COURSE DATA

Data Subject	
Code	36504
Name	Probability, Uncertainty, and Inference
Cycle	Grade
ECTS Credits	6.0
Academic year	2023 - 2024

Study (s)

Degree	Center	Acad. year	Period
1332 - Degree in Business Intelligence and Analytics	Faculty of Economics	1	Second term

Subject-matter

Degree	Subject-matter	Character
1332 - Degree in Business Intelligence and Analytics	5 - Fundamentos del Análisis de Datos	Basic Training

Coordination

Name	Department
MARTINEZ DE LEJARZA ESPARDUCER, IGNACIO MA	110 - Applied Economics

SUMMARY

"Randomness, Uncertainty and Inference" is a basic training subject assigned to the area of Quantitative Methods for Economics and Business that is taught in the second semester of the first year of the Degree in INTELLIGENCE AND BUSINESS ANALYTICS with a total teaching load of 6 ECTS credits.

Within the framework of a degree clearly oriented to train business professionals with deep knowledge of the analysis and process of large volumes of information it is necessary to provide the student with adequate knowledge in the main methods of statistical inference.

In another order of things, the usual situation of uncertainty and / or incompleteness of information regarding both the environment and business development makes it necessary for future professionals to be able to deal adequately with these situations.

Without losing sight of the eminently practical orientation that the degree inspires, the course considers a rigorous journey of both the main aspects of the treatment of chance and uncertainty, through Probability and the main Distributions of random variables, as well as aspects basics of random sampling and Statistical Inference.

In the development of these questions, it will always be intended, and in keeping with the objectives of other subjects, to keep in mind the practical applicability in the exploitation of the available information, the relations with the analysis of information and the automation of the methods of analysis resulting in the continued appeal to computer simulation and the exploitation of information; trying at all times the application to practical situations in the business world.

PREVIOUS KNOWLEDGE

Relationship to other subjects of the same degree

There are no specified enrollment restrictions with other subjects of the curriculum.

Other requirements

No prerequisites. It is assumed that to successfully complete this subject the student has a basic level of mathematics (the knowledge corresponding to first and second year of baccalaureate in the branch of science or social sciences) is familiar with the contents of the subject. Exploratory Data Analysis previously and has already acquired some of the competencies previously programmed on information management and the use of ICT.

OUTCOMES

1332 - Degree in Business Intelligence and Analytics

- Students must have acquired knowledge and understanding in a specific field of study, on the basis of general secondary education and at a level that includes mainly knowledge drawn from advanced textbooks, but also some cutting-edge knowledge in their field of study.
- Students must be able to apply their knowledge to their work or vocation in a professional manner and have acquired the competences required for the preparation and defence of arguments and for problem solving in their field of study.
- Students must have the ability to gather and interpret relevant data (usually in their field of study) to make judgements that take relevant social, scientific or ethical issues into consideration.
- Students must be able to communicate information, ideas, problems and solutions to both expert and lay audiences.
- Students must have developed the learning skills needed to undertake further study with a high degree of autonomy.

- Acquire basic training that can be used to learn new methods and technologies and to adapt to new situations in academic and professional areas.
- Be able to solve problems and to communicate and spread knowledge, skills and abilities, taking account of the ethical, egalitarian and professional responsibility of the activity of business intelligence and analytics.
- Be able to produce models, calculations and reports, and to plan tasks in the specific field of business intelligence and analytics.
- Be able to access and manage information in different formats for subsequent analysis in order to obtain knowledge through data.
- Be able to make autonomous decisions in digital environments characterised by the abundance and dynamism of data.
- Know and know how to properly use the appropriate quantitative and qualitative methods to reason analytically, evaluate results and predict economic and financial magnitudes.
- Be able to apply analytical and mathematical methods for the analysis of economic and business problems.
- Be able to plan, organise, monitor and evaluate the implementation of business strategies.
- Demonstrate skills for analysis and synthesis.
- Be able to analyse and search for information from diverse sources.
- Be able to learn autonomously.
- Be able to use ICT, both in academia and in professional practice.
- Be able to define, solve and present complex problems systemically.
- Be able to work in a team demonstrating commitment to quality, ethics, equality and social responsibility.
- Apply methods and techniques of analysis, synthesis and graphical representation by means of software tools.
- Express situations of uncertainty and randomness using mathematical, synthetic and graphic languages.
- Make decisions under certainty and uncertainty.
- Know the different types of data.
- Reorganise and restructure variables and databases.
- Communicate the results of analyses effectively.
- Manage and distinguish the concepts of universe, population, sample, parameters and estimators in real problems.
- Identify the basic probability distributions encountered in real problems.
- Use software tools to solve problems under uncertainty.

