Universitat Autònoma de Barcelona

2023/2024

Statistical Inference 2

Code: 104856
ECTS Credits: 6

Degree	Type	Year	Semester
2503852 Applied Statistics	OB	2	1

Contact

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Teaching groups languages

You can check it through this link. To consult the language you will need to enter the CODE of the subject.
Please note that this information is provisional until 30 November 2023.

Prerequisites

It is recommended that you have passed the Calculation, Probability and Inference-1 subjects.

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.

Competences

- Analyse data using statistical methods and techniques, working with data of different types.
- Correctly use a wide range of statistical software and programming languages, choosing the best one for each analysis, and adapting it to new necessities.
- Make efficient use of the literature and digital resources to obtain information.
- Select statistical models or techniques for application in studies and real-world problems, and know the tools for validating them.
- Select the sources and techniques for acquiring and managing data for statistical processing purposes.
- Students must be capable of applying their knowledge to their work or vocation in a professional way and they should have building arguments and problem resolution skills within their area of study.
- Students must be capable of communicating information, ideas, problems and solutions to both specialised and non-specialised audiences.

- Summarise and discover behaviour patterns in data exploration.
- Use quality criteria to critically assess the work done.

Learning Outcomes

1. Analyse data through different inference techniques using statistical software.
2. Analyse data through various inference techniques for one or more samples.
3. Critically assess the work done on the basis of quality criteria.
4. Identify statistical distributions.
5. Identify statistical inference as an instrument of prediction.
6. Interpret the results obtained and formulate conclusions regarding the experimental hypothesis.
7. Make effective use of references and electronic resources to obtain information.
8. Purge and store information on digital media.
9. Students must be capable of applying their knowledge to their work or vocation in a professional way and they should have building arguments and problem resolution skills within their area of study.
10. Students must be capable of communicating information, ideas, problems and solutions to both specialised and non-specialised audiences.
11. Understand the concepts associated with hypothesis tests in classical and Bayesian statistics.
12. Use statistical software to obtain summary indices of the variables in the study.
13. Use the properties of the functions of distribution and density.
14. Validate and manage information for statistical processing.

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.

Methodology

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.

Activities

Title	Hours	ECTS	Learning Outcomes
Type: Directed			
Practical work with computer tools	30	1.2	1, 2, 5, 6, 12
Practices	12	0.48	1, 2, 6, 12
Problems	14	0.56	2, 3, 5, 6, 7
Theory	26	1.04	1, 2, 3, 11, 4, 5, 6, 10, 9, 7, 13, 12, 14
Type: Supervised			
Tutorials	5	0.2	10, 9
Type: Autonomous			
Study and think problems	30	1.2	11, 5, 6, 13

Assessment

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.

Assessment Activities

Title	Weighting	Hours	ECTS	Learning Outcomes
Final exam	40%	8	0.32	2, 3, 11, 8, 4, 5, 6, 10, 9, 13, 14

Partial exam	30%	5	0.2	2, 8, 4, 6, 10, 9, 13, 14
Practices (deliveries, controls)	30%	20	0.8	1, 2, 3, 11, 8, 4, 5, 6, 10, 9, 7, 13, 12, 14

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

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