# Statistics

## Prof. Giulia Rivellini; Prof. Eugenio Brentari

***COURSE AIMS AND INTENDED LEARNING OUTCOMES***

The course aims to provide students with introductory notions of descriptive (both univariate and bivariate) and inferential Statistics.

*Intended learning outcomes*

*1) Knowledge and understanding*

Students will be able to identify and understand measures of synthesis, association and linear dependence adequate to the analysis of a sample of statistical units or of a population. Students will be able to identify the appropriate statistical measures to compare a phenomenon observed within two distinct collectives. Students will know definitions, formulas and meaning of univariate and bivariate descriptive statistics indices. Students will be able to visualize the frequency distributions of various types of statistical variables and of direct and inverse linear dependence. Students will know the definitions and axioms of probability calculation, on which statistical inference is based; students will be able to extract and recognize a probabilistic sample and will be able to explain the meaning of a representative sample of a population. Students will then be able to interpret the results of a statistical test and evaluate whether the sample data support predefined research hypotheses. Students will demonstrate knowledge of the specific terminology of the subject.

*2) Ability to apply knowledge and understanding*

Students will understand how to approach the study of a specific phenomenon using quantitative methods. Starting from a set of data, students will demonstrate to be able to synthesize the phenomenon through the calculation of adequate quantities. Students will be able to use the results of these analyses to answer questions regarding the topic the data refers to. If the data relates to a sample, students will be able to use the probability calculation tools to measure and control the uncertainty of the results observed. Students will be able to test if the sample data support research hypotheses. Students will demonstrate appropriate use of the specific terminology of the subject.

*3) Learning skills*

Students will be able to use their new skills in any field where empirical research and data analysis are needed.

***COURSE CONTENT***

Introductory mathematics

Three mental exercises: synthesise, associate and infer.

***1) Univariate descriptive statistics (Prof. Giulia Rivellini)***

From the detection of phenomena to the measurement

Types of statistical variables

Frequency distributions

Graphic representations and plots

Measuring averages

Measuring dispersion

Standardizing

Frequency distribution curves: relationships among the mean, median and mode.

From Histogram to the Normal distribution

Using the Normal curve as a probability distributions.

***2) Bivariate descriptive statistics (Prof. Giulia Rivellini)***

Creating and interpreting double entry tables.

Marginal and conditioned distributions.

Creating and reading a scatter diagram.

Stochastic independence and correlation.

Averages among groups. Analysis of the variance between and within groups.

Pearson’s r bivariate correlation coefficient

Linear regression

***3) Elements of statistical inference (Prof. Eugenio Brentari)***

From population to sample. Randomness, representativeness and inference.

The random variable: distribution function and synthetic values.

Discrete and continuous random variables.

Simple random and Bernoulli probability sampling.

Parameter estimation using confidence intervals

Statistical tests and hypothesis testing

A focus on p-value

***READING LIST***

E. Amaturo, B. Aragona, M. G. Grassia, C. N. Lauro, M. Marino (2021), *Statistica per le scienze sociali – Seconda edizione,* UTET, Turin.

G. Rivellini -A. SignorellI – M.E. Comune *Eserciziario di Statistica ,* EDUCatt, Milan, 2018

G. Rivellini, *Elementi di Statistica Descrittiva,* Materiali e Documenti, EDUCatt, Milan, 2023

F. Mecatti F., *Statistica di base. Come,* *quando e perché*, McGraw-Hill Education, Milan, 2022.

During the first lesson, the lecturer will explain how to use the recommended materials and texts.

***TEACHING METHOD***

Guided practical exercises (aimed at illustrating the typologies of questions given in the examinations by Prof. Giulio Ferrarese) are also held during lecture time. Use of the Blackboard platform.

***ASSESSMENT METHOD AND CRITERIA***

Written assessment, with questions on the definitions and the formulas of descriptive and inferential statistical indexes, and exercises on the three parts of the programme.

Students will be able to get up to 20 points in descriptive statistics, and 12 points in the inferential one (32 points in total). In order to pass the exam, students will have to get at least 12 points in the former and 6 points in the latter. The final mark will be expressed in thirtieths (*cum laude*, in case they get 31 or 32 points).

Any student that passes the two interim tests to be taken during the break between teaching cycles will be exempted from the final exam. The first test will be focused on the first and the second part of the course, while the second one will be based on the third part of the course.

The optional execution of an assignment to be prepared in groups during the course will allow classroom interaction between lecturers and students and provide an opportunity to enhance the final assessment (by a maximum of 3 points).

***NOTES AND PREREQUISITES***

For further clarifications, students can send an email to [giulia.rivellini@unicatt.it](mailto:giulia.rivellini@mi.unicatt.it).

Further information can be found on the lecturer's webpage at http://docenti.unicatt.it/web/searchByName.do?language=ENG or on the Faculty notice board.