Syllabus for STA545, Bayesian Statistics
Fall 2009
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The course is an introduction to Bayesian inference and decision analysis. Implementing Bayesian methods in free and open-source software, it explores varied scientific and policy applications.

Texts: Peter M. Lee, *Bayesian Statistics: An Introduction*, third edition (London: Arnold, 2004). Jim Albert, *Bayesian Computation with R*, second edition (New York: Springer, 2009).

Grading: Grades will be based on two midterm exams (18% each), a final exam (36%), and a project in which students apply Bayesian methods to analyze data in their fields of interest (28%). The midterms will be take-home exams. The first will be distributed on Sep. 30 and collected on Oct. 7. The second will be distributed on Oct. 28 and collected on Nov. 4.

Calendar

Date	Topic	Reading
Sep. 9	Bayesian probability concepts	Lee ch. 1
Sep. 16	Introduction to R	Albert ch. 1–2
Sep. 23	Normal distribution	Lee ch. 2
Sep. 30	Using R for one & two parameter problems	Albert ch. 3–4
Oct. 7	Other common distributions	Lee ch. 3
Oct. 14	Hypothesis testing	Lee ch. 4, Albert ch. 8
Oct. 21	Two-sample problems	Lee ch. 5
Oct. 28	Correlation, regression, & ANOVA	Lee ch. 6, Albert ch. 9
Nov. 4	Other topics in Bayesian theory	Lee ch. 7
Nov. 18	Bayesian computation	Albert ch. 5–6
Nov. 25	Hierarchical models	Lee ch. 8, Albert ch. 7
Dec. 2	Gibbs sampling	Lee ch. 9, Albert ch. 10–11
Dec. 9	Presentation of student projects	

H1N1 Flu Guidelines: The Provost requests that students with flu-like symptoms (fever, cough, sore throat, runny or stuffy nose, aches, chills, and fatigue) stay home for 24 hours after the fever is gone. If you miss an exam due to flu or other illness, you can notify me by email. You do NOT need to present a note from a doctor or nurse. The Centers for Disease Control and Prevention have posted simple methods to avoid transmission of illness at `www.cdc.gov/flu/protect/habits.htm`. URI information on the H1N1 flu will be posted on the URI website at `www.uri.edu/news/h1n1`.

Learning Outcomes: Students who successfully complete the course will be able to do the following:

1. Derive posterior probability distributions from likelihood functions and prior probability distributions
2. Compute and interpret conditional expectations and variances
3. Work with normal, uniform, binomial, Poisson, Cauchy, and circular normal distributions
4. Calculate and explain highest probability density regions
5. Compute and interpret the Bayes factor in favor of a hypothesis
6. Derive the posterior distribution of regression parameters
7. Explain and apply the likelihood principle and the stopping rule principle
8. Assess Bayes risk and derive a Bayes decision rule
9. Formulate and estimate a hierarchical model
10. Explain and apply Markov chain Monte Carlo methods such the Gibbs sampler
11. Use free and open-source software, such as R and BUGS, to perform Bayesian data analysis
12. Practice literate programming and conduct reproducible research