COURSE DESCRIPTION CARD - SYLLABUS

Course name
Probabilistic Methods [S1Cybez1>MP]

Course

Field of study
Cybersecurity

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
compulsory

Number of hours

Lecture
16

Laboratory classes
0

Other
0

Tutorials
24

Projects/seminars
0

Number of credit points

3,00

Coordinators

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Lecturers

Prerequisites

A student beginning this course should have a basic knowledge of calculus, linear algebra and logic and the basics of combinatorics. 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 aim of the course is to familiarize students with concepts and theorems from the scope of probability theory and to develop the ability to use them freely. In particular, to familiarize students with concepts such as random event, probability space, axiomatic definition of probability, random variable, probability distribution and its parameters, including marginal and conditional distributions, as well as to familiarize students with selected probability distributions.

Course-related learning outcomes

Knowledge:
Student has in-depth and extended knowledge of the basics of probability, necessary to describe and analyze the elements and systems appropriate to the field of study

Skills:
Understands and is able to apply probabilistic methods, understands the concept of continuous and discrete random variables, applies probability distributions appropriate to given issues and is able to interpret the obtained results and draw conclusions
When formulating and solving engineering tasks in the field of cybersecurity, the student is able to use known mathematical models and algorithms as well as simulation, experimental and analytical methods

Social competences:
Understands the importance of improving professional, personal and social competences; is aware that knowledge and skills in the area of cybersecurity are rapidly evolving
Understands the importance of knowledge in solving problems in the area of cybersecurity; is aware of the need to use expert knowledge when solving engineering tasks in a scope beyond one's own competences

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

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.
b) tutorials/classes: as part of the exercises, the learning outcomes are verified by two colloquia, continuous assessment at each class (oral answers) and obtaining additional points for activity during the classes. Positive grade is obtained by acquiring at least 50% of the maximum number of points from both tests.
In each form of the course assessment, the grade depends on the number of points the student earns relative to the maximum number of required points. Earning at least 50% of the possible points is a prerequisite for passing. The relationship between the grade and the number of points is defined by the Study Regulations. Additionally, the course completion rules and the exact passing thresholds will be communicated to students at the beginning of the semester through the university’s electronic systems and during the first class meeting (in each form of classes).

Programme content

Probabilistic space. Basics of probability. One-dimensional discrete and continuous random variables. Functional and numerical characteristics of random variables. Multidimensional discrete and continuous random variables.

Course topics

The course syllabus includes the following topics:
1) Sample space, random events and operations on them, classical probability, geometric probability
2) Probabilistic space, Kolmogorov axioms, properties of probability
3) Conditional probability, chain rule, total probability formula, Bayes' theorem;
4) Independent events and their properties, reliability of systems, Bernoulli scheme;
5) Random variables, distribution, discrete random variables, distributions: degenerate, two-point, discrete 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;
7) Multidimensional random variables, joint distribution, marginal and conditional distributions;
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, Moivre-Laplace theorem, centrcentral limit theorem.

Teaching methods

Lecture: multimedia presentation with additional examples solved on the blackboard.
Tutorials/classes: solving sample tasks on the board, discussion of solution

Bibliography

Basic:
1. Jacek Jakubowski, Rafał Sztencel, Rachunek prawdopodobieństwa dla prawie każdego, Script, 2002
2. Plucińska A., Pluciński E., Rachunek prawdopodobieństwa, statystyka matematyczna, procesy stochastyczne, WNT, W-wa, 2000
3. W.Krysicki i in., Rachunek prawdopodobieństwa i statystyka matematyczna w zadaniach, 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. Koronacki J., Mielniczuk J., Statystyka, WNT, W-wa, 2001

Breakdown of average student's workload

	Hours	ECTS
Total workload	85	3,00
Classes requiring direct contact with the teacher	40	1,50
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	45	1,50