VNIVERSITAT DE VALÈNCIA

Course Guide
43800 Advanced statistical methods for actuarial practice

COURSE DATA

DATA SUBJECT

Code: 43800
Name: Advanced statistical methods for actuarial practice
Cycle: Master's Degree
ECTS Credits: 3
Academic year: 2026-27

STUDY (S)

Degree	Center	Acad. year	Period
2171 - Master's Degree in Actuarial and Financial Sciences	Facultat d'Economia	2	Second quarter

SUBJECT-MATTER

Degree	Subject-matter	Character
2171 - Master's Degree in Actuarial and Financial Sciences	Insurance	ELECTIVES

COORDINATION

BAEZA SAMPERE ISMAEL

SUMMARY

Advanced Statistical Methods provides the necessary tools for applying statistical methods to the field of auditing and analyzing large databases in insurance companies. Special attention is paid to the analysis of the reality to be modeled and the corresponding statistical use and processing. The course is structured in two parts. The first (topics 1 to 3) reviews the statistical and simulation methods that will constitute the methodological basis for application in the specific field of data authoring, compliance testing, substantive testing, and monetary unit sampling (MUS). The second part (topics 4 to 6) focuses on the analysis and processing of large corporate databases using Big Data techniques.

PREVIOUS KNOWLEDGE

RELATIONSHIP TO OTHER SUBJECTS OF THE SAME DEGREE

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

OTHER REQUIREMENTS

Proper assimilation of the course content requires basic knowledge of descriptive and inferential statistics (which are briefly covered in the first part of theme 1 of the course).

COMPETENCES / LEARNING OUTCOMES

2171 - Master's Degree in Actuarial and Financial Sciences

Comprender y ser capaces de desarrollar las técnicas matemáticas y estadísticas que resultan relevantes para el trabajo actuarial: modelos de supervivencia, siniestralidad, tarificación, previsión y solvencia.

Ser capaces de construir modelos adecuados al entorno económico empresarial a partir de las posibilidades que ofrecen las modernas tecnologías de la información y de la computación.

Students should apply acquired knowledge to solve problems in unfamiliar contexts within their field of study, including multidisciplinary scenarios.

Students should communicate conclusions and underlying knowledge clearly and unambiguously to both specialized and non-specialized audiences.

Students should demonstrate self-directed learning skills for continued academic growth.

DESCRIPTION OF CONTENTS

1. Statistical methodology applied to auditing.

Discrete and continuous probability distributions. Sampling. Estimation. Hypothesis testing. Power of the test.

2. Simulation and resampling.

Pseudo-random numbers. Randomness tests. Non-uniform distribution. Inverse transform method. Monte-Carlo method. Bootstrap techniques.

3. Compliance tests. Substantive tests. Monetary unit sampling (MUS).

Introduction. Non-compliance rate. Estimation and testing. Acceptance-rejection techniques. Estimation of the total population. Mean per unit method. Hypothesis testing. Materiality testing. MUS planning. Random selection techniques applied to MUS.

4. Introduction to Big Data.

Data analysis methodology. Storage of large volumes of data. Working tools: RStudio.

5. Data Analysis Tools and Techniques.

Introduction to Machine Learning. Classical methods: logistic regression, decision trees, and cluster analysis. Modern methods: neural networks and SOM (self-organizing map). Processing unbalanced data and generating synthetic data. Model evaluation and calibration.

6. Practical Applications.

Machine learning applied to insurance pricing. Understanding the customer and the market (customer lifetime value). RFM models (Recency, Frequency, Monetary). Fraud detection techniques. Fraud modeling in the insurance sector.

WORKLOAD

PRESENCIAL ACTIVITIES

Activity	Hours
Theory	15,00
Classroom practices	15,00
Total hours	**30,00**

NON PRESENCIAL ACTIVITIES

Activity	Hours
Attendance at other activities	3,00
Individual or group project	10,00
Independent study and work	20,00
Preparation of lessons	0,00
Preparation for assessment activities	2,00
Resolution of case studies	10,00
Total hours	**45,00**

TEACHING METHODOLOGY

The participatory lecture will be the teaching-learning method used to convey the theoretical content of the course. This methodology will take advantage of the advantages of the lecture and encourage student participation and teacher-student interaction. Enhancing class participation and discussion is necessary for students to directly engage with the content.

When the class content is eminently practical, the professor will propose situations (real or fictional) to the students that they must solve by applying the theoretical concepts learned. The practical sessions will be carried out following different teaching strategies depending on the theoretical content discussed, although they will primarily be based on problem-solving and scenario simulation. Likewise, in the practical sessions, the professor will propose one or more activities to be solved by the students that will cover the different topics of the course, with the aim of helping the students acquire the skills listed in this academic guide. These activities will be part of the course assessment (see Evaluation section).

EVALUATION

The course evaluation will be based on attendance, attitude, and participation, and, fundamentally, on the quality of the student's classroom work. To this end, practical exercises related to the subject of study will be encouraged. These practical exercises, which will be fully guided by the instructor but are intended to help students acquire the skills specified in this guide, will be uploaded to the virtual classroom or emailed to the instructor.

If the student's attendance in the course is less than 70%, the assessment will consist of a final exam requiring the student to complete one or more practical exercises, similar to those completed throughout the course, to demonstrate that the student has acquired the required basic knowledge. This summary exam will account for a maximum of 60% of the final grade; the remainder of the final grade (maximum 40% of the grade) will be determined by continuous assessment, i.e., the quality of the classroom work, participation, attitude, etc. This same system will be used for the evaluation of the subject in a second session.

REFERENCES

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- HERNÁNDEZ BASTIDA, A.; MARTEL ESCOBAR, M.C and VÁZQUEZ POLO, F.J. (2001): Métodos estadísticos en auditoría de cuentas. Colección Cuadernos de Estadística. La Muralla. Madrid.
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- SERRANO ANGULO, J. (2003): Iniciación a la Estadística Bayesiana. Colección Cuadernos de Estadística. La Muralla. Madrid.
- STEELE, A. (1992): Audit Risk and Audit Evidence. Academic Press. Londres.
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• CHANDHURI, A. and STENGER, H. (1992): Survey Sampling. Theory and Methods. Marcel Dekker. New York.

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