R Notebook

HW3 H24081333 統計 112 林家同

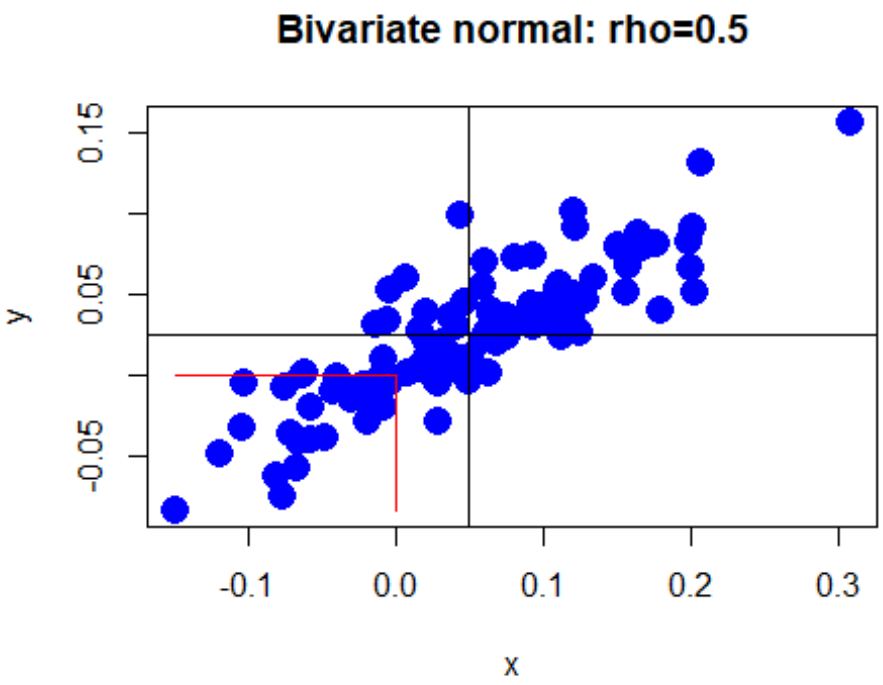
```
library("mvtnorm")

#PART 1
#(1)
mu.x = 0.05
sig.x = 0.10
mu.y = 0.025
sig.y = 0.05

rho.xy = 0.9
sig.xy = rho.xy*sig.x*sig.y
Sigma.xy = matrix(c(sig.x^2, sig.xy, sig.xy, sig.y^2), 2, 2, byrow=TRU
E)
Sigma.xy
```

```
##        [,1]   [,2]
## [1,] 0.0100 0.0045
## [2,] 0.0045 0.0025
```

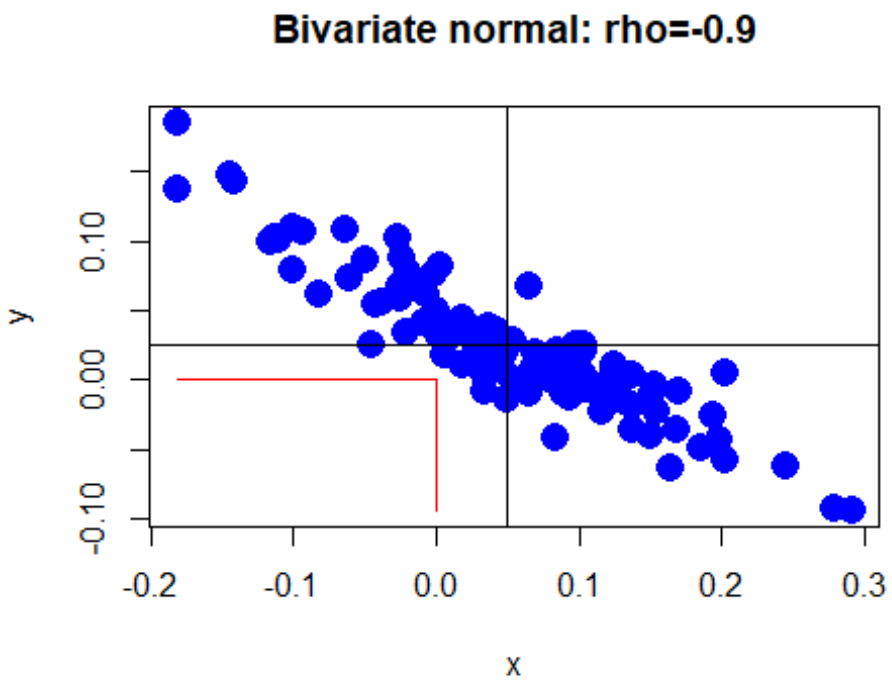
```
n = 100
set.seed(123)
xy.vals = rmvnorm(n, mean=c(mu.x, mu.y), sigma=Sigma.xy)
head(xy.vals)
```

```
##             [,1]         [,2]
## [1,] -0.01055124 -0.002720223
## [2,]  0.19865393  0.081562113
## [3,]  0.12156743  0.091291081
## [4,]  0.04939103 -0.004618093
## [5,] -0.02987387 -0.014866126
## [6,]  0.17729184  0.080391233
```

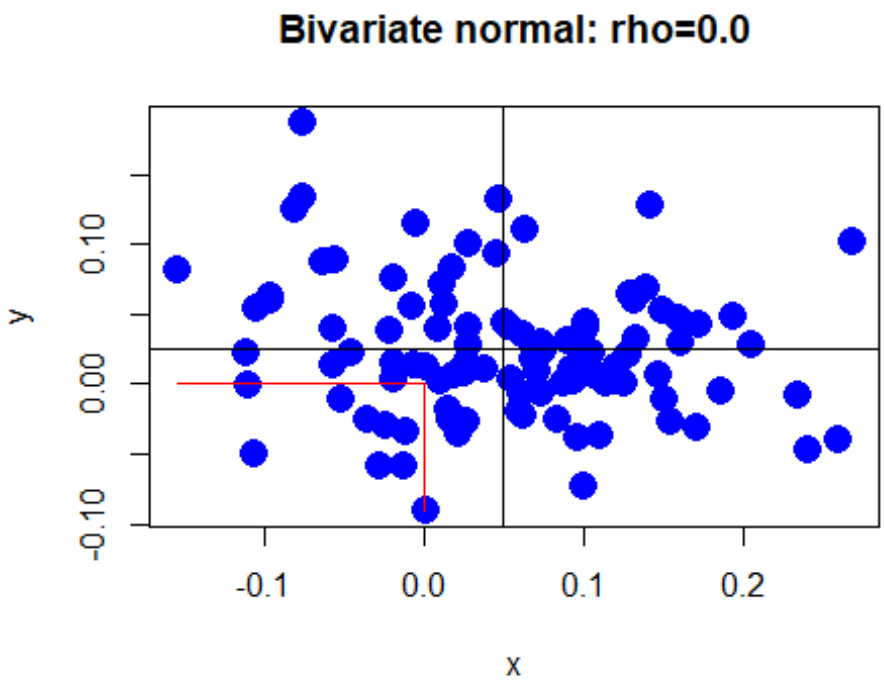
```
plot(xy.vals[,1], xy.vals[,2], pch=16, cex=2, col="blue",
xlab="x", ylab="y")
title("Bivariate normal: rho=0.5")
abline(h=mu.y, v=mu.x)
segments(x0=0, y0=min(xy.vals[,2]), x1=0, y1=0, col="red")
segments(x0=min(xy.vals[,1]), y0=0, x1=0, y1=0, col="red")
```




```
#comment
#when rho=0.5,呈正相關

pmvnorm(lower=c(-Inf, -Inf), upper=c(0, 0), mean=c(mu.x, mu.y), sigma=S
igma.xy)

