

## Subject card

|                                             |                                                                                                                                                                                                                                                                                                                               |                                                          |                                         |                                     |                                                                          |            |     |
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| Subject name and code                       | Statistics and probability theory for teachers, PG_00155425                                                                                                                                                                                                                                                                   |                                                          |                                         |                                     |                                                                          |            |     |
| Field of study                              | Mathematics                                                                                                                                                                                                                                                                                                                   |                                                          |                                         |                                     |                                                                          |            |     |
| Date of commencement of studies             | October 2025                                                                                                                                                                                                                                                                                                                  |                                                          | Academic year of realisation of subject |                                     | 2027/2028                                                                |            |     |
| Education level                             | Bachelor's studies                                                                                                                                                                                                                                                                                                            |                                                          | Subject group                           |                                     | Obligatory subject group in the field of study<br>Optional subject group |            |     |
| Mode of study                               | full-time studies                                                                                                                                                                                                                                                                                                             |                                                          | Mode of delivery                        |                                     | at the university                                                        |            |     |
| Year of study                               | 3                                                                                                                                                                                                                                                                                                                             |                                                          | Language of instruction                 |                                     | Polish                                                                   |            |     |
| Semester of study                           | 6                                                                                                                                                                                                                                                                                                                             |                                                          | ECTS credits                            |                                     | 5.0                                                                      |            |     |
| Learning profile                            | academic                                                                                                                                                                                                                                                                                                                      |                                                          | Assessment form                         |                                     | exam                                                                     |            |     |
| Conducting unit                             | Institute of Mathematics -> Faculty of Mathematics, Physics and Informatics -> Rector                                                                                                                                                                                                                                         |                                                          |                                         |                                     |                                                                          |            |     |
| Name and surname of lecturer (lecturers)    | Subject supervisor                                                                                                                                                                                                                                                                                                            |                                                          | dr Agnieszka Demby                      |                                     |                                                                          |            |     |
|                                             | Teachers                                                                                                                                                                                                                                                                                                                      |                                                          |                                         |                                     |                                                                          |            |     |
| Lesson types                                | Lesson type                                                                                                                                                                                                                                                                                                                   | Lecture                                                  | Tutorial                                | Laboratory                          | Project                                                                  | Seminar    | SUM |
|                                             | Number of study hours                                                                                                                                                                                                                                                                                                         | 30.0                                                     | 30.0                                    | 0.0                                 | 0.0                                                                      | 0.0        | 60  |
|                                             | E-learning hours included: 0.0                                                                                                                                                                                                                                                                                                |                                                          |                                         |                                     |                                                                          |            |     |
| Learning activity and number of study hours | Learning activity                                                                                                                                                                                                                                                                                                             | Participation in didactic classes included in study plan |                                         | Participation in consultation hours |                                                                          | Self-study | SUM |
|                                             | Number of study hours                                                                                                                                                                                                                                                                                                         | 60                                                       |                                         | 5.0                                 |                                                                          | 60.0       | 125 |
| Subject objectives                          | Deepening and broadening the knowledge of students - future teachers of mathematics - both about the basic concepts of descriptive statistics, combinatorics and probability calculus used in school mathematics, as well as the ability to solve tasks related to these concepts, including the use of an Excel spreadsheet. |                                                          |                                         |                                     |                                                                          |            |     |

