HW 5

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library(purrr)  
library(tidyr)  
library(knitr)  
library(invgamma)

### 2.3

set.seed(6)  
  
b<- seq(0,1, by = .0001)  
  
a\_ <- 0  
b\_ <- 0  
  
#checking a range of values to get the   
#appropiate a and b that meets conditions  
for(i in 1:length(b)){  
 a = (100\*b[i]^2)  
 med = qgamma(.5,a,b[i])  
 if(med%>%round(0) == 75){  
 a\_= a;b\_ = b[i]  
 break  
 }  
}  
  
#condition 1, var = 100  
  
var<- a\_/b\_^2  
var

## [1] 100

#condition 2 median = 75  
  
med\_<- rgamma(10000, a\_, b\_)%>%median()  
med\_%>%round()

## [1] 75

The prior that staify both conditions is Gamma(56.175025, 0.7495)

### 2.5

#information given in exercise  
c= c(1,1,2,2)  
a<- c(.1,1,.1,1)  
  
#matrix to store values  
data<- matrix(.0,nrow = 4, ncol = 9)  
  
data[,1]<- c  
data[,2]<- a  
data[,3]<- a  
  
#function to build determine the sse  
sse <- function(){  
 x2=15;x=-2;n= 20  
 (x2/2)%>%return()  
}  
  
#function for the mean  
mean<- function(a, b){  
 n = 20  
 ((2\*sse() +2\* b)/((n -1) + (2 \* a -1)))%>%return()  
}  
  
  
  
#calcuating the std  
for(i in 1:nrow(data)){  
 #post A  
 data[i,4]= (20/2) + data[i,3]  
 #post B  
 data[i,5] = (data[i,3] + sse())  
 #P(sigma>c)  
 data[i,6] = 1- pinvgamma(data[i,1]^2, data[i,4], data[i,5])  
 # post mean  
 data[i,7] = mean(data[i,3], data[i,3])  
 # post std  
 data[i,8] = (sse()/(20-1))^.5  
 #adding random a and b to see what effect the prior had on the posterior  
 data[i,9] = mean(10, 10)  
   
}  
  
df2<- as.data.frame(data)  
  
names(df2)<- c("c", "a", "b", "A", "B", "postProb", "postMean", "postStd", "priorTest")  
  
df2%>%kable(caption = "Results Of Posterior")

Results Of Posterior

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| c | a | b | A | B | postProb | postMean | postStd | priorTest |
| 1 | 0.1 | 0.1 | 10.1 | 7.6 | 0.2249838 | 0.8351648 | 0.6282809 | 0.9210526 |
| 1 | 1.0 | 1.0 | 11.0 | 8.5 | 0.2366380 | 0.8500000 | 0.6282809 | 0.9210526 |
| 2 | 0.1 | 0.1 | 10.1 | 7.6 | 0.0000256 | 0.8351648 | 0.6282809 | 0.9210526 |
| 2 | 1.0 | 1.0 | 11.0 | 8.5 | 0.0000145 | 0.8500000 | 0.6282809 | 0.9210526 |

The results for P(> c) are in column postProb.

#P(sigma>c | c= 1, a=b=0.1) / P(sigma>c | c=1, a=b=1)  
  
r1 <- data[1,6]/data[2,6]  
  
#P(sigma>c | c= 2, a=b=0.1) / P(sigma>c | c=2, a=b=1)  
  
r2 <- data[3,6]/data[4,6]

The ratio when c = 1 the ratio is 0.9507509 and when c = 2 the ratio is 1.7706743. Also, the posterior is very sensative to the prior. This is shown in column priorTest where the prior mean chnages greatly when I plug in any value for rate and shape.