University of Gdańsk

Subject card

Subject name and code	Combinatorial Optimization, PG_00198476		
Field of study	Informatics		
Date of commencement of studies	October 2026	Academic year of realisation of subject	2028/2029
Education level	Bachelor'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	3	Language of instruction	Polish
Semester of study	5	ECTS credits	5.0
Learning profile	academic	Assessment form	credit
Conducting unit			
Name and surname of lecturer (lecturers)	Subject supervisor	dr Hanna Furmańczyk	
	Teachers		

Lesson types

Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
Number of study hours	20.0	20.0	0.0	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 this course is to familiarize students with basic optimization algorithms and the methods used in this field. In addition, students will learn the fundamentals of algorithmic analysis as well as the different types of algorithms—exact and approximate approaches.

Learning outcomes

Course outcome	Subject outcome	Method of verification
[INFOL3_W03] knows and understands advanced concepts in the field of algorithms and data structures, formal languages, automata theory and computational complexity, and artificial intelligence	The student knows and understands the methods for modeling combinatorial optimization problems and the properties of basic algorithms used to solve discrete problems.	[SW4] test/exam - oral or written
[INFOL3_U06] is able to select and apply appropriate IT methods and tools to solve complex problems, is able to use acquired knowledge by appropriately selecting sources and information derived from them, and perform evaluation, critical analysis, and synthesis of this information	The student is able to model combinatorial optimization problems and use appropriate algorithms and computational tools to determine and analyze their solutions.	[SU4] test/exam - oral or written [SU5] implementation of a problem task
[INFOL3_U02] is able to use his/her knowledge of higher mathematics to model and solve complex problems	The student is able to model problems using graph theory and express these problems in a formalized manner	[SU4] test/exam - oral or written [SU5] implementation of a problem task

<table>
<tr><td>Subject contents</td><td>The course will cover the following topics:

1. Selected fundamentals of graph theory (connectedness, strongly connected, graph traversal)

2. Spanning trees and Steiner trees

3. Linear programming

4. The shortest path problem

5. Flows in networks

6. Approximation algorithms

7. Dynamic programming—knapsack problems, etc.</td></tr>
<tr><td>Prerequisites and co-requisites</td><td>1. Discrete mathematics.
2. Algorithms and data structures.
3. Programming skills in any language.</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>programming tasks</td><td>51.0%</td><td>40.0%</td></tr>
<tr><td>midterm exam</td><td>51.0%</td><td>20.0%</td></tr>
<tr><td>exam</td><td>51.0%</td><td>40.0%</td></tr>
</table></td></tr>
<tr><td>Recommended reading</td><td><table>
<tr><td>Basic literature</td><td>1. B. Korte, J. Vygen, Combinatorial optimization. Theory and algorithms, Springer 2018.
2. Ch.H. Papadimitriou, K. Steiglitz, Combinatorial optimization. Algorithms and complexity, David & Charles 2020.
3. P. Brucker, Scheduling algorithms, Springer 2006.
4. J. Wojciechowski, K. Pieńkosz, Grafy i sieci, PWN 2013.</td></tr>
<tr><td>Supplementary literature</td><td>JOHNSON, David S. Christos H. Papadimitriou Computational complexity In Eugene L. Lawler, Jan Karel Lenstra, Alexander HG Rinnooy Kan and David B. Shmoys, editors, The Traveling Salesman Problem: A Guided Tour of Combinatorial Optimization 37-85, 145-180, 1985.</td></tr>
<tr><td>eResources addresses</td><td></td></tr>
</table></td></tr>
<tr><td>Example issues/ example questions/ tasks being completed</td><td></td></tr>
<tr><td>Work placement</td><td>Not applicable</td></tr>
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