



UNIVERSITÀ
DEGLI STUDI DI MILANO-BICOCCA

COURSE SYLLABUS

Mathematics

2526-2-E4001N078

Aims

The course aims to provide basic knowledge of combinatorial calculus, discrete probability, and graph theory, with the goal of developing skills useful for the study and interpretation of social phenomena. Additionally, significant attention will be devoted across the course to the development of analytical, logical, and deductive skills for problem analysis and resolution.

(1) Knowledge and understanding.

Students will acquire basic knowledge primarily related to the following topics: combinatorial calculus, discrete probability, and graph theory. Learning these topics does not require prior knowledge other than the arithmetic taught in primary school. Through the study of elementary concepts, the course aims to develop the ability to understand logical processes of a mathematical nature and to lay the foundation for more advanced studies.

(2) Applying knowledge and understanding.

Students will be able to apply the concepts learned to solve problems.

(3) Making judgements.

The course aims to develop in students the ability to critically analyze the content presented. Independence in selecting the most appropriate problem-solving methods based on the type of problem will also be encouraged. These skills will be further enhanced through the comparison of different solution strategies for the same problem.

(4) Communication skills.

The use of formal mathematical language will be encouraged, while also emphasizing the importance of being able to translate ideas into intuitive terms.

(5) Learning skills.

The course aims to provide students with the tools needed to continue studying the proposed topics independently at more advanced levels, to approach new subjects with method and rigor, and to build on the knowledge already acquired. Students will also be encouraged to draw on various sources to deepen and update their competencies.

Contents

Combinatorics. Discrete probability. Matrices. Introduction to graph theory.

Detailed program

Sets: subsets, operations and relations between sets.

Combinatorics: sequences with and without repetitions. Permutations. Combinations. Finite probability space. Repeated and independent tests. Dependent and independent events. Conditional probability. Conditional probability and partitions. Bayes theorem.

Elementary functions: polynomials, exponentials, logarithms, their properties and graphs.

Operations with matrices.

Introduction to graph theory: definitions, properties and applications. Simple, complete, bipartite graphs. Path. Map coloring. Eulerian graphs.

Prerequisites

Elementary calculus.

Teaching form

42 hours of in-person lessons at the blackboard.

50% of the lessons are conducted in an expository mode in person (presentation of definitions, statements, examples) and 50% of the lessons are conducted in an interactive mode in person (exercises).

Textbook and teaching resource

- Introduction to graph theory, Douglas B. West
- Oxford University Press - Nets, Puzzles and Postmen - An Exploration of Mathematical Connections - Peter M. Higgins - (La matematica dei social network. Una introduzione alla teoria dei grafi - Higgins Peter M.)
- Introduzione alla teoria dei grafi - Wilson - [Cremonese 1975]
- Notes

Semester

First semester

Assessment method

Written exam with the possibility of an oral integration.

The oral exam can be requested by either the teacher or the student.

The written exam consists of closed and/or open-ended questions that cover all the topics discussed in class.

Two partial exams are scheduled during the course.

The exam is considered passed with the partial exams if the average score is equal to or greater than 18, and the score in each exam is equal to or greater than 16. If a score of 16 or higher is achieved in the first partial exam and the average score in the second exam is below 18, the result of the first partial exam will no longer be considered valid.

Office hours

By appointment

Sustainable Development Goals

QUALITY EDUCATION
