University of Gdańsk

Subject card

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|---|---|---|---|
| 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<br>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 | | |

**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_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 |
| [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 |

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| Subject contents | Chomsky's hierarchy. Turing machines, deterministic and non-deterministic. Languages and decision-making problems.<br>Time complexity (P and NP classes, NP-complete problems). Examples of NP-complete problems. Reduction of problems. Memory complexity.<br>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 |
|---|---|---|
| exam | 51.0% | 90.0% |
| tests | 51.0% | 10.0% |

**Recommended reading**

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

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| Example issues/ example questions/ tasks being completed | not applicable |
| Work placement | Not applicable |

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