

Subject card

Subject name and code	Statistics II, PG_00156742						
Field of study	Informatics and Econometrics						
Date of commencement of studies	October 2024		Academic year of realisation of subject		2024/2025		
Education level	Bachelor's 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	1		Language of instruction		Polish		
Semester of study	2		ECTS credits		7.0		
Learning profile	academic		Assessment form		credit		
Conducting unit	Department of Statistics -> Faculty of Management -> Rector						
Name and surname of lecturer (lecturers)	Subject supervisor		dr hab. Beata Jackowska				
	Teachers		dr Agnieszka Pobłocka dr hab. Beata Jackowska prof. dr hab. Mirosław Szreder				
Lesson types	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		30.0		70.0	175
Subject objectives	Learning the basics of probability theory, estimation theory and hypothesis testing theory. Familiarization with the possibilities of using statistical inference methods. Acquiring the ability to select appropriate methods for generalizing results from a sample to the entire population and interpreting the obtained results.						

Learning outcomes	Course outcome	Subject outcome	Method of verification
	[liEL3_U07] The student can build formal models of complex economic phenomena and processes, estimate them, carry out their verification, and apply them to modelling, forecasting and optimization of the resources of low-complexity economic institutions, their structure and the course of processes in them.	The student is able to determine the necessary sample size, select and apply appropriate methods of statistical inference and interpret the obtained results (generalize the results from the sample to the entire population).	[SU2] presentation/project/paper/report [SU3] text preparation/written work [SU4] test/exam - oral or written
	[liEL3_U01] The student can comprehensibly, orally and in writing, present and justify advanced economic theories and apply them to explain the functioning of the national economy and its elements. Understands and can explain the content of communications of economic institutions, articles published in the economic press and scientific journals.	The student is able to clearly present and explain the results of statistical analyses of the studied issue in the field of the learned methods of mathematical statistics.	[SU2] presentation/project/paper/report [SU3] text preparation/written work [SU4] test/exam - oral or written
	[liEL3_U05] The student can make a statistical description of advanced economic categories, formulate and verify simple hypotheses on their formation.	The student is able to select and apply appropriate methods of estimation and hypothesis testing and interpret the obtained results.	[SU2] presentation/project/paper/report [SU3] text preparation/written work [SU4] test/exam - oral or written
	[liEL3_K01] The student understands the need to constantly supplement and deepen acquired knowledge; is open to new ideas and teaching methods.	The student understands the need to deepen knowledge in the field of probability theory and mathematical statistics. The student is able to supplement and improve the acquired knowledge and skills.	[SK2] presentation/project/paper/report [SK3] text preparation/written work [SK4] test/exam - oral or written
	[liEL3_K02] The student can communicate with the public on computer science and econometrics topics in and outside the workplace, communicate his knowledge and share his skills through various media.	The student is able to present the studied issue in a way that is understandable to others, independently formulate conclusions based on statistical analyses.	[SK2] presentation/project/paper/report [SK3] text preparation/written work [SK4] test/exam - oral or written
	[liEL3_W04] The student has advanced knowledge of mathematical, statistical, econometric and computer methods of obtaining, processing and analysing data depicting the functioning and development of the national economy and its elements, as well as the phenomena and processes occurring in their environment.	The student knows the basics of probability theory, estimation theory and hypothesis testing theory. The student understands the conditions for applying statistical inference methods. The student knows the principles of designing and conducting a statistical study in accordance with the standards of statistical inference.	[SW4] test/exam - oral or written [SW2] presentation/project/paper/report [SW3] text preparation/written work

