# *Statistics for Managerial Decisions*

## Prof. Sergio Venturini (Module Statistics)

## Prof. Luca Bagnato (Module Business Statistics)

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

The course aim is twofold: on the one hand to provide students with the statistical tools deemed indispensable in the toolbox of a graduate in economic and business subjects. On the other hand, the course aims at providing students with the skills needed for modeling the world around us, skills that are necessary for the quantitative analysis of economic and social phenomena and for the development of suitable instruments for taking decisions under uncertainty. To highlight the applicability of the concepts and methodologies introduced, the presentation of the different topics is motivated by real situations and phenomena.

***COURSE CONTENT***

The course is divided in two modules: Module Statistics (Prof. Venturini) and Module Business (Prof. Luca Bagnato).

The modules are composed of the following topics:

 *Module Statistics (Prof. Venturini)*

1. Elements of descriptive statistics
* Statistical units and variables. Population and sample
* Analysis and representation of data through tables and graphs. Frequency distributions
* Indexes of position and variability
* Relations between two variables. Contingency tables, scatterplots, linear association, and simple linear regression model
1. Probability theory
* Introduction. Probability theory axioms and fundamental theorems of calculus. Conditional probability and independent events
* Random variables. Definition of probability distribution for a random variable (probability/density function and distribution function). Summary values for random variables (expected value, variance, standard deviation, median, quartiles). Random vectors. Independent random variables

 *Module Business Statistics (Prof. Bagnato)*

1. Probability theory (continue)
* Families of discrete random variables. Bernoulli, binomial, Poisson and discrete uniform
* Notable families of continuous random variables. Continuous uniform, exponential, normal, Student-t, Chi-square, F Fisher
* Independent random variables and central limit theorem
1. Statistical Inference
* Point estimate. Concept of estimator. Unbiasedeness, mean-square error, and efficiency of an estimator. Point estimation of the mean and variance of a population. Maximum likelihood estimators (overview).
* Interval estimate. Confidence intervals for the mean of a population; confidence intervals for a proportion.
* Hypothesis testing theory. Definition of the problem, acceptance and rejection regions, decision error classification, and power function.
* Specific tests. Test for the mean of a population; test for a proportion. Chi-square independence test and Chi square goodness of fit test.
1. Simple regression model
* Simple linear regression model from an inferential point of view. Normal assumption of errors and hypothesis testing on parameters.

***READING LIST***

In addition to the following reading list, additional material will be made available on the Blackboard page of the course.

*Module Statistics (Prof. Venturini)*

* Newbold, P., Carlson, W. L., Thorne, B. Statistica, Pearson, 2021. 9a edizione italiana

 *Module Business Statistics (Prof. Bagnato)*

* Zenga M., Elementi di inferenza statistica, Vita e Pensiero, 2009

***TEACHING METHOD***

* Standard front lectures
* Practical sessions
* Case studies

The teaching-learning method of this course, in addition to traditional lectures, includes practical sessions in which the various statistical problems previously illustrated will be applied to specific cases.

***ASSESSMENT METHOD AND CRITERIA***

The assessment, which is identical for both attending and non-attending students, takes place through a single written test that allows for a maximum score of 31/30. The exam text will contain: i) practical exercises, ii) theoretical questions and iii) interpretation of software output. The number of questions contained in the tests can vary from a minimum of 13 to a maximum of 16. The questions contained in the tests may be of the following types: 1) true/false questions 2) multiple choice questions, 3) questions with numerical answers (i.e., a numerical value to be entered in the appropriate box provided) or 4) questions with open answers (i.e., a text that must be shown in the box provided). For true/false questions, 1 point will be awarded for each correct answer, 0 points for each non-answer and -0.2. For multiple choice questions, 2 points will be awarded for each correct answer, 0 points for each non-answer and -0.5 points for each wrong answer. For questions with numerical answers, 1 point will be awarded for each correct answer and 0 points for each wrong answer. For questions with open ansers, a score between 0 and 5 will be assigned based on the correctness and completeness of the answer provided.

Alternatively, the exam can be taken through two partial tests at the end of each module, which will follow the same rules described above for the single test. The final grade in this case will correspond to the weighted average with weights of 2/3 and 1/3 of the two grades respectively rounded up appropriately (from .5 onwards the rounding will be in excess, otherwise down).

In both cases, the exam will be considered passed if the final grade is greater than or equal to 18. A final score of 31/30 is equivalent to a grade of 30 cum laude.

It is not possible to take the exam outside the official exam sessions.

***NOTES AND PREREQUISITES***

**Prerequisites.** The course presumes some familiarity with basic mathematical tools (powers, logarithms, concepts of function, derivative and integral) is assumed but these are not prerequisites for the course.

**Office hour for students.**Time and place of office hour will be made available on the instructors’ personal webpages available at <http://docenti.unicatt.it/>.