exercise_2.R

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```
#Xu Xu
#1
#(a)
A<-matrix(c(1,5,-2,1,2,-1,3,6,-3),nr=3)
A%*%A%*%A
```

```
##      [,1] [,2] [,3]
## [1,]    0    0    0
## [2,]    0    0    0
## [3,]    0    0    0
```

```
#(b)
A[,3]<-A[,2]+A[,3]

#2
B<-matrix(c(10,-10,10),nc=3,nr=15,b=TRUE)
t(B)%*%B
```

```
##       [,1]  [,2]  [,3]
## [1,]  1500 -1500  1500
## [2,] -1500  1500 -1500
## [3,]  1500 -1500  1500
```

```
#3
matE<-matrix(c(0,0,0,0,0,0),nc=6,nr=6)
row(matE)
```

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

```
col(matE)
```

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

```
row(matE)-col(matE)
```

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

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

```
matE[abs(row(matE)-col(matE))==1]<-1
matE
```

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

```
#4
c <- 0:4
C <- outer(c,c,"+")
C
```

```
##      [,1] [,2] [,3] [,4] [,5]
## [1,]    0    1    2    3    4
## [2,]    1    2    3    4    5
## [3,]    2    3    4    5    6
## [4,]    3    4    5    6    7
## [5,]    4    5    6    7    8
```

```
#5
#(a)
outer(0:4,0:4,"+")%%5
```

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

```
#(b)
outer(0:9,0:9,"+")%%10
```

```
##       [,1] [,2] [,3] [,4] [,5] [,6] [,7] [,8] [,9] [,10]
##  [1,]    0    1    2    3    4    5    6    7    8     9
##  [2,]    1    2    3    4    5    6    7    8    9     0
##  [3,]    2    3    4    5    6    7    8    9    0     1
##  [4,]    3    4    5    6    7    8    9    0    1     2
##  [5,]    4    5    6    7    8    9    0    1    2     3
##  [6,]    5    6    7    8    9    0    1    2    3     4
##  [7,]    6    7    8    9    0    1    2    3    4     5
##  [8,]    7    8    9    0    1    2    3    4    5     6
##  [9,]    8    9    0    1    2    3    4    5    6     7
## [10,]    9    0    1    2    3    4    5    6    7     8
```

```
#(c)
outer(0:8,0:8,"-")%%9
```

```
##       [,1] [,2] [,3] [,4] [,5] [,6] [,7] [,8] [,9]
##  [1,]    0    8    7    6    5    4    3    2    1
```

```
##  [2,]    1    0    8    7    6    5    4    3    2
##  [3,]    2    1    0    8    7    6    5    4    3
##  [4,]    3    2    1    0    8    7    6    5    4
##  [5,]    4    3    2    1    0    8    7    6    5
##  [6,]    5    4    3    2    1    0    8    7    6
##  [7,]    6    5    4    3    2    1    0    8    7
##  [8,]    7    6    5    4    3    2    1    0    8
##  [9,]    8    7    6    5    4    3    2    1    0
```

```
#6
y <- c(7,-1,-3,5,17)
A <- matrix(0,nr=5, nc=5)
A <- abs(col(A)-row(A))+1
x<-solve(A)%*%y
x
```

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

```
#7
set.seed(75)
aMat <- matrix( sample(10, size=60, replace=T), nr=6)
#(a)
apply(aMat, 1, function(x){sum(x>4)})
```

```
## [1] 4 7 6 2 6 7
```

```
#(b)
which(apply(aMat,1,function(x){sum(x==7)==2}))
```

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

```
#(c)
aMatColSums <- colSums(aMat)
outer(aMatColSums,aMatColSums,"+")>75
```

```
##        [,1]  [,2]  [,3]  [,4]  [,5]  [,6]  [,7]  [,8]  [,9] [,10]
##  [1,] FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE
##  [2,] FALSE  TRUE FALSE FALSE FALSE  TRUE FALSE  TRUE FALSE FALSE
##  [3,] FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE
##  [4,] FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE
##  [5,] FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE
##  [6,] FALSE  TRUE FALSE FALSE FALSE FALSE FALSE  TRUE FALSE FALSE
##  [7,] FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE
##  [8,] FALSE  TRUE FALSE FALSE FALSE  TRUE FALSE  TRUE FALSE FALSE
##  [9,] FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE
## [10,] FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE
```

```
which(outer(aMatColSums,aMatColSums,"+")>75, arr.ind=TRUE)
```

```
##      row col
## [1,]   2   2
## [2,]   6   2
## [3,]   8   2
```

```
## [4,]   2   6
## [5,]   8   6
## [6,]   2   8
## [7,]   6   8
## [8,]   8   8
```

```
#8
#(a)
sum((1:20)^4)*sum(1/(4:8))
```

```
## [1] 639215.3
```

```
#(b)
sum((1:20)^4/(3+outer(1:20,1:5,"*")))
```

```
## [1] 89912.02
```

```
#(c)
sum(outer(1:10,1:10,function(i,j){(i>=j)*i^4/(3+i*j)}))
```

```
## [1] 6944.743
```