## [1] 0.2453259
## attr(,"error")
## [1] 1e-15
## attr(,"msg")
## [1] "Normal Completion"

#(2)
rho.xy = -0.9
sig.xy = rho.xy*sig.x*sig.y
Sigma.xy = matrix(c(sig.x^2, sig.xy, sig.xy, sig.y^2), 2, 2, byrow=TRU
E)
n = 100
set.seed(123)
xy.vals = rmvnorm(n, mean=c(mu.x, mu.y), sigma=Sigma.xy)

plot(xy.vals[,1], xy.vals[,2], pch=16, cex=2, col="blue",
xlab="x", ylab="y")
title("Bivariate normal: rho=-0.9")
abline(h=mu.y, v=mu.x)
segments(x0=0, y0=min(xy.vals[,2]), x1=0, y1=0, col="red")
segments(x0=min(xy.vals[,1]), y0=0, x1=0, y1=0, col="red")
```




```
#comment
#when rho=-0.9,呈高度負相關

pmvnorm(lower=c(-Inf, -Inf), upper=c(0, 0), mean=c(mu.x, mu.y), sigma=S
igma.xy)

## [1] 0.0008028802
## attr(,"error")
## [1] 1e-15
## attr(,"msg")
## [1] "Normal Completion"

#(3)
rho.xy = 0
sig.xy = rho.xy*sig.x*sig.y
Sigma.xy = matrix(c(sig.x^2, sig.xy, sig.xy, sig.y^2), 2, 2, byrow=TRU
E)
n = 100
set.seed(123)
xy.vals = rmvnorm(n, mean=c(mu.x, mu.y), sigma=Sigma.xy)

plot(xy.vals[,1], xy.vals[,2], pch=16, cex=2, col="blue",
xlab="x", ylab="y")
title("Bivariate normal: rho=0.0")
abline(h=mu.y, v=mu.x)
segments(x0=0, y0=min(xy.vals[,2]), x1=0, y1=0, col="red")
segments(x0=min(xy.vals[,1]), y0=0, x1=0, y1=0, col="red")
