UAB
Universitat Autònoma de Barcelona

Linear Algebra

Code: 104843
ECTS Credits: 6

2025/2026

Degree	Type	Year
Applied Statistics	FB	1

Contact

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Teaching groups languages

You can view this information at the end of this document.

Prerequisites

Elementary knowledge of Mathematics corresponding to secondary education and high school.

Objectives and Contextualisation

(from Google Translate)

This subject is a presentation of matrix algebra, with emphasis on solving systems of equations and diagonalization of matrices, in particular symmetric matrices.

The main goal is for the student to reach maturity in matrix manipulation and acquire the theoretical knowledge that should allow him to use matrices in statistical treatments. In particular, the decompositions of matrices such as PAQ-reduction, decomposition into singular values (SVD), diagonalization, ...

Learning Outcomes

1. KM02 (Knowledge) Recognise the language and basic tools of linear algebra.
2. SM03 (Skill) Solve, using numerical methods, optimisation problems, linear algebra and analysis in general that appear in science and, especially, in statistics.

Content

(from Google Translate)

1. Systems of linear equations and matrices. Operations with matrices. Invertible matrices. Elementary transformations of matrices. Normal form of Gauss - Jordan. Range of an array. Inversibility criteria. Matrix of a system of linear equations. Solving systems of linear equations. Determinant of a square matrix.
PAQ-reduction and generalized inverse.

2. Vector Spaces and Linear Applications: Vectors in R ^ n and Linear Applications. Definition of vector space and examples. Vector structure of R ^ n and subspaces. Definition of linear application and examples. Core and image of a linear application. Dependence and linear independence of vectors. Generator systems, bases of vector spaces. Dimension and range. Coordination, base change matrices, matrix associated with a linear application with respect to bases fixed to the departure and arrival spaces.

3. Diagonalization of endomorphisms: Eigenvectors and eigenvalues of an endomorphism. Characteristic polynomial and minimum polynomial. Diagonalization criterion.

4. Vector spaces with scalar product. Bilinear product, definition and properties. Orthogonality. Orthonormal bases. Gram-Schmidt orthonormatization method. Screenings. Orthogonal complement. Orthogonal matrices. Orthogonal diagonalization of symmetric matrices, spectral theorem. Data adjustment. Singular values and decomposition into singular values.

Activities and Methodology

Title	Hours	ECTS	Learning Outcomes
Type: Directed			
Lesson	25	1	KM02, SM03, KM02
Problem solving and practical lessons	24	0.96	KM02, SM03, KM02
Type: Supervised			
Solving exercises	40	1.6	SM03, SM03
Type: Autonomous			
Learn theoretical concepts	27	1.08	KM02, SM03, KM02
Prepare avaluations	26	1.04	KM02, SM03, KM02

Time commitment

Considering that this subject is worth 6 credits, the total number of hours

Methodology

During the semester, the subject has 2 hours of theory classes per week
In the

theory classes, the contents of the subject will be presented, giving special emphasis to the meaning, motivation

problem classes, lists of exercises will be worked on that the student will receive in advance in which the most pr

practical classes, you will learn to use a certain computer program to assist us in solving the problems. As a com

Periodically there will be small tests in the classroom (type "Quiz") to ass
Within the computer practice sessions, small evaluative tests will also be

Annotation: Within the schedule set by the centre or degree programme, 15 minutes of one class will be reserved for students to evaluate their lecturers and their courses or modules through questionnaires.

Assessment

Continous Assessment Activities

Title	Weighting	Hours	ECTS	Learning Outcomes
Solving exercises	10	1	0.04	KM02, SM03
Work with Sage Math	10	1	0.04	SM03
Writting exams	80	6	0.24	KM02, SM03

(from Google Translate)

Continuous assessment

The assessment of the subject will consist of the following activities:

Exams:

-First part (November) P1 (30%)

-Second part (January) P2 (50%)

Classroom questionnaires:

- Continuous assessment questionnaires Q (10%)

- SageMath tests S (10%)

These activities, scored out of 10, will receive the weight indicated in the final grade. That is, the final grade of the

Final grade = 0.1Q+0.1S+0.3P1+0.5P2

In the event of not achieving a pass, the student may opt for a single retake exam, R, which will allow them to rec

The student will be considered "Not assessable" if they have carried out assessment activities that represent a w

Single assessment

If the student opts for the single assessment, he/she will take a single exam coinciding with the date of the secon

As in the case of continuous assessment, the grade of this exam can be recovered in a retake exam.

Bibliography

Basic:

M. Masdeu, A. Ruiz, Apunts d'Àlgebra lineal (https://mmasdeu.github.io/algebralineal/)

Otto Bretscher: Linear Algebra with Applications. Pearson Prentice Hall, 3rd edition.

Complementary:

Ferran Cedó i Agustí Reventós: Geometria plana i àlgebra lineal, Manuals UAB, (2004), UAB.

Stanley I. Grossman, *Álgebra lineal*, Grupo Editorial Iberoamérica, 1983.

Shayle R. Searle, *Matrix Algebra Useful for Statistics*, Wiley-Interscience

David A. Harville, *Matrix Algebra from a Statistician's Perspective*, Springer

Software

We use Sage Math (www.sagemath.org) software during some lessons.

Groups and Languages

Please note that this information is provisional until 30 November 2025. You can check it through this link. To consult the language you will need to enter the CODE of the subject.

Name	Group	Language	Semester	Turn
(PLAB) Practical laboratories	1	Catalan	first semester	afternoon
(PLAB) Practical laboratories	2	Catalan	first semester	afternoon
(SEM) Seminars	1	Catalan	first semester	afternoon
(SEM) Seminars	2	Catalan	first semester	afternoon
(TE) Theory	1	Catalan	first semester	afternoon