COURSE DESCRIPTION CARD - SYLLABUS

Course name
Probabilistic Methods [S1Inf1>PROB]

Course

Field of study
Computing

Year/Semester
1/2

Area of study (specialization)
–

Profile of study
general academic

Level of study
first-cycle

Course offered in
polish

Form of study
full-time

Requirements
elective

Number of hours

Lecture
24

Laboratory classes
0

Other (e.g. online)
0

Tutorials
24

Projects/seminars
0

Number of credit points

5,00

Coordinators

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Lecturers

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Prerequisites

A student beginning this course should have a basic knowledge of calculus, discrete mathematics, linear algebra and logic. In addition, in terms of social competences, the student must present such attitudes as honesty, responsibility, perseverance, cognitive curiosity, creativity, personal culture, and respect for other people.

Course objective

The objective of the course is to provide students with basic knowledge of the axiomatic definition of probability, random events, random variables and limit theorems, as well as to develop students' skills in calculating probability, basic parameters of distributions of random variables including marginal and conditional distributions, understanding and applying limit theorems.

Course-related learning outcomes

Knowledge

1. Has a detailed knowledge of the fundamentals of probability, essential for virtually any subject, especially operations research, statistical data analysis, decision theory

Skills
1. Is able to plan and carry out experiments including measurements and computer simulations, interpret the obtained results and draw conclusions
2. Is able to use analytical and simulation methods to formulate and solve computer tasks

Social competences
1. Understands that in information technology knowledge and skills become obsolete very quickly
2. Is aware of the importance of knowledge in solving engineering problems and knows examples and understands the causes of malfunctioning information systems that have led to serious financial, social or even life losses

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Formative assessment:
(a) lectures: on the basis of answers to questions on the material discussed in previous lectures;
b) for tutorials/classes: on the basis of the assessment of the current progress of tasks
Summative evaluation:
a) lectures: the knowledge acquired in the lecture is verified by a written examination. The exam questions are theoretical and practical. The exam is evaluated in the point system. The condition to pass the exam is obtaining at least 50% of points
b) tutorials/classes: learning outcomes are verified through tests, continuous assessment at each class (oral answers) and obtaining additional points for activity during the classes. The condition to obtain a positive evaluation from the classes is to obtain at least 50% of points.

Programme content

The course syllabus includes the following topics:
1) Sample space, random events and operations on them, classical probability, combinatorics, geometric probability;
2) Probabilistic space, sigma-algebras of events, Kolmogorov axioms, properties of probability, inclusion and exclusion principle, interpretation of probability;
3) Conditional probability, chain rule, total probability formula, Bayes' theorem;
4) Independent events and their properties, conditional independence, product spaces, reliability of systems, Bernoulli scheme, random walk;
5) Random variables, distribution, discrete random variables, distributions: degenerate, two-point, uniform, binomial, geometric, Pascal, Poisson distribution as limit of binomial distribution;
6) Moments of random variables, expected value and its properties, variance and its properties, standard deviation, moments of basic probability distributions, Markov's inequality, Chebyshev's inequality;
7) Multidimensional random variables, joint distribution, marginal and conditional distributions, conditional expected value;
8) Additivity of expected value, covariance and its properties, correlation coefficient, independent random variables, properties of independent random variables;
9) Continuous random variables, probability density, uniform distribution, exponential distribution, cumulative distribution function of a continuous variable, density of a function of a continuous random variable, moments of continuous random variables, normal distribution and its properties;
10) Multidimensional continuous random variables, joint, marginal, conditional density, independent continuous random variables, distribution of sum of independent random variables, chi-square distribution, Student's t distribution;
11) Bernoulli's and Khinchin's laws of large numbers, Monte Carlo method, sequences of random variables and their convergence, Moivre-Laplace theorem, central limit theorem.

Teaching methods

Lecture: multimedia presentation with additional examples solved on the blackboard.
Tutorials/classes: solving exercises

Bibliography

Basic:
1. Jacek Jakubowski, Rafał Sztencel: Rachunek prawdopodobieństwa dla prawie każdego. Script, 2002.
2. Rachunek prawdopodobieństwa, statystyka matematyczna, procesy stochastyczne, Plucińska A., Pluciński E., WNT, W-wa, 2000
3. Rachunek prawdopodobieństwa i statystyka matematyczna w zadaniach, W.Krysicki i in., PWN, W-wa, 2003

Additional:
1. W. Feller: Wstęp do rachunku prawdopodobieństwa. Tom 1 i tom 2. PWN, 2009
2. Jacek Jakubowski, Rafał Sztencel: Wstęp do teorii prawdopodobieństwa. Script, 2010
3. Statystyka, Koronacki J., Mielniczuk J., WNT, W-wa, 2001

Breakdown of average student's workload

	Hours	ECTS
Total workload	125	5,00
Classes requiring direct contact with the teacher	50	2,00
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	75	3,00