HW07

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Exercise 7.3

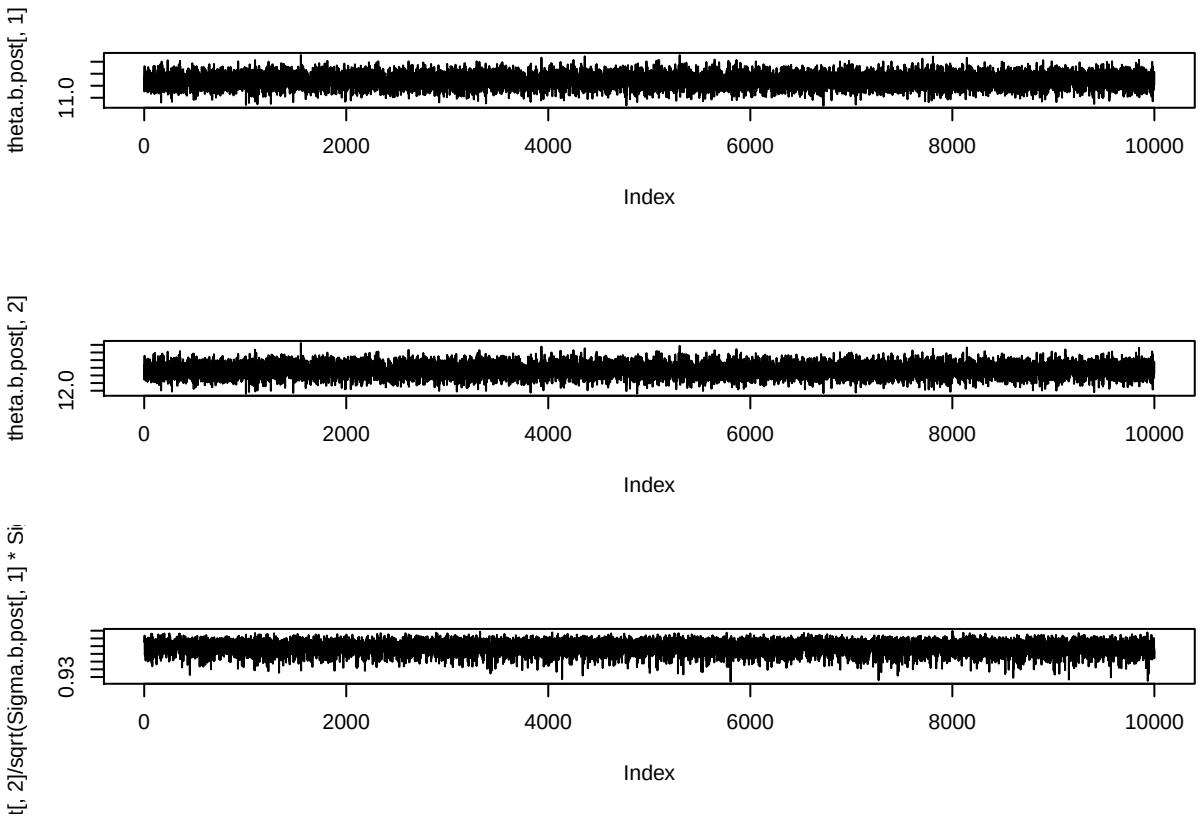
Part A

```
blue = read.table("~/sta601/HW/bluecrab.dat")
orange = read.table("~/sta601/HW/orangecrab.dat")
L.b.0 = S.b.0 = cov(blue)
L.o.0 = S.o.0 = cov(orange)
mu.b.0 = apply(blue,2,mean)
mu.o.0 = apply(orange,2,mean)

L.b.0.inv = S.b.0.inv = solve(L.b.0)
L.o.0.inv = S.o.0.inv = solve(L.o.0)

ybar.b = apply(blue,2,mean)
ybar.o = apply(orange,2,mean)
Sigma.b = cov(blue)
Sigma.o = cov(orange)
Sigma.b.inv = solve(Sigma.b)
Sigma.o.inv = solve(Sigma.o)

n.b = nrow(blue)
n.o = nrow(orange)
nu.0 = 4

n.iter = 10000

theta.b.post = theta.o.post = NULL
Sigma.b.post = Sigma.o.post = NULL




for(i in 1:n.iter){
  ### Update theta.b, theta.o
  Ln.b = solve(S.b.0.inv + n.b* Sigma.b.inv)
  Ln.o = solve(S.o.0.inv + n.o * Sigma.o.inv)
  mu.n.b = Ln.b %*% (L.b.0.inv %*% mu.b.0 + n.b*Sigma.b.inv %*% ybar.b)
  mu.n.o = Ln.o %*% (L.o.0.inv %*% mu.o.0 + n.o*Sigma.o.inv %*% ybar.o)
  theta.b = mvrnorm(1,mu.n.b,Ln.b)
  theta.o = mvrnorm(1,mu.n.o,Ln.o)

  theta.b.post = rbind(theta.b.post,theta.b)
  theta.o.post = rbind(theta.o.post,theta.o)
```

```
  ### Update Sigma.b, Sigma.o
  Sn.b = S.b.0 + (t(blue) - c(theta.b)) %*% t(t(blue) - c(theta.b))
  Sn.o = S.o.0 + (t(orange) - c(theta.o)) %*% t(t(orange) - c(theta.o))
  Sigma.b = solve(rWishart(1,nu.0 + n.b, solve(Sn.b))[,,1])
  Sigma.o = solve(rWishart(1,nu.0 + n.o, solve(Sn.o))[,,1])
  Sigma.b.post = rbind(Sigma.b.post,c(Sigma.b))
  Sigma.o.post = rbind(Sigma.o.post,c(Sigma.o))
}
```