| Learning outcomes | Course outcome                                                                                                                                                                                                                                                | Subject outcome                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Method of verification                                                                                                       |
|-------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------|
|                   | [MATL3_W08] knows and understands the structure of mathematical theories, is able to use mathematical formalism to build and analyze simple mathematical models in other fields of science                                                                    | Knows and understands the structure of mathematical theories, is able to use mathematical formalism to build and analyze simple mathematical models in other fields of science - is aware of the existence of different definitions of probability (in a historical approach), knows about the possibilities of building different probabilistic models to describe the same random experiment                                                                                       | [SW4] test/exam - oral or written<br>[SW1] oral statement/conversation/discussion                                            |
|                   | [MATL3_U09] is able to plan how to solve a specific problem and prepare a correct record of this solution, providing strict and precise justification for the correctness of his reasoning                                                                    | Is able to plan a way to solve a specific problem and prepare a correct record of this solution, providing precise and precise justifications for the correctness of his/her reasoning in terms of the objectives and content of the subject, with particular attention to accessibility for students.                                                                                                                                                                               | [SU1] oral statement/conversation/discussion<br>[SU4] test/exam - oral or written                                            |
|                   | [MATL3_K01] is ready to accept the limitations of his/her own knowledge and understands the need for further education                                                                                                                                        | s willing to acknowledge the limitations of his own knowledge and to pursue further education.                                                                                                                                                                                                                                                                                                                                                                                       | [SK8] observation of student's independent or team work                                                                      |
|                   | [MATL3_K06] is ready to formulate opinions on basic mathematical issues                                                                                                                                                                                       | Is ready to form opinions on basic mathematical issues.                                                                                                                                                                                                                                                                                                                                                                                                                              | [SK8] observation of student's independent or team work                                                                      |
|                   | [MATL3_U14] knows how to use computer programmes in the field of data analysis                                                                                                                                                                                | Can use Excel and GeoGebra computer programs for data analysis                                                                                                                                                                                                                                                                                                                                                                                                                       | [SU1] oral statement/conversation/discussion<br>[SU2] presentation/project/paper/report                                      |
|                   | [MATL3_U08] is able to formulate definitions and theorems in an understandable way, both orally and in writing, and present correct mathematical reasoning regarding the acquired issues                                                                      | Is able to formulate definitions and theorems in an understandable way, both orally and in writing, and present correct mathematical reasoning concerning elements of combinatorics, probability theory and descriptive statistics in the field of school mathematics and its extension presented during the lecture.                                                                                                                                                                | [SU1] oral statement/conversation/discussion<br>[SU2] presentation/project/paper/report<br>[SU4] test/exam - oral or written |
|                   | [MATL3_K04] is ready to understand and appreciate the importance of intellectual honesty in one's own and other people's actions; is willing to act ethically                                                                                                 | Jest gotów do rozumienia i docenienia znaczenia uczciwości intelektualnej w działaniach własnych i innych osób; etycznego postępowania.                                                                                                                                                                                                                                                                                                                                              | [SK8] observation of student's independent or team work                                                                      |
|                   | [MATL3_W10] knows and understands the basics of computational and programming techniques supporting the work of a mathematician and understands their limitations                                                                                             | Knows and understands the basics of computational and programming techniques that support the work of a mathematician in developing statistical data and understands their limitations (Excel, GeoGebra)                                                                                                                                                                                                                                                                             | [SW2] presentation/project/paper/report                                                                                      |
|                   | [MATL3_W05] knows and understands the basic concepts, methods and theorems of probability and statistics, as well as basic examples illustrating specific concepts in these fields and enabling the refutation erroneous hypotheses or unauthorized reasoning | Knows and understands the basic concepts and theorems of combinatorics and probability calculus, as well as the basic concepts and tools of descriptive statistics; knows basic examples both illustrating specific concepts from these fields and allowing to refute erroneous hypotheses or illegitimate reasoning, including examples of manipulation and erroneous reasoning that occur when applying statistics and probability calculus to interpretations from everyday life. | [SW4] test/exam - oral or written<br>[SW1] oral statement/conversation/discussion                                            |

