

Bayesian Analysis, 22S:238

Spring 2010

1 General Information

Instructors:	Kate Cowles 374 SH 335-0727 kcowles@stat.uiowa.edu	Aixin Tan 259 SH 335-0821 aixtan@stat.uiowa.edu
Office hours:	T 1:30 - 2:20 p.m. W 12:30 - 1:20 p.m. Th 1:30 - 2:20 p.m.	M 2:30 - 3:20 p.m. W 2:30 - 3:20 p.m. F 2:30 - 3:20 p.m.

Please feel free to make appointments to see us outside of office hours, and to send us questions by e-mail.

Department:	Statistics and Actuarial Science, 241 SH
DEO:	Luke Tierney, 241 SH, 335-0712
Lectures:	M, W, F 11:30 - 12:20 150 SH
Web page:	www.stat.uiowa.edu/kc_at/s238_2010 Lecture notes, homework assignments, datasets, etc. will be posted on the web page.
Textbook:	D. Gamerman and H. Lopes, <i>Markov Chain Monte Carlo</i> 2nd ed., Chapman & Hall/CRC, 2006
Also required:	C. Robert, <i>The Bayesian Choice</i> Available online infohawk.uiowa.edu

2 Course goals and objectives

- To introduce the theoretical foundations of Bayesian statistical inference, with emphasis on the Bayesian way of thinking and decision making.
- To present theoretical and practical aspects of Bayesian computational methods. A main focus is on various Markov chain Monte Carlo (MCMC) algorithms, their application in hierarchical models, dynamic models, spatial models, as well as reliable and effective implementation of these computational methods.

3 Evaluation of students

3.1 Homework

Six or seven homework assignments, each likely to include both theoretical and computational problems, will be assigned during the semester. Assignments will be posted on the course web page under “Handouts.” Homework usually will be submitted electronically.

Each homework assignment will be graded on a pass/fail basis. All students will be expected to work all problems on each assignment. However, each student will be responsible for preparation of a formal solution to one problem. These formal solutions will be posted for all students.

Late homework will not be accepted except as required by university policy, i.e. because of “illness, mandatory religious obligations, or other unavoidable circumstances or University activities.”

3.2 Projects

Each student must complete a class project on a topic of his/her choice involving Bayesian theory, Bayesian methodology, and/or Bayesian computation. The project should represent roughly 20 hours of new work (distinct from things you have done or are doing for other courses, your thesis, etc.)

Projects will be carried out in two phases.

- Project proposal (due Fri Mar 26)

This is a detailed description of what you plan to do, including question(s) to be addressed, dataset to be used (if any), methods and software to be applied, etc. It should be a maximum of 2 pages in length, including references.

- Project final report (papers or presentation materials must be submitted electronically by Mon May 3)

Projects must be finalized in a form that can be shared with the entire class, such as:

- posting a paper on the course web page
- giving an oral presentation with overheads, slides, or computer images

Final papers should be 4-6 pages in length, not including tables, figures, references, and other appendices. Presentations should be approximately 20 minutes in length.

You are welcome to present your project earlier in the semester instead of during the last week of classes, especially if your topic fits in well with lecture topics. Make arrangements with the instructors if you wish to do this.

3.3 Exams

There will be one 1-hour midterm exam and one comprehensive 2-hour final. Exams are open book and open notes. Missed exams may be made up only with documentation of reasons required by university policy (see “Late Homework” above).

Exam dates and times:

Midterm	Fri. 3/12	in class
Final	Wed. 5/12	9:45 a.m.

3.4 Grading

The course components will be weighted as follows:

Homework	20 %
Midterm	20 %
Project	20 %
Final	40 %

Grading will be on a curve, with +/- grades used. A grade of A+ represents exceptional work and rarely is awarded.

4 Campus Wide Flu Like Illness Classroom Absence Policy

The University of Iowa has cancelled the special policy regarding flu-like illness. In order to make up work missed due to illness, you must submit medical documentation.

5 College of Liberal Arts and Sciences: Policies and Procedures

5.1 Administrative Home of the Course

The administrative home of this course is the College of Liberal Arts and Sciences, which governs academic matters relating to the course such as the add/drop deadlines, the second-grade-only option, issues concerning academic fraud or academic probation, and how credits are applied for various graduation requirements. Different colleges might have different policies. If you have questions about these or other CLAS policies, visit your academic advisor or 120 Schaeffer Hall and speak with the staff. The CLAS Academic Handbook also contains important CLAS academic policies:

www.clas.uiowa.edu/students/academic_handbook/index.shtml

5.2 Electronic Communication

University policy specifies that students are responsible for all official correspondences sent to their University of Iowa e-mail address (@uiowa.edu). Faculty and students should use this account for correspondences. (Operations Manual, III.15.2. Scroll down to k.11.)

