

**DESCRIPTION OF STUDY MODULE\***

**Study programme** Applied Informatics and Programming

**Study module** DATA STRUCTURES AND ALGORITHMS **Credits in total** 4

<b>Learning outcomes</b>
<ul style="list-style-type: none"> <li>– Knows and understands main concepts of data types and data structures, knows main principles of data structure maintenance algorithms</li> <li>– Has fresh skills to apply appropriate data types and data structures in order to store and maintain data in developed applications.</li> <li>– Is able to use software tools and Integrated development environments (IDE) that are needed to implement data structures and algorithms in C++ and other languages.</li> <li>– Develops applications using C/C++ and/or Java and Delphi programming languages and implements user defined data types, algorithms and dynamic data structures used to store and process various types of data in solving practical tasks.</li> </ul>
<b>Aims of study module</b>
The module is aimed to provide students with fundamental knowledge of data structures and appropriate algorithms and to develop fresh programming skills of their implementation.
<b>Annotation of a study module</b>
This is a specialty fundamentals course which provides students with knowledge and skills of complex dynamic data structures, algorithms and their implementation using C/C++, Pascal/Delphi and/or Java programming languages. The course puts an emphasis on practical training on implementation of data structures and algorithms for information saving and retrieval as well as on evaluation of complexity of algorithms applied. The course also provides an introduction into methods of specification and implementation of abstract data types (ADT).
<b>Topics of the subject</b>
<ol style="list-style-type: none"> <li>1. Management of dynamic memory (heap). Dynamic data structures.</li> <li>2. Linear data structures: linked list, stack, queue and deck.</li> <li>3. Implementation of typical operations in linear dynamic data structures.</li> <li>4. Bidirectional linked lists. Cycled linked lists (rings).</li> <li>5. Table as a data structure. Operations in table.</li> <li>6. Keeping keys in array. Binary search.</li> <li>7. Hierarchical data structures. Trees. Binary search trees (BST).</li> <li>8. Implementation of binary search tree.</li> <li>9. Tree balancing problem, AVL and other trees.</li> <li>10. Evaluation of expressions.</li> <li>11. Sorting algorithms, comparison of them.</li> <li>12. Direct storage and retrieval. Hashing, hash tables and functions. Methods to avoid collisions.</li> <li>13. Graphs and their implementation. Main algorithms on graphs: DFS, BFS, minimal path, etc.</li> <li>14. Development of modular and object-oriented data structures in different programming environments.</li> <li>15. Abstract data types (ADT).</li> </ol>
<b>Procedure for assessment of knowledge and competences</b>
Ten grade and gathered evaluation system is applied. The semester's individual work (lab. works) tasks are evaluated by grades; the final grade is given during the examination session while multiplying particular grades by the lever coefficient and summing the products: $G = (1LD+2LD +3LD+4LD +5LD)*0.5+E*0.5$ here: G – final mark; xLD – evaluation mark of x laboratory work; E – exam mark.
<b>Main literature</b>
<ol style="list-style-type: none"> <li>1. Jusas V., Marcinkevičius R., Blonskis J., Bukšnaitis V., Rubliauskas D. (2011). Objektinis programavimas ir dinaminiai sąrašai C++. Kaunas, Technologija. – 456 p. (Object programming and dynamic lists in C++).</li> <li>2. Baniulis K., Tamulynas B. (2005) Duomenų struktūros: vadovėlis/Data structures textbook. Kaunas, Technologija. – 298 p.</li> <li>3. Čiegis R. (2007). Duomenų struktūros, algoritmai ir jų analizė/Data structures, algorithms and their analysis Vilnius, Technika. 344 p.</li> <li>4. Baniulis K., Tamulynas B., Aukštakalnis N., Pauliūtė J.(2007). Duomenų struktūrų studijų praktikumas: mokomoji knyga. / Data structures practical book for students.</li> <li>5. Blonskis J., Bukšnaitis V., Končienė J., Rubliauskas D.(2001). C++ praktikumas: Mokomoji knyga. / C++ practice: teaching materials Kaunas, Technologija. 168 p.</li> </ol>

\* Short form