# Homework 7

STA 360: Assignment 7, Fall 2020

Due Monday November 2nd, 5 PM Standard Eastern Time

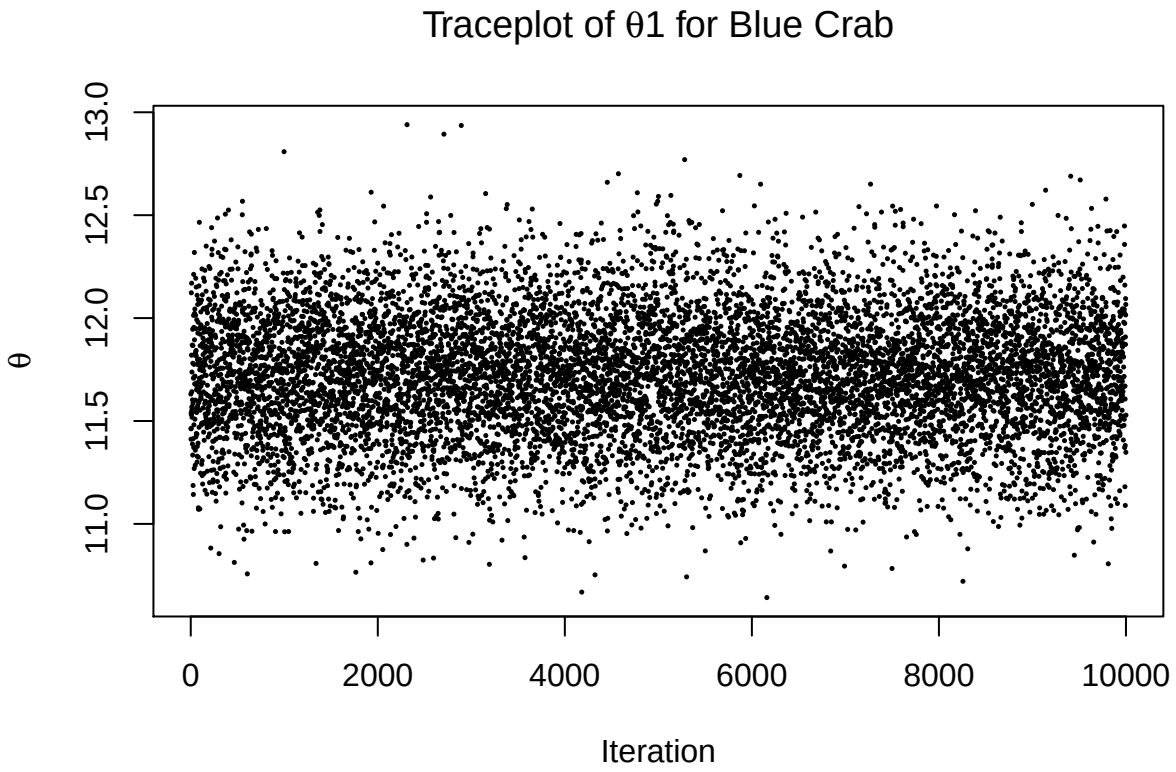
