AARMS Summer School 2008
Mathematical Finance

Instructor: Mark Reesor
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Office Hours: To Be Determined

Lectures: To Be Determined

Pre-requisite: The equivalent of a 2-semester upper level undergraduate course (3^{rd} or 4^{th} year) in probability and statistics is required. Knowledge of a quantitative environment in which one can write simple code and run basic simulations (e.g., MATLAB, R, C, Excel, SAS, Maple) is required. Basic knowledge of ordinary and partial differential equations and stochastic processes would be useful (but is not required). Exposure to basic mathematics of finance concepts (e.g., types of interest/discount, time value of money) would also be useful but is not required.

It is your responsibility to ensure that the course prerequisite has been successfully completed. If you are unsure about this, please discuss your situation with the instructor.

Description: This course is an introduction to the pricing or valuation of financial derivatives. Simple securities such as puts, calls, forwards, and futures and their arbitrage relations will be discussed. Bonds and simple interest-rate products will also be introduced. We will cover the binomial and geometric Brownian motion (GBM) models for prices as well as stochastic differential equations, martingales, and Ito Calculus. Arbitrage pricing and replication of derivatives using the binomial and GBM models will be discussed, including the celebrated Black-Scholes partial differential equation.

Key concepts that students should understand when finished this course:
- Use of derivatives for hedging, speculating, and arbitraging.
- Arbitrage and replication of securities.
- Discrete- and continuous-time stochastic processes for prices.
- Martingales, stochastic differential equations, Ito Calculus.

Things that students should be able to do when finished this course:
- Price (European) derivatives using the Binomial and GBM models.
- Compute the replicating portfolio of a derivative using the Binomial and GBM models.
- Compute arbitrage bounds on simple call and put options.
- Price derivatives by simulation (if time allows).

Required Text: Jaksa Cvitanic and Fernando Zapatero (2004). *Introduction to the Economics and Mathematics of Financial Markets.* MIT Press, Cambridge Massachusetts.

We will be covering material in chapters 1-3, 6, 7, my own notes on probability theory and stochastic processes and, depending on time constraints, selected material from other chapters.

Other Text: John Hull's *Options, Futures, and Other Derivatives* (not required)

Evaluation: Students will be evaluated on the basis of assignments, and a final examination. The details remain to be determined.

Assignments: Frequency to be determined.

Calculators: Any non-programmable calculator may be used for the final exam.

Email Policy: Email is a good way of contacting me regarding things such as absences (email does not count as appropriate documentation), clarifications of assignment questions or solutions, making an appointment, or for very short questions that require very short answers. I will not respond to email that requires lengthy explanations on my part, please make an appointment or come to my office hours to discuss such matters with me in person.