Course Plan

1. Course details

- Subject title: **Probability and Statistics**
- **Academic Year: 2011-12 Year: 2 Term: 1 and 2**
- **Degree / Studies: ECO/ADE Subject code: 20830**
- **Number of ECTS credits: 5+5 Student hours required: 125 + 125**
- **Course Language(s): Catalan/Spanish**
- **Teaching staff: Albert Satorra, Christian Brownlees, Mireia Besalú, David Roche, Joan Serra, Josep Ma. Joan, Omiros Papaspiliopoulos, Montse Vergara**

2. Presentation of the course

Probability and Statistics is designed as a basic module for students, structured over two consecutive terms. The first term mainly covers Probability and the second Statistics. The course follows on from *Data Analysis*, which students will have studied in their first year.

The subject aims to give students a solid base of theoretical knowledge and the capacity to apply it practically. Other statistical and econometric techniques will be added further on in the course.

In Probability, students will be introduced to the subject's basic concepts, which will be helpful not only for the Statistics course that follows, but also for many other areas in the study of economics and management. The basic models of discrete and continuous probability will also be introduced.

In Statistics, the basic concepts of statistical inference will be covered, starting with sampling distributions and univariate data modelling, confidence intervals and hypothesis contrast. Basic comparative contrast will be followed by the study of simple linear regression.

3. 3. Competences to be achieved in the subject

General competences	**Specific competences**
Instrumental 1. Capacity for analysis and synthesis 2. Capacity for organisation and planning 3. General basic knowledge 4. Problem solving 5. Written and oral communication in student's own language Interpersonal 6. Critical thinking. Systemic 7. Investigative skills 8. Capacity to learn 9. Ability to work autonomously 10. Capacity to generate new ideas (creativity) Others 11. Oral and written communication using specialized language	1. Knowledge of concepts and the language of probability and statistics. 2. Capacity to identify the constituent elements of modelling a real problem using a probabilistic model and adjusting it based on specific data. 3. Knowledge and application of mathematical properties of the concepts involved. 4. Use of statistical software and the capacity to read and interpret the results obtained.

4. Contents

Probability

Module 1. Probability: basic concepts.

Module 2. Discrete random variables.

Module 3. Discrete univariate probability distributions.

Module 4. Continuous random variables. Continuous univariate distributions.

Module 5. Bivariate distributions.

Module 6. Asymptotic distributions.

Statistics

Module 1. Sampling distributions.

Module 2. Confidence intervals.

Module 3. Nonparametric hypothesis contrast.

Module 4. Simple parametric comparisons.

Module 5. Contrasting differences between groups and variance analysis.

Module 6. Simple regression models.

5. Assessment

Assessment of the subject comprises of an evaluation each term and a final average.

Assessment each term

- Evaluations during seminars. Two or three evaluations are carried out during the term. These evaluations, which are not announced ahead of time, last 30 minutes and are held at the beginning of seminar sessions. Each evaluation is based on problems similar to those covered in class and in the seminars. These evaluations make up 25% of the final mark.

- Assessment of the seminar sessions. Evaluation is made of the student's participation in the sessions and of their capacity to resolve situations presented during the sessions, and also of their work outside the classroom. These evaluations make up 15% of the final mark.

- Final examination. The final examination covers all the contents of the course and lasts two hours. It accounts for 60% of the final mark.

Final assessment of the subject

The final grade for the subject is calculated using an average of the marks awarded during the two terms, providing the student has achieved a mark of at least four in each one. If not, the student will receive a fail.

Extraordinary examination sittings

Students may be examined separately, during an extraordinary examination sitting, for any terms where they receive a mark of less than five. The mark for any such terms will be weighted as follows: 20% for the evaluations and seminars during the year and 80% for the extraordinary examination.

The final mark for the extraordinary examination sitting for that subject will be in accordance with the same rules as the ordinary examination sitting: a minimum mark of four in each part of the examination will be required.

6. Bibliography and teaching resources

Books

QA276.12 .M66518 1998
Applied Basic Statistics
Moore, David S.
Barcelona : Antoni Bosch, DL 1998

QA276.12 .M665 2004
The Basic Practice of Statistics
Moore, David S.
New York [N.Y.] : W.H. Freeman, 2004, 3rd ed

http://www.whfreeman.com/bps/
has a range of support material relating to Moore.

