Probability – Syllabus 2018-2019

Objectives of the course
The course is intended for the 1st year students of the PhD Program in Economics and Management. The purposes of this course are: (i) to explain, at an intermediate level, the basis of probability theory and some of its more relevant theoretical features; (ii) to explore those aspects of the theory most used in advanced analytical models in economics and finance. The topics will be illustrated and explained through many examples.

Pre-requisites
Basic Calculus and basic knowledge of probability theory, as in: P. Newbold, W. Carlson, B. Thorne (2012), Statistics for Business and Economics, Pearson Higher Education, Chapters 3-5 (previous editions would be fine as well). Attendance to more advanced courses such as real analysis, probability, distribution theory and statistical inference would be desirable.

Contents
1. Algebras and sigma-algebras, axiomatic definition of probability, probability spaces, properties of probability, conditional probability, Bayes theorem, stochastic independence for events.
2. Random variables, measurability, cumulative distribution functions and density functions.
3. Transformations of random variables, probability integral transform.
4. Lebesgue integral, expectation and variance of random variables, Markov inequality, Tchebycheff inequality, Jensen inequality, moments and moment generating function.
5. Multidimensional random variables, joint distributions, marginal and conditional distributions, stochastic independence for random variables, covariance and correlation, Cauchy-Schwartz inequality.
7. Transformations of multidimensional random variables.
8. Convergence of sequences of random variables, weak law of large numbers and central limit theorem.

Textbook

Further readings

**Advanced readings**


**Assessment**

A two-hour written paper at the end of the course.