

CSC 522 : Automated Learning and Data Analysis

Homework 2

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1 Question 1

Write code in R or Matlab to perform each of the following tasks:

1. Generate a 3×3 matrix with input containing the sequence 1, 2, ... 9.

Ans: $x \leftarrow matrix(c(1:9), 3, 3)$

2. a) Access elements from the 2nd and 3rd columns only.

Ans:

2nd column alone : $x[,2] \Rightarrow [1] 4 5 6$

3rd column alone : $x[,3] \Rightarrow [1] 7 8 9$

both columns : $x[,2:3]$

\Rightarrow

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

- b) Access elements of the 2nd and 3rd rows only

Ans:

2nd row alone : $x[2,] \Rightarrow [1] 2 5 8$

3rd row alone : $x[3,] \Rightarrow [1] 3 6 9$

both rows : $x[2:3,]$

\Rightarrow

	[, 1]	[, 2]	[, 3]
[1,]	2	5	8
[2,]	3	6	9

- c) Access rows 1 and 3 only? (see `rbind()` function in R and `vertcat()` in matlab)

Ans:

$x2 \leftarrow rbind(x[2,], x[3,])$

\Rightarrow

	[, 1]	[, 2]	[, 3]
[1,]	1	4	7
[2,]	3	6	9

- d) Calculate sum of the 2nd row, the diagonal and the 3rd column in the matrix.

Ans:

$x[2,] + x[,3] + diag(x)$

$\Rightarrow [1] 10 18 26$

- e) Identify row and column dimensions of the matrix.

Ans:

```
dim(x)
=> [1] 3 3
```

- f) Transpose of a matrix.

Ans:

```
t(x)
      [,1] [,2] [,3]
[1,]    1    2    3
[2,]    4    5    6
[3,]    7    8    9
```

- g) Scalar multiplication of output matrix with itself.

Ans:

```
x * x
      [,1] [,2] [,3]
[1,]    1   16   49
[2,]    4   25   64
[3,]    9   36   81
```

- h) Matrix multiplication of output matrix with itself.

Ans:

```
x %>%*% x
      [,1] [,2] [,3]
[1,]   30   66  102
[2,]   36   81  126
[3,]   42   96  150
```

- i) Cross product of the output matrix from 1.

Ans:

```
crossprod(x)
      [,1] [,2] [,3]
[1,]   14   32   50
[2,]   32   77  122
[3,]   50  122  194
```

- j) Check if a matrix is a square matrix.

Ans:

```
function checksqmatrix(mat)
{
  if(dim(mat)[1]==dim(mat)[2])
  {
    print("It is a square matrix!")
  }
  else
  {
    print("It is NOT a square matrix")
  }
}
```

```
> checksqmatrix(x)
[1] "It is a square matrix!"

> checksqmatrix(matrix(c(1:10),2,5))
[1] "It is NOT a square matrix"
```

k) Inverse of a matrix

Ans:

`solve(x)`

Since this matrix has determinant 0 the inverse is not defined.

Error in `solve.default(x)` :

Lapack routine dgesv: system is exactly singular: $U[3,3] = 0$

l) Identity of a matrix.

Ans:

m) Sum of all elements in the matrix (use a for/while loop)

```
matrixsum <- function (mat) {  
  i<-1  
  sum<-0  
  while(i<=dim(mat)[1]*dim(mat)[2])  
  {  
    sum<-sum+mat[i]  
    i<-i+1  
  }  
  print (paste(sum, "is the sum of elements"))  
}  
  
> matrixsum(x)  
[1] "45 is the sum of elements"
```