

Homework 9  
MATH 5396, Fall 2005  
due Thurs. Nov. 10

1. Use the R source command to source the file bioassay.r (off the class calendar web page).

- (a) Make a histogram of the posterior distribution of  $\alpha$  and  $\beta$ .
- (b) What are the estimates of the posterior means for  $\alpha$  and  $\beta$ ?
- (c) Use the following R commands to fit a linear model for logistic regression.  
How do the estimates for  $\alpha$  and  $\beta$  compare with your answers to (b)?

```
> dd <- data.frame(y=log((bioassay$freq)/(1-bioassay$freq)), x=bioassay$doses)
> fit <- lm(y~x, data=dd)
> summary(fit)
```

2. Suppose the posterior distribution is a beta density with parameters  $\alpha$  and  $\beta$ . In Homework 3, Problem 5, you were asked to plot the beta density for various values. Now, calculate the 90% credible interval or set by generating 1000 random samples from each of the beta densities and using the quantile function (in R) as described on p. 5 of the Inference from Posterior Distributions handout from class.

- (a)  $\alpha = 2, \beta = 2$ .
- (b)  $\alpha = 6, \beta = 2$ .
- (c)  $\alpha = 6, \beta = 6$ .
- (d)  $\alpha = 0.5, \beta = 4$ .

3. Write a function in R that will return a  $100\gamma\%$  credible interval for a given beta distribution. The function should take as arguments  $\alpha, \beta, \gamma$ , and  $n$ , where  $n$  is the number of random samples to generate. The function should return the credible interval. Repeat Problem 2 (a)-(d), using your function.

Note: If you want to reproduce your results, then remember to set the seed.

4. From p. 2-4, Example 1 and Example 1A of the Bayesian Hypothesis Testing handout from class, the posterior distribution is given by  $N(1.412, 3.765)$ .

(a) Calculate the posterior odds given at the top of p. 3 and top of p. 4 by using the qnorm function in R for the numerators and denominators.

(b) Calculate the posterior odds given at the top of p. 3 and top p. 4 by generating 1000 random normal variables from the posterior distribution and summing to calculate the numerators and denominators.