30008 - Statistics

Información del Plan Docente

Academic Year	2016/17
Academic center	110 - Escuela de Ingeniería y Arquitectura
Degree	436 - Bachelor's Degree in Industrial Engineering Technology
ECTS	6.0
Course	1
Period	Half-yearly
Subject Type	Basic Education
Module	---

1.Basic info

1.1.Recommendations to take this course

1.2.Activities and key dates for the course

2.Initiation

2.1.Learning outcomes that define the subject

2.2.Introduction

A short introduction of the subject

Statistics is a subject corresponding to the basic module in the undergraduate program of Industrial Technology Engineering. In this course, topics cover exploratory data analysis, probability models, statistical inference and an introduction to optimization. The focus is on the practical use of the Statistics to actual problems and data in the engineering context. The purpose is to show to students the important applications of statistics in the everyday work of an engineer.

3.Context and competences

3.1.Goals

3.2.Context and meaning of the subject in the degree

3.3.Competences

3.4.Importance of learning outcomes

4.Evaluation

5.Activities and resources

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5.1.General methodological presentation

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.

5.2.Learning activities

5.3.Program

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: ESTIMATION AND HYPOTHESIS TESTING

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 likekihood. Confidenceintervals 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.

MÓDULE 4: AN INTRODUCTION TO OPTIMIZATION

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

5.4.Planning and scheduling

5.5.Bibliography and recomended resources