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|                                 | Course outcome                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Subject outcome                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Method of verification                                                                                                       |
|                                 | [MATL3_U16] can speak about mathematical problems in understandable colloquial language                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Is able to talk about mathematical issues that are covered by the scope of the objectives and content of the subject in understandable, everyday language.                                                                                                                                                                                                                                                                                                                  | [SU1] oral statement/conversation/discussion<br>[SU2] presentation/project/paper/report                                      |
|                                 | [MATL3_K02] is ready to precisely formulate questions to deepen his/her own understanding of a given topic or to find missing elements of reasoning                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Is ready to formulate precise questions that serve to deepen one's understanding of a given topic or to find missing elements of reasoning.                                                                                                                                                                                                                                                                                                                                 | [SK8] observation of student's independent or team work                                                                      |
|                                 | [MATL3_U05] is able to correctly use the known concepts of probability and statistics, is able - at a simple and medium level of difficulty - to apply the known theorems and methods in these fields and is able to interpret the obtained results                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Is able to correctly use the concepts of combinatorics, probability and statistics learned during this lecture, is able - at an easy and medium level of difficulty - to apply the theorems and methods learned in these fields and is able to interpret the obtained results, in particular when solving more difficult tasks in combinatorics and probability calculus from school mathematics, as well as when developing, presenting and interpreting statistical data. | [SU1] oral statement/conversation/discussion<br>[SU2] presentation/project/paper/report<br>[SU4] test/exam - oral or written |
| Subject contents                | <p>1. Basic types of statistical series. Analysis of statistical data - measures of central tendency, location, dispersion. Frequency distribution. Gaussian curve.</p> <p>2. Graphical representation of data series and dependencies between two data series. Correlation, regression.</p> <p>3. Examples of descriptive statistics exercises using a spreadsheet.</p> <p>4. Orderly counting of element systems, including the use of basic combinatorial schemes, trees and other graphs.</p> <p>5. Probability and statistics. Various definitions of probability.</p> <p>6. Modeling random experiments, including multi-stage ones.</p> <p>7. Bernoulli's scheme - various aspects and applications.</p> <p>8. Games of chance and lotteries. Expected value of winning.</p> <p>9. Solving more difficult combinatorics and probability problems from school mathematics.</p> <p>10. Relationships between statistics and probability theory with everyday life, including decision-making problems, examples of manipulation and fallacies. Examples of popularization of issues in statistics, combinatorics and probability theory.</p> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                              |
| Prerequisites and co-requisites |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                              |
| Assessment methods and criteria | Subject passing criteria                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Passing threshold                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Percentage of the final grade                                                                                                |
|                                 | Student Attitude Assessment                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 51.0%                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 0.0%                                                                                                                         |
|                                 | exam                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 51.0%                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 30.0%                                                                                                                        |
|                                 | Activity                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 51.0%                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 20.0%                                                                                                                        |
|                                 | Test                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 51.0%                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 25.0%                                                                                                                        |
|                                 | Project                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 51.0%                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 25.0%                                                                                                                        |

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|----------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Recommended reading                                            | Basic literature                                                                                                                                                                                                                                                                                                                                                                                                                                                        | <p>1. M.Zakrzewski, T.Żak, Kombinatoryka, prawdopodobieństwo i zdrowy rozsądek, Quadrivium, Wrocław 1998.</p> <p>2. M.Kałuska, Rachunek prawdopodobieństwa i statystyka dla uczniów szkół średnich, Wydawnictwa Naukowo-Techniczne, Warszawa 1997.</p> <p>3. Preparatory materials for the European Statistics Competition: <a href="https://eks.stat.gov.pl/materialy.html">https://eks.stat.gov.pl/materialy.html</a></p> <p>4. T.Michalski, Statystyka, WSiP, Warszawa 2012.</p> <p>5. A.Engel, T.Varga, W.Walser, Strategia czy przypadek? Gry kombinatoryczne i probabilistyczne, Wydawnictwa Szkolne i Pedagogiczne, Warszawa 1979.</p>                                                    |
|                                                                | Supplementary literature                                                                                                                                                                                                                                                                                                                                                                                                                                                | <p>1. Popular science books, e.g. from the series: Świat jest mathematical, RBA Collectables, S.A..</p> <p>2. Articles from popular science magazines and portals (e.g. <a href="http://deltami.edu.pl">deltami.edu.pl</a>) and portals and magazines for teachers (np. "Matematyka w Szkole", "Matematyka").</p> <p>3. A.Obecny, Statystyka opisowa w Excelu dla szkół. Ćwiczenia praktyczne, Helion, Gliwice 2002.</p> <p>4. W.J.Gmurman, Zbiór zadań z rachunku prawdopodobieństwa i statystyki matematycznej, Wydawnictwo Naukow-Techniczne, Warszawa 1976</p> <p>5. T.Gerstenkorn, T.Śródka, Kombinatoryka i rachunek prawdopodobieństwa, Państwowe Wydawnictwo Naukowe, Warszawa 1983.</p> |
|                                                                | eResources addresses                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Example issues/<br>example questions/<br>tasks being completed | <p>For the data set from the task below, determine two measures that make sense for the given study:<br/>(i) central tendency - other than the arithmetic mean and the weighted mean,<br/>(ii) dispersion.<br/>Provide the names of the measures determined.<br/>Task (from a school textbook): Andrzej asked 20 adults he met by chance how many children they had. He received the following answers: 2, 2, 3, 0, 1, 1, 0, 2, 3, 4, 0, 2, 1, 1, 0, 4, 5, 0, 1, 0.</p> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Work placement                                                 | Not applicable                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |

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