# Subject card

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| Subject name and code | Elements of Bioinformatics, PG_00055358 |
| Field of study | Informatics |

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| Date of commencement of studies | October 2023 | Academic year of realisation of subject | 2024/2025 |
| Education level | second-cycle studies | Subject group | Obligatory subject group in the field of study |
| | | | Subject group related to scientific research in the field of study |
| Mode of study | Full-time studies | Mode of delivery | at the university |
| Year of study | 2 | Language of instruction | English |
| Semester of study | 3 | ECTS credits | 2.0 |
| Learning profile | general academic profile | Assessment form | assessment |

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| Conducting unit | Department of Algorithms and Systems Modelling -> Faculty of Electronics, Telecommunications and Informatics |

| Name and surname of lecturer (lecturers) | Subject supervisor | dr inż. Piotr Mironowicz |
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| | Teachers | dr inż. Piotr Mironowicz |

| Lesson types and methods of instruction | Lesson type | Lecture | Tutorial | Laboratory | Project | Seminar | SUM |
|---|---|---|---|---|---|---|---|
| | Number of study hours | 15.0 | 0.0 | 0.0 | 15.0 | 0.0 | 30 |
| | 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 | 30 | 5.0 | 15.0 | 50 |

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| Subject objectives | Bioinformatics is a relatively new branch of computer science whose aim is to support biological research by computers. The scope of methods used by bioinformatics is very wide: we have fast text processing, discrete optimization algorithms, statistical analysis, artificial intelligence and machine learning, computational geometry and even computational models of physical systems. This subject is devoted to presentation of selected computational problems connected with the analysis of information obtained from biological data e.g. DNA and protein sequences. |

| Learning outcomes | Course outcome | Subject outcome | Method of verification |
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| | [K7_U43] can apply information technologies in market economy and information society conditions as well as algorithmize and computerize cognitive and decision-making processes in other areas of knowledge | Student describes the biological function of DNA, RNA and polypeptides. Student can model the evolution of sequences in terms of Markov chain. Student describes and uses computer algorithms for two sequence alignments and multi-alignments, performs phylogenetic analysis and searches genes in DNA. | [SU1] Assessment of task fulfilment [SU2] Assessment of ability to analyse information |
| | [K7_U41] can select methods of modelling and analysis of information systems and applications using selected elements of theoretical computer science and modern programming tools | The student is able to choose the appropriate bioinformatic algorithm for the indicated biological problem and use the programming environment for its implementation. | [SU4] Assessment of ability to use methods and tools |
| | [K7_U02] can perform tasks related to the field of study as well as formulate and solve problems applying recent knowledge of physics and other areas of science | The student understands the physical and biochemical context of the bioinformatics problems he analyzes. | [SU2] Assessment of ability to analyse information |
| | [K7_W02] knows and understands, to an increased extent, selected laws of physics and physical phenomena, as well as methods and theories explaining the complex relationships between them, constituting advanced general knowledge in the field of technical sciences related to the field of study | Student learned physical processes and models of higher-level phenomena, such as models of DNA mutation or the formation of species traits. | [SW1] Assessment of factual knowledge |
| | [K7_W05] Knows and understands, to an increased extent, methods of process and function support, specific to the field of study. | Student describes the biological function of DNA, RNA and polypeptides. Student can model the evolution of sequences in terms of Markov chain. Student describes and uses computer algorithms for two sequence alignments and multi-alignments, performs phylogenetic analysis and searches genes in DNA. | [SW1] Assessment of factual knowledge [SW3] Assessment of knowledge contained in written work and projects |

| Subject contents | 1. Biology introduction 2. Pairwise alignment 3. Multiple alignment methods 4. Modeling of biological sequences evolution 5. Introduction to phylogenetics, distance methods 6. Building phylogenetic trees - parsimony 7. Patterns searching, hidden Markov models |
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| Prerequisites and co-requisites | Subjects: <br><br> 1. Practice of Programming (PPR) <br><br> 2. Algorithms and Data Structures (ADST) lub Fundamentals of Algorithm Analysis (FAA) <br><br> 3. Probability and Mathematical Statistics (PMS) |
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| Assessment methods and criteria | Subject passing criteria | Passing threshold | Percentage of the final grade |
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| | Midterm colloquium | 25.0% | 50.0% |
| | Project | 26.0% | 50.0% |

| Recommended reading | Basic literature | 1. P. Higgs, T. Attwood, "Bioinformatics and Molecular Evolution", Wiley-Blackwell, 2005. <br><br> 2. A. Baxevanis, B. Ouellette i inni, "Bioinformatics: A Practical Guide to the Analysis of Genes and Proteins", Wiley-Interscience, 2004. <br><br> 3. R. Durbin, S. Eddy, A. Krogh, G. Mitchison, "Biological Sequence Analysis: Probabilistic Models of Proteins and Nucleic Acids", Cambridge University Press, 1999. |
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| | Supplementary literature | 1. P. Winter, G. Hickey, H. Fletcher, "BIOS Instant Notes in Genetics", Taylor & Francis, 2006. |
| | | 2. D. Gusfield, "Algorithms on Strings, Trees, and Sequences: Computer Science and Computational Biology", Cambridge University Press, 1997. |
| | | 3. M. Waterman, "Introduction to Computational Biology: Maps, Sequences and Genomes", Chapman & Hall, 1995. |
| | | 4. M. Nei, S. Kumar, "Molecular Evolution and Phylogenetics", Oxford University Press, 2000. |
| | eResources addresses | Adresy na platformie eNauczanie:<br><br>Elements of Bioinformatics 24-25 - Moodle ID: 41692<br>https://enauczanie.pg.edu.pl/moodle/course/view.php?id=41692 |
| Example issues/ example questions/ tasks being completed | | |
| Work placement | Not applicable | |

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