



Research
Education
Outreach

CCA

Allievi Program and PhD in Economics

PROBABILITY

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Introduction

Probability theory is at the core of modern economics and mathematical finance. This course provides the necessary foundations for a rigorous understanding of probability theory and its deep links with measure theory. Of particular relevance to economic-financial applications is the martingale theory and its use in the mathematical description of arbitrage-free markets and risk-neutral pricing. These applications will be touched upon at the end of the course and should be intended as first introduction to the topic (in discrete time).

Prerequisites

Students should have taken the course on Measure Theory.

Requirements and Grading

During lectures, numerous questions will be left to students for independent work in preparation for the exam. The assessment will be based on a written test at the end of the course. Exam questions will span theory and applications.

Textbooks

The course is based on:

- David Williams, *Probability with Martingales*, Cambridge University Press, 1991.

Other textbooks that students might also find useful are:

- Albert N. Shiryaev, *Probability*, Springer, 1991.
- Kai Lai Chung, *A Course in Probability Theory* (third edition), Academic Press, 2001.

Syllabus

- Brief recap on measure spaces
- Probability spaces and events
- Random variables as measurable functions
- Independence
- Brief recap on Lebesgue integration and product measure
- Introduction to L^p -spaces and mathematical expectation
- Conditional expectation
- Introduction to martingale theory
- Applications of martingale theory: the Black and Scholes model in discrete time