**Course Syllabus**

## I. General Information

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|---|---|
| Course name | Algorithms and data structures |
| Programme | Informatics |
| Level of studies (BA, BSc, MA, MSc, long-cycle MA) | BA (1st level) |
| Form of studies (full-time, part-time) | full-time |
| Discipline | Informatics |
| Language of instruction | English |

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|---|---|
| Course coordinator | Michał Horodelski |

| Type of class *(use only the types mentioned below)* | Number of teaching hours | Semester | ECTS Points |
|---|---|---|---|
| lecture | 30 | IV | 5 |
| tutorial | | | |
| classes | | | |
| laboratory classes | 30 | IV | |
| workshops | | | |
| seminar | | | |
| introductory seminar | | | |
| foreign language classes | | | |
| practical placement | | | |
| field work | | | |
| diploma laboratory | | | |
| translation classes | | | |
| study visit | | | |

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| Course pre-requisites | 1. Programming skills<br>2. Object-oriented programming,<br>3. Basics of programming in C++ |

## II. Course Objectives

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| 1 Presentation of the basic abstract data types and operations on them |
| 2 Own implementation of abstract data types |
| 3. Improving skills in programming and analytical thinking |
| 4. Abstract data types in C++ standard library |

## III. Course learning outcomes with reference to programme learning outcomes

| Symbol | Description of course learning outcome | Reference to programme learning outcome |
|---|---|---|
| KNOWLEDGE | | |
| W_01 | The student can recognize the basic data structures and indicate the differences between the learned data structures. | K_W01, K_W03, K_W06 |
| W_02 | The student knows basic methods that manipulates abstract data structures and their implementation. | K_W03 |
| SKILLS | | |
| U_01 | The student can use technical language related to the ADS concepts and can choose the appropriate abstract data structures and to a specific problem. | K_U06, K_U10 |
| U_02 | The student can use abstract data structures in application, implement own version of ADS and use frameworks or libraries with prepared implementation. | K_U08, K_U10, K_U11 |
| U_03 | The student can solve problems from various areas of sciences and real life using algorithms based on abstract data structures | K_U10, K_U11, K_U12 |
| U_04 | The student can work individually and in a team, understands the need for systematic work on long-term projects. The student Can properly define the priorities within the implemented IT project. | K_U17 |
| SOCIAL COMPETENCIES | | |
| K_01 | The student is ready to assess the level of his knowledge and skills and critically evaluates the received content. | K_K01 |
| K_02 | The student shows initiative and efficiency during the project. | K_K02 |

## IV. Course Content

Pointers.
Files and I/O operations
Function and class templates.
Stack and reverse Polish notation.
Queue and examples of its use.
Forward lists and lists with sorting options.
Trees, binary search trees (BST).
Tree operations. Balancing trees. The use of trees.
Heap - priority queues.
Sorting and search algorithms.
Hash table.
Pointers to functions.

## V. Didactic methods used and forms of assessment of learning outcomes

| Symbol | Didactic methods *(choose from the list)* | Forms of assessment *(choose from the list)* | Documentation type *(choose from the list)* |
|---|---|---|---|
| | KNOWLEDGE | | |
| W_01 | - Conventional lecture<br>- Conversational lecture<br>- Guided practice<br>- implementations in laboratory and in homework,<br>- using a projector<br>- group work | - Exam/Written test<br>- Preparation / implementation of the project<br>- homework programs | - written work,<br>- set of files,<br>- report |
| W_02 | - Conventional lecture<br>- Conversational lecture<br>- Guided practice<br>- implementations in laboratory and in homework,<br>- using a projector<br>- group work | - Exam/Written test<br>- Preparation / implementation of the project<br>- homework programs | - written work,<br>- set of files,<br>- report |
| | SKILLS | | |
| U_01 | - Practical classes<br>- Project-based Learning<br>- implementations in laboratory and in homework,<br>- using a projector<br>- design thinking<br>- group work | - Exam/Written test<br>- Preparation / implementation of the project<br>- homework programs<br>- activity during the laboratory | - written work,<br>- set of files,<br>- report |
| U_02 | - Practical classes<br>- Project-based Learning<br>- implementations in laboratory and in homework,<br>- using a projector<br>- design thinking<br>- group work | - Exam/Written test<br>- Preparation / implementation of the project<br>- homework programs<br>- activity during the laboratory | - written work,<br>- set of files,<br>- report |
| U_03 | - Practical classes<br>- Project-based Learning<br>- implementations in laboratory and in homework,<br>- using a projector<br>- design thinking<br>- group work | - Exam/Written test<br>- Preparation / implementation of the project<br>- homework programs<br>- activity during the laboratory | - written work,<br>- set of files,<br>- report |
| U_04 | - Practical classes | - Exam/Written test | - set of files, |

| | | | |
|---|---|---|---|
| | - Group work<br>- Project-based Learning<br>- implementations in laboratory and in homework,<br>- using a projector<br>- design thinking<br>- group work | - Preparation / implementation of the project<br>- homework programs<br>- activity during the laboratory | - report |
| | SOCIAL COMPETENCIES | | |
| K_01 | - Discussion<br>- Conventional lecture<br>- Conversational lecture<br>- group work<br>- Project-based<br>- design thinking Learning | - Exam/Written test<br>- Preparation / implementation of the project<br>- homework programs<br>- activity during the laboratory | - written work,<br>- set of files,<br>- report |
| K_02 | - Discussion<br>- Conventional lecture<br>- Conversational lecture<br>- group work<br>- Project-based<br>- design thinking Learning | - Exam/Written test<br>- Preparation / implementation of the project<br>- homework programs<br>- activity during the laboratory | - set of files,<br>- report |

## VI. Grading criteria, weighting factors.....

Passing laboratory: verification by written tests (20% of the final mark), activity in laboratories (10% of the final mark), homework covering particular topics of data structures (20% of the final mark) and a test (50% of the final mark).

Passing the lecture: written and oral exam (for people who have passed the laboratory), knowledge provided during the lecture.

Grading scale:
less than 50% insufficient (2.0)

Detailed rules of assessment are given to students with each edition of the subject.

## VII. Student workload

| Form of activity | Number of hours |
|---|---|
| Number of contact hours (with the teacher) | Lecture 30<br>Laboratory 30<br>Consultations 30 |
| Number of hours of individual student work | Preparation for classes and home projects 30<br>Studying Literature 10<br>Preparation for tests and exam 20 |

## VIII. Literature

| Basic literature |
|---|
| 1. M. A. Weiss, Data Structures Algorithm Analysis in C++, 4th edition, Pearson, 2014<br>2. Clifford A. Shaffer, Data Structures and Algorithm Analysis Edition 3.2 (C++ Version), published by Dover Publications, 2013<br>3. C++ Language Tutorials on the website cplusplus.com, site: http://www.cplusplus.com/doc/tutorial/, 2021 |
| Additional literature |
| 1. Cormen T.H., Leiserson C.E., Rivest R.L., Introduction to Algorithms, Wyd. Massachusetts Institute of Technology, 2009<br>2. Knuth D E. The art of computer programming. Volume 1, Volume 2, Volume 3<br>3. C++ language Tutorials on the website cppreference.com, site: https://en.cppreference.com/w/cpp/language, 2021 |