University of Gdańsk

Subject card

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Subject name and code | Logics in Computer Science, PG_00203606 | | | | | | |
| 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 | 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 | 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<br>• role and applications of logical calculi in computer science<br>• examples of logics relevant in computer science<br>• various methods of modeling and verification of properties of information processing systems<br>• selected tools to support the modeling, proving and verification of properties | | | | | | |

## 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 | is able to prepare a model of a simple IT system using tools such as SPIN and/or Alloy<br>is able to prove the theorem of a classical and an intuitionist logic, can prove that the theorem of a classical logic is not a theorem of an intuitionistic logic<br>is able to express the some property of an IT system in temporal logic, LTL, CTL, CTL*, distinguishes between these logics | [SU2] presentation/project/paper/ report<br>[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 | is familiar with several basic logical systems, their syntax, semantics, deductive systems, and key (meta)properties recognizes and can identify the connection between the logics studied and problems in computer science; knows how to define a logic using rules of natural deduction;<br>is familiar with classical and intuitionistic logic; is able to prove logical formulas; understands the semantics of these logics (Boolean algebra, Kripke structures)<br>is familiar with temporal logics, LTL, CTL, and CTL*<br>is familiar with tools that support modeling, expressing properties, and verifying those properties: SPIN, Alloy, and PIPE2 | [SW4] test/exam - oral or written<br>[SW2] presentation/project/paper/ report |
| [INFMU2_U02] is able to formulate questions with precision, serving to deepen his/her own reasoning on a given topic or to find missing elements of reasoning, to lead a debate | is able to precisely formulate questions to deepen their own reasoning on a given topic or to find missing elements of a reasoning | [SU2] presentation/project/paper/ report |

## Subject contents

- Classical propositional calculus: syntax, semantics, basic (meta)properties, natural deduction proof system
- Satisfiability Problem (SAT)
- Intuitionist logic: constructive interpretation of logical connectives, semantics based on Kripke structures
- Logic of first-order predicates: syntax, semantics, the most important (meta)properties, natural deduction proof system
- Applications of predicate logic to specification and modeling of systems
- Temporal logics: LTL, CTL, CTL*
- Model verification of temporal properties

## Prerequisites and co-requisites

## Assessment methods and criteria

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

## Recommended reading

| | |
|---|---|
| Basic literature | Lecture notes/slides. |
| Supplementary literature | • Gerard J. Holzmann, The Spin Model Checker, Primer and Reference Manual, Addison-Wesley, 2004.<br>• Michael Huth, Mark Ryan, Logic in Computer Science, Modelling and Reasoning about Systems, Cambridge University Press, 2004.<br>• Daniel Jackson. Software Abstractions: Logic, Language, and Analysis, Revised Edition, The MIT Press, 2012 |
| eResources addresses | |

| | |
|---|---|
| Example issues/ example questions/ tasks being completed | Using the method of natural deduction, prove that in classical propositional calculus (A->B) \/ (B-> C)<br><br>Construct a model M such that M \|=/ G F p and M \|= AG EF p<br><br>What is undecidability? Give an example and justify. |
| Work placement | Not applicable |

Document generated electronically. Does not require a seal or signature.