UNIVERSITÀ
DEGLI STUDI DI MILANO-BICOCCA

SYLLABUS DEL CORSO

Algebra Lineare

2021-1-E4102B002

Learning objectives

This course aims to provide the foundations of linear algebra that will form the basis of the courses of Probability and Multivariate Statistical Analysis.

Knowledge and understanding

This course will provide knowledge and understanding in relation to:

- Representation of vector spaces and systems of generators and bases
- Linear applications and their relationship with matrices and linear systems
- Orthogonal projections
- Role of eigenvalues and eigenvectors of a matrix

Ability to apply knowledge and understanding

At the end of the course the students will be able to:

- Study linear applications through the theory of matrices and linear systems
- Determine the best approximation of an element of a vector space among the elements of a subspace
- Apply the procedure of diagonalization of matrices

The course allows the student to acquire a solid foundation in the use of linear algebra necessary in any work context and representing an essential basis for the continuation of the university studies.

Contents

Vector spaces and linear maps; orthogonal projections; matrices and diagonalization procedure; determinants; similarity of matrices.

Detailed program

Vector spaces on R. Linear combinations and independence. Systems of generators and bases. Dimension of a vector space.

Algebra of matrices. Product between matrices. Determinant and its computation. Invertible matrices. Rank of a matrix. Orthogonal and symmetric matrices.

Linear maps. Study of linear maps by matrices and linear systems. Rank plus nullity Theorem.

Standard scalar product and Cauchy-Schwartz inequality. Norm and triangular inequality. Elements of analytic geometry. Orthonormal bases. Orthogonal projections.

Eigenvalues and eigenvectors. Diagonalization procedure. Quadratic forms. Spectral Theorem and its extensions.

Prerequisites

No prerequisites are required.

Teaching methods

Classic frontal lessons, partly devoted to the theoretical aspects of the course, and partly to the resolution of practical exercises, which allow the student to acquire a method and a logical approach in solving problems.

Assessment methods

Written exam based on exercises and theoretical questions aimed at evaluating the problem-solving skills and the ability to apply the theoretical results in order to solve specific problems.

Oral exam (upon student's or teacher's request).

The exam is written with optional oral (for those who have obtained an evaluation at least equal to 18/30 in the written part).

The written part consists of some theoretical questions and exercises. The theoretical questions allow to check the knowledge of the main concepts of the course. The exercises allow to verify the comprehension and the ability to use these notions in the different application contexts. Furthermore, the theoretical questions and the exercises allow to verify an appropriate technical language.

Textbooks and Reading Materials

T.M. Apostol, Calcolo, volume secondo (Geometria), Bollati Boringhieri.

E. Schlesinger, Algebra lineare e geometria, Zanichelli 2017;

Semester

II semester, III and IV cycle (approximately from March to June).

Teaching language

Italian.