

Statistics II

Code: 102114
ECTS Credits: 6

Degree	Type	Year	Semester
2501231 Accounting and Finances	FB	2	1
2501232 Business and Information Technology	FB	2	1

Contact

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Use of Languages

Principal working language: catalan (cat)
Some groups entirely in English: No
Some groups entirely in Catalan: Yes
Some groups entirely in Spanish: No

Teachers

Nestor García Álvarez
Arnau Juanmarti Mestres
David Gomez Guillen
Catalina Bonet Bonet

Prerequisites

It is recommended that the student has passed the following subjects: Statistics I, Mathematics I and Mathematics II. This way, the student will have acquired the competences necessary to Statistics II with the best warranty of success. It is also essential that the student demonstrates basic knowledge of R.

Objectives and Contextualisation

This subject will enable the students to understand and apply the statistical method to solve problems characteristic of economics and business. Thus, starting from empirical evidence gathered in a given sample the students will be able to arrive to conclusions scientifically valid which will help them in decision making.

This subject must also provide students with the theoretical foundations that will enable them to follow satisfactorily other subjects of quantitative content (Econometrics or Forecasting Models in Accounting & Finance; Operations Research in Business & Information Technologies); as well as tools that will help them with a better understanding of subjects such as Macroeconomics or Decision Support Systems (B&IT) in which some statistical concepts (theoretical or practical) can play an important role.

Competences

- Accounting and Finances
- Analysing, summarising and assessing information.
- Efficiently searching information, discriminating irrelevant information.

- Interpreting and using mathematical tools and statistics in order to identify and solve problems of the economical and business scope with deterministic or/and random components.
- Organising the work, regarding order and planning.
- Students must be capable of collecting and interpreting relevant data (usually within their area of study) in order to make statements that reflect social, scientific or ethical relevant issues.
- Students must have and understand knowledge of an area of study built on the basis of general secondary education, and while it relies on some advanced textbooks it also includes some aspects coming from the forefront of its field of study.

Business and Information Technology

- Display a capacity for analysis.
- Interpreting and using mathematical and statistic tools in order to identify and solve problems of the economical and business scope with deterministic or/and random components.
- Students must be capable of collecting and interpreting relevant data (usually within their area of study) in order to make statements that reflect social, scientific or ethical relevant issues.
- Students must be capable of communicating information, ideas, problems and solutions to both specialised and non-specialised audiences.

Learning Outcomes

1. Analysing and establishing both quantitative and qualitative conclusions about the behaviour of variables with random components.
2. Analysing the variables through the contrast of hypothesis about their main characteristics.
3. Analysing, summarising and assessing information.
4. Appropriately drawing up technical reports according to the customer's demands.
5. Describing and analysing the causal relationship between economic variables.
6. Develop critical thinking and reasoning.
7. Display a capacity for analysis.
8. Efficiently searching information, discriminating irrelevant information.
9. Organising the work, regarding order and planning.
10. Students must be capable of collecting and interpreting relevant data (usually within their area of study) in order to make statements that reflect social, scientific or ethical relevant issues.
11. Students must be capable of searching and analysing information of different sources.
12. Students must have and understand knowledge of an area of study built on the basis of general secondary education, and while it relies on some advanced textbooks it also includes some aspects coming from the forefront of its field of study.

Content

Statistics II - Inferential Statistics

Unit 1 Introduction to Inferential Statistics and Estimation

- 1.1 Inferential Statistics: Definition and Inference Methods
- 1.2 Definition, characteristics and Distribution of the main sample statistics: mean, variance and proportion
- 1.3 Methods of point estimation and interval estimation
- 1.4 Properties of estimators: bias, efficiency and consistency
- 1.5 Methods of estimation: maximum likelihood and method of moments

Unit 2 Parametric hypothesis tests

- 2.1 Concept of parametric test: null hypothesis and alternative hypothesis
- 2.2 Test statistic and error type

