LECTURE (6)

Advanced Operations on Matrixes

- ✓ Using the matrix pointer with coordinates from the matrix elements:

(بمعنى استدعاء مصفوفة جزئية من المصفوفة الأصلية وكما مبين في الشكل أدناه)

C =

1	2	5	6
1	6	0	9
4	7	8	10
2	4	5	6

```
c(1:2,3:4)        ans =  5   6
                         0   9
```

```
c(3:-1:1,:)       ans =  4   7   8   10
                         1   6   0   9
                         1   2   5   6
```

```
c(:,[3,4,3,4])    ans =  5   6   5   6
                         0   9   0   9
                         8   10  8   10
                         5   6   5   6
```

```
c([3,1,3,2],:)    ans =  4   7   8   10
                         1   2   5   6
                         4   7   8   10
                         1   6   0   9
```

✓ Manipulate the matrix, change its shape, and set its size

التعامل مع المصفوفة وتعيين حجمها وطولها وتغيير شكلها

$$if \quad a = \begin{matrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & 8 & 9 \end{matrix}$$

✓ Makes the matrix a vertical vector to matrix a:

✓ a(:)

ans=
1
4
7
2
5
8
3
6
9

✓ Make the matrix a horizontal vector of matrix a:

a(:)'
ans= 1 4 7 2 5 8 3 6 9

✓ Set the size of the matrix:

General formula: size (matrix name)

length (matrix name)

Example // $if \quad a = \begin{matrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & 8 & 9 \end{matrix} \; find \;\; size(a) \; and \; length(a)$

$$size(a) \rightarrow ans = 3 \quad 3$$
$$length(a) \rightarrow ans = 3$$

- ✓ Reshape the matrix so that the number of rows is (m) and the number of columns is (n)

General formula: reshape (matrix name, m, n)

Example// If $a = \begin{matrix} 1 & 6 & 11 \\ 5 & 10 & 4 \\ 9 & 3 & 8 \\ 2 & 7 & 12 \end{matrix}$ Find reshape(a,3,4)

ans =

$$\begin{matrix} 1 & 2 & 3 & 4 \\ 5 & 6 & 7 & 8 \\ 9 & 10 & 11 & 12 \end{matrix}$$

Example //

if $a = \begin{bmatrix} 1 & 2 & 3 & 4 & 5 & 6 \\ 7 & 8 & 9 & 10 & 11 & 12 \\ 1 & 2 & 3 & 4 & 5 & 6 \\ 7 & 8 & 9 & 10 & 11 & 12 \end{bmatrix}$

Find reshape(a,6,4)

ans=

$$\begin{matrix} 1 & 2 & 4 & 5 \\ 7 & 8 & 10 & 11 \\ 1 & 3 & 4 & 6 \end{matrix}$$

7	9	10	12
2	3	5	6
8	9	11	12

❖ Rotate matrix (a)

General formula: rot90(matrix name)

Example //

If $a = \begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & 8 & 9 \end{bmatrix}$ find rot90(a)

$a = \begin{bmatrix} 3 & 6 & 9 \\ 2 & 5 & 8 \\ 1 & 4 & 7 \end{bmatrix}$

Other Operations on Matrices:

1. Addition and subtraction:

To add or subtract any two (or more) matrices, they must be of the same matrix capacity. Both addition and subtraction operations are performed by adding (subtracting) the corresponding elements together.

The result of the addition (subtraction) operation is the same size as (a, b). The command is as follows:
C=a+b
C=a-b

The previous commands can also be written as follows:
C=plus(a,b)
C=minus(a,b)

2. Matrix multiplication:

Let two matrixes (a and b) the horizontal and vertical:

$$a = 1 \quad 2 \quad 3 \qquad b = \begin{matrix} 1 \\ 2 \\ 3 \end{matrix}$$

- dotproduct:

$$a * b = 14$$

Where the first column is multiplied by the first row, the second column is multiplied by the second row, and the third column is multiplied by the third row.

- outproduct:

$$b * a = \begin{matrix} 1 & 2 & 3 \\ 2 & 4 & 6 \\ 3 & 6 & 9 \end{matrix}$$

Where each line of (a) is multiplied by a line of (b).

The previous commands can also be written as follows:
C=mtimes(a,b).
C=mtimes(b,a).

Other instructions within matrix operations:

1. Constructing a vector with consecutive elements
   - ✓ A=1:20

- ✓ A=1 2 3 ……. 20
- ✓ B=1:2:20
- ✓ B=1 3 5 ……..19
- ✓ C=20: -1:1
- ✓ 20 19 18 ……. 1

ويمكن استخدام هذه الطريقة لإنشاء مصفوفة معينة:
فمثلاً

Example:

$$D = [1{:}\,5;\ 2{:}\,2{:}\,10;\ 7{:}\,-1{:}\,3]$$

Ans

$$D = \begin{matrix} 1 & 2 & 3 & 4 & 5 \\ 2 & 4 & 6 & 8 & 10 \\ 7 & 6 & 5 & 4 & 3 \end{matrix}$$

- Let us assume that (a) is a 3*3 matrix, were

$$a = \begin{matrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & 8 & 9 \end{matrix}$$

We will apply some instructions or commands to this matrix:

- ❖ sum(a): This command is used to find the sum of a particular matrix and gives a horizontal vector representing each of its elements.

  z= sum(a)

ans= 12 15 18

whereas:

12 represents the sum of the first column
15 represents the sum of the second column
18 represents the sum of the third column

And so on for the rest of the matrices.

- sum(A, 2): This command is used to find the sum of a particular matrix and gives a horizontal vector representing each of its elements.

$$a = \begin{matrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & 8 & 9 \end{matrix}$$

rowSums = sum(a, 2)

ans= 6
15
24

- diag(a): gives the elements of the main diagonal of array (a):

f=diag(a)

f= 1
5
9

- diag(a,k): gives a vertical vector containing the diagonal (k) of the matrix (a). If (k=0), this means the elements of the main diagonal (k>0, this means elements above the main diagonal, k<0, and this means elements below the main diagonal).

```
d=diag(a,-1)

ans=

    4
    8
```

❖ d=diag(a,2)

```
ans =

     3
```

❖ Now install the commands

```
sum(diag(a))

  ans =
        15
```

❖ The sum of the components of the main diagonal

```
sum(daig(a,-1))

ans =

        12
```

H.W.
Write a MATLAB program to print two matrices and then check them. If they are equal, add them. If they are not equal, subtract them. Use the following command: isequal (a, b)