## Question 1

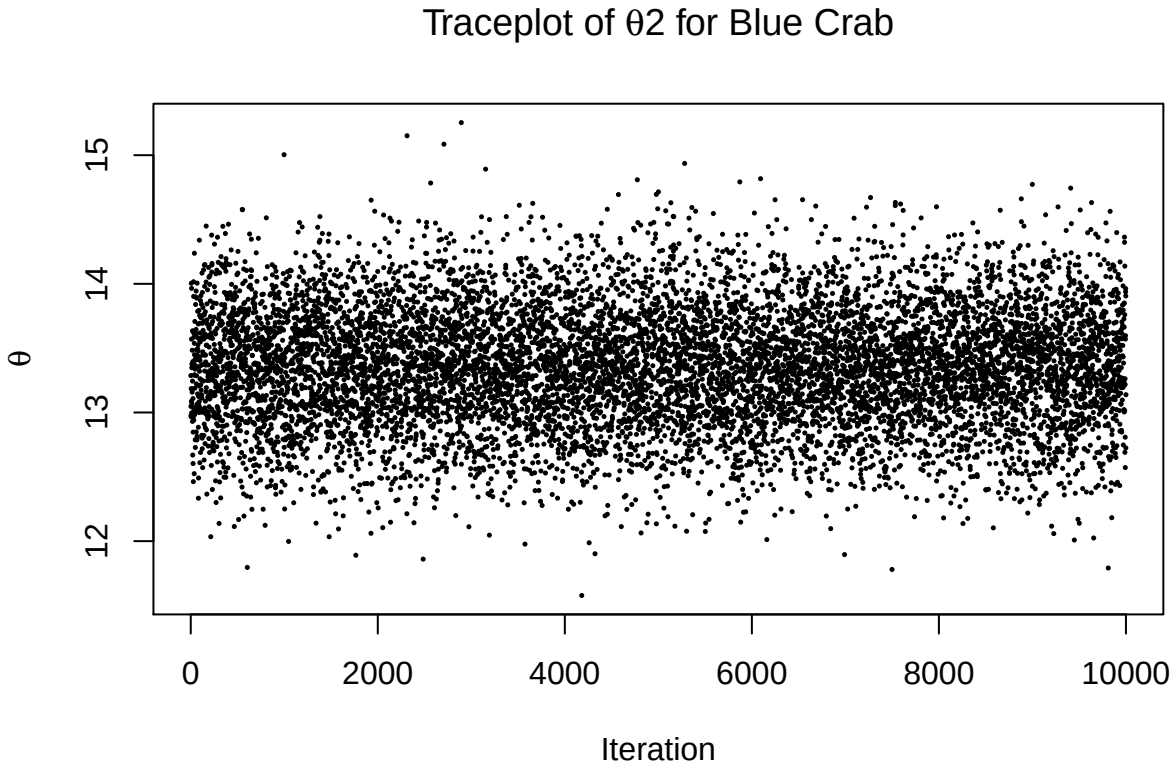
Hoff 7. 3

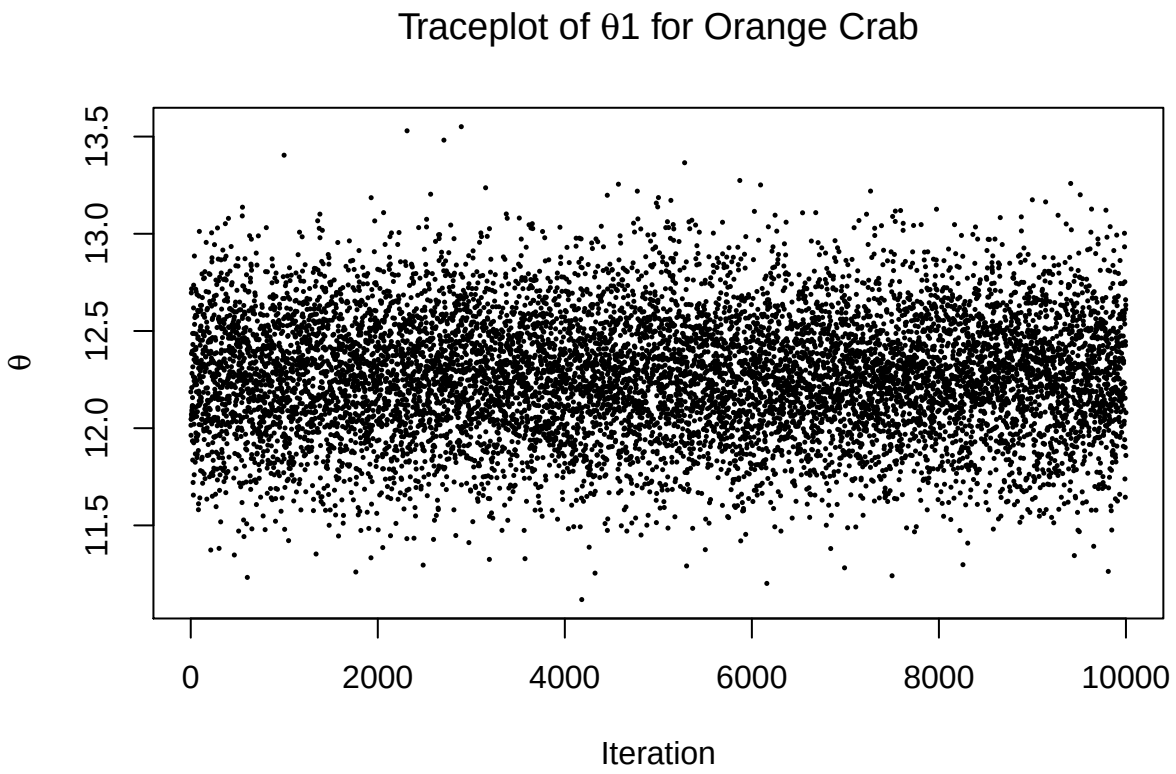
Part A.

