



Course guide

240725 - 240725 - Probability and Statistics

Last modified: 08/06/2023

Unit in charge: Barcelona School of Industrial Engineering
Teaching unit: 1039 - UPF - Universitat Pompeu Fabra.

Degree: BACHELOR'S DEGREE IN INDUSTRIAL TECHNOLOGIES AND ECONOMIC ANALYSIS (Syllabus 2018).
(Compulsory subject).

Academic year: 2023 **ECTS Credits:** 6.0 **Languages:** English

LECTURER

Coordinating lecturer: David Rossell (david.rossell@upf.edu)
UPF, Campus Ciutadella, Edifici Jaume I, 20.1E46

Others: David Rossell

PRIOR SKILLS

Working knowledge of calculus (differentiation, integration), basic programming

REQUIREMENTS

Linear algebra, Calculus

TEACHING METHODOLOGY

There are theory lectures (total 30h) and practical seminars (7 sessions of 90min, total 21h).

The lectures introduce basic concepts, motivating examples, and the mathematical and statistical tools required to solve the problems.

The seminars cover further examples and exercises to practice the tools learnt in the theory lectures, and they also introduce the R statistical software for basic Statistics and Data Analysis.

As part of the continuous assessment students will turn in homework exercises, and a final data analysis project (in the form of a report).

LEARNING OBJECTIVES OF THE SUBJECT

The main goal is to introduce basic notions and tools from probability and statistics that can help students solve applied problems involving data analysis or the interpretation of statistical results. It is intended that students learn how to apply such tools in simple applied settings, including the use of basic capabilities of statistical software. As an important secondary goal students shall also improve their experience in teamwork and writing technical reports.

STUDY LOAD

Type	Hours	Percentage
Hours medium group	9,0	6.00
Self study	102,0	68.00
Hours large group	30,0	20.00
Guided activities	9,0	6.00

Total learning time: 150 h

CONTENTS

Probability and Statistics

Description:

1. Introduction
 - Motivating examples
 - Basic notions: continuous & discrete variables, variability, sample vs. population
2. Descriptive Statistics
 - Univariate summaries and plots: central trend, dispersion, percentages, histograms, boxplots
 - Bivariate summaries and plots: correlation, contingency tables, scatterplot, bar plots
3. Probability
 - Random variables: probability mass, density, cumulative probability, expectation, variance
 - Common distributions: Bernoulli, Binomial, Poisson, Normal
 - Linear combinations: mean and variance
 - Central limit theorem
4. Inference
 - Sampling distributions and confidence intervals
 - Hypothesis tests: one- and K-sample chi-square test, one- and two-sample means
 - Regression
 - Bootstrap and permutation tests

Specific objectives:

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Resolution of problems arising in Engineering and Economics related to probability and data analysis, application of basic tools from calculus, introduction to Statistical programming, critical interpretation of statistical results.

Full-or-part-time: 130h 30m

Theory classes: 30h

Practical classes: 10h 30m

Self study : 90h

GRADING SYSTEM

To pass the course students must have a final mark greater or equal than 5.0 out of 10. The final mark is based on

- Continuous assessment (20%). Homework and resolution of exercises in seminar sessions
- Final project (20%)
- Midterm exam (30%)
- Final exam (30%)

Formula for computing the final mark:

$$0.2 CA + 0.2 FP + 0.3 ME + 0.3 FE$$

For students doing the retake exam, its mark replaces the midterm and final. Therefore their final mark is

$$0.2 CA + 0.2 FP + 0.6 RE$$



BIBLIOGRAPHY

Basic:

- Dekking, F.M. [et al.]. A Modern Introduction to Probability and Statistics : Understanding Why and How [on line]. London: Springer, 2005 [Consultation: 08/11/2023]. Available on: <https://link-springer-com.recursos.biblioteca.upc.edu/book/10.1007/1-84628-168-7>. ISBN 1846281687.