University of Gdańsk

Subject card

Subject name and code	Computability and Complexity, PG_00203617		
Field of study	Informatics		
Date of commencement of studies	October 2026	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	full-time studies	Mode of delivery	at the university
Year of study	1	Language of instruction	Polish
Semester of study	1	ECTS credits	5.0
Learning profile	academic	Assessment form	credit
Conducting unit			
Name and surname of lecturer (lecturers)	Subject supervisor	prof. dr hab. Andrzej Szepietowski	
	Teachers	prof. dr hab. Andrzej Szepietowski dr inż. Anna Nenca mgr Maciej Stankiewicz	

Lesson types							
	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	30.0	30.0	0.0	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	
	The aim of the course is to develop students' mathematical culture, develop intuition about computability barriers and the theory of complexity of computations, and the ability to determine whether an algorithm can be given for a given problem, whether a polynomial algorithm can be given, or whether the problem is NP-complete.

Learning outcomes

Course outcome	Subject outcome	Method of verification
[INFMU2_U01] is able to formulate, analyze and solve complex problems related to computer science by selecting and applying appropriate mathematical methods and tools	Able to formulate a decision problem and apply formal mathematical methods (reductions, undecidability proofs) to assess whether it admits an algorithm, a polynomial-time algorithm, and whether it is NP-complete.	[SU4] test/exam - oral or written
[INFMU2_W02] has in-depth knowledge of models of computation, and issues of computational complexity; is familiar with the formal apparatus for formulating and studying the properties of computer objects	Has in-depth knowledge of computation models (deterministic/ nondeterministic Turing machines, Chomsky hierarchy), complexity classes (P, NP, NP-complete problems, space complexity) and decidability fundamentals (Church–Turing thesis, undecidable problems, Rice's theorem).	[SW4] test/exam - oral or written
[INFMU2_U03] can design and analyze computational complexity and build algorithms	Able to analyse time and space complexity of problems and algorithms, classify problems into P and NP, and prove NP-completeness by polynomial reduction.	[SU4] test/exam - oral or written

Subject contents

Chomsky's hierarchy. Turing machines, deterministic and non-deterministic. Languages and decision-making problems.
Time complexity (P and NP classes, NP-complete problems). Examples of NP-complete problems. Reduction of problems. Memory complexity.
Elements of decidability theory. Turing-Church hypothesis. Decidable and undecidable problems. Rice's theorem.

Prerequisites and co-requisites

Introduction to mathematics.

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
pass	51.0%	90.0%
tests	51.0%	10.0%

Recommended reading

Basic literature	J. Jędrzejowicz, A. Szepietowski, Języki, automaty, złożoność obliczeniowa, Wydawnictwo UG, 2008.
Supplementary literature	C. H. Papadimitriou, Złożoność obliczeniowa, WNT 2002
eResources addresses	

Example issues/ example questions/ tasks being completed

not applicable

Work placement

Not applicable

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