

Academic Year/course: 2022/23

## 30207 - Statistics

### Syllabus Information

**Academic Year:** 2022/23

**Subject:** 30207 - Statistics

**Faculty / School:** 110 - Escuela de Ingeniería y Arquitectura  
326 - Escuela Universitaria Politécnica de Teruel

**Degree:** 439 - Bachelor's Degree in Informatics Engineering  
443 - Bachelor's Degree in Informatics Engineering

**ECTS:** 6.0

**Year:** 1

**Semester:** Second semester

**Subject Type:** Basic Education

**Module:**

## 1. General information

## 2. Learning goals

## 3. Assessment (1st and 2nd call)

## 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. These classes are complemented with real problem classes in small groups. 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

This course includes the following learning tasks:

- Block 1: *Explanatory data analysis*
- Block 2: *Probability models*
- Block 3: *Statistical inference*

### 4.3. Syllabus

**The course will address the following topics:**

#### **BLOCK 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.

## **BLOCK 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 and normal distributions.

4. Multivariate random variables. Joint, marginal and conditional distributions. Conditional expected value. Independent variables. Reproductive property of a sum of variables.

## **BLOCK 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. Optimization in Inference. 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 a population proportion. 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.

### **4.4. Course planning and calendar**

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

#### **Classroom activities**

- 30 hours (2hours/week) master class in large-group-class.
- 15 hours (1 hour/week) of problems in a small group (2 groups)
- 14 h (7 classes of 2 hours 2hour/2week) in the computer room in a small group (4 groups)

#### **Out of classroom activities**

- Self-study 70 h
- Statistical report 15 h

#### **Evaluation activities**

- 6 hours

### **4.5. Bibliography and recommended resources**

#### **Teruel:**

<http://psfunizar10.unizar.es/br13/egAsignaturas.php?codigo=30207&Identificador=12493>

#### **Zaragoza:**

<http://psfunizar10.unizar.es/br13/egAsignaturas.php?codigo=30207&Identificador=12635>