DATA 106 - Lab 1 SOLUTIONS

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General rules

- For some questions, the needed methods may not have been covered in class. For them, please do some research to solve them.
- You must show your work in order to get points. Providing correct answers without supporting codes or intermediate steps does not receive full credit.
- You must submit both the R file as a .R file and the Assignment file as a PDF. For the Assignment file include the code, the output and explanations (if necesssary).

Questions

1. a. Create a vector $a = (1, 3, 5, 7, 9)$ using both the concatenation `c` and `seq` command, respectively.

```
#Method 1
a=c(1,3,5,7,9)
a
```

```
## [1] 1 3 5 7 9
```

```
#Method 2
a=seq(1,9,by=2)
a
```

```
## [1] 1 3 5 7 9
```

```
b. Create a vector $b = (1,1,1,1,1)$ using both the `c` and `rep` command, respectively.
```

```
#Method 1
b=c(1,1,1,1,1)
b
```

```
## [1] 1 1 1 1 1
```

```
#Method 2
b=rep(1,times=5)
b
```

```
## [1] 1 1 1 1 1
```

```
c. Find the entrywise difference between $a$ and $b$. Find the sum of the last entry of $a$ and that of
```

```
a-b  #Entrywise difference
```

```
## [1] 0 2 4 6 8
```

```
a[5]+b[5] #Sum of last entries
```

```
## [1] 10
```

2. Use `rep` command to create a vector whose first 4 entries are all 1's, second 4 entries are all 2's, and last 4 entries are all 3's.

```
#Method 1
rep(seq(1,3, by=1), each=4)
```

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

```
#Method 2
rep(c(1,2,3), each=4)
```

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

3. a. Combine a and b (given/created above) into a matrix A by taking them as rows. Check if$A$ is a matrix.

```
#Method 1
A<-rbind(a,b)
is.matrix(A)
```

```
## [1] TRUE
```

```
A
```

```
##   [,1] [,2] [,3] [,4] [,5]
## a    1    3    5    7    9
## b    1    1    1    1    1
```

```
#Method 2
A=matrix(c(a,b), byrow=T,nrow=2)
is.matrix(A)
```

```
## [1] TRUE
```

```
A
```

```
##      [,1] [,2] [,3] [,4] [,5]
## [1,]    1    3    5    7    9
## [2,]    1    1    1    1    1
```

b. Combine a and b into a matrix B by taking them as columns.

```r
#Method 1
B<-cbind(a,b)
is.matrix(B)
```

```
## [1] TRUE
```

```r
B
```

```
##      a b
## [1,] 1 1
## [2,] 3 1
## [3,] 5 1
## [4,] 7 1
## [5,] 9 1
```

```r
#Method 2
B=matrix(c(a,b), byrow=F,ncol=2)
is.matrix(B)
```

```
## [1] TRUE
```

```r
B
```

```
##      [,1] [,2]
## [1,]    1    1
## [2,]    3    1
## [3,]    5    1
## [4,]    7    1
## [5,]    9    1
```

c. Create column and row names of A. Print A.

```r
rownames(A)=c("a","b")
colnames(A)=c("elem1","elem1","elem3","elem4","elem5")
A
```

```
##   elem1 elem1 elem3 elem4 elem5
## a     1     3     5     7     9
## b     1     1     1     1     1
```

d. Show the first row of A.

```r
A[1,]
```

```
## elem1 elem1 elem3 elem4 elem5
##     1     3     5     7     9
```

e. Show the $(2,2)$-entry of A.

```
A[2,2]
```

```
## [1] 1
```

f. Find the sum of all entries of A.

```
sum(A)
```

```
## [1] 30
```

g. Find the entrywise sum of the rows of A.

```
A[1,]-A[2,]
```

```
## elem1 elem1 elem3 elem4 elem5
##     0     2     4     6     8
```

h. Find the sum of entries for each row of A.

```
sum(A[1,])
```

```
## [1] 25
```

```
sum(A[2,])
```

```
## [1] 5
```