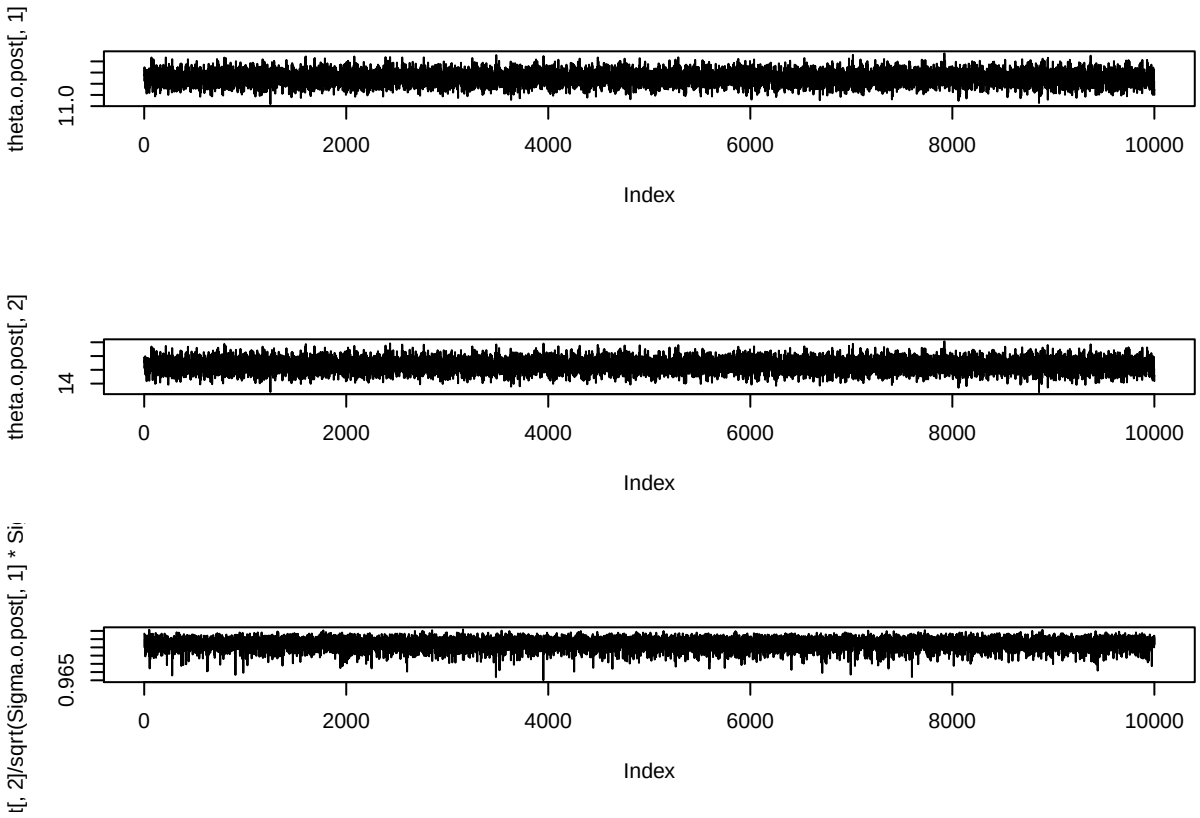
Part B

```
theta.b.post = as.data.frame(theta.b.post)
names(theta.b.post) = c("theta1","theta2")

theta.o.post = as.data.frame(theta.o.post)
names(theta.o.post) = c("theta1","theta2")

par(mfrow = c(3,1))
plot(theta.b.post[,1], type = "l")
plot(theta.b.post[,2], type = "l")
plot(Sigma.b.post[,2] / sqrt(Sigma.b.post[,1]*Sigma.b.post[,4]), type = "l")
```




```
par(mfrow = c(3,1))
plot(theta.o.post[,1], type = "l")
```

