Universidad Zaragoza

Year : 2018/19

29908 - Statistics

Syllabus Information

Academic Year:	2018/19
Subject:	29908 - Statistics
Faculty / School:	110 -
Degree:	435 - Bachelor's Degree in Chemical Engineering
ECTS:	6.0
Year:	2
Semester:	Half-yearly
Subject Type:	Basic Education
Module:	

General information

Aims of the course

Context and importance of this course in the degree

Recommendations to take this course

Learning goals

Competences

Learning goals

Importance of learning goals

Assessment (1st and 2nd call)

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

Methodology, learning tasks, syllabus and resources

Methodological overview

The proposed methodology aims at encouraging students for daily work. Concepts are presented sequentially in time from probability models and random variables to parameter estimation and hypothesis testing. Thus, the concepts related to random sampling and inference constitute the last topic to be covered in this course. In so doing a better understanding of the contents is achieved and at the same time 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 the course are presented in large-group-sessions where a formal description is carried out with applications in appropriate examples. Classes in computer room deal with both data analysis and modelling of real events. Students completing them are enabled to use specific statistical software.

Learning tasks

This course comprises four learning blocks:

- Block 1: *Descriptive statistics for one and two variables. Regression analysis*
- Block 2: *One random variable, Probability models*
- Block 3: *Point estimation and confidence intervals*
- Block 4: *Statistical inference. Test of hypothesis for one and two samples*
- Block 5: *Introduction to optimization.*

Syllabus

*.- INTRODUCTION

The role of statistics in engineering

*.- DESCRIPTIVE STATISTICS FOR ONE AND TWO VARIABLES

Univariate graphs.

Percentiles. Box-plot

Location and dispersion measures.

Skewness and kurtosis

Association measures. Scatterplots. Correlation coefficient. Smoothing.

Fitting simple regression lines to data. Model checking.

*.- SAMPLE SPACES, CONDITIONAL PROBABILITY. INDEPENDENCE

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.

*.- RANDOM VARIABLES. PROBABILITY DISTRIBUTIONS

Definition of random variable.

Distribution function.

Probability mass function.

Discrete random variable.

Continuous random variable: density function.

Conditional distribution.

*.- CHARACTERISTICS OF RANDOM VARIABLES

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

Chebyshev's inequality.

Skewness and kurtosis.

*.- PROBABILITY MODELS

Discrete uniform distribution.

Bernoulli random variable.

Binomial distribution.

Geometric distribution, memoryless property

Negative binomial distribution.

Poisson distribution. Aproximation to the binomial distribution.

Poisson process.

Exponential distribution. Memoryless property.

Gamma distribution.

Interarrival times in the Poisson process: exponential and gamma distributions.

Continuous uniform distribution.

Normal distribution. Aproximations to the binomial and Poisson distributions.

Weibull, Rayleigh and lognormal distributions.

*.- STATISTICS.

Random sampling.

Point estimation and confidence intervals.

Tests of hypotheses.

Statistical inference for a single sample. Test on the mean, variance and population proportion.

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

Distribution fitting. Probability plots. Anderson-Darling test

*.- OPTIMIZATION

Introduction to design of experiments. Factor and variation.

One-Way design. ANOVA table

Two-Way design. Interaction .

Course planning and calendar

The course corresponds to 6 ECTS equivalent to 150 hours of activities for students with the following distribution:

30 hours (2 hours/week) in large-group sessions.

30 hours (2 hours/week) of practical clases. These classes take place in a computer room for small groups, the target being the development of skills in both problem-solving and data analysis.

84 hours for out-of-class work .

6 hours for student appraisal.

Bibliography and recommended resources