QA276.18 .N49 2007
Statistics for Business and Economics
Newbold, Paul
Upper Saddle River, N.J. : Prentice Hall, cop. 2007, 6th ed.

A276.18 .N4918 2008
Statistics for Business and Economics
Newbold, Paul
Madrid : Pearson Educación, cop. 2008, 6th ed.

Answers to selected exercises by Newbold
http://shazam.econ.ubc.ca/newbold/

Teaching resources

Theory summaries and lists of solved problems are available on the internet or in the Virtual Classroom.

7. Methodology

The process of teaching and learning is based on theory classes, seminars and the student's own coursework.

Each term 16 theory sessions lasting 90 minutes will be held as a large group. These sessions will introduce the main concepts, techniques and applications, and students will be told what material and topics they need to work on outside the classroom.

The group will be divided into four sub-groups for a series of six seminar sessions each term. Checks will be made in the seminars of students' progress in the tasks assigned and students will be given exercises and situations to work on either on their own or in small groups. Some seminar sessions will include written evaluations.

Statistical software will be used in theory classes by the lecturer and also by students as they do their coursework outside the classroom, and also in the seminars.

The student is expected to complete the following tasks each week:
- Before theory classes: locate and read the materials (individual work).
- Attend theory classes (classroom).
- Carry out individual study, study solved problems, revise notes, solve the problems set, and read textbooks (individual work).
- Before the seminar sessions: solve the problems set. Practice using the statistical software (individual work).
- Take part in seminars (classroom).
- Compare the results of the exercises with the answers given by lecturers (individual work).

8. Activities schedule

During the first term, activities are structured as follows:

Week	*Classroom activity*	*Activities outside the classroom Group / type of activity*
Week 1	Theory session 1: Module 1, (1/2); (1.5h) – How the course works. – Probability: basic concepts. – Laplace's Law and computation techniques. Theory session 2: Module 1, (2/2); (1.5h) – Conditioned probability and the independence concept – Total probability theorem. – Bayes' Theorem	– *Individual / Finding and reading materials from the week's theory sessions (2h + 2h = 4h)* – *Individual / Personal study. (2h + 2h = 4h)*
Week 2	Theory session 3: Module 2, (1/2); (1.5h) – Random variables; discrete case. – Mass function. – Distribution function. Theory session 4: Module 2, (2/2); (1.5h) – Expectation and variance; properties. – Chebyshev's Inequality.	– *Individual – Finding and reading materials from the week's theory sessions (2h + 2h = 4h)* – *Individual / Personal study. (2h + 2h = 4h)*
Week 3	Seminar 1: Random experiments. (1.5h) Theory session 5: Module 3, (1/2); (1.5h) – Uniform distribution. – Bernoulli distribution. – Binomial distribution.	– *Individual / Before the seminar, solving problems that have been set. Practicing using the statistical software. (2h)*