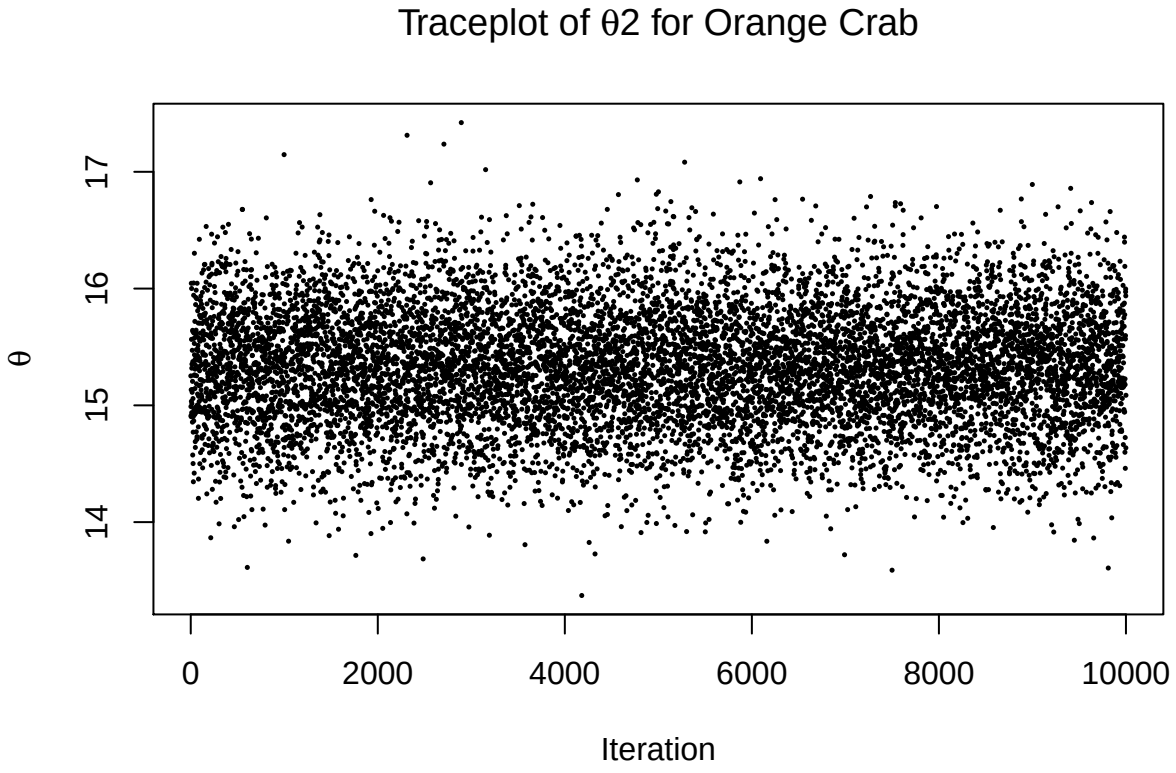
```
#Read in the data sets from github
blue_crab_data = as.matrix(read.table(url('https://raw.githubusercontent.com/resteorts/modern-bayes/mas

orange_crab_data = as.matrix(read.table(url('https://raw.githubusercontent.com/resteorts/modern-bayes/ma

#We need to sample from the posterior for both data sets, so let's use lapply with a function
#The function is heavily based on Rebecca Steort's code in Module 8
crab.mcmc = lapply(list('blue_crab' = blue_crab_data, 'orange_crab' = orange_crab_data), function(crab)
   n = nrow(crab)
   # Set prior parameters according to problem
  mu0 = colMeans(crab)
  lambda0 = cov(crab)
  s0 = cov(crab)
  nu0 = 4
  THETA <- SIGMA <-NULL
  # Start with sigma sample
  sigma = s0
  set.seed(1);
  for (s in 1:10000) {
    # Update theta
    Ln <- solve(solve(lambda0) + n * solve(sigma))
    mun <- Ln %*% (solve(lambda0) %*% mu0 + n * solve(sigma) %*% mu0)
    theta <- rmvnorm(1, mun, Ln)

    ## update sigma
    Sn <- s0 + (t(crab) - c(theta)) %*%       t(t(crab)-c(theta))
    sigma <- solve(rwish(nu0 + n, solve(Sn)))
    ## save results
    THETA <- rbind(THETA, theta)
    SIGMA <- rbind(SIGMA, c(sigma))
  }

  list(theta = THETA, sigma = SIGMA)
})
```

