Universitat Autònoma de Barcelona

2020/2021

Linear Algebra

Code: 104843
ECTS Credits: 6

Degree	Type	Year	Semester
2503852 Applied Statistics	FB	1	1

The proposed teaching and assessment methodology that appear in the guide may be subject to changes as a result of the restrictions to face-to-face class attendance imposed by the health authorities.

Contact

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Use of Languages

Principal working language: catalan (cat)
Some groups entirely in English: No
Some groups entirely in Catalan: Yes
Some groups entirely in Spanish: No

Prerequisites

Nothing required.

Objectives and Contextualisation

Have the basic knowledge on Linear Algebra course with emphasize on factorization of matrices: PAQ, P^{-1}AP,P^tAP,SVD-decomposition, and methods for Estadistics: as resolution by linear systems by use in Datta Fitting, generalized inverse matrix, SVD applied to big data.

Competences

- Calculate and reproduce certain mathematical routines and processes with agility.
- Critically and rigorously assess one's own work as well as that of others.
- Make efficient use of the literature and digital resources to obtain information.
- Students must be capable of applying their knowledge to their work or vocation in a professional way and they should have building arguments and problem resolution skills within their area of study.
- Students must be capable of communicating information, ideas, problems and solutions to both specialised and non-specialised audiences.
- Use quality criteria to critically assess the work done.

Learning Outcomes

1. Critically assess the work done on the basis of quality criteria.
2. Make effective use of references and electronic resources to obtain information.
3. Master the basic language and tools of linear algebra.
4. Master the specific algebraic tools that in future will be used for advanced modelling.
5. Reappraise one's own ideas and those of others through rigorous, critical reflection.
6. Students must be capable of applying their knowledge to their work or vocation in a professional way and they should have building arguments and problem resolution skills within their area of study.
7. Students must be capable of communicating information, ideas, problems and solutions to both specialised and non-specialised audiences.

Content

1. Linear Systems and matrix operations. Operations with matrices. Invertible matrices. Elemental matrix transformations. Gauss-Jordan normal form associated to a matrix. Rang of a matrix. Invertibility criterion. Resolution of linear system equations. Determinants. PAQ-reduction. Inverse generalized matrix.

2. Vector spaces and linear maps: Definition of vector space and examples. Vector structure of R ^ n and subspaces. Definition of linear application and exemples. The Kernel and the image of a linear map. Linear dependence and independence of vectors. Generator systems, Bases of a vector space. Dimension.Coordinates, base change matrices, matrix associated with a linear map fixing basis.

3. Diagonalization of endomorphisms: eigenvectors and eigenvalues of an endomorphism. Character polynomial and minimum polynomial. Diagonalization criteria.

4. Vector spaces with scalar product. Bilinear product, definition and properties. Ortogonality Orthonormal bases. Gram-Schmith ortonormatilization method. Projections Orthogonal Complement. Projection to a subspace. Orthogonal diagonalization of symmetrical matrices, spectral theorem. Data Fitting. Singular values and decomposition in singular values.

Methodology

The subject provides during the semester of 2 hours per week of theory class and 2 hours per week of classes of problems and practices. It is advisable to attend all sessions. The theory given is quite contained in the texts recommended in the bibliography, although in each of them its presentation has slightly different characteristics, and class notes will be posted in the classroom. last topic where there is no text of the bibliography that corresponds to the course syllabus. It is convenient for the student to get used to learning from textbooks, which are well structured and written tools and where both mathematical language and logical demonstration reasoning are clearly reflected. The books, at least one, are an important complement to the classes. It will open an application of this subject in the Moodle of the university in order to provide material and information related to the subject, when necessary.

Periodically, the student will receive lists of problems that he or she should try to solve personally or in a group and about which problems will arise in the classes of problems. There will be approximately every 3 or 4 weeks, an evaluative test (type "Quiz") that the student must answer in situ in the class or at a specific time before starting the usual class.

Activities

Title	Hours	ECTS	Learning Outcomes
Type: Directed			
Lesson	26	1.04	5, 3, 4
practical lessons with or without Math sources	26	1.04	5, 1, 3, 4, 7
Type: Supervised			
Solving exercises	40	1.6	5, 1, 7, 6
Type: Autonomous			
Learn theoretical concepts	24	0.96	5, 3, 4, 7
Prepare avaluations	26	1.04	5, 1, 3, 4, 7, 2

Assessment

The evaluation of the Linear Algebra course will consist of:

a) Problem solving, "Quiz" type tests 2 points.

b) Computer knowledge test, computer test, Linear Algebra with SageMath or Magma 1.5 points

c) A partial exam 1.5 punts

d) A final exam 5 points.

In case of No positive avaluation (mark lower than 5) there is a single recovery test of sections (c) and (d) of value 6.5 points.

The Linear Algebra course is positive avaluated if one obtain a grade of 5 or higher and obtained a grade higher than 4 in the final exam or in its recovery. (In case of having a grade higher than 5 and a grade lower than 4 in the final exam and recovery exam, the student's grade will be 4.5 points, and will fails the Linear Algebra Course).

It is considered that a student has attended the course (and therefore will be assigned a mark for the Linear Algebra course) if she (or he) has carried out assessment activities that represent a weight equal to or greater than 50% of the final grade of the subject.

Assessment Activities

Title	Weighting	Hours	ECTS	Learning Outcomes
Solving exercises	15	1	0.04	5, 3, 4, 7, 6
Work with Sage Math	15	1	0.04	3, 4, 2
Writting exams	70	6	0.24	5, 1, 3, 4, 6, 2

Bibliography

Basic Bibliography:

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

Enric Nart,Xavier Xarles: Apunts d'àlgebra lineal,Material UAB, 237 (2016), UAB.

Additional Bibliography:

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