



## Information about the subject

**Degree:** Bachelor of Science Degree in Business Administration and Management

**Faculty:** Faculty of Legal, Economic and Social Sciences

**Code:** 300308 **Name:** Statistical Inference

**Credits:** 6,00 **ECTS Year:** 3 **Semester:** 2

**Module:** Quantitative Methods

**Subject Matter:** Statistical and Econometric Methods **Type:** Compulsory

**Field of knowledge:** Ingeniería y Arquitectura

**Department:** Economics, Business Management, and Marketing

**Type of learning:** Classroom-based learning / Online

**Languages in which it is taught:** English, Spanish

### Lecturer/-s:

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## Module organization

### Quantitative Methods

Subject Matter	ECTS	Subject	ECTS	Year/semester
Information Systems	12,00	Information Systems for Management I	6,00	1/2
		Information Systems for Management II	6,00	2/1
Mathematics	6,00	Mathematics for Economics and the Business	6,00	1/1
Statistical and Econometric Methods	12,00	Econometrics	6,00	4/1
		Statistical Inference	6,00	3/2
Statistics	6,00	Descriptive Statistics	6,00	2/1

## Recommended knowledge

Basic knowledge of descriptive statistics and the normal probability distribution.



## Learning outcomes

At the end of the course, the student must be able to prove that he/she has acquired the following learning outcomes:

- R1 To consult, based on the problem proposed, the most important information sources and make an adequate analysis form the data obtained.
- R2 To break down a complex problem into several parts and establish complex causal links . To recognize several possible causes of an event or several consequences of an action or a chain of events.
- R3 Given an already formalized problem, be able to apply the techniques learned to solve it and be able to decide whether or not you can get a solution or not, so that, in the second case, you can approximate the solutions. To be able to decide if the solution obtained is reasonable, according to the context in which the problem is formulated.
- R4 To recognize accurately the populations and random variables underlying the problems they face and to be able to define the concept of a representative sample. Expose the basic idea of the Central Limit Theorem and its practical implications .
- R5 To express opinions clearly and precisely and to be able to ask control and follow-up questions. Given a "verbalized" problem, be able to translate it into formal language and identify economic facts based on their numerical substrate and be able to establish basic relationships.
- R6 To calculate the probability of complex economic events, obtained by means of econometric operations, and to recognize these operations in statements of real problems.
- R7 To differentiate discrete random variables from continuous variables and to calculate mathematical expectations and variances of both types of variables, as well as to apply appropriate mathematical theorems.
- R8 To solve simple problems involving the distribution of continuous variables . To identify in real problems random variables that can be modeled using different distributions and easily handle distribution tables to solve problems where variables can be modeled using this distribution.
- R9 To express the conclusions of an econometric study in economic terms and to convey those conclusions to people unfamiliar with statistical terminology.
- R10 To consult, based on the problem posed, the most appropriate sources of information and to make appropriate use of the data collected. To carry out systematic work to obtain the maximum and most appropriate information from all the available secondary sources (newspapers, magazines, databases, etc.)



- R11 To handle office packages and especially be able to use the Excel formulation fluently . To be able to handle some of the usual computer tools, so that he/she can provide numerical approximations to the problems posed. To use and interpret the results of a computer program to handle the various econometric techniques, in order to overcome the obstacle of complex calculations associated with them.



## Competencies

Depending on the learning outcomes, the competencies to which the subject contributes are (please score from 1 to 4, being 4 the highest score):

BASIC		Weighting			
		1	2	3	4
CB1	That students have demonstrated knowledge and understanding in an area of study that is at the core of general secondary education, and is often at a level that, while supported by advanced textbooks, also includes some aspects that involve knowledge from the cutting edge of their field of study.	X			
CB2	That students know how to apply their knowledge to their work or vocation in a professional way and possess the skills that are usually demonstrated through the elaboration and defense of arguments and the resolution of problems within their area of study.	X			
CB3	That students have the ability to gather and interpret relevant data (usually within their area of study) to make judgments that include reflection on relevant social, scientific or ethical issues.			X	
CB4	That students can convey information, ideas, problems and solutions to both specialized and non-specialized audiences.			X	
CB5	That students have developed those learning skills necessary to undertake further studies with a high degree of autonomy.				X
GENERAL		Weighting			
		1	2	3	4
CG0	Speaking well in public.		X		
CG1	Capacity of analysis and synthesis.				X
CG3	Capacity to apply knowledge into practice.				X
CG5	Oral and written communication.			X	
CG6	Use of ICTs			X	



