COURSE GUIDE
SUBJECT

1. DETAILS OF THE COURSE

1.1. Name: Advanced Statistics

1.2 Code: 63102202	**1.3 Plan: ADE (2010)**	**1.4.Level: Undergraduate**
1.5 Course: 2nd	**1.6. Type: Compulsory**	**1.7. Semester: 1st**
1.9. ECTS: 6	**1.9.1.Theoretical: 4**	**1.9.2.Practical: 2**

1.10. Descriptors: Statistical inference, Analysis of Variance and Simple linear regression.

2. LECTURER

2.1. Name: María E. Morales Giraldo

2.2. Department: Mathematics

2.3. Field of Knowledge: Statistics and Operations Research

2.4. Office: 2.46 CITE III

2.6. Mentoring: Time and place will be set at the beginning of the term

2.6.1. 1st Semester:	**2.6.2. 2nd Semester:**

2.7. Phone: 950 01 58 13	**2.8. E-Mail: maria.morales@ual.es**	**2.9. Virtual platform WEB CT: Yes**

2.10. Personal Webpage:

3. DATA OF THE DEPARTMENT

3.1. Name: Mathematics

3.2. Fields of Knowledge of the Department: Statistics and Operations Research, Applied Mathematics, Real Analysis, Algebra, Geometry and Topology.

3.3. Director: Antonio Salmerón Cerdán

3.3.1. Office: 2.41 CITE III	**3.3.2.Phone: 950 01 5668**	**3.3.3.E-Mail: asalmero@ual.es**

3. 4. Head of Administration: Jesús Chaparro Torres

3.4.1. Office: 0.11 CITE III	**3.4.2. Phone: 950 01 5480**	**3.4.3 Fax: 950 01 5167**	**3.4.4.E-Mail: chaparro@ual.es**

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4. CONTEXT

4.1. Main objective of the course:

This subject strengthens the approach of statistics as a tool for obtaining and analyzing business information as well as information about the economic and social environment through the treatment and modelling of databases using statistical inference techniques. This way, the procedures included in this subject provide us with methods to infer properties of a population from a small part of it, called sample. This subject also offers the student the opportunity to learn and practice with the statistical software SPSS, which will be used to perform the statistical studies with databases.

4.2 Previous knowledge:

This subject is a continuation of 1st course subject Statistics. Some knowledge of the subject Maths of 1st course is also needed

4.3. Prior conditions:

None

5. COMPETENCIES AND OBJECTIVES

5.1 COMPETENCIES OF THE COURSE	*5.2 OBJECTIVES OF THE COURSE*
5.1.1. GENERAL COMPETENCIES: Having and understanding knowledge (RD1) Basic knowledge of the profession (UAL1) Problem solving skills (UAL3)	*5.2.1. GENERAL OBJECTIVES OF THE COURSE* - The student must show knowledge and understanding of the theoretical and practical foundations of Statistical Inference. - Knowledge, skills and attitudes which facilitate understanding of new theories, interpretations, methods and techniques within different curricular fields, leading to meet the professional requirements. - The ability to identify, analyse and define the main parts of a problem in order to solve it rigorously.
5.1.2 . Specific objectives *Specific conceptual competencies (theoretical knowledge) :* *Knowing and applying the basic concepts of Statistical Inference (AFB02)*	*Knowing and understanding of Statistical Inference methods. Analyzing statistically a set of data, interpreting the results and drawing conclusions.*
Specific procedural competencies (practical knowledge): *Acquiring skills and master computer tools applied to different areas.(FBC12)*	*Knowing and operating with ease the computer program for statistical analysis SPSS*

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6.CONTENTS

6.1. THEORETICAL CONTENTS:

Module I: Introduction to Statistical Inference

Unit 1: Multidimensional random variable

1. Independence
2. Expectation and variance
3. Reproductivity
4. Central limit theorem
5. Normal associated distributions

Unit 2: Samples and statistics

1. General setting of Inference and basic concepts
2. Parametric point estimation:

   - Sample mean, variance and proportion.
   - Mean square error
   - Properties: Unbiasedness, relative efficiency and consistency.

Module II: Confidence intervals estimation and hypothesis tests

Unit 3: Confidence intervals and hypothesis tests estimation

1. General setting of a confidence interval
2. General methodology to obtain a confidence interval
3. General setting of the a parametric hypothesis test

   - Error types
   - Power of a test
   - P-value concept

4. General methodology to obtain a hypothesis test
5. Determination of confidence intervals and hypothesis tests of frequent use.

Module III: Data analysis methods

Unit 4: Non-parametric hypothesis tests

1. General setting of the problem
2. Normality tests
3. Independence chi-square test
4. Randomness test

Unit 5: Analysis of variance

1. Introduction
2. The means test. The ANOVA table
3. Ad hoc comparisons. Analysis of mean differences.
4. Checking previous assumptions. Analysis of residuals.

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5. Non-parametric alternative: The Kruskal-Wallis test

Unit 6: Linear regression model

1. Introduction. The simple linear regression model.

2. Parameter estimates

3. Inferences over the model

4. Checking previous assumptions.

6.2. PRACTICAL CONTENTS:

All practical lessons will deal with the SPSS computer program. In each of the practical lessons the contents of the theoretical lessons will be used and the student will learn to apply them using the SPSS.

