박한빈_과제 week4

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A 번

```
Y = bluecrab = as.matrix(read.table(url('http://www2.stat.duke.edu/~pdh10/FCBS/Exercises/bluecrab.dat')))
Y2 = orangecrab = as.matrix(read.table(url('http://www2.stat.duke.edu/~pdh10/FCBS/Exercises/orangecrab.dat')))
```

Blue Crab

```
n = nrow(bluecrab)
ybar = colMeans(bluecrab)
Mu0 = c(ybar)
Sigma = cov(bluecrab)
S0 = Lambda0 = Sigma
nu0 = 4
```

Gibbs Sampler

```
inv = solve
S = 10000
MU = matrix(NA, nrow = S, ncol = 2)
SIGMA = matrix(NA, nrow = S, ncol = 4)

for(s in 1:S){
  #Update MU
  Lambdan = inv(inv(Lambda0) + n*inv(Sigma))
  Mun = Lambdan %*% (inv(Lambda0) %*% Mu0 + n*inv(Sigma) %*% ybar)
  Mu = MASS::mvrnorm(n=1, Mun, Lambdan)

  #Update Sigma
  Sn = S0 + (t(Y) - c(Mu)) %*% t(t(Y)-c(Mu))
  Sigma = inv(rWishart(1, nu0 + n, inv(Sn))[,,1])

  MU[s,] = Mu
  SIGMA[s,] =c(Sigma)
}
```

Orangecrab

```
n = nrow(orangecrab)
y2bar = colMeans(orangecrab)
Mu0 = c(y2bar)
Sigma = cov(orangecrab)
S0 = Lambda0 = Sigma
nu0 = 4
```

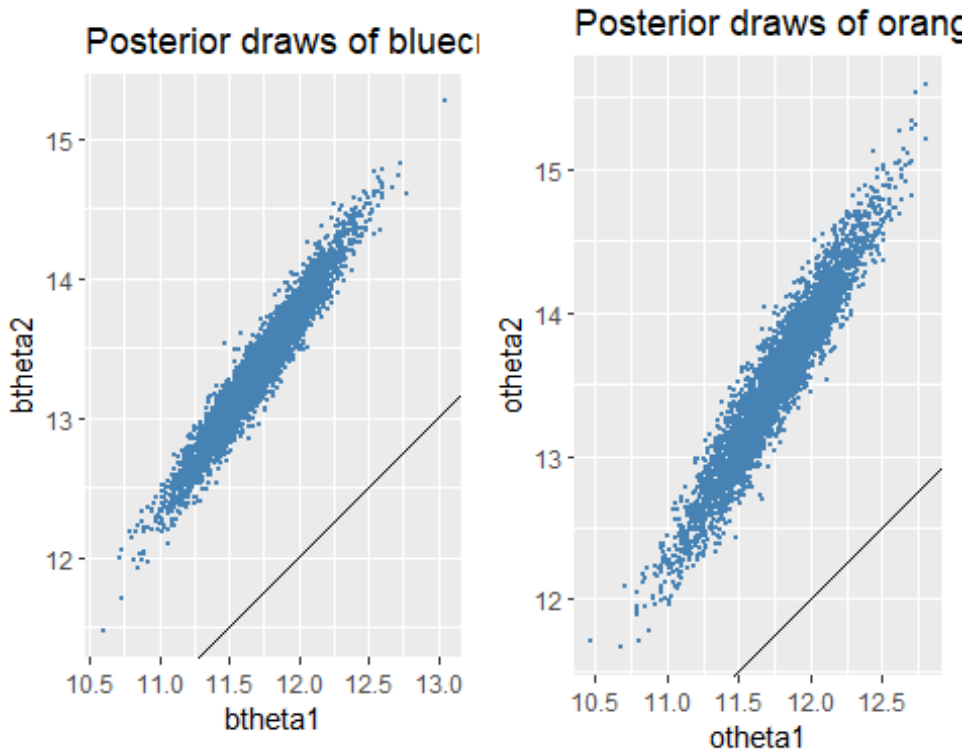
Gibbs Sampler

```
inv = solve
S = 10000
MU2 = matrix(NA, nrow = S, ncol = 2)
SIGMA2 = matrix(NA, nrow = S, ncol = 4)

for(s in 1:S){
  #Update MU
  Lambdan = inv(inv(Lambda0) + n*inv(Sigma))
  Mun = Lambdan %*% (inv(Lambda0) %*% Mu0 + n*inv(Sigma) %*% ybar)
  Mu = MASS::mvrnorm(n=1, Mun, Lambdan)

  #Update Sigma
  Sn = S0 + (t(Y2) - c(Mu)) %*% t(t(Y2)-c(Mu))
  Sigma = inv(rWishart(1, nu0 + n, inv(Sn))[,,1])

  MU2[s,] = Mu
  SIGMA2[s,] =c(Sigma)
}
```