CG7	Information management.				X
CG8	Orientation to problem-solving.				X
CG9	Decision-making orientation.			X	
CG11	Creativity and ability to generate new ideas.			X	
CG13	Ability to learn and research skills.				X
CG18	Ability to obtain, from the data, valuable information for decision making.				X

SPECIFIC	Weighting			
	1	2	3	4
CE14 To understand the potential impact of aspects related to the macro- and microeconomic environment and its institutions on business organizations (e.g. the monetary and financial system, domestic markets)			X	
CE15 Ability to obtain, from the data, valuable information for decision making.				X
CE17 Application of professional criteria to the analysis of business problems.			X	
CE18 Ability to integrate in any functional area of a company and develop different tasks related to its management.		X		



## Assessment system for the acquisition of competencies and grading system

### In-class teaching

Assessed learning outcomes	Granted percentage	Assessment method
R1, R2, R3, R4, R5, R6, R7, R8, R9, R10, R11	15,00%	Objective Tests
R1, R2, R3, R4, R5, R6, R7, R8, R9, R10, R11	25,00%	Conduct of Theory-Practice
R1, R2, R3, R4, R5, R6, R7, R8, R9, R10, R11	10,00%	Class attendance and participation
R1, R2, R3, R4, R5, R6, R7, R8, R9, R10, R11	50,00%	Final Exam

### Observations

1. In order to pass the course, it is an essential requirement to obtain **at least 5 out of 10 points in the final on-site exam**, in any of the available calls: **first call, second call, early call, or single assessment**. If the student fails the final exam, the **overall weighted grade for the course may not exceed 4.9 out of 10 points**.

2. In the **second call**, and **single assessment**, objective tests, theoretical-practical activities, and attendance and participation in class will be assessed through a **practical on-site test involving data analysis using a computer**, in addition to the final on-site exam.

**3. Single assessment:** According to Article 9 of the General Regulations for the Evaluation and Grading of Official Degrees and Own Degrees at UCV, the single assessment is linked to the impossibility of attending classes for students enrolled in an on-site program. It is therefore considered an **extraordinary and exceptional** assessment system that may be requested by students who, for justified and documented reasons, are unable to follow the continuous assessment system. The request must be submitted to the course instructor, who will make an express decision regarding the acceptance or rejection of the request, and will inform the student accordingly.

The evidence to be submitted and/or the test(s) to be taken under the single assessment will consist of the **same theoretical exam as for the rest of the students**, as well as a **practical on-site test consisting of data analysis using a computer**. The final grade will be calculated according to the following weighting: **50% theoretical exam and 50% practical test**. This criterion applies **both in the first and second calls**.

1. Students who do not attend **at least 80% of the scheduled in-person sessions** will not be eligible for evaluation through the continuous assessment system. In such cases, they will be



required to complete, in addition to the final on-site exam, a **practical on-site test consisting of data analysis using a computer**. The final grade in this case will be calculated as follows: **50% practical test and 50% theoretical exam (final on-site exam)**.

2. During the course, the instructor will dedicate one session to defining and discussing **best practices in the use of artificial intelligence (AI) tools applied to data analysis**. **Students who violate these best practices**, either during the continuous assessment tests or in the final practical test, **will receive a grade of 0 (zero points)** in the corresponding test or project.

## Online teaching

Assessed learning outcomes	Granted percentage	Assessment method
R1, R2, R3, R4, R5, R6, R7, R8, R9, R10, R11	5,00%	Attendance and participation in the activities of synchronous communication
R1, R2, R3, R4, R5, R6, R7, R8, R9, R10, R11	25,00%	Conduct of deliverables
R1, R2, R3, R4, R5, R6, R7, R8, R9, R10, R11	15,00%	Regular evaluations through online questionnaires.
R1, R2, R3, R4, R5, R6, R7, R8, R9, R11	5,00%	Participation in discussion forums
R1, R2, R3, R4, R5, R6, R7, R8, R9, R10, R11	50,00%	Final on-site assessment.

## Observations

1. In order to pass the course, it is an essential requirement to obtain **at least 5 out of 10 points in the final on-site exam**, in any of the calls: first call, second call, early call, or single assessment. If the student fails the final exam, the overall weighted grade for the course **may not exceed 4.9 out of 10 points**.

2. In the **second call** and in the **single assessment**, participation in synchronous communication activities, deliverable assignments, periodic evaluations through online quizzes, and participation in discussion forums will be assessed through a **practical on-site test**, in addition to the final on-site exam.

