Stat 577 Homework 1

Due by 9/20/23 in Canvas using SubmitHW1

Name:

**Total points: 60**

**Note: R code should be provided as an Appendix at the very end of your completed homework.**

In this homework, you will be using Baumann data from carData package. First install the package and load it using

#install.packages("carData")  
library(carData)

## Warning: package 'carData' was built under R version 4.3.1

Type Baumann in the Help window and read detail information about the data. To see all the variables in the data and to attach Baumann data, type

names(Baumann)  
attach(Baumann)

Now create a new data considering all rows and columns 2 through 6 from Baumann data and let’s call this new data newBaumann.

## Question 1

For newBaumann data,

1. [5 points] Find the mean of each variable.
2. [5 points] Find the covariance matrix. Round your answers to 3 decimal places. What is the dimension of this matrix?
3. [2 points] Report the covariance value between pretest.1 and pretest.2 variables.
4. [5 points] Find the correlation matrix. Round your answers to 3 decimal places. What is the dimension of this matrix?
5. [2 points] Report the correlation value between post.test.1 and post.test.2 variables.

## Question 2

[10 points] Draw a bivaritate boxplot for pretest.1 and pretest.2 variables. In your graph, pretest.1 and pretest.2 variables will go along x and y axis, respectively. Find the index of any outlier(s) that is outside the fence (the outer ellipse). Write down the text “Outlier” to the right of the outlier point in the graph. Make sure to have x and y axes titles as well as the graph title.

## Question 3

[10 points] Draw a convex hull for post.test.1 and post.test.2 variables. In your graph, post.test.1 and post.test.2 variables will go along x and y axis, respectively. Make sure to have x and y axes titles as well as the graph title. Report the index of extreme points in each direction.

## Question 4

[6 points] Draw a scatterplot matrix of the following four variables: pretest.1,pretest.2,post.test.1, post.test.2 and provide your graph below.

## Question 5

[15 points] Create a by matrix **z** whose elements are random numbers generated from a uniform distribution. Use set.seed(1233):

set.seed(1233)  
z=matrix(runif(30,1,2), nrow=6, ncol=5, byrow=F)  
z

1. Now form **z’z**. Is **z’z** symmetric?
2. Find the eigenvalues of **z’z**.
3. Based on the eigenvalues of **z’z**, is your **z’z** non-negative definite or positive definite?
4. Find the determinant of **z’z**. Is the determinant of **z’z** equal to the product of the eigenvalues?
5. Find the trace of **z’z**. Is the trace of **z’z** equal to the sum of the eigenvalues?
6. Find the generalized inverse matrix of **z’z**.
7. Find the square root matrix of **z’z**.