#### card of course

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| Subject name | Algorithms and data structures |

1. The placement of the subject in the study system

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| 1.1. Field of study | Computer science |
| 1.2. Form and path of study | Full-time/Part-time |
| 1.3. Level of education | First-cycle studies |
| 1.4. Study profile | Practical |

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| 1. 5. Specialty | - |
| 1.6. Subject Coordinator | Dr Marek Łatko |

2. General characteristics of the subject

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| 2.1. Belonging to a subject group | Directional/Practical |
| 2.2. Number of ECTS | 5 |
| 2.3. Language of lectures | English |
| 2.4. Semesters in which the subject is taught | I |
| 2.5.Criteria for selecting course participants | - |

1. Learning outcomes and course delivery
   1. Subject Objectives

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| No. | Subject Objectives |
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| C1 | Learning the basics of algorithm theory |
| C2 | Learning simple and complex data structures |
| C3 | Learning selected algorithms and the ability to evaluate them |
| C4 | Learning the rules for selecting and assessing the complexity of algorithms |
| C5 | Creating your own algorithms for selected mathematical and practical problems. |

* 1. Subject-specific learning outcomes, divided into knowledge , skills and competences , with reference to the directional learning outcomes

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| No. | Description of subject  learning outcomes | Reference to  directional effects  learning (symbols) | Method of implementation (mark "X") | | | |
| ST | | NST | |
| Classes at the University | Activities on  the platform | Classes at the University | Activities on  the platform |
| After passing the course, the student knows and understands **the knowledge** | | | | | | |
| W1 | Knows basic algorithmic constructs and simple and complex data structures | INF\_W02 INF\_W11 | X |  |  | X |
| W2 | Understands the importance of selecting the right algorithm depending on available IT resources (memory, operating time) | X |  |  | X |
| W3 | Knows various techniques for creating efficient algorithms | X |  |  | X |
| W4 | Understands the importance of knowledge from various areas of mathematics in the process of creating efficient algorithms | X |  |  | X |
| W5 | Has a general understanding of issues related to graph theory and understands their importance in solving many important practical problems | X |  |  | X |
| W6 | Understands the importance of choosing the right data structure in the construction of algorithms | X |  |  | X |
| After passing the course, the student is **able** to: | | | | | | |
| U1 | Can develop simple linear algorithms and algorithms with decision blocks | INF\_U01 INF\_U17 INF\_U18 | X |  | X |  |
| U2 | Can develop iterative algorithms with For, While, Repeat loops. | X |  | X |  |
| U3 | Can use one- and two-dimensional arrays in algorithms. | X |  | X |  |
| U4 | For the sorting problem, it is able to select the appropriate algorithm depending on the type and size of the data set being sorted. | X |  | X |  |
| U5 | Is able to develop algorithms for basic numerical tasks such as solving nonlinear equations, numerical integration and solving systems of linear equations. | X |  | X |  |
| U6 | Is able to conduct tests for the algorithms he has developed | X |  | X |  |
| U7 | Can use interpolation in numerical algorithms | X |  | X |  |
| After completing the course, the student is ready to take part in **social competences.** | | | | | | |
| K1 | constructively evaluate the results of your work, use your knowledge to solve problems and seek help from specialists in case of any difficulties | INF\_K01 | X |  | X |  |

3.3. Forms of teaching and their number of hours - Full-time studies (ST), Part-time studies (NST)

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| Path | Lecture | Exercises | Design | Workshop | Laboratory | Seminar | Lecturer | Classes conducted using distance learning methods and techniques in the form of a lecture | Other | **ECTS points** |
| **ST** | 30 | 30 |  |  |  |  |  |  |  | 5 |
| **NST** |  | 15 |  |  |  |  |  | 10 |  | 5 |

3.4. Content of education (separately for each form of classes: (W, ĆW, PROJ, WAR, LAB, LEK, OTHER). It should be marked (X) how the given content will be implemented (classes at the university or classes on the e-learning platform conducted using distance learning methods and techniques)