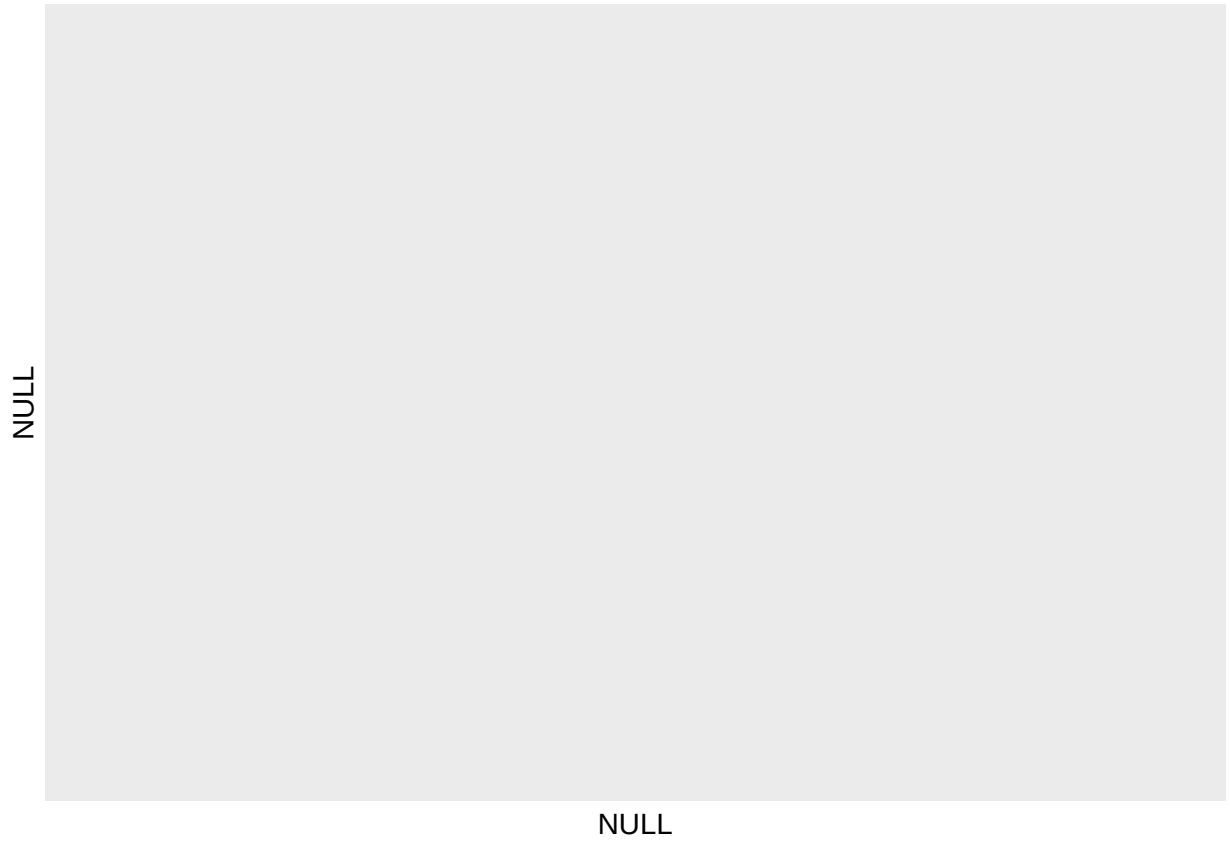
```r
plot(theta.o.post[,2], type = "l")
plot(Sigma.o.post[,2] / sqrt(Sigma.o.post[,1]*Sigma.o.post[,4]), type = "l")
```