**3. Single assessment:** According to Article 9 of the General Regulations for the Evaluation and Grading of Official Degrees and Own Degrees at UCV, the single assessment is linked to the impossibility of attending classes for students enrolled in an on-site program. It is, therefore, an extraordinary and exceptional assessment system that may be requested by students who, for justified and documented reasons, are unable to follow the continuous assessment system. The request must be submitted to the course instructor, who will make an express decision on whether to accept or reject the request, and will inform the student accordingly. The evidence to be submitted and/or the test(s) to be taken in the single assessment will consist of the **same theoretical exam as the rest of the students**, as well as a **practical on-site test**





**consisting of data analysis using a computer.** The final grade will be calculated based on the following weighting: **50% theoretical exam and 50% practical test.** This criterion applies **both in the first and second calls.**

1. The evidence to be submitted and/or the test(s) to be taken in the single assessment will consist of the **same theoretical exam as the rest of the students**, as well as a **practical on-site test consisting of data analysis using a computer.** The final grade will be calculated based on the following weighting: **50% theoretical exam and 50% practical test.** This criterion applies **both in the first and second calls.**

## CLASS ATTENDANCE IN FACE-TO-FACE DEGREES

In accordance with the development guidelines of the General Regulations for the Evaluation and Qualification of Official Teachings and Own Degrees of the UCV, in face-to-face degrees, class attendance with a minimum of 80% of the sessions of each subject will be required as a requirement to be evaluated. This means that, if a student does not attend the sessions of each subject, in a percentage greater than 20%, he/she will not be able to be evaluated, neither in the first nor in the second call, unless the person responsible for the subject, with the approval of the person responsible for degree, in view of duly justified exceptional circumstances, exempt from the minimum attendance percentage. The same criterion will be applicable for hybrid or virtual degrees in which teachers must maintain the same percentage in the requirement of "presence" in the different training activities, if any, even if these are carried out in virtual environments.

## MENTION OF DISTINCTION:

The mention of "Honors" may be awarded to students who have obtained a grade equal to or greater than 9.0. Their number may not exceed five percent of the students enrolled in a group in the corresponding academic year, unless the number of students enrolled is lower.

## Learning activities

The following methodologies will be used so that the students can achieve the learning outcomes of the subject:

- |    |  |
|----|--|
| M1 | Problem solving, commentaries, summaries to hand in periodically.  |
| M3 | Teacher presentation of contents, analysis of competences, explanation and in-class display of skills, abilities and knowledge.  |
| M5 | Group work sessions supervised by the professor. Case studies, diagnostic tests, problems, field work, computer room, visits, data search, libraries, on-line, Internet, etc. Meaningful construction of knowledge through interaction and student activity. |



- M7 Supervised monographic sessions with shared participation.
- M9 Application of multidisciplinary knowledge.
- M11 Personalized and small group attention. Period of instruction and / or orientation conducted by a tutor with the objective of reviewing and discussing the materials and topics presented in classes, seminars, readings, conducting work, etc.
- M13 Set of oral and/or written tests used in initial, formative or additive assessment of the student.
- M14 Student study: Group Individual preparation of readings, essays, problem solving, seminars, papers, reports, etc. to be presented or submitted in theoretical lectures, practical and/or small-group tutoring sessions.
- M16 Group preparation of readings, essays, problem solving, seminars, papers, reports, etc. to be presented or submitted in theoretical lectures, practical and/or small-group tutoring sessions.
- M17 Teacher presentation of contents, analysis of competences, explanation and in-class display of skills, abilities and knowledge.
- M19 Groupwork sessions in the chat under supervision of the lecturer. Analysis of economic and business case studies, both real and fictitious, in order to build knowledge through the student's interaction and activity. Critical analysis of values and social commitment.
- M21 Monographic sessions though the semester, which will be aimed at current aspects and applications of the subject.
- M23 Set of written or oral tests used for the initial, formative or cumulative assessment of the student.
- M25 Student study: Individual preparation of readings, essays, problem solving, seminars, papers, reports, etc., for their discussion or submission in electronic format.
- M27 Individual support for the monitoring and orientation of the learning process. It will be carried out by a lecturer and will pursue the revision and discussion of the materials, topics, readings, tasks, etc.
- M29 Group preparation of readings, essays, problem solving, seminars, papers, reports, etc., for their discussion or submission.



M31 Participation in discussion forums related to the subject under the supervision of the lecturer.



