Math 152 - Statistical Theory - Homework 2

write your name here

Due: 9/14/2018

Book problems (if you have the 3rd edition of the book, the problems will be the same unless they don't exist – that is, the 4th edition *added* problems but didn't change them). Stop by my office or ask me in class if you want to see the statement of the problem.)

- 7.2 – 6, 9, 10, 11
- 7.3 – 7, 8, 9, 11

R problem

Consider the beta-binomal family (i.e., beta prior, binomial likelihood (with parameter theta), beta posterior). That is, the parameter of interest is theta, and both the prior and posterior distributions of theta are from the beta family.

(a) Write down the posterior distribution of theta given the data as a function of prior α, prior β, n, and **p-hat = proportion of successes**.

(b) How does the posterior expected value of theta change as a function of each of the values above?

(c) Using simulations, histograms, and means, **discuss the role of sample size** when using a prior and Bayesian inference. For the discussion:

i. give posterior histogram and sample means for the following combinations (12 histograms):

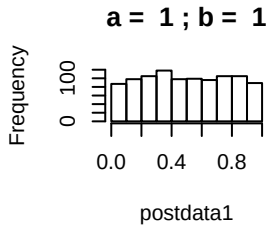
(α, β) = (4,4); (4,10)
p-hat = 0.2, 0.5
n = 10, 100, 1000

```
par(mfrow=c(2,3))  # creates a 2x3 grid of figures.  Run this line only once.
a1 = 1 # you need to change this
b1 = 1 # you need to change this
postdata1 = rbeta(1000, a1, b1)
hist(postdata1, main = paste("a = ", a1, "; b = ", b1))
mean(postdata1)
```

```
## [1] 0.50029
```

```
sd(postdata1)
```

```
## [1] 0.28289
```



ii. Using your histograms and means above, discuss the role of sample size in determining the posterior distribution of the parameter.