GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Mathematical statistics, PG_00045298
Field of study	Data Engineering

Date of commencement of studies	October 2023	Academic year of realisation of subject	2024/2025
Education level	first-cycle studies	Subject group	Obligatory subject group in the field of study
			Subject group related to scientific research in the field of study
Mode of study	Full-time studies	Mode of delivery	at the university
Year of study	2	Language of instruction	English
Semester of study	3	ECTS credits	4.0
Learning profile	general academic profile	Assessment form	exam

Conducting unit	Katedra Statystyki i Ekonometrii -> Faculty of Management and Economics

Name and surname of lecturer (lecturers)	Subject supervisor	dr inż. Karol Flisikowski
	Teachers	dr inż. Karol Flisikowski

Lesson types and methods of instruction	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	30.0	30.0	15.0	0.0	0.0	75
	E-learning hours included: 0.0						

Learning activity and number of study hours	Learning activity	Participation in didactic classes included in study plan	Participation in consultation hours	Self-study	SUM
	Number of study hours	75	8.0	17.0	100

Subject objectives	Main aim of the course is to teach students the basic concepts of probability and their application in mathematical modeling. After the course students will be able to perform the procedure of testing of statistical hypotheses (parametric and nonparametric) using R and R-studio environment. Classes will be delivered using a micro-learning method - i.e. through a series of short interactive tutorials and video tutorials on the eLearning platform and meetings in the laboratory and exercise room.

Learning outcomes	Course outcome	Subject outcome	Method of verification
	[K6_U11] is able to use mathematical and IT tools in economics.	A student, on the basis of knowledge infer regarding the real statistical problems. A student can use appropriate inferencial statistical analysis.	[SU2] Assessment of ability to analyse information [SU4] Assessment of ability to use methods and tools
	[K6_K01] is aware of quickly changing trends and the resulting need for further education and self-improvement in the area of the performed profession of an engineer with IT and economic-financial skills.	A student is aware of the limitations of his knowledge and skills of using tools of mathematical statistics designed for research purposes. A student is aware of the role played by other quantitative methods in the study of socio-economic phenomena.	[SK3] Assessment of ability to organize work [SK2] Assessment of progress of work
	[K6_W08] Knows the models and structure of the data mining process and their multidimensional analysis and can assess the results of such analyses	A student knows the basic linear and nonlinear models and time series models and is able to implement them to visualize the multiple analyzed relations.	[SW1] Assessment of factual knowledge
	[K6_W01] has advanced knowledge in the field of mathematics, including mathematical analysis, algebra, geometry, probability calculus, statistics and numerical methods, necessary to formulate and solve simple tasks in the field of IT	Students will be familiar with the basic mathematical techniques necessary to carry out calculations in probability calculus, mathematical statistics.	[SW3] Assessment of knowledge contained in written work and projects

Subject contents	
	Probability space: the classic scheme, drawing with replacement and without replacement. Geometric Probability. Conditional probability, total probability, Bayes' formula. Independence of events.
	Discrete random variable: probability distribution function and cumulative distribution. A review of selected distributions of discrete random variables: the distribution of single-point, two-point, Binomial, Poisson. Continuous random variable: probability density function and cumulative distribution. A review of selected distributions of continuous random variables: uniform distribution, exponential, normal, chi-square, Student's t. The basic numerical characteristics of discrete and continuous random variables.
	Population and sample; Sampling schemes; the sample distributions. Basic statistics and their distributions; Estimators and their properties; Methods of obtaining estimators; Point estimation; Interval estimation; Testing of statistical hypotheses; The level of significance and power of the test; Parametric tests for one-dimensional population. Parametric tests for two-dimensional population. Tests for multidimensional population. Analysis of variance. Nonparametric tests; Normality tests; Test of independence (chi-square test); Tests of randomness. Sign tests. Tests for outliers; Tests used in the analysis of correlation and regression.

Prerequisites and co-requisites	
	Mathematics, descriptive statistics.

Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	Final exam (lecture)	60.0%	40.0%
	Final test (seminar)	60.0%	30.0%
	Final test (laboratory)	60.0%	30.0%

Recommended reading		
	Basic literature	1. Foundations of Statistics for Data Scientists: With R and Python, Agresti Alan, Taylor & Francis Ltd., 2021. 2. Mathematical Statistics, Leemis Lawrence, Ascended Ideas, 2020. 3. Probability and Statistical Inference, Third Edition, Magdalena Niewiadomska-Bugaj, John Wiley and Sons Ltd, luty 2021
	Supplementary literature	1. Discovering statistics using R, Andy Field, Jeremy Miles, Zoe Field, Sage, 2012. 2. G. Jay Kerns, Introduction to Probability and Statistics using R, Third Edition, 2018.
	eResources addresses	Podstawowe https://docs.python.org/3/library/statistics.html - Mathematical statistics functions Adresy na platformie eNauczanie: Mathematical Statistics 2024/25 - Moodle ID: 39501 https://enauczanie.pg.edu.pl/moodle/course/view.php?id=39501

Example issues/ example questions/ tasks being completed	1. Theoretical and empirical probability distribution and central limit theorem.
	2. Point and interval estimation, precision of the estimator, the minimum sample size required to obtain a specific precision.
	3. Parametric and nonparametric hypothesis testing.
	The final exam will test your knowledge of all the course material taught in the entire course.
Work placement	Not applicable

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