University of Gdańsk

Subject card

Subject name and code	Computability and Complexity, PG_00143887						
Field of study	Informatics						
Date of commencement of studies	October 2025		Academic year of realisation of subject	2026/2027			
Education level	Master'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	part-time studies		Mode of delivery	at the university			
Year of study	2		Language of instruction	Polish			
Semester of study	3		ECTS credits	6.0			
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 Andrzej Borzyszkowski				
	Teachers						
Lesson types	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	20.0	20.0	0.0	0.0	0.0	40
	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	40		0.0	110.0	150	
Subject objectives	The aim of the course is an introduction to computability and the theory of complextiy; in particular, that there are undecidable problems and determining whether for a given problem there exists a polynomial algorithm or whether the problem is NP-complete.						

Learning outcomes

Course outcome	Subject outcome	Method of verification
[INFMU2_K01] knows the limits of his own knowledge and understands the need for further learning	understands the need for further education in the field of computability and complexity	[SK8] observation of student's independent or team work
[INFMU2_U01] can apply mathematical knowledge to formulate, analyze and solve tasks related to computer science	knows Turing machines and the existence of uncomputable problems resulting from them, knows the basics of time complexity and classes P and NP	[SU4] test/exam - oral or written
[INFMU2_W01] has in-depth knowledge of the branches of mathematics necessary for the study of computer science; has a good understanding of the role and importance of the construction of mathematical reasoning	knows diagonalization and reduction	[SW4] test/exam - oral or written
[INFMU2_W02] has in-depth knowledge of formal languages, models of computation, and issues of computational complexity; is familiar with the formal apparatus for formulating and studying the properties of computer objects	knows Chomsky hierachy	[SW4] test/exam - oral or written
[INFMU2_U05] can apply known algorithms in specific situations, can effectively select the type of algorithm depending on the problem at hand	knows the kinds of deterministic, non-deterministic and polynomial algorithms.	[SU4] test/exam - oral or written
[INFMU2_U04] Defines formal languages using grammars and automata; distinguishes between decidable and undecidable problems.	defines regular, context-free, and context-sensitive languages	[SU4] test/exam - oral or written

Subject contents

Turing machines (deterministic and non-deterministic), Turing-Church hypothesis

Elements of computability theory (universal functions, decidable and undecidable problems, reduction, Rice's theorem)

Formal languages and their decision problems (Chomsky's Hierarchy)

Time complexity (DTIME and NTIME classes, Blum's theorem, gap theorem)

Classes P and NP

Prerequisites and co-requisites

Discrete Mathematics

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
test	51.0%	60.0%
exam	51.0%	40.0%

Recommended reading

Basic literature	Hopcroft, Ullman: Introduction to automata theory, languages, and computation Jędzrejowicz, Szepietwski; Języki, automaty, złożoność obliczeniowa
Supplementary literature	Sommerhalder, vanWestrhenen: The theory of computability
eResources addresses	

Example issues/ example questions/ tasks being completed

Work placement

Not applicable