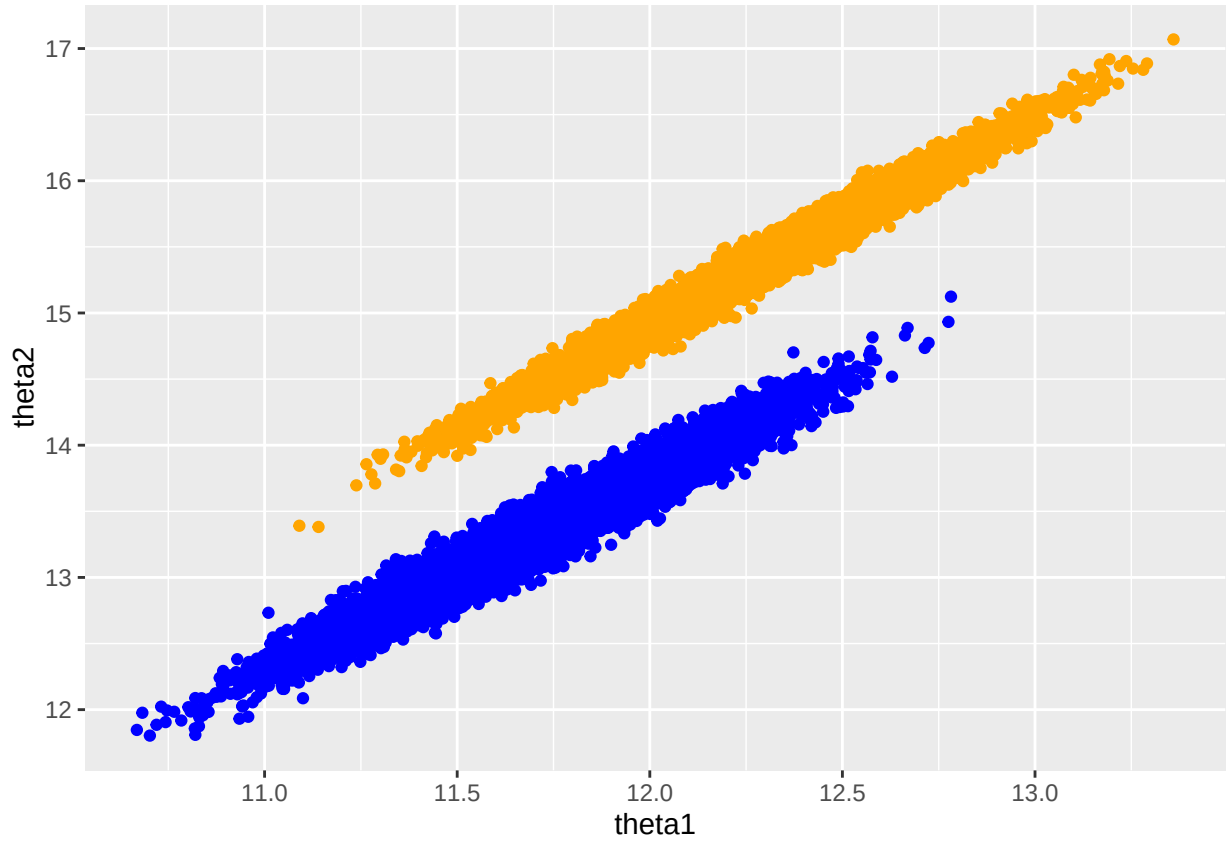

```r
both.theta.post = cbind(theta.b.post, theta.o.post)
```

```
## Warning in data.row.names(row.names, rowsi, i): some row.names duplicated:
## 2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18,19,20,21,22,23,24,25,26,27,28,29,30,31,32,33,34,35,36,37,3

## Warning in data.row.names(row.names, rowsi, i): some row.names duplicated:
## 2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18,19,20,21,22,23,24,25,26,27,28,29,30,31,32,33,34,35,36,37,3
```

```r
id = rownames(both.theta.post)
both.theta.post = cbind(id,both.theta.post)
names(both.theta.post) = c("id","b.theta1","b.theta2","o.theta1","o.theta2")
both.theta.post = as.data.frame(both.theta.post)

par(mfrow = c(1,1))
ggplot(data = both.theta.post,aes(x = NULL,y = NULL))
```

