MATH 7685-8685: Simulation and Statistical Computing
Spring, 2020
TR 2:40-4:05pm (DH231)
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Office Hours:

TR 10am-11:30am (DH219) or by appointment (O) 901-678-3134, email: `lihdeng@memphis.edu`.

Course Contents:

1. R and High-Performance Computing
2. Random Variable Generation
3. Monte Carlo Integration
4. Monte Carlo Optimization
5. Metropolis Hastings Algorithms
6. Gibbs Samplers
7. Monitoring and Adaptation for MCMC Algorithms

Textbook Used:

Introducing Monte Carlo Methods with R (Use R!), by Christian P. Robert and George Casella (2010) Publisher: Springer, ISBN-13: 978-1441915757 ISBN-10: 1441915753

Software Used:

R will be the major program used symbolic program such as MAPLE/Mathematica/Sage is recommended for this course.

Grading:

Midterm exam or Class Project	25%
Homework (program or written)	20%
Class Participation	15%
Final Exam (Project)	40%

Detailed List of Topics

1. Random Variable Generation
    (a) Uniform simulation
    (b) The inverse transform
    (c) General transformation methods
    (d) A normal generator
    (e) Discrete distributions
    (f) Mixture representations
    (g) Accept reject methods
2. Monte Carlo Integration
    (a) Classical Monte Carlo integration
    (b) Importance sampling
3. Monte Carlo Optimization
    (a) Stochastic gradient methods
    (b) Simulated annealing
    (c) The EM algorithm
    (d) Monte Carlo EM
4. Metropolis Hastings Algorithms
    (a) A peek at Markov chain theory
    (b) Basic Metropolis Hastings algorithms
    (c) A generic Markov chain Monte Carlo algorithm
    (d) The independent Metropolis Hastings algorithm
    (e) Acceptance rates
5. Gibbs Samplers
    (a) The two-stage Gibbs sampler
    (b) The multistage Gibbs sampler
    (c) Missing data and latent variables
    (d) Hierarchical structures
6. Monitoring and Adaptation for MCMC Algorithms
    (a) Monitoring convergence to stationarity
    (b) Monitoring convergence of averages
    (c) Adaptive MCMC