2.3 Tests on the population mean, population variance and population proportion

2.4 Sample comparison test

2.5 Analysis of Variance

2.6 The p-value

Unit 3 Goodness-of-fit and analysis of the relationship between variables

3.1 Chi-Square goodness-of-fit test for discrete variables

3.2 K-S goodness-of-fit test for continuous variables

3.3 Test of independence between qualitative variables

3.4 Analysis of the correlation between quantitative variables: correlation coefficient

Unit 4 Introduction to the regression model

4.1 Presentation and objectives of the model

4.2 Hypothesis of the model specification

4.3 Estimation by Ordinary Least Squares (OLS) and their properties

4.4 Model testing

4.5 Coefficient of the goodness-of-fit and relationship between the correlation and the regression analysis

4.6 Forecasting

Methodology

The activities that will allow the students to learn the basic concepts included in this course are:

1. Theory lectures where the instructor will explain the main concepts.

The goal of this activity is to introduce the basic notions and guide the student learning.

2. Problem Sets

A problem set which students will have to solve individually will be included in every unit. The goal of this activity is twofold. On one hand students will work with the theoretical concepts explained in the classroom, and on the other hand through this practice they will develop the necessary skills for problem solving.

3. Lab sessions

The aim of this activity is to learn to use computational tools for the treatment and analysis of data. This activity will be developed, on the programmed days, in the computer rooms of the faculty. Faculty or in the teaching room depending on the circumstances and availability of spaces. If the activity is developed in the regular classroom, students will need to bring a laptop in order to participate in the activity.

4. Tutoring hours

Students will have some tutor hours in which the subject instructors will help them solve any doubts they may have.

Annotation: Within the schedule set by the centre or degree programme, 15 minutes of one class will be reserved for students to evaluate their lecturers and their courses or modules through questionnaires.

Activities

Title	Hours	ECTS	Learning Outcomes
Type: Directed			
Lab sessions	17	0.68	1, 2, 5
Lectures with ITC support	32.5	1.3	1, 2, 5
Type: Supervised			
Tutoring and monitoring work in progress	7.5	0.3	1, 2, 5
Type: Autonomous			
Exercici solving	89.5	3.58	1, 2, 5

Assessment

The evaluation of the students will be carried out according to the following activities:

1. A midterm exam

Written evidence in which the student will not be allowed to consult any kind of teaching material. The maximum resolution time will be 60 minutes. This test does not release matter.

2. A final exam

Written evidence in which the student will not be allowed to consult any kind of teaching material. The maximum resolution time will be 2 hours, and will include all the subject matter of the course.

The exam is designed so that the student performs a last learning effort that is considered necessary to consolidate the previously acquired knowledge, thus guaranteeing the success in the continuous learning process of the greatest possible number of students.

3. Submission of problem sets and essays, and/or lab practices

Students will submit, at the request of the teaching staff and following their instructions, various exercises, lab practices and/or essays to be solved individually and/or in groups of between 2 and 4 students.

Evaluation criteria

The grade of the midterm exam will weight a 20% of the average grade of the subject.

The grade of the final exam will weight a 50% of the average grade of the subject.

The grade of the submission of exercises, essays and/or lab practices will weight a 30% of the average grade of the subject.

Therefore, the average grade of the subject is computed as:

$$\begin{aligned} \text{average grade of the subject} &= 20\% (\text{grade of the midterm exam}) + \\ &+ 50\% (\text{grade of the final exam}) + \\ &+ 30\% (\text{grade exercises/essays/lab practices}) \end{aligned}$$

The subject will be considered "passed" if the following two requirements are met:

1. the average grade of the subject is equal to or greater than 5 and

2. the grade of the final exam is equal to or greater than 3.

- A student that meets the first requirement above but does not meet the second will receive an average grade of the subject equal to 4.5, and will qualify for the re-evaluation test according to what is established in the section "Retake Process" below.
- A student that meets the second requirement above but does not meet the first, or any of them, will qualify for the re-evaluation test according to what is established in the section "Retake Process" below.

