# 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 essential understanding of statistical techniques. In the second part, students are introduced to the statistical software and the course aims at statistical data analysis in practice. The course provide 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 includes a written test (mandatory) and an oral interview (optional). The written test consists of a theoretical part and a practical part. The theoretical part is worth 10 points and includes TRUE/FALSE answer questions (0.35 points each). The practical part is worth 20 points and involves solving some exercises (the scores of the various exercises are indicated in the exam text). By solving the exercises, the students should demonstrate their ability to apply the techniques of analysis treated in the course to small data sets. The theoretical questions are designed to test their ability to use concepts to solve simple problems of data analysis. The oral test verifies that students have understood the logic behind the various tools for data analysis, are able to illustrate their economic applications and possess basic concepts of mathematical statistics. Only those students who have achieved a positive result in the written test (at least 18/30) are admitted to oral interview; the grade obtained in the oral test may change the grade obtained in the written test of at most 3 points (in both directions).

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). 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/>.