27012 - Introduction to Probability and Statistics

Información del Plan Docente

Academic Year	2016/17
Academic center	100 - Facultad de Ciencias
Degree	453 - Degree in Mathematics
ECTS	6.0
Course	2
Period	Second semester
Subject Type	Basic Education
Module	---

1.Basic info

1.1.Recommendations to take this course

1.2.Activities and key dates for the course

2.Initiation

2.1.Learning outcomes that define the subject

2.2.Introduction

3.Context and competences

3.1.Goals

3.2.Context and meaning of the subject in the degree

3.3.Competences

3.4.Importance of learning outcomes

4.Evaluation

5.Activities and resources

5.1.General methodological presentation

The learning process will be mainly based on:

-Lectures on the theoretical topics listed in Section 5.3. The explanations will be illustrated by means of a variety of examples and real problems, trying to motivate the student`s participation. Computer presentations will be used. Such lectures will represent, at most, the 50% of the learning activities.

-Practical classes in which different exercises and questions will be solved in detail. The students will have in advance the whole collection of such exercises, in order to facilitate their homework. These practical sessions will represent, at least, the 40% of the learning activities.

-Practical sessions in computer labs, where the students will learn to use computer tools in order to solve exercises from a numerical viewpoint. They will represent, at least, the 10% of the learning activities.

-Individual tutorial sessions to discuss issues concerning the difficulties in the learning process, to correct the way of working, to monitorize the practical work assigned to each student,....

General information about the program, theoretical notes, collection of exercises, complementary material, references,...will be at the student`s disposal in the Moodle page of the Zaragoza University.

5.2.Learning activities

In accordance with Section 5.2, the main learning activities will be the following:

-Two hours per week of theoretical lectures, addressed to all of the students in the course.

-Two hours per week of practical sessions, including those in computer labs. To carry out these activities, the students will be splitted into two groups.

-Other learning activities: individual tutorials, personal study and homework, works in groups,...

5.3.Program

1. DATA ANALYSIS

Introduction: population and sample.

Relative frequencies and graphic representations.

Mean and standard deviation. Median and quantiles. Symmetry and kurtosis.

Outliers. Transformation of variables.

Two-dimensional data: joint, marginal and conditional distributions.

Moments. Covariance matrix and Pearson`s correlation coefficient.

The simplest linear model. Linear regression. Residuals analysis.

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2. INTRODUCTION TO PROBABILITY

Sample space, events and algebras of events.

Axioms of probability. Consequences.

Classical probability. Combinatorics.

Finite, discrete, and geometric models. Examples.

Conditional probability and independence.

Total probability formula. Bayes formula.

3. DISCRETE RANDOM VARIABLES

Introductory examples. Probability laws and distribution functions.

The most usual distributions: uniform, Bernoulli and binomial, hypergeometric, geometric, negative binomial, and Poisson distributions.

Mathematical expectations. The expectation of a function of a discrete random variable.

Moments and central moments. Computations.

Moments and Chebyshev`s inequality.

Approximations: from the hypergeometric to the binomial, and from the binomial to the Poisson distributions.

4. DISCRETE RANDOM VECTORS

Preliminary examples: the bivariate binomial and the negative binomial distributions.

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Joint, marginal, and conditional distributions. The multinomial distribution.

The expectation of a function of a discrete random vector. Moments.

Mean and covariance matrix. Pearson`s correlation coefficient.

Independent random variables. Distributions and moments of sums of independent random variables.

Convolution of distributions. Examples: Bernoulli, binomial, negative binomial, and Poisson distributions.

5. ABSOLUTELY CONTINUOUS RANDOM VARIABLES

Introduction. Probability densities.

Distribution functions. Properties.

The most usual distributions: uniform, triangular, exponential, gamma, beta, Pareto, Cauchy, and normal distributions.

Transformations of absolutely continuous random variables. Change of variables.

Moments and central moments. Computations.

Moments and Chebyshev`s inequality.

The normal distribution: specific analysis and perspectives.

5.4.Planning and scheduling

The schedule of theoretical lectures and practical sessions will be previously announced in the web page of the faculty, as well as in the web page of the course.

A mid-term exam will be done. The exam date will be previously announced in the web page of the course.

5.5.Bibliography and recomended resources

References

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Bartoszynski, Robert. Probability and statistical inference / Robert Bartoszynski, Magdalena Niewiadomska-Bugaj New York [etc.] : John Wiley and Sons, cop. 1996

Chung, Kai Lai. Elementary probability theory : with stochastic processes and an introduction to mathematical finance / Kai Lai Chung, Farid AitSahlia . - 4th ed. New York : Springer cop. 2003

Grimmett, Geoffrey. Probability and random processes / Geoffrey Grimmett and David Stirzaker . - 3rd. ed., repr. with corr. Oxford : Oxford University Press, 2004

Lasala, Pilar. Introducción al cálculo de probabilidades / Pilar Lasala Calleja Zaragoza : Prensas Universitarias de Zaragoza, 1996

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Uña Juárez, Isaías. Lecciones de cálculo de probabilidades : curso teórico- práctico / Isaías Uña Juárez, Venancio Tomeo Perucha, Jesús San Martín Moreno Madrid [etc.] : Thomson, D.L. 2003

Uña, I.. Cálculo de Probabilidades. Garceta. 2010.

Vélez Ibarrola, Ricardo. Cálculo de probabilidades I / Ricardo Vélez Ibarrola, Víctor Hernández Morales . - [1a.ed.] Madrid : UNED, 1995

- Lecture notes on the course. Available online at the Moodle page of the Zaragoza University.