A student who has not participated in any of the assessment activities will be considered "Not evaluable".

Calendar of evaluation activities

The dates of the evaluation activities (exercises in the classroom, assignments, ...) will be announced well in advance during the semester (Campus Virtual). The dates of the final exam and mid-term exam are scheduled in the assessment calendar of the Faculty.

"The dates of evaluation activities cannot be modified unless there is an exceptional and duly justified reason why an evaluation activity can not be carried out. In this case, the degree coordinator will contact both the teaching staff and the affected student, and a new date will be scheduled within the same academic period to make up for the missed evaluation activity." Section 1 of Article 115. Calendar of evaluation activities (Academic Regulations UAB).

Students of the Faculty of Economics and Business, who in accordance with the previous paragraph need to change an evaluation activity date must process the request by filling out an "Application for exams' reschedule" on the Faculty website.

Grade revision process

After all grading activities have ended, students will be informed of the date and way in which the course grades will be published.

Students will be also be informed of the procedure, place, date and time of grade revision following University regulations.

Retake Process

"To be eligible to participate in the retake process, it is required for students to have been previously been evaluated for at least two-thirds of the total evaluation activities of the subject." Section 3 of Article 112 ter. The recovery (UAB Academic Regulations). Additionally, it is required that the student to have achieved an average grade of the subject between 3.5 and 4.9.

The date of the retake exam will be posted in the calendar of evaluation activities of the Faculty. Students who take this exam and pass, will get a grade of 5 for the subject. If the student does not pass the retake, the grade will remain unchanged, and hence, student will fail the course.

Irregularities in evaluation activities

In spite of other disciplinary measures deemed appropriate, and in accordance with current academic regulations, "in the case that the student makes any irregularity that could lead to a significant variation in the grade of evaluation activity, it will be graded with a 0, regardless of the disciplinary process that can be instructed. In case of various irregularities occur in the evaluation of the same subject, the final grade of this subject will be 0". Section 10 of Article 116. Results of the evaluation. (UAB Academic Regulations).

Assessment Activities

Title	Weighting	Hours	ECTS	Learning Outcomes
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Exercises, essays and/or lab practices	30%	0.5	0.02	1, 2, 3, 8, 5, 6, 9, 10, 4, 11
Final exam	50%	2	0.08	1, 2, 8, 5, 6, 12, 7
Midterm exam	20%	1	0.04	1, 2, 8, 5, 6, 12, 7

Bibliography

- Canavos, G. C. Applied probability and statistical methods. McGraw-Hill. McGraw-Hill. 1998
- Heumann C, Schomaker M. and Shalabh Introduction to Statistics and Data Analysis Springer 2016
<https://link.springer.com/content/pdf/10.1007%2F978-3-319-46162-5.pdf>
- Illowsky, B., and Dean, S. Introductory Statistics OpenStax Rice University 2018
<https://openstax.org/details/books/introductory-statistics>
- **Lind, DA et al.** Statistical Techniques in Business and Economics. McGraw-Hill. 2018
- Newbold P. Statistics for business and economics. Pearson-Prentice Hall. 2013

Software

R and Rstudio

R is a mighty programming language for doing statistics. It covers from the most basic concepts, like computing the mean of a list of numbers, to the most advanced techniques as linear and nonlinear modeling, statistical tests, time series analysis, classification, clustering, etc. As a matter of fact, R is considered to be one of the most widely used statistical software tools in the industry and the academia. R is a highly versatile and easy to expand open source project, which means that is freely distributable and that there is a community of thousands of users and developers continuously contributing to this software. You can learn everything about R by visiting the Comprehensive R Archive Network at CRAN. R Studio is a powerful IDE (Integrated Development Environment) for working with R, and is the tool that will be used throughout this course.