

Bayesian Statistics
Statistics W640 — Spring 2016

Assignment 1

Reading:

By Friday, January 29, read Chapters 1–3 of *Bayesian Data Analysis, third edition*; by Gelman et al.

Homework 1:

The following problems are due in class on Friday, February 5. Homework can also be submitted to the course mailbox in Room 904 SSW by 6:00pm on Monday, February 8.

1. Do Chapter 1 Exercises 1, 3, 6, and 7 from Gelman et al., but only submit your solution to Exercise 7 (you can find solutions to the other problems at the book's web page <http://www.stat.columbia.edu/~gelman/book/>).
2. Do Chapter 2 Exercises 2, 5, 8, 9, 11, 12ab but don't turn them in. You can find their solutions on the book's web page.
3. Write the computer code to perform Bayesian inference about a probability, based on Binomial data and using a *witch's hat* prior distribution, like that illustrated in Figure 2.4(a) of Gelman et al. Specifically, your code should take as inputs the prior (the witch's hat distribution is characterized by three hyperparameters) and data summaries n and y , and return the posterior density $p(\theta|y)$ for $\theta \in \{0.000, 0.001, 0.002, \dots, 0.999, 1.000\}$. Use this output to produce
 - (a) a plot of the posterior density,
 - (b) the posterior mean and variance,
 - (c) the posterior median, and
 - (d) the 95% central posterior intervalfor the witch's hat prior that puts 40% of the probability mass outside the interval $[0.385, 0.585]$, and given $y = 437$ successes in $n = 980$ trials.
4. Chapter 2 Exercise 19.
5. Chapter 2 Exercise 21.