GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Fundamentals of Algorithm Analysis, PG_00047660		
Field of study	Informatics		
Date of commencement of studies	October 2025	Academic year of realisation of subject	2026/2027
Education level	first-cycle 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	3.0
Learning profile	general academic profile	Assessment form	assessment
Conducting unit	Department of Algorithms and Systems Modelling -> Faculty of Electronics Telecommunications and Informatics -> Faculties of Gdańsk University of Technology		
Name and surname of lecturer (lecturers)	Subject supervisor	dr hab. Paweł Żyliński	
	Teachers	dr hab. Paweł Żyliński	

Lesson types

Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
Number of study hours	15.0	15.0	0.0	0.0	0.0	30

E-learning hours included: 0.0

eNauczanie source address: https://enauczanie.pg.edu.pl/2025/course/view.php?id=3919

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	30	15.0	30.0	75

Subject objectives

The aim of the course is to familiarize students with the fundamental issues related to the analysis of computational complexity of algorithms and the difficulty of computational problems.

Learning outcomes

Course outcome	Subject outcome	Method of verification
[K6_U07] can apply methods of process and function support, specific to the field of study	The student is able to use the techniques learned to analyze the complexity of algorithms/problems.	[SU1] Assessment of task fulfilment [SU2] Assessment of ability to analyse information [SU4] Assessment of ability to use methods and tools
[K6_W10] knows and understands, to an advanced extent, the parameters, functions, and methods of analysis, design, and optimization of electronic circuits and systems, the definitions of error and measurement uncertainty, measurement methods, including time, frequency, and phase measurements, the properties of converters, and methods of digital signal processing, as well as the basic processes occurring in the life cycle of technical devices, objects, and systems, and methods of supporting processes and functions, specific to the field of study	The student knows the fundamental issues related to the analysis of computational complexity of algorithms and the difficulty of computational problems.	[SW1] Assessment of factual knowledge

<table>
<tr><td>Subject contents</td><td>Course content – lecture
1. Algorithmic and non-algorithmic problems.
2. Asymptotic estimation symbols.
3. The concept of computational complexity (optimistic, expected, pessimistic).
4. Randomized/non-deterministic algorithms.
5. Analysis of recursive algorithms (divide and conquer algorithms, backtracking algorithms, linear recursiv equations).
6. Turing machines.
7. Classes P and NP, reductions, NP-complete problems, proofs of NP-completeness.
8. Approximation algorithms.
9. PRAM model.

Course content – exercises
1. Asymptotic estimation symbols.
2. Computational complexity (optimistic, expected, pessimistic).
3. Randomized/nondeterministic algorithms.
4. Analysis of recursive algorithms (divide and conquer algorithms, backtracking algorithms, linear recursiv equations).
5. Classes P and NP, reductions, NP-complete problems, proofs of NP-completeness.
6. Turing machines.
7. PRAM model.</td></tr>
<tr><td>Prerequisites and co-requisites</td><td>Fundamentals of discrete mathematics, graph theory, and algorithmics.</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>End-of-semester exam</td><td>51.0%</td><td>100.0%</td></tr></table></td></tr>
<tr><td>Recommended reading</td><td><table><tr><td>Basic literature</td><td>1. M. Kubale: Łagodne wprowadzenie do analizy algorytmów, Wydawnictwo PG.
2. J. Jędrzejowicz, A. Szepietowski: Języki, automaty, złożoność obliczeniowa, Wydawnictwo UG.
3. M. Kubale: Introduction to Computational Complexity and Algorithmic Graph Coloring, Wydawnictwo GTN.</td></tr><tr><td>Supplementary literature</td><td>1. M.R. Garey, D..S Johnson: Computers and Intractability. A Guide to the Theory of NP-Completeness, Freeman
2. E.J. Hopcroft, R. Motwani, D.J. Ullman: Wprowadzenie do teorii automatów, języków i obliczeń, Wydawnictwo Naukowe PWN.</td></tr><tr><td>eResources addresses</td><td></td></tr></table></td></tr>
<tr><td>Example issues/ example questions/ tasks being completed</td><td>1. Determine the status (P/NP) of the decision problem given below. (...)
2. Solve the following recursive equations based on the theorems from the lecture. (...)
3. For the Turing machine given below, check whether it accepts the word 00100 and determine its computational complexity. (...)
4. For the algorithm below, give tight asymptotic estimates for its optimistic/expected/pessimistic time/ memory complexity. Justify the estimate you obtained for the expected time complexity. (...)
5. Determine the parameters of the following algorithm in the PRAM model. (...)</td></tr>
<tr><td>Practical activites within the subject</td><td>Not applicable</td></tr>
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