5.3 Accommodations for Disabilities

A student seeking academic accommodations first must register with Student Disability Services and then meet with an SDS counselor who determines eligibility for services. A student approved for accommodations should meet privately with the course instructor to arrange particular accommodations. www.uiowa.edu/~sds/

5.4 Academic Fraud

Plagiarism and any other activities that result in a student presenting work that is not his or her own are academic fraud. Academic fraud is reported to the departmental DEO and then to the Associate Dean for Academic Programs and Services in the College of Liberal Arts and Sciences who deals with academic fraud according to these guidelines: www.clas.uiowa.edu/students/academic_handbook/ix.shtml

5.5 Making a Suggestion or a Complaint

Students have the right to make suggestions or complaints and should first visit with the instructor, then with the course supervisor if appropriate, and next with the departmental DEO. All complaints must be made within six months of the incident.

www.clas.uiowa.edu/students/academic_handbook/ix.shtml#5

5.6 Understanding Sexual Harassment

Sexual harassment subverts the mission of the University and threatens the well-being of students, faculty, and staff. All members of the UI community have a responsibility to uphold this mission and to contribute to a safe environment that enhances learning. Incidents of sexual harassment should be reported immediately. Visit

www.uiowa.edu/~eod/policies/sexual-harassment-guide/index.html for definitions, assistance, and the full policy.

5.7 Reacting Safely to Severe Weather

The University of Iowa Operations Manual section 16.14 outlines appropriate responses to a tornado (i) or to a similar crisis. If a tornado or other severe weather is indicated by the UI outdoor warning system, members of the class should seek shelter in rooms and corridors in the innermost part of a building at the lowest level, staying clear of windows, corridors with windows, or large free-standing expanses such as auditoriums and cafeterias. The class will resume, if possible, after the UI outdoor warning system announces that the severe weather threat has ended. For more information on Hawk Alert and the siren warning system, visit the Public Safety web site at www.uiowa.edu/~pubsfty/intlinks.htm.

5.8 Student Classroom Behavior

The ability to learn is lessened when students engage in inappropriate classroom behavior, distracting others; such behaviors are a violation of the Code of Student Life. When disruptive activity occurs, a University instructor has the authority to determine classroom seating patterns and to request that a student exit the classroom, laboratory, or other area used for instruction immediately for the remainder of the period. One-day suspensions are

reported to appropriate departmental, collegiate, and Student Services personnel (Office of the Vice President for Student Services and Dean of Students).

5.9 University Examination Policies

5.9.1 Missed Exam Policy

University policy requires that students be permitted to make up examinations missed because of illness, mandatory religious obligations, certain University activities, or unavoidable circumstances. Excused absence forms are required and are available on the Registrar web site. www.registrar.uiowa.edu/forms/absence.pdf

5.9.2 Final Examinations

Final exams may be offered only during finals week. No exams of any kind are allowed during the last week of classes. Students should not ask their instructor to reschedule a final exam since the College does not permit rescheduling of a final exam once the semester has begun. Questions should be addressed to the Associate Dean for Undergraduate Programs and Curriculum.

An undergraduate student who has two final examinations scheduled for the same period or more than three examinations scheduled for the same day may file a request for a change of schedule before the published deadline at the Registrar's Service Center, 17 Calvin Hall, 8-4 M-F, (384-4300).

6 Syllabus

This is an approximate schedule of lecture topics and assigned readings. It will be updated as needed during the semester. In assigned reading, “G&L” indicates *Markov Chain Monte Carlo*, and “R” indicates *The Bayesian Choice*.

1/20 - 1/22	Intro to Bayesian inference G&L Sections 2.1 - 2.3; R Chapter 1, Sections 2.1, 2.3, 2.5	MKC
1/25 - 1/29	Inference continued; hierarchical models G&L Section 2.4; R Sections 3.3, 3.5, 10.1-10.2	MKC
2/01 - 2/05	Approximate inference G&L Chapter 3, R Sections 6.1-6.2	AT
2/08 - 2/12	Approximate inference, continued G&L Chapter 3	AT
2/15 - 2/19	Markov chain theory G&L Chapter 4	AT
2/22 - 2/26	Markov chain theory, continued G&L Chapter 4	AT
3/01 - 3/05	Gibbs sampling G&L Sections 5.1-5.3	AT
3/08 - 3/12	Convergence assessment G&L Sections 2.4, 5.4, R Section 10.3 Midterm 3/12	MKC
3/15 - 3/19	Spring Break	
3/22 - 3/26	Hierarchical and dynamic models G&L Sections 2.5, 5.5; R Section 4.5 Project proposals due 3/26	MKC
3/29 - 4/02	Applications and software, continued Spatial and other models G&L Sections 2.6, 5.5-5.6	MKC
4/05 - 4/09	Metropolis-Hastings G&L Chapter 6	AT
4/12 - 4/16	Metropolis-Hastings cont, and Slice sampling R Sections 6.3-6.4	AT & MKC
4/19 - 4/23	Model adequacy and Model choice G&L Section 7.2 - 7.3	MKC
4/26 - 4/30	Model choice cont, and Convergence acceleration R Chapter 7 G&L Section 7.4	MKC
5/03 - 5/07	Project presentations Projects due 5/03	Students
5/12 9:45	Final exam	