Allievi Program

PROBABILITY
Fall 2023

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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:


Other textbooks that students might also find useful are:


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