

Math 194

The Mathematics of Finance

Winter 2024

In this course we examine the mathematics of some of the basic *derivative securities* encountered in financial markets. A prototype for such a derivative is the *European put option*, which is a contract giving its owner the right (but not the obligation) to sell a share of a specific stock at a fixed price (the *strike price*) on a fixed date. The buying of such an option provides the owner with a hedge against some of the risk associated with owning the stock—if on the fixed date the price of the stock exceeds the strike price, the option is worthless, but if the stock price falls below the strike price, the owner can exercise the option and sell the stock at a better-than-market price. Economists R. Merton and M. Scholes won the Nobel Prize for their work on pricing such European put (and call) options, when the stock price is modeled by an exponential Brownian motion. (Scholes' collaborator F. Black died before the Nobel was awarded; Merton refined and extended the early work of Black and Scholes.)

In this course we will study a discrete version of the Black-Scholes-Merton (BSM) model, the Cox-Ross-Rubinstein (CRR) model. The mathematics of the CRR model is simpler than that needed for the BSM model, but all of the key ideas necessary for the analysis are present in our study of the CRR model. The model and its analysis are based on probability theory learned in Math 180A, and will also make use of linear algebra (Math 18) and differential equations (Math 20D) learned in prerequisite courses.

- We will be using the first three chapters of the text *Introduction to the Mathematics of Finance* by R.J. Williams.
 - Lectures will be on Monday, Wednesday and Friday, from 2:00 PM to 2:50 PM, in HSS 1330.
 - Discussion sections with your TA meet on Fridays according to the following schedule:
 - **Section A01:** 4 to 4:50 PM, APM B402A
 - **Section A02:** 5 to 5:50 PM, APM B402A
 - **Section A03:** 6 to 6:50 PM, APM B402A
 - **Section A04:** 7 to 7:50 PM, APM B402A
 - Your course grade will be based on your performance on the two midterm exams and the final exam. These exams will be weighted as follows:
 - Midterm 1: 25%
 - Midterm 2: 25%
 - Final: 35%
- You will have the option of substituting your final exam score for *one* of your midterm scores.
- There will be NO MAKEUP EXAMS given.

- In addition there will be weekly homework assignments which in total will account for the remaining 15% of your grade. The assignments will be posted on this website and on CANVAS; the solutions will be posted on CANVAS only. Your solutions should be clear and cogent, and neatly presented. These assignments will be due (typically) on Thursdays.
- You will be submitting your homework assignments through GRADESCOPE at <https://gradescope.com>.
 - Your login is your university email address, and your password can be changed (or set) at https://gradescope.com/password_resets/new.
 - Your homework solutions should be in a single pdf file before being uploaded, or as a picture for each question.
 - Please make sure your files are legible before submitting them — unreadable solutions will not earn credit.
 - Most word processors can save files as a pdf.
 - There are many tools to combine pdfs, such as <http://www.pdfmerge.com/>, and others for turning jpgs into pdfs, such as <http://jpg2pdf.com>.
- The midterm exams will be given in class on February 2 and March 1 (Friday of fourth and eighth weeks).
- The final exam is scheduled for Monday, March 18, from 3 PM to 6 PM.
- The +/− grading system will be used for course grades.
- TURN OFF cell phones in lecture, discussion sections, and exams.
- **Academic Integrity** is highly valued at UCSD and academic dishonesty is considered a serious offense. Occurrences of academic dishonesty will be reported to the Academic Integrity Office. Students involved in an academic integrity violation will face administrative sanctions which may include suspension or, in very serious cases, expulsion from the university. Cultivate and protect your academic integrity! For more about academic integrity and its value, visit <https://academicintegrity.ucsd.edu>.

Instructor: P. Fitzsimmons, Office: AP&M' 5715, email: pfitzsimmons@ucsd.edu, Phone: 534-2898, Office hours: MWF 10-11 AM, or by appointment.

TAs:

Chuqing Shi (Sections A01 and A02), Office: AP&M 2313, email: chs139@ucsd.edu, Office hours: MW 4-5 PM, Th 10-12 AM

Chase Wilson (Sections A03 and A04), Office AP&M' 5712, email: c7wilson@ucsd.edu, Office hours: MW 12-1 PM, TTh 11 AM - Noon
