Institute of Applied Mathematics			Semester 2. of the curriculum 2025-26-2			
Name of the subject:	Code of the subject:	Credits:	Weekly hours:			
				lec	sem	lab
Algorithm theory	NMXAE1EMNF	4	full-time	3	0	0
Responsible person for the subject: Dr. HEGEDÜS Gábor			Classification: associate professor			
Subject lecturer(s):						
Prerequisites:						
Way of the assessment:	exam					

Course description	
Goal:	Developing the student's conceptualization, abstraction, and problem-solving abilities by learning about the basic topics of algorithm theory as well as their applications in problem solving and model creation. The basic concepts of graph algorithms and complexity theory are learned.
Course description:	Dynamical programming, graph algorithms: BFS, DFS, maximal matching in bipartite graphs, Bellman-Ford's, Floyd's, Dijkstra's algorithm, sorting: insertion sort, bubble sort, shell sort, merge sort, quick sort, bucket and radix sort, binary search tree, 2-3 tree, B tree, Jarnik-Prim's algorithm, Kruskal's algorithm, P, NP, coNP classes and their connections, NP-completeness

Lecture schedule	
Education week	Topic
1.	Ordo, omega, theta, branch and bound, dynamical programming (binomial coefficients, backpack)
2.	Graphs, breadth first search, depth first search, maximal matching in bipartite graphs
3.	Bellman-Ford's, Floyd's, Dijkstra's algorithms
4.	Searching (linear, binary), sorting: insertion sort, bubble sort, shell sort
5.	Sorting: shell sort, merge sort, bucket and radix sort
6.	First midterm test
7.	Topological order, dag, searching of the shortest and longest paths in dags, strong connectivity of graphs
8.	Binary search tree, 2-3 tree, B tree, AVL tree
9.	Minimal spanning trees: Kruskal's and Prim's algorithm
10.	Decision problems, P, NP and coNP classes
11.	Basic properties of Karp reduction
12.	NP-completeness, NP-complete problems
13.	Second midterm test
14.	Test retake

Mid-term requirements	
Conditions for obtaining a mid-term grade/signature	The student obtains the signature only if they have written both midterm test and reach at least 50% of the scores. The midterm tests consist of theoretical questions and exercises from the material of the lectures and classes. It is compulsory to attend the lectures and classes,

	the absence may not exceed 30% of the lectures.
Assessment schedule	
Education week	Topic
6.	Material of weeks 1 to 5
13.	Material of weeks 7 to 12
14.	One of the midterms
Method used to calculate the *mid-term grade* (to be filled out only for subjects with mid-term grades)	
Type of the replacement	
Type of the replacement of written test/mid-term grade/signature	Test retake in the last week of the lecture period, signature retake exam in the first 10 days of the examination period.
Type of the exam (to be filled out only for subjects with exams)	
Written exam consisting of theoretical and practical parts.	
Calculation of the exam mark (to be filled only for subjects with exams)	
50% for theoretical questions and 50% for exercises	
Final grade calculation methods:	

Total points	**Colloquium grade**
86–100	excellent (5)
74–85	good (4)
62–73	satisfactory (3)
50–61	pass (2)
0–49	fail (1)

References	
Obligatory:	Materials uploaded to the e-learning system of the university
Recommended:	R. Sedgewick, K. Wayne: Algorithms Herbert S. Wilf: Algorithms and Complexity
Other references:	