Universidad Zaragoza

Year : 2020/21

30008 - Statistics

Syllabus Information

Academic Year: 2020/21
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: First semester o 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 proposed methodology aims at encouraging students for everyday 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. Practice sessions deal with both data analysis and modeling of real events. Students completing them will be able to use specific statistical software.

4.2.Learning tasks

The course includes the following learning tasks:

- Lectures: 30 hours.
- Practice 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.

Practice sessions (2 hours per week) are organized in small groups. These 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 practice sessions. In so doing, difficulties in the learning process can be identified. Moreover, some formative evaluation activities related to the practice sessions serve to evaluate the student skills in exploratory data analysis.

Notes:

*Lecture*s: the professor will explain the theoretical contents of the course and solve illustrative applied problems. The professor will proposed some exercises and cases for solving by students. 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.

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

Autonomous work: students are expected to spend about 64 hours to study theory, solve problems, prepare works and oral presentation, 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 a random variable: discrete and continuous. Distribution function. Probability mass function. Discrete random variable. Continuous random variable: density function. Conditional distribution. The expected value of a random variable. The 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. The 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. The connection between hypothesis tests and confidence intervals. Tests on the mean, variance and population proportion. Control charts: XBar, S and run tests. Statistical inference for two samples. Tests on the difference in means, on the ratio of the variances 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 problems. Linear programming problem and graphical solving. Integer optimization problems: knapsack problem and traveling salesman problem.

4.4.Course planning and calendar

Further information concerning the timetable, classroom, office hours, assessment dates and other details regarding this course will be provided on the first day of class or please refer to the Escuela de Ingeniería y Arquitectura de la Universidad de Zaragoza (EINA), website, https://eina.unizar.es/ and Moodle, https://moodle2.unizar.es/add/

4.5.Bibliography and recommended resources

Link:
http://biblos.unizar.es/br/br_citas.php?codigo=30008&year=2019