## IN-CLASS LEARNING

### IN-CLASS LEARNING ACTIVITIES

	LEARNING OUTCOMES	HOURS	ECTS
On-campus Class M3	R1, R2, R3, R4, R5, R6, R7, R8, R9, R10, R11	22,50	0,90
Practical Class M5	R1, R2, R3, R4, R5, R6, R7, R8, R9, R10, R11	15,00	0,60
Seminar M7	R1, R2, R3, R4, R5, R6, R7, R8, R9, R10, R11	4,50	0,18
Group Presentation of Papers M5	R1, R2, R3, R4, R5, R6, R7, R8, R9, R10, R11	6,00	0,24
Office Assistance M11	R1, R2, R3, R4, R5, R6, R7, R8, R9, R10, R11	6,00	0,24
Assessment M13	R1, R2, R3, R4, R5, R6, R7, R8, R9, R10, R11	6,00	0,24
<b>TOTAL</b>		<b>60,00</b>	<b>2,40</b>

### LEARNING ACTIVITIES OF AUTONOMOUS WORK

	LEARNING OUTCOMES	HOURS	ECTS
Group Work M16	R1, R2, R3, R4, R5, R6, R7, R8, R9, R10, R11	30,00	1,20
Independent Work M14	R1, R2, R3, R4, R5, R6, R7, R8, R9, R10, R11	60,00	2,40
<b>TOTAL</b>		<b>90,00</b>	<b>3,60</b>



## ON-LINE LEARNING

### SYNCHRONOUS LEARNING ACTIVITIES

	LEARNING OUTCOMES	HOURS	ECTS
Synchronous Virtual Session M17	R1, R2, R3, R4, R5, R6, R7, R8, R9, R10, R11	4,00	0,16
Synchronous Virtual Practical Session M19	R1, R2, R3, R4, R5, R6, R7, R8, R9, R11	4,00	0,16
Seminar and Synchronous Virtual Videoconference M21	R1, R2, R3, R4, R5, R6, R7, R8, R9, R10, R11	4,00	0,16
On-site or Synchronous Virtual Assessment M23	R1, R2, R3, R4, R5, R6, R7, R8, R9, R10, R11	3,00	0,12
<b>TOTAL</b>		<b>15,00</b>	<b>0,60</b>

### ASYNCHRONOUS LEARNING ACTIVITIES

	LEARNING OUTCOMES	HOURS	ECTS
Individual Work M25	R1, R2, R3, R4, R5, R6, R7, R8, R9, R10, R11	60,00	2,40
Tutorial Support Sessions M27	R1, R2, R3, R4, R5, R6, R7, R8, R9, R10, R11	5,00	0,20
Group Work M29	R1, R2, R3, R4, R5, R6, R7, R8, R9, R10, R11	10,00	0,40
Discussion Forum M31	R1, R2, R3, R4, R5, R6, R7, R8, R9, R10, R11	10,00	0,40
Continuous Assessment Tasks M1	R1, R2, R3, R4, R5, R6, R7, R8, R9, R10, R11	50,00	2,00
<b>TOTAL</b>		<b>135,00</b>	<b>5,40</b>



## Description of the contents

Description of the necessary contents to acquire the learning outcomes.

### Theoretical contents:

Content block	Contents
1 Introduction to Statistical Inference	Sample and Population: From the Calculation of Sample Statistics to the Estimation of Population Parameters.
2. Estimation of Population Parameters: Confidence Intervals.	<p>Impact of the confidence level, observed variability in the sample, and sample size on the range of a confidence interval.</p> <p>Construct a confidence interval for the population mean when the population standard deviation is known. Construct a confidence interval for the population mean when the population standard deviation is not known. Construct a confidence interval for a population proportion. Determine the minimum sample size to estimate a population proportion with a pre-established maximum margin of error.</p>
3. Hypothesis Testing for a Single Sample	<p>Concept of null hypothesis and alternative hypothesis and the asymmetry of the evidence needed to choose between them.</p> <p>Directional and non-directional alternative hypotheses. Hypothesis testing for a population mean with known and unknown population standard deviation. Concept and method of the p-value. Hypothesis testing for a population proportion. Method of the p-value.</p>
4. Hypothesis Testing for Two Populations	Hypothesis testing for the means of two populations with known and unknown population standard deviations. Method of the p-value. Hypothesis testing for two population proportions. Method of the p-value. Hypothesis testing for the population mean difference with paired or dependent observations.



## 5. Hypothesis Testing for More Than Two Population Means. Analysis of Variance (ANOVA)

Concept of Analysis of Variance. Null hypothesis and alternative hypothesis in ANOVA. Model assumptions: Normality and Homoscedasticity. Graphical methods. Introduction to Levene's test and Kolmogorov-Smirnov test. F-test for hypothesis testing. Method of the p-value. Post-hoc pairwise multiple comparison methods. Bonferroni test with corrected p-values.

