University of Gdańsk

Subject card

Subject name and code	Data analysis and numerical methods, PG_00143859		
Field of study	Informatics		
Date of commencement of studies	October 2024	Academic year of realisation of subject	2026/2027
Education level	Bachelor's studies	Subject group	Obligatory subject group 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	4.0
Learning profile	academic	Assessment form	
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	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	60.0	100

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
[INFL3_U03] can design and analyze algorithms for their correctness and computational complexity using appropriate algorithmic techniques and data structures	can write simple procedures in known programs that allow solving selected mathematical problems numerically and analyzes the results of their operation	[SU2] presentation/project/paper/ report [SU8] observation of student's independent or team work
[INFL3_W10] knows the basic principles of occupational health and safety in the IT profession	knows the basic principles of occupational health and safety in the IT profession	[SW1] oral statement/ conversation/discussion
[INFL3_U01] can apply mathematical knowledge to formulate, analyze and solve problems related to computer science	Applies knowledge of mathematical analysis and linear algebra to the design of numerical algorithms and data analysis.	[SU2] presentation/project/paper/ report [SU4] test/exam - oral or written
[INFL3_W01] has knowledge in mathematics including issues of mathematical analysis and linear algebra with geometry and numerical methods	knows the theoretical foundations of computational methods used to solve selected mathematical problems numerically	[SW4] test/exam - oral or written
[INFL3_U02] can precisely formulate questions to deepen one's understanding of a given topic or find missing elements of reasoning	designs and analyzes algorithms for solving mathematical problems numerically	[SU1] oral statement/conversation/ discussion [SU2] presentation/project/paper/ report

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.

<table>
<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>Test</td><td>51.0%</td><td>65.0%</td></tr>
<tr><td>Projects</td><td>51.0%</td><td>35.0%</td></tr>
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</td></tr>
<tr><td>Recommended reading</td><td>
<table>
<tr><td>Basic literature</td><td>• 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.</td></tr>
<tr><td>Supplementary literature</td><td>• David Kincaid, Analiza numeryczna, WNT, 2006.
• R. Johansson, Matematyczny Python. Obliczenia naukowe i analiza danych z użyciem NumPy, SciPy, Matplotlib. Helion, 2021.</td></tr>
<tr><td>eResources addresses</td><td></td></tr>
</table>
</td></tr>
<tr><td>Example issues/ example questions/ tasks being completed</td><td>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:
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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</td></tr>
<tr><td>Work placement</td><td>Not applicable</td></tr>
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