

Subject card

Subject name and code	Multivariate Analysis, PG_00157317						
Field of study	Information Science and Econometrics						
Date of commencement of studies	October 2024		Academic year of realisation of subject		2024/2025		
Education level	postgraduate 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	1		ECTS credits		6.0		
Learning profile	academic		Assessment form				
Conducting unit	Katedra Statystyki -> Faculty of Management						
Name and surname of lecturer (lecturers)	Subject supervisor		dr hab. Kamila Migdał-Najman				
	Teachers		dr hab. Kamila Migdał-Najman				
Lesson types	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	15.0	0.0	15.0	0.0	0.0	30
	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	30		25.0		95.0	150
Subject objectives	1. Learning the essence of the multidimensional approach in statistical research.2. Free use of acquired knowledge in solving socio-economic problems.3. Understanding the purpose of the multidimensional methods used and the interpretation of the obtained results in relation to economic phenomena.						

Learning outcomes	Course outcome	Subject outcome	Method of verification
	[liEMU2_K02] The student can communicate freely with the public on specialised topics in the field of computer science and econometrics in and outside the workplace, communicate his knowledge and share his skills through various media. Culturally participates in discussions, is not afraid to ask questions and knows how to give constructive criticism.	The student is able to establish communication with the environment in the field of specialist topics in the field of computer science and econometrics. The student is able to convey his knowledge, share it using various media. The student discusses, asks questions and expresses constructive criticism in the methodological and practical area.	[SK1] oral statement/conversation/discussion [SK2] presentation/project/paper/report [SK8] observation of student's independent or team work
	[liEMU2_K01] The student understands the need for continuous completion and deepening of acquired knowledge. The student inspires and organizes others' learning processes.	The student understands the need to constantly supplement and deepen knowledge in the area of statistical methods of multivariate analysis. He is able to inspire and organize the learning process of others.	[SK4] test/exam - oral or written [SK5] implementation of a problem task
	[liEMU2_U02] The student is able to proficiently acquire detailed information about economic processes and phenomena through direct observation, planned experimentation or database queries, as well as collect and process it using modern information technology tools.	The student is able to plan the research organization stage in the research process, including data collection. The student is able to obtain multidimensional data sets describing socio-economic processes and phenomena. The student is able to process the obtained data using modern IT tools.	[SU3] text preparation/written work [SU5] implementation of a problem task
	[liEMU2_U09] The student has an in-depth ability to prepare written works, oral speeches and multimedia presentations on the functioning and growth of the national economy and its components, the course of complex economic phenomena and processes, the acquisition of data about them, their collection, processing and analysis with the help of modern mathematical, statistical, econometric and IT tools, as well as their use in modeling, forecasting and optimization.	The student has an in-depth ability to prepare written works, oral presentations and multimedia presentations using multivariate statistical analysis methods. The student is able to acquire and collect data on the studied phenomena and socio-economic processes. The student is able to process and analyze multivariate sets using modern statistical and IT tools.	[SU1] oral statement/conversation/discussion [SU3] text preparation/written work [SU5] implementation of a problem task
	[liEMU2_U01] The student can comprehensibly, orally and in writing, present and justify in depth advanced economic theories and apply them to explain the functioning of the national economy and its components. Understands and can explain the content of communications from economic institutions, articles in the economic press and scientific journals.	The student is able to present in an understandable way and justify in-depth advanced methods of multivariate statistical analysis to explain the functioning of the national economy and its components. The student is able to explain the content of announcements of economic institutions, articles published in the economic and scientific press, which contain methods of multivariate statistical analysis.	[SU1] oral statement/conversation/discussion [SU2] presentation/project/paper/report [SU6] demonstration of practical skills [SU8] observation of student's independent or team work
	[liEMU2_U05] The student is able to make a statistical description of basic and detailed economic categories at an advanced level, formulate and verify hypotheses about their formation.	The student is able to perform advanced analysis of a multidimensional data set, interpret the obtained results and present conclusions.	[SU2] presentation/project/paper/report [SU3] text preparation/written work [SU5] implementation of a problem task [SU6] demonstration of practical skills
	[liEMU2_W05] The student has an in-depth knowledge of socio-economic data sources, their databases and how to create them.	The student has in-depth knowledge of the sources of multidimensional socio-economic data, their databases and methods of creation.	[SW1] oral statement/conversation/discussion [SW2] presentation/project/paper/report [SW3] text preparation/written work

