

MATH 548 – Mathematical Finance I: Discrete Time

Course Description from Bulletin: This is an introductory course in mathematical finance. Technical difficulty of the subject is kept at a minimum by considering a discrete time framework. Nevertheless, the major ideas and concepts underlying modern mathematical finance and financial engineering are explained and illustrated. Credit may not be granted for MATH 485 and MATH 548. (3-0-3)

Enrollment: Elective for AM and other majors

Textbook(s): Stanley Pliska, *Introduction to Mathematical Finance: Discrete Time Models*, Blackwell

Other required material: None

Prerequisites: MATH 475 or equivalent

Objectives:

1. Students will understand the basic principles of mathematical finance such as pricing and hedging in complete and incomplete markets, use of self-financing portfolios, etc.
2. Students will understand the role of risk neutral probability measure and its relation with a chosen numeraire asset.
3. Students will understand the use of elementary stochastic analysis (conditional expectations, filtrations, martingale theory, changes of measure – all for discrete time and finite state space processes) in mathematical finance.
4. Students will understand application of basic principles of mathematical finance for pricing and hedging of typical financial securities (such as options, futures and forwards).
5. Students will understand the financial concept of term structure of interest rates and some of its mathematical properties.
6. Students will work on projects that will provide a basis for some topics in the follow-up course MATH 582.

Lecture schedule: 3 50 minute (or 2 75 minute) lectures per week

Course Outline:

	Hours
1. Single period securities markets	12
a. Finite market model	
b. Arbitrage	
c. Risk neutral probability	
d. Valuation and hedging	
e. Completeness	
2. Multiperiod securities markets	12
a. Mathematical set-up and basic concepts	
b. Conditional expectations and martingales	
c. Return and dividend processes	
d. What all this means for valuation and hedging	
e. Binomial and Markov models	

- 3. Financial derivatives 12
 - a. Contingent claims
 - b. European and American options
 - c. Futures and forward contracts
- 4. Fixed income instruments 9
 - a. Term structure and yield curve
 - b. Forward pricing measure
 - c. Bond derivatives

Assessment:	Homework	0-10%
	Quizzes/Tests	45-50%
	Final Exam	45-50%

Syllabus prepared by: Tomasz Bielecki and Fred Hickernell

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