Module/Course Syllabus
Program: COMPUTER SCIENCE
Full-time master degree program

Course:	Experiment Planning and Results Analysing
Type of the course:	directional
Course code:	I2S1.03
Year:	I
Semester:	1
Form of the degree program:	full-time
Form of classes and number of hours per semester:	60
Lecture	30
Classes	0
Laboratory	30
Project	0
Number of ECTS credits:	4
Form of assessment:	Exam
Course language:	English

Course objective (CO)	
CO1	Familiarizing with advanced concepts, theorems and methods of mathematical statistics. Acquisition by the student of the ability to use these methods in the R program.
CO2	Acquisition of knowledge on planning a scientific experiment, analysis of results, drawing conclusions and presenting results.

Prerequisites in terms of knowledge, skills and other competencies	
1	Knowledge of the calculus of probability and the basics of mathematical statistics.
2	Knowledge of basics programming in C++.

Learning outcomes (LO)	
	In terms of knowledge:
LO 1	He has knowledge of advanced methods of mathematical statistics and their use in the R program for data analysis.
LO 2	Has knowledge of a scientific experiment, analysis of results and ways of presenting them.
	In terms of skills:
LO 3	Can analyze and develop experimental data using the methods of mathematical statistics using the tools of the R program.
LO 4	He is able to present and verify the hypotheses concerning the experiment and indicate the factors influencing the result of the experiment. In addition, he can find relationships between such factors and make a critical assessment of the results obtained.
	In terms of social competence:
LO 5	He is ready to critically assess his knowledge and received content.

Course content	
Form of classes – lectures (L)	
	Course content
L1	Measurement units, measurement. Introduction to the R program.

L2	Measurement error and uncertainty - statistical models.
L3	General Population and Sample. Distributions of random variables. Histograms and the empirical distribution function. Randomization.
L4	Estimation and estimators. Construction of confidence intervals.
L5	Verification of statistical hypotheses. Parametric and non-parametric hypotheses.
L6	Distribution compatibility tests. Pearson chi-square test, Kolmogorov-Smirnov test. Testing the normality of distributions.
L7	Independence tests. Contingency tables. Qualitative data analysis.
L8	Analysis of the relationship between variables, correlation relationship. Correlation measures.
L9	Regression. Linear and non-linear regression. Factor analysis.
L10	Analysis of variance.
L11	Functional dependency graphs. Least squares method. Testing the significance of the impact.
L12	Experiment planning. Plackett-Burman method.
Form of classes – laboratories (Lab)	
	Course content
Lab1	Basics of working with the R program: variables, operators, functions.
Lab2	Data structures in the R program. Creating data frames.
Lab3	Random sample: math and statistical functions in R. Performing calculations and presenting results in R.
Lab4	Discrete and continuous probability distributions in R. Generating numbers and random samples in R. Plotting, histograms, and empirical distributions in R.
Lab5	Estimation of distribution parameters in R. Determination and presentation of confidence intervals in R.
Lab6	Statistical hypothesis testing in R. Significance tests in R.
Lab7	Compatibility of distributions in R. Presentation of results: histograms, distribution functions, PP graphs, QQ graphs. Choosing the right packages. Model verification.
Lab8	Independence testing in R. Creating contingency tables in R. Using the chi-square test in R. Categorical variables and their analysis. Testing the randomness of the sample.
Lab9	Investigation of the correlation relationship between features in R. Determination of correlation measures.
Lab10	Study of relationships between variables. Plotting regression lines and curves in R.
Lab11	Verification of statistical hypotheses using analysis of variance methods in R.

Didactic methods	
1	Lecture with multimedia presentation.
2	Laboratory exercises: performing exercises.
3	Project.

Assessment methods and criteria		
Assessment method symbol	**Assessment method description**	**Passing threshold**
A1	Exam	51%
A2	Pass	51%

Required textbooks and other course materials	
1	Dalgaard P. Introductory Statistics with R, Springer, 2008

2	Korzyński M., Experiment methodology, WNT, 2017
3	Górecki T., Basic statistics in R, Publishing house BTC, Legionowo, 2011
Recommended textbooks and other course materials	
1	Montgomery D., Design and analysis of experiments, Wiley&Sons, 2005

Student workload	
Form of activity	**Average number of hours to complete the activity**
Contact hours with the lecturer, including:	60
participation in lectures	30
participation in laboratories	30
Student's own work, including:	40
preparation for the laboratory	10
implementation of the project	20
preparation for the exam	10
Total student workload	100
Total number of ECTS credits	4

Learning outcomes matrix					
Learning outcome	**Reference to learning outcomes defined for the master's program**	**Course objectives**	**Course content**	**Didactic methods**	**Assessment methods**
LO1	I2A_W06 +++ I2A_W10 +++	CO1	L3 - L10	1	A1
LO2	I2A_W06 +++ I2A_W10 +++	CO2	L1, L3, L12	1	A1
LO3	I2A_U04 +++ I2A_U12 +++	CO1	Lab1 - Lab6	2, 3	A2
LO4	I2A_U04 +++ I2A_U12 +++	CO2	Lab7 - Lab11	2, 3	A2
LO5	I2A_K01 ++	CO1, CO2	L7 - L12	1	A1

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