteristic functions: Definition and elementary properties of generating and characteristic functions.
• Limitni izreki teorije verjetnosti: Zakon velikih števil. Centralni limitni izrek.	• Limit theorems of probability theory: Law of large numbers. The central limit theorem.
• Uvod v teorijo slučajnih procesov: Markovske verige. Klasifikacija stanj. Stacionarna porazdelitev. Primeri: slučajni sprehod, proces razvejanja, proces rojevanja, Poissonov proces.	• Introduction to random processes: Markov chains. Classification of states. Stationary distribution. Examples: random walk, branching process, birth process, Poisson process.

Temeljni literatura in viri / Readings:

1. R. Drnovšek, T. Košir, E. Kramar, G. Lešnjak: *Zbirka rešenih nalog iz verjetnostnega računa*, DMFA, 1998.
2. B. V. Gnedenko: *The theory of probability*, Mir Publishers, 1988.
3. G. R. Grimmett, D. R. Stirzaker: *Probability and random processes*, Oxford University Press, 1992.
4. M. Hladnik: *Verjetnost in statistika*, Fakulteta za računalništvo in informatiko 2002.
5. R. Jamnik: *Verjetnostni račun*, DMFA, 1987.
6. R. Jamnik: *Verjetnostni račun in statistika*, DMFA, 1995.
7. N. Sarapa: *Teorija vjerojatnosti*, Školska knjiga, 2002.

Cilji in kompetence:	**Objectives and competences:**
Glavni cilj predmeta je proučiti najpomembnejše koncepte in rezultate teorije verjetnosti.	The main goal of the course is to study the fundamental concepts and results of probability theory.

Predvideni študijski rezultati:	**Intended learning outcomes:**
Znanje in razumevanje: • Razumevanje verjetnosti in različnih pristopov k definiranju le-te ter osvojitev različnih tehnik računanja verjetnosti. • Osvojiti najpreprostejši primer slučajnega procesa - homogene markovske verige. • Razumevanje in poznavanje osnovnih rezultatov teorije verjetnosti, ki so povezani s slučajnimi spremenljivkami in vektorji. • Poznavanje osnovnih rezultatov, ki so povezani z rodovnimi in karakterističnimi funkcijami ter limitnimi izreki. Prenesljive/ključne spretnosti in drugi atributi: • Uporaba znanja iz teorije verjetnosti pri statistiki in na drugih področjih uporabne matematike.	Knowledge and Understanding: • Understanding the notion of probability, different approaches to its definition, and techniques of calculating probability. • Understanding of the simplest example of the random process – Markov chain. • Understanding and knowledge of basic results of the probability theory which are related to random variables and vectors. • Knowledge of basic results which are related to generating and characteristic functions and also to limit theorems. Transferable/Key Skills and other attributes: • Knowledge transfer of methods of probability theory into statistics and to other fields of applied mathematics.

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

Načini ocenjevanja: / **Assessment:**

Način (pisni izpit, ustno izpraševanje, naloge)	Delež (v %) / Weight (in %)	Type (examination, oral, coursework):
<u>Izpit:</u> Pisni izpit – problemi Ustni izpit – teorija Pisni izpit – problemi se lahko nadomesti z dvema testoma (sprotni obveznosti).	 50% 50%	<u>Exams:</u> Written exam – problems Oral exam – theory Written exam – problems can be repalced with two mid-term tests. Each of the mentioned commitments must be assessed with a passing grade.

Vsaka izmed naštetih obveznosti mora biti opravljena s pozitivno oceno. Opravljen pisni izpit – problemi je pogoj za pristop k ustnemu izpitu – teorija.		Passing grade of written exam – problems is required to take the oral exam – theory.

Reference nosilca / Lecturer's references:

1. BENKOVIČ, Dominik, GRAŠIČ, Mateja. Generalized skew derivations on triangular algebras determined by action on zero products. *Communications in algebra*, ISSN 0092-7872, 2018, vol. 46, iss. 5, str. 1859-1867. https://doi.org/10.1080/00927872.2017.1360334.

2. BENKOVIČ, Dominik. Generalized Lie derivations of unital algebras with idempotents. *Operators and matrices*, ISSN 1846-3886, 2018, vol. 12, no. 2, str. 357-367. https://doi.org/10.7153/oam-2018-12-23.

3. BENKOVIČ, Dominik. Jordan σ-derivations of triangular algebras. *Linear and Multilinear Algebra*, ISSN 0308-1087, 2016, vol. 64, no. 2, str. 143-155. http://dx.doi.org/10.1080/03081087.2015.1027646.

4. BENKOVIČ, Dominik. A note on f-derivations of triangular algebras. *Aequationes mathematicae*, ISSN 0001-9054, 2015, vol. 89, iss. 4, str. 1207-1211. http://dx.doi.org/10.1007/s00010-014-0298-y.

5. BENKOVIČ, Dominik. Lie triple derivations of unital algebras with idempotents. *Linear and Multilinear Algebra*, ISSN 0308-1087, 2015, vol. 63, no. 1, str. 141-165. http://dx.doi.org/10.1080/03081087.2013.851200.