



UNIVERSITÀ
DEGLI STUDI DI MILANO-BICOCCA

COURSE SYLLABUS

Statistics

2526-2-E4001N085

Learning objectives

The course has a primarily methodological focus and aims to achieve the following objectives:

Knowledge and understanding:

To introduce statistical reasoning and basic statistical methods for data collection and for transforming data into information that supports decision-making processes and the production of empirical evidence for the analysis of social phenomena.

Ability to apply knowledge and understanding:

To provide both theoretical and practical foundations in univariate and bivariate descriptive statistics and classical statistical inference; to formally organize and contextualize tools and data analysis techniques that students may have already encountered in their academic journey; and to introduce new basic statistical tools for both descriptive and inferential purposes.

Independent judgment:

To foster critical statistical thinking both in the "production of" and in the role of "users receiving" quantitative statistical information derived from data, with particular attention to sources, data quality and valid generalization.

Communication skills:

To refine oral, written, and infographic communication skills, as well as the ability to critically interpret quantitative information.

Learning skills:

To encourage openness, curiosity, and a critical approach to the use of statistical tools appropriate for extracting new knowledge from data collected in the social context.

Contents

The course offers an introduction to the formal principles of modern statistical reasoning, the basic tools of univariate and bivariate descriptive statistics, and the foundational methods of classic inferential statistics.

Practical applications are addressed through hands-on exercises integrated with the course.

Throughout the course, online tools will be provided via the e-learning platform to support student–instructor interaction and autonomous learning, including self-guided exercises, weekly quizzes, and intermediate assessments (see the “Teaching Methods” section for details).

Detailed program

Elements of univariate descriptive statistics:

Population, unit, statistical phenomenon and its modalities; observation of a statistical phenomenon (data collection) and frequency distributions; measures of central tendency and measures of variability.

Elements of bivariate descriptive statistics:

Joint observation of a pair of statistical phenomena and two-way tables; statistical independence, detection and measurement of connection, dependence, and correlation; introduction to simple regression and the regression line.

Elements of statistical inference:

Sampling, sampling variability and sampling errors; review of probability calculus; point estimation for the mean, variance, and proportion; properties of an estimator, mean squared error, and standard error; confidence intervals for the mean and for the proportion—exact for Normal populations and approximate for large samples; introduction to statistical tests—Z and T tests for the mean and proportion, exact for Normal populations and approximate for large samples; Chi-square test of independence (approximate for large samples) for bivariate data.

A detailed examination syllabus (with references to the adopted textbook) will be made available on the e-learning platform at the end of the course (December 2025) and will remain valid for all exam sessions in the academic year 2025/26.

Prerequisites

Recommended prerequisite: Mathematics for Social Sciences

It is strongly recommended that students acquire the following elements of basic mathematics:

- Sets and cardinality (finite, countable, continuum cardinality);
- Real intervals;
- Solutions of simple first-degree parametric equations;
- Definition of a (real) function and its values;
- Equation of a straight line;
- Minimum of a real-valued function.

Teaching methods

80% Traditional (Didactic) Teaching (DE):

Delivered in Italian through in-person lectures; use of slides and web pages; in-class exercises and discussions based on pre-distributed material.

20% Interactive Teaching (DI):

Delivered in Italian, it includes online lessons and discussions based on pre-distributed material and internet research; open-access weekly quizzes for learning assessment; optional, conditional-access pathway of intermediate online assessments.

Additional in-person practical sessions delivered in Italian, supplement the course, composed of 50% traditional teaching using slides and 50% interactive teaching with online quizzes conducted in a computer lab as preparation for the final exam.

Throughout the course, the e-learning page <http://elearning.unimib.it> is regularly updated with student–instructor interaction tools, teaching materials, and additional online learning resources. Specifically

Sections *Introduction* and *Lectures* on the e-learning page:

- Q&A Forum and anonymous Online Whiteboard for questions/doubts/comments
- Weekly preview of lecture topics
- Slides from completed lectures

Section *Additional Online Teaching Materials* on the e-learning page:

-Weekly quizzes (open-access): multiple-choice online quizzes without time limits, covering topics from the previous week's lectures. Completing all weekly quizzes with a passing score (at least 50% correct answers, with up to 2 attempts) is one of the requirements for accessing the Intermediate Online Assessments.

- Intermediate Online Assessments (conditional access): timed, single-attempt, multiple-choice quizzes that are optional and self-administered, covering specific parts of the course syllabus. There are four such assessments, each scheduled after the completion of the corresponding part of the course. The date and time of each quiz (usually over the weekend), along with access requirements and rules for participation and evaluation, are communicated on the e-learning page at the start of the semester.

If all four intermediate assessments are successfully passed with a sufficient average score, they replace the exercise component of the regular written exam and grant access to a simplified exam.

More details about the regular and simplified exam formats can be found in the section *Assessment Methods* below.

Assessment methods

Written exam (regular) for all exam sessions of the academic year 2025/26

An online quiz (administered in person in the computer lab) consisting of both numerical exercises (multiple-choice) and theoretical questions (open-ended), covering all topics listed in the syllabus published on the e-learning page at the end of the course.

The numerical exercises aim to assess the student's ability to: understand the data provided, interpret the question and identify the appropriate statistical tool, correctly apply the tool to the data (performing simple calculations with a calculator), and clearly communicate and correctly interpret the resulting number/indicator.

The open-ended theoretical questions allow for teacher–student interaction and aim to assess the student's ability to: understand the statistical question, place it within the appropriate formal framework according to the relevant statistical tool and objective (univariate descriptive, bivariate descriptive, inferential), and explain the method effectively and with sufficient rigor.

The regular written exam normally lasts 1 hour and 30 minutes.

Withdrawal from the exam is possible at any time during the session.

If the written exam receives a passing grade (at least 18 out of 30), students may optionally request an oral exam on the entire course syllabus to improve their final grade. This is subject to the student's explicit request, refusal of the written exam grade, and registration for the oral exam.

Simplified exam – with restricted access to students who successfully completed all 4 intermediate online assessments during the course (October–December 2025), with a sufficient average grade. This option is **limited** to one of the two winter sessions (January or February 2026).

The simplified exam consists of an online quiz with 4 open-ended theoretical questions covering the entire syllabus published on the e-learning page at the end of the course. These open questions allow for teacher–student interaction and aim to assess the student's ability to: understand the statistical question, place it within the correct formal context in relation to the statistical tools and goals (univariate, bivariate, or inferential), and clearly and rigorously explain the relevant method.

The simplified exam typically lasts 30 minutes and is held in person (in the computer lab) on the official date and time of the regular written exam.

Textbooks and Reading Materials

In Italian

F. Mecatti, "Statistica di Base. Come, quando e perché". McGraw-Hill, III ed. (2022);

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

Additional digital tools and materials at <http://elearning.unimib.it> (see previous section Teaching methods**)

English textbooks and additional digital resources will be advised on demand and/or according to specific needs

Sustainable Development Goals

NO POVERTY | ZERO HUNGER | GOOD HEALTH AND WELL-BEING | GENDER EQUALITY | CLEAN WATER AND SANITATION | AFFORDABLE AND CLEAN ENERGY | DECENT WORK AND ECONOMIC GROWTH | INDUSTRY, INNOVATION AND INFRASTRUCTURE | REDUCED INEQUALITIES | SUSTAINABLE CITIES AND COMMUNITIES | RESPONSIBLE CONSUMPTION AND PRODUCTION | CLIMATE ACTION | LIFE BELOW WATER | LIFE ON LAND | PEACE, JUSTICE AND STRONG INSTITUTIONS
