OPRE 504B: Research in Mathematical Finance II

Instructor: Peter Ritchken

Text : "Options, Futures and other Derivative Securities" by J. Hull, Prentice Hall

- This book is very readable and provides a working knowledge of how derivative securities can be analyzed. I will assign chapters to read from this book and I also will assign some homework problems from the book.
- The book is geared towards advanced MBA students and does not provide as much rigor as is required from this class. However, the book does provide an excellent breadth of material, and will allow us to cover the basics in short order.
- You may also want to read some of my interest rate notes which you can download from my web page. <u>http://weatherhead.cwru.edu/faculty_research/homes/ritchken</u>.
- In class I will provide notes that are more technical.

Recommended Readings: There are some excellent books that may be useful to you. These include:

- "Investment Under Uncertainty", A. Dixit, S. Pindyck, Princeton
- "Financial Calculus", Baxter, M. and A. Rennie, Cambridge University Press, 1996
- "Mathematics of Financial Derivatives: A student Introduction" by Paul Wilmot, et al. Cambridge University Press, 1995
- There are lots of good readings on web. sites. I will provide these addresses.

Grading:	Homework Project or Paper Final Exam	20% 30% 50%	(approx. one every 2 weeks)

The final exam is on Wed. October 18th.

Objective

The field of financial economics has mushroomed both in scope and applications in recent years and these developments have a profound effect on many methodologies in Operations Research and Operations

Management. This course attempts to capture some key elements of this theory, with a strong emphasis on applications in valuation, and risk management.

This course builds on OPRE504A. In that class, the basic theoretical tools were developed. This course complements that class by providing many applications of the theory.

Project

Every student will be expected to read and analyze a published research paper. After finding a paper you must have it approved by me. You will be responsible for putting together a set of overheads that articulate the important points of the paper. Where appropriate, you may program the model, and provide illustrations of the main ideas. Of course, using related material, and building around the central ideas of the paper will be rewarded. Time permitting, you may present the material to the class.

The grade for the project will be determined in large part by your ability to convey the important messages of the paper.

Class Schedule

Below is an outline that covers the basic topics that we will consider. The exact topics may vary according to the interests of the class. For example, some of the topics in Modules 4 and 6 could occupy substantial time.

Module 1: Applications of Option Pricing Theory in Pricing Financial Claims

- The Black Scholes Model Revisited
- The Compound Option Model of Geske
- Pricing Convertible Bonds
- Pricing Subordinated Debt
- Pricing Deposit Insurance

Module 2: Pricing Interest Rate Sensitive Claims

- Interest Rate Claims and Heath Jarrow Morton Models (see my notes)
- Special Volatility Structures
- Multi-factor Markovian Interest Rate Models
- Market Based Models
- GARCH Interest Rate Models

Module 3: Credit Derivatives

- Ito's Lemma for Jump processes and Markov Chains
- Reduced Form Models for Credit Derivatives including Jarrow-Turnbull, Duffie Singleton, Madan-Unal Models
- Pricing Special Credit Derivative Products.
- Applications

Module 4: Real Options

- The option to wait
- The option to expand and shut down
- Options, Options, everywhere!
- Applications of Option Pricing Theory in Capital Budgeting
- Option Pricing Under Asymmetric Information
- Options in Supply Chains.

Module 5: Game Theory and Option Pricing

- Moral Hazard and Option pricing
- Capital Structure Issues with Option Models
- Deposit Insurance Revisited
- Inventory Options in Supply Chains
- Applications

Module 6: Special Topics

- Advanced Pricing Methods for American Claims
- Numerical Procedures for Pricing
- Pricing Exotic Options
- Stochastic Volatility Models

Module 7: Student Paper Presentations