University of Gdańsk

Subject card

Subject name and code	Numerical Algorithms, PG_00198479						
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	6		ECTS credits	5.0			
Learning profile	academic		Assessment form	exam			
Conducting unit							
Name and surname of lecturer (lecturers)	Subject supervisor		dr Adrian Karpowicz				
	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 the course is to familiarize students with numerical calculations, their applications and problems arising when conducting such calculations.						

Learning outcomes

Course outcome	Subject outcome	Method of verification
[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	Student understands the concepts of interpolation and approximation. Student understands the types of errors that arise during calculations, observes their occurrence, and applies methods to limit and control them. Student is able to find papers on a specific problem and apply selected elements to solve the assigned homework.	[SU4] test/exam - oral or written [SU5] implementation of a problem task
[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	Student knows and is able to apply methods for representing matrices in computer memory, including sparse matrix representations. Student will understand the impact of the chosen method on the computational and memory complexity of the implemented algorithm.	[SW4] test/exam - oral or written [SW5] implementation of a problem task
[INFOL3_U02] is able to use his/her knowledge of higher mathematics to model and solve complex problems	Student knows the iterative method and examples of its application. Student knows methods for solving linear equations. Student can apply the learned methods to solve a design problem.	[SU4] test/exam - oral or written [SU5] implementation of a problem task

Subject contents

1. Examples of numerical algorithms solving a given mathematical problem precisely, e.g. polynomial interpolation, solving systems of linear equations.
2. Examples of numerical algorithms solving a given mathematical problem, e.g. the problem of function approximation, finding approximate solutions to equations and systems of equations.
3. Data prediction using linear regression.
4. Data grouping methods, e.g. k-means grouping.

Prerequisites and co-requisites

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
Projects	51.0%	35.0%
Test	51.0%	65.0%

Recommended reading

Basic literature	• Wojciech Kordecki, Karol Selwat, Metody numeryczne dla informatyków, Helion, 2020. • H. Zhou, Eksploracja danych za pomocą Excela, Metody uczenia maszynowego krok po kroku, Helion, 2024.
Supplementary literature	• David Kincaid, Analiza numeryczna, WNT, 2006. • R. Johansson, Matematyczny Python. Obliczenia naukowe i analiza danych z użyciem NumPy, SciPy, Matplotlib. Helion, 2021.
eResources addresses	

Example issues/ example questions/ tasks being completed

1. Determine the LU decomposition of a given matrix. Discuss its application in solving systems of linear equations.

2. Find the line that best approximates the given measurement data using the **least squares method**. Calculate the error of the method.

3. Load a dataset containing coordinates of points in two-dimensional space. Apply the **k-means clustering algorithm** to group the points into **three clusters**. Additionally:

- Visualize the points with cluster assignments marked in different colors.
- Determine the coordinates of the cluster centers (centroids).
- Compute the total **within-cluster sum of squared distances** between the points and their centroids

Work placement

Not applicable

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