

## STATISTICAL INFERENCE INTRODUCTION

### COURSE DETAILS

<b>Code</b>	36276
<b>Degree</b>	Degree in Business Management
<b>Mention</b>	Business creation and management
<b>Character</b>	Compulsory
<b>Year</b>	2nd
<b>ECTS</b>	6

### PROFESSORS

<b>Name</b>	<b>Department</b>	<b>Tutorials</b>
Carrión García, Alicia	Applied economy	Thursday from 15:00 to 17:00 (under request through email)

### SUMMARY

Statistical Inference: Introduction is a course taught in first semester of the second year of the Grado en Administración y Dirección de Empresas, mención Creación y Dirección de Empresas, Itinerario Emprendedores. It is a subject of basic training, taught in English, and has a total study load of 6 ECTS credits.

In a degree which aims to train future business managers, able to contribute to the management of economic and social development, Statistical Inference: Introduction is a prerequisite for analysis and decision-making matter.

For the specific itinerary of entrepreneurship, is a tool of knowledge required for its direct applicability in the development of business initiatives and innovative component. Also, in the design and testing of new products, services or technologies is a key component of its release.

This course, a continuation of the Basic Statistics course taught in the first grade of ADE, has a strong instrumental character.

The contents therein are relevant to develop a further understanding of the subject of Econometrics and also support for other subjects of the degree as Financial Statement Analysis, Market Research, Environment and Quality Management, Survey Methodology, and many others. Also, its contents can address other important

aspects of business management such as Audit, Inventory and Stock Control, Human Resource Evaluation, Experimental Design of Goods and Services, and others.

As for the contents of the course, we begin by a brief review of the concept of random variable and probabilistic models to develop, then, the concepts of sampling, confidence intervals, hypotheses tests and others commonly used to represent and analyze socio-economic and business phenomena.

## **PRIOR KNOWLEDGE**

### **Restriction of registration**

Restrictions of registration with other subjects of the degree have not been specified.

### **Other requirements**

Although there are no prerequisites, it is recommended to have studied previously the subjects of Mathematics I, Mathematics II, and Basic Statistics.

## **COMPETENCES**

### **GENERAL COMPETENCES:**

- GP.1 - Ability to work in teams.
- GP.3 - Critical and self-critical ability.
- GP.5 - Managing time effectively.
- GI.1 - Capacity for analysis and synthesis.
- GI.2 - Capacity of organization and planning.
- GI.3 - oral and written communication in the native language.
- GI.4 - Ability to use English in the professional field.
- GI.5 - Ability to use ICT in the field of study.
- GI.6 - Ability to analyze and seek information from different sources.
- GI.7 - Ability to solve problems.
- GI.8 - Ability to make decisions.
- GI.9 - Ability to negotiate and reconcile interests effectively.
- GI.10 - Ability to transmit and communicate complex ideas and approaches to both a specialist and non-specialist audiences.

### **SPECIFIC COMPETENCES:**

- EG.7 - Know and properly use the various quantitative and qualitative methods appropriate to reason analytically evaluate results and predict economic and financial figures.
- EA.4 - Know how to make strategic diagnoses in complex and uncertain environments, using appropriate methodologies to solve them.
- EA.5 - Ability to make decisions in an environment of certainty and uncertainty.
- EA.6 - Ability to apply analytical and mathematical methods for analysis of economic and business problems.
- EA.10 - Ability to communicate in formal, graphical and symbolic languages.
- EA.73 - Develop critical capacity on the Spanish and international economic news.
- EA.74 - Ability to analyze the economic situation and understand its implications.

- EA.30 - Ability to plan, organize, monitor and evaluate the implementation of corporate strategies.

## LEARNING OUTCOMES

Upon completion of this course, students will be able to:

- Ability to recognize an economic problem from the observation of the economic reality.
- Increasing ability to use logical/strategical reasoning to address real economic and business problems.
- Use of basic quantitative tools and their application to the economic environment.
- Ability to choose a theoretical framework to analyze reality.
- Knowledge of the basic quantitative tools for the economic analysis, diagnosis and forecast, such as mathematics, statistics and econometrics.
- Ability to identify econometric problems in the model and to apply theoretical knowledge to address them.
- Search, choose and assess adequate information for the analysis of economic and business environments.
- Application of different analytical tools under uncertainty.

## COURSE CONTENTS

### Unit 1. Introduction to statistical inference

- 1.1 Introduction: universe, population and sample.  
Objectives of Statistical inference.
- 1.2 Basic Statistics revisited: The normal distribution.
- 1.3 Probability and stochastic convergence. Examples.

### Unit 2. Sampling

- 2.2 Sampling methods. Simple random sampling
- 2.3 Sampling distribution of sample means. Central limit theorem
- 2.4 Sampling distribution of sample proportions and variances.

### Unit 3. Estimation

- 3.1 Point estimation. Properties of estimators
- 3.2 Confidence interval for the mean: known & unknown variance.  
Sample size determination.
- 3.3 Confidence interval for the proportion. Sample size determination.
- 3.4 Confidence interval for the variance.

### Unit 4. One population hypothesis testing

- 4.1 General approach of statistical hypothesis testing.  
Null and alternative hypotheses. Two-tailed and one tailed tests.
- 4.2 Hypothesis testing for the mean.
- 4.3 Power of the test.
- 4.3 Hypothesis testing for the proportion.
- 4.4 Hypothesis testing for the variance.

**Unit 5. Two population hypothesis testing**

- 5.1 Test of the difference between two population means. Known variances. Unknown variances assumed equal. Unknown variances not assumed equal. Paired samples.
- 5.2 Test of the difference between two population proportions.
- 5.3 Pearson's  $r$ . Hypothesis testing on linear relations.

