Rachunek prawdopodobieństwa - opis przedmiotu

Informacje ogólne

Nazwa przedmiotu	Rachunek prawdopodobieństwa
Kod przedmiotu	11.1-WK-IiEP-RP-W-S14_pNadGen9VRE3
Wydział	Wydział Matematyki, Informatyki i Ekonometrii
Kierunek	Computer science and econometrics
Profil	ogólnoakademicki
Rodzaj studiów	pierwszego stopnia z tyt. licencjata
Semestr rozpoczęcia	semestr zimowy 2019/2020

Informacje o przedmiocie

Semestr	3
Liczba punktów ECTS do zdobycia	4
Typ przedmiotu	obowiązkowy
Język nauczania	polski
Sylabus opracował	• dr Marta Borowiecka-Olszewska

Formy zajęć

Forma zajęć	Liczba godzin w semestrze (stacjonarne)	Liczba godzin w tygodniu (stacjonarne)	Liczba godzin w semestrze (niestacjonarne)	Liczba godzin w tygodniu (niestacjonarne)	Forma zaliczenia
Wykład	30	2	-	-	Egzamin
Ćwiczenia	30	2	-	-	Zaliczenie na ocenę

Cel przedmiotu

Familiarizing students with the basic concepts, theorems and methods of reasoning related to the probability theory.

Wymagania wstępne

Getting a pass in Mathematical Analysis 1 and 2.

Zakres tematyczny

Lecture

1. Events and the probability

- The revision of combinatorics. The classical definition of the probability. (2 hrs.)
- The general definition of the probability. The definition and examples of the probability space and the event. Basic properties of the probability. Different interpretations of the probability – frequentist, personalistic. (3 hrs.)
- The geometrical probability. The conditional probability, the law of total probability and Bayes' rule. (3 hrs.)
- The independence of events. The Bernoulli scheme, the most likely number of successes in the Bernoulli scheme. (2 hrs.)

2. Random variables and their distributions

- The definition, examples and properties of the random variable. The distribution of the random variable. The cumulative distribution function of the random variable and its properties. The cumulative distribution function and types of distributions. (4 hrs.)
- Absolutely continuous and discrete distributions. The probability density function and its property. Overview of the most important absolutely continuous and discrete distributions. Mixed distributions. The independence of random variables. (4 hrs.)
- Multidimensional random variables. The joint and marginal distributions, multidimensional and marginal cumulative distribution functions, marginal probability density functions. Connections with independent random variables. Distributions of sums of independent random variables. (3 hrs.)

3. The expectation and moments of random variables

- The expectation and moments of a random variable. Examples of basic absolutely continuous and discrete distributions. The expectation and moments of random variables of mixed distribution, basic properties and interpretations. The variance and the standard deviation of random variables, basic properties and interpretation. (4 hrs.)
- The concept of the covariance and the correlation coefficient of random variables, their connections with independent random variables. Parameters of random vectors. The multidimensional normal distribution. (2 hrs.)
- The moment generating function and its properties (for information). (1 hr.)

4. Limit theorems

- Chebyshev's inequality, the law of large numbers, the central limit theorem and their applications. (2 hrs.)

Class

1. Events and the probability

- The binomial coefficient and its interpretation. The use of basic combinatorial schemes to exercises related to the classical definition of the probability. (4 hrs.)
- Determination of elementary events and events. Basic properties of the probability. (2 hrs.)
- Exercises that use the geometric probability, the conditional probability, the law of total probability and Bayes' rule. (2 hrs.)
- Checking the independence of events. The calculation of probabilities of events with the assumption of independence. Exercises that use the Bernoulli scheme. (2 hrs.)
- Colloquium (2 hrs.)