Subject contents	Probability theory 1. Definition of a sigma-algebra and a probability measure. Interpretations of probability and properties of probability. 2. Conditional and total probability, Bayes' theorem. Independence of random events. 3. One-dimensional random variables: discrete and continuous random variables, the cumulative distribution function and its properties, moments of the random variable. 4. Selected distributions of a discrete random variable: two-point, binomial, geometric, negative binomial, hypergeometric and Poisson distribution. 5. Selected distributions of a continuous random variable: uniform, exponential and normal distribution. 6. Functions of random variables, truncated distributions. 7. Multivariate random variables: cumulative distribution function and its properties, moments of the random variable, discrete and continuous random variables, marginal distributions, conditional distributions, independence and correlation of random variables. 8. Limit theorems (laws of large numbers, central limit theorem). Mathematical statistics 1. Descriptive statistics and statistical inference. Definition of a simple random sample. A sample statistic as a random variable. Sampling distributions 2. Exact and asymptotic properties of estimators. Point estimation 3. Interval estimation. Definition and interpretation of the confidence interval. Principles for constructing confidence intervals. Principles for determining the minimum sample size. 4. Testing statistical hypotheses. The relationship between type I and type II errors. Significance level, critical region, p-value and power of the test. 5. Parametric tests for: one mean, one proportion, two means, two variances, two proportions. 6. Non-parametric tests: one-sample tests (Kolmogorov-Smirnov test, chi-square test), Shapiro-Wilk test for normality, two-sample tests (Wald-Wolfowitz test, Kolmogorov-Smirnov test, chi-square test, sign test), chi-square test of independence.		
Prerequisites and co-requisites	1. Fundamentals of differential and integral calculus ("Mathematics I" in the 1st semester) 2. Fundamentals of descriptive statistics ("Statistics I" in the 1st semester)		
Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	project in two-person teams	51.0%	33.0%
	written colloquium on mathematical statistics	51.0%	33.0%
	written colloquium on probability theory	51.0%	34.0%
Recommended reading	Basic literature	1. Aczel A. D., Statystyka w zarządzaniu, PWN, Warszawa 2000; 2. Balicki A., Makać W., Metody wnioskowania statystycznego, Wydawnictwo Uniwersytetu Gdańskiego, Gdańsk 2004; 3. Fisz M., Rachunek prawdopodobieństwa i statystyka matematyczna, PWN, Warszawa 1976; 4. Kryszicki W., Bartos J., Dyczka W., Królikowska K., Wasilewski M., Rachunek prawdopodobieństwa i statystyka matematyczna w zadaniach, Część I i II, PWN, Warszawa 2004.	
	Supplementary literature	1. Freund J.E., Walpole R.E., Mathematical Statistics, Prentice-Hall, 1987; 2. Gersternkorn T., Śródka T., Kombinatoryka i rachunek prawdopodobieństwa, PWN, Warszawa 1983; 3. Jakubowski J., Sztencel R., Rachunek prawdopodobieństwa dla (prawie) każdego, SCRIPT, Warszawa 2002; 4. Keller G., Managerial Statistics, South-Western Cengage Learning, 9th edition, 2012; 5. Krzykowski G., Szreder M., Rachunek prawdopodobieństwa i statystyka matematyczna, Część 1. Rachunek prawdopodobieństwa, Wydawnictwo Uniwersytetu Gdańskiego, Gdańsk 2002; 6. Krzyśko M., Statystyka matematyczna, Wyd. Uniwersytetu im. A. Mickiewicza w Poznaniu, 1997; 7. McColl J.H., Probability, Edward Arnold, London 1995; 8. Plucińska A., Pluciński E., Rachunek prawdopodobieństwa. Statystyka matematyczna. Procesy stochastyczne, Wydawnictwa Naukowo-Techniczne, Warszawa, 2000; 9. Szreder M., Istotność statystyczna w czasach Big Data, Wiadomości Statystyczne, vol. 64, 2019; 10. Wycinka E., Szreder M. (red), Zastosowania metod ilościowych w ubezpieczeniach, Wydawnictwo Uniwersytetu Gdańskiego, Gdańsk 2020 (rozdziały 6, 7).	
	eResources addresses		
Example issues/ example questions/ tasks being completed			
Work placement	Not applicable		