Universitat Autònoma de Barcelona

2022/2023

Statistics

Code: 103797
ECTS Credits: 6

Degree	Type	Year	Semester
2500895 Electronic Engineering for Telecommunication	FB	1	2
2500898 Telecommunication Systems Engineering	FB	1	2

Contact

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Use of Languages

Principal working language: catalan (cat)
Some groups entirely in English: No
Some groups entirely in Catalan: Yes
Some groups entirely in Spanish: No

Teachers

Josep Maria Burgues Badia
Magdalena Caubergh
Yamila Garcia Martinez
Juan Pablo Roberto Márquez Arias
David Agis Cherta

Prerequisites

There are no prerequisites.

Objectives and Contextualisation

The objective of this course is to introduce the basic statistical tools to analyze data arising from experiments or observations, focusing on their correct use and the interpretation of the results.

The practices with computer of this subject, that are realized with a statistical software package in the computer classroom, are an indispensable part of the course in order to achieve these goals.

Competences

Electronic Engineering for Telecommunication

- Communication
- Develop personal work habits.
- Develop thinking habits.
- Learn new methods and technologies, building on basic technological knowledge, to be able to adapt to new situations.
- Work in a team.

Telecommunication Systems Engineering
- Communication
- Develop personal work habits.
- Develop thinking habits.
- Learn new methods and technologies, building on basic technological knowledge, to be able to adapt to new situations.
- Work in a team.

Learning Outcomes

1. Analyse measurements in the area of engineering, using statistical tools to extract and understand information.
2. Analyse measures in the area of engineering, using statistical tools to extract and understand information.
3. Communicate efficiently, orally and in writing, knowledge, results and skills, both professionally and to non-expert audiences.
4. Develop scientific thinking.
5. Develop the capacity for analysis and synthesis.
6. Manage available time and resources.
7. Manage available time and resources. Work in an organised manner.
8. Prevent and solve problems.
9. Reason and model non-deterministic engineering systems or processes using discreet and continuous random variables and their corresponding distributions.
10. Reason and model non-deterministic systems and processes in engineering using discreet and continuous random variables and their corresponding distributions.
11. Resolve the mathematical problems that can arise in engineering.
12. Work autonomously.
13. Work cooperatively.

Content

1. Descriptive statistics:

- Types of variables and data. Data frames.
- Empirical experimet associated to a data frame.
- Frequency tables and graphs: histograms and others.
- Measures of localization. Scattering measures
- Correlation coefficient and regression line.
- Joint, marginal and conditional data distributions.

2. Introduction to the theory of probability:

- Basic properties of probability. Combinatorics.
- Conditional probability and independence. Bayes Formula.
- Random variables. Density and distribution functions.
- Expected value and variance. Moments of a random variable.
- Discrete distributions: Bernoulli, Binomial, Poisson and others
- Continuous distributions: uniform, exponential, normal and others.
- Central limit theorem and laws of large numbers.

3. Random vectors and stochastic processes:

- Joint, marginal and conditional distributions.
- Bivariate normal distribution. Covariance and correlation coefficient.
- Functions of random variables: distributions khi-square, Rayleigh, Rice.
- Concept of stochastic process. Poisson processes. Markov chains.

4. Statistical Inference:

- Estimation and confidence intervals of averages, variances and proportions.
- Tests for the expected value and for the proportion.
- Comparison tests for expected values and proportions.
- Khi-square tests: goodness of fit, independence and homogeneity.

Methodology

The course consists of:

1. Theory classes where the basic concepts of the subject are introduced and the main techniques of statistics are explained, showing examples of their application.
2. Problem solving classes where the concepts and statistical tools introduced in the theory classes are put into practice by means of the analysis of concrete examples.
3. Practices at the computer classroom where the student will learn to use specific statistical software.

•Study and personal work weekly guides (GETPS), as well as other materials, will be published in the course workspace on the UAB Virtual Campus Moodle.

Annotation: Within the schedule set by the centre or degree programme, 15 minutes of one class will be reserved for students to evaluate their lecturers and their courses or modules through questionnaires.

Activities

Title	Hours	ECTS	Learning Outcomes
Type: Directed			
Practices with statistical software	12	0.48	1, 2, 3, 4, 6, 7, 9, 10, 11, 13
Problem solving classes	12	0.48	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 13, 12
Theory classes	26	1.04	1, 2, 3, 4, 6, 7, 9, 10, 11, 13
Type: Supervised			
Tutoring	7	0.28	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 13, 12
Type: Autonomous			
Autonomous study	74	2.96	1, 2, 5, 6, 7, 9, 10, 11, 13, 12

Assessment

The mark of the subject by continuous assessment, AC, will be obtained from:

1. the marks of two partial exams, E1 and E2, (0<= E1, E2 <=10).
2. the mark of the practice exam with computer, P, (0<= P <=10).
3. delivery of resolved problems and exercises, Pb, (0<= Pb <=10).

according to the formula: AC = 0,25 E1 + 0,30 E2 + 0,25 P + 0,20 Pb.

Continued avaluation students passes the course if AC is greater than or equal to 5 and min(E1,E2)>=3. Otherwise has a recovery exam whose mark, ER, will replace the mark of the two partial examinations, E1 + E2, and even the mark of the delivery of solved problems, Pb, whenever it is most favorable. However the mark P of the practice exam is NOT recoverable. In the first case the final mark F will be given by the formula F = 0.55 ER + 0.20 Pb + 0.25 P, and by F = 0.75 ER + 0.25 P in the second case. Notice now that in order to be able to attend the recovery exam, the student must have previously been evaluated of continuous assessment activities with a total weight superior to 65%.

It is considered that the student presents himself for the evaluation of the course if he has participated in evaluation activities that exceed 50% of the total.

Assessment Activities

Title	Weighting	Hours	ECTS	Learning Outcomes
Delivery of solved problems Pb	20%	8	0.32	1, 2, 3, 4, 5, 8, 9, 10, 11
Exam E1	25%	3	0.12	1, 2, 3, 4, 5, 9, 10, 11, 12
Exam E2	30%	3	0.12	1, 2, 3, 4, 5, 9, 10, 11, 12
Practice exam P	25%	2	0.08	1, 2, 4, 5, 6, 7, 8, 13
Recovery exam ER	75%	3	0.12	1, 2, 3, 4, 5, 9, 10, 11, 12

Bibliography

1. Delgado, R.: "Probabilidad y Estadística para Ciencias e Ingenierías". Delta Publicaciones Universitarias, 2008.(*)
2. Kay, Steven M.: "Intuitive probability and random processes using Matlab". Kluwer Academic, 2006.
3. Peña, D. "Fundamentos de Estadística". Alianza Editorial, 2008.(*)
4. Box, G., Hunter, J., Hunter, W.: "Estadística per a científics i tècnics. Disseny d'experiments i innovació". Reverté, 2008.
5. DeGroot, M., Schervish, M.: Probability and Statistics. Addison Wesley. 2002.
6. R Tutorial. An R introduction to statistics. www.r-tutor.com (2016).
7. Balka, J.: Statistical channel, jbstatistics.com

(*) most relevant bibliography.

Software

R Core Team (2021). R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria. URL https://www.R-project.org/.