**CARD of course**

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| Subject name | **Mathematical statistics** |

1. Location of the subject in the system of studies

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| --- | --- |
| 1.1. Programme | Management |
| 1.2. Mode of study | Full time studies |
| 1.3. Level of degree | Master’s degree |
| 1.4. Profile | Practical |

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| 1.5. Speciality | - |
| 1.6. Lecturer responsible for the subject | Paweł Wlaź |

2. General characteristic of the subject

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| --- | --- |
| 2.1. Connection with a subject group | Directional/practical |
| 2.2. Total credits (ECTS) | 3 |
| 2.3. Language of instruction | English |
| 2.4. Semesters in which the subject is carried out | II |
| 2.5. Criterion for selection of listeners | - |

1. Learning outcomes and method of conducting classes
   1. Aim of the subject

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| --- | --- |
| Lp. | Aim of the subject |
|
| C1 | To acquaint students with the concept of probabilistic space, the concept of a random variable and its distribution, as well as the basic probability distributions and their properties |
| C2 | To acquaint students with the basic concepts of mathematical statistics: statistical feature, population, simple random sample, sample statistics, distribution of sample statistics, empirical distribution |
| C3 | To acquaint students with the issue of point and interval estimation, with particular emphasis on various models of interval estimation and the problem of the necessary number of measurements |
| C4 | To familiarize students with the theory of verification of statistical hypotheses and to review the most commonly used one- and two-parameter significance tests, significance tests in correlation and regression analysis, non-parametric tests (randomness, consistency, homogeneity) |

* 1. Learning outcomes, divided into KNOWLEDGE, SKILLS AND COMPETENCIES, with reference to learning outcomes for an area(s) and a field of study

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| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Lp. | Description of learning outcomes | Reference to the  learning outcomes  (symbols) | Form of teaching  (mark with a „X”) | | | | | |
| ST | | NST | | NST PUW | |
| Classes at the University | Classes  on a platform | Classes at the University | Classes  on a platform | Classes at the University | Classes  on a platform |
| After completing the subject, student in the range of **KNOWLEDGE**,know and understand | | | | | | | | |
| W1 | Knows and understands the basic concepts of probability and mathematical statistics | Z2\_W03 |  | X |  |  |  |  |
| W2 | Knows and understands the basic methods and computational techniques used in mathematical statistics |  | X |  |  |  |  |
| W3 | Understands the concept of estimation, recognizes the estimated parameters, is able to choose the appropriate model of the construction of confidence intervals and determine the necessary sample size |  | X |  |  |  |  |
| W4 | Formulates statistical hypotheses, selects correct models for their verification on the basis of a sample, knows the stages of verification of statistical hypotheses |  | X |  |  |  |  |
| After completing the subject, student in the range of **SKILLS**, can | | | | | | | | |
| U1 | Can correctly use the basic concepts of probability and mathematical statistics | Z2\_U03  Z2\_U04  Z2\_U06 | X |  |  |  |  |  |
| U2 | Recognizes selected probability distributions of random variables, knows their parameters, can determine the appropriate critical values of the distributions based on statistical tables | X |  |  |  |  |  |
| U3 | Defines research problems and selects an appropriate statistical research scheme | X |  |  |  |  |  |
| U4 | It determines the confidence intervals for unknown values of the parameters of the distribution of the examined feature and determines the necessary number of measurements | X |  |  |  |  |  |
| Has the ability to verify basic statistical hypotheses and conducts statistical inference | | | | | | | | |
| K1 | understand the limitations of his/her knowledge and the need for further education | Z2\_K01 | X | X |  |  |  |  |

3.3. Type of classes and number of hours - full time studies (ST), part time studies (NST)

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Mode  of study | Lecture | Exercises | Project | Workshops | Lab | Seminar | Lectorate | Using distance learning methods and techniques in the form of lecture | Others | **ECTS** |
| **ST** |  | 30 |  |  |  |  |  | 15 |  | 3 |
| **NST** |  |  |  |  |  |  |  |  |  |  |
| **NST PUW** |  |  |  |  |  |  |  |  |  |  |

3.4. Curriculum content (separately for each type of classes). Mark (X) how the content will be implemented (classes at the university or classes on the platform conducted using distance learning methods and techniques)

