GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Algorithms and data structures, PG_00060216		
Field of study	Technical Physics		
Date of commencement of studies	October 2026	Academic year of realisation of subject	2027/2028
Education level	first-cycle studies	Subject group	Optional subject group Subject group related to scientific research in the field of study
Mode of study	Full-time studies	Mode of delivery	at the university
Year of study	2	Language of instruction	Polish
Semester of study	3	ECTS credits	5.0
Learning profile	general academic profile	Assessment form	exam
Conducting unit	Division of Theoretical Physics and Quantum Informaton -> Institute of Physics and Applied Computer Science -> Faculty of Applied Physics and Mathematics -> Faculties of Gdańsk University of Technology		
Name and surname of lecturer (lecturers)	Subject supervisor	dr hab. inż. arch. Jan Kozicki	
	Teachers		

Lesson types

Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
Number of study hours	30.0	0.0	30.0	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	5.0	60.0	125

Subject objectives

Learning the theoretical knowledge with some practical aspects of algorithms and data structure.

Learning outcomes

Course outcome	Subject outcome	Method of verification
[K6_U01] demonstrates the ability for lifelong independent learning, including acquiring information from literature, databases and other appropriate sources.	The student is able to independently search, analyze, and critically select information related to algorithms and data structures, using scientific literature, technical documentation, and reliable online sources in order to solve computational problems.	[SU2] Assessment of ability to analyse information
[K6_W05] has knowledge of programming methodologies and techniques, as well as the use of selected IT tools in physics and engineering.	The student knows and understands fundamental programming methods and techniques, including principles of algorithm design and data structure selection, as well as their implementation possibilities using selected computational tools.	[SW1] Assessment of factual knowledge
[K6_K01] demonstrates readiness for continuous learning and updating knowledge in physics and related fields, critically evaluating it and recognising its importance in solving practical and theoretical problems.	The student is ready to independently update their knowledge in the field of algorithms and data structures, critically evaluate available information, and apply it to solving practical problems, recognizing the importance of continuous learning in professional practice.	[SK5] Assessment of ability to solve problems that arise in practice
[K6_U03] possesses programming skills in a selected language and the ability to use selected software packages.	The student is able to design, implement, and test programs solving problems in the field of algorithms and data structures using a selected programming language, applying basic libraries and programming tools.	[SU1] Assessment of task fulfilment

<table>
<tr><td>Subject contents</td><td>Course content – lecture
1. Growth of functions- asymptotic notation and standard notations and common functions
2. Recurrences- the subsittution method and the iteration method
3. The master method
4. Tables
5. Hash tables- hash functions and open addressing
6. Hash functions and open addressing
7. Heapsort- heaps, maintaining the heap property, building a heap, the heapsort algorith and priority queues
8. Quicsort- description, performance, randomized versions and analysis of quicksort
9. Elementary date structures- stacks and queues and linked lists
10. Trees
11. Binary search trees- what is a binary search tree, quering a binary searcg tree, insertion and deletion
12. Balanced trees
13. String Matching- the naive string-matching algorithm and the rabin-Karp algorithm
14. String matching with finite automata and the Knuth-Morris-Pratt algorithm
15. The Boyer-Moore algorithm</td></tr>
<tr><td>Prerequisites and co-requisites</td><td>Taking courses in mathematical analisys, algebra and discrete mathematic.</td></tr>
<tr><td>Assessment methods and criteria</td><td><table>
<tr><th>Subject passing criteria</th><th>Passing threshold</th><th>Percentage of the final grade</th></tr>
<tr><td>Practical exercise</td><td>56.0%</td><td>50.0%</td></tr>
<tr><td>Written examination</td><td>56.0%</td><td>50.0%</td></tr>
</table></td></tr>
<tr><td>Recommended reading</td><td><table>
<tr><td>Basic literature</td><td>T. H. Cormen, Ch. E. Leiserson, R. L. Rivest, Introduction to algorithms, The MIT Press, Cambridge, 1990

K. Goczyła, Struktury danych, Wydawnictwo PG, Gdańsk 2002</td></tr>
<tr><td>Supplementary literature</td><td>D. Harel, rzecz o istocie informatyki, Algorytmika, Wydawnictwo naukowo-Techniczne, Warszawa 2001D. Harel, Y. feldman, Algorithmics. The Spirit of Computing, Addison-Wesley, 2004</td></tr>
<tr><td>eResources addresses</td><td></td></tr>
</table></td></tr>
<tr><td>Example issues/ example questions/ tasks being completed</td><td>What is an asymptotic notation?

Standard notation and growth of functions

Solving of recurrence equations.

Pseudocodes, the rules.

Executing chosen sorting algorithms.

Building string matching algorithms with finite automata.</td></tr>
<tr><td>Practical activites within the subject</td><td>Not applicable</td></tr>
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