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Probability and Data Analysis

Academic Year: (2022 / 2023)   **Review date: 16-05-2022**

Department assigned to the subject: Statistics Department

Coordinating teacher: RUIZ MORA, CARLOS

Type: Basic Core ECTS Credits : 6.0

Year : 1 Semester : 1

Branch of knowledge: Engineering and Architecture

OBJECTIVES

SPECIFIC COMPETENCES: To acquire knowledge and understanding to
1.   Analyze univariate and bivariate data
2.   Solve probability problems
3.   Analyze problems involving random phenomena
4.   Use random variables
5.   Be able to solve problems using a statistical software.

TRANSVERSAL COMPETENCES:
1.   Capacity for analysis and synthesis.
2.   Knowledge of the use of statistical software.
3.   Resolution of problems.
4.   Teamwork.
5.   Critical reasoning.
6.   Oral and written communication.

DESCRIPTION OF CONTENTS: PROGRAMME

The objective of the course is that the student learns basic statistical concepts and tools that will allows
him to: a) analyze, summarize, and draw conclusions from real world data and b) understand the
concepts of uncertainty and probability and apply distribution models to solve relevant problems.

1.   Introduction
1.1.   Concepts and use of Statistics
1.2.   Statistical terms: populations, subpopulations, individuals and samples
1.3.   Types of variables

2.   Analysis of univariate data
2.1.   Representations and graphics of qualitative variables
2.2.   Representations and graphics of quantitative variables
2.3.   Numerical summaries

3.   Analysis of bivariate data
3.1.   Representations and graphics of qualitative and discrete data
3.2.   Representations and numerical summaries of quantitative data: covariance and correlation

4.   Introduction to Probability
4.1.   Introduction
4.2.   Random phenomena
4.3.   Definition of probability and properties
4.4.   Assessment of probabilities in practice
4.5.   Conditional probability
4.6.   Bayes Theorem

5.   Random variables
5.1.   Definition of random variable
5.2.   Discrete random variables
5.3.   Continuous random variables
5.4.   Characteristic features of a random variable
5.5.   Random vectors

5.6.   Independence of random variables

6.   Distribution models
6.1.   Binomial distribution
6.2.   Geometric distribution
6.3.   Poisson distribution
6.4.   Uniform distribution (continuous)
6.5.   Exponential distribution
6.6.   Normal distribution (with CLT)

7.   Linear regression
7.1.   Introduction
7.2.   Simple linear regression
7.3.   Multiple linear regression

LEARNING ACTIVITIES AND METHODOLOGY
- Lectures: introducing the theoretical concepts and developments with examples, 2.2 ECTS
- Problem solving sessions: 2.2 ECTS
- Computer (practical) sessions: 0.6 ECTS -- 4 SESSIONS
- Evaluation sessions (continuous evaluation and final exam): 1 ECTS

ASSESSMENT SYSTEM
There will be continuous evaluation by means of two partial examinations. There will be some questions about the computer sessions at those exams.

If the grade obtained at the continuous evaluation is 6 or higher, the student should not attend the final exam and his/her final grade will be the grade of the continuous evaluation.

If the grade obtained at the continuous evaluation is lower than 6, the student will have to attend the final exam. For those students, the final grade will be computed giving a 40% weight to the partial examinations, and a 60% weight to the grade at the final exam.

The grade for the students attending the extraordinary examination will be the grade obtained at such exam.

% end-of-term-examination:	0
% of continuous assessment (assigments, laboratory, practicals…):	100

BASIC BIBLIOGRAPHY
- MONTGOMERY, D.C., RUNGER, G.C. Applied Statistics and Probability for Engineers, John Wiley & Sons, 2003

- Navidi, W. Statistics for Engineers and Scientists, McGraw-Hill, 2006

- SONG, TT. Fundamentals of Probability and Statistics for Engineers, John Wiley & Sons, 2004

ADDITIONAL BIBLIOGRAPHY
- GUTTMAN, L., WILKS, S.S., HUNTER, J.S. Introductory Engineering Statistics. , Wiley. , 1992

- Newbold, P. Statistics for Business and Economics., Prentice-Hall., 1995.

- PEÑA, D. Regresión y Diseño de Experimentos., Alianza Editorial., 2002

- PEÑA, D. Fundamentos de Estadística., Alianza Editorial., 2001