	Course outcome	Subject outcome	Method of verification
	[liEMU2_U07] The student is able to build advanced formal models of complex economic phenomena and processes, estimate them, carry out their verification and apply them to modeling, forecasting and optimization of resources of economic institutions of varying degrees of complexity, their structure and the course of processes in them.	The student is able to use advanced methods of statistical multivariate analysis, which they can use to describe complex economic phenomena and processes. The student is able to apply methods of statistical multivariate analysis, verify the obtained results and apply the results to describe socio-economic processes and phenomena.	[SU2] presentation/project/paper/report [SU3] text preparation/written work [SU6] demonstration of practical skills
	[liEMU2_K04] The student can work in a team, co-create it, effectively manage and supervise it; efficiently adapts his behavior and conduct to his role in it; is ready to take responsibility for the team and bear the consequences; understands the necessity of systematicity and consistency in action; is open to other team members and critical of himself.	The student is able to work in a team, co-create it, effectively manage it and supervise it. Is able to propose solutions and adapt them to market needs. Is ready to take responsibility for the team and face the consequences. Understands how important systematic consistency and regularity in action are. Is open to other team members. Is critical of oneself.	[SK1] oral statement/conversation/discussion [SK6] demonstration of practical skills [SK8] observation of student's independent or team work
	[liEMU2_W04] The student has an in-depth knowledge of advanced mathematical, statistical, econometric and IT methods that enable the acquisition, processing and analysis of data reflecting the functioning and growth of the national economy and its components, as well as the phenomena and processes occurring in their environment.	The student has in-depth knowledge in the area of advanced methods of statistical multivariate analysis. The student is able to apply the methods in practice. The student understands the idea of methods of statistical multivariate analysis. The student is able to describe socio-economic processes and phenomena using these methods.	[SW4] test/exam - oral or written [SW2] presentation/project/paper/report [SW3] text preparation/written work
	[liEMU2_K06] The student knows the need for ethical, sustainable and socially responsible behavior in professional and social life. Initiates and organises activities for the social environment and public interest.	The student is aware of ethical, sustainable and socially responsible behavior in professional and social life when using and applying multivariate statistical analysis methods in economic life. He is able to initiate and organize a team that can use the discussed methods.	[SK5] implementation of a problem task [SK8] observation of student's independent or team work
	[liEMU2_K03] The student is able to communicate freely with the public inside and outside the workplace, transfer his knowledge and share his skills through various media.	The student is able to communicate with the environment in the workplace and beyond. He is able to indicate the usefulness of multidimensional solutions in socio-economic research, and is able to share this knowledge.	[SK1] oral statement/conversation/discussion [SK2] presentation/project/paper/report [SK6] demonstration of practical skills [SK8] observation of student's independent or team work
Subject contents	Introductory issues: The essence of multivariate analysis and a brief historical outline; Scope and classification of multivariate analysis methods; Multivariate observations; Covariance matrix and correlation matrix. Principal component analysis: The essence and model of component analysis; Hotelling's method of determining principal components; Stages of component analysis; Interpretation of the results of principal component analysis; Applications of principal component analysis. Cluster analysis: The essence of cluster analysis; Similarity of objects and its measurement. Distance (similarity) matrix; Measurement of similarity of objects for quantitative features by distance; Measurement of similarity of objects for quantitative features by correlation; Variable normalization procedures; The essence of agglomerative hierarchical clustering; Hierarchical clustering methods: nearest neighbor method; farthest neighbor method; group mean method; centroid method; median method; Ward's method; flexible strategy. Lance and Williams scheme; Evaluation of clustering based on a dendrogram. Cophenetic correlation; Non-hierarchical grouping procedures: the idea of partition grouping; partition grouping algorithms. Choosing the number of groups. Interpreting and profiling groups; Linear ordering: The essence of linear ordering; The pattern method of development: determining the nature of variables; solution in the pattern method, weighting and normalization of variables; Other simple methods of linear ordering: the standardized sum method, methods using other normalization procedures; the rank sum method; the distance method; other methods; Ordering by the first principal component; Discriminant analysis: The essence of discriminant analysis; Classical linear discriminant analysis. Estimation of Fisher's discriminant function; Generalization of discriminant analysis; Other discrimination methods. Other methods of multivariate analysis.		
Prerequisites and co-requisites	The student should have basic knowledge of descriptive statistics and mathematical statistics.		
Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	final project	51.0%	50.0%
	written exam	51.0%	50.0%

Recommended reading	Basic literature	1. Balicki A. (2009), Statystyczna analiza wielowymiarowa i jej zastosowania społeczno-ekonomiczne, UG, Gdańsk 2. Jajuga K. (1993) Statystyczna analiza wielowymiarowa, PWN, Warszawa 3. Manly B.F.J. (1994) Multivariate Statistical Methods, Chapman & Hall / CRC, Boca Raton
	Supplementary literature	1. Morrison D.M. (1990) Wielowymiarowa analiza statystyczna, PWN, Warszawa 2. Statystyczna analiza danych z wykorzystaniem programu R / redaktor naukowy Marek Walesiak, Eugeniusz Gatnar, PWN, Warszawa (2012)
	eResources addresses	Adresy na platformie eNauczanie:
Example issues/ example questions/ tasks being completed		
Work placement	Not applicable	

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