R Notebook

Code

DATA SCIENCE PROGRAMMING II (BSD2223)

LAB REPORT 2 NAME: TEAN JIN HE MATRIC ID: SD21063 SECTION: 01G

QUESTIONS 1

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```
#a)
##A vector is a list of numbers that can be in a row or column while a matrix is an array of numbers that can be one or more either columns or rows. A vector has magnitude and direction, however a matrix can represent linear transformations, such as rotations or scaling.

#b)
##Conformable in matrix multiplication is referring to two matrices have the same dimensions (number of rows and number of columns). For example, if A is an m x n matrix and B is an s x p matrix, then n needs to be equal to s for the matrix product AB to be defined. So, we say that A and B are conformable for multiplication (in that sequence).
```

Questions 2

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```
#a)
v1 <- c(1,7,0,1,-3,-2,2,4,1,0)
A <- matrix(v1, nrow = 5, ncol = 2)
A
```

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

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```
v2 <- c(2,0,5,1,2,3,1,1,1,4,-1,4,-2,1,1,1,2,0,1,0,0,5,3,1,-1)
B <- matrix(v2, nrow = 5, ncol = 5)
B
```

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

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```
#b)
A_new <- A
A_new[, 1] <- sort(A_new[, 1])
A_new
```

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

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```
#c)
A_new %*% B
```

```
Error in A_new %*% B : non-conformable arguments
```

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```
#d)
diag(B)
```

```
[1]  2  1 -2  1 -1
```

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```
#e)
inv_B <- solve(B)
inv_B
```

```
           [,1]        [,2]        [,3]       [,4]        [,5]
[1,] -0.3396226 -0.23270440  0.14465409  0.8050314  0.07547170
[2,]  0.3207547  0.20125786 -0.04402516 -0.7232704  0.15094340
[3,] -0.4339623 -0.05660377 -0.01886792  0.5471698  0.20754717
[4,]  0.2830189 -0.19496855 -0.17610063  1.1069182 -0.39622642
[5,]  0.1698113  0.28301887  0.09433962 -0.7358491 -0.03773585
```

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```
#f)
##1. Matrix B is a square matrix.
dim(B)
```

```
[1] 5 5
```

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```
##2. Determinant matrix B must not zero.
det(B)
```

```
[1] -159
```

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```
##3. BB^(-1)=I
I <- B %*% inv_B
I
```

```
              [,1]          [,2]         [,3]          [,4]          [,5]
[1,]  1.000000e+00  2.775558e-17 5.551115e-17 -2.220446e-16 -2.220446e-16
[2,]  0.000000e+00  1.000000e+00 5.551115e-17  0.000000e+00 -2.775558e-17
[3,]  1.110223e-16 -1.110223e-16 1.000000e+00  0.000000e+00  2.775558e-17
[4,] -1.387779e-16 -5.551115e-17 0.000000e+00  1.000000e+00  6.245005e-17
[5,]  2.775558e-17  0.000000e+00 2.775558e-17 -1.110223e-16  1.000000e+00
```

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```
Id_B <- round(I, 4)
Id_B
```

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

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```
#g)
B_t <- t(B) #the transpose of B
B_t
```

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

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```
B %*% B_t #multiply B and transpose of B
```

```
     [,1] [,2] [,3] [,4] [,5]
[1,]   15    1   15    5   15
[2,]    1   46    8   12    3
[3,]   15    8   39    7    9
[4,]    5   12    7    5    6
[5,]   15    3    9    6   22
```