

30308 - Probability and processes

Syllabus Information

Academic year: 2024/25

Subject: 30308 - Probability and processes

Faculty / School: 110 - Escuela de Ingeniería y Arquitectura

Degree: 581 - Bachelor's Degree in Telecommunications Technology and Services Engineering

ECTS: 6.0

Year: 2

Semester: First semester

Subject type: Basic Education

Module:

1. General information

The subject presents the basic tools for modeling random situations useful in the field of Telecommunications. Examples of errors produced in a sequential transmission of digits are presented and addressed in the learning of probability calculus, the times between successive arrivals of random events motivate the definition of random variables. The need to know the characteristics of a phenomenon from observations leads to the study of statistical inference tools. The analysis of the time evolution of a system supports the study of stochastic processes.

Skills will be acquired in probabilistic modeling, in the use of statistical techniques to approach the analysis of a database, and to make and critically evaluate a report with statistical analysis relevant to decision making.

2. Learning results

1. Ability to apply data processing and analysis techniques.
2. Know the fundamental concepts, applications and results of probability.
3. Understand the concepts of unidimensional and multidimensional random variables.
4. Master the modeling of engineering environments under stochastic nature by means of random variables as well as the performance of calculations under uncertainty.
5. Understand the meaning and use of a stochastic process.
6. Get to know the most common processes: Gaussian, Poissonian, Markovian
7. Know the elements to represent the most relevant characteristics of a process: mean functions, autocorrelation and covariance.
8. Ability to prepare, understand and critique reports based on statistical analysis.

3. Syllabus

1. Exploratory analysis

Measures of centralization, dispersion, shape.

2. Probability

Conditional probability. Independence.

3. Random variables

Discrete and continuous distributions.

Conditioning.

Hope. Variance.

4. Usual distributions

Binomial, geometric, negative binomial, Poisson.

Normal, exponential, gamma, Weibull, Rayleigh, lognormal.

Poisson process.

5. Multidimensional distributions

Joint, marginal and conditional distribution.

Moments. Covariance and correlation matrix.

Conditional expectation.

Two-dimensional normal distribution.

6. Introduction to statistical inference

Successions. Central limit theorem.

Estimate. Usual hypothesis testing.

7. Stochastic processes

K-order functions, means, autocorrelation and autocovariance.

Stationarity. Linear transformations.

Ergodicity.

Gaussian process. Random telegraph signal. Markov processes.

4. Academic activities

In the lectures sessions with a full group, theoretical aspects are dealt with and motivated with applications in typical examples . The approach and modeling of realistic problems and the treatment with databases is done in practical sessions using statistical software.

Face-to-face activities:

30 h of lectures, in a single group.

30 hours of case studies in small groups (15 sessions, 2 hours).

Non-face-to-face activities:

30 hours of individual work dedicated to the study of theoretical aspects and 54 hours of practical activities. 6 hours dedicated to assessment activities.

5. Assessment system

A sequenced learning path throughout the term and continuous assessment is recommended.

The learning results will be assessed through the following activities:

1. Written test to solve theoretical-practical questions and problems related to Probability Distribution Models (learning results 2-4). It will take place towards the middle of the term.
2. Written test related to Two-dimensional random distributions and Stochastic processes (learning outcomes 5-7).

It will be carried out at the official call.

3. Activities proposed in the computer lab to assess skills in exploratory analysis, definition of an appropriate probabilistic model and decision making in situations of uncertainty, optimization and planning of resources (learning results 1, 8). They will be carried out throughout the term.

4. Test related to the contents developed in the laboratory practices. It will be carried out at the official call.

Students who do not take or do not pass the test in point 1 must take it at the official call.

Each written test in items 1 and 2 accounts for half of the grade through written tests, which is 75% of the final grade . A grade of at least 4 (out of 10) must be obtained in each of them and an average of at least 5.

The learning results related to statistical analysis skills will be evaluated with the joint grade of the test 4 (15% of the final grade) and the activities of item 3 (10%). Students who have not completed the activities of point 3, will have a specific test in the official call. A score of at least 5 out of 10 must be obtained in these activities.

To pass the subject, the student must obtain a final grade of at least 5 points out of 10.

6. Sustainable Development Goals

4 - Quality Education

9 - Industry, Innovation and Infrastructure

12 - Responsible Production and Consumption