

Syllabus --- Financial Mathematics

Course Instructor: Lin, Shih-Kuei

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Teaching Assistant:

Room:

Office: Health Center Building 150410

Office Hour: 9:00-11:00 Tuesday

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Aim (Course objectives):

This course is about the active and practical use of mathematics, which includes probability theory, linear algebra, calculus, partial differential equations, and stochastic calculus, and numerical mathematics, with the main focus on three interrelated financial topics: asset pricing, portfolio allocation, and hedge for the asset.

Course Description:

This course establishes the basics of the one-period model, shows how securities can be represented by vectors and matrices, and introduces the concept of hedging. Further, the course introduces important financial notions such as returns, arbitrage and state prices, and gives examples of asset pricing both in complete and incomplete markets. Then, we introduce the multi-period binomial model for stock prices and compute a dynamic hedging strategy that replicates a given option. Finally, we take the binomial modeling from the discrete-time numerical explorations to the continuous-time complete market trail in Black-Scholes option pricing formula.

Textbook:

Ales Cerny (2009). "Mathematical Techniques in Finance: Tools for Incomplete Markets". Princeton University Press.

Reference:

S. R. Pliska (2002). "Introduction to Mathematical Finance: Discrete Time Models". Blackwell Publishers Inc.

Schedule of the Course

- Chapter 1. The Simplest Model of Financial Markets
 - 1.1 One-Period Finite State Model
 - 1.2 Securities and Their Par-Offs
 - 1.3 Securities as Vectors
 - 1.4 Operations on Securities
 - 1.5 The Matrix as a Collection of Securities
 - 1.7 Matrix Multiplication and portfolios

- 1.8 Systems of Equations and Hedging
- 1.9 Linear Independent and Redundant Securities
- 1.10 The Structure of the Marketed Subspace
- 1.11 The Identity Matrix and Arrow-Debreu Securities
- 1.12 Matrix Inverse
- 1.13 Inverse Matrix and Replicating Portfolios
- 1.14 Complete Market Hedging Formula
- 1.15 Summary

Chapter 2. Arbitrage and Pricing in the One-Period Model

Midterm Exam.

Chapter 5. Pricing in Dynamically Complete Markets

Chapter 6. Towards Continuous Time

Final Exam.

Chapter 10 Brownian Motion and Ito Formulae

Teaching approach:

Teaching using the slide and the blackboard about the financial theories and financial example.

Grading:	(1) Homework	50%
	(2) Final Exam	40%
	(3) Others	10%