Course Overview

Monte Carlo simulation is a wide scope of computational algorithms that rely on recurrent random sampling from some distribution to obtain numerical results. They are often used in quantitative, mathematical, and physical problems and are most useful when dealing with problems which are difficult or not possible to use any other methods.

Monte Carlo methods are used in generating samples/draws from a probability distribution, numerical integration, optimization, and more. The computational platform for the course will be Python/R/Matlab.

Prerequisites:
Core courses in the first semester of MSFE should be sufficient.

Textbook:
There are no required textbooks for the course, recommended textbooks are:
- Monte Carlo methods in finance (J. Wiley) by Peter Jackel
- Simulation (Academic Press) by Sheldon M. Ross
- Monte Carlo Methods in Financial Engineering (Springer) by Paul Glasserman
- Computational Methods in Finance (Chapman & Hall/CRC) by Ali Hirsa (Chapters 6 & 8)

Required Work and Grading Policy:
Assignments: 7/8 assignments
Exams: midterm & final
Grading is based the following weighting schemes (subject to change):
30% assignments, 30% midterm, 40% final exam

Statement of academic integrity:
Students are allowed to collaborate on assignments however, they are not allowed to copy one another’s work/code. The work/code should be your own. If students are caught copying, all participants would receive zero for that assignment. Use of online sources are allowed with proper citation.
In-Class examination is closed book, closed notes, no cell phone, or a calculator. During the examination students should have their area clear of any notes/materials (including cell phones) otherwise it would constitute as cheating and would receive zero for the final grade.

Class Outline (subject to change):

Generating random numbers

Sampling from various different distributions

Output analysis

Variance reduction techniques

Estimating greeks via Monte-Carlo

Simulating stochastic differential equations (SDEs)

Markov Chain Monte-Carlo (MCMC) methods including Metropolis-Hastings and Gibbs sampling

Quasi Monte-Carlo and low discrepancy sequences (LDS)

Particle filtering (PF)

Optimization using Monte Carlo