LECTURE (5)

Operations on matrixes

1. Addition and subtraction: "The basic condition for these two operations is that the dimensions of the matrix match (تطابق ابعاد المصفوفة)."

Example // Write a program using the statement ((for)) to calculate the sum and subtraction of two matrices, knowing that their dimensions are ((4*2)).

```
>> for i= 1:2        قراءة المصفوفة الاولى
>>      for j= 1:4
>>   a(i,j) =input ("a(i,j) =")
>>       end
>>   end
>>    for i= 1:2          قراءة المصفوفة الثانية
>>       for j= 1:4
>>    b(i,j) =input ("b(i,j)=") ,.
>>       end
>>   end
>>    for i= 1:2          لجمع وطرح المصفوفتين
>>       for j= 1:4
>>  c(i,j)= a(i,j) + b(i,j)
>>  d(i,j)= a(i,j) - b(i,j)
>>     end
>>   end
```

2. The multiplication process: [multiplying matrices]: It is done by adding the product of row (i) of the first matrix by column (j) of the second matrix until we get the element in row (i) and column (j).

((The condition for achieving multiplication is that the number of columns of the first matrix = the number of rows of the second matrix)).

((وشرط تحقق الضرب هو ان يكون عدد أعمدة المصفوفة الاولى = عدد صفوف المصفوفة الثانية)).

The result is a matrix whose dimension is the number of rows of the first matrix and whose columns are the number of columns of the second matrix.

Its general formula is:

$$C(I,J) = \sum_{i=1}^{n} a(i,k) * \ b(k,j)$$

Where ((n)) is the number of columns of ((a))

Example // Write a program using the (for) statement to find the product of the two matrices (a, b).

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

The output is

$$c = \begin{bmatrix} 77 & 114 \\ 68 & 57 \\ 90 & 107 \\ 47 & 38 \end{bmatrix}$$

3. Relationship of an element to an array: It is possible to ((add, subtract, multiply, or divide)) a matrix with a fixed number. For example, write a program to calculate b+3, 5*b if you know that

$$b = \begin{bmatrix} 3 & 2 \\ 0 & 9 \\ 1 & 7 \end{bmatrix}$$

```
>> b= [3   2 ; 0   9 ; 1   7]
>> for i=1:3
>>     for j=1:2
>>         b1(i,j) =b(i,j) *5
>>     b2(i,j) =b(i,j) +3
>>     end
>>   end
>>     b1
>>  b2
```

4. Dot multiplication between two matrices: It is the process of multiplying the corresponding elements between the two matrices

Example //Find the dot product of (X)*(Y)

```
clear;
clc;
X=[3,4,5,-6];
Y=[7,8,9,10];
for i=1:4
C(i)=X(i)*Y(i);
end
C
```

C = 21 32 45 -60

Example // Find the dot product of (a)*(b)

$$a = \begin{bmatrix} 4 & 1 \\ 5 & -3 \end{bmatrix} \qquad b = \begin{bmatrix} 8 & 5 \\ 6 & 9 \end{bmatrix}$$

5. Adding vector or matrix elements to another matrix

Example // If we have the following array:

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

We want to add the following vector $Y = [10 \quad 11 \quad 12]$

We use the following formula

$$x = [x\ ;\ y]$$

```
>> y = [11 12 13];
>> x = [x; y]
x =
    1    2    3
    4    5    6
    7    8    9
   11   12   13
```

NOW: If we want to add a column, we use the following formula

$$X = [X, Y]$$

Example // $x = \begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & 8 & 9 \end{bmatrix}$ *and* $y = [11\ ;12\ ;13];$

```
x =
    1    2    3   11
    4    5    6   12
    7    8    9   13
```

6. Handle a group of items at the same time:

التعامل مع مجموعة من العناصر في نفس الوقت

Example //If we have $x = [1\ 2\ 3\ ,4\ 5\ 6, 7\ 8\ 9]$

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

What is required is to create from the matrix (X) a matrix that includes the first and third rows and the second and third columns.

General formula:

var name (st. row : step : end row , st . col : step : end col)

$$Y = X(1:2:3\ ,2:3)$$

$$Then \quad Y = \begin{bmatrix} 2 & 3 \\ 8 & 9 \end{bmatrix}$$

Example // Construct a matrix by selecting the second and third rows and all the columns and inversely.

$$Y1 = X\ (2:3\ ,3:-1:1)$$

$$Then \quad Y_1 = \begin{bmatrix} 6 & 5 & 4 \\ 9 & 8 & 7 \end{bmatrix}$$

Note: :// ((The symbol (:) means everyone))

Example // Construct a matrix (R) from the matrix (X) by selecting the second row and all columns:

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

Solution:

$$R = X(2,:) \quad \text{or} \quad R = X(2,1:3)$$

$$Then \quad R = 4 \;\; 5 \;\; 6$$

Other operations on matrices

1. Finding a matrix transpose i.e. (replacing columns with rows):

Example // If we have the following matrix: $d = \begin{bmatrix} 3 & 6 \\ 8 & 9 \end{bmatrix}$

Find the transposed matrix

Solution:

$d = [3\ 6; 8\ 9];$

P=d'

$$d = \begin{bmatrix} 3 & 8 \\ 6 & 9 \end{bmatrix}$$

2. Find the inverse of a matrix: S = inv(D)

Example // Find the inverse of the following matrix

$$d = \begin{bmatrix} 3 & 4 \\ 2 & 0 \end{bmatrix}$$

Solution:

S = inv(D)

The resulting

$$d = \begin{bmatrix} 0 & 0.5 \\ 0.25 & -0.375 \end{bmatrix}$$