Universitat Autònoma de Barcelona

2018/2019

Statistics

Code: 100105
ECTS Credits: 7

Degree	Type	Year	Semester
2500149 Mathematics	OB	3	2

Contact

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Use of languages

Principal working language: catalan (cat)
Some groups entirely in English: No
Some groups entirely in Catalan: No
Some groups entirely in Spanish: No

Prerequisites

Linear algebra. Mathematical analysis. Probability.

Objectives and Contextualisation

In this course, the concept of Inference, in its inductive version, must be fundamentally learned.

The concepts of Modeling, Estimation (by point and intervals) and Goodness of fit must be introduced. And the linear regression techniques.

The students will have to learn:

1. The descriptive and exploratory statistics that will allow to extract and summarize efficiently information of the data.

2. Statistical Inference: how the Statistics quantifies the uncertainty of the information extracted from the data.

3. The modeling of populations, the estimation of parameters, especially maximum likelihood, and the planning and resolution of contrasts of hypotheses (parametric and non-parametric).

3. Basic properties of optimal estimators: invariance, sufficiency, efficiency, bias, variance and asymptotic properties.

4. Establish and solve applied problems. With the examples, the resolution of problems and the practices with statistical software (R), the student will work with concrete models and with real data: inferential for the most important parameters of one and two normal populations. Adjustment tests, inferential methods for the linear model.

Content

The subject is structured in four chapters:

Topic 1: Introduction to Inference.

Summary of the fundamental tools of probability: LLN and CLT.

Binomial and normal. Comparison of two proportions. Pearson test.

Simulation and goodness of fit.

Topic 2: Modeling and estimation.

Normal, gamma, Pareto, Poisson, negative binomial distributions, ...

Estimation methods: moments, maximum likelihood, minimum least squares.

Generating functions.

Topic 3: Comparisons with small samples and Linear regression.

Fisher Theorem. Student Laws, Pearson's $\chi 2$ and Fisher's F.

Contrasts. Null and alternative hypothesis. Type of error

Comparison of two populations and analysis of the variance.

Simple linear regression. Estimate and contrasts.

Topic 4: Assessment of estimators and asymptotic theory.

Bias, mean quadratic error, consistency, asymptotic normality, ...

Cramér-Rao inequality. Fisher information. Efficiency

Asymptotic distribution of the maximum likelihood estimator .

Likelihood ratio test. Scoring and Wald test.