2. Random variables and their distributions, the expectation and moments of random variables

- The verification whether some functions are random variables, cumulative distribution functions of some random variables. The determination of the cumulative distribution function of a random variable. The analysis of the distribution of a random variable on the basis of the cumulative distribution function. The verification whether some functions are probability density functions. The application of different types of discrete and absolutely continuous distributions in mathematical models. The application of normal distribution in exercises. (7 hrs.)
- The determination of the joint and marginal distributions of two-dimensional random vectors using the tabular method. The determination of two-dimensional and marginal cumulative distribution functions, marginal probability density functions. The verification of the independence of random variables. Distributions of sums of independent random variables. (3 hrs.)
- The determination of the expectation, moments and the variance of random variables. The properties of the expectation and the variance. The application in exercises. Calculations of the covariance and the correlation coefficient of random variables and their connections with the independence. The parameters of two-dimensional random vectors and two-dimensional normal distribution. (4 hrs.)

3. Limit theorems

- The application of Chebyshev's inequality to estimate the probability of random variables. The application of the law of large numbers and the central limit theorem in exercises. (2 hrs.)
- Colloquium (2 hrs.)

Metody kształcenia

A traditional lecture. Solving previously given tasks (exercises and short proofs) during the classes.

Efekty uczenia się i metody weryfikacji osiągania efektów uczenia się

Opis efektu	Symbole efektów	Metody weryfikacji	Forma zajęć
The student is able to analyse the distribution of random variables on the basis of e.g. a cumulative distribution function or a probability density function. He is able to apply different types of discrete and absolutely continuous distributions in mathematical models.	• K_W07 • K_U13	• bieżąca kontrola na zajęciach • dyskusja • egzamin - ustny, opisowy, testowy i inne • kolokwium	• Wykład • Ćwiczenia
The student is able to explain concepts and give examples of the elementary event, the event, the probability measure, the probability space and the random variable.	• K_W03 • K_U13 • K_K06	• bieżąca kontrola na zajęciach • dyskusja • egzamin - ustny, opisowy, testowy i inne • kolokwium	• Wykład • Ćwiczenia
The student is able to use the conditional probability, the law of total probability and Bayes' rule. He is able to check the independence of events and use the Bernoulli scheme.	• K_U14	• bieżąca kontrola na zajęciach • dyskusja • egzamin - ustny, opisowy, testowy i inne • kolokwium	• Wykład • Ćwiczenia
The student is able to calculate the probability of events, the expectation and the variance of random variables. He knows and is able to use limit theorems to estimate probabilities.	• K_W04 • K_U03 • K_U14	• bieżąca kontrola na zajęciach • dyskusja • egzamin - ustny, opisowy, testowy i inne • kolokwium	• Wykład • Ćwiczenia

Warunki zaliczenia

Class – The class grade consists of scores in two colloquia with tasks of varying difficulty (80%) and an activity during the classes (20%). To pass the class it is necessary to get passing scores in two colloquia. To take the exam it is necessary to pass the class.

Lecture – The exam in the form of a multiple-choice test, consisting of several dozen statements that require the verification on the basis of the acquired knowledge. The verification of statements is connected with the use of the theory or making simple calculations. The possible answers are Yes or No. The student may receive +1,-1 or 0 points

for each statement.

The final course grade is based on graded components: the class grade (50%) and the exam grade (50%).

In order to pass the course it is necessary to get passing score from classes and in the exam.

Literatura podstawowa

1. G. Grimmett, D. Welsh, Probability: an introduction (Oxford University Press, 1986).
2. Ch.M. Grinstead, J.L. Snell, Introduction to Probability (American Mathematical Society, 2006).
3. G. Roussas, Introduction to Probability (Elsevier, 2007).
4. S.M. Ross, Introduction to Probability Models (first two chapters) (Elsevier, 2007).

Literatura uzupełniająca

1. J.K. Misiewicz, Wykłady z rachunku prawdopodobieństwa (SCRIPT, Warszawa 2005).
2. J. Jakubowski, R. Sztencel, Rachunek prawdopodobieństwa dla (prawie) każdego (SCRIPT, Warszawa, 2002).
3. G. Jay Kerns, Introduction to Probability and Statistics Using R (http://cran.r-project.org/web/packages/IPSUR/vignettes/IPSUR.pdf, 2011).

Uwagi

Zmodyfikowane przez dr Alina Szelecka (ostatnia modyfikacja: 21-11-2020 06:10)