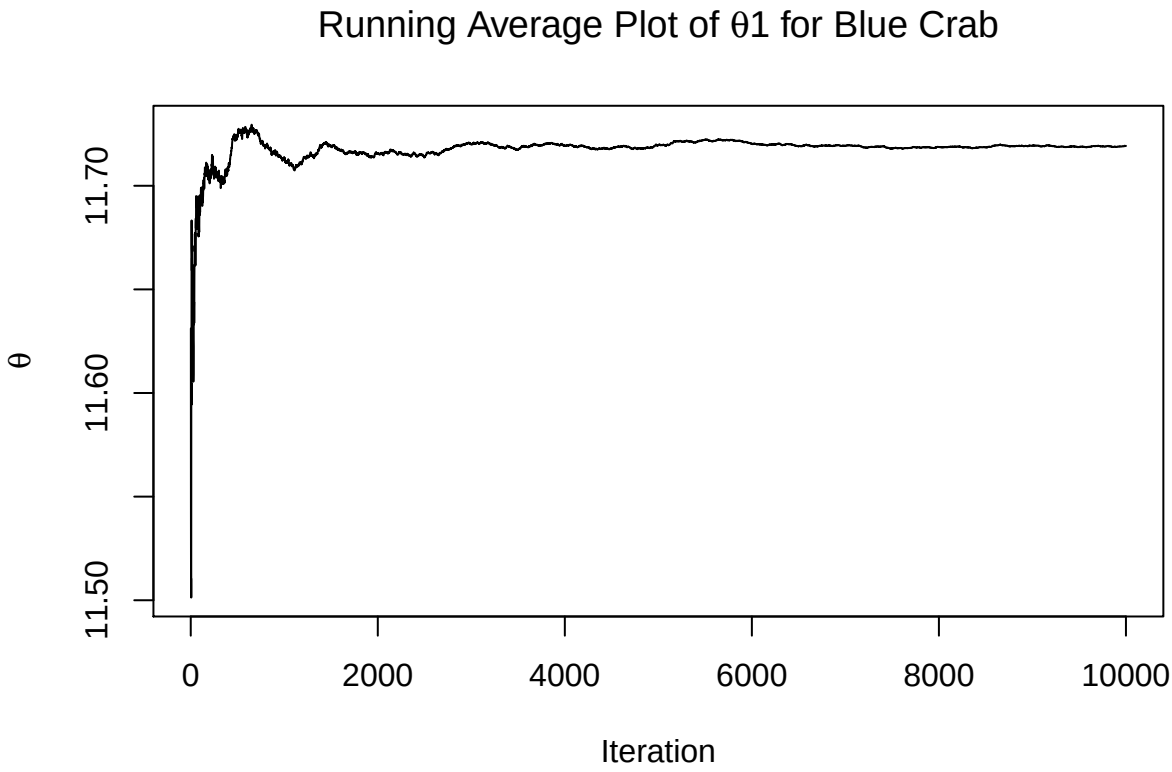
Part B.

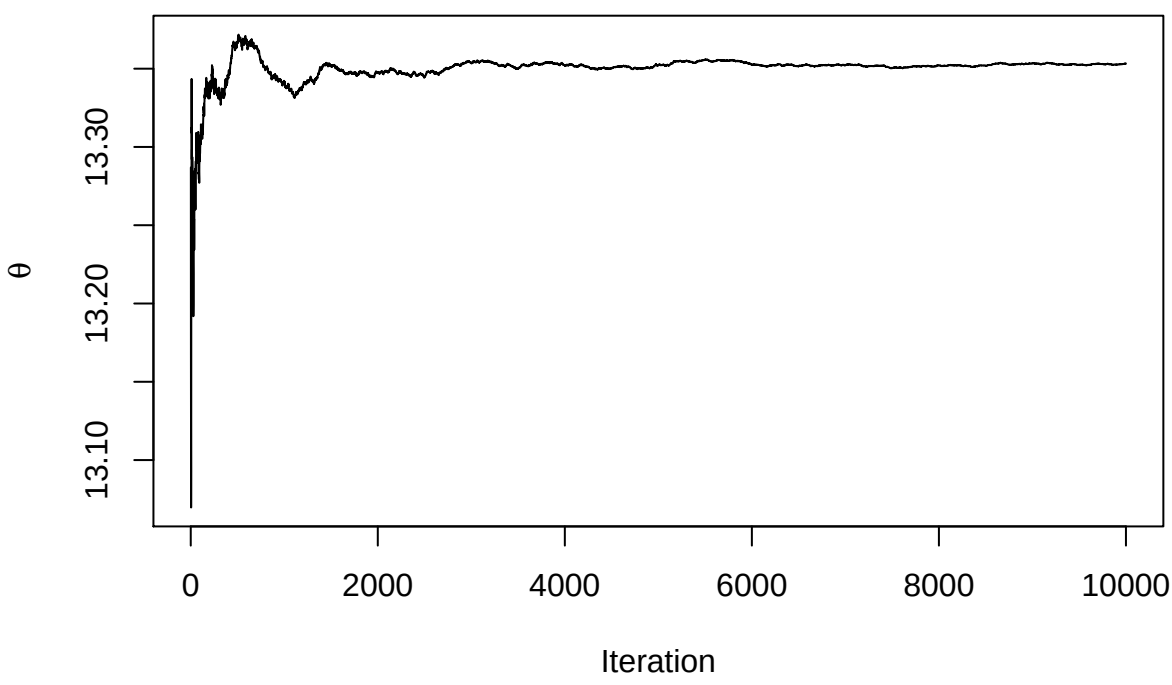

Traceplot of θ1 for Blue Crab
θ
11.0
11.5
12.0
12.5
13.0
0
2000
4000
6000
8000
10000
Iteration

