uc3m | Universidad **Carlos III** de Madrid

Data Analysis Methods

Academic Year: (2022 / 2023)   **Review date: 22-06-2022**

Department assigned to the subject: Statistics Department

Coordinating teacher: ARRIBAS GIL, ANA

Type: Compulsory ECTS Credits : 6.0

Year : 2 Semester : 1

SKILLS AND LEARNING OUTCOMES

LEARNING OUTCOMES:

- Explain some findings from the forefront of science in terms that are accessible to students without in-depth knowledge of the subject matter.
- Make estimates of order of magnitude and avoid common fallacies and errors in the use of numerical information and in the interpretation of scientific results (diagnostic tests, clinical trials, etc.).
- Make competent use of software for analysing, synthesising and transmitting quantitative information, especially through graphs and computer graphics.
- Analyse data rigorously to draw conclusions from them.
- Explain the basic mathematical concepts and gain familiarity with mathematical reasoning.
- Formulate and apply programming models and languages to basic problem solving in statistics and probability.
- Summarise the fundamentals of data management and analysis technologies, and tools for representing information.
- Collect and interpret data to substantiate the conclusions drawn, including, where necessary, a reflection on social, scientific or ethical matters.
- Apply the main statistical distributions, the concept of regression to the mean and the basic notions of statistical inference to specific problems.

OBJECTIVES

Specific competences:
E05 - Analyse questions related to science, technology and society by the means of basic and fundamental mathematical and statistical reasoning.

Transversal competences:
T01 - Make a critical use of digital tools and be able to interpret specific documental sources.

Learning outcomes:
1. To analyse data rigorously to extract information from them.
2. Use statistical distribution, regression to the mean and basic notions of statistical inference to specific problems.
3. Define and use models and programming languages for the resolution of basic statistical and probability problems.
4. Conduct estimation of order of magnitude and avoid fallacies and common mistakes in the use of numerical information and interpretation of scientific results (diagnostic tests, clinical trials, etc)
5. Collect and interpret data and information to base conclusions on, including, if necessary, a discussion on social, scientific or ethic issues.
6. Summarise the basis of management technologies and data analysis, as well as information representation tools.
7. Sound use of software to analyse, summarise and present quantitative information, in particular, by the use of graphics and infographics.

DESCRIPTION OF CONTENTS: PROGRAMME

This course deals with basic ideas on Probability and Statistics, with the objetive of providing the necessary tools and concepts that allow analysing and managing quantitative information.

Contents:
· Introduction: data, information, knowledge.
· Where to find information: resources, research techniques, reliability.

· Numeric alphabetisation: percentages, magnitude orders, linearity and non linearity.
· Graphical information representation techniques and scientific visualization.
· Spreadsheets as tools for basic data management and representation.
· Correlation and causality. From data to theory
· Discrete correlation: the classification problem. Sensibility and specificity. Bayes theorem.
· Signal and noise: random phenomena. Binomial, normal and Poisson distributions.
· Continuous correlation: regression to the mean.
· Introduction to inferential statistics: surveys and clinical trials.
· Fundamentals of programming for data analysis.

LEARNING ACTIVITIES AND METHODOLOGY

Directed activities:
Practical classes - 16h - 0.64 ECTS - Learning outcomes: 4, 7, 5, 1
Theory classes - 33h - 1.32 ECTS - Learning outcomes: 4, 7, 5, 2, 1, 3, 6

Supervised activities:
Tutoring and project supervision - 4.25h - 0.17 ECTS - Learning outcomes: 7, 2, 1

Autonomous activities:
Study and project elaboration - 94.75h - 3.79 ECTS - Learning outcomes: 4, 7, 5, 2, 1, 3, 6

ASSESSMENT SYSTEM

Final exam:
Exam - Weight 50% - 2h - 0.08 ECTS - Learning outcomes: 4, 2, 1, 3, 6

Continuous assessment:
Test 1 - Weight 20% - Learning outcomes: 4, 7, 5, 2, 1
Test 2 - Weight 20% - Learning outcomes: 4, 7, 5, 2, 1
Group project - Weight 10% - Learning outcomes: 4, 7, 5, 2, 1, 3

In the extraordinary exam, the student will sit a new written exam and will receive a grade equal to the maximum of the exam grade or a weighted average of the exam (50%) and coursework (50%) in the same way as the usual convocation.

% end-of-term-examination:	50
% of continuous assessment (assigments, laboratory, practicals…):	50

BASIC BIBLIOGRAPHY

- C. Criado Pérez Invisible women. Exposing data bias in a world dessigned for men, Abrams Press.

- D. Huff How to lie with statistics, W.W. Norton & Company.

- D. Peña y J. Romo Introducción a la Estadística para las Ciencias Sociales, Mc Graw Hill.

- I. Portilla Estadística descriptiva para comunicadores, Editorial EUNSA.

ADDITIONAL BIBLIOGRAPHY

- D. Rowntree Statistics without tears, Penguin Books.

- G. Klass Just plain data analysis (2nd ed.), Rowman & Littlefield.