

Class time and place: Tu. & Thur. 11:00 – 12:15 Hanes 130

Instructor: Chuanshu Ji Hanes 301 962-3917 cji@email.unc.edu

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References: No textbook, just a few references for now, more later ...

- *Monte Carlo Statistical Methods (2nd edition)*, Christian Robert & George Casella (2004 Springer)
- *Simulation (5th edition)*, Sheldon Ross (2012 Academic Press) — a concise coverage on basic topics, less on MCMC.
- *Monte Carlo Strategies in Scientific Computing*, Jun Liu (2008 Springer) — highlighting important theoretical and computational issues, also including a broad range of examples in many scientific areas.
- *Monte Carlo Methods in Financial Engineering*, Paul Glasserman (2003 Springer) — although focusing on financial applications, it also contains careful treatments of many general issues, especially for simulating various stochastic processes.
- *Handbook of Markov Chain Monte Carlo*, edited by Steve Brooks et al (2011 Chapman & Hall) — a comprehensive collection of modern MCMC related topics.

Requirement: Every participant is to give a presentation and write a short report.

Tentative plan:

- Part 1: Introduction to Monte Carlo — pros and cons of Monte Carlo methods; how to generate random variables and stochastic processes; variance reduction; output analysis; etc.
- Part 2: Basic elements of MCMC — the need for MCMC; Metropolis-Hastings dynamics and the Gibbs sampler; Markov chain convergence rates via spectral analysis and practical diagnostics; some MCMC optimization; etc.
- Part 3: Other selected topics (depending on the available time) — sequential importance sampling (SIS) and particle filters; perfect sampling; applications in statistics, physics, engineering, biology, economics/finance, etc. (more likely through class presentations)