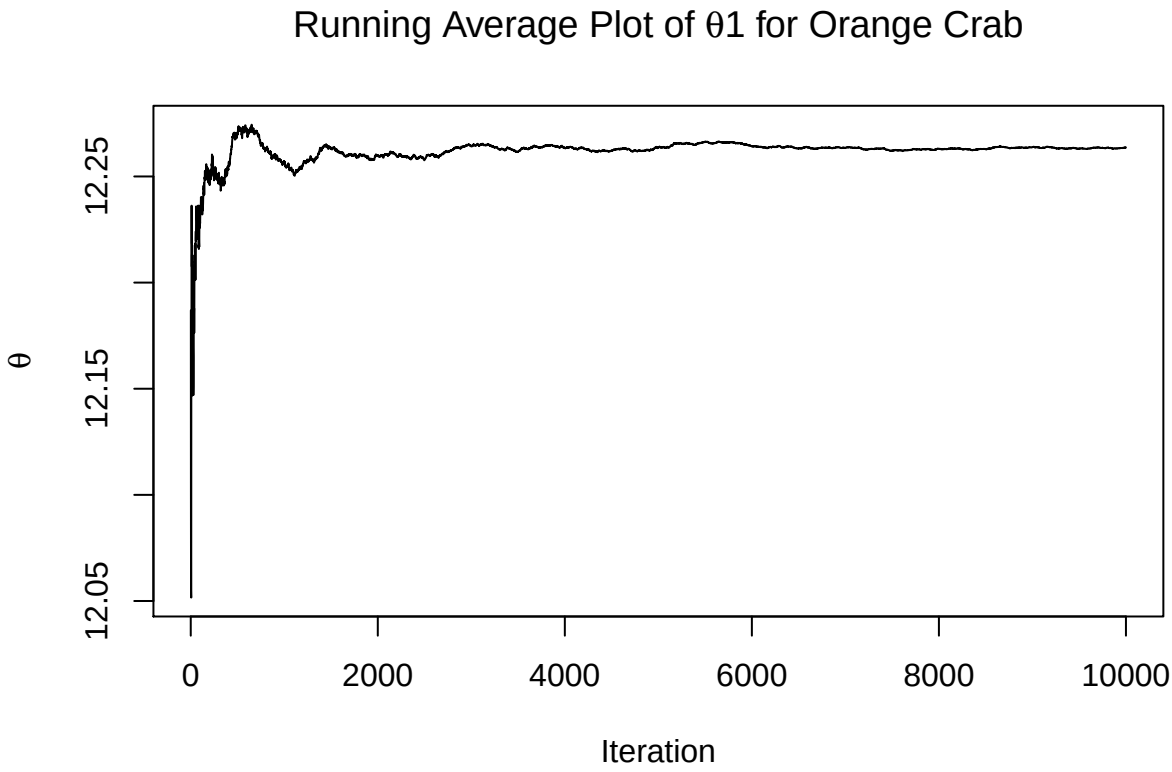

Traceplot of θ2 for Blue Crab
θ
12
13
14
15
0
2000
4000
6000
8000
10000
Iteration

