Assignment Covering Chapter 4 of *Bayesian Computation with R*

Chris Hayduk

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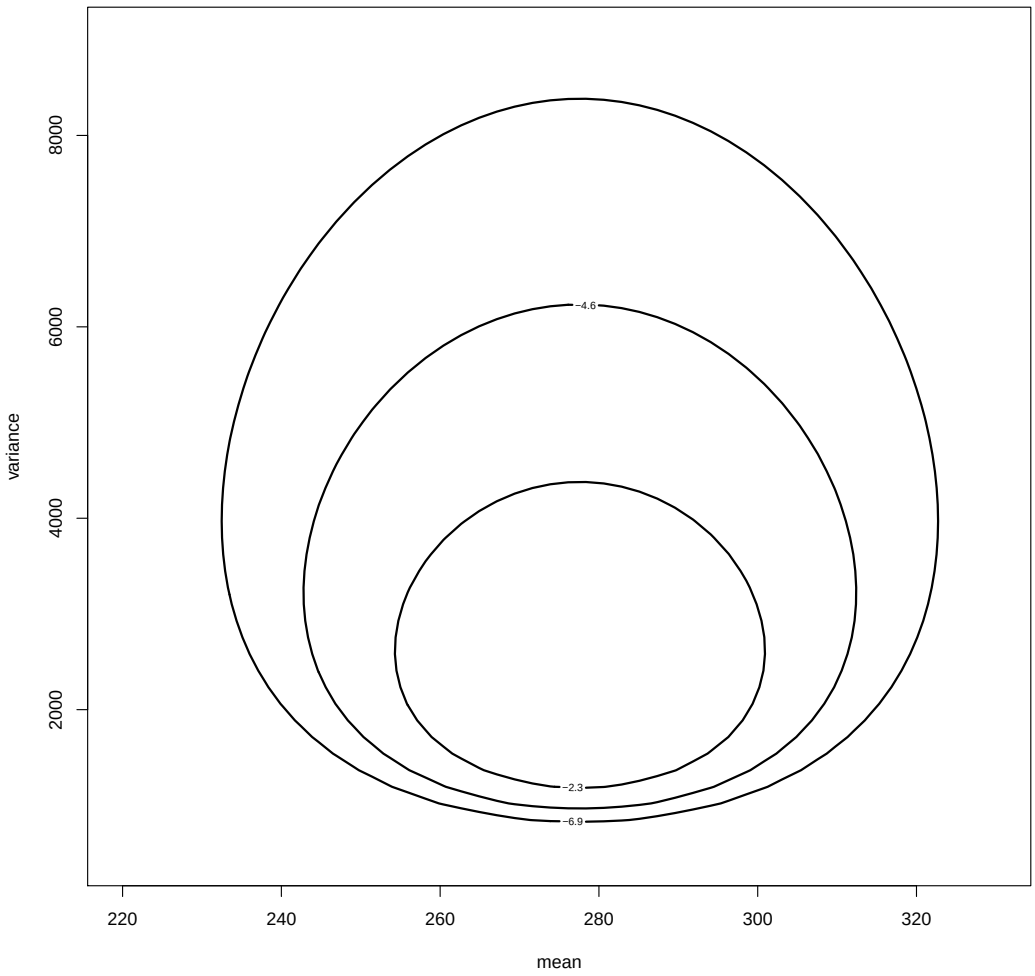
1. **Chapter 4: Multiparameter Models** Write your own code for the following:
   (a) `normchi2post()` on pg. 64
   (b) `normpostsim()` on pg. 64
   (c) `rdirichlet()` on pg. 66
   (d) `beta.select()` on pg. 71
   (e) `logisticpost()` on pg. 72
   (f) `howardprior()` on pg. 77

Solution:

