UAB
Universitat Autònoma de Barcelona

Statistical Inference 2

Code: 104856
ECTS Credits: 6

2024/2025

Degree	Type	Year
2503852 Applied Statistics	OB	2

Contact

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Teachers

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Teaching groups languages

You can view this information at the end of this document.

Prerequisites

It is recommended that you are familiar with the contents of Calculus 1 and 2, Probability and Inference-1.

Objectives and Contextualisation

In this course, the concept of Inference must be based fundamentally, that is, how the Statistics quantifies the uncertainty of the information extracted from the data. The concepts of Modeling, Estimate and Swing of Adjustment will be introduced.
The different methods of estimation will be studied, especially the maximum veracity method, and the fundamental properties of the estimators: Invariantness, sufficiency, efficiency, bias, quadratic mean error and asymptotic properties.

Learning Outcomes

1. KM09 (Knowledge) Discover the fundamental properties of estimators: invariance, sufficiency, efficiency, bias, mean square error and asymptotic properties, in the classical and Bayesian domains.
2. KM11 (Knowledge) Identify exact and asymptotic sampling distributions of different statistics.
3. SM09 (Skill) Analyse data through different inference techniques using statistical software.
4. SM10 (Skill) Use different estimation methods depending on the context of application.

Content

Topic 1: Modeling and Inference.

• Estimation methods: moments, maximum likelihood, minimum squares. Principle of invariance. Calculation of moments and generating functions.
• Comparison of estimators: Bias and half quadratic error. Consistency and asymptotic normality.
• Cramér-Rao Fisher and Cota information. Sufficiency and Efficiency.
• Exponential models. Numerical methods for estimation.

Topic 2: Contrasts of hypotheses

• Fisher's exact theory. Type of error. Null and alternative hypothesis.
• Motto by Neyman and Pearson. Feasibility tests reasonably.
• Validation of the model and goodness of adjustment. Pearson Tests, Kolmogorov-Smirnov, Jarque Bera. Graphics tools: PP-plot and QQ-plot.

Topic 3: Asymptotic theory.

• Properties of convergence in probability and distribution.
• Slutsky theorem. The delta method.
• Asymptotic distribution of the maximum veracity estimator.
• Asymptotic distribution of the scoring, verifiability and Wald test results.

Activities and Methodology

Title	Hours	ECTS	Learning Outcomes
Type: Directed			
Practical work with computer tools	30	1.2	
Practices	12	0.48	
Problems	14	0.56	
Theory	26	1.04	
Type: Supervised			
Tutorials	5	0.2	
Type: Autonomous			
Study and think problems	30	1.2	

The subject is structured from theoretical classes, problems and practices. The follow-up of the subject must be present, but it will be necessary to extend the teacher's explanations with the student's autonomous study, with the support of the reference bibliography.
The problem class will be devoted to the resolution oriented of some proposed problems. Students' participation in problem classes will be especially valued. In practical classes, Excel and R. software tools will be introduced. You will have to deliver some practical work.

The proposed teaching methodology may experience some modifications depending on the restrictions to face-to-face activities enforced by health authorities

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.

Assessment

Continous Assessment Activities

Title	Weighting	Hours	ECTS	Learning Outcomes
Final exam	40%	8	0.32	KM09, KM11, SM10
Partial exam	30%	5	0.2	KM09, KM11, SM10
Practices (deliveries, controls)	30%	20	0.8	SM09, SM10

The subject will be assessed with assignments (exercise assignments, problem checks and/or practicals) and 2 exams. To obtain the weighted grade of continuous assessment you must have a minimum of 3/10 in each of the parts.
Students who have opted for the single assessment modality will have to complete an assessment that will consist of a theory exam, a problem test and the delivery of the first and last practical reports of the course. Assessment of submissions may require an assessment interview with the teacher. The student's grade will be the weighted average of the three previous activities, where the exam will account for 45% of the grade, the test 45% and the assignments 10%.
If the final grade does not reach 5/10, the student has another opportunity to pass the subject through the remedial exam that will be held on the date set by the degree coordinator. In this test you can recover 70% of the grade corresponding to the theory and the problems. The part of internships is not refundable.

Bibliography

1. Casella, G..and Berger, R. (2002) . *Statistical Inference, 2º ed*. Wadsworth, Belmont, CA.
2. Casella, G., Berger, R. and Santana, D. (2002). Solutions Manual for Statistical Inference, Second Edition.
3. Luis Ruiz Maya Pérez, Francisco Javier Martín-Pliego López. (2006). Estadística. II, Inferencia. Editoria AC.
4. Millar, R. (2011). *Maximum Likelihood Estimation and Inference*. Wiley.
5. D. Peña. (2002). "Fundamentos de Estadística". Alianza Editorial.

Software

R Core Team (2024). R: A language and environment for statistical ## computing. R Foundation for Statistical Computing, Vienna, Austria. ## URL https://www.R-project.org/.

Language list

Name	Group	Language	Semester	Turn
(PAUL) Classroom practices	1	Catalan	first semester	afternoon
(PLAB) Practical laboratories	1	Catalan	first semester	afternoon
(PLAB) Practical laboratories	2	Catalan	first semester	afternoon
(TE) Theory	1	Catalan/Spanish	first semester	afternoon