UNIVERSITÀ
DEGLI STUDI DI MILANO-BICOCCA

SYLLABUS DEL CORSO

Statistica

2627-2-E4002N011

Learning objectives

The course has a mainly methodological approach and aims to achieve the following learning outcomes.

Knowledge and understanding
By the end of the course, students will have acquired:

- the fundamentals of statistical reasoning and the main methods for data collection, organisation and analysis;
- the ability to transform data into useful information for decision-making and empirical analysis in the study of social phenomena.

Applying knowledge and understanding
By the end of the course, students will be able to:

- understand and use the fundamental elements of univariate and bivariate descriptive statistics and classical statistical inference;
- formally relate and frame statistical tools and techniques already encountered in their previous educational path;
- apply basic statistical tools to descriptive and inferential problems.

Making judgements
By the end of the course, students will have developed:

- a critical approach to the production and use of quantitative statistical information;
- the ability to assess data quality, source reliability and the validity of data-based generalisations.

Communication skills
By the end of the course, students will have acquired:

- tools for oral, written and graphical communication of quantitative information;
- the ability to critically read and interpret statistical results and representations.

Learning skills
By the end of the course, students will have developed:

- an attitude of openness and curiosity towards the quantitative analysis of social phenomena;
- the ability to identify and use the most appropriate statistical tools for extracting new knowledge from data.

Contents

The course provides an introduction to the formal principles of modern statistical reasoning, as well as to the fundamental tools of univariate and bivariate descriptive statistics and the main methods of statistical inference.

Applied aspects are addressed through practical exercises integrated with theoretical lectures.

The course also makes use of online tools available on the e-learning platform, aimed at fostering interaction between instructors and students and supporting learning through individual exercises and midterm assessments (see the “Teaching Methods” section).

Detailed program

Univariate descriptive statistics

- Population, statistical unit, statistical variable and its modalities.
- Data collection and frequency distributions.
- Measures of central tendency.
- Measures of variability.

Bivariate descriptive statistics

- Joint observation of two statistical variables and contingency tables.
- Statistical independence.
- Measures of association, dependence and correlation.
- Introduction to simple linear regression and the regression line.

Statistical inference

- Sampling, sampling variability and sampling errors.
- Review of probability theory.
- Point estimation of the mean, variance and proportion.
- Properties of estimators, mean squared error and standard error.
- Confidence intervals (exact for normal populations and approximate for large samples) for the mean and proportion.
- Introduction to hypothesis testing.
- Z and t tests (exact for normal populations and approximate for large samples) for the mean and proportion.
- Chi-square test of independence for bivariate data (approximate for large samples).

At the end of the course, a detailed examination syllabus, including references to the prescribed textbook, will be

made available on the e-learning platform. This syllabus will remain valid for all examination sessions of the 2026/27 academic year.

Prerequisites

Prior completion (or concurrent enrolment) of the Mathematics course is **recommended**.

Students are strongly advised to have acquired the following basic mathematical concepts:

- sets and cardinality (finite and countable sets, and the cardinality of the continuum);
- real intervals;
- solution of simple first-degree equations, including parametric equations;
- definition of a real-valued function and evaluation of function values;
- equation of a straight line;
- notion of the minimum of a real-valued function.

Teaching methods

The course consists of 56 hours of in-person teaching activities delivered in Italian.

Erogative teaching (DE – 80%)
Lecturing activities include traditional lectures supported by slides and web-based materials. During lectures, exercises and discussions based on instructor-prepared materials are also proposed.

Interactive teaching (DI – 20%)
Interactive activities include online discussions on pre-assigned materials, self-assessment exercises and an optional pathway of four in-class midterm assessments.

Practical sessions
Additional in-person practical sessions are provided alongside the course. These sessions are split approximately 50% into lecturing activities (using slides) and 50% into interactive activities. They also include online quizzes aimed at exam preparation.

E-learning platform
Throughout the course, the e-learning platform (http://elearning.unimib.it) is regularly updated with teaching materials and tools for interaction between instructors and students. In particular, the following resources are made available:

- a Q&A forum and an anonymous online board for questions, comments and clarifications;
- lecture slides from completed classes;
- self-assessment activities;
- information and materials related to midterm assessments.

Assessment methods

The examination can be taken in two alternative ways.

Standard mode
The standard examination consists of a written test, taken in person in a computer lab, in the form of an online quiz. It includes both multiple-choice numerical exercises and open-ended theoretical questions, covering the entire syllabus published on the course e-learning page at the end of the course.
The numerical exercises aim to assess the ability to understand the available data, identify appropriate statistical methods, apply them correctly (including simple calculations using a calculator) and interpret the results. The open-ended theoretical questions are designed to evaluate students' understanding of key statistical concepts and methods, their ability to place them within the appropriate formal framework (univariate, bivariate, and inferential statistics) and their ability to present them clearly and rigorously.
The duration of the exam is usually 1 hour and 30 minutes.

Simplified mode
The simplified examination is based on four midterm written tests administered during the course. These tests are conducted in class as individual assignments.
Students who successfully pass the four midterm tests with a sufficient average grade are eligible for the simplified examination, which can be taken in one of the two winter exam sessions (January or February 2027).
The simplified exam consists of a written test, taken in person in a computer lab, in the form of an online quiz with four open-ended theoretical questions covering the entire course syllabus.
The questions aim to assess students' understanding of key statistical concepts and methods, their ability to place them within the appropriate formal framework (univariate, bivariate, and inferential statistics) and their ability to present them clearly and rigorously.
The duration of the exam is usually 30 minutes. The test is scheduled on the same day and time as the standard written examination.

In both cases, students who obtain a sufficient grade in the written test (at least 18/30) may optionally take an oral examination on the entire course syllabus in order to improve their grade. In this case, the written grade is discarded, and the final grade is determined solely by the oral examination.

Assessment criteria

- completeness and accuracy of the knowledge acquired;
- ability to critically interpret the results of statistical analyses;
- ability to apply appropriate statistical tools to the solution of specific problems;
- ability to synthesize information effectively;
- appropriate use of statistical language and terminology.

Textbooks and Reading Materials

F. Mecatti, "Statistica di Base. Come, Quando e Perchè". McGraw Hill, III Edizione (2022).

L. Pagani, "Complementi ed esercizi di statistica descrittiva ed inferenziale". Amon (2022).

Additional teaching materials and digital resources are available on the e-learning platform: http://elearning.unimib.it.

Sustainable Development Goals

NO POVERTY | ZERO HUNGER | GOOD HEALTH AND WELL-BEING | GENDER EQUALITY | DECENT WORK AND ECONOMIC GROWTH | REDUCED INEQUALITIES | SUSTAINABLE CITIES AND COMMUNITIES |

CLIMATE ACTION | PEACE, JUSTICE AND STRONG INSTITUTIONS