

STA 6934: Monte Carlo Statistical Methods

Spring 2008

Professor George Casella

Griffin-Floyd 225

casella@ufl.edu

Credits: 3

Co-requisite: STA 6327 or permission of instructor.

Teaching Assistant: Ritao Liu

rliu@stat.ufl.edu

Lecture and office hours Lectures: MWF Period 5: 11:45-12:35,
Griffin- Floyd 230

Office Hours: To be announced

Textbook *Monte Carlo Statistical Methods, Second Edition*, Robert
and Casella.

Course Web Page

The web page for the course is

<http://www.stat.ufl.edu/casella/MCSM08/>

All important information will be posted there, including assignments
and solutions.

**There will be no class Friday January 11 (Winter Workshop),
Monday January 14, Wednesday January 16 (Casella at NSF),
Monday January 21 (MLK Day). I will try to find a time to
make up the missed classes.**

Course Notes Portions of this material have been taught as a short
course over the years. There are 289 slides that I will be showing
in class, but they will be supplemented, with much of the underlying
theory done on the board. You can download the slides if you wish,
and have them to take notes on. There are two versions available on
the web page. One is formatted as slides, and in the other the slides
are smaller with a lot of room to write.

Homework

First Assignment Due Wednesday January 23, 2008.

There is a conference here at UF on Objective Bayesian Model Selection Friday and Saturday January 11-12. For information and program go to <http://www.stat.ufl.edu/> and follow the links to UF Winter Workshop.

You are required to go to one talk (of your choice) and write a short summary (no more than one page). I do not expect you to understand all of the material presented - just do your best. *Do not merely copy the abstract!!!! That will be worth no points.*

Homework There will be seven homework assignments (plus the WW writeup). Due dates are given on the schedule below. Everyone is expected to do every problem that is assigned.

I would like to encourage you to hand in your assignments in Latex, to get you more familiar with it. Latex is available as a free download from <http://www.miktex.org/>.

Each HW problem will be graded on a scale of 0-4. Homework is due in the TA mailbox by 5pm of the due date. If your homework is late it will be graded on a scale of 1-3.

Computing

Throughout the course there will be examples and assignments requiring computing. I will typically illustrate things using R (available as a free download from <http://www.r-project.org/>). I will also use WinBugs, which is also free from <http://www.mrc-bsu.cam.ac.uk/bugs/>. You are expected to learn both of these programs

Exams

- Midterm: Tuesday March 4, Evening
- Final Exam: Wednesday April 30, 5:30-7:30pm

All exams are closed book exams. The exams will consist of 4-6 problems, one of which you have seen before (if you do the homework). Any requested formula will be provided.

Project

There will also be a project. These will be individual projects, and can be of your own choosing. For example, you might do

- A data analysis using a Monte Carlo method
- A critical review of a paper that uses a Monte Carlo method
- A report on a Monte Carlo method not covered in class
- Something of your choosing

I will be available to discuss possibilities and alternatives.

A one-page outline of your project is due March 28

-The final project report, in Latex or Word, not to exceed 5 pages, is due Monday April 28 at 5pm.

Grades

- Homework: 40%
- Midterm : 15%
- One-page outline: 5% (0% if late)
- Final Project: 20%
- Final Exam: 20%

Outline →

Outline

We will cover as much of the textbook as we can.

Chapter	Title	Contents
1	Introduction	Review of Basic Methodology
2	Random Variable Generation	Generating uniform random variables, transformation methods, accept-reject
3	Monte Carlo Integration	Classical, importance sampling, and others
5	Monte Carlo Optimization	EM and related algorithms
6	Markov Chains	Basic theory needed for the next four chapters
7	The Metropolis Hastings Algorithm	The basic M-H algorithm and many variations
8	The Slice Sampler	A first Gibbs sampler
9	The Two-Stage Gibbs Sampler	The basic Gibbs sampler and many variations
10	The Multi-Stage Gibbs Sampler	The workhorse; hierarchical models, etc.
12	Diagnosing Convergence	Methods for detecting convergence of a Markov chain

Schedule

The last page contains a tentative schedule. You are responsible for knowing when assignments are due and when exams are coming!!!

W Starting	Tentative Topic	Monday	Wednesday	Friday	Comments
1/7/2008	1:Review of Basic Methodolog			No Class - go to Workshop	
4-Jan	1:Review of Basic Methodolog	No Class- NSF	No Class- NSF		
11-Jan	2:Random Variable Generation	No Class- MLK	HW1 Due		
18-Jan	3:Monte Carlo Integration				
1-Feb	3:Monte Carlo Integration		HW2 Due		
1-Feb	5:Monte Carlo Optimization				
8-Feb	6:Markov Chains		HW3 Due		
5-Feb	7:The Metropolis Hastings Algorithm				
1-Mar	7:The Metropolis Hastings Algorithm			HW4 Due	Midterm - Tuesday March 4
10-Mar		Spring Break	Spring Break	Spring Break	
7-Mar	8:The Slice Sampler				
4-Mar	9:The Two-Stage Gibbs Sample		HW5 Due		Project Outline Due - Friday March 28
1-Mar	9:The Two-Stage Gibbs Sample				
1-Apr	10:The Multi-Stage Gibbs Sampler		HW6 Due		
4-Apr	10:The Multi-Stage Gibbs Sampler				
1-Apr	12:Diagnosing Convergence		Last Day of Class HW 7 Due		Project Due - Monday April 28
Final Exam - Wednesday April 30 5:30pm					
Homework Schedule					
		Assigned	Due		
	HW1	Mon 1/7	Weds 1/23		
	HW2	Mon 1/28	Weds 1/30		
	HW3	Mon 2/11	Weds 2/20		
	HW4	Mon 2/25	Weds 3/5		
	HW5	Mon 3/17	Weds 3/26		
	HW6	Mon 3/31	Weds 4/9		
	HW7	Mon 4/14	Weds 4/23		