# Mathematical Statistics I (6cfu)

## Prof. Giulia Giantesio

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

Introduce the fundamentals of the theory of probability and of unidimensional random variables in hypothetical-deductive form and illustrate the theory's main applications. At the end of the course, the students are suppose to be able to solve simple probability problems and to describe a random variable.

***COURSE CONTENT***

Probability space, events. Algebra and σ-algebra of events. Kolmogorov axioms and derived theorems. Conditional probability and independent events. Total probability theorem and Bayes theorem. Frequentist and subjective interpretations of probability.

One-dimensional random variables. Distribution function and density function. Expected value and variance. Moments and generating functions. Functions of random variables.

Analysis and application of specific discrete and continuous random variables: discrete uniform, Bernoulli, binomial, geometric, Poisson, continuous uniform, Gamma, normal.

Multivariate distributions. Variance-covariance matrix, correlation matrix.

Markov and Čebyšëv's inequality. Laws of convergence. Law of large numbers. Central limit theorem and applications.

***READING LIST***

A.M.Mood-F.A.Graybill-D.C.Boes, *Introduzione alla Statistica,* McGraw-Hill, 1991.

M.S. Ross*, Calcolo delle probabilità*, Apogeo, 2007.

Supplemental notes will be provided.

***TEACHING METHOD***

Lectures on theory and assignments.

***ASSESSMENT METHOD AND CRITERIA***

Written tests and interviews. The written test will consist of some exercises in which the student will need to demonstrate that he has acquired knowledge about probability theory, and knows how to apply such knowledge to specific situations similar or related to those illustrated in the supplemental instruction sessions. The grade on the written exam will take into account the accuracy of the results and the procedures used to obtain the results, as well as the quality of the presentation of the same.

The interview is designed to ascertain the extent to which the students have assimilated the concepts, results and procedures illustrated during the course, through explaining and discussing some of the points of the course programme, not excluding references to prerequisites or relationships between the parts of the programme. The grading of the interview will take into account the accuracy of the concepts illustrated, their logical and methodological rigour, and the effectiveness and accuracy in explanation, with a value assigned to the assimilation of concepts and the reworking thereof by the student.

The final mark is unique and takes into account for 60% of the assessment of the written test and for 40% of the oral exam.

***NOTES AND PREREQUISITES***

In order to address the course, some knowledge of set theory, differential and integral calculus are required. Nevertheless, the useful concepts will be recall during the lessons.

*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.*