

Academic Year: ( 2017 / 2018 )

Review date: 30-06-2017

Department assigned to the subject: Statistics Department

Coordinating teacher: VELILLA CERDAN, SANTIAGO

Type: Compulsory ECTS Credits : 5.0

Year : 1 Semester : 1

**REQUIREMENTS (SUBJECTS THAT ARE ASSUMED TO BE KNOWN)**

Foundations of Statistics

**OBJECTIVES**

The aim of the course is to review, at an intermediate level, the basic concepts and methods of Linear Regression. Emphasis is both in theory and applications.

**DESCRIPTION OF CONTENTS: PROGRAMME****1. INTRODUCTION.**

- \*\* 1.1 Formulation and meaning of a statistical regression problem.
- \*\* 1.2 Regression models. Goals of a regression analysis.
- \*\* 1.3 Data in a regression analysis.
- \*\* 1.4 Regression software.

**2. THE MULTIPLE LINEAR REGRESSION MODEL: ESTIMATION.**

- \*\* 2.1 Definition and matrix expression.
- \*\* 2.2 Least squares estimation.
- \*\* 2.3 Analysis of variance.

Appendix:

- \*\* A.1 The multivariate normal distribution.

**3.THE MULTIPLE LINEAR REGRESSION MODEL: HYPOTHESIS TESTING AND CONFIDENCE REGIONS.**

- \*\* 3.1 The F-test for the linear general hypothesis.
- \*\* 3.2 Confidence regions.
- \*\* 3.3 Prediction intervals.

Appendix:

- \*\* A.1 Indicator variables.

**4. MULTICOLLINEARITY, RESIDUAL ANALYSIS, AND DIAGNOSTIC TECHNIQUES.**

- \*\* 4.1 Multicollinearity: description and consequences.
- \*\* 4.2 Residual analysis.
- \*\* 4.3 Outliers and extreme cases.

**5. GENERALIZED LEAST SQUARES THEORY.**

- \*\* 5.1 Cases of known and unknown covariance matrix.
- \*\* 5.2 Heteroscedasticity.
- \*\* 5.3 Transformations.
- \*\* 5.4 Serial correlation.

## 6. TIME SERIES MODELS

\*\* 6.1 Autoregressive (AR) and moving average (MA) models.

\*\* 6.2 ARMA and ARIMA models.

### LEARNING ACTIVITIES AND METHODOLOGY

There will be computer classes, in which several statistical packages will be used, Excel, Matlab, R, SAS, SPSS, Statgraphics, ..., with the purpose of illustrating the derivations of the theoretical classes.

### ASSESSMENT SYSTEM

Written exam (50%) and Practice Workbook (50%) in both the ordinary and extraordinary exams.

<b>% end-of-term-examination:</b>	50
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<b>% of continuous assessment (assignments, laboratory, practicals...):</b>	50
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### BASIC BIBLIOGRAPHY

- Brockwell, P. J. and Davis, R. A. Introduction to Time Series and Forecasting, 3rd Edn., Springer Verlag, 2016
- Chatterjee, S. and Hadi, A. Regression Analysis by Example, 5th Edn, John Wiley, 2012
- James, G., Witten, D., Hastie, T. and Tibshirani, R. An Introduction to Statistical Learning with Applications in R , Springer Verlag, 2013
- Weisberg, S. Applied Linear Regression, 4th Edition, Wiley, 2014

### ADDITIONAL BIBLIOGRAPHY

- Kabacoff, R. L. R in action: Data analysis and graphics with R, 2nd Edn. , Manning Publications , 2015
- Kutner, M. H., Nachtsheim, C., and Neter, J. Applied Linear Statistical Models 4th Edition. , McGraw Hill, 2004
- Rawlings, J. O., Pantula, S. G. and Dickey, D. A. Applied Regression Analysis: A Research Tool, 2nd Edn., Springer Verlag, 1998