**Course Syllabus**

## I. General Information

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|---|---|
| Course name | STATISTICS |
| 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 |

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| 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 | | | |

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| Course pre-requisites | 1. Fundamentals of differential and integral calculus.<br>2. Fundamentals of probability theory. |

## II. Course Objectives

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| 1. To familiarise students with statistical methods, tools and procedures. |
| 2. To develop the ability to analyse statistical material and interpret the results obtained. |
| 3. To develop the ability to make statistical inferences by using estimation methods and statistical tests. |

## 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 statistics and its applications, in particular its role in the context of the dilemmas of modern civilisation. | K_W01 |
| W_02 | The student knows the statistical tools and the conditions and assumptions that must be met in order to apply them. | K_W02 |
| W_03 | The student understands the structure of mathematical theories, can use mathematical formalism to build and analyse simple mathematical models in other sciences. | K_W03 |
| W_04 | The student knows basic concepts of descriptive statistics and methods of presentation and description of statistical material. | K_W04 |
| W_05 | The student knows and understands basic concepts and theorems in mathematical statistics, including the issue of estimation and verification of statistical hypotheses. | K_W04, KW_05 |
| W_06 | The student knows examples illustrating specific statistical concepts and problems and examples allowing to refute false hypotheses or unsupported argumentation. Student knows and understands the rules of applying and using statistical tests. | K_W05 |
| SKILLS | | |
| U_01 | The student, depending on the research problem, can choose an appropriate statistical method, conduct statistical analysis of data, draw conclusions and present them in an understandable way both in speech and writing. | K_U01, K_U02, K_U03, K_U04, K_U05, K_U06 |
| U_02 | The student can employ statistical population characteristics and their sample equivalents. | K_U34 |
| U_03 | The student is able to determine estimators and study their properties and is able to construct confidence intervals. The student is able to use statistical tests to verify statistical hypotheses referring to given problems. | K_U35 |
| SOCIAL COMPETENCIES | | |
| K_01 | The student is ready to consider the limits of his own knowledge and skills, adequately assesses the level of his competence, his weaknesses, the need for constant improvement of his professional competence, and At the same time he knows his strengths and presents a critical attitude towards opinions not supported by rational justification. | K_K01 |
| K_02 | The student is prepared to make a popular presentation of selected developments in higher mathematics, including statistics, to the layperson. | K_K05 |
| K_... | | |

## IV. Course Content

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| 1. Elements of probability calculus. Random variables. Selected distributions of continuous and discrete type. Normal distribution and its properties.<br>2. The concept of statistics and its functions. Basic issues in statistics such as population, sample, statistical feature, statistical data and others. Statistical survey - its stages and objectives.<br>3. Ways of presenting statistical material.<br>4. Calculation and interpretation of statistical measures. Measures of location, variability, asymmetry and concentration.<br>5. Interdependence of statistical characteristics. The issue of correlation and regression.<br>6. The concept of an estimator. Examples of estimators of parameters of feature distribution in general population. Properties of estimators: unbiasedness, consistency, mean square error, efficiency.<br>7. Point estimation. Determination of estimators by method of moments and by method of maximum likelihood.<br>8. Interval estimation. Construction of confidence intervals for mean, variance, and structure index.<br>9. Statistical hypothesis verification. Basic concepts such as null and alternative hypothesis, significance level, empirical and theoretical statistics, error of I and II kind, power of test, area of rejection and others.<br>10. Parametric hypothesis verification for mean, variance, and structure index.<br>11. Estimation and significance test for correlation coefficient. Homogeneity tests for linear correlation coefficients. Estimation and significance tests for linear regression coefficients. Test of parallelism.<br>12. Consistency tests of distributions, e.g., chi-square test, Kolmogorov lambda test, and others. Normality tests.<br>13. Chi-square test of independence.<br>14. Tests based on runs theory (verification of hypotheses concerning randomness of sample, identity of distributions of two populations and linear form of regression function).<br>15. Verification of hypotheses that two or more samples are from the same population (sign test, ranked sign test, rank sum test, median test). |

## 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_03 | Conventional lecture, guided practice | Exam, written test | Evaluated written exam, evaluated written test, protocol |
| W_04 | Conventional lecture, guided practice | Exam, written test | Evaluated written exam, evaluated written test, protocol |
| W_05 | Conventional lecture, guided practice | Exam, written test | Evaluated written exam, evaluated written test, protocol |
| W_06 | Conventional lecture, guided practice | Exam, written test | Evaluated written exam, evaluated written test, |

| | | | |
|---|---|---|---|
| | | | protocol |
| | | SKILLS | |
| U_01 | Practical classes, guided practice | Exam, written test | Evaluated written exam, evaluated written test, protocol |
| U_02 | Practical classes, guided practice | Exam, written test | Evaluated written exam, evaluated written test, protocol |
| U_03 | Practical classes, guided practice | Exam, written test | Evaluated written exam, evaluated written test, protocol |
| | | 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.....**

Credit of the lecture:

Written exam testing theoretical knowledge and the ability to apply acquired knowledge in practice.
Final evaluation criteria:
[0-50%) of the points - failing grade (2),
[50%-60%) - pass mark (3),
[60%-70%) - sufficient plus (3.5),
[70%-80%) - good grade (4),
[80%-90%) - good grade plus (4.5),
[90%-100% ]- very good grade (5).

Credit for classes:

Two tests during the semester (written tests using computer programs for statistical data analysis).
Final evaluation criteria:
[0-50%) of the points - failing grade (2),
[50%-60%) - pass mark (3),
[60%-70%) - sufficient plus (3.5),
[70%-80%) - good grade (4),
[80%-90%) - good grade plus (4.5),
[90%-100% ]- very good grade (5).

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

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