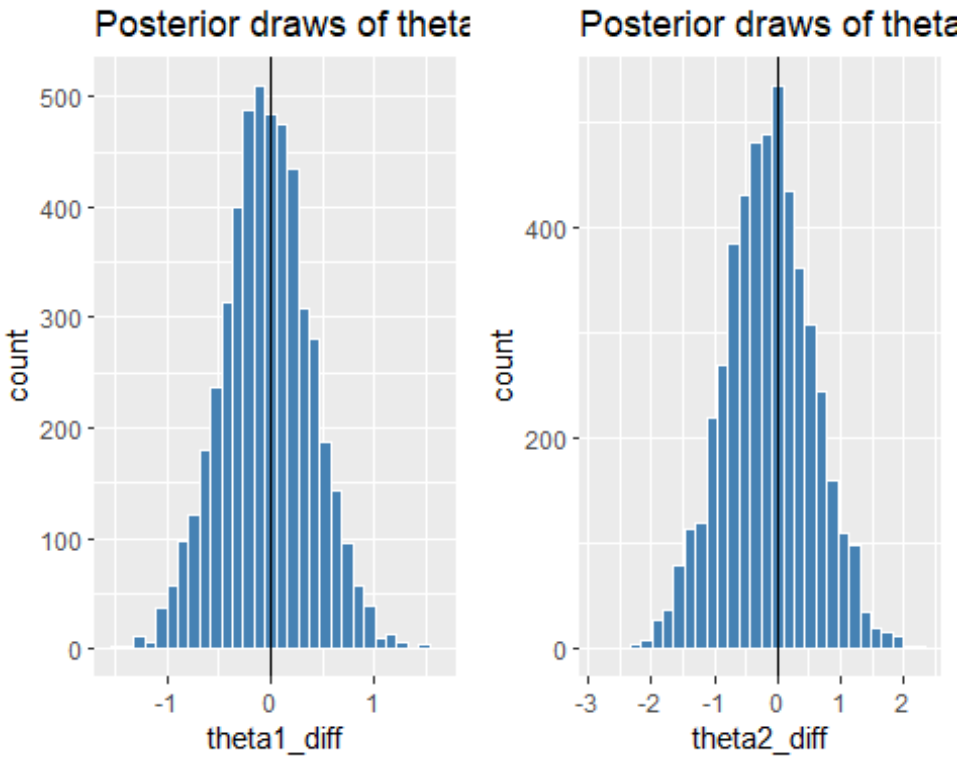
B 번

```
library(ggplot2)
library(ggpubr)

disp = tail(1:S, S/2)
title1 = 'Posterior draws of bluecrab size'
p1 = data.frame(btheta1 = MU[disp,1], btheta2 = MU[disp,2]) %>%
  ggplot(aes(x=btheta1, y=btheta2)) + geom_point(size = 0.5, color = 'steelbl
ue')+
  geom_abline(slope = 1, intercept = 0)+
  coord_fixed(ratio = 1)+
  labs(title = title1)

title2 = 'Posterior draws of orangecrab size'
p2 = data.frame(otheta1 = MU2[disp,1], otheta2 = MU2[disp,2]) %>%
  ggplot(aes(x = otheta1, y = otheta2)) + geom_point(size = 0.5, color = 'ste
elblue')+
```

```
  geom_abline(slope = 1, intercept = 0)+
  coord_fixed(ratio = 1)+
  labs(title = title2)

ggarrange(p1, p2)
```




```
title3 = 'Posterior draws of theta1 difference'
theta1_diff = MU[disp,1] - MU2[disp,1]
p3 = data.frame(theta1_diff = theta1_diff) %>%
  ggplot(aes(x=theta1_diff))+
  geom_histogram(color = 'white', fill = "steelblue", bins = 30)+
  geom_vline(xintercept = 0) +
  labs(title = title3)

title4 = 'Posterior draws of theta2 difference'
theta2_diff = MU[disp, 2] - MU2[disp, 2]
p4 = data.frame(theta2_diff = theta2_diff) %>%
  ggplot(aes(x=theta2_diff))+
  geom_histogram(color = 'white', fill = "steelblue", bins = 30)+
  geom_vline(xintercept = 0) +
  labs(title = title4)

ggarrange(p3, p4)
```

