University of Gdańsk

Subject card

Subject name and code	Statistical Inference I, PG_00155283		
Field of study	Mathematical Modeling and Data Analysis		
Date of commencement of studies	October 2024	Academic year of realisation of subject	2026/2027
Education level	Bachelor's studies	Subject group	Obligatory subject group in the field of study
Mode of study	full-time studies	Mode of delivery	at the university
Year of study	3	Language of instruction	Polish Not applicable
Semester of study	5	ECTS credits	4.0
Learning profile	academic	Assessment form	exam
Conducting unit	Division of Real Functions -> Institute of Mathematics -> Faculty of Mathematics, Physics and Informatics -> Rector		
Name and surname of lecturer (lecturers)	Subject supervisor	dr Janusz Przewocki	
	Teachers	dr Nikodem Mrożek dr Janusz Przewocki	

Lesson types	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	30.0	15.0	15.0	0.0	0.0	60
	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	60	5.0	35.0	100

Subject objectives	Not applicable

Learning outcomes

Course outcome	Subject outcome	Method of verification
[MMiADL3_W09] knows and understands the basics of computational and programming techniques supporting mathematician's work and understands their limitations	The student: - is familiar with methods for deriving estimators and the properties of estimators; - possesses knowledge regarding the construction of confidence intervals and classical parametric and non-parametric tests, including tests for the normality of a univariate distribution; - possesses knowledge regarding the properties of estimators.	[SW4] test/exam - oral or written
[MMiADL3_U04] correctly uses the concepts of probability theory and statistics, is able - at a simple and medium level of difficulty - to apply the theorems and methods of these fields, and is able to interpret the results obtained	Student: - is able to justify the relationships between the most important distributions in statistics - is able to determine confidence intervals for the mean, variance, and median - is able to examine the properties of estimators - is able to justify the choice of statistical test based on the specific problem	[SU4] test/exam - oral or written
[MMiADL3_U13] knows how to use computer programmes in the field of data analysis	The student: - given a distribution, is able to assess the goodness of fit based on a sample using graphical methods (comparing histograms and density functions, empirical and theoretical cumulative distribution functions, and quantile-quantile plots) as well as appropriate statistical tests; - is able to determine confidence intervals for the mean, variance, and median using computer software; - is able to perform classical comparative analyses for two datasets in both parametric and non-parametric contexts (comparing means, variances, and medians); - is able to interpret the obtained results.	[SU4] test/exam - oral or written
[MMiADL3_W04] knows the basic concepts, methods and theorems of the theory of probability and statistics, and basic examples both illustrating specific concepts in these areas, and allowing to refute incorrect hypotheses or unauthorized reasoning	The student: - is familiar with methods for deriving estimators and the properties of estimators; - possesses knowledge regarding the construction of confidence intervals and classical parametric and non-parametric tests, including tests for the normality of a univariate distribution.	[SW4] test/exam - oral or written
[MMiADL3_K10] is ready to analyse data and communicate the conclusions of such analysis in an accessible form	The student is prepared to analyze data and communicate the conclusions of such analysis in an accessible form.	[SK8] observation of student's independent or team work
[MMiADL3_U09] is able to use the learned software package or the learned programming language to solve selected problems from the known fields, in particular from mathematical analysis, linear algebra and statistics	The student: - is able to use key programming constructs in a selected programming language (e.g., R, Python) - is able to write code that enables efficient data processing in a selected programming language - is able to visualize data in a selected programming language	[SU4] test/exam - oral or written

Subject contents	1. Selected statistics and their distributions – estimators of the mean and variance. 2. Estimation of distribution parameters. Methods for deriving estimators (method of moments, maximum likelihood estimation). 3. Properties of estimators (consistency, unbiasedness, asymptotic normality). Interval estimation. 4. Confidence intervals for the expected value and variance. 5. Statistical hypothesis testing: Type I and Type II errors, test power, Neyman-Pearson lemma. 6. Testing for normality. Selected parametric tests (significance tests for the mean and variance, tests for the difference between means of two populations, tests for homogeneity of variance). 7. Selected nonparametric tests (e.g., Mann-Whitney test, Kolmogorov-Smirnov test, Wilcoxon test, Pearson's chi-squared test). 8. Practical application of the above topics using R and Statistica software packages.
Prerequisites and co-requisites	Knowledge of the fundamentals of mathematical analysis and probability theory.

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
oral or written exam	51.0%	50.0%
observation of the student's attitude	100.0%	0.0%
test	51.0%	50.0%

Recommended reading

Basic literature	1. P. Biecek, Przewodnik po pakiecie R, Wrocław : Oficyna Wydawnicza GIS, cop. 2008. 2. W. Krysicki, J. Bartos, W. Dyczka, K. Królikowska, M. Wasilewski, Rachunek prawdopodobieństwa i statystyka matematyczna w zadaniach - częśćII, PWN W-wa 2012. 3. Y. Cohen, J.Y. Cohen, Statistics and data with R, Wiley.
Supplementary literature	1. S.J. Sheather, A modern approach to regression with R,Springer. 2. B. Efron, R. Tibshirani, An introduction to the bootstrap, Chapman&Hall. 3. H. Wicham, ggplot2: Elegant graphics for data analysis, Springer.
eResources addresses	

Example issues/ example questions/ tasks being completed	Not applicable
Work placement	Not applicable

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