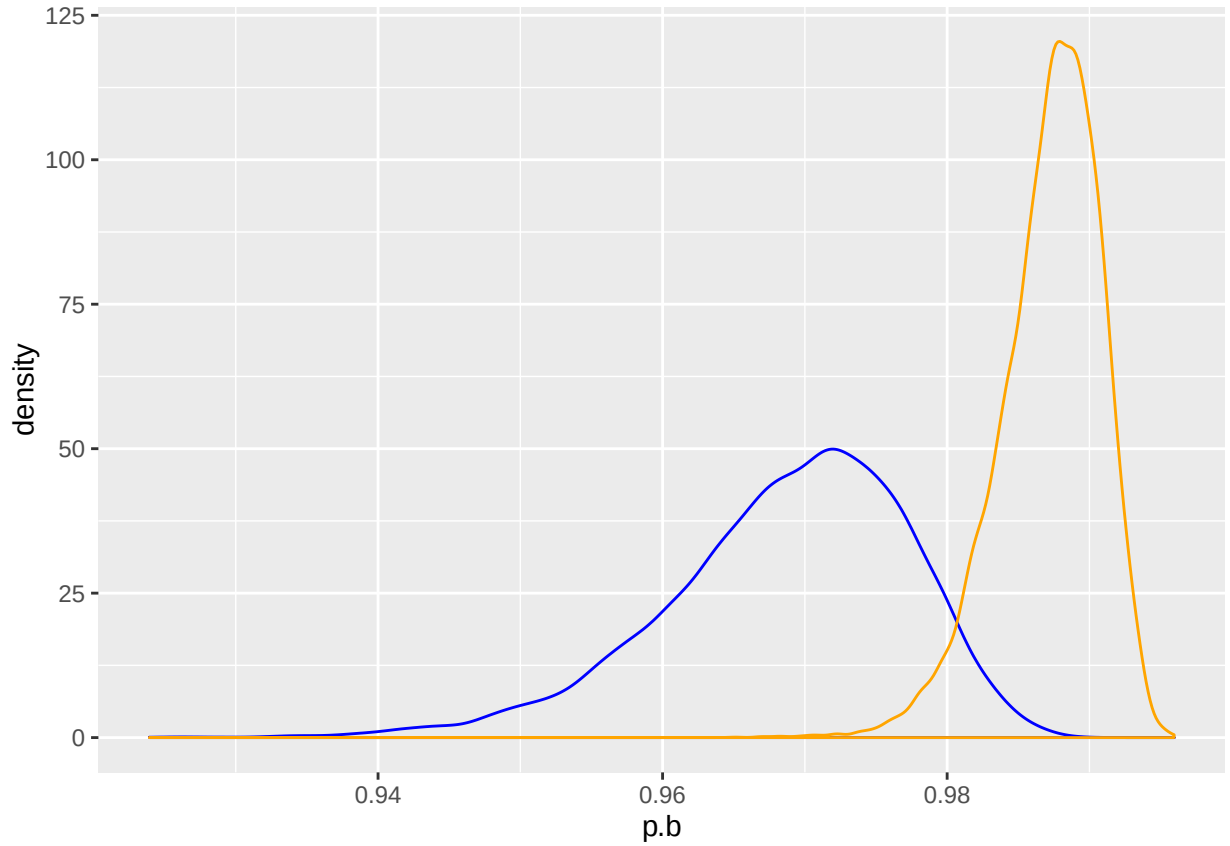



```
ggplot(data = theta.b.post, aes(x = theta1, y = theta2)) + geom_point(color = "blue") + geom_point(data
```



Part C

```
p.b = Sigma.b.post[,2] / sqrt(Sigma.b.post[,1] * Sigma.b.post[,4])
p.o = Sigma.o.post[,2] / sqrt(Sigma.o.post[,1]*Sigma.o.post[,4])

ggplot(data = as.data.frame(p.b) , aes(x = p.b)) + geom_density(color = "blue") + geom_density(data = as
```




```
mean(p.b < p.o)
```

```
## [1] 0.9879
```

Exercise 7.5

```
inter.exp = read.table("~/sta601/HW/interexp.dat", header = TRUE)
```

Exercise 8.2

```
n.a = n.b = 16
y.bar.a = 75.2
s.a = 7.3
y.bar.b = 77.5
s.b = 8.1
```