LEARNING OUTCOMES

The objective of the course is that the student could be able to model and approach practical situations in which the available information is incomplete or uncertain and should be treated probabilistically.

It is intended that the student knows the main probability models andthe theoretical-practical basis of statistical inference and its use in the business environment.

It is also pursued that the student manages these methods with powerful computer tools that could be integrated in the analysis of large masses of data situations.

DESCRIPTION OF CONTENTS

1. UNCERTAINTY AND PROBABILITY

1.1. Introduction. Chance, uncertainty, random selection in a BD
1.2. Frequentist Probability and Bayesian conception. Uncertainty Indicators
1.3. Probability of events. Axiomatics Properties
1.4. Conditioned Probability . Stochastic independence. Bayes theorem

2. RANDOM VARIABLE

2.1. Random variables. Probability distributions.
2.2. Discrete and continuous distributions.
2.3. Empirical approach to probability functions. Calculation of probabilities by simulation
2.4. Expected value and variance. Indicators. Transformations. Numerical approximation

3. MAIN PROBABILITY DISTRIBUTIONS

3.1. Discrete models. Binomial Poisson
3.2. Continuous models. Normal distribution
3.3. Computer simulation and visualization. Relations between models
3.4. Central limit theorem
3.5. Distributions derived from Normal.
3.6. Functions in R

4. INTRODUCTION TO STATISTICAL INFERENCE AND SAMPLING DISTRIBUTIONS

4.1. Introduction to Inference.
4.2. Sampling. Types .
4.3. Sampling Distributions
4.4. Computer simulations. Re-Sampling

5. ESTIMATION

5.1 Classical approach. Statistic, estimator and estimation.
5.2 Estimation methods . Maximum-likelihood estimators.
5.3 Confidence intervals.
5.4 Main confidence intervals
5.5 Computer applications and visualization.

6. HIPOTHESIS TESTING

6.1. Statistical test of hypothesis: basic concepts. Null and alternative hypothesis. Significance, power and p-value
6.2. Main parametric contrasts
6.3. Main non-parametric contrasts. Goodness of fit
6.4. Statistical significance and practical significance

7. ANALYSIS OF VARIANCE

7.1 Approach of the issue. One way Anova . Decomposition of variance. Hypothesis contrast.
7.2. Multiple comparisons Criteria
7.3. Extension to more than one way anova.

WORKLOAD

ACTIVITY	Hours	% To be attended
Theory classes	30,00	100
Computer classroom practice	30,00	100
Development of group work	20,00	0
Study and independent work	20,00	0
Preparation of evaluation activities	10,00	0
Preparing lectures	10,00	0
Preparation of practical classes and problem	10,00	0
Resolution of case studies	20,00	0
TOTAL	**150,00**	

TEACHING METHODOLOGY

The subject development is mainly structured around the theoretical and differentiated practical sessions of two hours in both cases. In the theoretical sessions the professor will explain the concepts and methods of application to the analysis of situations that imply uncertainty without neglecting the applications and the essential aspects of the use and implementation through the adequate Software (R, Caest, SPSS / PSPP , Excel, etc.) complementing the applications with situations and practical examples. The practical

sessions will mean, instead, the student's use of these tools, concepts and methods to solve practical questions under the tutelage of the teacher.

The predominant teaching method in the theoretical classes will be the participatory master class. This methodology makes it possible to manage large groups of students in an organized manner, offering the advantages of a master class without limiting the participation of students and the teacher-student interaction. Attempt to encourage participation and discussion in the class, in order to offer the student a direct involvement with the content.

In the practical sessions, of two hours, the teacher will propose to the students situations (real or fictitious) for the resolution of problems or studies of cases that these will have to solve with application of techniques and use of suitable computer programs, realizing if it is pertinent, oral presentations or debates ..., individually and / or as a team. In the practical classes projects and situations will be proposed that the students will have to solve delivering in time and form the outputs that are determined.

EVALUATION

The subject will be evaluated based on the following double procedure:
1.- Theoretical / practical exam with the help of computer systems, in which a situation must be resolved, in which it will be necessary to apply the methods of analysis and the concepts developed during the course to solve the questions raised.

2.- Assessment of the practical activities developed by the student during the course, starting with the elaboration of papers / reports and / or oral presentations, with defense of the positions developed by the student.

REFERENCES

Basic

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-LIND, D.A. y otros (2008). Estadística Aplicada a los Negocios y la Economía. McGraw Hill, México, (13ª Edición).

-NEWBOLD, P. y otros (2008). Estadística para Administración y Economía. Pearson-Prentice Hall, Madrid (6ª Edición).

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