#### card of course

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| Subject name | Probability and Statistics |

1. Location of the subject in the system of studies

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| --- | --- |
| 1.1. Programme | Computer science |
| 1.2. Mode of study | Full time studies |
| 1.3. Level of degree | Bachelor 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 | Interdirectional/practical |
| 2.2. Total credits (ECTS) | 3 |
| 2.3. Language of instruction | English |
| 2.4. Semesters in which the subject is carried out | III |
| 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 | Acquisition by students of the ability to correctly use the concept of probabilistic space and calculating the probabilities of random events. |
| C2 | Acquiring by students the ability to study probability distributions and to determine parameters of random variables. |
| C3 | The acquisition by students of the ability to analyze basic experimental patterns and probabilistic modeling of simple random phenomena. |
| C4 | To acquaint students with the issue of point and interval estimation. |
| C5 | Getting to know the theory of verification of statistical hypotheses and reviewing the most commonly used one- and two-parameter significance tests  |

* 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 learing outcomes | Reference to the learning outcomes (symbols) | Form of teaching (Mark with a „X”) |
| ST | NST |
| 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 | student knows and understands the basic concepts and theorems of probability | INF\_W02 | X |  |  |  |
| W2 | student knows the basic methods and computational techniques used in theory probabilities | X |  |  |  |
| W3 | student knows the measures of descriptive statistics and interprets the obtained values | X |  |  |  |
| W4 | student understands the concept of estimation, recognizes the estimated parameters and is able to choose the appropriate model of the construction of confidence intervals | X |  |  |  |
| W5 | student 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 | correctly use the basic concepts and theorems of the probability theory | INF\_U01 INF\_U03 | X |  |  |  |
| U2 | determine selected probability distributions and basic parameters of discrete and continuous random variables | X |  |  |  |
| U3 | describe the surveyed population using statistical measures and provides a graphic illustration | X |  |  |  |
| U4 | determine the confidence intervals for unknown values of the parameters of the distribution of the examined feature and determines the necessary number of measurements | X |  |  |  |
| U5 | verify basic statistical hypotheses and conducts statistical inference  | X |  |  |  |
| After completing the subject, student in the field of **SOCIAL COMPETENCES**, is able to |
| K1 | understand the limitations of their own knowledge and the need for further education | INF\_K06 | 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 distan-ce learning methods and techniques in the form of ………………. | Others | **ECTS** |
| **ST** | 15 | 30 |  |  |  |  |  |  |  | 3 |
| **NST** |  |  |  |  |  |  |  |  |  |  |

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

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| --- | --- | --- | --- |
| Lp. | Treść zajęć | Reference to the subject learning outcomes  | Sposób realizacji (zaznaczyć „X”) |
| ST | NST |
| Classes at the University | Classes on a platform | Classes at the University | Classes on a platform |
| 1. | Definition of a random variable, distribution of a random variable, probability function and probability density of a random variable; distribution function of a random variable and its properties. | W1 | X |  |  |  |
| 2. | Parameters of distributions of random variables. Independence of random variables. | W1, W2 | X |  |  |  |
| 3. | Step distribution: one-point, two-point, Bernoulli, Poisson, geometrical; continuous distributions: uniform, exponential, normal; standardization of the normal distribution. | W1, W2 | X |  |  |  |
| 4. | Basic statistical concepts. Elements of descriptive statistics (statistical series, analysis of the structure of statistical communities). | W3 | X |  |  |  |
| 5. | Interval Estimation. Confidence interval models for the mean, variance and standard deviation, and the structure index. Necessary number of measurements. | W4 | X |  |  |  |
| 6. | 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.  | W5 | X |  |  |  |

TYPE OF CLASSES: EXERCISES

|  |  |  |  |
| --- | --- | --- | --- |
| Lp. | Treść zajęć | Reference to the subject learning outcomes  | Sposób realizacji (zaznaczyć „X”) |
| ST | NST |
| Classes at the University | Classes on a platform | Classes at the University | Classes on a platform |
| 1. | Calculating event probabilities using conditional probability; applications of the total probability theorem and Bayes' formula; event independence testing. | U1 | X |  |  |  |
| 2. | Random variable, determining the distributions of random variables of discrete and continuous type; determining the parameters of these distributions | U2 | X |  |  |  |
| 3. | Examples of applications of discrete and continuous distributions. | U2 | X |  |  |  |
| 4. | Building detailed or interval statistical series, creating histograms, determining and interpreting the basic parameters of the empirical distribution of the examined feature. | U3 | X |  |  |  |
| 5. | Determining confidence intervals for the mean value, variance and standard deviation as well as the structure index. Determination of the necessary number of measurements. | U4 | X |  |  |  |
| 6. | Formulating and verifying single-parameter hypotheses. | U5 | X |  |  |  |
| 7. | Formulating and verifying two-parameter hypotheses.  | U5, K1 | X |  |  |  |

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

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| --- | --- | --- | --- |
| Learning outcomes | Methods of teaching | Methods of verification of learning outcomes | Methods of documentation |
| KNOWLEDGE |
| W1-W5 | Lectures with presentations including theory and ways to solve problems | using the material contained in the presentation to pass the exam | graded exam paper |
| SKILLS |
| U1-U5 | solving problems connected with probability, statistics and their applications | Test written during the exercises, also the final exam | graded test and exam paper |
| SOCIAL COMPETENCES |
| K1 | solving problems connected with probability, statistics and their applications | Test written during the exercises, also the final exam | graded test and exam paper |

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. Prasanna Sahoo. *Probability and Mathematical Statistics* [available online]
3. 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. Robert Johnson. *Elementary statistics*

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

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| --- | --- |
| **Student’s activity** | **Student’s workload**  |
| **ST** | **NST** |
| **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  | 5.11.2023 |
| Changes introduced | Paweł Wlaź |
| Changes approved | Dr inż. Michalina Gryniewicz-Jaworska  |