Student will be required to solve problems autonomously using the SPSS computer program, and this will be the core of their evaluation.
There are 7 practical lessons expected:
Practical lessons 1 and 2 – Unit 1
Practical lesson 3 – Unit 3
Practical lesson 4 – Unit 4
Practical lessons 5 and 6 – Unit 5
Practical lesson 7 – Unit 6

7. SCHEDULE
7.1 Schedule for the different units

Unit	Theory hours	Practical hours
Unit 1: Multidimensional random variable	5	2
Unit 2: Samples and statistics	2	0
Unit 3: Confidence intervals and hypothesis tests estimation	8	2
Unit 4: Non-parametric hypothesis tests	3	2
Unit 5: Analysis of variance	6	4
Unit 6: Linear regression model	6	4
Evaluation	3	
Total	**31**	**14**

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8. METHODOLOGY

8.1 Methodology for the treatment of the theoretical contents:

Before the date of the lesson, students should download and print the slides of the corresponding unit, available via WebCt. Also, there will be some documents that students must read **before** the unit starts, and complementary material provided by the lecturer.

Even though attendance is not compulsory, students are expected to attend to the theoretical lessons for a better understanding of the subject.

The lecturer will explain the concepts of the unit, using the given slides, and some other documents available to the student.

Students will be motivated to participate actively in class.

Related material will be provided by the lecturer for each unit: Applets, videos, web links, recommended bibliography, etc.

As autonomous work, students should study the contents, look up the bibliography and attend to mentoring if necessary.

8.2 Methodology for the treatment of practical content:

Practical contents are closely related to theoretical contents, so student must have covered the corresponding theoretical content and attended to the practical lessons.

At the beginning of the class the lecturer will summarize the needed theoretical contents to perform the lesson and will explain briefly how the exercises in the SPSS have to be done.

The exercises proposed in each lesson have to be solved individually.

The lecturer will reply questions and solve problems when performing the proposed exercises.

In some of the lessons, the teacher will ask for the solutions of the exercises (using WebCt), which will become part of the evaluation.

As autonomous work, students should operate the SPSS program, available in the free-access computer room in the University, and complete all the exercises proposed in the practical lessons, in order to acquire great skills using the program.

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8.3 Workload of the student (calculated by number of hours)		
WORKING HOURS OF THE STUDENT		

8.3.1. IN-CLASS HOURS (with professor)

TEACHING ACTIVITY		NO. HOURS
CLASS of theory (THEORY GROUP ACCORDING TO OD)		31
CLASS OF PRACTICAL TRAINING (PRACTICE GROUPS ACCORDING TO OD)	Laboratory	
	Problems	
	Informatics	14
	Field	
	Other	
SUBTOTAL IN-CLASS HOURS		45
HOURS FOR TESTS AND EXAMS		5

8.3.2 . AUTONOMOUS WORKING HOURS (not in-class, estimated)

HOURS OF PREPARATION FOR ACTIVITIES AND WORK (theory)	40
HOURS OF PREPARATION FOR ACTIVITIES AND WORK (practice)	40
HOURS OF STUDY FOR TESTS AND EXAMS	25
OTHER	
SUBTOTAL AUTONOMOUS WORKING HOURS	*105*

TOTAL WORKING HOURS	*STUDENT*
	150

9. BIBLIOGRAPHY OF THE COURSE

9.1 Recommended Reading:

Practical Business Statistics -6th edition (Andrew F. Siegel)
SPSS Statistics 19 Guide to Data Analysis - With CD *(Marija Norusis)*
Statistics for business and financial economics (Cheng F. Lee, John C. Lee y Alice C. Lee)
Statistics for business and economics (David R. Anderson, Dennis J. Sweeney, Thomas A. Williams)

9.2 Web addresses:

You can check the existing bibliography in the University Library in the following link:

http://almirez.ual.es/search/x?SEARCH=63102202

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10 EVALUATION SYSTEM

10.1 Aspects and/or criteria:

The evaluation of the subject will be mostly based on the performance in the SPSS computer practice. Students are expected not only to obtain the numerical result of a problem, but also to interpret it theoretically. They should know how to apply the procedures explained in theory, when to apply them, how these procedures work and why, interpret the results and study the previous conditions before applying them.

Students should also be able to extract the important information provided by the statistical procedures learnt in theory and write simple reports expressing the solution to the proposed exercises.

It will be specially well valued the clarity of the concepts, the correct use of the mathematical terminology and notation, the reasoning skill and deep understanding of statistical procedures.

10.2 Modalities and instruments:

Written final exam
Computer practices during practical lessons.
Handing in activities through WebCt.
Handing in activities in class.

10.3 Marking system:

The total mark of the subject is 10 points, divided this way:

1. **Five points (50%), as** maximum, can be obtained completing a two hours computer practice in the computer room, whose contents will correspond to the ones that have been dealt with during the practical lessons. This computer practice will take place at the end of the subject (see Temporary sequencing in the WebCt). The use of a Flash-USB memory drive is compulsory. Teacher is not responsible of possible missing files in the case of not using the USB-memory drive, and so, in this case, the practice will not be repeated. (Evaluation of competencies RD1, UAL1, UAL3, AFB02, FBC12).

2. **Two points (20%), as** maximum, can be obtained handing in through WebCt the exercises solved in some of the practical lessons. The lecturer will select these practical lessons. In order to obtain the two points, it is an essential requirement to hand in the required exercises in the date and hour (within the deadline) pointed by the lecturer. The use of a Flash-USB memory drive is compulsory. Teacher is not responsible of possible missing files in the case of not using the USB-memory drive, and so, in this case, the practice will not be repeated. (Evaluation of competencies RD1, UAL1, UAL3, AFB02, FBC12).

3. **Three points (30%), as** maximum, can be obtained through a theoretical-practical written final exam over the contents of the subject, to check if the student has reached the objectives. A minimum mark of 1 point is required in this exam in order to pass the subject. (Evaluation of competencies RD1, UAL1, UAL3, AFB02).

The marks of 2., obtained during the course, will be maintained for the extraordinary exam in September, whilst 1. and 3. will be again evaluated in September.