```




```
#comment
#when rho=0.0,零相關

pmvnorm(lower=c(-Inf, -Inf), upper=c(0, 0), mean=c(mu.x, mu.y), sigma=S
igma.xy)

## [1] 0.09519541
## attr(,"error")
## [1] 1e-15
## attr(,"msg")
## [1] "Normal Completion"

#PART 2
#(1)
matA=matrix(data=c(1,2,6,4,4,1,7,8,3),nrow=3,ncol=3)
matA

##      [,1] [,2] [,3]
## [1,]    1    4    7
## [2,]    2    4    8
## [3,]    6    1    3

matB=matrix(data=c(4,5,2,4,9,2,0,1,5),nrow=3,ncol=3)
matB

##      [,1] [,2] [,3]
## [1,]    4    4    0
```

```
## [2,]    5    9    1
## [3,]    2    2    5
```

```
x=matrix(c(1,2,3),nrow=3,ncol=1)
x
```

```
##      [,1]
## [1,]    1
## [2,]    2
## [3,]    3
```

```
y=matrix(c(5,2,7),nrow=3,ncol=1)
y
```

```
##      [,1]
## [1,]    5
## [2,]    2
## [3,]    7
```

```
#(2)
t(matA)
```

```
##      [,1] [,2] [,3]
## [1,]    1    2    6
## [2,]    4    4    1
## [3,]    7    8    3
```

```
t(matB)
```

```
##      [,1] [,2] [,3]
## [1,]    4    5    2
## [2,]    4    9    2
## [3,]    0    1    5
```

```
t(x)
```

```
##      [,1] [,2] [,3]
## [1,]    1    2    3
```

```
t(y)
```

```
##      [,1] [,2] [,3]
## [1,]    5    2    7
```

```
#(3)
matA+matB
```

```
