University of Gdańsk

Subject card

Subject name and code	Computational group theory, PG_00179132		
Field of study	Informatics		
Date of commencement of studies	October 2023	Academic year of realisation of subject	2025/2026
Education level	Bachelor's studies	Subject group	Obligatory subject group in the field of study Optional subject group
Mode of study	part-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	
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
[INFL3_W02] has knowledge of discrete mathematics and probabilistic methods and statistics	The student understands the importance of precise mathematical reasoning in computational group theory, can construct and analyze such reasoning, and recognizes its role in algorithm design and result verification, including through the use of the GAP system.	[SW4] test/exam - oral or written [SW5] implementation of a problem task
[INFL3_U03] can design and analyze algorithms for their correctness and computational complexity using appropriate algorithmic techniques and data structures	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

Subject contents

1. Definition and selected properties of groups
2. Group actions: arbits and stabilizers
3. Permutation groups:
   - stabilizer chains
   - Schreiera-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

<table>
<tr><td>Prerequisites and co-requisites</td><td colspan="3"></td></tr>
<tr><td>Assessment methods and criteria</td><td colspan="3"><table><tr><th>Subject passing criteria</th><th>Passing threshold</th><th>Percentage of the final grade</th></tr><tr><td>test</td><td>51.0%</td><td>100.0%</td></tr></table></td></tr>
<tr><td rowspan="3">Recommended reading</td><td>Basic literature</td><td colspan="2">1. Alan F. Beardon, Algebra and Geometry, Cambridgr Universiy Press, 2005
2. Alexander Hulpke, Notes on Computational Group Theory, 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</td></tr>
<tr><td>Supplementary literature</td><td colspan="2">n/a</td></tr>
<tr><td>eResources addresses</td><td colspan="2"></td></tr>
<tr><td>Example issues/ example questions/ tasks being completed</td><td colspan="3">1. Determine the orbit of a group action.
2. Determine the stabilizer of a group action.
3. Determine stabilizer chain.</td></tr>
<tr><td>Work placement</td><td colspan="3">Not applicable</td></tr>
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