

**Fall 2004: IEOR E4703 Monte Carlo Simulation
Columbia University**

Syllabus and Course Logistics

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Course Website: www.columbia.edu/~mh2078/MCS04.html

Class Time: Wednesdays: 4.10pm to 6.40pm

Location: Mudd 535

Prerequisites

1. SIEO W4606: Stochastic Processes for Financial Engineering
2. IEOR E4007: Optimization Models and Methods for Financial Engineering

Textbooks There are no required textbooks for the class as course notes will be provided. Useful references include

1. *Simulation* (Harcourt Academic Press) by Sheldon Ross.
2. *Monte Carlo Methods in Financial Engineering* (Springer) by Paul Glasserman.

Assignments

There will be 6 to 8 assignments, due in class one week after they have been assigned. Late assignments will NOT be accepted! Students are welcome to work together on the assignments but each student MUST write up his or her own solution.

Exams

A midterm exam will be held on October 27th and the final examination will PROBABLY be held in finals week. Any student who is unable to take an exam must have a very good reason for doing so, e.g., a medical emergency. Such students will take a makeup exam that will be MORE difficult than the regular exam!

Exam regrades may be requested by:

1. Explaining in a written statement why you think you should obtain more marks.

2. Submitting this statement and the exam to either the TA or course instructor no later than one week after the exam was returned to the class. (This means that if you failed to collect your exam within a week of it being returned to the class, then you cannot request a regrade!)

It should be kept in mind that when a regrade is requested the entire exam will be regraded and it is possible that your overall mark could go down as well as up. We will also photocopy a subset of the exams before returning them to the class. This is intended to deter the very few people (hopefully there are no such people in this class!) who might be tempted to rewrite parts of their exams before requesting a regrade.

Grading

An *approximate* overall grading scheme is: Assignments 10%, Midterm 35%, Final 55%.

Syllabus and Tentative Course Schedule

- Lecture 1: Overview of MCS; Review of probability; Introduction to Matlab
- Lecture 2: Generating univariate random variables
- Lecture 3: Generating univariate random variables
- Lecture 4: Generating normal random variables; Simulating stochastic processes
- Lecture 5: Generating correlated random variables and stochastic processes
- Lecture 6: Output analysis and run-length control
- Lecture 7: Common random variables; Control variates
- Lecture 8: Antithetic variates; Conditional Monte Carlo
- Lecture 9: Stratified sampling
- Lecture 10: Importance sampling
- Lecture 11: Simulating stochastic differential equations
- Lecture 12: Pricing American options using simulation
- Lecture 13: To be decided

Most of the applications in this course will be from financial engineering. Sometimes, however, non-financial applications will be used to emphasize how Monte Carlo simulation may be applied in many fields.