

## Subject card

|                                             |                                                                                                                                                                                   |                                                          |                                                                                                                                                       |                                     |         |                                                                                                                      |     |
|---------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------|---------|----------------------------------------------------------------------------------------------------------------------|-----|
| Subject name and code                       | Advanced Algorithms, PG_00155255                                                                                                                                                  |                                                          |                                                                                                                                                       |                                     |         |                                                                                                                      |     |
| Field of study                              | Informatics                                                                                                                                                                       |                                                          |                                                                                                                                                       |                                     |         |                                                                                                                      |     |
| Date of commencement of studies             | October 2025                                                                                                                                                                      |                                                          | Academic year of realisation of subject                                                                                                               |                                     |         | 2025/2026                                                                                                            |     |
| Education level                             | Master'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                               | 1                                                                                                                                                                                 |                                                          | Language of instruction                                                                                                                               |                                     |         | Polish                                                                                                               |     |
| Semester of study                           | 2                                                                                                                                                                                 |                                                          | ECTS credits                                                                                                                                          |                                     |         | 7.0                                                                                                                  |     |
| Learning profile                            | academic                                                                                                                                                                          |                                                          | Assessment form                                                                                                                                       |                                     |         |                                                                                                                      |     |
| Conducting unit                             |                                                                                                                                                                                   |                                                          |                                                                                                                                                       |                                     |         |                                                                                                                      |     |
| Name and surname of lecturer (lecturers)    | Subject supervisor                                                                                                                                                                |                                                          | dr Maciej Dziemiańczuk                                                                                                                                |                                     |         |                                                                                                                      |     |
|                                             | Teachers                                                                                                                                                                          |                                                          |                                                                                                                                                       |                                     |         |                                                                                                                      |     |
| Lesson types                                | Lesson type                                                                                                                                                                       | Lecture                                                  | Tutorial                                                                                                                                              | Laboratory                          | Project | Seminar                                                                                                              | SUM |
|                                             | Number of study hours                                                                                                                                                             | 20.0                                                     | 0.0                                                                                                                                                   | 20.0                                | 0.0     | 0.0                                                                                                                  | 40  |
|                                             | 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                                                                                                                                                             | 40                                                       |                                                                                                                                                       | 0.0                                 |         | 135.0                                                                                                                | 175 |
| Subject objectives                          | The aim of the course is to familiarize students with basic techniques for designing parallel algorithms. Familiarizing students with English terminology.                        |                                                          |                                                                                                                                                       |                                     |         |                                                                                                                      |     |
| Learning outcomes                           | Course outcome                                                                                                                                                                    |                                                          | Subject outcome                                                                                                                                       |                                     |         | Method of verification                                                                                               |     |
|                                             | [INFMU2_K03] is able and ready to formulate opinions on basic IT issues                                                                                                           |                                                          | Understands the necessity of expanding their knowledge in the field of designing parallel algorithms.                                                 |                                     |         | [SK8] observation of student's independent or team work                                                              |     |
|                                             | [INFMU2_U03] designs, analyzes for correctness and computational complexity, and builds algorithms using advanced programming techniques and data structures                      |                                                          | Can assess the computational complexity of designed algorithms. Can design constant-time or logarithmic-time parallel algorithms for simple problems. |                                     |         | [SU4] test/exam - oral or written                                                                                    |     |
|                                             | [INFMU2_U05] can apply known algorithms in specific situations, can effectively select the type of algorithm depending on the problem at hand                                     |                                                          | Can design an algorithm utilizing techniques such as balanced tree, pointer jumping, tree contraction, and Eulerian cycle.                            |                                     |         | [SU4] test/exam - oral or written                                                                                    |     |
|                                             | [INFMU2_W04] knows complex data structures and advanced methods of algorithmic solution of computationally difficult problems (exponential algorithms, approximation, heuristics) |                                                          | Is familiar with selected data structures used by parallel algorithms. Is familiar with techniques for designing parallel algorithms.                 |                                     |         | [SW4] test/exam - oral or written                                                                                    |     |
|                                             | [INFMU2_K01] knows the limits of his own knowledge and understands the need for further learning                                                                                  |                                                          | Can formulate opinions on parallel algorithms.                                                                                                        |                                     |         | [SK8] observation of student's independent or team work                                                              |     |

|                                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                        |                               |
|----------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------|
| Subject contents                                               | 1. PRAM model assumptions, potential conflicts and their resolution in PRAM sub-models;<br>2. Writing parallel algorithms;<br>3. Parameters of parallel algorithms;<br>4. Methods for designing parallel algorithms: balanced tree method, pointer jumping (algorithms on lists), divide and conquer, breaking symmetry, Eulerian cycle technique;<br>5. Selected algorithms: prefix sum algorithms, binary number addition, arithmetic expression tree evaluation, sorting, cycle coloring. |                                                                                                                                                                                                        |                               |
| Prerequisites and co-requisites                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                        |                               |
| Assessment methods and criteria                                | Subject passing criteria                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Passing threshold                                                                                                                                                                                      | Percentage of the final grade |
|                                                                | tests                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 51.0%                                                                                                                                                                                                  | 50.0%                         |
|                                                                | exam                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 51.0%                                                                                                                                                                                                  | 50.0%                         |
| Recommended reading                                            | Basic literature                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 1. Joseph Jaja, <i>An Introduction to Parallel Algorithms</i> , Addison-Wesley Publishing Company, 1992;<br>2. Selim Akl, <i>The Design and Analysis of Parallel Algorithms</i> , Prentice-Hall, 1989. |                               |
|                                                                | Supplementary literature                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | not applicable                                                                                                                                                                                         |                               |
|                                                                | eResources addresses                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                        |                               |
| Example issues/<br>example questions/<br>tasks being completed | not applicable                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                        |                               |
| Work placement                                                 | Not applicable                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                        |                               |

Document generated electronically. Does not require a seal or signature.