	Theory session 6: Module 3, (2/2); (1.5h) – Geometric distribution. – Poisson distribution. – Negative binomial distribution.	– *Individual – Group / Comparison of the results of the exercises set with the answers given by lecturers (individual work). (1.5h)* – *Individual / Finding and reading materials from the week's theory sessions (2h + 2h = 4h)* – *Individual / Personal study. (2h + 2h = 4h)*
Week 4	Seminar 2: Discrete distributions. (1.5h) Theory session 7: Module 4, (1/3); (1.5h) – Continuous random variables. – Density function. – Distribution function. – Percentiles and the calculation of probabilities. Theory session 8: Module 4, (2/3); (1.5h) – Expectation and variance. – Uniform distribution. – Exponential distribution.	– *Individual / Before the seminar, solving problems that have been set Practicing using the statistical software. (2h)* – *Individual – Group / Comparing the results of the exercises with the answers given by lecturers (individual work). (1.5h)* – *Individual / Finding and reading materials from the week's theory sessions (2h + 2h = 4h)* – *Individual / Personal study. (2h + 2h = 4h)*
Week 5	Seminar 3: Classic discrete distributions. (1.5h) Theory session 9: Module 4, (3/3); (1.5h) – Normal distribution and associated distributions: log-normal and Chi-squared, etc. Theory session 10: Module 5, (1/3); (1.5h) – Joint distribution. – Marginal distributions. – Conditional distribution.	– *Individual / Before the seminar, solving problems that have been set Practicing using the statistical software. (2h)* – *Individual – Group / Comparing the results of the exercises with the answers given by lecturers (individual work). (1.5h)* – *Individual / Finding and reading materials from the week's theory sessions (2h + 2h = 4h)* – *Individual / Personal study. (2h + 2h = 4h)*
Week 6	Seminar 4: Continuous distributions. (1.5h) Theory session 11: Module 5, (2/3); (1.5h) – Conditional expectation. – Law of Iterated Expectation. – Covariance, correlation and independence. Theory session 12: Module 5, (3/3); (1.5h) – Bivariate normal distribution.	– *Individual / Before the seminar, solving problems that have been set. Practicing using the statistical software. (2h)* – *Individual – Group / Comparing the results of the exercises with the answers given by lecturers (individual work). (1.5h)* – *Individual / Finding and reading materials from the week's theory sessions (2h + 2h = 4h)* – *Individual / Personal study. (2h + 2h = 4h)*

Week 7	Seminar 5: Bivariate distributions. (1.5h) Theory session 13: Module 6, (1/3); (1.5h) – Simple random sampling. Sample mean random variable. – Weak Law of Large Numbers.	– *Individual / Before the seminar, solving problems that have been set. Practicing using the statistical software. (2h)* – *Individual – Group / Comparing the results of the exercises with the answers given by lecturers (individual work). (1.5h)* – *Individual / Finding and reading materials from the week's theory sessions (2h)* – *Individual / Personal study. (2h)*
Week 8	Seminar 6: Asymptotic distributions. (1.5h) Theory session 14: Module 6, (2/3); (1.5h) – Central Limit Theorem.	– *Individual / Before the seminar, solving problems that have been set. Practicing using the statistical software. (2h)* – *Individual – Group / Comparing the results of the exercises with the answers given by lecturers (individual work). (1.5h)* – *Individual / Finding and reading materials from the week's theory sessions (2h)* – *Individual / Personal study. (2h)*
Week 9	Theory session 15: Module 6, (3/3); (1.5h) – Central Limit Theorem applications.	– *Individual / Finding and reading materials from the week's theory sessions (2h)* – *Individual / Personal study. (2h)* – *Individual – Group / Preparation of queries from the course (3h)*
Week 10	Theory session 16: Resolving queries from the course. (1.5h)	– *Individual – Group / Preparation of queries from the course (3h)* – *Individual / Personal study of problems resolved and discussed during Theory session 16 (5h)*

Structure of the second term:

Week	*Classroom activity*	*Activities outside the classroom Group / type of activity*
Week 1	Theory session 1 Theory session 2	*Personal study, problem solving, submission of some selected problems.*
Week 2	Theory session 3 Theory session 4	*Personal study, problem solving, seminar preparation.*
Week 3	Seminar 1 Theory session 5 Theory session 6	*Personal study, problem solving, checking results of the problems and results from the seminar, seminar preparation.*

Week 4	Seminar 2 Theory session 7 Theory session 8	*Personal study, problem solving, checking results of the problems and results from the seminar, seminar preparation.*
Week 5	Seminar 3 Theory session 9 Theory session 10	*Personal study, problem solving, checking results of the problems and results from the seminar, seminar preparation.*
Week 6	Seminar 4 Theory session 11 Theory session 12	*Personal study, solving exercises, checking results of the exercises and results from the seminar, seminar preparation.*
Week 7	Seminar 5 Theory session 13	*Personal study, solving exercises, checking results of the exercises and results from the seminar, seminar preparation.*
Week 8	Seminar 6 Theory session 14	*Personal study, solving exercises, checking results of the exercises and results from the seminar, seminar preparation.*
Week 9	Theory session 15	*Personal study, problem solving, checking results of the problems and results from the seminar.*
Week 10	Theory session 16	*Personal study, problem solving.*

The student can find a detailed description of the contents to be covered in each theory session and seminar in the Virtual Classroom.