

ECES 490: Special Topics: Financial Engineering II: Monte-Carlo methods for option pricing (Winter, 2011)

Class locations and times

Instructor	Steven Weber (Dept. of ECE)
Instructor email	sweber@ece.drexel.edu
Lecture times	9-9:50am on Monday, Wednesday, Friday
Lecture room	Bossone 616
Instructor office hour	Thursdays 9am (Bossone 211)

Description

Covers option pricing with a mathematical and computational focus. The specific goal is to employ Monte Carlo methods to price exotic options. Specific topics include:

- Chapter 10: Forwards, futures, and swaps: forward contracts/prices/values, future contracts/prices, hedging
- Chapter 11: Models of asset dynamics: binomial lattice model, lognormal random variables, Wiener processes, Ito's lemma
- Chapter 12: Basic options theory: put-call parity, single and multi-period models, risk-neutral pricing
- Chapter 13: Additional options topics: Black-Scholes equation, risk-neutral valuation, replication, exotic options, martingale pricing
- Probability review: expectation and the law of large numbers, point estimates and confidence intervals
- The Monte-Carlo simulation/estimation paradigm
- Techniques for generating random variables with specified distributions
- Variance reduction techniques: control and antithetic variables, stratified sampling, importance sampling
- Pricing exotic options by Monte Carlo

Textbook: *Investment science*, D. G. Luenberger, Oxford University Press, 1998.

Supplemental resources:

- *Simulation, 4th ed.*, S. M. Ross, Academic Press, 2006.
- *An elementary introduction to mathematical finance, 2nd ed.*, S. M. Ross, Cambridge University Press, 2003.

Course logistics

- Website
 - We will use Drexel's **BB/Vista** course management website for this class extensively.
 - I will mail you important information regarding the class through this system. Please make sure you setup the system to forward BB/Vista emails to an account you check regularly.
 - Lecture notes, homework, solutions, etc. will be posted on the main course page, grouped by week.
 - The gradebook will hold your homework and midterm exam scores.

- Lectures
 - **Partial** lecture notes will be posted on the website **after** the lecture.
 - Website will indicate what sections of the book each lecture covered.
 - **Please** ask questions. If you are confused, then there is a very good chance someone else in the class is confused as well. Without questions I have little insight regarding class comprehension.
 - **Laptops** are not to be used during lecture without prior approval by the instructor. **Cell phones** are to be turned off or put in silent mode.
- Homework
 - HW is due **in class** one week after it is assigned.
 - HW may be handed in up to one week after the due date at a 50% penalty.
- Midterm and final exam
 - There will be a midterm exam on TBA
 - There will be a final exam on TBA. The final exam is mandatory for all students.
 - The final exam is comprehensive, it will cover the entire course, but with an emphasis on the material since the midterm exam.
 - Exams will consist of problems for you to solve that are similar to or extensions of homework problems.
 - Exams are closed-book and closed notes. You are allowed to bring in one 8.5×11 inch page with notes on the front and back. This sheet of paper will be collected along with your exam.
 - I **strongly** prefer not to reschedule final exams. If you have a compelling case you should give me as much notice as possible. Rescheduling requests will be reviewed on a case by case basis.
- Office hours
 - Office hours are available to you each week on Thursdays 9-10am.
 - Please come to office hours. Office hours are often a very under-utilized resource.

Grading

Homework	40%
Midterm Exam	30%
Final Exam	30%

Your course letter grade will be assigned as follows:

95	100	A
90	94	A-
87	89	B+
83	86	B
80	82	B-
77	79	C+
73	76	C
70	72	C-
65	69	D+
60	64	D
0	59	F

Academic Dishonesty

The Drexel University policy on academic dishonesty will be strictly enforced. Plagiarism, fabrication, and cheating will, at the discretion of the instructor, constitute grounds for failure of the course.

Course calendar

Day	Date	Lecture	Topic	HW due	HW assigned
M	1/3	Lecture1M	Course logistics		
W	1/5	Lecture1W	Chapter 10		
F	1/7	Lecture1F	Chapter 10		HW1 assigned
M	1/10	Lecture2M	Chapter 11		
W	1/12	Lecture2W	Chapter 11		
F	1/14	Lecture2F	Chapter 11	HW1 due	HW2 assigned
M	1/17	NO CLASS (MLK Day)			
W	1/19	Lecture3W	Chapter 12		
F	1/21	Lecture3F	Chapter 12	HW2 due	HW3 assigned
M	1/24	Lecture4M	Chapter 12		
W	1/26	NO CLASS			
F	1/28	Lecture4F	Chapter 12	HW3 due	HW4 assigned
M	1/31	Lecture5M	Chapter 13		
W	2/2	NO CLASS			
F	2/4	Lecture5F	Chapter 13	HW4 due	HW5 assigned
M	2/7	NO CLASS			
W	2/9	NO CLASS			
F	2/11	MIDTERM EXAM			
M	2/14	Lecture7M	Monte Carlo overview		
W	2/16	Lecture7W	Monte Carlo overview		
F	2/18	Lecture7F	Monte Carlo overview	HW5 due	HW7 assigned
M	2/21	Lecture8M	Generating rvs		
W	2/23	Lecture8W	Generating rvs		
F	2/25	Lecture8F	Generating rvs	HW7 due	HW8 assigned
M	2/28	Lecture9M	Variance reduction		
W	3/2	Lecture9W	Variance reduction		
F	3/4	Lecture9F	Variance reduction	HW8 due	HW9 assigned
M	3/7	Lecture10M	Monte Carlo option pricing		
W	3/9	Lecture10W	Monte Carlo option pricing		
F	3/11	Lecture10F	Monte Carlo option pricing	HW9 due	