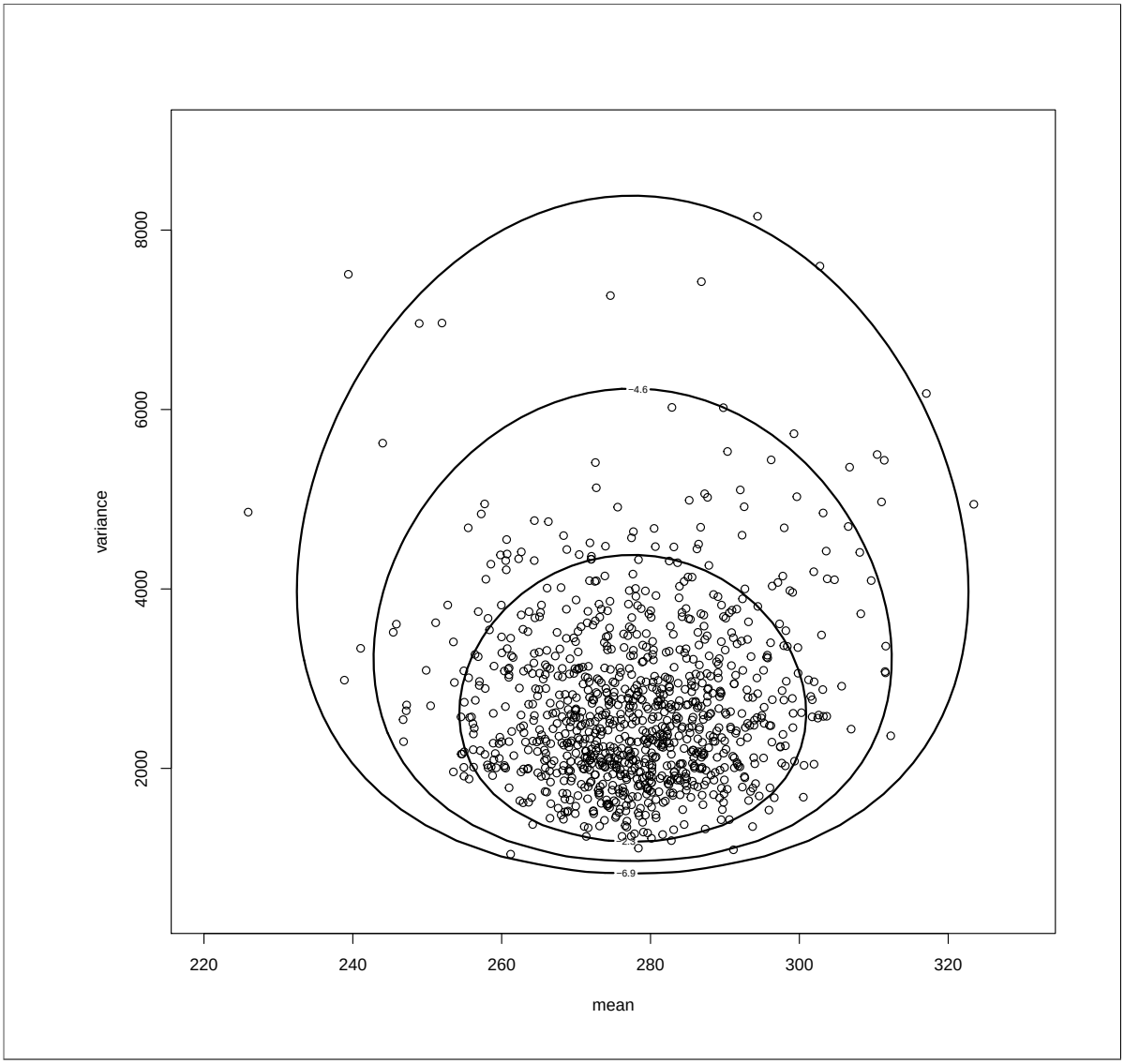
(a)

```r
normchi2post <- function(theta, data){
  mean <- theta[1]
  variance <- theta[2]

  y_bar <- mean(data)

  S <- sum((data-y_bar)^2)
  n <- length(data)

  posterior_density <- 1/((variance^(n/2+1))) *
    exp(-1/(2*variance)*(S+n*(mean-y_bar)^2))

  log_density <- log(posterior_density)
  #print(log_density)
  return(log_density)
}

#Example run

data("marathontimes")
attach(marathontimes)

d <- mycontour(normchi2post, c(220, 330, 500, 9000), time, xlab="mean",
               ylab="variance")
```


variance
8000
6000
4000
2000
−4.6
−2.3
−6.9
220
240
260
280
300
320
mean

(b)

```r
normpostsim <- function(data, m){
  S <- sum((data-mean(data))^2)

  n <- length(data)

  sigma2 <- S/rchisq(m, n-1)

  mu <- rnorm(m, mean = mean(data), sd = sqrt(sigma2)/sqrt(n))

  results <- data.frame(mu = mu, sigma2 = sigma2)

  return(results)
}

#Example run
results <- normpostsim(time, 1000)
d <- mycontour(normchi2post, c(220, 330, 500, 9000), time, xlab="mean",
               ylab="variance")
points(results$mu, results$sigma2)
```



2. **Chapter 4: Multiparameter Models** Pg. 66 introduces the Dirichlet distribution. Draw pdfs of this distribution for various parameter values using the functions in the R package. Find some examples on the internet of where the Dirichlet distribution is used in statistics.

3. Do all CH. 4 exercises.

4. **CH4, Q8 extra:** fit model using a frequentist logistic regression model; figure out how to make the equivalent confidence interval for part (d). (Could use bootstrap, probably BC_a and its approximation ABC, try package `bootBCa`; include a histogram of your BC_a bootstrap resampled probability values and normal quantile plot of those values. Let number of bootstrap samples be $B = 9,999$.)