

LOGIC AND SET THEORY

Faculty of Computer Science			
Study programme:	Computer Science		Degree level: Engineer's degree full-time programme
Specialization	---		Diploma path: 2026/2027W - 2026/2027S
Module name:	Logic and Set Theory (Logika i teoria mnogości)		
Module type:	obligatory	Semester: 1	ECTS:4 Module ID: FCS-00058
No. of hrs in semester:	Lecture (L) - 30 Classes(C) - 30 Specialization workshop (SW) - 0 Project (P) - 0 Laboratory classes (LC) - 0 Seminar (S) - 0		
Prerequisites	-		
Aims and objectives:	The aim of the lecture is to give the students a wide general view of the fundamental notions concerning algebra of sets, algebra of relations and basic deductive systems at the level of propositional and predicate logic. Students learn how to properly construct mathematical reasoning and develop the ability to provide mathematical proofs. Emphasis will be put on providing a context for the application of the presented notions within the computer science.		
Forms of teaching activities:	lecture, classes,	Assessment:	Evaluation must be relevant to the intended learning outcomes:
		Lectures: exam Classes: test	
Module content:	<p>Lecture:</p> <ol style="list-style-type: none"> Natural numbers. Axioms of the natural numbers. Mathematical induction. Algebra of sets. Propositional calculus. Propositional calculus cont.. Methods of proving. First-order predicate calculus. Relations and their properties. Equivalence relations. Abstraction classes. Ordering relations and their types. Functions as unambiguous relations. Countable and uncountable sets. Cantor and Cantora-Bernstein theorems. Well-ordered sets and ordinal numbers. Lattices and Boolean algebras. <p>Classes:</p> <ol style="list-style-type: none"> Applying the axioms of natural numbers to define operations and prove basic properties of arithmetic Proving statements using mathematical induction Determining the properties of sets. Performing operations on sets Examining of tautology and satisfiability of propositional calculus formulas Examining of tautology and satisfiability of propositional calculus formulas cont. Verification of the correctness of selected reasoning Examining of tautology and satisfiability of predicate calculus formulas in selected models Determining the properties of relations. Performing operations on relations Determining classes of abstraction and division of a set for selected equivalence relations Finding special elements of posets (upper and lower bound, the largest, the smallest, a maximal, a minimal element) Determining the properties of functions. Performing operations on functions Determining whether sets are countable and proving uncountability of selected sets Applying Cantor's and Cantor-Bernstein theorems Analyzing well-ordered sets and determining and comparing basic ordinal numbers Studying lattice structures and Boolean algebras 		
Teaching methods:	subject exercises, lecture problem, informative lecture,		
Learning outcomes			
Symbol	Specify min. 4, max. 8 learning outcomes in the following order: knowledge - skills - competence. Each learning outcome must be verifiable		Reference to the programme learning outcomes of education
L01	is familiar with the axioms of the natural numbers and set theory; understands the significance of inductive proofs; is familiar with the formal definitions of set operations; defines the basic concepts of mathematical logic and their applications in proving set properties; lists and describes the basic methods of proof		INF1_W01
L02	defines the basic concepts and structures of set theory, understands the characterisations of relations and functions, understands the fundamentals of cardinality theory and the theory of ordered sets, and can cite basic theorems from set theory		INF1_W01
L03	provides inductive proofs of theorems, applies formal methods of proving theorems, verifies the satisfiability and tautality of formulas in classical propositional logic and selected formulas in predicate logic, and proves basic properties of sets, relations and functions		INF1_U01
L04	examines the properties of relations and functions, including equivalence relations and ordering relations; identifies the classes of abstraction for equivalence relations; determines the cardinalities of typical infinite sets		INF1_U01
No. of learning outcome	Methods of assessing the learning outcome		Type of teaching activities (if more than one) during which the outcome is assessed

L01	exam	L	
L02	exam	L	
L03	tests	C	
L04	tests	C	
Student's workload (in hours)	1 - Attendance at lectures	None	30
	2 - Attendance at classes		30
	3 - Preparation for classes	None	20
	4 - Participation in student-teacher sessions	None	5
	6 - Preparation for exam	None	13
	7 - Participation in exam		2
		TOTAL:	
Quantitative indicators	Student's workload - activities that require direct teacher participation: (7)+(2)+(1)+(4)	67	ECTS 2.7
	Student's workload connected with practical classes (3)+(2)	50	2.0
Basic references:	1. K. H. Rosen, Discrete Mathematics and Its Applications, McGraw-Hill Education - Europe, 1999 2. K. A. Ross, C. R. B. Wright. Discrete Mathematics, Prentice Hall, 1988 3. E. Mendelson, Introduction to Mathematical Logic, CRC Press, 1997 4. K. Devlin, Sets, Functions, and Logic, An Introduction to Abstract Mathematics. Chapman & Hall/CRC Mathematics (3rd ed.), 2003 5. N. Nisanke, Introductory logic and sets for computer scientists. Addison-Wesley, 1999		
Further reading	1. M. Ben-Ari, Mathematical Logic for Computer Science, Springer, 2001. 2. N. L. Biggs, Discrete Mathematics, Oxford University Press, 1989. 3. A. Hajnal, P. Hamburger, Set Theory, Cambridge University Press, 1999. 4. J. Matousek, J. Nešetřil, Discrete Mathematics, Clarendon Press, Oxford, 2002. 3. J.L. Bell, M. Machover, A course in mathematical logic, North-Holland, Amsterdam 1977.		
Unit:	Department of Theoretical Computer Science	Lecturer/ instructor	dr Magdalena Kacprzak
Date of issuing the programme:	30th March 2026	Author of the programme:	dr Magdalena Kacprzak

L - lecture, C - classes, LC - laboratory classes, P-project, SW - specialization workshop, S - seminar