MAST30025 Assignment 1 S1 2020

## Question 3

#Part a: Describe the distribution of Ay.

A = matrix(c(2,0,-1,0,3,0,-1,0,2)/3,3,3)  
V = matrix(c(2,0,1,0,1,0,1,0,2),3,3)  
mu = t(matrix(c(1,-1,0),1,3))

## 

#Mean of the Ay distribution

A%\*%mu

## [,1]  
## [1,] 0.6666667  
## [2,] -1.0000000  
## [3,] -0.3333333

#Variance of the Ay distribution

A%\*%V%\*%t(A)

## [,1] [,2] [,3]  
## [1,] 0.6666667 0 -0.3333333  
## [2,] 0.0000000 1 0.0000000  
## [3,] -0.3333333 0 0.6666667

## Question 3

#Part b: Find E[t(y)Ay].

#Using Theorem 3.2

sum(diag(A%\*%V)) + t(mu)%\*%A%\*%mu

## [,1]  
## [1,] 4.666667

## Question 3

#Part c: Describe the distribution of t(y)%*%A%*%y

lamba = 0.5%\*%t(mu)%\*%A%\*%mu  
lamba #Our noncentrality parameter

## [,1]  
## [1,] 0.8333333

## Question 5

#Part a:

y = matrix(c(8.5,8,7.5,10,11,15,13.5,14),8,1)  
y

## [,1]  
## [1,] 8.5  
## [2,] 8.0  
## [3,] 7.5  
## [4,] 10.0  
## [5,] 11.0  
## [6,] 15.0  
## [7,] 13.5  
## [8,] 14.0

X = cbind(rep(1,8),c(1.35,1.33,2,1.4,1.43,1.2,1.3,1.28),c(50,55,60,52,47,45,49,63))  
X

## [,1] [,2] [,3]  
## [1,] 1 1.35 50  
## [2,] 1 1.33 55  
## [3,] 1 2.00 60  
## [4,] 1 1.40 52  
## [5,] 1 1.43 47  
## [6,] 1 1.20 45  
## [7,] 1 1.30 49  
## [8,] 1 1.28 63

#Least square estimators

b = solve(t(X)%\*%X, t(X)%\*%y)  
b #b0,b1 and b2 from each row respectively

## [,1]  
## [1,] 21.048202099  
## [2,] -7.418663570  
## [3,] 0.006819703

#Part c: Calculate the residual sum of squares SSres and sample variance s^2.

e = y - X%\*%b   
e

## [,1]  
## [1,] -2.8739914  
## [2,] -3.5564632  
## [3,] 0.8799429  
## [4,] -1.0166977  
## [5,] 0.2399608  
## [6,] 2.5473076  
## [7,] 1.7618951  
## [8,] 2.0180460

#Now t o find s2

N=8  
P=3  
SSRES = sum(e^2)  
s2 = SSRES/(N-P)  
s2

## [1] 7.287874

#Part d: Predict (using a point estimate) the average fuel mileage of a car which weighs 1.8 tons and is driven at 59 km/hr.

c(1,1.8,59)%\*%b

## [,1]  
## [1,] 8.09697