4. a. Turn the matrix A created above into a data frame.

```
as.data.frame(A)
```

```
##   elem1 elem1 elem3 elem4 elem5
## a     1     3     5     7     9
## b     1     1     1     1     1
```

b. Find the dimension of A.

```
dim(A)
```

```
## [1] 2 5
```

c. Append the vector $q = (``A",``B")$ as the 6-th column of A and name the new data frame as C. I

```
q=c("A","B")
q
```

```
## [1] "A" "B"
```

```r
C=cbind(A,q)
C=as.data.frame(C,stringsAsFactors = FALSE)
C
```

```
##   elem1 elem1 elem3 elem4 elem5 q
## a     1     3     5     7     9 A
## b     1     1     1     1     1 B
```

d. What happens when C is transposed?

```r
t(C)
```

```
##       a   b
## elem1 "1" "1"
## elem1 "3" "1"
## elem3 "5" "1"
## elem4 "7" "1"
## elem5 "9" "1"
## q     "A" "B"
```

e. Provide 2 methods to access the 6-th column of C.

```r
#Method 1
C[,6]
```

```
## [1] "A" "B"
```

```r
#Method 2
C$q
```

```
## [1] "A" "B"
```

```r
#Method 3
C[,"q"]
```

```
## [1] "A" "B"
```

5. a. Refer to C created above. Print$C$.

```r
C
```

```
##   elem1 elem1 elem3 elem4 elem5 q
## a     1     3     5     7     9 A
## b     1     1     1     1     1 B
```

b. Replace the first 5 entries of the 2nd row of C by 0's.

```r
C[2,1:5] = c(0,0,0,0,0)
C
```

```
##   elem1 elem1 elem3 elem4 elem5 q
## a     1     3     5     7     9 A
## b     0     0     0     0     0 B
```

c. Delete the last column of C. Name the new dataframe $C1$

```r
#Method 1
C1<-C[,1:5]
C1
```

```
##   elem1 elem1.1 elem3 elem4 elem5
## a     1       3     5     7     9
## b     0       0     0     0     0
```

```r
#Method 2
C1<-subset(C, select = -c(q) )
C1
```

```
##   elem1 elem1.1 elem3 elem4 elem5
## a     1       3     5     7     9
## b     0       0     0     0     0
```

```r
#Method 3
drop <- c("q")
C1 = C[,!(names(C) %in% drop)]
C1
```

```
##   elem1 elem1.1 elem3 elem4 elem5
## a     1       3     5     7     9
## b     0       0     0     0     0
```

6. Create the following 5-by-5 diagonal matrix:

```
##      [,1] [,2] [,3] [,4] [,5] [,6] [,7]
## [1,]    1    0    0    0    0    0    0
## [2,]    0    3    0    0    0    0    0
## [3,]    0    0    5    0    0    0    0
## [4,]    0    0    0    7    0    0    0
## [5,]    0    0    0    0    9    0    0
## [6,]    0    0    0    0    0   11    0
## [7,]    0    0    0    0    0    0   13
```

```r
diag(seq(1,13,by=2))
```

```
##      [,1] [,2] [,3] [,4] [,5] [,6] [,7]
## [1,]    1    0    0    0    0    0    0
## [2,]    0    3    0    0    0    0    0
```

```
## [3,]    0    0    5    0    0    0    0
## [4,]    0    0    0    7    0    0    0
## [5,]    0    0    0    0    9    0    0
## [6,]    0    0    0    0    0   11    0
## [7,]    0    0    0    0    0    0   13
```

7. Summarize the difference and similarity between a matrix and a data frame.

see https://bookdown.org/ndphillips/YaRrr/creating-matrices-and-dataframes.html

OR

https://www.quora.com/What-is-the-difference-between-a-matrix-and-a-dataframe-in-R#targetText=
Matrix%20%2D%20A%20matrix%20is%20a,of%20vectors%20of%20equal%20length.&targetText=A%20data%20frame%20c