**Unit 6. Non-parametric hypothesis testing**

- 6.1 Multiple percentage comparisons: Crosstabulations and Chi2.
- 6.2 Other non-parametric hypothesis testing.

**WORKLOAD**

<b>PRESENIAL ACTIVITIES</b>	<b>HOURS</b>
Theoretical sessions	30
Practical sessions	30
<b>Total Presential Activities</b>	<b>60</b>
<b>NON-PRESENIAL ACTIVITIES</b>	
Preparation theoretical sessions	10
Preparation practical sessions	20
Readings of complementary material	5
Self-study	40
Preparation grading activities	15
<b>Total Non-Presential Activities</b>	<b>90</b>
<b>TOTAL</b>	<b>150</b>

**TEACHING METHODOLOGY**

The subject is primarily structured around theoretical and practical sessions, which will be as participatory and active as possible. All relevant materials will be available at the campus virtual with the objective that students can prepare in advance each session. The use of statistical computer packages will be a priority to a better understanding of the theoretical concepts and to solve practical exercises.

In the theoretical sessions, professor will present the main theoretical concepts, which will be contextualized to different fields of application, mainly related to socio-economic and business cases. It will be encouraged the participation and discussion of students in order to capture their attention and concentration and to promote their ability to discuss about real-world examples. During the practical sessions, following the indications of the professor, students will solve individually or in groups several real and fictitious exercises. Some of them will be solved using Excel.

In order to have an adequate understanding of the subject, students can attend to the office hours or participate in the forum at the campus virtual (an online platform where student can share questions and doubts).

## EVALUATION CRITERIA

Following the rules of the center, each student has the right to use four different calls.

### Students of first enrollment

The final mark depends on written exams and continuous assessment.

1. **Written exams** represent **60 percent** of the final mark and consist in:
  - a. **In the first call**
    - i. **Fundamentals exam** (5 percent) is a writing test about all the topics covered in the course introduction (Unit 1).
    - ii. **Mid term exam** (20 percent) is a writing test about all the topics covered up to Unit 4.2 (Hypothesis testing for the mean).
    - iii. **Final exam** (35 percent) is a writing test about **all the topics of the course**.
  - b. **In the second call**
    - i. **Retake exam** (60 percent) is a writing test about **all the topics of the course**.
2. **Continuous evaluation** represents **40 percent** in the final grade and will consist in:
  - a. **Class participation** (10 percent)

Attendance and participation is essential and all students are expected to participate. Relevant discussions are expected from each student.

**Cellular phones and tablets** should be switched off and out of reach of the students. **Laptop computers should be switched off and folded** unless the professor indicates they should be switched on. **Students violating these rules will be invited to abandon the classroom** and their absences will be computed. Equally, students involved in side comments will be invited to abandon the class room.

- b. **Group Research work** (30 percent)

Research work is a central element in this course. It should be **original** and will be developed in groups composed by 6 participants. The group work will consist in the identification of a business related problem. Students will formalize a research design that will be presented and discussed publicly. Once approved by the professor, research designs cannot be changed any more without specific authorization. **An approved research design is a prerequisite for presenting the final research report.** Students will deliver a first version of their report by mid term exam. Electronic and printed versions of the final research report should be handed to the professor in the final exam day.

**Honesty Rules.** Research reports will be scanned by the means of specific antiplagiarism software. The research work is a central element in this course, as a consequence **the professor will apply strong enforcement of honesty rules**. Any violation of academic honesty rules will be reported to the Ethics commission. **Cheating students should be ready to face the most serious academic consequences**, including the **expulsion** from the study program.

Due to its nature, the **continuous evaluation is non-recoverable** and will be maintained in the 1<sup>st</sup> and the 2<sup>nd</sup> call.

One of the requirements **to pass** the course is to pass the **written exams**. Therefore, if the weighted average grade of the written exams is equal to or larger than 5 (over 10 points), the weighted final mark of the course is computed. Obviously, to pass the course, the computed final mark has to be equal to or larger than 5. On the other hand, if the weighted average grade of the written exams is lower than 5 (over 10 points), students will not pass the course and the final mark will be the weighted average grade of the written exams (over 10 points).

In the final exams and the research papers written along the course, students should follow orthography and grammar standard for academic essays. Otherwise their grades will be down weighted accordingly.

**Class attendance** is mandatory for optimal monitoring of the subject, so that absence in more than 15% of the sessions means that a student will not be part of continuous assessment. Then, the final mark will be equal to 60 percent of the grade obtained in the final exam.

### **Students of second enrollment**

Students who have not passed the subject during the 1<sup>st</sup> and 2<sup>nd</sup> calls and are not repeaters, should enroll for the second time in the subject and will have right to two additional calls (3<sup>rd</sup> and 4<sup>th</sup> calls). Their evaluation will be as follows:

1. The final **exam**, which represents 80% of the final mark, is a writing test about all the topics of the program.
2. The **continuous assessment**, which represents 20% of the mark, will consist in a practical research paper.

Students that are in this situation should contact the professor at the beginning of the course to have an initial meeting.

## REFERENCES

### Recommended books

- Paul Newbold, William Carlson, Betty Thorne (2015) - Statistics for Business and Economics: Global Edition, 8e, Pearson Education, ISBN: 9780273767084.

### Complementary references

- Quirk, Thomas J. Excel (2016) for Business Statistics. Springer International Publishing Switzerland, 2016. ISBN: 978-3319389585