Finance 4480 - Derivatives Markets

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- **Course Location:** BUS 605
- **Course Time:** TR 12:00 - 1:15 PM
- **Course Dates:** January 7 - May 1, 2015
- **Course Room:** Engineering Laboratory 248

Course Description

This course is an introduction to derivative securities, the markets in which they trade, theoretical models for obtaining rational prices for them, and their applications in hedging and speculation. Derivatives are an advanced finance topic. At one time, a course in derivatives was considered a specialized elective, but is now considered mandatory in any finance major. Our topic is by nature an analytical one that will require a good deal of mathematics and quantitative reasoning. However, we will seek a balance between the theoretical presentation of the material and a practical implementation. The skill set necessary to effectively implement modern financial derivative pricing models is a crucial one to have for those seeking a job in the finance industry.

Course Objectives

- Learn fundamental principles and theories.
  - Learn what derivatives are and their basic vocabulary.
  - Learn how derivatives markets operate and the institutional features of the markets in which they trade.
  - Learn the principles of modern financial economic theory explaining how derivative securities are priced.
- Learn to apply course materials
  - Learn a framework for corporations, individuals, and other organizations to determine how and when to use derivative securities for hedging and speculation.
  - Learn to implement derivative pricing models for applications in hedging and speculation.
- Developing specific skills, competencies and points of view needed by professionals in the finance industry and in academic finance.
  - Learn the basics of Python programming for purposes of financial modeling.

Python Programming

One unique objective of this course is to learn the basics of Python programming for financial modeling. I have found that programming financial models is an extremely helpful pedagogical tool for learning financial theory. In addition, I have found that my past students have benefited very much from learning some basic programming skills.

We will be mainly using two different tools for Python:

- The Sage Math Cloud, which I will refer to henceforth as (SMC). This is a free computing service offered by The University of Washington in partnership with Google. Please create an account as soon as possible.
- The Anaconda edition of Python by Continuum Analytics. This will have everything that we will need preinstalled. Please install the version that comes with Python 3. It is completely free.

Python is a very good choice for a programming language for this course. As a programming language, Python is fairly easy to learn and can be put to productive use very quickly. Python is quickly becoming the de facto scripting language for scientific computing, and is widely used in the finance industry. Programming will be used as a tool to reinforce learning about derivatives and how they are priced, it will not be the main focus of the course. The amount of programming that you will be required to learn is quite modest. Nevertheless, I cannot emphasize enough how important these skills are for a student of finance to be competitive in the labor market.

Linux/UNIX

I also **highly** recomment that you learn a little about the UNIX command line as well. I will be covering some basic material about UNIX in the course, and will use if heavily myself. The SMC is basically a free linux computer in the cloud so you will have access to everything you need to get by. Your grade will not depend on this material at all, but you will find it a very helpful addtion to your skill set.

Textbook

The *required* textbook for the course is *Fundamentals of Derivatives Markets* by Robert L. McDonald.

In addition, I will follow the book *Python for Data Analysis*, in my presentation of the Python programming language. This book is **not** required, but it is

strongly suggested for those who have never programmed before. You may choose to purchase the ebook in PDF format from the publisher O'Reilly.

Those with anxiety about learning to program may also benefit from a more introductory Python programming book. I can suggest two different books, though again neither is required.

- *Python Programming for the Absolute Beginner, 3rd Edition*
- *Practical Programming, 2nd Edition*

While the first book doesn't have a very serious subject (simple computer games) the programming taught is *serious* programming and it is taught in a way that takes away some of the intimidation associated with other beginning programming books. I highly recommend it!

Grading

The grade that you will earn will be determined from your ranking in the class based on the weighted total points accumulated on class preparation and particaption, a class project, as well as on exams. There is no predetermined percentage of the class that will earn an A or that will fail. If you all do excellent work you will all earn exceptional grades. The weights given to each part of the class are as follows:

Class Preparation & Participation (20%)

This portion of your grade will be determined by your preparation for class lectures, your participation in class discussions and the completion of homework assignments. Homework assignments will be given approximately every Thursday and will be due a week later. I will drop your lowest assignment and replace it with the average of the others if you hand all assignments in with full effort. Participation in class is crucial!

Class Projects (40%)

This portion of your grade will be determined by a class project. The project will consist of a computational modeling exercise. You can work in teams of two. Potential topics will be discussed in class, but here are some suggestions:

- Monte Carlo pricing of an exotic option such as Asian option
- Monte Carlo estimation of hedging strategies
- Monte Carlo pricing of a swaption
- Monte Carlo pricing of an option subject to stochastic volatility
- Monte Carlo pricing of an option subject to price jumps
- Monte Carlo evaluation of the Stutzer pricing methodology

Exams (40%)

This portion of your grade will be determined by your performance on the midterm and final exams. I will calculate your grade two ways:

- The total of your two exam scores
- Drop the midterm exam and place all of the weight on the final

Your grade will be determined by which ever method gives you the highest total points.

Topics (Subject to Change)

Week	Lecture Topic	Book Sections
1	Intro to Derivatives & Python Basics	Chp 1 (FDM) / Appendix (PFDA)
2	Probability Review I	Handout notes
3	An Intro to Derivatives & Forwards and Futures	Chp 2 & Chp 3 (FMD)
4	Futures Markets, Pricing, and Hedging	Chp 6 (FDM) & Handout notes
5	Swaps	Chp 8 (FDM)
6	Midterm Exam & Introduction to Options	Chp 9 (FDM)
7	Probability Review II	Handout Notes
8	The Binomial Model & Python Implementation	Chp 10 (FDM)
9	The Black-Scholes Model & Python Implementation	Chp 11 (FDM)
10	Monte Carlo Option Pricing	Handout notes
11	Monte Carlo continued	
12	Exotic Options	Handout notes
13	Real Options	Chp 14 (FDM)
14	Project Presentations	
15	Review and Final Exam	

Important Dates:

- **Feb 17** - Monday Schedule
- **Mar 9 - 13** - Spring Break
- **Apr 24** - Last Day of Classes
- **Apr 28** - Final Exam