TYPE OF CLASS: LECTURE

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| No. | Content of the course | Reference to subject-specific learning outcomes | Method of implementation (mark "X") | | | |
| ST | | NST | |
| **Classes at the University** | **Activities on  the platform** | **Classes at the University** | **Activities on  the platform** |
| 1. | Basic concepts of algorithm theory: the concept of an algorithm, types of algorithms, NS diagrams, flowcharts, forms of algorithms | W1, W3, W4 | x |  |  | x |
| 2. | Recursion: Basics, Applications, Examples | W3 | x |  |  | x |
| 3. | Analysis of algorithm complexity | W2 | x |  |  | x |
| 4. | Data structures: lists, stack, queue, trees, binary trees, heaps | W6 | x |  |  | x |
| 5. | Sorting algorithms overview: SELECTIONSORT, NSERTIONSORT, BUBBLESORT, QUICKSORT, COUNTING, BUCKETTING | W2 | x |  |  | x |
| 6. | Heap sorting |  | x |  |  | x |
| 7. | Overview of Search Algorithms; BST Trees | W4, W5 | x |  |  | x |
| 8. | Text algorithms: exhaustive method, Knuth-Morris-Pratt method | W2 | x |  |  | x |
| 9. | Numerical algorithms: Gaussian algorithm, numerical integration using the trapezoidal and parabolic methods, solving nonlinear equations using the bisection method, falsi, secant, Newton rule | W2, W4 | x |  |  | x |
| 10. | Overview of basic concepts in graph theory and selected graph algorithms | W5 | x |  |  | x |
| 11. | Interpolation: Lagrange method, Newton method | W2, W4 | x |  |  | x |
| 12. | Summary of classes and discussion of grades. |  | x |  |  | x |

TYPE OF CLASSES: EXERCISES

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| No. | Content of the course | Reference to subject-specific learning outcomes | Method of implementation (mark "X") | | | |
| ST | | NST | |
| **Classes at the University** | **Activities on  the platform** | **Classes at the University** | **Activities on  the platform** |
| 1. | NS Schemes for Simple Linear Algorithms | U1, K1 |  |  | x |  |
| 2. | NS schemes for branching algorithms (number theory, geometry, algebra) | U1, K1 | x |  | x |  |
| 3. | NS schemes with loops of the WHILE type | U2, U6, K1 | x |  | x |  |
| 4. | NS diagrams with FOR loops | U2, U6, K1 | x |  | x |  |
| 5. | NS diagrams with REPEAT loops | U2, U6, K1 | x |  | x |  |
| 6. | Complex loop algorithms | U6, K1 | x |  | x |  |
| 7. | Algorithms using 1-dimensional arrays | U3, K1 | x |  | x |  |
| 8. | Algorithms using 2-dimensional arrays | U3, K1 | x |  | x |  |
| 9. | Special algorithms: generating subsets, binary numbers, monotonicity of numerical sequences, sorting, selected numerical algorithms, | U3, U4, U5, U7, K1 | x |  | x |  |
| 10. | Summary of classes and discussion of grades. |  | x |  | x |  |

3.5. Methods of verifying learning outcomes (indication and description of methods of conducting classes and verification of achievement of learning outcomes and method of documentation)

Conducting classes:

Lecture – discussion of issues using multimedia presentation and teaching materials

Exercises

* Providing students with the content of tasks for which algorithms will be constructed in the form of NS diagrams
* Each task will be discussed and illustrated with an example. In the case of tasks requiring mathematical formulas, they will be provided.
* Discussion of different ways of solving a given task, and then one way will be chosen, for which an NS diagram will be drawn on the board - the diagram will be created by the student.
* After drawing the NS diagram, an analysis of its correctness will be carried out and a discussion on possible corrections to increase its effectiveness will be carried out. In the case of alternative solutions, they will also be presented by students in the form of NS diagrams.
* For the selected NS scheme, a simulation of its execution will be performed for data allowing for checking the complete set of possible solutions.
* At the end of each thematic group, students will receive sets of tasks to complete independently.

