

Academic Year: (2023 / 2024)

Review date: 26-04-2023

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 Python is also recommended

OBJECTIVES

Knowledge of multivariate data analysis with applications in finance and actuarial sciences

Knowledge of statistical software for multivariate data analysis

DESCRIPTION OF CONTENTS: PROGRAMME

1. Introduction to multivariate analysis

1.1 Introduction

1.2 Basic concepts of matrix algebra

1.3 Description of multivariate data: data matrix, mean vector, covariance matrix, and correlation matrix

1.4 Representation of multivariate data

2. Multivariate normal distribution

2.1 Basic properties

2.2 Simulation methods

2.3 Application examples

3. Regression analysis

3.1 Simple linear regression

3.2 Multiple linear regression

3.3 Model validation

3.4 Application examples

4. Generalized linear models

4.1 Logistic regression

4.2 Poisson regression

4.3 Application examples

5. Principal components

5.1 Motivation and construction

5.2 Standardized case

5.3 Examples with data

6. Factor analysis

6.1 Orthogonal factorial model

6.2 Estimation and factor rotation

6.3 Application examples

7. Cluster analysis

7.1 Proximity measures

7.2 Hierarchical clustering: Ward's method

7.3 Non-hierarchical clustering: K-means method

7.4 Application examples with 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 (20%+25%), a group project (15%) and final exam (40%).

% end-of-term-examination:	40
% of continuous assessment (assignments, laboratory, practicals...):	60

BASIC BIBLIOGRAPHY

- DEISENROTH, M., FAISAL, A. and ONG, C.S. Mathematics for Machine Learning, Cambridge University Press, 2020
- 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
- SHALIZI, C. Advanced Data Analysis from an Elementary Point of View, Cambridge University Press, 2013

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