

On-line course materials

MATH37001 - Martingales with Applications to Finance

Year: 3 - Semester: 1 - Credit Rating: 10

Requisites

Prerequisites

MATH20701 Probability 2

Aims

To provide a firm grasp of a range of basic concepts and fundamental results in the theory of martingales and to give some simple applications in the rapid developing area of financial mathematics.

Brief Description

An introduction to a circle of ideas and fundamental results of the theory of martingales, which play a vital role in stochastic calculus and in the modern theory of finance.

Learning Outcomes

On successful completion of this course unit students will

- have a good understanding of the basic concept of integration with respect to a probability measure and the basic properties of fair games;
- be able to answer simple questions on martingales;
- experience applications of stochastic processes in discrete financial models.

Syllabus

- Probability spaces, events, σ -fields, probability measures and random variables. Integration with respect to a probability measure. Convergence theorems (dominated, monotone and Fatou). [5]
- Conditional expectations. Fair games and martingales, submartingales and supermartingales. Doob decomposition theorem. Stopping times and the optional sampling theorem. The upcrossing inequality and the martingale convergence theorem. The Doob maximal inequality and the martingale modification theorem. [13]

- Applications. Discrete time random models in financial markets. Price processes, self-financing portfolio and value processes. Arbitrage opportunities and equivalent martingale measures. Completeness of the markets. Options and option pricing. [6]

Teaching & Learning Process (Hours Allocated To)

Lectures	Tutorials/ Example Classes	Practical Work/ Laboratory	Private Study	Total
22	11	0	67	100

Assessment and Feedback

End of semester examination: two hours weighting 100%

Further Reading

- O. Kallenberg, Foundations of Modern Probability, Springer-Verlag, 2001.
- N. H. Bingham and R. Kiesel, Risk-Neutral Valuation, Springer-Verlag, 1998.
- D. Williams, Probability with Martingales, Cambridge Univ. Press, 1991.
- A. N. Shiryaev, Probability, Springer-Verlag, 1996.

Staff Involved

Prof Tusheng Zhang - Lecturer

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