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| Subject Effects | Teaching methods | Methods of verifying learning outcomes | Documentation methods |
| KNOWLEDGE | | | |
| W1-W6 | discussion of issues using multimedia presentations and teaching materials | Exam (100% of the lecture grade) conducted in the form of a test. | Graded exam |
| SKILLS | | | |
| U1-U7 | Providing the content of tasks and discussing them, presenting examples, discussing solutions, drawing diagrams, simulations | Passing the exercises: two tests:   1. Writing 4 NS diagrams for algorithms using decision blocks and single loops of the FOR, UNTIL and REPEAT type (maximum 40 points) 2. Writing 4 NS diagrams for algorithms using one- and two-dimensional arrays and complex loops (maximum 60 points)   The final grade is based on the sum of the points obtained from the two tests. The points for the individual tests and the final grade are given during the classes. | Graded colloquia |
| SOCIAL COMPETENCES | | | |
| K1 | Providing the content of tasks and discussing them, presenting examples, discussing solutions, drawing diagrams, simulations | Passing the exercises: two tests:   1. Writing 4 NS diagrams for algorithms using decision blocks and single loops of the FOR, UNTIL and REPEAT type (maximum 40 points) 2. Writing 4 NS diagrams for algorithms using one- and two-dimensional arrays and complex loops (maximum 60 points)   The final grade is based on the sum of the points obtained from the two tests. The points for the individual tests and the final score are given during classes. | Graded colloquia |

3.6. Assessment criteria for the achieved learning outcomes

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| Learning effect | For a grade of 3 or "pass."  the student knows and understands/is able to/is ready to | For a grade of 3.5, the student knows and understands/is able to/is ready to | For a grade of 4, the student knows and understands/is able to/is ready to | For a grade of 4.5, the student knows and understands/is able to/is ready to | For a grade of 5, the student knows and understands/is able to/is ready to |
| W | 51-60% of knowledge indicated in learning outcomes | 61-70% of knowledge indicated in learning outcomes | 71-80% of knowledge indicated in learning outcomes | 81-90% of knowledge indicated in learning outcomes | 91-100% of knowledge indicated in learning outcomes |
| U | 51-60% of skills indicated in learning outcomes | 61-70% of skills indicated in learning outcomes | 71-80% of skills indicated in learning outcomes | 81-90% of skills indicated in learning outcomes | 91-100% of skills indicated in learning outcomes |
| K | 51-60% of skills indicated in learning outcomes | 61-70% of skills indicated in learning outcomes | 71-80% of skills indicated in learning outcomes | 81-90% of skills indicated in learning outcomes | 91-100% of skills indicated in learning outcomes |

3.7. Literature

Basic

1. Algorytmy i struktury danych, L. Banachowski, K. Diks, W. Rytter, PWN, 2018
2. Algorytmy : struktury danych i techniki programowania / Piotr Wróblewski. - Wyd.3.Gliwice: Helion, 2003.
3. Wprowadzenie do algorytmów, T. H. Cormen i inni, WNT, 2016
4. Algorytmy i struktury danych, A. Aho, J. Hopcroft, I. Ullman, Helion, 2003
5. Algorytmy + struktury danych = programy / Niklaus Wyd.5.Warszawa : Wydawnictwa Naukowo-Techniczne, 2001.

**Supplementary**

1. Algorytmy i struktury danych : zadania. A. Dańko i inni. Wyd. PJWSTK, 2006
2. Algorytmy. Maciej M. Sysło Helion, 2016

4. Student workload - ECTS points balance

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| **Types of student activity** | **Student Load** | |
| **ST** | **NST** |
| **Classes requiring direct contact between the student and the academic teacher at the university premises** | **60** | **25** |
| Classes included in the study plan | 60 | 25 |
| **Student's own work** | **65** | **100** |
| Ongoing preparation for classes, preparation of project work/presentations/etc. | 30 | 50 |
| Preparation for passing classes | 35 | 50 |
| **TOTAL STUDENT HOURLY LOAD** | **125** | **125** |
| **Number of ECTS points** | **5** | **5** |

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| Last change date | 30.09.2024 |
| The changes were introduced | Zespół ds. Jakości Kształcenia INF |
| The changes were approved | Mgr Arkadiusz Gwarda |