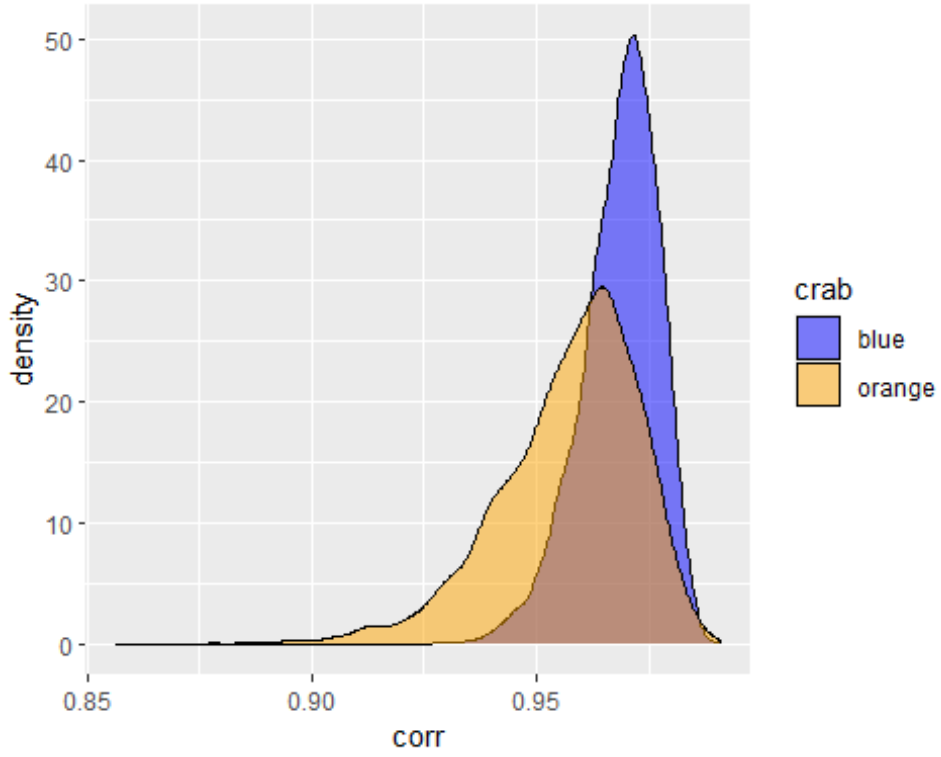



```
mean(MU[disp,1] > MU2[disp,1])

## [1] 0.4598

mean(MU[disp,2] > MU2[disp,2])

## [1] 0.4128
```

c 번

```
bcorr = apply(SIGMA, MARGIN = 1, FUN = function(SIGMA){
  SIGMA[2] / sqrt(SIGMA[1] * SIGMA[4])
})

ocorr = apply(SIGMA2, MARGIN = 1, FUN = function(SIGMA){
  SIGMA[2] / sqrt(SIGMA[1] * SIGMA[4])
})


p5 = data.frame(crab = c(rep('blue', length(bcorr)/2), rep('orange', length(o
corr)/2)),
                corr = c(bcorr[disp], ocorr[disp])) %>%
  ggplot(aes(x=corr, fill = crab)) +
  geom_density(alpha = 0.5) +
  scale_fill_manual(values = c('blue','orange'))
```

```
ggarrange(p5)
```




```
mean(bcorr < ocorr)
```

```
## [1] 0.2664
```