

Información del Plan Docente

Academic Year	2018/19
Subject	30008 - Statistics
Faculty / School	110 - Escuela de Ingeniería y Arquitectura
Degree	436 - Bachelor's Degree in Industrial Engineering Technology
ECTS	6.0
Year	1
Semester	Half-yearly
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 proposed methodology aims at encouraging students for every day work. The student's interest is promoted by means of a practical approach based on the use of actual problems and data.

The general principles of this course are presented in large-group-sessions where a formal description is carried out with applications in standard examples. Classes in computer room deal with both data analysis and modelling of real events. Students completing them will be able to use specific statistical software.

4.2.Learning tasks

30008 - Statistics

- Lectures: 30 hours.
- Laboratory sessions: 30 hours.
- Guided assignments: 20 hours.
- Autonomous work: 64 hours.
- Evaluation activities: 6 hours.

Lectures take place in Large for 4 weekly hours during the semester distributed as follows.

Lectures (2 hours per week) are developed in large group sessions. The teacher explains the statistical procedures specified in the contents of the course and solves some illustrative applied problems.

The laboratory sessions (2 hours per week) take place in the computer room for small groups. The lab sessions are designed to improve the student skills in modelling and analysis of realistic problems by using specific software.

Guided assignments:

Students will complete periodical assignments, problems and exercises related to methods seen in both lectures and laboratory sessions. In so doing, difficulties in the learning process can be identified. Moreover, some formative evaluation activities related to the lab sessions serve to evaluate the student skills in exploratory data analysis.

Notes:

Lectures: the professor will explain the theoretical contents of the course and solve illustrative applied problems. The professor will propose some exercises and cases for solving by students in class. Lectures run for 2 weekly hours. Although it is not a mandatory activity, regular attendance is highly recommended. Lectures will be complemented by problem-solving sessions (1 weekly hour during 10 weeks).

Guided assignments: students will complete assignments, problems and exercises related to concepts seen in problem-solving sessions and lectures.

Autonomous work: students are expected to spend about 40 hours to study theory, solve problems, prepare works and oral presentations, and take exams.

Tutorials: the professor's office hours will be posted on Moodle and the degree website to assist students with questions and doubts. It is beneficial for the student to come with clear and specific questions.

4.3.Syllabus

The course will address the following topics:

MODULE 1: EXPLORATORY DATA ANALYSIS

1. Descriptive statistics for one variable: descriptive measures (location, dispersión, skewness and kurtosis) and univariate graphs.
2. Model checking: Percentiles and probability plots.
3. Descriptive statistics for several variables: association measures, correlation coefficient, smoothing and fitting simple regression lines to data.

MODULE 2: PROBABILITY MODELS

1. Introduction to probability: Random experiments. Sample space and events. The axioms of probability. Consequences. Conditional probability. Partition of the sample space. Total probability rule and Bayes formula. Independence of two events. Mutually independent events.
2. Random variables and characteristics: Definition of random variable: discrete and continuous. Distribution function. Probability mass function. Discrete random variable. Continuous random variable: density function. Conditional distribution. Expected value of a random variable. Expected value of a function of a random variable. Properties of the expected value. Variance and its properties. Standard deviation. Skewness and kurtosis. Percentile. Probability bounds: Chebyshev's inequality.
3. Main probability models: Sampling with and without replacement. Hypergeometric distribution. Bernoulli process: Bernoulli, binomial, geometric and negative binomial distributions. Poisson process: Poisson, exponential and gamma distribution. Uniform, normal and Weibull distributions.
4. Multivariate random variables. Joint, marginal and conditional distributions. Conditional expected value. Independent variables. Reproductive property of a sum of variables. Bivariate normal distribution.

MODULE 3: STATISTICAL INFERENCE

1. Random sampling: Likelihood function. Statistics. Sampling distribution. Chi-squared, t-Student and F-Snedecor distributions. Central limit theorem. Fisher theorem. Computation of the random sample size.
2. Point estimation and confidence intervals: Unbiased estimators. Variance of a Point Estimator. Standard Error. Methods of point estimation, method of moments and maximum likelihood. Confidence intervals on the mean, the variance and a population proportion.
3. Tests of hypothesis: Hypothesis testing. Null and alternative hypothesis. One-sided and two-sided hypotheses. Type I and type II errors. Power and sample size. Connection between hypothesis tests and confidence intervals. Tests on the mean, variance and a population proportion. Control charts: XBar, S and run tests. Statistical inference for two samples. Tests on difference in means, on the variances ratio and on two population proportions. Paired t-test. Independence tests. Chi-Squared test. Anderson-Darling test. Analysis of single-factor experiments.

MÓDULO 4: AN INTRODUCTION TO OPTIMIZATION

30008 - Statistics

Optimization problems: Decision variables, objective function and constraints. Classification of optimization problems. Linear programming problems and graphical solving. Integer optimization problems: knapsack problem and travelling salesman problem.

4.4. Course planning and calendar

For further details concerning the timetable, classroom and further information regarding this course, please refer to the Escuela de Ingeniería y Arquitectura de la Universidad de Zaragoza (EINA), website, <https://eina.unizar.es/>.

4.5. Bibliography and recommended resources