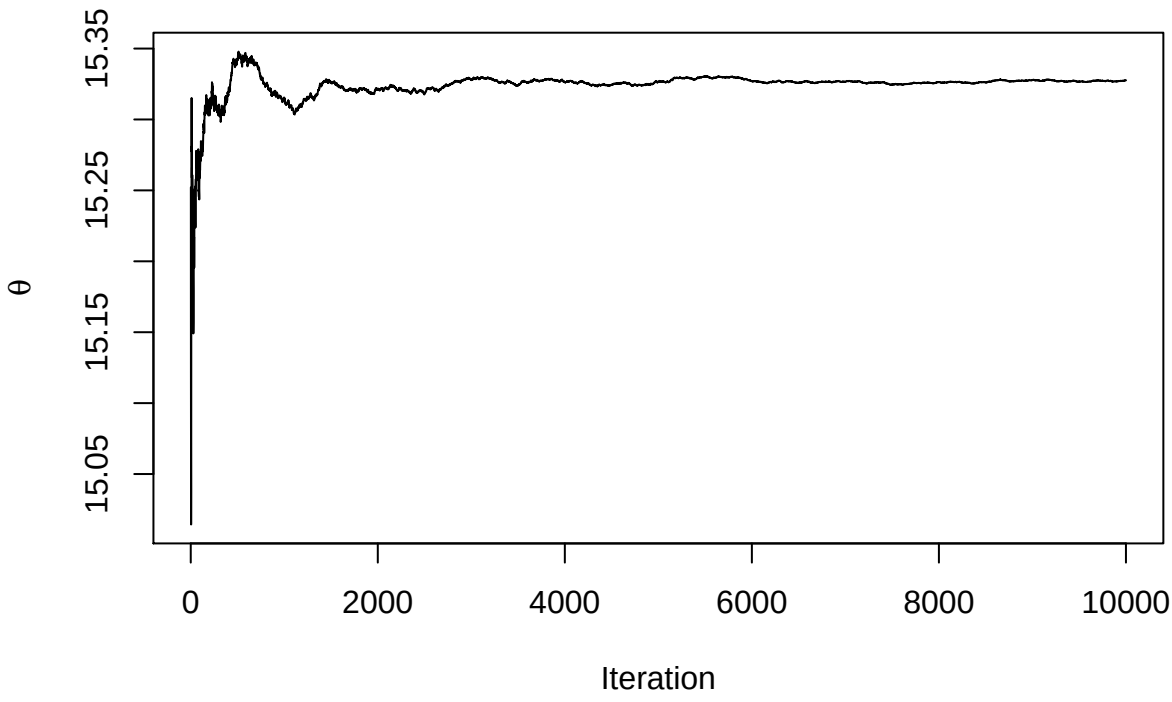

Traceplot of θ1 for Orange Crab
θ
11.5
12.0
12.5
13.0
13.5
0
2000
4000
6000
8000
10000
Iteration

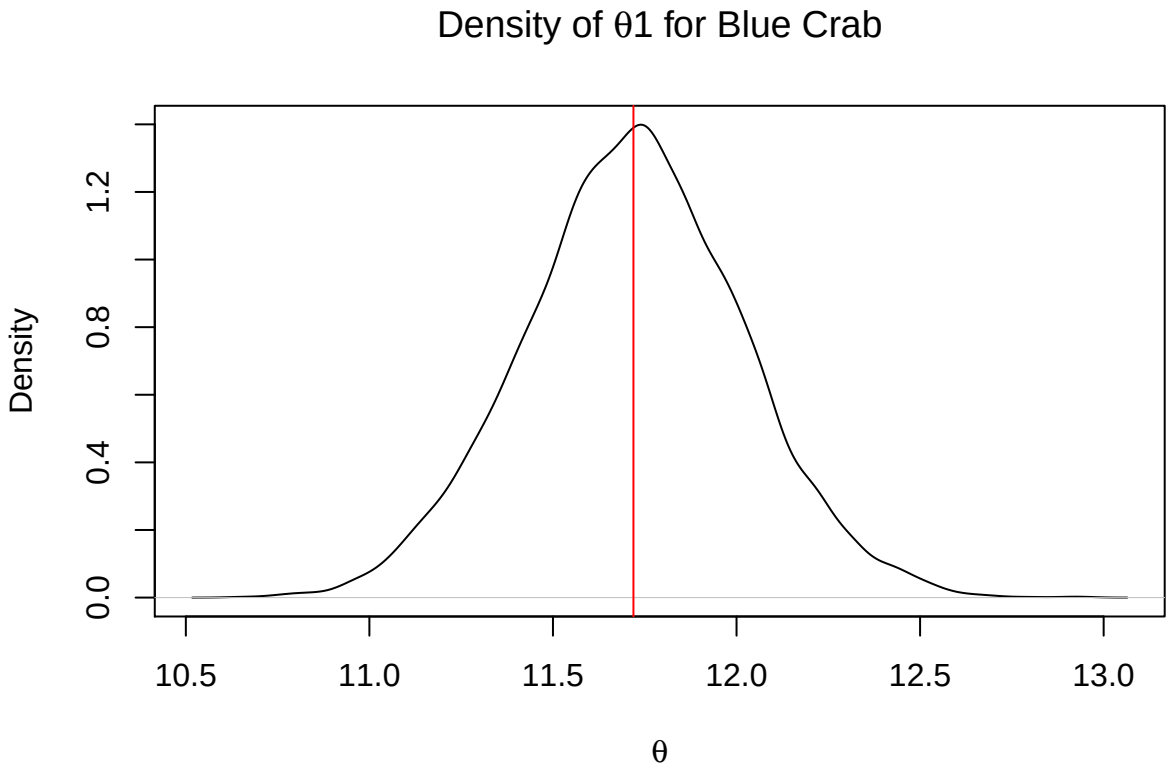

Traceplot of θ2 for Orange Crab
θ
14
15
16
17
0
2000
4000
6000
8000
10000
Iteration

