Math 565 Monte Carlo Methods in Finance

Course Description from Bulletin: In addition to the theoretical constructs in financial mathematics, there are also a range of computational/simulation techniques that allow for the numerical evaluation of a wide range of financial securities. This course will introduce the student to some such simulation techniques, known as Monte Carlo methods, with focus on applications in financial risk management. Monte Carlo and Quasi Monte Carlo techniques are computational sampling methods which track the behavior of the underlying securities in an option or portfolio and determine the derivative's value by taking the expected value of the discounted payoffs at maturity. Recent developments with parallel programming techniques and computer clusters have made these methods widespread in the finance industry. (3-0-3).

Enrollment: Graduate elective

Textbook(s): Paul Jaeckel, *Monte Carlo Methods in Finance*, Wiley and Sons
Paul Glasserman, *Monte Carlo Methods for Financial Engineering*, 1st ed., Springer

Other required material: None

Prerequisites: MATH 474

Objectives:

1. Students will understand the basics of Monte Carlo and Quasi-Monte Carlo Methods.
2. Students will understand how these methods are used for financial computations and as derivative parity.
3. Students will understand how to assess the performance of Monte Carlo methods and improve their effectiveness.
4. Students will understand basic implementation issues in performing Monte Carlo calculations.

Lecture schedule: 2 75 minute lectures

Course Outline:	Hours
1. Introduction	3
a. What is a Monte Carlo method?	
b. Why are Monte Carlo methods useful in finance?	
2. General asset sample path	6
a. Pseudo-Random numbers	
b. Random vectors with different distributions	
3. Option pricing	12
a. Asian options	
b. American options	
c. Error estimation	
4. Enhancing efficiency	15
a. Variance reduction techniques	

b. Quasi-Monte Carlo methods
c. Parallel Computing

5. Selected topics 9

Assessment:	Homework	25%
	Computer Programs/Project	25%
	Final Exam	50%

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Date: 12/17/05