TYPE OF CLASSES: LECTURE

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Lp. | Content of classes | Form of teaching  (mark with a „X”) | | | | | |
| ST | | NST | | NST PUW | |
| **Classes at the University** | **Classes  on a platform** | **Classes at the University** | **Classes  on a platform** | **Classes at the University** | **Classes  on a platform** |
| 1. | The concept of a probabilistic space, the concept of a random variable and its distribution |  | X |  |  |  |  |
| 2. | Basic probability distributions of random variables and their properties |  | X |  |  |  |  |
| 3. | Basic concepts of mathematical statistics: statistical feature, population, simple random sample, sample statistics, distribution of sample statistics, empirical distribution |  | X |  |  |  |  |
| 4. | Point and interval estimation; confidence interval models for the mean, variance, standard deviation and structure ratio; the necessary number of measurements |  | X |  |  |  |  |
| 5. | General principles of testing statistical hypotheses; Significance tests for mean value, variance and structure index, and two mean values, two variances, and two structure indexes |  | X |  |  |  |  |

TYPE OF CLASSES: EXERCISES

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Lp. | Content of classes | Form of teaching  (mark with a „X”) | | | | | |
| ST | | NST | | NST PUW | |
| **Classes at the University** | **Classes  on a platform** | **Classes at the University** | **Classes  on a platform** | **Classes at the University** | **Classes  on a platform** |
| 1. | Random variable, determining the distribution of random variables; determining the parameters of these distributions | X |  |  |  |  |  |
| 2. | Examples of statistical features; tasks for determining the population, simple random sample, sample statistics; determining the distribution of sample statistics, determining empirical distribution functions | X |  |  |  |  |  |
| 3. | Determining confidence intervals for the mean value, variance, standard deviation and the structure index; determining the minimum sample size | X |  |  |  |  |  |
| 4. | Formulating and verifying single-parameter and two-parameter hypotheses (mean, variance, fraction) | X |  |  |  |  |  |

3.5. Methods of evaluation of learning outcomes (describe the methods of teaching and verification of learning outcomes):

Methods of teaching:

Lectures with presentations including theory and ways to solve problems;

during exercises – solving problems connected with statistics

Methods of verification of learning outcomes:

Activity during exercises, tests written during exercises, final test

3.6. Criteria for assessing the achieved learning outcomes

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| --- | --- | --- | --- |
| Learning outcome | For a grade of 3 student knows and understands/can/is able to: | For a grade of 4 student knows and understands/can/is able to: | For a grade of 5 student knows and understands/can/is able to: |
| W | 60-75% of the knowledge indicated in the learning outcomes | 76-90% of the knowledge indicated in the learning outcomes | 91-100% of the knowledge indicated in the learning outcomes |
| U | 60-75% of the skills indicated in the learning outcomes | 76-90% of the skills indicated in the learning outcomes | 91-100% of the skills indicated in the learning outcomes |
| K | 60-75% of the skills indicated in the learning outcomes | 76-90% of the skills indicated in the learning outcomes | 91-100% of the skills indicated in the learning outcomes |

3.7. Literature

**Basic**

1. J.R. Movellan. *Introduction to Probability Theory and Statistics* [available online]
2. F.M. Dekking, C. Kraaikamp, H.P. Lopuhaa, L.E. Meester. *A Modern Introduction to Probability and Statistics* [available online]

**Supplementary**

1. D.M. Lane at al. *Online Statistics Education: An Interactive Multimedia Course of Study* [available online]
2. R. Johnson. Elementary statistics.

4. Student’s workload – balance of credits (ects)

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| --- | --- | --- | --- |
| **Student’s activity** | **Student’s workload** | | |
| **ST** | **NST** | **NST PUW** |
| **CONTACT HOURS (activities that require direct participation of an academic teacher)** | **45** |  |  |
| Classes provided by the study plan | 45 |  |  |
| Consultation (min. 10% of hours provided for any form of classes) | 5 |  |  |
| **STUDENT’S OWN WORK** | **30** |  |  |
| Preparation for class, preparation of project work/presentations/etc | 15 |  |  |
| Preparation for passing the classes | 15 |  |  |
| **TOTAL STUDENT WORKLOAD** | **75** |  |  |
| **Credits (ECTS) for a subject** | **3** |  |  |

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| --- | --- |
| Date of last change | 12.03.2023 r. |
| Changes introduced | Paweł Wlaź |
| Changes approved |  |