University of Gdańsk

Subject card

Subject name and code	Algorithms and Data Structures , PG_00198492						
Field of study	Informatics						
Date of commencement of studies	October 2026		Academic year of realisation of subject	2027/2028			
Education level	Bachelor's studies		Subject group	Obligatory subject group in the field of study 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	academic		Assessment form	exam			
Conducting unit	Institute of Informatics -> Faculty of Mathematics, Physics and Informatics -> Rector						
Name and surname of lecturer (lecturers)	Subject supervisor		dr Paweł Pączkowski				
	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		0.0		65.0	125
Subject objectives	To familiarize students with classical algorithms and data structures used to effectively solve typical programming tasks, methods of implementing the studied algorithms, analysis of the time complexity of these algorithms and justification of their correctness.						

Learning outcomes

Course outcome	Subject outcome	Method of verification
[INFOL3_W03] knows and understands advanced concepts in the field of algorithms and data structures, formal languages, automata theory and computational complexity, and artificial intelligence	Knows classical data structures (lists, stacks, trees, hash tables) and operations on these structures. Knows selected effective sorting algorithms. Knows facts about the time complexity of sorting algorithms and time complexity of searching, inserting and deleting in tree structures and hash tables	[SW4] test/exam - oral or written
[INFOL3_U02] is able to use his/her knowledge of higher mathematics to model and solve complex problems	Can justify facts about the time complexity of sorting algorithms and time complexity of searching, inserting and deleting in tree structures and hash tables	[SU4] test/exam - oral or written
[INFOL3_U06] is able to select and apply appropriate IT methods and tools to solve complex problems, is able to use acquired knowledge by appropriately selecting sources and information derived from them, and perform evaluation, critical analysis, and synthesis of this information	Can explain, using an example, the operation of selected classical algorithms. Can provide definitions of selected commonly used data structures and illustrate them with an example (stacks, queues, heaps, tree structures, hash tables). Can program the studied algorithms using their description in the form of a pseudocode.	[SU4] test/exam - oral or written [SU5] implementation of a problem task

Subject contents

- Introductory concepts: semantic correctness, pessimistic and expected time complexity, asymptotic notation
- Sorting by comparison. Algorithms with quadratic complexity, linear-logarithmic complexity (heapsort), and expected linear-logarithmic complexity (quicksort).
- Lower bound on time complexity of sorting by comparisions, linear time sorting
- Basic data structures: lists, stacks, queues, priority queues. Implementations using arrays and linked structures.
- Data structures for insertion, deletion and searching: hash tables, binary search trees, balanced trees (red-black trees), B_trees
- Amortized cost analysis
- Methods of constructing effective algorithms: "divide and conquer" method, dynamic programming, greedy strategy - examples of such algorithms and their time complexity.

Prerequisites and co-requisites

Programming skills, knowledge of mathematical apparatus at the level of a Discrete Mathematics lecture.

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
programs	51.0%	25.0%
tests	51.0%	25.0%
exam	51.0%	50.0%

Recommended reading

Basic literature	T. H. Cormen, C. E. Leiserson , R. L. Rivest, C. Stein, Introduction to Algorithms, The MIT Press, 2022
Supplementary literature	L. Banachowski, K. Diks, W. Rytter, Algorytmy i struktury danych, PWN 2018
eResources addresses	

Example issues/ example questions/ tasks being completed

to be given during lectures

Work placement

Not applicable

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