Universidad Zaragoza

Year : 2019/20

29815 - Statistics

Syllabus Information

Academic Year: 2019/20
Subject: 29815 - Statistics
Faculty / School: 110 - Escuela de Ingeniería y Arquitectura
326 - Escuela Universitaria Politécnica de Teruel
Degree: 440 - Bachelor's Degree in Electronic and Automatic Engineering
444 - Bachelor's Degree in Electronic and Automatic Engineering
ECTS: 6.0
Year: 2
Semester: 440 - 440-First semester o Second semester
444-Second semester
107-Second semester
444 - Second semester
Subject Type: Basic Education
Module: ---

1.General information

1.1.Aims of the course

1.2.Context and importance of this course in the degree

1.3.Recommendations to take this course

2.Learning goals

2.1.Competences

2.2.Learning goals

2.3.Importance of learning goals

3.Assessment (1st and 2nd call)

3.1.Assessment tasks (description of tasks, marking system and assessment criteria)

4.Methodology, learning tasks, syllabus and resources

4.1.Methodological overview

The learning process designed for this subject is based on the following:

The proposed methodology seeks to promote student work and continued focus on the practical aspects of statistics: working with real data.

In sessions with the whole group, theoretical aspects are addressed in the form of lectures. These theoretical sessions will be complemented with practical classes in small groups, in which real problems and cases are solved.

The real data processing is done in sessions in the computer lab where the students learn to handle statistical software and also are solved basic optimization problems.

The assessment focuses on both theoretical and applied aspects according to the evaluation criteria established.

4.2.Learning tasks

The course includes the following learning tasks:

1: ON-SITE WORK: 2.4 ECTS (60 hours)

The course is organized with 4 hours of class a week for the 15 weeks of the semester. Of these, two hours are given to the entire group for exposure of theoretical concepts and examples. Other two hours are given to small groups, usually in the computer lab, to develop skills in posing real problems (modelling or selection of proper technique), resolution and interpretation of results.

More specifically:

Activity Type I: Lectures (30 hours with the entire group of students). In these sessions, theoretical aspects are addressed in the form of a participatory lecture to facilitate their assimilation. Following these classes is fundamental for the consolidation and development of programmed learning good.

Activity Type III: Problem-solving and case studies classes (30 hours in small groups). The lectures are supplemented by problem-solving sessions and case studies. As far as possible computer lab will be used in these sessions. Sessions computer lab are designed for students to manage a statistical software support troubleshooting and data analysis exercises involving, on the one hand, the selection of the proper technique applied to the data and on the other hand the interpretation of the results. During these classes, they are scheduled activities to incorporate methodological strategies that promote participatory learning and formative assessment.

For educational reasons, the same software practices (or other learning activities) will be used in all groups of the teaching of the subject of a specific Center (EINA of Zaragoza and EUP Teruel)

2: OFF-SITE WORK: 3.6 ECTS (90 hours)

Activity Type VI: Practical work (15 hours of non-contact work). An activity scheduled throughout the course is the realization of a small project that results in a statistical report.

Activity type VII: Personal study (70 hours of non-contact work).

Activity type VIII: Evaluation (5 hours of non-contact work).

4.3.Syllabus

The course will address the following topics:

MODULE: Exploratory data analysis

1. Exploratory analysis of one variable: frequency table, descriptive measures of central tendency, dispersion and form, graphical representations.
2. Exploratory analysis of two or more variables: relationships between variables, correlation coefficient, linear regression. Cross tabulations and chi-square test of independence.
3. Goodness-of- fit test.
4. Introduction to statistical quality control. Variables control charts.

MODULE: Probability distribution models

1. Introduction to probability theory. Random experiment. Laplacian and frequentist interpretations of probability. Axiomatic definition of probability. Conditional probability. Independence of events. Complete system of events. Total probability theorem. Bayes theorem.
2. Concept of random variable. Classification. Discrete random variable: probability function, distribution function, properties. Continuous random variables: density function, distribution function, properties.
3. Characteristics of random variables. Expected value of a random variable. Moments of a random variable: variance, skewness, kurtosis. Quantile of a random variable. Chebyshev inequality. Two dimensional distributions: joint, marginal and conditional distributions. Calculation of expected values and variances of linear combinations of random variables.
4. Main discrete and continuous distributions: Bernoulli, binomial, Poisson, geometric, negative binomial, hypergeometric, uniform, exponential, gamma, chi square, normal. Reproductivity of random variables. Poisson process and relation with the exponential and gamma distributions. Approximations between variables. Two dimensional normal distribution.

MODULE: sampling, estimation and hypothesis testing

1. Sampling and estimation. Statistical and sampling distributions. Bernoulli's theorem, central limit theorem and Fisher's theorem. Calculation of the minimum sample size. Distributions associated with sampling on normal populations: chi-square, t and F. Construction of a confidence interval. Confidence intervals for means, variances and proportions.
2. Hypothesis testing. Null and alternative hypotheses. Type I and II errors. Significance level, confidence level and power of the test. Relationship of confidence intervals and bilateral hypothesis tests. Hypothesis testing for means, variances and proportions. Calculating the p-value of the test.

MODULE: Introduction to Optimization

1. Optimization problems. Decision variables, objective function and constraints. Classification of optimization problems. Linear Programming: graphic resolution. Integer programming: knapsack and travelling salesman problem.

4.4.Course planning and calendar

Following the academic calendar established by the Centre, shall be indicated in class.

4.5.Bibliography and recommended resources

http://biblos.unizar.es/br/br_citas.php?codigo=29815&year=2019