

Subject card

Subject name and code	Computational group theory, PG_00179132						
Field of study	Mathematical Modeling and Data Analysis						
Date of commencement of studies	October 2023		Academic year of realisation of subject		2025/2026		
Education level	Bachelor's studies		Subject group				
Mode of study	full-time studies		Mode of delivery		at the university		
Year of study	3		Language of instruction		Polish		
Semester of study	6		ECTS credits		8.0		
Learning profile	academic		Assessment form		exam		
Conducting unit							
Name and surname of lecturer (lecturers)	Subject supervisor		dr Rafał Lutowski				
	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		0.0	60
Subject objectives	The purpose of the course is to familiarize students with the basic algorithms of computational group theory and the GAP program.						
Learning outcomes	Course outcome		Subject outcome		Method of verification		
	[MMiADL3_U11] knows how to arrange and analyse an algorithm in accordance with the specification and save it in the selected programming language		The student can design and analyze an algorithm that solves a group theory problem according to a given specification and implement it in a chosen programming language, including using the GAP environment.		[SU5] implementation of a problem task [SU8] observation of student's independent or team work		
	[MMiADL3_K02] is ready to precisely formulate questions to deepen his/her own understanding of a given topic or to find missing elements of reasoning		The student can formulate precise questions that support solving problems in group theory using the GAP system, particularly to deepen understanding of algorithm behavior and interpretation of results.		[SK5] implementation of a problem task [SK8] observation of student's independent or team work		
	[MMiADL3_W09] knows and understands the basics of computational and programming techniques supporting mathematician's work and understands their limitations		The student understands the basic computational techniques and programming principles used in computational group theory; they can use tools such as GAP effectively, with awareness of both their capabilities and limitations.		[SW5] implementation of a problem task		
	[MMiADL3_U10] is able to recognise problems, including practical issues, that can be solved algorithmically; can make a specification of such a problem		The student can identify problems in group theory that can be solved algorithmically and to formally specify such problems; they can select appropriate tools, including GAP functions, to solve them.		[SU5] implementation of a problem task [SU8] observation of student's independent or team work		

Subject contents	1. Definition and selected properties of groups 2. Group actions: orbits and stabilizers 3. Permutation groups: • stabilizer chains • Schreier-Sims algorithm • „backtrack” algorithms • natural actions and decompositions • primitive groups • composition series 4. GAP - groups, algorithms, programming • examples of theoretical concepts • GAP kernel - extending functionality		
Prerequisites and co-requisites	Basic knowledge of group theory and related algebraic objects.		
Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	test	51.0%	100.0%
Recommended reading	Basic literature	1. Alan F. Beardon, <i>Algebra and Geometry</i>, Cambridge University Press, 2005 2. Alexander Hulpke, <i>Notes on Computational Group Theory</i>, https://www.math.colostate.edu/~hulpke/CGT/cgtnotes.pdf 3. Various authors, documentations and tutorials for GAP, https://www.gap-system.org/Doc/doc.html	
	Supplementary literature	1. Holt, D. F., Eick, B., & O'Brien, E. A. (2005). <i>Handbook of Computational Group Theory</i>. Chapman & Hall/CRC	
	eResources addresses		
Example issues/ example questions/ tasks being completed	1. Determine the orbit of a group action. 2. Determine the stabilizer of a group action. 3. Determine stabilizer chain.		
Work placement	Not applicable		

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