DA410\_assignment2\_grahn

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# 3.10

Use the calcium data in Table 3.4: ##(a) Calculate S using the data matrix Y as in (3.29).

#make the calcuim matrix  
Y <- matrix(c(35, 35, 40, 10, 6, 20, 35, 35, 35, 30, 3.5, 4.9, 30.0, 2.8, 2.7, 2.8, 4.6, 10.9, 8.0, 1.6, 2.80, 2.70, 4.38, 3.21, 2.73, 2.81, 2.88, 2.90, 3.28, 3.20),   
 nrow = 10,   
 ncol = 3,  
 byrow = FALSE)  
Y

## [,1] [,2] [,3]  
## [1,] 35 3.5 2.80  
## [2,] 35 4.9 2.70  
## [3,] 40 30.0 4.38  
## [4,] 10 2.8 3.21  
## [5,] 6 2.7 2.73  
## [6,] 20 2.8 2.81  
## [7,] 35 4.6 2.88  
## [8,] 35 10.9 2.90  
## [9,] 35 8.0 3.28  
## [10,] 30 1.6 3.20

#calculate "S" (sample covariance matrix)  
S <- round(var(Y), 2)  
S

## [,1] [,2] [,3]  
## [1,] 140.54 49.68 1.94  
## [2,] 49.68 72.25 3.68  
## [3,] 1.94 3.68 0.25

## (c) Find R using (3.37)

#Use the calcuim Matrix to find the sample correlation matrix  
R <- round(cor(S), 2)  
R

## [,1] [,2] [,3]  
## [1,] 1.00 0.51 0.33  
## [2,] 0.51 1.00 0.98  
## [3,] 0.33 0.98 1.00

# 3.14

For the variables in Table 3.4, define z = 3y1 — y2 + 2y3 = (3, —1, 2)y. Find z-hat and s(sq)z in two ways:

## Use z = a’y and s(sq)z = a’Sa, as in (3.54) and (3.55)..

#use the calcium matrix from the previous quesiton, find z-hat  
#build the constant matrix alpha  
a <- matrix(c(3, -1, 2), nrow = 3, ncol = 1)  
  
#find y-hat for each column  
y\_hats <- colMeans(Y)  
  
#multiply the constant matrix 3x1 with the column means 1x3 to get z-hat  
y\_hats %\*% a

## [,1]  
## [1,] 83.298

#and s(sq)z from a and S  
t(a) %\*% S %\*% a

## [,1]  
## [1,] 1048.59

# 3.21

The data in Table 3.8 consist of head measurements on first and second sons (Frets 1921). Define y1 and y2 as the measurements on the first son and x1 and X2 for the second son.

## (a) Find the mean vector for all four variables and partition it into (y-hat / x-hat) as in (3.41).

table\_3\_8 <- matrix(c(191,195,181,183,176,208,189,197,188,192,179,183,174,190,188,163,195,  
 186,181,175,192,174,176,197,190,155,149,148,153,144,157,150,159,152,  
 150,158,147,150,159,151,137,155,153,145,140,154,143,139,167,163,179,  
 201,185,188,171,192,190,189,197,187,186,174,185,195,187,161,183,173,  
 182,165,185,178,176,200,187,145,152,149,149,142,152,149,152,159,151,  
 148,147,152,157,158,130,158,148,146,137,152,147,143,158,150),  
 ncol = 4, byrow = FALSE)  
  
#View(table\_3\_8)  
  
#get the column means as a 4x1 matrix  
ymeans <- matrix(colMeans(table\_3\_8))  
ymeans

## [,1]  
## [1,] 185.72  
## [2,] 151.12  
## [3,] 183.84  
## [4,] 149.24

## (b) Find the covariance matrix for all four variables and partition it into S as in (3.42).

S <- round(var(table\_3\_8), 2)  
S

## [,1] [,2] [,3] [,4]  
## [1,] 95.29 52.87 69.66 46.11  
## [2,] 52.87 54.36 51.31 35.05  
## [3,] 69.66 51.31 100.81 56.54  
## [4,] 46.11 35.05 56.54 45.02