Universidad Zaragoza

27016 - Probability

<u>**Información del Plan Docente**</u>

Academic Year	2017/18
Faculty / School	100 - Facultad de Ciencias
Degree	453 - Degree in Mathematics
ECTS	6.0
Year	3
Semester	First semester
Subject Type	Compulsory
Module	---

1.General information

1.1.Introduction

1.2.Recommendations to take this course

1.3.Context and importance of this course in the degree

1.4.Activities and key dates

2.Learning goals

2.1.Learning goals

2.2.Importance of learning goals

3.Aims of the course and competences

3.1.Aims of the course

3.2.Competences

4.Assessment (1st and 2nd call)

4.1.Assessment tasks (description of tasks, marking system and assessment criteria)

The students may take two mid-term exams corresponding to Block 1 and Block 2. The first exam, corresponding to Block 1 will be held at the end of that block. The exam corresponding to Block 2 will be held at the official date of the February exam. A mean score of 5 and a minimum score of 4.5 in the two midterm exams is needed to pass the subject.

The students may also take a unique final exam in each of the two calls (February and September) of the subject.

5.Methodology, learning tasks, syllabus and resources

5.1.Methodological overview

A learning process based on critical reflection of concepts is proposed. In order to achieve these objectives, problem based learning is used. The aim of these learning processes is to encourage management of documentary sources, reflection on previously learned theoretical aspects, and structuring a logical discourse from the problem statement to its resolution.

5.2.Learning tasks

Lectures: they will be based on a participative learning-teaching approach, promoting the interaction with students.

Small group classes : Problems and exercises will be worked in small group classes. Additional exercises will be provided for student personal work.

Depending on the time availability, some seminars or computer lab classes will be held to complement the contents developed in class.

Office hours . Students will have tutorials with the teacher on a schedule to be agreed jointly.

Personal work . Individual study will allow to consolidate the concepts explained in class as well as learn and properly apply the techniques studied. They should handle literature, in addition to class notes. It should also dedicate a significant part of their time to solving the proposed exercises.

5.3.Syllabus

Block 0. A review of probability and one-dimensional variables

Block 1. Random vectors

1.1. General random vectors. Definition. Cumulative distribution function. Transforms of random vectors. Types of random vectors.

1.2. Discrete random vectors. Probability distributions: joint, marginal, condicional. Independent random variables.

1.3. Continuous random vectors. Probability distributions: joint, marginal, condicional. Independent random variables. Diferentiable transformof a continuous random vector aleatorio.

1.4. Moments and properties of random vectors. Moments. Moment generating functions. Reproductive property.

1.5. Correlation and least mean square principle. Correlation coefficient. Schwarz's inequality. Functional relationships between two random variables and the least mean square principle.

1.6. Some multivariate probability distributions. Multinomial distribution and Multivariate Normal distribution.

Block 2. Stochastic convergence, Law of large numbers and Central limit theorem.

2.1. Convergence of sequences of random variables. Convergence in probability. Almost sure convergence.

Convergence in distribution. Convergence in the Lp-norm. Properties and relationships between the types of

convergence.

2.2. Laws of Large Numbers. Weak laws of large numbers. Strong laws of large numbers. Central limit theorem for independent and identically distributed random variables. General central limit theorem.

5.4.Course planning and calendar

The classroom teaching activities will be held according to the schedule established and published by the Science Faculty before the start of the course.

5.5.Bibliography and recommended resources

[BB: Bibliografía básica / BC: Bibliografía complementaria]

- [BB] Grimmett, Geoffrey. One thousand exercices in probability / Geoffrey R. Grimmett and David R. Stirzaker . - 1st ed., reprinted Oxford : Oxford University Press, 2003
- [BB] Lasala, Pilar. Problemas resueltos de cálculo de probabilidades / Pilar Lasal Calleja Zaragoza : Prensas Universitarias de Zaragoza, 1996
- [BB] Rohatgi, Vijay K.. An introduction to probability theory and statistics / Vijay K. Rohatgi, A. K. Md. Ehsanes Saleh . 3rd ed. New York [etc.] : John Wiley, cop. 1976.
- [BB] Vélez Ibarrola, Ricardo. Cálculo de Probabilidades 2 / Ricardo Vélez Ibarrola . - [1ª ed.] Madrid : Ediciones Académicas, 2004
- [BB] Vélez Ibarrola, Ricardo. Cálculo de probabilidades I / Ricardo Vélez Ibarrola, Víctor Hernández Morales . - [1a.ed.] Madrid : UNED, 1995