Course guide
240725 - 240725 - Probability and Statistics

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: 2022
ECTS Credits: 6.0
Languages: English

LECTURER

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

Others:

PRIOR SKILLS
Working knowledge of high school calculus (differentiation, integration), basic programming

REQUIREMENTS
High school mathematics, Basic programming

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

<table>
<thead>
<tr>
<th>Type</th>
<th>Hours</th>
<th>Percentage</th>
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</thead>
<tbody>
<tr>
<td>Self study</td>
<td>102,0</td>
<td>68.00</td>
</tr>
<tr>
<td>Guided activities</td>
<td>9,0</td>
<td>6.00</td>
</tr>
<tr>
<td>Hours medium group</td>
<td>9,0</td>
<td>6.00</td>
</tr>
<tr>
<td>Hours large group</td>
<td>30,0</td>
<td>20.00</td>
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</tbody>
</table>
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

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

Important: to pass this course students must obtain a minimum average mark of 4.0 across the two exams (midterm and final), or a mark of 4.0 in the retake