

Course Syllabus**I. General Information**

Course name	Multidimensional data analysis
Programme	Mathematics
Level of studies (BA, BSc, MA, MSc, long-cycle MA)	BA
Form of studies (full-time, part-time)	Full-time studies
Discipline	Mathematics
Language of instruction	english

Course coordinator/person responsible	Dr Małgorzata Nowak-Kępczyk
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Type of class (<i>use only the types mentioned below</i>)	Number of teaching hours	Semester	ECTS Points
lecture	30	III or V	5
tutorial			
classes	30	III or V	
laboratory classes			
workshops			
seminar			
introductory seminar			
foreign language classes			
practical placement			
field work			
diploma laboratory			
translation classes			
study visit			

Course pre-requisites	First course in statistics, linear algebra, probability theory.
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II. Course Objectives

C1. Introduction to the basic methods of multidimensional data analysis
C2. Developing the skills of proper interpretation of multidimensional data

III. Course learning outcomes with reference to programme learning outcomes

Symbol	Description of course learning outcome	Reference to programme learning outcome
KNOWLEDGE		
W_01	The student understands the importance of mathematics and its applications, in particular its role in the context of contemporary civilization's dilemmas	K_W01
W_02	The student has advanced knowledge of the basic areas of higher mathematics, in particular in calculus, algebra, geometry, logic, measure and integral, probability theory, differential equations, statistics, set theory, topology and others selected fields of mathematics and its applications.	K_W04
SKILLS		
U_01	The student can in a clear manner, in speech and writing, present correct mathematical reasoning, formulate theorems and definitions	K_U38
SOCIAL COMPETENCIES		
K_01	The student is prepared to appreciate the role and importance of knowledge in solving cognitive and practical problems, typical of occupations and workplaces appropriate for graduates in the field of mathematics and consulting experts in the case of difficulties in solving the problem	K_K02
K_02	The student is ready to present selected achievements of higher mathematics in a popular way	K_K05

IV. Course Content

1. Basic concepts of statistics, multidimensional random variables, types of distributions probability density
2. Linear regression, correlation and covariance - definitions and applications
3. Testing statistical hypotheses, analysis of variance
 - a. formulation of hypotheses
 - b. types and selection of statistical tests
 - c. test reliability criteria and statistical confidence intervals
5. Basic methods of dimensionality reduction and data representation
6. Principal component analysis, discriminant analysis - definitions and examples of applications
7. Cluster analysis, main components and factor analysis
8. Analysis of canonical correlation
9. Decision trees
10. Multi-dimensional scaling

V. Didactic methods used and forms of assessment of learning outcomes

Symbol	Didactic methods <i>(choose from the list)</i>	Forms of assessment <i>(choose from the list)</i>	Documentation type <i>(choose from the list)</i>
KNOWLEDGE			
W_01	Conventional lecture	Exam, tests	Filled, evaluated tests and exams
W_02	Discussion, problem solving	Evaluation during classes	Grade sheets
SKILLS			
U_01	Practical classes	Submitted spreadsheets, documentation	Printouts
SOCIAL COMPETENCIES			
K_01	Work in pairs	Submitted spreadsheets, documentation	Printouts
K_02	Discussion, problem solving	Evaluation during classes	Grade sheets

VI. Grading criteria, weighting factors...

Passing exercises - 2 tests on the 6th and 12th exercises,

the colloquium may be moved to another date after agreeing with the students.

Written exam - for people who have passed the exercises.

The student may be released from the written part of the examination on the basis of the result obtained in the tests. Detailed conditions of the release are given to students with each edition of the course.

Detailed rules of assessment are given to students with each edition of the subject.

VII. Student workload

Form of activity	Number of hours
Number of contact hours (with the teacher)	30
Number of hours of individual student work	50

VIII. Literature

Basic literature
J. Hair, W.C. Black, et al., Multivariate Data Analysis: Pearson New International Edition, (2014)
Additional literature
1. M. Zaki, W. Meira, Data Mining and Analysis: Fundamental Concepts and Algorithms, 2014
2. Neil H. Spencer, Essentials of Multivariate Data Analysis (2013)
3. J. Leskovec, A. Rajaraman, J. D. Ullman, Mining of Massive Datasets, Stanford. Univ. 2019.
4. R. Zafarani, M.A. Abbasi, H. Liu, Social Media Mining, Oxford Univ. Press 2014