

## Subject card

|                                             |                                                                                                                                                                                                                                 |                                                          |                                         |                                     |                                                                                                                      |            |     |
|---------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------|-----------------------------------------|-------------------------------------|----------------------------------------------------------------------------------------------------------------------|------------|-----|
| Subject name and code                       | Algorithms and Data Structures, PG_00143796                                                                                                                                                                                     |                                                          |                                         |                                     |                                                                                                                      |            |     |
| Field of study                              | Informatics                                                                                                                                                                                                                     |                                                          |                                         |                                     |                                                                                                                      |            |     |
| Date of commencement of studies             | October 2025                                                                                                                                                                                                                    |                                                          | Academic year of realisation of subject |                                     | 2026/2027                                                                                                            |            |     |
| Education level                             | Bachelor's studies                                                                                                                                                                                                              |                                                          | Subject group                           |                                     | Obligatory subject group in the field of study<br>Subject group related to scientific research in the field of study |            |     |
| Mode of study                               | part-time studies                                                                                                                                                                                                               |                                                          | Mode of delivery                        |                                     | at the university                                                                                                    |            |     |
| Year of study                               | 2                                                                                                                                                                                                                               |                                                          | Language of instruction                 |                                     | Polish                                                                                                               |            |     |
| Semester of study                           | 3                                                                                                                                                                                                                               |                                                          | ECTS credits                            |                                     | 8.0                                                                                                                  |            |     |
| Learning profile                            | academic                                                                                                                                                                                                                        |                                                          | Assessment form                         |                                     | exam                                                                                                                 |            |     |
| Conducting unit                             |                                                                                                                                                                                                                                 |                                                          |                                         |                                     |                                                                                                                      |            |     |
| Name and surname of lecturer (lecturers)    | Subject supervisor                                                                                                                                                                                                              |                                                          | dr inż. Anna Nenca                      |                                     |                                                                                                                      |            |     |
|                                             | 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                                                       |                                         | 0.0                                 |                                                                                                                      | 140.0      | 200 |
| Subject objectives                          | Introduce students to classical algorithms and data structures used to efficiently solve typical programming tasks, justify the correctness of the algorithms learned and conduct time complexity analysis of these algorithms. |                                                          |                                         |                                     |                                                                                                                      |            |     |

| Learning outcomes               | Course outcome                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Subject outcome                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Method of verification                                                      |
|---------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------|
|                                 | [INFL3_U02] can precisely formulate questions to deepen one's understanding of a given topic or find missing elements of reasoning                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | is able to formulate questions with precision, serving to deepen his own understanding of the of a given topic or to find missing elements of reasoning                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | [SU8] observation of student's independent or team work                     |
|                                 | [INFL3_U03] can design and analyze algorithms for their correctness and computational complexity using appropriate algorithmic techniques and data structures                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | can explain, using an example, the operation of selected classical algorithms<br>is able to give definitions of selected classical, commonly used data structures and illustrate them with an example<br>is able to give examples of algorithms with different time complexity<br>computational complexity and is able to evaluate the time complexity of a simple algorithm                                                                                                                                                                                                                                                                                                                                                                                                       | [SU4] test/exam - oral or written<br>[SU5] implementation of a problem task |
|                                 | [INFL3_W03] has structured, theoretically grounded general knowledge in the field of algorithms and data structures, formal languages, automata theory and computational complexity, and artificial intelligence                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | has a structured, theoretically supported general knowledge in the field of classical sorting algorithms and those implementing dictionary operations (insert, delete, search) and their time complexity knows examples of algorithms representing basic methods of creating efficient algorithms: divide and conquer, dynamic programming, greedy strategy<br>has basic knowledge of analyzing the correctness and complexity of algorithms<br><br>knows classical data structures: stacks, lists, queues, mounds, trees, arrays with hashing<br>knows classical data structures (lists, stacks, trees, hash tables, balanced trees) and operations on them knows selected sorting algorithms knows facts about the time complexity of sorting algorithms, search, insert, delete | [SW4] test/exam - oral or written                                           |
| Subject contents                | <ul style="list-style-type: none"> <li>• Introductory concepts: semantic correctness, pessimistic and expected time complexity, asymptotic complexity notation.</li> <li>• Sorting by comparisons. Algorithms of quadratic complexity, linear-logarithmic complexity (heapsort), average linear-logarithmic complexity (quicksort).</li> <li>• Lower bound theorems of pessimistic and expected time complexity for sorting algorithms.</li> <li>• Sorting in linear time.</li> <li>• Basic data structures: lists, stacks, queues, priority queues. Implementations using arrays and linked structures. Data structures for dictionary operations (insert, delete, search): hash tables, binary search trees,</li> <li>• Methods for constructing efficient algorithms: divide-and-conquer method, dynamic programming (longest common subsequence), greedy algorithms (Huffman codes).</li> <li>• Searching for a pattern in a text</li> </ul> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                             |
| Prerequisites and co-requisites | ability to program knowledge of the mathematical apparatus at the level of a discrete mathematics lecture                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                             |

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| Assessment methods and criteria                                | Subject passing criteria               | Passing threshold                                                                                                                                                                                                    | Percentage of the final grade |
|                                                                | exam                                   | 51.0%                                                                                                                                                                                                                | 50.0%                         |
|                                                                | implementations                        | 0.0%                                                                                                                                                                                                                 | 10.0%                         |
|                                                                | Activity during lectures and exercises | 0.0%                                                                                                                                                                                                                 | 10.0%                         |
|                                                                | tests                                  | 50.0%                                                                                                                                                                                                                | 30.0%                         |
| Recommended reading                                            | Basic literature                       | T. H. Cormen, C. E. Leiserson , R. L. Rivest, C. Stein -- Introduction to algorithms, Wydawnictwo Naukowe PWN 2012. L. Banachowski, K. Diks, W. Rytter -- Algorytmy i struktury danych, Wydawnictwo Naukowe PWN 2018 |                               |
|                                                                | Supplementary literature               | none                                                                                                                                                                                                                 |                               |
|                                                                | eResources addresses                   |                                                                                                                                                                                                                      |                               |
| Example issues/<br>example questions/<br>tasks being completed | none                                   |                                                                                                                                                                                                                      |                               |
| Work placement                                                 | Not applicable                         |                                                                                                                                                                                                                      |                               |

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