Multivariate data analysis

Academic Year: (2022 / 2023)   **Review date: 03-10-2022**

Department assigned to the subject: Statistics Department

Coordinating teacher: MEILAN VILA, ANDREA

Type: Compulsory ECTS Credits : 6.0

Year : 1 Semester : 2

REQUIREMENTS (SUBJECTS THAT ARE ASSUMED TO BE KNOWN)

Actuarial Statistics

Fundamentals of Statistics, Linear Algebra, and Mathematical Analysis

Some familiarity with programming techniques based on MATLAB, R and Phyton is also recommended

OBJECTIVES

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

Knowledge of Statistical software for Multivariate Data Analysis, with emphasis Phyton.

DESCRIPTION OF CONTENTS: PROGRAMME

1. Population and sampling concepts
1.1 Random vectors and matrices
1.2 Expected values
1.3 Sampling distributions

2. Multivariate normal distribution
2.1 Basic properties
2.2 Simulation methods
2.3 Examples of application in finance

3. Multivariate Data
3.1 Multivariate data
3.2 The data matrix
3.3 Mean vector. Covariance and correlation matrices
3.4 Graphical methods
3.5 Linear combinations

4. Regression analysis
4.1 Simple and multiple regression
4.2 Diagnostic and residual analysis
4.3 Examples of application

5. Generalized linear models
5.1 Logit and probit models
5.2 Poisson regression
5.3 Multiple choice models
5.4 Examples of application

6. Principal components
6.1 Motivation and construction
6.2 Standardized case
6.3 Data example

7. Factor analysis
7.1 The orthogonal factor model
7.2 Estimation and rotation of factors
7.3 Examples of application

8. Cluster analysis
8.1 Distances and similarities
8.2 Hierarchical procedures: Ward's method
8.3 Nonhierarchical procedures: K-means method
8.4 Examples of application with real data

LEARNING ACTIVITIES AND METHODOLOGY

Competences will be acquired by students from:

1.Theory classes: one per week (14 sessions)

2. Practical classes in the computer room: one per week (14 sessions)

Activities 1. and 2. will be devoted to exercises, problems, data examples, and case studies. Teaching will make intensive use of the resources available in Aula Global.

ASSESSMENT SYSTEM

Continuous evaluation through two tests (40%), a group project (10%) and final exam (50%).

% end-of-term-examination:	50
% of continuous assessment (assigments, laboratory, practicals…):	50

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