



UNIVERSIDADE LUSÍADA  
LISBOA

Course Unit Program  
Multivariate Statistics

Academic Year 2024/2025

**1. Organic Unit**

Faculty of Business and Economic Sciences

**2. Course**

Human Resource Management

**3. Cycle**

1st

**4. Course Unit**

Multivariate Statistics (11314)

**5. Scientific Area**

**6. Curricular Year**

2nd

**7. Type of Curricular Unit / Semester**

2nd Semester



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#### 8. Class type and workload (work time)

Theoretical classes:

Practical classes:

Theoretical-Practical Classes 30,00

Tutorial Guidance: 20,00

#### 9. ECTS Credits

6,00

#### 10. Scientific Area Coordinator

#### 11. Regent

Prof. Doutor FERNANDO MANUEL MONTEIRO MARTINS

#### 12. Assistants

#### 13. Teaching Language

Portuguese

#### 14. General Objectives

Develop the elements introduced in basic Statistics and Probability courses in a multivariate framework, providing the instruments that allow analyzing multidimensional data. The course will focus on a good understanding of the methods and on training in the application conditions, including knowledge of methods for collecting information, constructing a survey and defining the appropriate experimental design for each situation.

#### 15. Specific Objectives

Show the potential of matrix notation for the treatment of multidimensional data. Explore the graphical techniques of exploratory analysis of multidimensional data. Approach to dimension reduction techniques for continuous variables (principal component analysis) and for qualitative variables (factorial analysis of correspondences). Presentation of basic automatic classification techniques. Linear, log-linear and discriminant analysis models.

#### 16. Skills to be acquired

Teaching is centered on solving applications, that is, on developing skills for solving data analysis problems in social sciences. Through a systematic resolution methodology: How to present the problem in quantitative terms? What are useful concepts? Are the validity conditions checked? How to manipulate the concepts? What is the answer to the problem? The course is based on a good understanding of the methods and training in the application conditions.



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## 17. Teaching Methodology

Theoretical-practical classes (the teacher introduces the concepts through an application and deduces the abstract aspects); tutorial classes (the teacher presents the applications to the students and with their active participation a solution is sought).

## 18. Course Unit Program

### 1. MULTIVARIATE ANALYSIS MODELS.

In this part of the course, models that allow establishing relationships between variables are studied.

- 1.1. Linear models: regression and analysis of variance.
- 1.2. Log-linear models.

### 2. DESCRIPTIVE METHODS AND NOTATIONS.

It is intended to show how matrix theory allows an easy treatment of multidimensional data and to indicate the graphical techniques used in multidimensional exploratory analysis.

Review of the basic notions of Linear Algebra.

Data frame. Weight matrix. Gravity center. Variance-covariance matrix and correlation matrix. The space of individuals. The role of metrics. The inertia.

Multidimensional graphic techniques.

### 3. MULTIVARIATE DATA ANALYSIS TECHNIQUES.

Dimension reduction and automatic classification techniques are studied.

#### 3.1. CANONICAL CORRELATION.

#### 3.2. ANALYSIS ON MAIN COMPONENTS.

Projection of individuals into subspaces: principal axes, principal components and principal factors. Reconstitution formulas. Interpretation and quality of the results of a principal component analysis.

3.3. DISCRIMINANT ANALYSIS. Discriminant factor analysis. The case of two groups. Assignment rules.

3.4. AUTOMATIC SORTING. Distances and similarities. Partition methods and hierarchical methods

#### 3.5. FACTOR ANALYSIS OF SIMPLE CORRESPONDENCES

Contingency tables and associated point clouds. The chi-square metric.

Interpretation and quality of the results of a factorial analysis of simple correspondences.

#### 3.6. FACTOR ANALYSIS OF MULTIPLE CORRESPONDENCES.

Data and notations. Burt's painting. Interpretation and quality of the results of a factorial analysis of multiple correspondences.



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## 19. Assessment Methods

Two tests with a weighting of 50% each.

## 20. Didactic Resources

Systematic use of SPSS software

## 21. Sustainability Objectives

- 1 - Ensure equal access to quality technical, professional and cultural education.
- 2 - Substantially increase the number of young people and adults with relevant qualifications, including technical and professional skills, for employment, decent work and entrepreneurship.
- 3 - Guarantee equal opportunities in university education, including for people in vulnerable situations.
- 4 - Understand to what extent statistics can be an important means of assessing the impact of climate change.

## 22. Keywords

Multiple regression  
Analysis of variance  
Principal components analysis



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### 23. Main Bibliography

Author(s): R. Ho  
Title: Handbook of Univariate and Multivariate Data Analysis with SPSS  
Edition: 1<sup>a</sup> Year: 2014  
Local: Boca Raton, Florida  
Publisher: CRC Press

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Author(s): T. Cleff  
Title: Applied Statistics and Multivariate Data Analysis for Business and Economics  
Edition: 1<sup>a</sup> Year: 2019  
Local: Cham, Switzerland  
Publisher: Springer

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Author(s):  
Title:  
Edition: Year:  
Local:  
Publisher:

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### 24. Complementary Bibliography

Author(s): J. D. Jobson  
Title: Applied Multivariate Data Analysis, vol II: Categorical and Multivariate Methods  
Edition: 2<sup>a</sup> Year: 1992  
Local: Paris  
Publisher: Springer-Verlag

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Author(s): G. A. F. Seber  
Title: Multivariate Observations  
Edition: 1<sup>a</sup> Year: 1994  
Local: New York  
Publisher: John Wiley

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| Ficha técnica MIP / MIP Datasheet |                                                                         |
|-----------------------------------|-------------------------------------------------------------------------|
| Título / Title                    | Course Unit Program 'ESTATÍSTICA MULTIVARIADA': Academic Year 2024/2025 |
| Autor / Author                    | Prof. Doutor FERNANDO MANUEL MONTEIRO MARTINS                           |
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