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Statistical methods for telecommunications

Academic Year: (2021 / 2022)   **Review date: 28-06-2021**

Department assigned to the subject: Statistics Department

Coordinating teacher: GARCIA PORTUGUES, EDUARDO

Type: Electives ECTS Credits : 3.0

Year :   Semester :

REQUIREMENTS (SUBJECTS THAT ARE ASSUMED TO BE KNOWN)
  Statistics
  Calculus I and II

OBJECTIVES
  * General skills

   - Ability to apply knowledge of mathematics, statistics, computer science, and engineering as it applies to the fields of computer hardware and software.
   - Ability to interpret data and results of experiments.
   - Ability to independently acquire and apply required information related to statistical techniques with the aim of designing, monitoring, and managing computer systems.
   - An ability to communicate effectively by oral, written, and graphical means, the results of statistical analysis.

  * Specific skills

   - An ability to identify statistical problems of multivariate dimension, with special emphasis in telecommunication engineering.
   - An ability to describe multivariate datasets.
   - Knowledge of multivariate statistical models.
   - An ability to solve statistical models for regression analysis, and ANOVA models, applied to real data of telecommunication engineering.
   - An ability to model time series data, estimate their parameters and apply it to real problems of signal processing and telecommunications.

DESCRIPTION OF CONTENTS: PROGRAMME
  1. Review of basic concepts
   1.1. Descriptive Statistics
   1.2. Probability
   1.3. Random variables
   1.4. Probability models

  2. Point estimation
   2.1. Introduction to statistical inference: population and sample
   2.2. Sample statistics and their distribution
   2.3. Estimation and estimators
   2.4. Methods of maximum likelihood

  3. Confidence intervals and hypothesis testing
   3.1. Confidence intervals
   3.2. Parametric hypothesis tests

  4. Comparison of populations
   4.1. Comparison of two means from independent samples
   4.2. Comparison of two means from paired samples
   4.3. Comparison of two proportions

  5. The linear regression model
   5.1. The simple regression model

5.2. The multiple regression model
5.3. Inference in the regression model

LEARNING ACTIVITIES AND METHODOLOGY

The learning methodology consists on the following elements:

- Lecture classes: Presentation of the main 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 classes: Classes devoted to solving exercises in small groups.
- Lab classes: In a computer room, the students, in small groups, solve data analysis problems using a statistical package. Also, students use the computer to solve exercises and conceptual problems.

ASSESSMENT SYSTEM

The evaluation of the course will be based on a continuous evaluation by means of the development of a case study with MATLAB and a midterm exam of theoretical and practical contents.

The continuous evaluation mark will be calculated giving a 70% weight to the midterm exam and a 30% weight to the development of a case study with MATLAB.

If the continuous evaluation grade is above 5, the student does not need to take the final exam and his/her final mark will be equal to his/her continuous evaluation mark.

If the continuous evaluation mark is below 5, the student must take a final exam that will consist of theoretical and practical problem-solving.

Final exam - ordinary session
The student's final grade will be calculated giving a 60% weight to the continuous evaluation grade and a 40% weight to the final exam.

Final exam - extraordinary session
The evaluation system in the extraordinary session will be the higher of the following two criteria:
  a) 100% of the final exam.
  b) 60% of the continuous evaluation grade + 40% of the final exam.

% end-of-term-examination: 40

% of continuous assessment (assigments, laboratory, practicals…):   60

BASIC BIBLIOGRAPHY

- Montgomery, D. C. and Runger, G. C. Applied Statistics and Probability for Engineers, Wiley, 2007

- Peña, D. Fundamentos de Estadística, Alianza, 2001