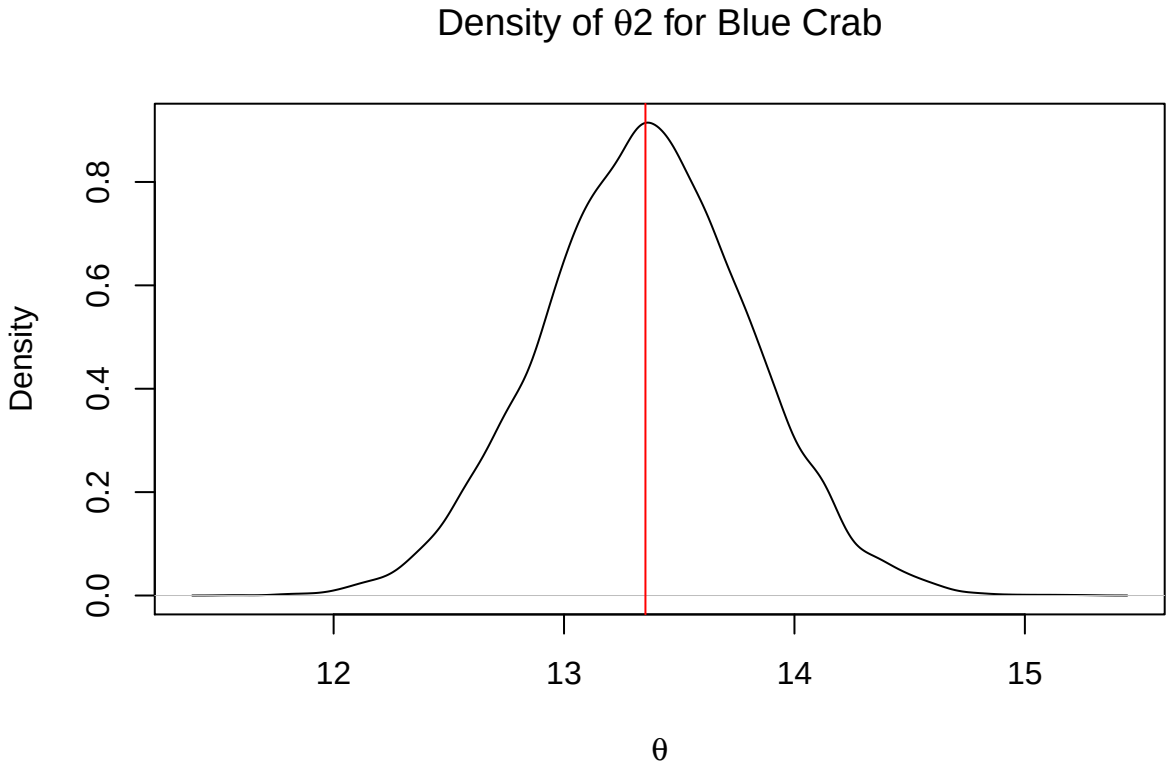

Running Average Plot of θ1 for Blue Crab
θ
11.50
11.60
11.70
0
2000
4000
6000
8000
10000
Iteration

