Discrete Mathematics 1 - course description

General information

Course name	Discrete Mathematics 1
Course ID	11.1-WK-MATP-MD1-Ć-S14_pNadGenKDJP9
Faculty	Faculty of Mathematics, Computer Science and Econometrics
Field of study	Mathematics
Education profile	academic
Level of studies	First-cycle studies leading to Bachelor's degree
Beginning semester	winter term 2020/2021

Course information

Semester	2
ECTS credits to win	6
Course type	obligatory
Teaching language	polish
Author of syllabus	• dr hab. Ewa Drgas-Burchardt, prof. UZ

Classes forms

The class form	Hours per semester (full-time)	Hours per week (full-time)	Hours per semester (part-time)	Hours per week (part-time)	Form of assignment
Class	30	2	-	-	Credit with grade
Lecture	30	2	-	-	Exam

Aim of the course

The course introduces basic notions and ideas of the discrete mathematics in theoretic and algorithmic aspects.

Prerequisites

Introduction to mathematics, Linear algebra 1.

Scope

Lecture

1. Basic notions of the graph theory: neighbourhood, adjacency, isomorphism, paths, cycles, connectivity, subgraphs (2 h).
2. Graph matrixes (2 h).
3. Some classes of graphs (2 h).
4. Union, join and complement graph operations (2 h).
5. Trees and their properties (4 h).
6. BFS and DFS algorithms (2 h).
7. Vector spaces of the graph (2 h).
8. n-connectivity (2 h).
9. Eulerian graphs. Hamiltonian Graphs (3 h).
10. Planar graphs, Kuratowski's Theorem, Harary's Theorem (3 h).
11. Covers and independence (2 h).
12. Vertex colouring of graphs, list colouring of graphs, Brooks's Theorem, the Szekeres-Wilf Theorem, Vizing's Theorem, Thomassen's Theorem (4 h).

Class

1. Reading information on a graph from its matrixes, adjacency lists, sets of pairs. Interpretation of operations on graph matrixes. Matrixes of graph operations (4 h).
2. Investigation of basic tree's features. Counting labeled trees, using known algorithms to find a spanning tree of a graph, its sets of fundamental cycles and elementary cut. Generating of cycle and cut spaces of a graph. Construction of a modular decomposition tree of a graph (8 h).
3. Analysis of graph connectivity (2 h).
4. Investigation of Eulerian and Hamiltonian graphs and dependence of these properties on other features of graphs. Using known algorithms to recognize an Euler tour and a Hamilton cycle in a graph (4 h).
5. Recognition of problems associated with graph planarity, independence and covers numbers of a graph in practical exercises. Application of theoretical knowledge in practical problems on this topic (4 h).
6. Recognition of coloring problems in practice. Theoretical and algorithmic approach (6 h).
7. Test completion (2 h).

Teaching methods

Conversation lecture, traditional lecture, discussion exercises.

Learning outcomes and methods of theirs verification

Outcome description	Outcome symbols	Methods of verification	The class form

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A student is able to name and define the basic concepts of discrete mathematics.	• K_W06	• a discussion • a written assignment • an exam - oral, descriptive, test and other • an observation and evaluation of activities during the classes	• Lecture • Class
A student is able to perform simple proofs in the field of discrete mathematics.	• K_W02 • K_U01 • K_U04	• a discussion • a written assignment • an exam - oral, descriptive, test and other • an observation and evaluation of activities during the classes	• Lecture • Class
A student is able to decide with which objects in the field of discrete mathematics the solution of the practical problem can be identified.	• K_U17	• a discussion • a written assignment • an exam - oral, descriptive, test and other • an observation and evaluation of activities during the classes	• Lecture • Class
A student is able to apply an appropriate algorithm, among those which were presented at the course, to solve the problem of discrete mathematics.	• K_U25	• a discussion • a written assignment • an exam - oral, descriptive, test and other • an observation and evaluation of activities during the classes	• Lecture • Class
A student is able to name linear spaces associated with a graph.	• K_U29	• a discussion • a written assignment • an exam - oral, descriptive, test and other • an observation and evaluation of activities during the classes	• Lecture • Class
A student understands the significance of intellectual honesty, both in their own and in other people's activities; demonstrate ethical behavior.	• K_K04	• a discussion • an observation and evaluation of activities during the classes	• Lecture • Class

Assignment conditions

Methods: D - participation in the discussions during the course P1 - essay P2 - written exam PU2 - oral exam S - self-esteem
Assessment of individual classes:
1. Checking of preparedness of students and their activity during exercise (D, S).
2. Colloquium with the tasks of different difficulty, allowing to evaluate whether the students have achieved specified learning outcomes in terms of skills and competencies (P1).
3. Conversation during the lecture in order to verify the effects of higher levels of education in terms of knowledge and skills (D, S).
4. Written exam to verify the learning outcomes in terms of knowledge and skills (P2).
5. Oral exam, which allows to complete student's written [removed]PU2).
The grade of the module consists of the assessment exercise (50%), exam grade (P2 + PU2) (50%). The condition of the exam is to get a positive assessment of the exercise.
The prerequisite to obtain a positive evaluation of the module is the positive evaluation of the exercise and the exam.

Recommended reading

1. V. Bryant, Aspekty kombinatoryki, WNT, Warszawa, 1997.
2. W. Lipski, Kombinatoryka dla programistów, WNT, Warszawa, 2005.
3. K.A. Ross, Ch.R.B. Wright, Matematyka dyskretna, PWN, Warszawa 1996.
4. R. J. Wilson, Wprowadzenie do teorii grafów, PWN, Warszawa, 1998.
5. D. West, Introduction to Graph Theory, 2nd ed., Prentice Hall, Upper Saddle River, 2001.

Further reading

1. W. Lipski, W. Marek, Analiza kombinatoryczna, PWN, Warszawa, 1989.

Notes

Modified by dr Alina Szelecka (last modification: 18-09-2020 13:45)