Universitat Autònoma de Barcelona

**2019/2020**

# Statistical Inference 2

Code: 104856
ECTS Credits: 6

| Degree | Type | Year | Semester |
|---|---|---|---|
| 2503852 Applied Statistics | OB | 2 | 1 |

## 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

## 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.

## 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 practice assignments, problem controls, practices, and exams. The examinations can only be recovered together at the end, as long as the student has previously passed a 3 in each partial. Work in general is not recovered.

## 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 | 35% | 5 | 0.2 | 2, 8, 4, 6, 10, 9, 13, 14 |
| Practices (deliveries, controls) | 25% | 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.