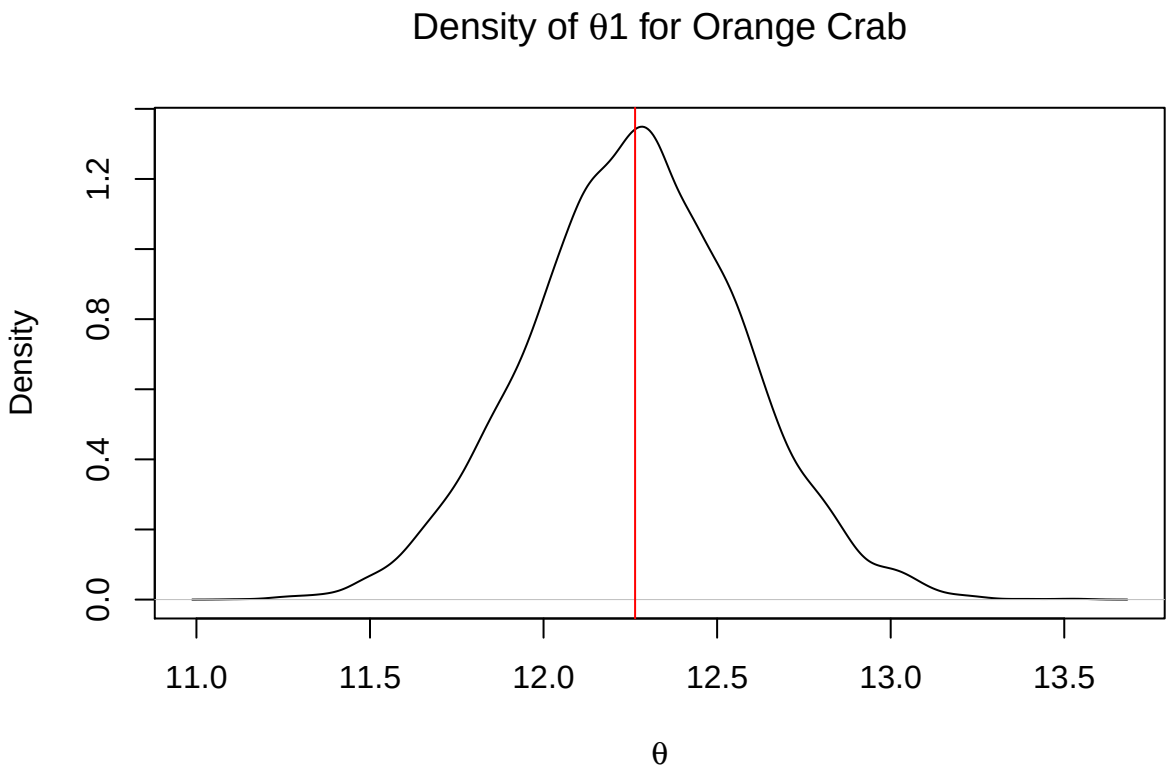

Running Average Plot of θ2 for Blue Crab
θ
13.10
13.20
13.30
0
2000
4000
6000
8000
10000
Iteration

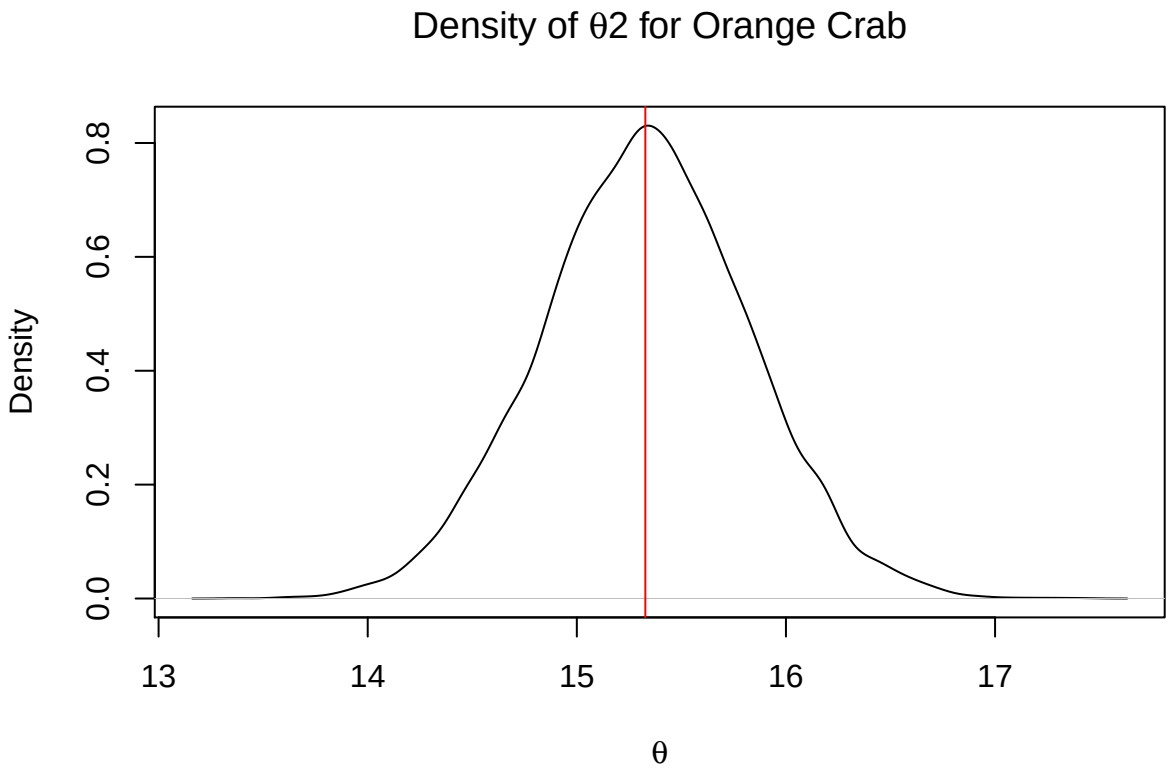

Running Average Plot of θ1 for Orange Crab
θ
12.05
12.15
12.25
0
2000
4000
6000
8000
10000
Iteration


Running Average Plot of θ2 for Orange Crab
θ
15.05
15.15
15.25
15.35
0
2000
4000
6000
8000
10000
Iteration


Density of θ1 for Blue Crab
Density
0.0
0.4
0.8
1.2
10.5
11.0
11.5
12.0
12.5
13.0
θ


Density of θ2 for Blue Crab
Density
0.0
0.2
0.4
0.6
0.8
12
13
14
15
θ


Density of θ1 for Orange Crab
Density
0.0
0.4
0.8
1.2
11.0
11.5
12.0
12.5
13.0
13.5
θ


Density of θ2 for Orange Crab
Density
0.0
0.2
0.4
0.6
0.8
13
14
15
16
17
θ