# Statistics for Business Decisions

## Professors Laura Barbieri – Elena Calegari

***COURSE AIMS AND LEARNING OUTCOMES***

The course introduces the basic concepts and methods for statistical data analysis. The first part of the course is methodological and provides an essential understanding of statistical techniques. In the second part, students are introduced to the statistical software and the course aims at an empirical statistical data analysis. The course provides a preparation for more advanced statistical techniques students will face during the rest of their degree course.

***Learning outcomes.*** At the end of the course students should be able to analyze data, individuating proper methods to summarize data and deal with problems in statistical inference such as point inference and hypothesis testing. The students should also be able to analyze data using R. Moreover, they should be able to read and understand research reports based on statistical data analysis.

***COURSE CONTENT***

***Module 1: Statistics, Prof. Laura Barbieri***

Part I: Descriptive statistics

*Introduction*. Tabulation and graphical representations. Histograms.

*Means.* Main Means and their properties. Median and Mode.

*Variability.* Variance and its properties. Coefficient of variation, absolute deviation from the median.

*Concentration.* Lorenz curve. Gini coefficient. Absolute Mean Difference.

*Bivariate descriptive statistics.* Covariance and its properties. Linear Correlation. Least Squares.

Part II: Probability theory

*Introduction*

*Theory of discrete random variables*

*Families of discrete random variables*

*Theory of continuous random variables*

*Notable families of continuous random variables*

*Discrete and continuous dual random variables*

Part III: Statistical inference

*Point estimate*

*Interval estimate*

*Hypothesis testing theory*

Part IV: Regression models

*Simple linear regression model*

***Module 2: Business statistics, prof. Elena Calegari***

1. Introduction to the use of R software and its role in data analysis and "data science".
2. Review of the basic theoretical notions introduced in the Statistics course with practical applications carried out using the software.
3. Theoretical introduction to the multiple linear regression model: description of the assumptions underlying the model, least squares estimators, maximum likelihood estimators, confidence intervals and statistical inference for the model parameters.
4. Estimation of the multiple linear regression model in R: practical applications of theoretical notions, diagnostic tools, use of dichotomous variables as explanatory variables and interpretation of the estimated coefficients. Threats to the internal validity of the model.
5. ANOVA models and their applications in business and marketing disciplines.

***READING LIST***

Reference text.

***Module 1: Statistics***

S. Borra-A. Di Ciaccio, *Statistica. Metodologie per scienze economiche e sociali,* 4a ed., McGraw-Hill, Milano, 2021.

***Module 2: Business statistics***

S. Borra-A. Di Ciaccio, *Statistica. Metodologie per scienze economiche e sociali,* 4a ed., McGraw-Hill, Milano, 2021.

J.H. Stock – M.W. Watson, *Introduzione all’econometria,* 5a ed., Pearson, 2020.

Notes and supplementary material provided by the lecturer.

***TEACHING METHOD***

Lectures and class exercises.

***ASSESSMENT METHOD***

***Module 1 - Statistics.*** The exam consists of a written test composed by a theoretical part and a practical part. The theoretical part is worth 10 points and includes TRUE/FALSE answer questions. The practical part is worth 20 points and involves solving some exercises (the scores of the various exercises are indicated in the exam text). The theoretical questions are designed to test students’ theoretical knowledge and their correct use of the technical terminology. Furthermore, by solving the exercises, students are required to demonstrate their ability to solve simple problems of data analysis applying the analysis techniques presented during the course.

According to the decisions taken in this regard by the faculty, the written test can be passed by getting a positive result in two written exams: a first mid-term test in the (unique) date approved for this purpose by the faculty, and a second test in exam sessions immediately following the end of the course teaching period. The average marks obtained in intermediate examinations defines the written test grade.

***Module 2 - Business statistics.*** The exam consists in a practical test (in computer lab) designed to verify students' ability to analyze a data set using the statistical software R, introduced during the course. In particular, the exam involves performing an exercise using R which is composed of five/six questions (5/6 points each). The score obtained in each question depends on the correct choice of the methodology and the R commands used to conduct the analysis, as well as on the consistency and precision in the comments. Exam simulations will be provided on Blackboard.

***INSTRUCTIONS AND PREREQUISITES***

More detailed information on the course program, the parts of the recommended texts of specific interest for the course, bibliographical material and additional study, will be provided by the teacher during the lessons and in Blackboard.

As a basic course, teaching does not need any prerequisite for content. It is advisable to follow this course after following the course of *Matematica generale* of the first year.

***NOTES***

Information on office hours available on the teacher's personal page at <http://docenti.unicatt.it/>.