



Subject card

Subject name and code	MULTIVARIATE DATA ANALYSIS, PG_00070521						
Field of study	Economic Analytics						
Date of commencement of studies	October 2026		Academic year of realisation of subject		2027/2028		
Education level	second-cycle studies		Subject group		Specialty subject group 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		3.0		
Learning profile	general academic profile		Assessment form		exam		
Conducting unit	Department of Statistics and Econometrics -> Faculty of Management and Economics -> Faculties of Gdańsk University of Technology						
Name and surname of lecturer (lecturers)	Subject supervisor		dr hab. Marta Kuc-Czarnecka				
	Teachers						
Lesson types	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	15.0	0.0	30.0	0.0	0.0	45
	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	45		3.0		27.0	75
Subject objectives	preparation of students to apply advanced methods of multi-dimensional analysis in solving complex socio-economic and business problems.						
Learning outcomes	Course outcome		Subject outcome		Method of verification		
	[K7_K03] responsibly fulfills professional roles, demonstrating the ability to identify ethical dilemmas and recognize and evaluate alternative courses of action.		is able to select and apply multivariate analysis methods to complex problems, integrating data from multiple sources and placing them in a coherent analytical context.		[SK4] Assessment of communication skills, including language correctness [SK5] Assessment of ability to solve problems that arise in practice		
	[K7_W06] knows and understands the principles of evaluating the reliability of utilized data, applying in-depth specialized knowledge in the field of economic analysis.		knows and understands approaches to assessing data quality and reliability in multivariate analysis and their importance for interpreting complex economic phenomena.		[SW3] Assessment of knowledge contained in written work and projects		
	[K7_U01] creates innovative solutions for complex and unstructured processes, considering unpredictable environmental conditions through the synthesis of information from various sources.		is ready to use data analysis methods responsibly, recognising their limitations and the ethical considerations associated with their application.		[SU1] Assessment of task fulfilment [SU2] Assessment of ability to analyse information [SU3] Assessment of ability to use knowledge gained from the subject [SU4] Assessment of ability to use methods and tools [SU5] Assessment of ability to present the results of task		

Subject contents	Course content – lecture 1. Fundamentals of Multivariate Statistical Analysis (MSA) 2. Databases. Eurostat, OECD, World Bank and ILO as the main source of data for multivariate analysis 3. Possibilities of using MSA for socio-economic and business analysis 4. Selection of diagnostic variables, similarity measures 5. Selection of diagnostic variables, similarity measures 6. Transformation of diagnostic variables 7. Cluster analysis (hierarchical methods, k-means method, density-based clustering (DBSCAN)) 8. Principal Component Analysis (PCA) 9. Sparse Principal Component Analysis 10. Factor Analysis 11. Correspondence Analysis 12. Discriminant Analysis 13. Multidimensional Scaling		
	Course content – laboratory 1. Fundamentals of Multivariate Statistical Analysis (MSA) 2. Databases. Eurostat, OECD, World Bank and ILO as the main source of data for multivariate analysis 3. Possibilities of using MSA for socio-economic and business analysis 4. Selection of diagnostic variables, similarity measures 5. Selection of diagnostic variables, similarity measures 6. Transformation of diagnostic variables 7. Cluster analysis (hierarchical methods, k-means method, density-based clustering (DBSCAN)) 8. Principal Component Analysis (PCA) 9. Sparse Principal Component Analysis 10. Factor Analysis 11. Correspondence Analysis 12. Discriminant Analysis 13. Multidimensional Scaling		
Prerequisites and co-requisites	Knowledge of descriptive and mathematical statistics		
Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	Group project	60.0%	50.0%
	Oral exam	60.0%	50.0%
Recommended reading	Basic literature	1. Daniel J. Denis (2021). Applied Univariate, Bivariate, and Multivariate Statistics : Understanding Statistics for Social and Natural Scientists, with Applications in SPSS and R 2. Rencher A. Christensen W. (2011). An Introduction to Applied Multivariate Analysis with R	
	Supplementary literature	1. Rencher A. Christensen W. (2012). Methods of Multivariate Analysis	
	eResources addresses		
Example issues/ example questions/ tasks being completed	1. Explain what the transformation of diagnostic variables entails in multivariate statistical analysis. 2. What is the interpretation of the Euclidean distance in cluster analysis, and when should it not be used? 3. In principal component analysis (PCA), how should the variance explained by each component be interpreted?		
Practical activities within the subject	Not applicable		

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