Universidad Zaragoza

Year : 2019/20

27012 - Introduction to Probability and Statistics

Syllabus Information

Academic Year: 2019/20
Subject: 27012 - Introduction to Probability and Statistics
Faculty / School: 100 -

Degree: 453 - Degree in Mathematics

ECTS: 6.0
Year: 2
Semester: Second semester
Subject Type: Basic Education
Module:

1.General information

1.1.Aims of the course

1.2.Context and importance of this course in the degree

1.3.Recommendations to take this course

2.Learning goals

2.1.Competences

2.2.Learning goals

2.3.Importance of learning goals

3.Assessment (1st and 2nd call)

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

4.Methodology, learning tasks, syllabus and resources

4.1.Methodological overview

The methodology followed in this course is oriented towards the achievement of the learning objectives. A wide range of teaching and learning tasks are implemented, such as lectures, problem-solving sessions, laboratory sessions, tutorials and autonomous work and study.

4.2.Learning tasks

This course is organized as follows:

- **Lectures**. Two weekly hours. Theory explanations will be illustrated by means of a variety of examples and real problems, trying to motivate the students participation. Computer presentations will be used. Such lectures will represent, at most, the 50% of the learning activities.
- **Problem-solving sessions**. Two weekly hours. Class splitted into two groups. In which different exercises and questions will be solved in detail. The students will have the whole collection of such exercises in advance, in order to facilitate their homework. These problem-solving sessions will represent, at least, the 40% of the learning activities.
    - Laboratory sessions. 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.

- **Tutorials**. 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, etc.
- Autonomous work and study.
- **Assessment tasks**. A midterm exam will take place.

4.3.Syllabus

This course will address the following topics:

- **Topic 1. Data Analysis**
  - 1.1 Introduction: population and sample.
  - 1.2 Relative frequencies and graphic representations.
  - 1.3 Mean and standard deviation. Median and quantiles. Symmetry and kurtosis.
  - 1.4 Outliers. Transformation of variables.
  - 1.5 Two-dimensional data: joint, marginal and conditional distributions.
  - 1.6 Moments. Covariance matrix and Pearson's correlation coefficient.
  - 1.7 The simplest linear model. Linear regression. Residuals analysis.
- **Topic 2. Introduction to Probability**
  - 2.1 Sample space, events and algebras of events.
  - 2.2 Axioms of probability. Consequences.
  - 2.3 Classical probability. Combinatorics.
  - 2.4 Finite, discrete, and geometric models. Examples.
  - 2.5 Conditional probability and independence.
  - 2.6 Total probability formula. Bayes formula.
- **Topic 3. Discrete Random Variables**
  - 3.1 Introductory examples. Probability laws and distribution functions.
  - 3.2 The most usual distributions: uniform, Bernoulli and binomial, hypergeometric, geometric, negative binomial, and Poisson distributions.
  - 3.3 Mathematical expectations. The expectation of a function of a discrete random variable.
  - 3.4 Moments and central moments. Computations.
  - 3.5 Moments and Chebyshev's inequality.
  - 3.6 Approximations: from the hypergeometric to the binomial, and from the binomial to the Poisson distributions.
- **Topic 4. Absolutely Continuous Random Variables**
  - 4.1 Introduction. Probability densities.
  - 4.2 Distribution functions. Properties.
  - 4.3 The most usual distributions: uniform, triangular, exponential, gamma, beta, Pareto, Cauchy, and normal distributions.
  - 4.4 Transformations of absolutely continuous random variables. Change of variables.
  - 4.5 Moments and central moments. Computations.
  - 4.6 Moments and Chebyshev's inequality.
  - 4.7 The normal distribution: specific analysis and perspectives.
  - 4.8 General random variables. Mixed random variables.

4.4.Course planning and calendar

Further information concerning the timetable, classroom, office hours, assessment dates and other details regarding this course will be provided on the first day of class or please refer to the Faculty of Sciences website and Moodle.

4.5.Bibliography and recommended 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

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http://biblos.unizar.es/br/br_citas.php?codigo=27012&year=2019