##      [,1] [,2] [,3]
## [1,]    5    8    7
## [2,]    7   13    9
## [3,]    8    3    8
```

```
matA-matB
```

```
##      [,1] [,2] [,3]
## [1,]   -3    0    7
## [2,]   -3   -5    7
## [3,]    4   -1   -2
```

```
2*matA
```

```
##      [,1] [,2] [,3]
## [1,]    2    8   14
## [2,]    4    8   16
## [3,]   12    2    6
```

```
matA%*%x
```

```
##      [,1]
## [1,]   30
## [2,]   34
## [3,]   17
```

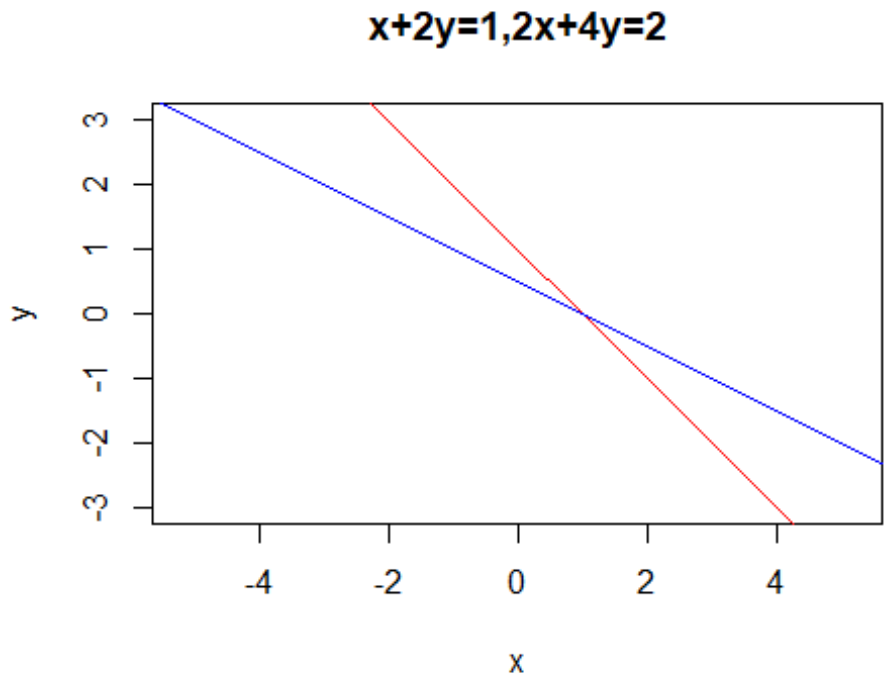
```
t(x)%*%matA%*%y
```

```
##      [,1]
## [1,]  369
```

```
t(y)%*%matA%*%x
```

```
##      [,1]
## [1,]  337
```

```
#(4)
plot(c(-3,3), c(-3,3),type="n",xlab ="x",ylab ="y",main="x+2y=1,2x+4y=2
",asp=1)
abline(a=1,b=-1,col="red")
abline(a=0.5,b=-0.5,col="blue")
```




```
matA=matrix(c(1,2,1,4),2,2)
matA.inv=solve(matA)
vecB=c(1,2)
z=matA.inv%*%vecB
z
```

```
##      [,1]
## [1,]    1
## [2,]    0
```

```
#(5)
x.vec=rep(1,3)/3
matR=matrix(c(0.01,0.04,0.02),nrow=3,ncol=1,byrow=TRUE)
mu=crossprod(x.vec,matR)
mu
```

```
##             [,1]
## [1,] 0.02333333
```

```
#expected_return
#0.02333333


sig.mat=matrix(c(0.1,0.3,0.1,0.3,0.15,-0.2,0.1,-0.2,0.08),3,3)
var=t(x.vec)%*%sig.mat%*%x.vec
var
```

```
##             [,1]
## [1,] 0.08111111

#variance
#0.08111111
```