Course Syllabus

I. General Information

Course name	Graph and network theory
Programme	Mathematics
Level of studies (BA, BSc, MA, MSc, long-cycle MA)	BA
Form of studies (full-time, part-time)	full-time
Discipline	Informatics, Mathematics
Language of instruction	English

Course coordinator/person responsible	Małgorzata Nowak-Kępczyk

Type of class *(use only the types mentioned below)*	Number of teaching hours	Semester	ECTS Points
lecture	30	III or V	5
tutorial			
classes	30	III or V	
laboratory classes			
workshops			
seminar			
introductory seminar			
foreign language classes			
practical placement			
field work			
diploma laboratory			
translation classes			
study visit			

Course pre-requisites	Linear algebra with analytical geometry Basic information about graphs - Discrete mathematics Basic information on algorithm analysis and computational complexity Knowledge of abstract data structures Ability to program in Java (or other object-oriented language)

II. Course Objectives

C1 - To familiarize students with issues related to graph theory and network.
C2 - Acquisition by students of skills to study the properties of the graph algorithms discussed.
C3 - Improving programming skills in the field of abstract data structures.

III. Course learning outcomes with reference to programme learning outcomes

Symbol	Description of course learning outcome	Reference to programme learning outcome
KNOWLEDGE		
W_01	The student understands the importance of mathematics and its applications, in particular its role in the context of contemporary civilization's dilemmas	K_W01
W_02	The student has advanced knowledge of the basic areas of higher mathematics, in particular in calculus, algebra, geometry, logic, measure and integral, probability theory, differential equations, statistics, set theory, topology and others selected fields of mathematics and its applications.	K_W04
SKILLS		
U_01	The student can in a clear manner, in speech and writing, present correct mathematical reasoning, formulate theorems and definitions	K_U38
SOCIAL COMPETENCIES		
K_01	The student is prepared to appreciate the role and importance of knowledge in solving cognitive and practical problems, typical of occupations and workplaces appropriate for graduates in the field of mathematics and consulting experts in the case of difficulties in solving the problem	K_K02
K_02	The student is ready to present selected achievements of higher mathematics in a popular way	K_K05

IV. Course Content

1. Comparison of computer graph representation methods.
2. Euler and Hamiltonian cycle. Examples of graph processing algorithms.
3. Searching algorithms in depth (DSF). Methods of implementation and application.
4. Searching algorithms across (BSF). Methods of implementation and application.
5. Minimal spanning tree. Comparison of Prima, Kruskal and Boruvka algorithms.
6. The shortest paths. Dijkstra's algorithm.
7. Graphs with negative weights. Bellman - Ford, Floyd Warshal, Johnson algorithms.
8. Basic concepts of flow networks. Ford - Fulkerson algorithm.
9. Maximum association in a graph. Hall's theorems. Examples of using flow networks.
10. Coloring of graph vertices. Basic definitions and theorems. Greedy algorithm.
11. Methods of sequential selection of vertices.
12. Coloring the edges of the graph. Application of graph coloring.
13. Planar graphs. Coloring regions.

V. Didactic methods used and forms of assessment of learning outcomes

Symbol	Didactic methods *(choose from the list)*	Forms of assessment *(choose from the list)*	Documentation type *(choose from the list)*
		KNOWLEDGE	
W_01	Conventional lecture	Exam, tests	Filled, evaluated tests and exams
W_02	Discussion, problem solving	Evaluation during classes	Grade sheets
		SKILLS	
U_01	Practical classes	Submitted spreadsheets, documentation	Printouts
		SOCIAL COMPETENCIES	
K_01	Work in pairs	Submitted spreadsheets, documentation	Printouts
K_02	Discussion, problem solving	Evaluation during classes	Grade sheets

VI. Grading criteria, weighting factors..

Completing classes based on the project, developing a given problem, implementing the discussed algorithms, involvement and work in class, tests results - detailed requirements and assessment criteria are established in the class with students.

Below 50% of all possible points obtained is unsatisfactory. Detailed criteria are given to students with each edition of the subject.

Written exam: below 50% unsatisfactory.

VII. Student workload

Form of activity	Number of hours
Number of contact hours (with the teacher)	***90***
Number of hours of individual student work	***60***

VII. Literature

Basic literature
R. Balakrishnan, K. Ranganathan, A Textbook of Graph Theory, Springer-Verlag, New York, 1999. T.H. Cormen, C.E. Leiserson, R.L. Rivest, Introduction to algorithms, 3rd ed. The MIT Press Cambridge, Massachusetts London, England R. Sedgewick, Algorithms in C, Part 5: Graph Algorithms 3rd Edition, ISBN-13: 978-0201316636 ISBN-10: 0201316633
Additional literature
M. Kubale, Optymalizacja dyskretna - modele i metody kolorowania grafów, Wydawnictwo Naukowo-Techniczne, Warszawa, 2002. R. J. Wilson, Wprowadzenie do teorii grafów, PWN, Warszawa, 2008.