Statistics

Academic Year: (2023 / 2024) **Review date: 27/04/2023 12:52:44**

Department assigned to the subject: Statistics Department

Coordinating teacher: ALONSO FERNANDEZ, ANDRES MODESTO

Type: Compulsory ECTS Credits : 6.0

Year : 2 Semester : 2

REQUIREMENTS (SUBJECTS THAT ARE ASSUMED TO BE KNOWN)

Calculus and Linear Algebra

LEARNING OUTCOMES

LEARNING OUTCOMES:

- Understand the fundamentals of probability and statistics.
- Understand and analyze problems about random phenomena.
- Manage and understand parameter estimation techniques, confidence intervals and hypothesis tests.
- Correctly interpret the statistical conclusions of scientific publications in which the simplest statistical methods are used.
- Carry out these analyzes yourself (without making conceptual errors or abuses of interpretation) in your future professional activity and manage the appropriate computer tools.
- Apply statistical methods to the analysis of specific problems
- Interpret world news based on physical, economic, social and cultural diversity.
- Maintain an ethical commitment.
- Propose projects and actions in accordance with the principles of ethical responsibility and respect for fundamental rights and duties, diversity and democratic values.

OBJECTIVES

OBJECTIVES:

The objective of this course is for the student to acquire a set of competencies related to Statistics both at a theoretical and applied level.

DESCRIPTION OF CONTENTS: PROGRAMME

Chapter I: Univariate Descriptive Statistics
1.1 Introduction. The purpose of Statistics.
1.2 Description of data by tables
1.3 Description of data by graphs
1.4 Characteristics measures of a variable

Chapter II: Bivariate Descriptive Statistics
2.1 Introduction.
2.2 Bivariate Frequency Tables
2.3 Scatterplots
2.4 Measures of linear dependence
2.5 The regression line

Chapter III: Probability
3.1 Introduction
3.2 Probability: definition and properties
3.3 Conditional and total probability
3.4 Independence of events

3.5 Bayes Theorem

Chapter IV: Introduction to Random Variables
4.1 Introduction
4.2 Univariate discrete random variables
4.3 Univariate continuous random variables
4.4 Characteristics measures of a random variables

Chapter V: Probability models
5.1 Introduction
5.2 Bernoulli process
5.3 Poisson process
5.4 Normal distribution
5.5 Relationship between Normal, Binomial and Poisson distributions
5.6 Simple regression model

Chapter VI: Introduction to statistical inference
6.1 Statistical inference. Population and sample
6.2 Estimation and estimators
6.3 Confidence intervals for the mean with large samples
6.4 Determining the sample size
6.5 Other confidence intervals
6.6 Introduction to the Hypothesis Testing
6.7 Hypothesis test for the mean with large samples
6.8 Interpreting the test using the p-value
6.9 Diagnosis of the model
6.10 Transformations that improve normality

Chapter VII: Comparison of Populations
7.1 Introduction
7.2 Comparing two populations means: Independent samples
7.3 Comparing two populations means: Paired data
7.4 Comparing two population proportions
7.5 Comparing two populations variances (normal populations)

Chapter VIII: Introduction to Multiple Regression
8.1 Statistical model for Simple Regression.
8.2 Statistical model for Multiple Regression.
8.3 Estimation of the Multiple Regression parameters.
8.4 Inference for Multiple Regression.
8.5 Test for the Multiple Regression model.
8.6 Regression with binary variables.

LEARNING ACTIVITIES AND METHODOLOGY

The learning methodology consists on the following elements:
-Lecture class will be taught in face-to-dace mode: Presentation of the main statistical concepts, with their justification and examples. The instructor will illustrate the methodologies with the computer and real or simulated data. Discussion of the concepts with the students. Discussion of the questions and doubts aroused during the self learning process.
-Exercises class. Classes devoted to solving exercises in small groups.
-Lab class. The students solve data analysis problems by using a statistical package. They are asked to solve exercises and conceptual problems by using the statistical software. After each class and organized in small groups, they are asked to make a case study that will be evaluated.

ASSESSMENT SYSTEM

% end-of-term-examination/test:	40
% of continuous assessment (assigments, laboratory, practicals…):	60

The evaluation of the course will be based on continuous evaluation and a final exam. The final score will be a weighted average of both types of evaluation:
40% - final exam,
60% - continuous evaluation.
There is no requirement for a minimum score in each of these parts.

% end-of-term-examination/test:	40
% of continuous assessment (assigments, laboratory, practicals…):	60

Continuous evaluation
The continuous evaluation consists of the realization of a case study (20%), as well as two theoretical-practical midterm exams (40% each).

Final exam - regular session
- The final exam will consist of solving theoretical questions as well as doing data analysis.
Students will need to use all the tools learned during the course.
- The final grade will be 60% continuous evaluation + 40% final exam
- In the ordinary call, students who have not followed the continuous assessment will be allowed to take a final exam worth 60% of the subject.

Final exam - extraordinary session
- The final exam will consist of solving theoretical questions as well as doing data analysis and interpreting results obtained by the statistical software. Students will need to use all the tools learnt during the course.
- The evaluation system in the extraordinary session will be the maximum between the following criteria:
    a) 100% final exam
    b) 60% continuous evaluation + 40% final exam

BASIC BIBLIOGRAPHY

- MONTGOMERY, D.C; RUNGER, G.C; HUBELE, N.F. "Engineering Statistics", John Wiley & Sons.

- MOORE, D.S; MCCABE, G.P. "Introduction to the practice of statistics, Duxbury Press.

- OSTLE, B.; TURNER, K.V; CHARLES R. HICKS, C.R. "Engineering Statistics: The industrial experience", Duxbury Press.

ADDITIONAL BIBLIOGRAPHY

- GUTTMAN, I.; WILKS, S.S; HUNTER, J.S. "Introductory Engineering Statistics", Wiley.

- TRIVEDI, K.S.; "Probability and Statistics with reliability, queuing and computer science applications, Prentice-Hall.