Multivariate data analysis

Academic Year: (2019 / 2020) **Review date: 21-04-2020**

Department assigned to the subject: Statistics Department

Coordinating teacher: VELILLA CERDAN, SANTIAGO

Type: Compulsory ECTS Credits : 6.0

Year : 1 Semester : 2

REQUIREMENTS (SUBJECTS THAT ARE ASSUMED TO BE KNOWN)

Actuarial Statistics

In general: Fundamentals of Statistics, Linear Algebra, and Mathematical Analysis

OBJECTIVES

Knowledge of Multivariate Data Analysis with applications in Finance and Actuarial Sciences

Knowledge of Statistical software for Multivariate Data Analysis, with emphasis in R

DESCRIPTION OF CONTENTS: PROGRAMME

The course focuses on Multivariate Data Analysis Techniques, with particular emphasis in computer applications

1. INTRODUCTION

** 1.1 Multivariate data
** 1.2 The data matrix
** 1.3 Summary statistics. Mean vector. Covariance and correlation matrices
** 1.4 Graphical methods
** 1.5 Linear combinations

APPENDIX 1A

** 1A.1 Review of basic concepts of vectors and matrices

APPENDIX 1B

** 1B.1 Introduction to R. Use of RStudio and RGui in Multivariate Analysis

2. PRINCIPAL components

** 2.1 Motivation and construction
** 2.2 Standardized case
** 2.3 Data example

3. CLUSTER analysis

** 3.1 Distances and similarities
** 3.2 Hierarchical procedures: Ward's method
** 3.3 Nonhierarchical procedures: K-means method
** 3.4 Examples of application with real data

4. POPULATION concepts and SAMPLING

** 4.1 Random vectors and matrices
** 4.2 Expected values
** 4.4 Sampling distributions

5. Multivariate NORMAL distribution

** 5.1 Basic properties
** 5.2 Simulation methods
** 5.3 Examples of application in finance

6. FACTOR analysis

** 6.1 The orthogonal factor model
** 6.2 Estimation and rotation of factors
** 6.3 Examples of application

7. REGRESSION analysis

** 7.1 Simple and multiple regression
** 7.2 Diagnostic and residual analysis
** 7.3 Examples of application

8. GENERALIZED linear models

** 8.1 Logit and probit models
** 8.2 Poisson regression
** 8.3 Multiple choice models
** 8.4 Examples of application

LEARNING ACTIVITIES AND METHODOLOGY

Competences will be acquired by students from:

[I] Theory classes: one per week (14 sessions)

[II] Practical classes in the computer room: one per week (14 sessions)

Activities [I] and [II] will be devoted to exercises, problems, data examples, and case studies. Teaching will make intensive use of resources available in Aula Global. Some short reading notes will be also distributed, for helping to understand specific parts of the course, and to facilitate the transmission of information during the lectures.

ASSESSMENT SYSTEM

Continuous evaluation: 70%

This will consist in the completion of a collection of computer and data analysis activities. Attendance to class will be taken into account for the grading process.

Final exam: 30%

Further details can be however discussed at the beginning and end of the course, in order to reach a common agreement between both instructor and students.

Minimum grade: Students with a mark equal to or greater than 4.0 in the final exam will be evaluated as described above. With less than 4, they will not pass, and the grade will be that of the final exam.

% end-of-term-examination:	30
% of continuous assessment (assigments, laboratory, practicals…):	70

BASIC BIBLIOGRAPHY

- JOHNSON, R. A. and WICHERN, D. W. Applied Multivariate Statistical Analysis, Sixth Edition, Prentice Hall , 2007

- KABACOFF, R. L. R in action: Data analysis and graphics with R, Second Edition, Manning Publications, 2015

ADDITIONAL BIBLIOGRAPHY

- EVERITT, B. and HOTHORN, T. An Introduction to Applied Multivariate Analysis with R, Springer Verlag, 2011

- FREES, E. W. Regression Modeling with Actuarial and Financial Applications, Cambridge University Press , 2010

- JAMES, G., WITTEN, D., HASTIE, T. and TIBSHIRANI, R. An Introduction to Statistical Learning with Applications in R , Springer Verlag, 2013

- MATLOFF, N. The Art of R programming: A Tour of Statistical Software Design, No Starch Press, 2011

- McNEIL, A., FREY, R. and EMBRECHTS, P. Quantitative Risk Management: Concepts, Techniques and Tools, Revised edition, Princeton Series in Finance, 2015

- ZUMEL, N. and MOUNT. J. Practical Data Science with R, Manning Publications, 2014