## 6. Hypothesis Testing for More Than Two Proportions. Contingency Tables.

Construction of contingency tables. Concept of expected frequencies vs. observed frequencies. Examples of use in historical contexts: The V1 bombs over London: Random or targeted towards popular neighborhoods? (Poisson and Chi2 at His Majesty's service) Non-parametric hypothesis testing using the Chi2 statistic. Method of the p-value.

## 7. Hypothesis testing on the linear association between two quantitative variables

Scatter plots. Pearson's linear correlation. The p-value method. Linear regression. From the degree of association between two variables to prediction: The regression line.



## Temporary organization of learning:

Block of content	Number of sessions	Hours
1 Introduction to Statistical Inference	3,00	6,00
2. Estimation of Population Parameters: Confidence Intervals.	3,00	6,00
3. Hypothesis Testing for a Single Sample	5,00	10,00
4. Hypothesis Testing for Two Populations	8,00	16,00
5. Hypothesis Testing for More Than Two Population Means. Analysis of Variance (ANOVA)	5,00	10,00
6. Hypothesis Testing for More Than Two Proportions. Contingency Tables.	2,00	4,00
7. Hypothesis testing on the linear association between two quantitative variables	4,00	8,00

## References

### ·BASIC REFERENCES:

- Newbold, Paul, Carlson, William L. & Thorne, Betty (2013) Statistics for Business and Economics. Pearson Prentice Hall / 8th global edition/
- Haslwanter, Thomas (2016) An Introduction to Statistics with Python. Springer.
- Thomas , Dariin (2022). Introductory Statistics Using Python. Sujisola.

### ·ADDITIONAL REFERENCES:

- Salsburg, David. (2002) The Lady Tasting Tea: How Statistics Revolutionized Science in the Twentieth Century ISBN-13 978-0805071344
- Wooldridge, Jeffrey. (2012) Introductory Econometrics A Modern Approach. ISBN-13 : 978-1111531041
- Heiss, Florian & Brunner, Daniel. (2020) Using Python for Introductory Econometrics. ISBN-13 : 979-8648436763





## Addendum to the Course Guide of the Subject

Due to the exceptional situation caused by the health crisis of the COVID-19 and taking into account the security measures related to the development of the educational activity in the Higher Education Institution teaching area, the following changes have been made in the guide of the subject to ensure that Students achieve their learning outcomes of the Subject.

**Situation 1: Teaching without limited capacity** (when the number of enrolled students is lower than the allowed capacity in classroom, according to the security measures taken).

In this case, no changes are made in the guide of the subject.

**Situation 2: Teaching with limited capacity** (when the number of enrolled students is higher than the allowed capacity in classroom, according to the security measures taken).

In this case, the following changes are made:

### 1. Educational Activities of Onsite Work:

All the foreseen activities to be developed in the classroom as indicated in this field of the guide of the subject will be made through a simultaneous teaching method combining onsite teaching in the classroom and synchronous online teaching. Students will be able to attend classes onsite or to attend them online through the telematic tools provided by the university (videoconferences). In any case, students who attend classes onsite and who attend them by videoconference will rotate periodically.

In the particular case of this subject, these videoconferences will be made through:

☒ Microsoft Teams

☐ Kaltura



## **Situation 3: Confinement due to a new State of Alarm.**

In this case, the following changes are made:

### **1. Educational Activities of Onsite Work:**

All the foreseen activities to be developed in the classroom as indicated in this field of the guide of the subject, as well as the group and personalized tutoring, will be done with the telematic tools provided by the University, through:

☒ Microsoft Teams

☐ Kaltura

Explanation about the practical sessions:



## 2. System for Assessing the Acquisition of the competences and Assessment System

### ONSITE WORK

#### Regarding the Assessment Tools:

☒ The Assessment Tools will not be modified. If onsite assessment is not possible, it will be done online through the UCVnet Campus.

☐ The following changes will be made to adapt the subject's assessment to the online teaching.

Course guide		Adaptation	
Assessment tool	Allocated percentage	Description of the suggested changes	Platform to be used

The other Assessment Tools will not be modified with regards to what is indicated in the Course Guide.

#### Comments to the Assessment System:



## ONLINE WORK

### Regarding the Assessment Tools:

☒ The Assessment Tools will not be modified. If onsite assessment is not possible, it will be done online through the UCVnet Campus.

☐ The following changes will be made to adapt the subject's assessment to the online teaching.

Course guide		Adaptation	
Assessment tool	Allocated percentage	Description of the suggested changes	Platform to be used

The other Assessment Tools will not be modified with regards to what is indicated in the Course Guide.

### Comments to the Assessment System: