IEOR4404 Fall 2025 Simulation

Instructor
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Teaching Assistants
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Lectures
Time: Tue, Thu 4:10-5:25pm
Location: Mudd 833

Recitations
Time: TBA
Location: TBA

Prerequisites
Understanding of basic probability. Basic knowledge of programming, statistics and stochastic processes will be helpful.

Textbook
The main reference textbook is *Simulation* by Sheldon M. Ross (5^{th} edition) (Available online in the library/ScienceDirect).

Course Summary
Simulation, or the Monte Carlo method, is a widely used tool in engineering and management that span many applications in service, technology and finance. Modern stochastic models used to describe system behaviors and to make decisions are often too complex to be analyzed mathematically. Instead, advances in computer technology give us the means to analyze these models. This is done precisely by simulation, namely encoding these models via computer programs and random trajectory generation.

This course introduces the foundation of simulation. Upon reviewing basic background in probability, we study the generation of random objects (variables, vectors, processes), the analysis of simulation outputs using statistical tools, system simulation, and techniques to improve the efficiency of simulation runs.

Topics covered
Topics roughly include:

- Review of probability
- Generating random variables and vectors
- Output analysis
- Discrete-event and stochastic process simulation
- Variance reduction
- Additional topics (e.g., Markov Chain Monte Carlo), if time permits

Grading
Homework (20%)
Midterm (40%)
Final (40%)

Course Components
Homework:

- Weekly, usually due on Friday midnight, submitted online in canvas.
- No late assignment is accepted. However, the two lowest scored assignments will be dropped from calculation in the final grade.
- Discussion among students on the assignments is allowed. However, every student must complete the assignments on his/her own.

Midterm:

- Date and time: Oct 16 (Thu) lecture time
- Closed-book, but you are allowed to bring one sheet (two pages) of notes

Final:

- Date and time: Dec 4 (Thu) lecture time
- The final exam is non-cumulative and covers only materials after the midterm.
- Closed-book, but you are allowed to bring two sheets (four pages) of notes