



Subject card

Subject name and code	Discrete Optimisation Algorithms, PG_00063909						
Field of study	Informatics						
Date of commencement of studies	February 2027	Academic year of realisation of subject			2026/2027		
Education level	second-cycle studies	Subject group			Optional subject group Specialty subject group Subject group related to scientific research in the field of study		
Mode of study	Full-time studies	Mode of delivery			at the university		
Year of study	1	Language of instruction			English		
Semester of study	1	ECTS credits			3.0		
Learning profile	general academic profile	Assessment form			exam		
Conducting unit	Department of Algorithms and Systems Modelling -> Faculty of Electronics Telecommunications and Informatics -> Faculties of Gdańsk University of Technology						
Name and surname of lecturer (lecturers)	Subject supervisor	dr hab. inż. Michał Małafiejski					
	Teachers	dr inż. Tytus Pikies					
Lesson types	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	15.0	0.0	15.0	0.0	0.0	30
	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	30		6.0		39.0	75
Subject objectives	Introduction to the methods of the construction of approximation algorithms to the computationally hard problems. The ability to prove guaranteed approximation ratios of algorithms for selected optimization problems. The construction of approximation schemes using pseudo-polynomial time algorithms based on dynamic programming. Overview of the significant problems of discrete optimization.						

Learning outcomes	Course outcome	Subject outcome	Method of verification
	[K7_W04] knows and understands, to an increased extent, the principles, methods and techniques of programming and the principles of computer software development or programming devices or controllers using microprocessors or other elements or programmable devices specific to the field of study, and organization of work of systems using computers or such devices	Student is able to find or construct by himself an efficient approximation algorithm for the proposed model.	[SW3] Assessment of knowledge contained in written work and projects
	[K7_U01] can apply mathematical knowledge to formulate and solve complex and non-typical problems related to the field of study by: - appropriate selection of source information and its critical analysis, synthesis, creative interpretation and presentation, - application of appropriate methods and tools	Student analyzes real-world problems using discrete mathematical models.	[SU1] Assessment of task fulfilment [SU2] Assessment of ability to analyse information
	[K7_W01] knows and understands, to an increased extent, mathematics to the extent necessary to formulate and solve complex issues related to the field of study	Student examines and analyzes the quality of the approximate algorithms.	[SW2] Assessment of knowledge contained in presentation
[K7_U08] while identifying and formulating engineering tasks specifications and solving these tasks, can: - apply analytical, simulation and experimental methods, - notice their systemic and non-technical aspects, - make a preliminary economic assessment of suggested solutions and engineering work	Student is able to analyze a computational problem. The student is able to analyze the resources necessary to solve the problem. The student is able to perform experiments to verify quality of the solution.	[SU2] Assessment of ability to analyse information [SU1] Assessment of task fulfilment	
Subject contents	<p>Course content – lecture</p> <p>0. Grading rules.</p> <p>1. Basic methods of construction and analysis of the algorithms. An analysis of chosen sample algorithms.</p> <p>2. Absolute and relative approximation ratio of algorithm. Approximation algorithms and schemas. Pseudo-polynomial time algorithm for the partition.</p> <p>3. FPTAS for knapsack problem. Strong NP-Hardness. Problems outside APX. L-reductions.</p> <p>4. Randomized Approximation Algorithms.</p> <p>5. Approximation algorithms based on LP.</p> <p>6. Approximation algorithm for the chosen problems from: max-cut, metric k-center, VC (layering method), bin packing, shortest superstring problem (greedy and constant-ratio approximation), for Steiner Tree problem, TSP.</p> <p>Course content – laboratory</p> <p>Analysis and implementation of chosen approximation algorithms, e.g. Christofides algorithm for TSP, Vizing Algorithm, APTAS for bin-packing, randomized algorithm for SAT.</p>		
Prerequisites and co-requisites			
Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	Exam	50.0%	100.0%
Recommended reading	Basic literature	<p>Vazirani, Vijay V. "Approximation Algorithms"</p> <p>Thomas H. Corman: Introduction to Algorithms</p> <p>G. Ausiello et al: "Complexity and Approximation Combinatorial Optimization Problems and Their Approximability Properties"</p>	
	Supplementary literature	<p>Wilson Robin J. "Introduction to Graph Theory"</p> <p>Michael Mitzenmacher, E. Upfal: "Probability and Computing Randomized Algorithms and Probabilistic Analysis"</p>	
	eResources addresses		

Example issues/ example questions/ tasks being completed	-
Practical activities within the subject	Not applicable

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