University of Gdańsk

Subject card

Subject name and code	Advanced Algorithms, PG_00203638						
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 Subject group related to scientific research in the field of study			
Mode of study	part-time studies		Mode of delivery	at the university			
Year of study	1		Language of instruction	Polish			
Semester of study	2		ECTS credits	5.0			
Learning profile	academic		Assessment form	exam			
Conducting unit							
Name and surname of lecturer (lecturers)	Subject supervisor		dr Maciej Dziemiańczuk				
	Teachers						
Lesson types	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	20.0	0.0	20.0	0.0	0.0	40
	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	40		0.0		85.0	125
Subject objectives	The aim of the course is to introduce students to the basic techniques of designing parallel algorithms. Another aim is to familiarize students with the subject-specific terminology in English.						

<table>
<tr><td>Learning outcomes</td><td>
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<tr><th>Course outcome</th><th>Subject outcome</th><th>Method of verification</th></tr>
<tr><td>[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</td><td>Knows the PRAM model and its submodels. Understands the conflicts that occur in parallel programming. Knows asymptotic notation for estimating the complexity of parallel algorithms.</td><td>[SW4] test/exam - oral or written</td></tr>
<tr><td>[INFMU2_W04] knows and understands in depth the principles of designing and implementing complex software systems, the impact of system architecture on its concurrency, performance and scalability, concurrent and parallel processing models and their application in modern systems</td><td>Knows selected data structures used by parallel algorithms.
Knows selected techniques for designing parallel algorithms.</td><td>[SW4] test/exam - oral or written</td></tr>
<tr><td>[INFMU2_U05] is able to effectively select the type of algorithm depending on the given problem, is able to apply algorithms using advanced information and communication techniques</td><td>Can design an algorithm utilizing techniques such as balanced tree, pointer jumping, tree contraction, and Eulerian cycle.</td><td>[SU4] test/exam - oral or written</td></tr>
<tr><td>[INFMU2_U03] can design and analyze computational complexity and build algorithms</td><td>Can design constant-time or logarithmic-time parallel algorithms for simple problems.
Can assess the computational complexity of designed algorithms.</td><td>[SU4] test/exam - oral or written</td></tr>
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<tr><td>Subject contents</td><td>1. PRAM model assumptions, potential conflicts and their resolution in PRAM sub-models;
2. Writing parallel algorithms;
3. Parameters of parallel algorithms;
4. Methods for designing parallel algorithms: balanced tree method, pointer jumping (algorithms on lists), divide and conquer, breaking symmetry, Eulerian cycle technique;
5. Selected algorithms: prefix sum algorithms, binary number addition, arithmetic expression tree evaluation, sorting, cycle coloring.</td></tr>
<tr><td>Prerequisites and co-requisites</td><td></td></tr>
<tr><td>Assessment methods and criteria</td><td>
<table>
<tr><th>Subject passing criteria</th><th>Passing threshold</th><th>Percentage of the final grade</th></tr>
<tr><td>tests</td><td>51.0%</td><td>50.0%</td></tr>
<tr><td>exam</td><td>51.0%</td><td>50.0%</td></tr>
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<tr><td>Recommended reading</td><td>
<table>
<tr><td>Basic literature</td><td>1. Joseph Jaja, An Introduction to Parallel Algorithms, Addison-Wesley Publishing Company, 1992;
2. Selim Akl, The Design and Analysis of Parallel Algorithms, Prentice-Hall, 1989.</td></tr>
<tr><td>Supplementary literature</td><td>not applicable</td></tr>
<tr><td>eResources addresses</td><td></td></tr>
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<tr><td>Example issues/ example questions/ tasks being completed</td><td>not applicable</td></tr>
<tr><td>Work placement</td><td>Not applicable</td></tr>
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