Course Syllabus

I.   General Information

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

Course coordinator/person responsible	dr Kamil Powroźnik

Type of class *(use only the types mentioned below)*	Number of teaching hours	Semester	ECTS Points
lecture	30	VI	5
tutorial			
classes	30	VI	
laboratory classes			
workshops			
seminar			
introductory seminar			
foreign language classes			
practical placement			
field work			
diploma laboratory			
translation classes			
study visit			

Course pre-requisites	1. Fundamentals of differential and integral calculus. 2. Fundamentals of probability theory.	

II.   Course Objectives

1. To familiarise students with the methods and procedures of descriptive statistics and mathematical statistics that are used to analyse statistical data.
2. To familiarise students with the elements of descriptive statistics, including statistical measures and their interpretation and ways of presenting data.
3. To familiarise students with the elements of statistical inference, including methods of estimation and verification of statistical hypotheses.

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 statistical analysis of data and its applications, in particular its role in the context of the dilemmas of modern civilisation.	K_W01
W_02	The student has advanced knowledge of the basic areas of higher mathematics, in particular in statistical analysis of data and its applications.	K_W04
W_...		
SKILLS		
U_01	The student is able to use his knowledge of statistical analysis of data to formulate complex and non-typical mathematical problems in a correct and comprehensible way, discuss them and methods of solving them, and present mathematical results and contents, in particular using information and communication techniques.	K_U38
U_...		
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 prepared to present selected developments in statistical data analysis to the layperson in a popular manner.	K_K05
K_...		

IV.   Course Content

1. The concept of statistics, its objectives and its application in other fields of science. Examples of statistical problems.
2. Basic concepts in statistics such as general population, sample, statistical data. Statistical features: qualitative and quantitative features, discrete and continuous features. Measurement scales.
3. Forms of presentation of statistical material: tabular and graphic. Construction of point and interval series. Histogram and other graphs.
4. Measures of central tendency: mean, dominant, quantiles, and others. Measures of variability: variance, standard deviation, quarter deviation, coefficient of variation, and others. Measures of asymmetry. Measures of concentration.
5. Selected distributions of random variables, e.g. normal distribution, Student's t distribution, Poisson distribution, binomial distribution, exponential distribution. Standardisation of a random variable. Generation of pseudorandom numbers from selected distributions.
6. The issue of the estimator. Review of basic estimators. Properties of estimators.
7. Point estimation - determination of estimators by the method of moments and the method of maximum likelihood.
8. Interval estimation - construction of confidence intervals.

9. Verification of statistical hypotheses. Basic concepts such as null and alternative hypothesis, significance level, empirical and theoretical statistics, error of I and II kind, power of test, rejection area and others.
10. Selected parametric tests.
11. Selected non-parametric tests.
12. Analysis of interdependence of phenomena - the issue of correlation and regression.
13. Time series.
14. Introduction to simulation methods - the Monte Carlo method and its applications.

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

Symbol	Didactic methods *(choose from the list)*	Forms of assessment *(choose from the list)*	Documentation type *(choose from the list)*
KNOWLEDGE			
W_01	Conventional lecture, guided practice	Exam, written test	Evaluated written exam, evaluated written test, protocol
W_02	Conventional lecture, guided practice	Exam, written test	Evaluated written exam, evaluated written test, protocol
W_...			
SKILLS			
U_01	Practical classes, guided practice	Exam, written test	Evaluated written exam, evaluated written test, protocol
U_...			
SOCIAL COMPETENCIES			
K_01	Discussion, practical classes	Exam, written test	Evaluated written exam, evaluated written test
K_02	Discussion, practical classes	Exam, written test	Evaluated written exam, evaluated written test
K_...			

VI. Grading criteria, weighting factors.....

Specific grading policies are given to students in the first class.

Credit of the lecture:

Examination in written form (for students who have obtained credit from classes).

The examination grade is given according to the following rules:

[90%-100%] of points - very good (5),

[80%,90%) - good plus (4.5),

[70%,80%) - good (4),

[60%,70%) - sufficient plus (3.5),

[50%,60%)- satisfactory (3),

below 50% - unsatisfactory (2).

Credit for classes:

Two written tests using computer tools to analyse statistical material (e.g. Excel, SPSS).

Final grade is given according to the following rules:

[90%-100%] of points - very good (5),

[80%,90%) - good plus (4.5),

[70%,80%) - good (4),

[60%,70%) - sufficient plus (3.5),

[50%,60%) - satisfactory (3),

below 50% - unsatisfactory (2).

VII.   Student workload

Form of activity	Number of hours
Number of contact hours (with the teacher)	*90*
Number of hours of individual student work	*60*

VIII.   Literature

Basic literature
1. Z. Holcomb, „Fundamentals of Descriptive Statistics", Routledge, 1997. 2. D. Rach, D. Schott, "Mathematical Statistics", Wiley, 2018. 3. D. Freedman, R. Pisani, R. Pruves, "Statistics", W W Norton & Co Inc. 4. P. Sahu, S. Pal, A. Das, „Estimation and Inferential Statistics", Springer, 2015. 5. David Sheskin, "Handbook of Parametric and Nonparametric Statistical Procedures", CRC 2003. 6. Notes from lectures.
Additional literature
1. J.C. Watkins, „An introduction to the Science of Statistics: from theory to implementation". 2. R.S. Burington, D.C. May, "Handbook of Probability and Statistics with Tables", McGraw-Hill Book Company.