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Introduction

This course is an elementary course of Statistics, with especial emphasis on practical data analysis. It differs from other introductory courses in that multiple regression is covered and analysis of variance is restricted to one-way ANOVA.

The course has three parts. The first part is a refresher of descriptive statistics. The second part is devoted to probability basics. The third part of the course is devoted to estimation and testing, covering the classical tests on group differences and regression coefficients.

Objectives

This course has two objectives. First, to cover a range of elementary statistical techniques, such as two-sample testing, one-way analysis of variance and linear regression. Second, to introduce probability as the language of Statistics, so the students can understand the precise meaning of the concepts involved in the statistical analyses that they will perform later in their research projects: the null hypothesis, significance, bias, etc.

Learning Outcomes

i.   <u>Calculate</u> conditional probabilities.
ii. <u>Select</u> the appropriate probability.
iii. <u>Estimate</u> and test means and variances.
iv. <u>Fit</u> a linear regression equation to data.
v.   <u>Test</u> heteroskedasticity in a linear regression model.
vi. <u>Estimate</u> and test moderation effects.
vii. <u>Test</u> differences between groups using Nonparametric Statistics.

Competencies

General Competencies
- CG6: Use appropriate tools and techniques for problem solving, correction contrasting and decision validation.

Basic Competencies
- CB9: Students should be able to communicate clearly and concisely their conclusions, underlying knowledge and reasons to a specialized and non-specialized audience.
- CB 10: Students should possess the learning outcomes that enable them to continue studying in a way that will be largely self-directed or autonomous.

Specific Competencies
- CE2: Profound knowledge of tools in the fields of mathematics, statistics, econometrics and multivariable analyzes in order to carry out relevant research projects on a global level.
- CE8: Analyze business phenomena formal analysis tools (logic and mathematics) in order to develop consistent structural theories.
- CE9: Knowledge of and ability to use the tools of economic analysis and the classical theory of markets in the analysis of organizations.
- CE20: Ability to use econometric methods, mainly regression analysis of real data of organizations and to assess the scope and limitations these methods can have.
- CE27: Develop a scientific report with the objective to integrate the existing literature of a chosen research topic and to articulate research questions that could extend our understanding of the field.

Content

1. Descriptive Statistics
2. Probability Calculus
3. Estimation and testing
4. Classical tests of means and variances
5. Nonparametric testing
6. Regression analisis

Methodology

The course is based on lectures, given in a traditional, professor-to-student way. The topics covered in the lectures are explained in a set of lecture notes.

Evaluation

Grading is based on the exercises proposed at the end of each session (50%) and the final exam (50%).

Course Outline

TITLE OF SESSION & MATERIAL

1	*Mean, variance and covariance* Lecture notes: [STAT-01] Mean, variance and covariance
2	*Regression and correlation (1)* Lecture notes: [STAT-02] Regression and correlation (1)
3	*Introduction to probability* Lecture notes: [STAT-03] Introduction to probability
4	*Conditional probability* Lecture notes: [STAT-04] Conditional probability
5	*Discrete probability distributions* Lecture notes: [STAT-05] Discrete probability distributions
6	*Expectation and variance of a probability distribution* Lecture notes: [STAT-06] Expectation and variance of a probability distribution
7	*Binomial and Poisson distributions* Lecture notes: [STAT-07] Binomial and Poisson distributions
8	*Continuous probability distributions* Lecture notes: [STAT-08] Continuous probability distributions
9	*Computer session*
10	*Expectation in continuous distributions* Lecture notes: [STAT-09] Expectation in continuous distributions
11	*The normal distribution* Lecture notes: [STAT-10] The normal distribution
12	*Sampling distributions* Lecture notes: [STAT-11] Sampling distributions
13	*The central limit theorem* Lecture notes: [STAT-12] The central limit theorem
14	*Computer session*
15	*Parameter estimation* Lecture notes: [STAT-13] Parameter estimation
16	*Confidence limits for the mean* Lecture notes: [STAT-14] Confidence limits for the mean
17	*The one-sample t test* Lecture notes: [STAT-15] The one-sample t test

18	*Two-sample t tests* Lecture notes: [STAT-16] Two-sample t tests
19	*One-way ANOVA* Lecture notes: [STAT-17] *One-way ANOVA*
20	*Nonparametric testing* Lecture notes: [STAT-18] *Nonparametric testing*
21	*The linear regression model* Lecture notes: [STAT-19] The linear regression model
22	*Testing regression coefficients* Lecture notes: [STAT-20] Testing regression coefficients
23	*Testing nested models* Lecture notes: [STAT-21] Testing nested models
24	*Regression and correlation (2)* Lecture notes: [STAT-22] Regression and correlation (2)
25	*Regression with dummy variables* Lecture notes: [STAT-23] Regression with dummy variables
26	*Moderation effects* Lecture notes: [STAT-24] Moderation effects
27	*Heteroskedasticity* Lecture notes: [MATH-25] Heteroskedasticity
28	*Computer session*
29/30	*Final exam*

Bibliography

- MH DeGroot & MJ Schervish (2002), *Probability and Statistics*, Addison-Wesley.

- WN Venables, DM Smith & The R Core Team (2016), An Introduction to R.

- JM Wooldridge (2013), Introductory Econometrics --- A Modern Approach, South-Western College Publishing.

Professor's Biography

Prof. Miguel-Angel Canela
Associate Professor of Managerial Decision Sciences

Prof. Canela holds a Ph. D. degree in Mathematics from the Universitat de Barcelona (1980). Before joining IESE in 2009, he was a professor at the Department of Applied Mathematics and Analysis of that university and a part-time professor of the Ph. D. Program at IESE. He also worked many years as a consultant at the Institut Català de Tecnologia.

His Ph. D. Dissertation and first research papers were concerned with various problems of Functional Analysis. Later, his interest switched towards interdisciplinary research, entering diverse fields, such as Management Science, Nutrition, Botany, Toxicology and Biochemistry. He has coauthored several research papers with IESE professors and students. Nowadays, his attention is focused on the application of Data Science to various aspects of management.